

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

- Peter Drucker

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# 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 2017 Engineering Design Expo an outstanding success.

Special gratitude goes to those 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 are also 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, Department of Mechanical & Aerospace Engineering

Engineering staff: Sue Radtke, Bethany Repp, Sheri Thomson, 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, university marketing and communications, campus operations, as well as Bon Appetit Management Company, who helped to make this day a success.

Sincerely,



Tim Tyler, Ph.D., P.E.

Dean, Allen School of Engineering & Technology



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**INNOVATORS CLUB**

FIVE YEARS OUT

**AROW**

# DEPARTMENT OF BIOMEDICAL ENGINEERING

## SmartMed Case Development Project

**Members:** Daniel Baughman, Julia DeBelly, Joshua Kline, Anne Mammel, Zach Seder and Taylor Zoch  
**Advisor:** Melanie Watson, Ph.D.  
**Sponsor:** HandHeld Medical Technologies, LLC

The purpose of this project is to develop a low-cost, handheld medical device that will run different blood tests when attached to a smartphone from the comfort of one's own home. The device is considered an FDA 510K Class II hematology, minimally invasive, medical device. A smartphone application has been designed to analyze blood components, store parameter data, compute results and then display physiological information to the user. Hybrid microfluidic paper-based analytical devices ( $\mu$ PADs) are used in conjunction with a cell cytometer powered by a 9V battery to sort blood cells via an electro-kinetic force. The new testing substrate is a paper hybrid called TerraSkin<sup>®</sup>, comprised of calcium carbonate and poly-ethylene. Microchannel designs, containing a mega-channel bifurcated into two smaller channels, are sketched onto TerraSkin<sup>®</sup> paper using a marker containing phosphate buffer solution (PBS). Modified hemocytometers are attached to each bifurcated channel allowing for increased functionality. Histological stains, i.e. Giemsa and Wright stains, contrast blood components and help reduce cost when compared to the previous quantum dots method. The hybrid  $\mu$ PADs and histological stains work collectively to verify the cell cytometer functionality in separating live and dead cells. A magnification bead clipped over a smartphone's camera was designed to obtain images of cells, eliminating the need for a microscope. The application analyzes magnified images by determining cell boundaries and reporting computational counts.

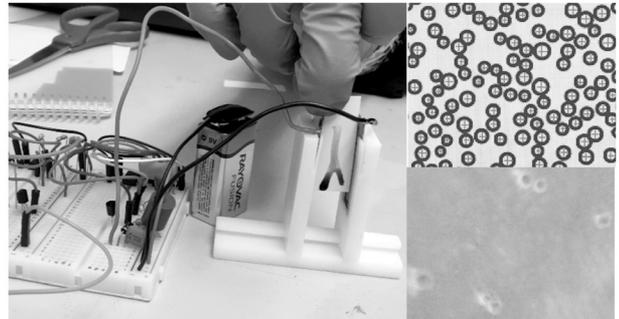


Figure 1: (A) Cell cytometer circuit with hybrid  $\mu$ PAD sample, (B) computational red blood cell boundary analysis, and (C) magnified image of white blood cells and Wright stain using smart phone camera

## Freeman Manufacturing Company Lumbar Back Brace

**Members:** Alexander Kuhn, Allyson Ross and Stephen Shelton  
**Advisor:** Melanie G. Watson, Ph.D.  
**Sponsor:** Freeman Manufacturing

The purpose of this project is to remodel a back brace design produced by Freeman Manufacturing. The current brace design has been in continuous use for the last 125 years and is available to customers in 20 different sizes. Our main project objective is to redesign the Freeman back brace, decreasing the number of size options down to four, thus reducing the variety of stock-on-hand necessary for Freeman to operate successfully. Additionally, our design is highly adjustable, user-friendly and comfortable, increases functionality, incorporates breathable materials, and includes a sizing chart generated from anthropometric data. The main function of our back brace is to be a semi-immobilizing lumbar brace for pre-op and post-op patients. Our design provides additional support and has a more modern appeal as compared to the prior brace. In addition to these qualities, our design follows Medicare and Medicaid requirements for a 510K: Class I medical device.



Figure 1: Redesigned back brace.  
(A) Front view, (B) Side view

# MCKETTA DEPARTMENT OF CHEMICAL & BIOPROCESS ENGINEERING

## 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 2017 Chemical Engineering Minor Design Projects are summarized below.

## Affordable Ozone Generation for Water Purification

**Members:** Mohammad Alsahli, Andrew Bunting and Josh Marty

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

The purpose of this project is to develop a fan-powered ozone generation device using materials costing less than \$20. This device incorporated a corona discharge plate to convert oxygen into ozone. This ozone could be fed through a water reservoir to kill any microbes present. Success was evaluated by the analysis of agar plates inoculated with distilled water (as a control), dirty water from an outside source, water that has been inoculated with *E. coli* without purification, and inoculated water after purification.

This device operates on the principles of corona discharge. Two electrodes are aligned on opposite sides of an insulating glass plate so that there is little overlap. A direct current is passed through the electrodes from a power source. Electrons form a corona of free electricity around the edges of the electrodes without creating a spark. These free electrons break the bonds of the oxygen molecule, which is unstable and attempts to rapidly reform. Some of this oxygen forms the less stable molecule ozone ( $O_3$ ). Ozone is a strong free radical donor and rapidly reacts with cellular membranes, killing any microbes with which it comes into contact.

Air containing small amounts of ozone generated by this unit was forced through a bottleneck by a small fan. Tubing connected to this bottleneck forced the air to bubble through the water reservoir.

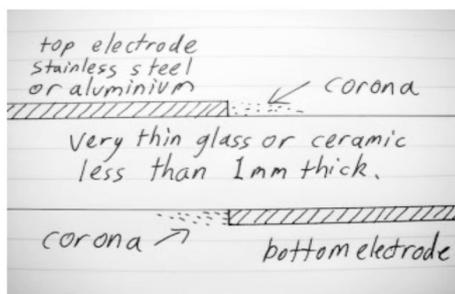
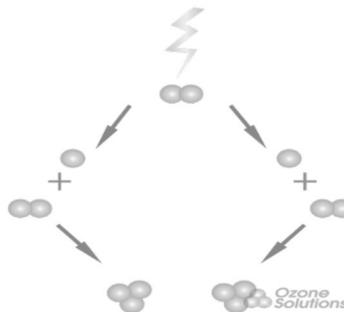


Diagram of corona discharge  
<http://www.bigclive.com/oz.htm>

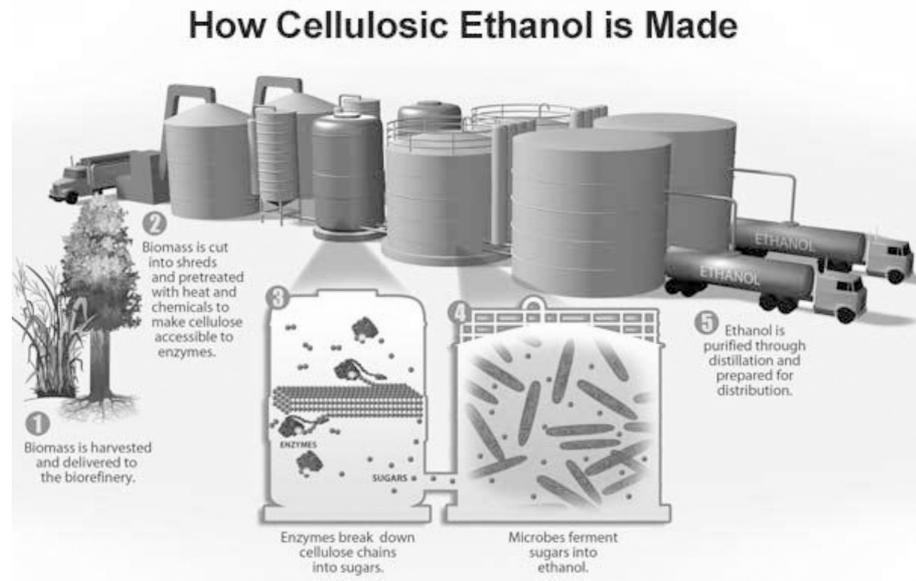


Oxygen to Ozone: <http://www.ozonesolutions.com/journal/tag/how-corona-discharge-makes-ozone/>

# Ethanol from Wastepaper

**Members:** Alexandria Claudy, Christopher Green and Aissatou Samaque  
**Advisor:** John Wagner, Ph.D.

Ethanol to be used as a fuel is traditionally made from corn. Cellulosic ethanol is made from unwanted plant matter or waste paper products (biomass) to reduce the amount of corn used. This reduction either allows more corn to go into food production or allows farmland to be used to grow other cash crops. This experiment compared ethanol production between Fleischmann's ActiveDry yeast, Fermentis' S-04 and Fermentis' US-05 using waste paper as a biomass source. Pretreatment involved boiling in 2% sulfuric acid followed by saccharification using cellulase enzymes. Sugar concentrations were measured via a glucose assay. Once the yeast strains were activated, fermentation occurred under ambient conditions for 24 hours, at which point ethanol concentrations were determined using gas chromatography. Each yeast strain also was used to ferment a sucrose solution as a method of control.



Graves. "Ethanol." wikispaces, <http://energygravesclass.wikispaces.com/ETHANOL>

# High School Outreach - I Scream for Ice Cream

**Members:** Kelsey Ortiz, Joseph Robinson and Lila Wilczynska  
**Advisor:** John Wagner, Ph.D.

Most high school students have not been introduced to concepts that are fundamental in engineering. Take-along kits were produced to allow Trine Chemical Engineering students to demonstrate heat transfer principles to high school science students using ice cream.

In the production of ice cream, one mode of heat transfer is convection, which is the transfer of heat due to the motion of the fluid. A second mode is conduction, which is heat transfer driven by a temperature gradient even in a static material. High school students will measure the time it takes for ice cream to solidify in containers made of various materials and thereby determine the dominant mode of heat transfer. The concepts discussed while the experiment is being conducted are:

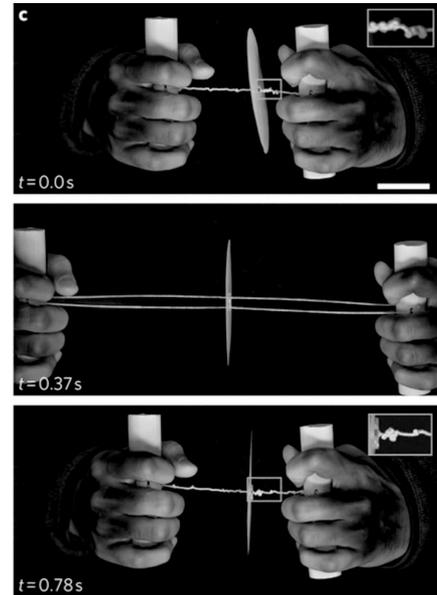
- The general definitions and calculations for convection and conduction.
- How to determine which mode of heat transfer dominates.
- The role of chemical engineering and heat transfer in the production of everyday products.

The kits will allow six groups to conduct the experiments. Every group will be given supplies and ingredients for a small batch of ice cream. For the ice cream solidification step, each group will receive one of three types of containers made from materials that have very different thermal conductivities. The ice cream will be cooled in these containers using a circulating cooling medium and in this way the differences in time between the materials will indicate a difference due to the materials themselves. After much interaction and discussion with the students, the Biot number will be calculated to quantitate the dominant mode of heat transfer.

# The Paperfuge: A Handheld 20-cent Centrifuge

**Members:** Kirstan Scott, Jordan Tinkle and Nicole Walters  
**Advisor:** John Wagner, Ph.D.

This project uses a design developed by a Stanford bioengineering lab to produce a cheap, handheld centrifuge. Based off of a whirligig, a child's toy, this centrifuge has the power to separate plasma from a blood sample. This has widespread applications in the medical field, particularly for developing countries. Separated blood samples are often used for diagnostic tests. The Paperfuge is a viable substitute for heavy, electricity-requiring, expensive centrifuges for small sample sizes like those required for blood tests. The design can be optimized to produce the fastest-spinning centrifuge by altering the length and thickness of the string, along with the weight distribution of the spinning center. We created and tested cheap, handheld centrifuges. The rotational speed was measured and compared to the Paperfuge created in the Stanford lab.



(Gonzalez)

# Paper Microscope

**Members:** Anas Alghamdi, Osama Almengash and Omar Alshaheen  
**Advisor:** John Wagner, Ph.D.

The objective of this project is to create a high school outreach kit that contains the instructions and materials to build an ultra-low-cost paper microscope. This paper microscope, called a Foldscope, is light-weight (about 8 grams) and based on work by a researcher at Stanford University. The kit also will contain multiple lenses that provide magnification up to 2,000X and a lighting source. High school students using the kits will work in teams to build working microscopes and then use their Foldscope to observe the microscopic world. These microscopes are inexpensive to produce and portable, making them useful, especially in underdeveloped countries where commercial microscopes are not always available.



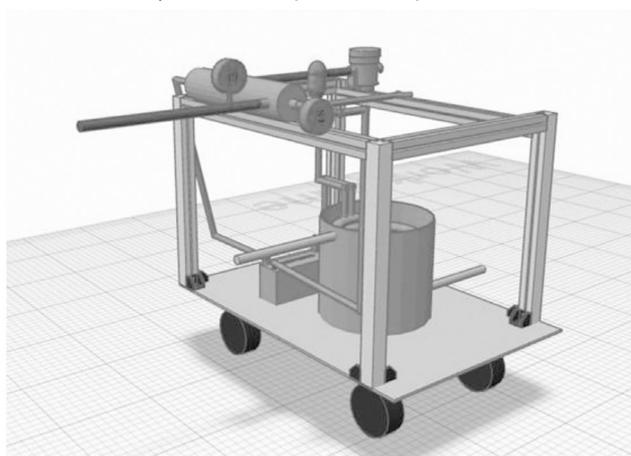
Figure 1 Paper microscope model taken from headstuff.com

# Pasteurization Experiment for Unit Operations Laboratory

**Members:** Cooper Gast, Stuart Gillig and Kevin Mercks  
**Advisor:** John Wagner, Ph.D.

Flash pasteurization is a commonly used method for the removal of unwanted yeast or bacteria within a biological sample. This technique utilizes high temperatures for short periods of time to inactivate or denature the undesired components with minimal effect on product quality. Trine University's chemical engineers currently have the option to experiment with flash pasteurization as a portion of Unit Operations, but only three to five students can do so. This system is extremely versatile as a Unit Operations experiment due to the application of heat transfer, biological inactivation techniques, steam flow and recycle systems, and the possibilities for future process control experiments.

Therefore, this project entails the construction of a flash-pasteurization system including hardware for an automatic controls system, and a supporting structure for mounting and rigidity. To complete the structure, an outdated heated mixing tank experiment will be extensively modified. This system currently contains a useful base for the support structure and a steam recycle subsystem that can be modified to fulfill the needs of the new system. The modifications made to the existing unit will include the removal of the current water tank and heating coil, introduction of the necessary units for effective flash-pasteurization, and the installation of controls hardware. A frame also will be constructed to mount all of the hardware and the entire system will be modified to allow for transportation.



*Schematic of the flash pasteurization apparatus to be constructed and implemented into the Unit Operations II lab course.*

## High School Outreach: Water Pollution Cleanup

**Members:** Bridget Marlow and Skye Nguyen  
**Advisor:** John Wagner, Ph.D.

The goal of this project is to design an outreach program to introduce high school students to chemical engineering. The program includes an introduction where the students' knowledge of water pollution is challenged, a wastewater cleanup activity and a follow-up discussion. Activity kits include plastic cups, pH strips, contaminants such as dirt and vegetable oil, and treatment options such as baking soda, cotton ball, and coffee filters. Each group of students is given the same materials to make a similar dirty water sample, which they must purify using only the given treatment options. Each treatment option has an associated time and costs to go with it. In addition to analyzing the quality of the final water solution, students will evaluate the total cost of their treatment method to determine the best method for a given time frame. This allows students to collaborate in groups, use problem-solving to determine their water treatment plan, and complete a cost analysis.



*Left: Sample of "contaminated" water. Right: Contents of the kits distributed to high school students for cleanup and analysis of water samples.*

## **“How to Decaffeinate Coffee” film viewing Trine’s entries in the 2017 AIChE Video Competition**

**Members:** Team 1 - Justin Franchville, Samuel Hunt, Grant Klopfenstein and Josh Simmons  
Team 2 - Kaitlyn Clark, Breann Cooper and Will Dixon  
Team 3 - Joe Jacobs and Tyler Kinsley

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

Short video clips were produced as entries into the American Institute of Chemical Engineers 2017 Global Undergraduate Student Video Competition. This year’s theme is “How to Decaffeinate Coffee.” Each team will create and present a 2-5 minute video that explains and inspires high school students to learn more about chemical engineers and their impact on the world. The submitted videos will be judged in a national contest to win a judge’s choice award or a public choice award. These films will be presented on the Trine campus in one of the classrooms on a 15-minute rotating schedule.

## **Cell Therapy for Spinal Cord Injuries: Commercial Manufacturing Facility**

**Members:** McKetta Department of Chemical & Bio-Process Engineering,  
Trine University – Nicholas Cassidy, Jennifer Jackemeyer, Amanda Kempher, Caleb Knust,  
Lucas Krupp and Michael Sheperd  
AIChE 2016 National Student Contest – Winner – individual category  
Safety and Health Division Winner

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

As part of the senior design course, students in the McKetta Department of Chemical & Bioprocess Engineering compete in the AIChE National Student Design Contest. Last year, the contest problems involved the design of a facility to produce a stem cell treatment for spinal cord injuries.

Michael Sheperd from Trine University won both the national contest and a safety award while two teams - Jennifer Jackemeyer and Amanda Kempher, as well as Lucas Krupp, Nicholas Cassidy and Caleb Knust - won national safety awards. Michael Sheperd’s abstract is given below:

In the United States, there are approximately 250,000 people living with spinal cord injuries, with an additional 12,000 added each year. There is currently an unmet need in the market for the treatment of SCI.1. The purpose of this report is to outline a preliminary design for the development of a clinical facility to create a spinal cord therapy. The design begins with a vial of frozen undifferentiated cells and entails both the upstream and downstream processes. The upstream process involves the expansion of UC-MSCs in T-flasks and rotating bioreactors, which utilize microcarriers to increase surface area. The UC-MSCs are differentiated into neural stem cells, which will be used for treatments. Downstream processes involve separation techniques using fluorescent activated cell sorting (FACS), the use of sterile filtration to remove viruses, and storage of the NSCs using cryopreservation.

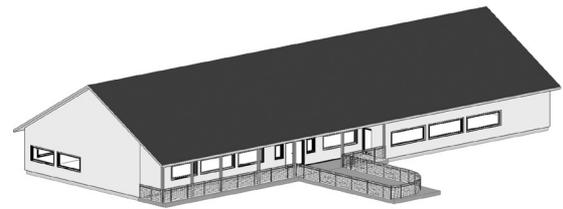
A total of 24 batches will be performed per year producing treatment for 37,000 patients. The fixed capital investment of this plant would be \$9.6 million. If the product is sold for \$480 per treatment, the revenue generated will be \$17.7 million with an NPW of \$18.5 million and an IRR of 50%. If the product is sold for market price (\$2000), the revenue will be \$74 million with a NPW of \$202 million and an IRR of 366%. All the major equipment needed for the facility is detailed in this report, along with necessary safety and environmental considerations. This cost-effective 10-year plan will effectively and efficiently meet the market need in a safe, reliable manner. It is recommended that a supervisor review this project to verify calculations and assumptions. If confirmed, the design should be further investigated and finalized in preparation for the production of the facility.

# REINERS DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

## Dr. T. K. Lawless Park Nature Center and Land Development

**Members:** Joshua Wyman (Project Manager), Drew Burgess (Structural Engineer), Michael Cain (Environmental Engineer) and Logan Lindsley (Land Development Engineer)  
**Advisor:** Professor T. J. Murphy  
**Sponsor:** Cass County Parks and Recreation Department

The purpose of this project is to increase the capacity of a county park during the off months. This particular nature park has huge summer and fall attendance from the surrounding community, but is reduced significantly during the winter and spring. The main goal for the Cass County Parks and Recreation Department is to create a space for the community to bridge the gap between nature and society. To complete this task, the entrance area to the park was reimagined entirely, highlighted by an organized parking structure and a fully functional nature center.

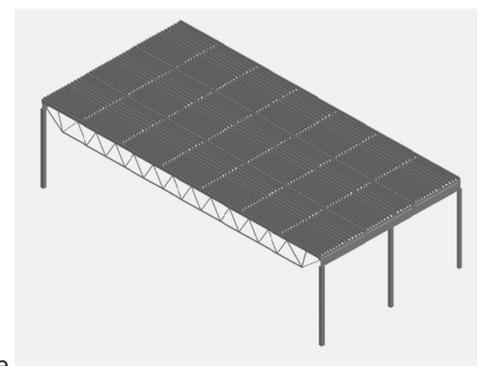


To begin the project, our group used a Topcon Total Station to complete a topographic survey of the construction limits. With this information, we determined the land development and stormwater collection system that is the most efficient for the park. The Nature Center is a 6,200-square-foot structure with the capacity for 200 nature enthusiasts. The floorplan consists of a large chapel-style assembly area for presentations, a large historical display room complete with interactive stations, and an observation room for astronomical learning. The structure itself is composed of timber, supported on a reinforced concrete foundation. Accompanied with the enclosed structure is an equally as exciting outdoor observation deck that gives the public an exhilarating birds-eye view of Dr. T. K. Lawless Park in its' entirety. Lastly, a reorganized asphalt parking facility has been expanded to better accommodate the growing capacity of Lawless Park.

## DeKalb County Outdoor Theater Spectator Roofing Structure

**Members:** Justen Hochstetler, David Webster, Luke Wenger and Ricardo Zambonino  
**Advisor:** Prof. T.J. Murphy

This project was for the design of a canopy structure for the DeKalb County Outdoor Theater in Auburn, Indiana. Historically, if rain occurs on the day of an event at the outdoor venue, the attendance at the event drops dramatically, even if the rain has stopped by the time of the show. The client wants to improve attendance by providing some protection during inclement weather. The DeKalb County Outdoor Theater committee requested a preliminary design of a permanent structure that has a movable roof. The goal was to provide the open-air experience for the audience during good weather, while providing protection during rainy weather.

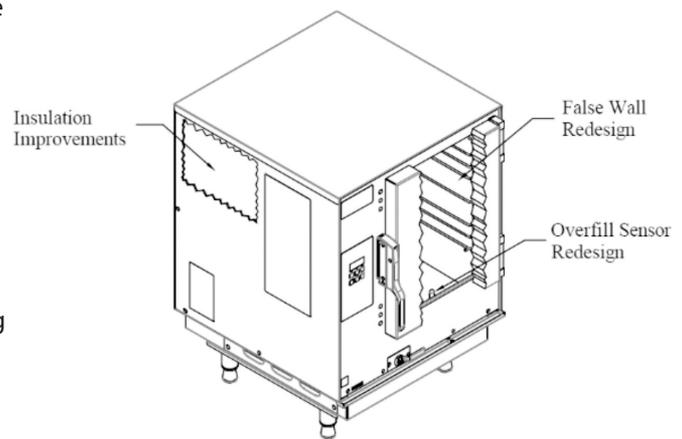


The design team looked at several alternatives, and after discussing options with the client, chose to design a steel-framed structure with a louvered roof. The structure will be located approximately 24 feet from the existing stage. It will be 50 feet deep by 100 feet wide and will be 28 feet tall. The roof was designed using a prefabricated mechanically operated louver system, which can be rotated to allow the roof to be either opened or closed based on weather conditions.

## Evolution Steamer Redesign Project

**Members:** Courtney Mitchell, Brian Orr, Joseph Rasdorf and Johannes Wilbrink  
**Advisor:** Tim Jenkins, Ph.D.  
**Sponsor:** AccuTemp Products, Inc. and Innovation One

In 2008 AccuTemp Products Inc. released the Evolution boilerless steamer to the steam cooker market. This product leads the competition in standard performance benchmark tests but is also one of the most expensive units available. Some of the current issues with the steamer include the utilization of four expensive bolts to secure the false wall in the steam chamber and overfill occurrences on the connected model, causing hot water to flow out of the steamer. This project intends to add customer value to the Evolution boilerless steamer in several areas including improvement of the cook chamber insulation, the overfill protection system, and the use of a removable false door in the steamer. These modification solutions added significant value to the product by minimizing the cost and improving the performance of the existing design. It is recommended to implement these design changes to the Evolution boilerless steamer.

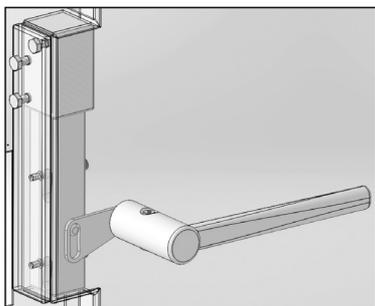


## Evolution Steamer 2-Stage Handle Project

**Members:** Joseph Brinkman, James Gregory, Taylor Myers and Kyle Siegrist  
**Advisor:** Tim Jenkins, Ph.D.  
**Sponsor:** AccuTemp Products, Inc. and Innovation One

In the food service industry, commercial steamers are used to quickly prepare food at restaurants, catered events and buffets. This is achieved by lowering the pressure inside a specially reinforced steamer cavity to boil water and generate steam at temperatures as low as 150°F to cook the food. However, when opening the steamer door at the end of the cooking cycle, a common safety hazard to the user is posed by the escaping steam from the cooking chamber, which easily causes discomfort or burns to the worker. The proposed two-stage steamer door handle shown is a solution to this potentially hazardous issue. The design team

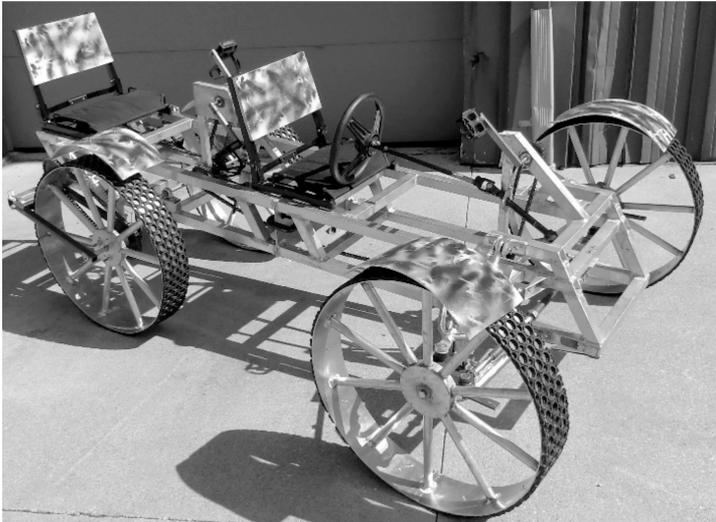
considered several opening mechanisms in developing this final design. Further, a Pugh matrix was used to illustrate how this solution would best meet product needs over other proposed designs. This work has resulted in a final prototype handle that can be slammed shut, easily cleaned and maintained, have an expected durability of approximately seven years through 250,000 cycles, and prevent the operator from being burned by the steam upon opening the steamer door. The two-stage handle will provide safe, ergonomic and reliable operation for the user of the steamer by allowing the steam to completely vent out of the cooking chamber before the steamer door can be completely opened.



# NASA Human Exploration Rover Challenge Project

**Members:** Adam Boles, Christopher Britton, Xavier Colter-Mosiman, Ryan Hanks, Kody Hutchison, Jordan Miller, Nathan Smoker, Jordan Stevens and Rachel Zink  
**Advisors:** Tim Jenkins, Ph.D., and Brian Thomas, Ph.D.  
**Sponsor:** Design Engineering Technology Department

The purpose of the NASA Human Exploration Challenge is to engage student teams to design and test new concepts that could possibly be used on future exploratory missions in outer space by building and racing a two-person human-powered vehicle.

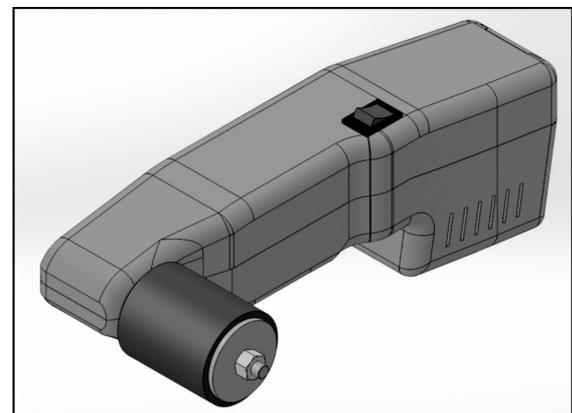


The rover is required to be operated by two passengers over an obstacle course that simulates extraterrestrial terrain found on planets, moons and asteroids. Initially, the team brainstormed ideas for a rover that could successfully complete all obstacles. Then the team developed needs and specifications for the rover to further refine viable concepts for the rover from the developed ideas. After selecting concepts, individual concepts were expanded upon and used to make a system-level design. The team chose a final design and performed necessary calculations and modelling for the design to refine the design further. One of the key aspects of this year's design is a significant reduction in weight, almost 20%. This was accomplished in part by changing the wheel design and using different materials, in turn reducing the wheel weight by 50% from 2016. The team once again went to Huntsville, Alabama, and participated in the NASA Rover Challenge competition with the rover design shown here.

# Handheld Sander Project

**Members:** Joshua Calhoun, Jack Guyas, Chase Hardebeck and Alec Patterson  
**Advisors:** Tim Jenkins, Ph.D.  
**Sponsor:** Douglas McGregor and Innovation One

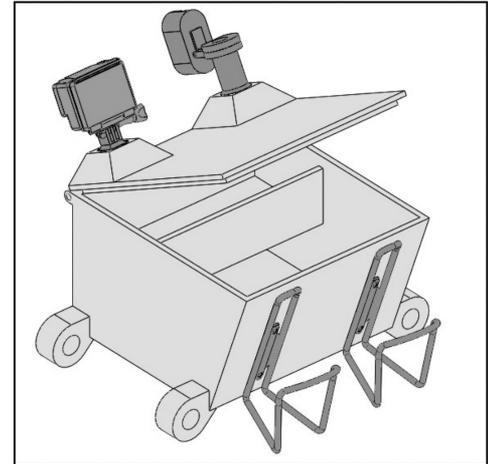
The rotary tool market is vast and ever-changing. Companies like Dremel, Black and Decker and Milwaukee are constantly raising the bar with innovative products, but there is still room for improvement. A local entrepreneur saw an opportunity to develop a new handheld rotary tool. The vision was for a handheld portable sander, with capabilities similar to a Dremel, but with the tool head axis of rotation oriented perpendicular to the user's forearm. The design team determined the needed requirements including safety, durability, versatility, portability and ease of use. With these five criteria in mind, the team generated four viable options that would meet those needs and have market potential. The sponsor selected the concept shown above that would be the final prototyped sanding tool. This portable drum sander is designed to be used with one hand and provides the perpendicular axis of rotation to the forearm as desired by the sponsor. The sander has variable speed and an ergonomic design that increases comfort and productivity for the user.



# Direct Digital Manufacturing Competition Project

**Members:** Tim Billow, Tanner Thompson and Brandon Walters  
**Advisors:** Tim Jenkins, Ph.D., and Professor Tom Trusty  
**Sponsor:** Design Engineering Technology Department

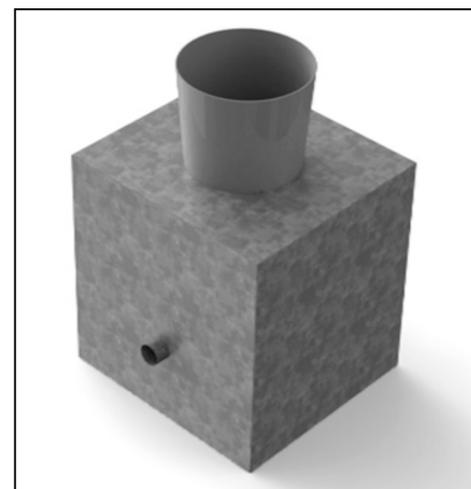
Every year SME sponsors a Direct Digital Manufacturing (DDM) design competition. The topic for 2017 was improved mobility, and teams were to consider a new or existing product that can be created using additive manufacturing processes. Each team's product is judged based on functionality, durability, value analysis, use of DDM materials and processes, and design integration, as well as social and environmental impacts. The design team focused on assisting a local Paralympic cyclist by creating a storage compartment for a hand-operated cycle to help benefit personal mobility. There are currently no storage products specifically designed to mount to hand cycles of this type. The storage compartment will be manufactured using a material extrusion process due to the process's affordability. The compartment will utilize nylon as its material due to its strength and durability. The storage compartment is designed to safely enclose the rider's possessions as well as carry water bottles on the outside, without causing annoyances. The compartment also has different mounting capabilities that will allow for different safety products, such as a safety light or caution flag, to be securely mounted in place of the camera and light as shown in the figure.



## SMART Feeder Project

**Members:** Alex Harman, Marcus Hedrick, Anastasia John and Nathan Wonderly  
**Advisors:** Professor Tom Barkimer  
**Sponsor:** David Corcoran and Innovation One

The sponsor of the SMART Feeder requested the help of Trine University to design, fabricate and test an all-weather feeder that allows for remote operation, is pest-resistant, moisture-resistant and can operate in any season. A microcomputer activates the conveyance of feed, as well as connecting the feeder to the internet and a web application that controls the feeder. The importance of being able to work in either an interior or exterior setting was also emphasized. The proposed solution to this project utilizes a sealed exterior to prevent any kind of unwanted interference and eliminate the effects of moisture internally. The hopper at the top of the feeder employs gravity to deliver the feed to an auger, which is driven horizontally and transports the feed to the desired location. The final design of the SMART Feeder prototype utilizes galvanized steel to prevent corrosion and ensure the longevity and integrity of the feeder long-term in poor conditions. Additionally, a team from the school of business is developing a business marketing plan for the sponsor.



# MTI Impression Design Project

**Members:** Jon Blanton, Joe Bowman, Jordan Penry and Devin Wolf  
**Advisors:** Professor Tom Barkimer  
**Sponsor:** Metal Technologies Inc.

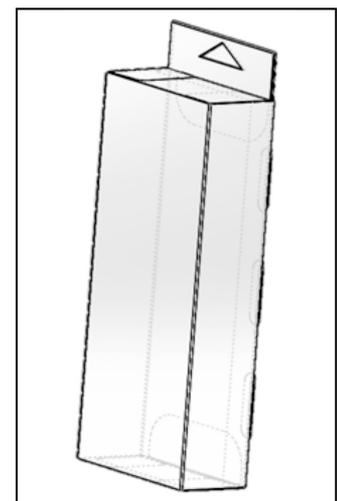
Metal Technologies (MTI) has been considering the use of polymer-based mold impressions for some time. Two students currently working at MTI determined this might make a nice design project and approached MTI and Trine faculty about the idea. The MTI Impression Design project was devised to determine the best rapid prototyping materials and part geometries to create quick inexpensive prototype tooling to save time and reduce costs. The group has chosen to do a designed experiment to find the best solution. The group designed, printed and tested three “test” impressions to ascertain the best printing method, surface finish, and what geometry capabilities are possible in the Disamatic sand molding process. The focused geometries studied were draft angles, fillet sizes, radii, pocket sizes and boss sizes. The 3D printed impression will need to at last 1000 mold hits for its lifetime. The group also researched solvents to aid in the removal of the printing layers, which helps create a smooth surface finish for the printed impression. An example of a polymer impression is shown in the left figure.



# Freeman Medical Package Redesign Team

**Members:** Brandon Heath, Sierra Henderson and Robby Scheckelhoff  
**Advisors:** Professor Tom Barkimer  
**Sponsor:** Freeman Manufacturing and Innovation One

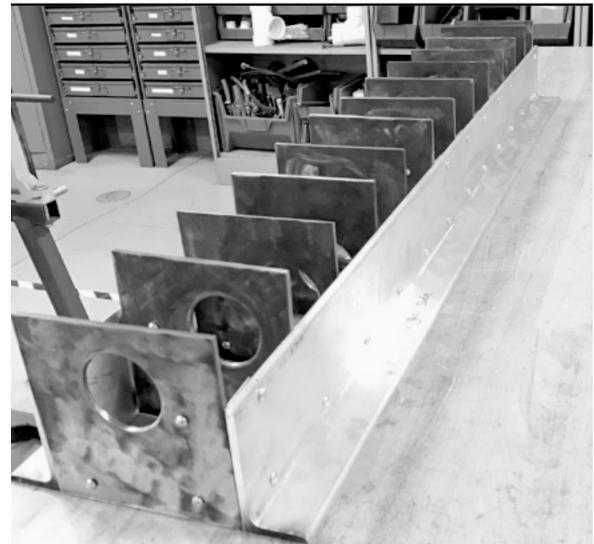
Freeman Manufacturing Company produces prosthetics, orthopedic braces and other soft goods for the medical industry and patients. The project involves a redesign of a package to hold orthopedic braces. The package design must offer multiple lengths to hold different-sized products while being economical to produce. Additionally, the container must offer the customer a visually attractive appearance in order to be sold in retail stores. The team was given basic parameters for size, shape and the manufacturing process. Also, the package must support the ability to open and reclose the package multiple times. Testing was done using a variety of materials and the manufacturing process based on the abilities of the sponsor’s in-house equipment to make a series of physical prototypes. Once the physical prototypes were made, fatigue and compression tests were conducted to ensure a quality design. The designs and material choice were refined, after which the team and sponsor selected a final design. An example of one of the designs is shown here.



## MaxDuct Applicator Project

**Members:** Travis Bandt, Collin Goodin, Dalton Raper and Jared VanHook  
**Advisor:** Prof. Tom Barkimer  
**Sponsor:** Conduit Space Recovery Systems and Innovation One

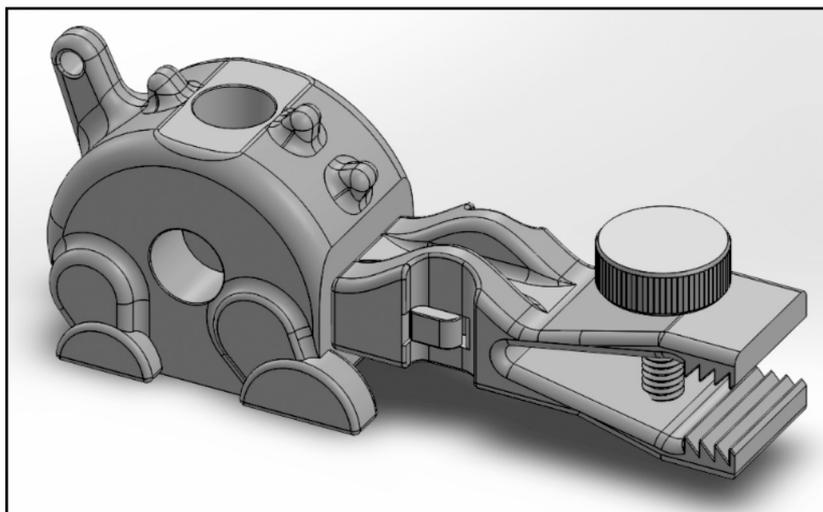
The MaxDuct Applicator team was given a challenge to design and produce an apparatus that will wrap fiber optic cable with MaxDuct sheaving in the field while laying or pulling the cable. This apparatus had to be able to wrap the MaxDuct around a circumference of the cable with overlap for the full cable's desired length. This apparatus will help save time and space while on the jobsite. The team came up with several concepts and decided on a sequential die system. The final solution was found through concept development and then prototype construction and testing. Several prototypes were built and tested and changes were made to increase functionality. The result of this process was a simple apparatus that can wrap various diameters of fiber optic cable at a rate of 150 ft./min. The apparatus can be easily relocated anywhere on the jobsite and used by anyone.



## Blanket Fort Clip Project

**Members:** Lucas Drerup, Austin Foste and Brennon Furnas  
**Advisor:** Prof. Tom Barkimer and Prof. Tom Trusty  
**Sponsor:** Douglas McGregor and Innovation One

The sponsor approached Trine University with a concept for a clip to allow kids to have active play and create indoor blanket forts. The design team was to develop several concepts in 3D space and present the best ones to the sponsor for consideration. The overall design itself was left up to the team with a simple prototype as a guide. Based on an intellectual property search and manufacturing considerations, the design at left has been approved. The process and material had to meet specified cost targets so that the product could be sold to the target market at a competitive price. A design recommendation provided to the sponsor was approved and prototypes were made for a market test to determine the functionality in the target market. The market testing

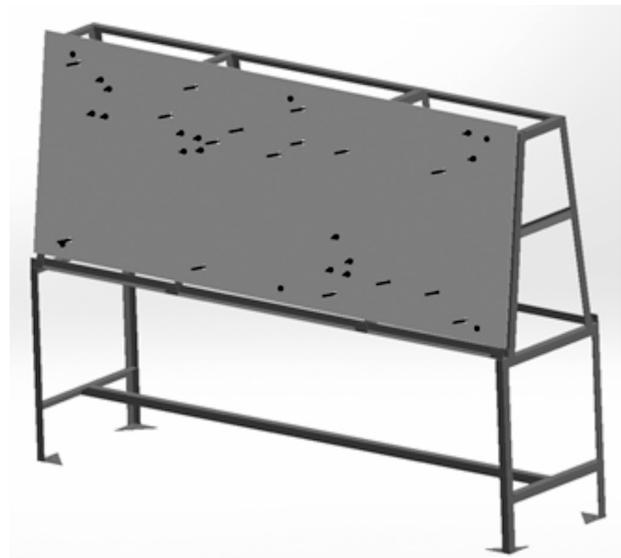


was conducted on Trine's main campus by area families with children aged 4-10 using 3D-printed prototypes, blankets and PVC pipe. The team also has collaborated with a team from the business school to develop a business and marketing plan for the product.

# Universal Wiring Harness Board Project

**Members:** Jesus Castillo, Chase Harker, Luke Porter and Larry Smith  
**Advisor:** Prof. Tom Barkimer  
**Sponsor:** Indiana Marine Products

The scope of this project is to improve the process that creates wiring harnesses at Indiana Marine Products. The current method requires the storage of unused wiring harness boards and additional time for setup and tear down. The current system also involves an IMP worker physically replacing one board with another in order to create a different wiring harness design. The proposed solution will free up more than 800 square feet of storage space for other purposes and also reduce the amount of time it takes workers to create wiring harnesses. This design eliminates the board switching requirement by using an adaptable board system that will allow for the layout of any wiring harness design. The adaptable board has a series of drilled holes into which pegs can be placed based on the harness design to be made. The team implemented a reusable canvas material that the harness design drawings will be printed on and the worker will simply pin to the board. The figure illustrates the concept developed.



## DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

### Rubik's Cube

**Members:** Alyssa Atkinson, Terin Betz, Andrew Carpenter and Kaitlin Tubbs  
**Advisor:** Andrea Mitofsky, Ph.D.

This project takes the original Rubik's Cube design and replaces it with a more modern design, featuring a 3D-printed case, LEDs, buttons and voice control. The voice option for the cube will be controlled by an app on an Android device. The app will take voice commands and turn them into basic text which will be sent via Bluetooth to the cube. The cube will perform the action by changing the LEDs so that colors appear to rotate around the cube. To operate the cube using the button interface, two buttons must be pressed. The first button controls which face will move. The second button indicates the destination for that face.

# Custom Game Cabinet

**Members:** Justin Coplin, Danin Fluke, Peter Howland and Cameron Voss  
**Advisor:** Andrea Mitofsky, Ph.D.

The Custom Game Cabinet seeks to provide a unique, exciting, new factor of entertainment on the Trine campus. The cabinet will allow the player to enjoy classic arcade fun with a modern twist. Players can enjoy features such as haptic feedback, an in-depth storyline and the ability to save and share high scores. The arcade cabinet will include functionality to incorporate student ID's and allow students to compare scores. Alongside the Game Cabinet, the game software shall be available as a desktop application, so that it can be played on personal devices as well.

# Three-Phase DC-AC Inverter

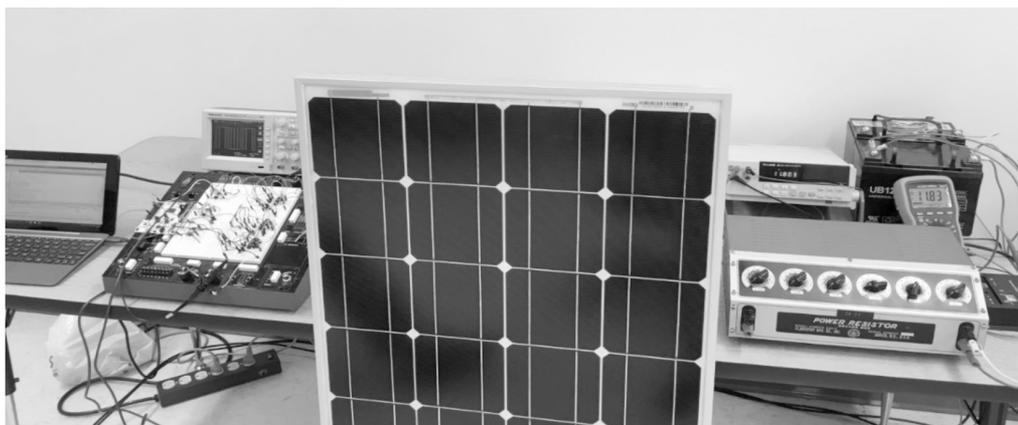
**Members:** John Cook, Zach Cross and Haley Reed  
**Advisor:** Stephen Carr, Ph.D.

This design project aims to create a three-phase electrical supply from a solar panel array. The three-phase supply is to be compatible with the requirements of our undergraduate machinery laboratory and so produce a 208 V, line-to-line, sinuous supply at 60 HZ. This is for application to the laboratory electrical loads, possibly in conjunction with the other electromechanical generators in the laboratory.

The energy produced from the panel is stored in a battery system and the battery system is then used as DC source for a DC to three-phase AC inverter. The inverter is to supply, for a first test, a purely resistive 120 W load consisting of the three 40 W light bulbs in a star connection. Since the inverter operates from a low-voltage DC supply (12 V/24 V) a step-up transformer bank is employed to meet the load voltage requirements.

The architecture implemented for the inverter consists of a PWM-driven, power MOSFET-based, three-branch bridge structure. The PWM control signals are generated through an Arduino/ARM-based algorithm and these signals are processed through a power MOSFET driver to operate the six power transistors. Smoothing of the transistor-stage PWM output signal is accomplished with an inductance filter for each phase.

Further enhancements will include feedback control for the DC to DC convertor stage that controls the voltage level into the inverter and hence the peak amplitude at the output of the inverter.



# Solar-Power Eightfold USB Charging Station

**Members:** Faisal Alraouji, Simon Gordon, Joshua Poston and Adam Suter  
**Advisor:** Sean Carroll, Ph.D.

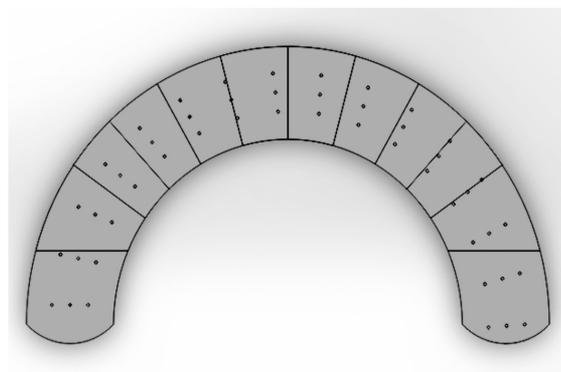
This project is the design of a solar-powered cellphone charger located at one of Trine University's gazebos. The charger will have two different power sources: green energy (solar panels) and domestic power. The solar power source will charge a battery, which will supply power to a cellphone charger. The circuitry and battery will be contained inside waterproof boxes connected using electrical conduit. The charging box will be level with the rail on the gazebo and the solar panel on the gazebo's roof. This charging station will allow students, faculty and staff to use green energy to recharge their cell phones.



# Semaphore: A Theremin-Like Electronic Musical Instrument

**Members:** Trent Eubanks, Zach Ward, Bill Wilson and Adam Younce  
**Advisor:** Sameer Sharma, Ph.D.

Our group is designing Semaphore, a Theremin-like instrument. It is an electronic musical instrument that can be played without physically touching the instrument. For our design, 16 infrared (IR) sensors are used along with an Arduino MEGA 2560 microcontroller. The 16 different sensors play 16 different notes. Each note is designated using two IR LEDs, one IR sensor and one white LED. The IR sensors will detect the distance of a hand from the instrument and gives the amplitude (volume) of the note, which will be represented using the brightness of the LED while white LEDs will show the note that is currently being played. An Arduino microcontroller is also connected to a PC running custom software. The software can be used to select different instruments as well as allow the user a music editing feature to record and play back tracks in a loop to play another instrument over them.

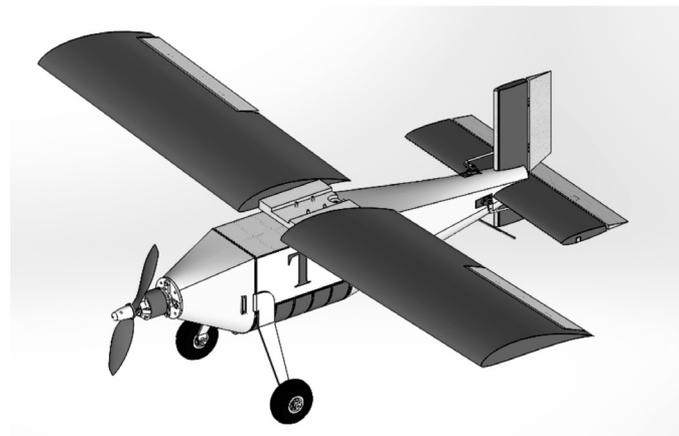


# WADE DEPARTMENT OF MECHANICAL & AEROSPACE ENGINEERING

## AIAA Design/Build/Fly Competition

**Members:** Zachary Bailey, Aaron Mast, Adam Schaaf, Evan Warfel and Ben Wilson  
**Advisor:** Pavan Karra, Ph.D.

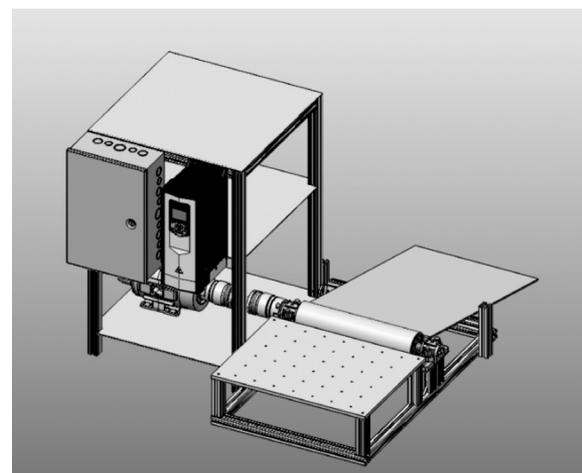
The project consisted of the design, analysis and construction of a model airplane for the American Institute of Aeronautics and Astronautics (AIAA) student Design/Build/Fly competition. Students were challenged to design a hand-launched model radio-controlled airplane that could carry three hockey pucks, fit inside a carrying tube and have all surfaces fold into a flight-ready position. The performance criteria included speed of aircraft, maneuverability, payload capacity and minimum cross-sectional characteristic length in folded position. An airplane was designed using the available tools for Aerodynamics, Stability and Control and manufacturing processes. As of the writing of this abstract, the airplane has completed all the requirements to obtain a score except smooth landing. Efforts are underway to complete the remaining task to successfully compete.



## Trine University Chassis Dynamometer

**Members:** Devin Anderson and Chris Hull  
**Advisor:** Pavan Karra, Ph.D.

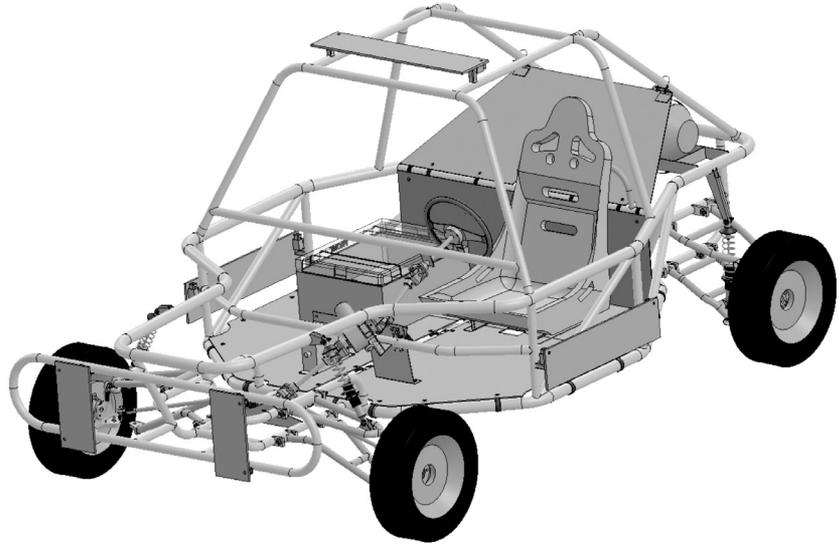
The purpose of the project is to design and build a single unit that acts as both a chassis dynamometer and a track simulator, to be used by the Shell Eco Marathon team as an analytical/experimental tool in their design and testing. Alongside the dynamometer, a sample test rig has been built to allow future teams to test drivetrain configurations before a full system has been built or developed. The dynamometer consists of a roller, an AC motor and a variable frequency drive. A National Instruments cDAQ is used to collect data as well as command various functions to aid in the dynamometer control. The dynamometer is capable of performing track simulations. As of the writing of this abstract, the build portion of the project is almost complete and testing is underway.



## LHP Engineering Solutions Car Team

**Members:** Ryker Bonte, Devin Gingerich, Blake Gurzynski, Kyle Roskowski and Cory Sank  
**Advisor:** Pavan Karra, Ph.D  
**Sponsor:** LHP Engineering Solutions

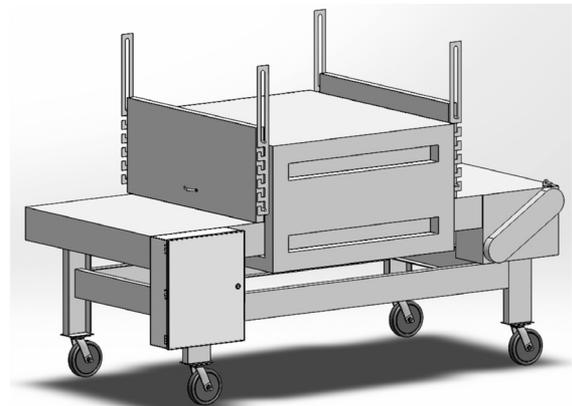
This project was a collaboration between students at Trine University and LHP Engineering Solutions based out of Columbus, Indiana. LHP is expanding into the autonomous vehicle sector and wishes to have a vehicle test bed for various sensor packages and control software. The team designed a tube-frame vehicle using readily available parts from various vendors with the goal of creating an original, reproducible vehicle subject to customer requirements. The team has learned many aspects of both mechanical and electrical engineering, designing the various subcomponents such as steering, brakes, throttle and frame. From a mechanical standpoint, MATLAB was utilized heavily to design and size out the braking and steering systems. The team used ANSYS Workbench to perform Finite Element Analysis (FEA) to ensure structural integrity and strength of components. On the electrical side the Keil  $\mu$ Vision 5 IDE was used to program the STM32F407 Discovery Board in the C programming language to control the steering, brakes and engine systems remotely. At the time of writing this abstract, the build portion is predominantly complete and testing is yet to be completed.



## Metal Technologies Core Heater

**Members:** Wesley Grubbs, Justin Holley and Andrew Rowan  
**Advisors:** Pavan Karra, Ph.D., and Jon Koch, Ph.D.  
**Sponsor:** Metal Technologies Auburn

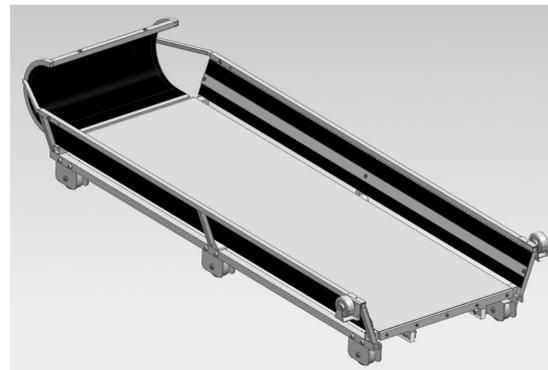
This project is for the design of a core heating system to be used in production in the Metal Technologies facility in Auburn, Indiana. Cores are parts that go into sand castings to define interior geometry. Cores not being at the desired temperature affect the quality of the product. The purpose of the heating system is to heat the cores to a stated temperature. Thermal analysis has been performed which yielded a required power of 12 kW. A 480V electric heating system has been designed along with temperature control system to maintain temperature. The heating system is composed of a conveyor, a box to contain the heat, controls, and heating elements. Safety features have been built into the design to avoid accidents. The build portion is underway and is expected to be completed by the end of the semester.



# Pokagon State Park Toboggan Redesign

**Members:** Blake Balka, Bradley Cooper and Evan Poole  
**Advisor:** Pavan Karra, Ph.D.  
**Sponsor:** Pokagon State Park

The purpose of this project was to design a toboggan to be used in the summer months at Pokagon State Park and to improve the toboggan's launching system. The improvements made at Pokagon accomplished three fundamental goals: improve rider and operator ergonomics, improve rider safety and allow for summer operation. To improve operator and rider ergonomics, a lever was added to the launch system to reduce the input force required to operate the table, and an additional step was added to assist with passenger loading. A toboggan was designed and built to customer requirements. In order to allow for additional summer operation, removable wheels were added to the summer toboggan. Finally, the winter and summer toboggans were stopped using the designed and constructed braking lane.



# Rolls-Royce Composite Compressor Blisk and Arbor Design

**Members:** Austin Ganger, Jacob Leopold and Austin Roberts  
**Advisor:** Jamie Canino, Ph.D.  
**Sponsors:** Rolls-Royce Corporation (RRC)

The project encompassed design and analysis of a composite rotor configuration for application in gas turbines. The project focus was on minimizing weight and cost of the composite rotor configuration compared to an existing titanium compressor blisk. An iterative design/analysis effort was done starting with a baseline blade geometry provided by Rolls-Royce Corporation (RRC). An acceptable composite rotor configuration must be able to withstand the loads and conditions acting on the typical metal blisk. Three configurations were converged upon for the final designs. The first configuration utilized two C-clamps to limit the radial throw of the blade as well as a carbon epoxy filament wound ring. The second configuration utilized one C-clamp as well as a carbon epoxy filament wound ring. The third configuration utilized two carbon epoxy filament wound rings. A test specimen was designed based on the composite rotor configurations in order for them to be tested in a spin test pit.

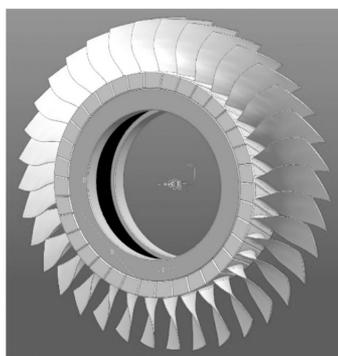


Figure 1: first configuration

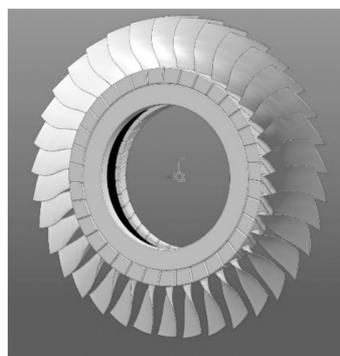


Figure 2: second configuration

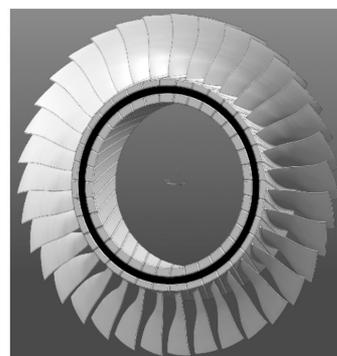


Figure 3: third configuration

# Burr Oak Fin Stock Loader Design Project

**Members:** Jayden Remsburg, Jacob Swanson, Christopher Vojtko and Kyle Westjohn  
**Advisor:** Jamie Canino, Ph.D.  
**Sponsor:** Burr Oak Tools

With an ever-increasing demand for higher productivity, Burr Oak Tools continually seeks ways to make its equipment faster and decrease down time. In the case of its fin press, a significant amount of down time is associated with changing out empty rolls of fin stock. The current system takes approximately 20 minutes from the time a roll runs out until an operator can have a new roll in place making fins. Burr Oak Tool has requested a new uncoiling system that will reduce this downtime to less than 5 minutes. This involved designing a device capable of handling a 12,000-pound roll of aluminum and placing it onto an unwind machine. Following this, the aluminum would be fed through a pinch roller to a location at which it would be spliced to the end of the previous roll. In order to accomplish this task, a loading cart was designed to handle the initial transfer of the roll onto the unwind device and a splicing table was designed to handle the splicing process.

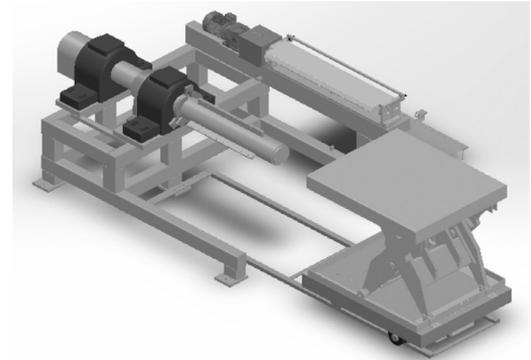


Figure 1: Loading Cart with Unwind

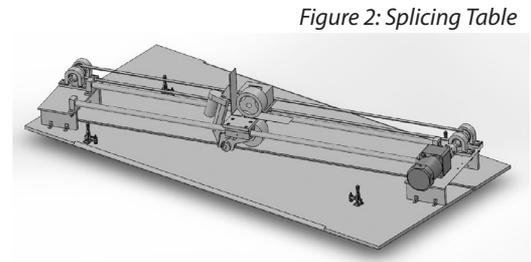
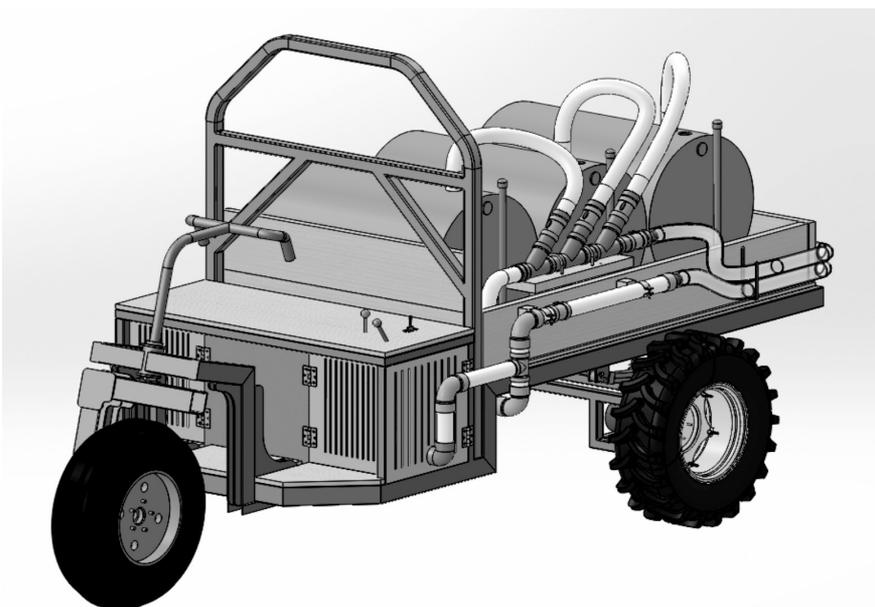


Figure 2: Splicing Table

# Basic Utility Vehicle (BUV)

**Members:** Matt Clark, Ian Jindrich, Jared Kline and Fernando Ortiz  
**Advisor:** Jamie Canino, Ph.D.  
**Sponsor:** DENSO Foundation, Parker Hannifin, Kraft Fluid Systems, Best One Tire, Sherwin Williams, Timken

In developing parts of the world, people often travel miles to obtain water from springs, rivers or wells. To make the transportation of water and goods more efficient for these developing countries, the Institution for Affordable Transportation (IAT) created the Basic Utility Vehicle (BUV). The 2016-2017 Trine University BUV is comprised of four main components: frame, steering, drivetrain and water supply system. The frame is a C-channel steel chassis that supports the steering, roll bar and cargo bed. To minimize the number of steering components, a single, front-wheel design was fabricated. A nine-horsepower diesel engine is used to supply

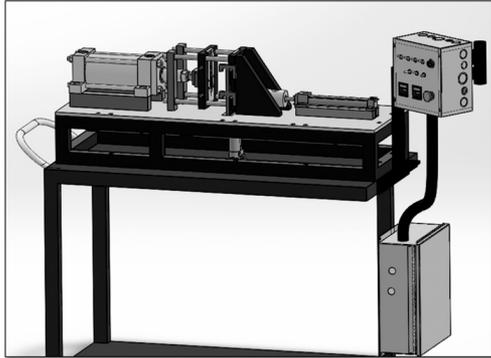


power to a hydraulic pump, which is capable of turning two independent wheel motors and the water pump. The water system is comprised of three 55-gallon barrels and utilizes a water pump to fill and empty the system.

# Trine University Laboratory Die Casting Machine

**Members:** Andy Farrell, Andrew Leichty, Shaun Seigneur and Kyle Thomas  
**Advisor:** Jamie Canino, Ph.D.  
**Sponsors:** Foundry Educational Foundation, Parker Hannifin

The goal of this project was to redesign and build a laboratory-scale die casting machine that would demonstrate the capabilities of die casting to current students, prospective students and faculty members. The die cast machine will produce two parts made of a tin alloy: a tensile test specimen and a thickness step block. The injection tube and one half of the die will be heated to keep the tin liquid until injection. Two hydraulic cylinders will clamp the two halves of the die together and then proceed to inject



the molten tin. An electric actuator will lock the die together in the case of hydraulic failure of the cylinders to protect bystanders. As a safety precaution, the machine is also surrounded by an acrylic enclosure to ensure that any splatter will not harm observers. All mechanisms (heaters, cylinders, actuators, pump) are controlled from the control box.

# Haitian Christian Outreach Solar Power System Design

**Members:** Cameron Crenshaw, Emily Dunn and Christopher Laudenschlager  
**Advisor:** Jamie Canino, Ph.D.

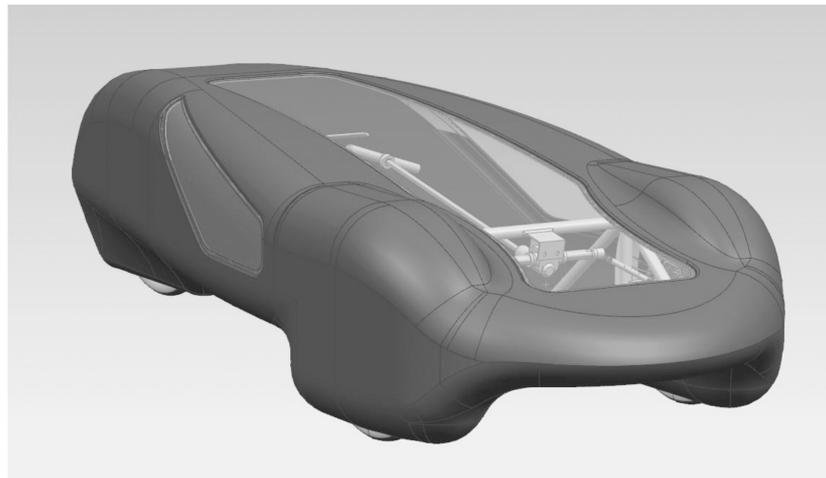
This project aimed to design a solar panel mounting and monitoring system for Haitian Christian Outreach's campus in Peredo, Haiti. The overall scope of this project involved designing and building a mounting system for pre-built solar panels, as well as designing and wiring a system to monitor panel temperature and solar irradiance, and calculate overall system efficiency. The details for the mount and control systems, technical drawings, assembly instructions and operation/maintenance plans have been given to Haitian Christian Outreach (HCO), so they are now able to move forward with the installation phase of their long-term energy sustainability plan for the campus in Peredo. The system will provide more than 50 kWh of energy per day to power their hospital, church, school and dormitories; reducing their reliance on the diesel generator currently used to provide electricity. The team hopes this project will inspire fellow engineers to use their talents and abilities to improve the conditions of others around the world.



# Trine University Shell EcoMarathon Vehicle 2017

**Members:** Logan Konopka, Drew Palmer, Zachary Schiller, Sam Spitzer, Frank Vuocolo and Jared Witt  
**Advisor:** Jamie Canino, Ph.D.  
**Sponsor:** DENSO Foundation, Technique Inc., World Class Prototyping, Michigan Pattern, S&T Auto Body and Holland Custom Signs

The goal of the 2017 Trine University Shell EcoMarathon design team was to design and build a battery-electric car that qualifies, competes and finishes in the top 10 in the Shell EcoMarathon competition on April 27-30 in Detroit, Michigan. We had a budget of \$4,800 for the vehicle. The vehicle consists of a motor, battery, steering components, electrical components, windshield, braking components and a carbon fiber frame. The main difference between this year's car and previous Trine University designs is the monocoque carbon fiber frame. The monocoque design will significantly reduce the vehicle's weight and improve its performance. A computer simulation was developed to provide the driver with a race strategy indicating the velocity the driver should maintain at each point along the course.



# PROFESSIONAL SOCIETY – STUDENT CHAPTERS

## American Institute of Aeronautics and Astronautics (AIAA)

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

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 Maj. James Doolittle and Maj. Lester Gardner visited campus to approve the aeronautical program for membership in the Institute of Aeronautical Sciences (IAS).

## American Institute of Chemical Engineers (AIChE)

**Advisor:** Majid Salim, Ph.D.  
**President:** Roger Chase  
**Vice President:** Madison Fain  
**Secretary:** Elijah Brandt  
**Treasurer:** Ryan Kosek  
**Student Gov't Rep:** Cameron Orr  
**JR Class Rep:** Ayasha Faria  
**SO Class Rep:** Nate Buening

AIChE is a global professional association of more than 50,000 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 around the globe. This past year, members of Trine's AIChE student chapter attended the Regional and National Conferences to compete in both AIChE Jeopardy and Chemical Engineering Car Competitions. In addition to organizing plant tours and hosting guest speakers on campus, the Trine student chapter sponsored fall and spring picnics for the Chemical Engineering Department. As a part of our commitment to encouraging the pursuit of Chemical Engineering and strong community relations between the student body and the community, the local chapter has participated in college visit days, the Steuben County Regional Science Fair, and Introduction to Engineering Day.

## American Society of Civil Engineers (ASCE)

**Advisor:** Professor T.J. Murphy  
**President:** Brad Whitehead  
**Vice President:** Rick Perry  
**Treasurer:** David Gaff  
**Corresponding Secretary:** Taylor Eash  
**Recording Secretary:** Jake Shelly

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. Additionally, service projects such as designing wheelchair-accessible ramps for the Christian Campus House allow the organization to promote civil engineering while giving back to the community. ASCE also strives for professional development via guest speakers with local professionals, and field trips such as the Ohio Contractor for a Day event and the yearly ASCE Indiana Section meeting.

## 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:** Sydney Schlafer

**Vice President:** Erika Kasen

**Secretary:** Claire Barnett

**Treasurer:** Anna Kersey

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:** Sam Driffill

**Vice President:** Ethan Price

**Treasurer:** Luke Wenger

**Secretary:** Mitch Mott



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 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.

## **Eta Kappa Nu (HKN)**

**(ELECTRICAL AND COMPUTER ENGINEERING HONOR SOCIETY)**

**Advisor:** Sameer Sharma, Ph.D.  
**President:** Bryce Hina  
**Vice President:** Samantha Stensland  
**Treasurer:** Josh Poston  
**Secretary:** Paul Jackemeyer

The Zeta Phi chapter of Eta Kappa Nu (HKN), the honor society for Electrical and Computer Engineering students, was established at Trine University in 1975. The chapter is dedicated to encouraging and recognizing individual excellence in education and admirable work in professional practice, and in any of the areas within the electrical and computer engineering fields of interest.

## **Institute of Electrical and Electronics Engineering (IEEE)**

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

The IEEE promotes the engineering process of creating, developing, integrating, sharing and applying knowledge about electrical 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, computer and software engineering students through interaction with industry and between more and less experienced students.

## **Institute of Transportation Engineers (ITE)**

**Advisor:** Ryan Overton, Ph.D.  
**President:** Rick Perry  
**Vice President:** Bradley Whitehead  
**Treasurer:** Alex Duran  
**Secretary:** David Gaff  
**Student Rep:** Austin Gurley

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 other 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, where they attend technical sessions and collaborate with professional engineers.

## **Omega Chi Epsilon (Chemical Engineering Honor Society)**

**Advisor:** John Wagner, Ph.D.  
**President:** Stuart Gillig  
**Vice President:** Joseph Jacobs  
**Treasurer:** Joshua Marty  
**Secretary:** Jordan Tinkle

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)

<b>Advisors:</b>	<b>Pavan Karra, Ph.D.</b>
<b>President:</b>	<b>Allen Oeung</b>
<b>Secretary:</b>	<b>Kendall Miller</b>
<b>Treasurer:</b>	<b>Anthony King</b>
<b>Student Senate Rep:</b>	<b>Austin Baker</b>
<b>Crew Chief (VP):</b>	<b>Austin Snyder</b>

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.

## SME

<b>Advisor:</b>	<b>Dr. Tim Jenkins</b>
<b>President:</b>	<b>Matthew Magliola</b>
<b>VP/Student Gov’t Rep:</b>	<b>Matthew Seasor</b>
<b>Secretary:</b>	<b>Devin Kershner</b>

SME has a rich and evolving heritage spanning more than 80 years. We serve the manufacturing industry as a nonprofit by promoting advanced manufacturing technology and developing a skilled workforce. 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. The Trine University SME student chapter, S280, currently has 13 student members. Chapter members attend plant tours and expert presentations from local manufacturing companies. Some of the field trips have included visits to GM Powertrain (Defiance, Ohio), Steel Dynamics (Butler, Indiana) and Caterpillar (Lafayette, Indiana). The chapter also co-sponsors Foundry Night each semester in the Bock Center foundry lab.

## Society of Women Engineers (SWE)

<b>Advisor:</b>	<b>Andrea Mitofsky, Ph.D.</b>
<b>President:</b>	<b>Robin Furnish</b>
<b>Vice President:</b>	<b>Emily Dunn</b>
<b>Secretary:</b>	<b>Kaethe Henke</b>
<b>Treasurer:</b>	<b>Sarah Tiedemann</b>
<b>Student Senate Rep:</b>	<b>Annie John</b>

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 to 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)**

<b>Advisor:</b>	<b>Ryan Overton, Ph.D.</b>
<b>President:</b>	<b>Jonathan Phillips</b>
<b>Vice President:</b>	<b>Caleb Stoffel</b>
<b>Corresponding Secretary:</b>	<b>Spencer Faull</b>
<b>Recording Secretary:</b>	<b>JJ LaBounty</b>
<b>Treasurer:</b>	<b>Zach Shepard</b>

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 their university. There are now collegiate chapters at 241 U.S. 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 Feb. 22, 1975. Each year, the student chapter hosts Engineering Futures sessions – professional seminars focusing on the “soft” skills 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, students are encouraged to travel to regional and national conferences to expand their professional networks as well as polish their leadership skills.

## **Trine University Materials Society**

<b>Advisor:</b>	<b>Darryl Webber, Ph.D., and Kai Hartman</b>
<b>President:</b>	<b>Landon Pearson</b>
<b>Vice President:</b>	<b>Zachary Shepard</b>

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 by 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 FEF, 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 industrial tours.