Welcome to the 2015 Senior Design Clinic! What you see here today are 19 projects that were nothing more than ideas 8 months ago. 18 companies and non-profits have engaged our students with the real life experience of asking, “is it possible?” then letting the teams go to work. The teams will all tell you that at times it got tough and they themselves weren’t sure how it was all going to unfold. And that is exactly what we are trying to capture in the St. Thomas Senior Design Clinic. Where the comforts of well-defined textbook problems are abandoned, real engineering emerges. What you see here today is the manifestation of that uncertain process of translating ideas into reality.

In short, what you see here today is engineering.

On behalf of the School of Engineering faculty, I would like to thank you for coming today. We are grateful for the support of the sponsoring companies and non-profits who have committed the funds, equipment, and time to truly make this a great experience for our students. And lastly, we are especially grateful for the support of the family and friends that each one of our seniors has relied upon to make it this far in their incredible life journey.

Again, thank you and enjoy!

Don Weinkauf - Dean of Engineering
To find out more about how your company can get involved with the Senior Design Clinic at St. Thomas, just call our main office.
(651) 962-5750

or email: dhweinkauf@stthomas.edu
Electric Machine Hood Redesign

Team
Andy Blommer, Ibrahim Wardi, Quinn Mogil, and Kevin Mealey

Clinic Advisor
Surya Iyer

Industry Representative
Nate Murfield

Project Summary
Electric Machinery (EM) is located in Minneapolis, MN, known for designing and manufacturing custom large-scale electric motors and generators. The weather-protected tier II (WPII) hood enclosure of EM’s slow speed synchronous motor needs to be redesigned. The current design and manufacturing process needs improvements in efficiency and standardization. The team will provide a completed CAD model and manufacturing drawings of the design using SolidWorks. Computational fluid, structural, and modal analysis will be provided to ensure the design meets the appropriate standards and design requirements.

Design Goal
Create a new enclosure design that reduces the cost to manufacture by 25%, reduces the size by 10%, and maintains all WPII industry standards. The design should be scalable and maintain the performance of the motor.

Design Constraints
- WPII standard (NEMA MG-1, section 1.25.8.2) requires a minimum number of 90 air flow turns (3) and a maximum inlet air velocity (600 ft./min).
- The base plate of the enclosure must fit over the current motor configuration.
- The split flow path must be maintained.
Team
Cole Harris, Brandon Hoshaw, Aaron Johnson, and Hezam Alhajri

Clinic Advisor
Chris Haas

Industry Representative
Steve Pribyl

Project Summary
At the end of the WC 65 patio door production line in Andersen’s Bayport facility, packaged doors must be moved off from a packaging table to a loading table. The transfer process currently used is a manual push from the operator. These packaged doors can weigh up to 200 lbs. and can harm the operators back and shoulders. The team was brought in to come up with a solution that would eliminate the manual aspects of this process. The team developed a solution using a belt transfer system to transfer the doors. A transfer system was designed and built to be used in the current production line and will fulfill design constraints.

Design Goal
Our Design goal was to take away the manual push of the packaged door and replace it with an automated process.

Design Constraints
- Does not scratch or damage the panel or packaging.
- Capable of moving packages varying in weight from 81 pounds to 200 pounds and between 27 and 48 inches in width and between 70 and 96 in height.
- Pneumatically or electrically powered with a 480V (or smaller) electric supply or with house air at 90 psi.
- Does not increase the cycle time of the line by more than 5 seconds.
Submersible Fuel Transfer Pump

Team
Quinn Impola, Sean Lipinski, Teegan Harrington, and Will Peckels

Clinic Advisor
Tom Shepard

Industry Representatives
Ben Paar, Mark Bauck, and Brad Kahler

Project Summary
Graco, a world leader in fluid handling equipment, is looking to expand their fuel dispensing equipment through the addition of a submersible fuel pump. The team designed a new type of submersible fuel pump by adapting existing rotary vane technology. To combat the loss in prime caused by the competitor’s pumps location above the fuel, the team has designed, built, and tested a pump that is submerged in the fuel. Using a flow meter and pressure sensors, with theoretical calculations, the team characterized the design variables responsible to optimize the pump efficiency.

Design Goal
The goal of this project is to design a submersible fuel pump that will eliminate the pump priming issues that the current market of fuel transfer pumps suffer.

Design Constraints
• Design needs to fit into existing 2-inch bunghole on fuel tanks
• Pumps at 15 gallons per minute
• Runs at temperature range of -20°F to 125°F
**Injera Bread Cooker**

**Team**  
Brent Moua, Tien-Dat Nguyen, Claire Choudek, and Matias Nagel

**Clinic Advisors**  
Camille George and Jeff Hammer

**Sponsor Name**  
Ame Gelalecha, Greg Mowry

**Project Summary**  
This project aims to develop an injera bread cooker, or mitad, which is efficient, economical, modern, and easily assembled in Ethiopia using local materials. Injera, the national bread staple of Ethiopia, is traditionally made out of teff flour and consumed at almost every meal. The team strives to improve the design of 2013-2014 senior design team’s electric mitad prototype. Improvements are to be made to the homogeneity of the cooking surface temperature, temperature control, heat up time, and insulation. A major improvement was the change of the cooking plate from clay to aluminum. This provided the team with more design flexibility and the ability to create a streamlined, modern appliance.

**Design Goal**  
The main goal of this project was to improve the homogeneity of the heating surface without compromising the gains made by last year’s prototype.

**Design Constraints**  
- Power consumption of 2kW or less
- Homogeneous heating profile
- 20” cooking plate
- Non-stick surface
Advanced Turkey Timer

Team
Kyle Statsman, William Ogren, Cole Hazelbaker, and Megan McGill

Clinic Advisor
Kundan Nepal

Industry Representatives
Shelly Venenga, Petri Papinaho

Project Summary
The design team from the University of Saint Thomas is working with Jennie-O’s Oven Ready line of turkey products. Oven Ready turkeys come frozen, packaged in a pre-seasoned cooking bag, with a traditional pop-up timer inserted into the turkey. As the turkey is cooking, the seasonings darken the inside of the bag, obscuring the cook’s view of the turkey. By the time the turkey is done cooking, it is difficult to determine if the pop-up timer has popped. Additionally, the timer gives no indication of how long the turkey has been at the correct temperature once it has popped.

Design Goal
The goal of the project is to build, design and test a proof of concept timer that addresses the challenges with the current timer.

Design Constraints
- Must not perforate the external packaging
- Accurately reflect the temperature in the center of the breast muscle
- Must not be obtrusively large
- Accurate to +/-2°F
- Appealing to consumers
- Give an auditory/visual indication of product reaching 165°F
- Provide feedback as to approximate cook time remaining
Exoskeletal Range of Motion Assistance Device

Team
Lauren Thornhill, Max Keenan, Cherjay Thao, and Kate Steuer

Clinic Advisor
Katherine Acton and Sarah Baxter

Company Sponsor
Tom Kramer

Project Summary
Magic Arms for the World is a non-profit company looking to develop assistance devices for children affected with Arthrogryposis Multiplex Congenita. Children born with this disease, more than 6000 in the U.S., have a very limited ability to move their arms. This lack of mobility affects many areas of their developmental life, including mental development. Current assistive, exoskeletal devices are large and clunky, time consuming to make and expensive. They are difficult to fit to individual children, not adjustable, and often the insurance companies do not reimburse their cost. The design team has been asked to redesign an existing device, known as the Wrex, to address these problems.

Design Goal
The specific goal of the Magic Arms project is to redesign the Wrex device so that it is less expensive and can be easily fabricated and adjusted to fit an individual child, both initially and as the child grows. Secondary goals include making the device more “kid-friendly” i.e. easier

to fit under clothes, water-proof and easy to clean.

Design Constraints
New Prototype for 4-6 year old child must
- Be adjustable to at least 1.5”
- Minimize vest fitting time by removing plaster-casted vest component
- Links, elbow, and wrist design must maintain 4 degrees of freedom
- Be scalable for children 6 yrs. of age
- Sleek and close-fitting to body
Formula SAE Racecar Telemetry System

Team
Matt Nafe, Tyler Porter, Dan Hellkamp, and Joe Lewis

Clinic Advisor
Ramesh Rajagopalan

Sponsor
UST School of Engineering

Industry Representative
Andy Tubesing

Project Summary
Each year the University of St. Thomas’s Formula Society of Automotive Engineering (FSAE) Team designs and builds a race car for competition at Michigan International Speedway. The team and their vehicle are judged on a variety of criteria, including; project logistics, vehicle design, and vehicle performance. A system that would allow for wireless data acquisition from the vehicle as it is being operated is requested. This system would allow the team to view information such as engine temperatures, fluid pressures, RPM readings, GPS, and a live video feed from the vehicle, on a large interface in the pit stall.

Design Goal
The goal of this project is to collect sensor data from the FSAE race car and wirelessly transmit it back to the pit stall at distances up to ½ mile. The data shall be displayed on a user friendly interface in real time on a portable base station.

Design Constraints
- 5 lb. maximum system weight
- ½ mile transmission distance
- Less than 2 second data transmission delay (Real Time)
- Ability to log the data for future viewing.
Synthetic Magnetic Vascular Grafts

MAYO CLINIC

Team
Sam Shreve, Andrew Hornik, Alyssa Johnson, and Michael Foerster

Clinic Advisor
Brittany Nelson-Cheeseman

Industry Representatives
Brandon Tefft, Susheil Uthamaraj, Sean McEligot, Dan Dragomir Daescu

Project Summary
Existing synthetic vascular grafts are susceptible to blood clots and excessive scar tissue when used in small diameter applications (< 6mm). The chances of rejection are greatly reduced by applying a layer of endothelial cells to the inner surface of the graft. Magnetic synthetic vascular grafts have been developed to attract magnetically labeled endothelial cells to reduce the chance of graft failure.

The team refined the current fabrication process, creating thin magnetic disks to simplify the geometry for magnetic characterization. Various methods were explored to increase the retentive magnetic field strength of the samples. These included increasing disk thickness, increasing CoCr content, and exploring the use of different ferromagnetic materials.

Design Goal
The goal of this project was to increase the retentive magnetic field strength of the porous synthetic magnetic grafts, with a stretch goal to achieve endothelial cell capture.

Design Constraints
Magnetic Disk Samples must have:
- Uniform disk thickness between 0.5-1.0mm
- Porosity 60-80% with a pore size from 25-100µm
- Retentive magnetic field strength of 300mG or greater
Light-Cured Conformable Polymer Stents

MAYO CLINIC

Team
Kernal Buhler, Garen David, Chris Lanari, and Michael Trinh

Clinic Advisors
James Ellingson and Chris Haas

Industry Representatives
Dr. Susheil Uthamaraj, Dr. Brandon Tefft, Dr. Dan Dragomir-Daescu, and Dr. Sean McEligot

Project Summary
When plaque build-up blocks blood flow, coronary intervention surgeons use a catheter balloon to break up this build-up and restore the blood vessel's original cross-section. A stent is crimped around the balloon to stay in place post-procedure, helping prop open the blood vessel as it heals. Stents are currently made from a metal mesh. However, metal stents do not conform well to varying blood vessel geometries such as elbows, narrowing, and bifurcation. Mayo Clinic is developing a polymer stent that conforms better to varying blood vessel geometries. The team is tasked with developing and prototyping this conformable stent.

Design Goal
Improve conformable stent fabrication process to enable construction of a 2:1 size prototype.

Design Constraints
- 12 mm diameter prototype
- Curable inside a 2:1 sized blood vessel model, using ultraviolet radiation, in under 2 minutes
- Retain mechanical strength to support artery
Automated Cleaner for 3D Printed Parts

Team
Michael Eigenmann, Zach Vidlund, Connor Hanson, and Christine Gorzycki

Clinic Advisor
Chris Haas

Industry Representative
Brian Dobson, Tom Bergner, and Chris Young

Project Summary
Starkey is a leader in manufacturing and delivering hearing solutions. Their 3D printed hearing aid part prototypes are covered in wax structures that assist in the printing process. The team was tasked to create a machine that will automate the wax removal process. The team created a machine that is fully automated and can remove the wax structures by passing parts through a series of heated, mechanically agitated, fluid bath cycles and ultimately produce clean 3D printed parts free of wax and ready for use.

Design Goal
Construct a device capable of fully removing wax from 3D printed parts of a wide variety of shapes and sizes. The device must require no user interference after set-up and be fully automated.

Design Constraints
- Must remove wax from small interior geometries
- Limited power supply of 120 Volts
- Full cycle must be less than 2 hours
- Temperature of parts cannot exceed 70°C
Pre-Paint Bumper Scuffing

Team
James Beard, Luke Halloran, Saad Alhajri, and Zach Berglund

Clinic Advisor
Ravi Sura

Industry Representatives
Paul D. Graham, John W. Henderson, and Steve C. Joseph

Project Summary
3M’s Automotive Aftermarket Division is looking to increase automotive painting throughput. Bumper scuffing helps paint adhesion and is commonly completed manually. The team’s main focus was to determine an automated process which will allow the painter to maximize the time spent applying paint. The proposed solution consists of an arm that traverses a single axis power screw and rotates at either end of the motion. Current work is on optimizing the blasting variables will inform the continuing design of the automated system.

Design Goal
The goal for this project was to research and design an automated device which imparts a surface finish capable of achieving sufficient mechanical paint adhesion to bumper covers.

Design Constraints
- Must scuff plastic bumper equivalent to the results of manual processing
- Each cycle will take less than 20 minutes
Rotary Union Test Stand

Team
Jake Knowles, Ethan Podritz, Kelsey Gates, and Bryan Ramler

Clinic Advisor
Bob Mahmoodi

Industry Representative
Ross Wenk

Project Summary
Dynamic Sealing Technologies Inc. (DSTI) is a manufacturer of custom rotary unions, devices that allow for the transfer of fluid between a stationary part and a rotating component. Unions are tested for proper function and durability before being supplied to the customer. Currently, DSTI uses a lathe to turn the union being tested. The team is tasked with creating a test stand that will automate the testing procedure that is currently labor and equipment intensive. This test stand will accommodate a variety of union sizes while taking temperature, torque, and rpm measurements.

Design Goal
Develop a complete design of a test stand that turns rotary unions while collecting temperature and torque data. Provide CAD drawings, finite element analysis, a bill of materials, and a list of suggested suppliers.

Design Constraints
The test stand will operate under the following conditions:
- Minimum rotational speed of union: 1 rpm
- Maximum rotational speed of union: 350 rpm
- Minimum required to turn union: near 0 ft-lb at 350 rpm
- Maximum required to turn union: 1000 ft-lb at 1 rpm
- Weight of union to be supported by stand: up to 1000 lbs.
- Record temperatures up to 350 F within ± 1°F
- Record torque data up to 1000 ft-lbs. within ± 2 ft-lb
Automated Deburring Knife Grinding

Team
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Clinic Advisor
John Wentz

Industry Representatives
Sean Bradshaw, Dave Mooney

Project Summary
1000-1200 deburring knives are made each week at RMS to deburr machined parts. Machine operators use these knives to clean the small medical devices that RMS manufactures. Each knife is 2 inches long, features a point with 3 faces and is used until broken or worn and then discarded. With each knife costing $5-$8, the current process RMS uses is not economical. The team is designing and building an automated system for sharpening these knives so that they may be reused. The system incorporates a programmable XY table that feeds the knives across a diamond grinding wheel to sharpen each knife.

Design Goal
The goal of this project was to design a system for sharpening knives that required minimal user input and could sharpen each knife multiple times.

Design Constraints
- Grinding process shall be automated
- The device shall include a dust containment system
- The device shall sharpen the knives in a way to not compromise their effectiveness
**Long Range Quad-Copter**

**Team**
Trevor Maninga, Tony Jaworski, Chris Nagel, Roy Pillers, and Alex Niewenhuis

**Clinic Advisor**
Chris Greene

**Sponsors**
Larry and Rolly Rauenhorst

**Project Summary**
It is expected that there will be increased use of unmanned aerial vehicles (UAVs) in agriculture. The Rauenhorsts, who are commercial farmers, believe that multi-rotor vehicles are the best choice for farmers involved in precision agriculture. This project looked at the interactions between the motors, propellers, and batteries to theoretically and experimentally determine the best possible motor propeller combination. The team also looked at the different possible configurations in terms of body and number of propellers, which were narrowed down by weight and compatibility with the control board and then tested in a controlled environment, to understand the effects of propeller wash interference in flight.

**Design Goal**
To research and design the best multi-rotor vehicle possible with today’s technology using calculation, experimentation, and analysis presuming a constant ground speed of 25 miles per hour.

**Design Constraints**
- The vehicle shall weigh no more than 3.5 lbs.
- The vehicle shall be capable of maintaining a ground speed of 25 mph.
- The vehicle shall be able to survive a controlled landing, involving less than a foot of drop distance.
- The vehicle shall be powered by a Lithium Polymer Battery.
- The vehicle’s propellers shall be T-style propellers for safety reasons.
Autonomous Crop Rover Vehicle

Team
Thomas Gray, Paul Underwood, Lucas Unger, Bianca Peterson, and Paul Latt

Clinic Advisor
Tony Beck

Industry Representative
Scott Morgan

Project Summary
Stealth Engineering is involved in developing autonomous vehicles for use with precision agriculture and the UST Center for Optimal Autonomy and Control. The team was tasked with designing and constructing a ground based platform capable of hosting farm-related crop sensors. The rover platform can traverse fields where crops are grown while the hosted sensors collect data on targeted crops and fields. The final rover design utilizes tracks to minimize its footprint and hydraulic motors to drive the platform forward. Trade studies that analyze the forces, footprint, center of gravity, suspension architecture, and power conversion design have been completed and delivered as part of this project.

Design Goal
The goal of this project is to design a ground based crop rover platform that can host sensor equipment capable of gathering basic agronomy information about the conditions in which commercial plant cultures are grown. The gathering of this information will increase the efficiency of farming and improve the health of crops.

Design Constraints
- The Rover shall have a maximum weight of 100 kilos.
- The Rover center of gravity shall be designed to allow the platform to safely navigate a 25-degree slope (front to back or side to side).
- The Rover shall have a maximum velocity of at least 16 kph [or 32 kph (objective)].
- The Rover shall have a minimum operational range of 1.6 kilometers.
Discrete Length Coating of Guidewires

Team
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Clinic Advisor
Todd Jones

Industry Representative
Arne Rimmereide

Project Summary
Lake Region Medical currently operates a small-scale, discrete-length wire coating process that coats small diameter guidewires with a PTFE coating. Discrete-length coating is the process of coating wires of finite length, compared to a continuous spool of material. They are interested in reducing defects on these guidewires, which can be used to direct catheters and other medical devices within the body. The defects are classified as inconsistent coating and clumps. The team conducted a root cause and statistical analysis to address the causes of the defects, such as vibrations, coating flow rate, and cleanliness. Improved pre-cleaning procedures showed a significant reduction in defects.

Design Goal
The goal of the project is to decrease the amount of defects in the Polytetrafluoroethylene (PTFE) coating, on discrete length medical guidewires. This analysis will help the team provide Lake Region Medical with designs to address coating defects.

Design Constraints
- Wire material: MP35N
- Wire lengths: 180-270 cm.
- Wire diameter: 0.005 – 0.018 in.
- Base coat of PTFE
Micro Perforation Inspection System

Team
Josh Martin, Alex Maslakow, Mitchell Hoffmann and Thomas Fuller

Clinic Advisor
Greg Mowry

Industry Representative
Andy Gikling

Project Summary
LasX Industries, Inc. manufactures high-performance laser systems. Their primary product—the Laser Processing Module (LPM)—is used to create precisely bore micro perforations in polymer films which are used in food packaging. The perforations allow for a controlled atmosphere in the packaging which extends the shelf-life of the food. LasX wants to develop the ability to measure the perforations on-line using a visual inspection system. Integration of a visual inspection system to the existing LPM will allow the perforation dimensions, measured by the camera, to be used to automatically adjust the laser that is creating the perforations. This would allow the LPM to become a closed loop system.

Design Goal
The goal of this project is to create a visual inspection system—consisting of a machine vision camera, telecentric lens, multimode laser light, and specialized image acquisition software—at a minimal cost but with the ability to measure micro perforations at very high speeds.

Design Constraints
- Primary component cost around $2000
- Capture clear images of the perforation with a web speed of 2000 ft./min (10m/s)
- Measure perforations that range from 100μm to 500μm
Heated Platen Profiling

MINCO

Team
Seamus Kane, Nicolas Benish, Matthew Koehler, and Mohammed Albrahim

Clinic Advisor
Surya Iyer

Industry Representative
Isaac Remer

Project Summary
Minco Products designs and manufactures devices for heating and sensing, as well as flexible circuit and control solutions. Their products see use in medical devices, rocketry, military vehicles and weapons, and semiconductor manufacture. MINCO desires a way to reduce time spent on the design of their custom profiled heaters through streamlining the profiling process and removing excessive iteration. The team developed a robust five step method for profiling custom heaters and designed a coded algorithm around said method. The method was validated through physical testing and simulations in ANSYS FEA software.

Project Goal
The goal for this project was to develop and validate a profiling method for circular MINCO Thermofoil™ Heaters.

Design Constraints
- Circular heater design
- Heater diameter is no greater than 12in. diameter
- Maximum operating temperature range of the heater is 250°C
- Temperature on the top surface of the heater must not vary more than 2°C
- No more than 2 ANSYS simulations may be utilized in profiling method
Mapping Resistance within Capacitive Touch Panels

Team
Sara Hemmer, Henry Kinane, Raed Alhajri, and Ian McHattie

Clinic Advisor
Ranjan K. Chakravarty

Industry Representative
Robert J. Monson

Project Summary
Carestream Health has developed a next generation capacitive touch panel, an alternative to the standard indium-tin oxide touch panels utilizing a new more transparent, flexible conductive film called Flexx™. The team was tasked to investigate methods that can measure and map the resistance in a Flexx™ film touch panel and provide data on the electrical characteristics inside an assembled touch panel.

Design Goal
The goal is to create a simple test to provide feedback of the touch panel’s internal transmission line characteristics. Sought out information includes capacitance and resistance per unit length. The test will use these characteristics to identify problem areas and provide engineers with sufficient data for implementation of controls or future designs changes.

Design Constraints
- Testing method shall not render the touch panel unusable. No undue damage caused by the measurement taken.
- Reasonable consideration with design of future touch panels. Design shall accommodate all models of FlexxTM film touch panels.
Vertical Axis Wind Turbine

AF Energy

Team
John Simpson, Chris Hannigan, Jeff Timm, and Andre Kuhn

Team Advisor
Ranjan Chakravarty

AF Energy Representatives
John Alexander
Steve Fuchs

Project Summary
The Vertical Axis Wind Tunnel (VAWT) project has been a joint operation between AF Energy and the University of Saint Thomas for two years. This is the third year of improvements culminating in a wind turbine that will be able to produce power for industrial applications. Our team’s mission was to take the next step in the VAWT’s production by creating a completed wind turbine that can be tested. In order to achieve this goal mechanical improvements are needed and a generator tailored to the VAWT’s output potential.

Project Goal
To produce a VAWT prototype that can withstand testing in high wind conditions, producing a power curve displaying the wind turbines output characteristics.

Design Constraints
- Combined weight shall weigh no more than 800lbs
- Improve on previous team’s design
Sam Cam

Team
Majed Alharbi, Kelly Brandenburg, Stephanie McCartan, Ben Bibeau, and Doug Pflaum

Clinic Advisor
Anton Beck

Industry Representative
Sam Friedrichs

Project Summary
National Geographic’s underwater Crittercam was first introduced as a research tool in 1987. This camera system attaches to various oceanic species where it records the behaviors and interactions of ocean life. The video footage reveals unknown habits without any disturbance from a human’s presence. The sponsor, Sam Friedrichs, has used the Crittercam since 2011 and focuses much of his research in the study of large billfish. Out of the 50 deployments he has initiated, he has lost 5 Crittercam systems due to a malfunctioning release mechanism. At ~$5000 a system, these losses have proven to be crippling to Friedrichs’ work. Friedrichs sought out help from the University of St. Thomas engineering program in the hopes of redesigning this system to make it more cost effective and reliable.

Problem Statement
The Crittercam design is bulky, expensive, and unreliable:
- 12.5” long, 3” maximum outer diameter
- $5,000 per system
- 10% failure rate

Design Constraints
- Design an underwater camera system that will:
  - Attach to oceanic billfish
  - Perform at depths of 2000ft (~900psi)
  - Be smaller and less expensive (~$500)
  - Reliably release at a predetermined time
    - 1-5 hours, increments of 1 hour
    - Accuracy +/- 30 minutes
    - Maximum of 5% failure rate
  - When released, will float to the surface to be located so data can be collected
The Grasshopper Pipeline Welding Ground

Universal Engineering Services, Inc.

Team:
Brice Lu, Abdullah Alzahrani, Grant Mongin, and Carl Willkom,

Advisor:
Chris Haas

Industry Representative:
Mathew Michel

Project Summary:
Grasshoppers are used to ground electric current during pipeline welding operations in the field. Most grasshoppers are built and designed by each welder. Tommy Carter, a 60 year veteran of the industry, has his own version of a Grasshopper. Relatives of Tommy contacted Universal Engineering Services to create a manufacturable design that held true to Tommy Carter’s original. Universal Engineering Services then partnered with the University of St. Thomas Senior Design team to accomplish this goal.

Design Goal:
Provide a product that improves upon Tommy Carter’s original, in particular the manufacturability, without a dramatic redesign. The device must be manufactured for under $125 dollars, and safely ground electric current during pipeline welding. The team will provide Mathew Michel of Universal Engineering Services with testing plans, engineering drawings, and a manufacturing plan to immediately take the Grasshopper into production.

Design Constraints:
- Must be able to conduct a maximum of 400 Amps for 1 hour.
- Must adapt to diameters of pipe ranging from 4 to 60 inches.
- Must have a manufacturing cost of under $125.
- Device must be able to withstand falls from up to 40 feet.
- Device must look similar to Tommy Carter’s original design.
- Setup time must be less than 90 seconds.
Energy Harvesting Device (EHD)

Team
Anna Hegdahl, Benjamin Stassen, Christopher Stack, Andrew Grunloh, and Walter Franklin

Clinic Advisor
Thomas Shepard

Industry representatives:
Benjamin Paar, Eric Mjolus, Igor Radzyuk

Project Summary
The EHD project is focused on supporting Graco’s Industrial Lubrication Equipment (ILE). The ILE product line includes products which control, pump, meter, and dispense lubricants necessary to keep fixed and mobile machinery operating. According to Graco, automatic grease and oil lubrication systems are increasingly replacing manual lubrication operations. The EHD project focused on designing a device that can be attached to a grease injector indicator pin that is capable of harvesting energy from its mechanical motion.

Design Goal
Create a device that can be attached to the indicator pin capable of harvesting the mechanical indicator pin motion to signal a successful lube event and power a wireless communication circuit.

Design Constraints
- Retro-fit to existing model GL-1 injector
- Generate minimum .54mJ of energy from mechanical pin motion
- Cost of device < $50
- Must meet Graco’s environmental, vibration, and lifecycle requirements
Thank you, Seniors!