design expo 2015
A showcase of enterprise and senior design student projects
imagination • collaboration • innovation • solutions
ITC is proud to sponsor Michigan Tech’s 2015 Design Expo.

If this is your first visit to Michigan Tech’s Design Expo, you will be astounded at the creativity and sophistication of the demonstrations and displays at this event. These Enterprise and Senior Design Student Projects are more than the products of student imagination. They reflect everything that goes into an engineer’s education and preparation at MTU – a dedicated and involved faculty and staff, a laser-focused administration and tremendously supportive alumni, donors and corporate benefactors. It all adds up to an environment that produces top-tier engineers who are fully prepared to take on and master the most difficult real-world challenges.

Jon E. Jipping, PE
Executive Vice President and Chief Operating Officer
ITC Holdings Corp.
MTU class of 1991 – MS, Electrical Engineering

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Undergraduate Expo

Michigan Tech Design Expo 2015

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Senior Design

Senior Design

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More Special Thanks

To the distinguished judges who give of their time and talents to help make the Design Expo a success, to the faculty advisors who generously and richly support Enterprise and Senior Design, and to all the behind-the-scenes superstars—you know who you are—thank you for your dedication to our students.

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   Director, Enterprise Program

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Scope

Design Expo highlights hands-on, discovery-based learning at Michigan Tech. More than 600 students on Enterprise and Senior Design teams showcase their work and compete for awards. A panel of judges, made up of distinguished corporate representatives and Michigan Tech staff and faculty members, critique the projects. Many team projects are sponsored by industry, which allows students to gain valuable experience through competition, as well as direct exposure to real industrial problems. Design Expo is hosted by the College of Engineering and the Pavlis Honors College.

Student Awards

BLACK & VEATCH

Building a World of Difference® Senior Design Award
   Based on poster
      First place—$150
      Second place—$100
      Third place—$75
      Honorable mention—$50 (three to be awarded)

MERITOR


Enterprise Awards
   Based on poster and presentation
      First place—$300
      Second place—$150
      Third place—$100

Design Expo Image Contest
   Photo or non-photo graphics
      First place—$100
      Second place—$50

On the cover

Velovations team member Derek Turner puts the final touches on a frame-testing setup. The Enterprise team is dedicated to collaborating with the bicycle industry to develop new products and processes. This photo, submitted by the team, won first place in the Design Expo Image Contest last year.
Don’t just declare your major, create your path! We invite highly-motivated students, regardless of GPA and test scores, to participate in our distinctive programs. In the Pavlis Honors College, we believe that every student should take advantage of the great opportunities that Michigan Tech has to offer outside of the classroom. That’s why we’ve identified several leadership pathways from which to choose. Choose one, mix and match a couple, or design your own. Each pathway showcases high-impact opportunities for you—visit our website, explore the pathways, and create yours!

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Pavlis Institute Intern Abroad

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Enterprise Entrepreneurship

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PAVLIS HONORS COLLEGE
Home to the Enterprise Program
Welcome to Design Expo 2015

Design Expo highlights the core foundations of a Michigan Tech education: experiential learning; teamwork; application of theory, design, and innovation; leadership and communication; and multidisciplinary solutions to problems. The Enterprise and Senior Design students showcasing their projects today have embraced these foundations. We take tremendous pride in their accomplishments and hard work.

Michigan Tech’s innovative Enterprise program enables interdisciplinary learning, leadership development, and team-based work. Teams of first- through fourth-year students from diverse disciplines operate much like real companies to develop products, processes, and services within their market space. Faculty advisors serve as coaches and mentors, with industry leaders playing a supporting role as collaborators and clients.

Senior Design enables small teams of highly dedicated students to explore and solve real industry challenges throughout their senior year. Our program connects students and industry through open-ended projects, which enable teams to experience and follow the complete design process—from ideation to realization.

We would like to take this opportunity to thank the 200 partners and sponsors who generously support our educational mission by providing invaluable project experiences, along with guidance and mentorship for our students. The benefits of industry and academia working together as partners in higher education are clearly evident at Michigan Tech’s Design Expo.

As you visit with our students today, be sure to challenge them with your questions and encourage them with your praise. Enjoy your Design Expo experience.

Sincerely,

Leonard J. Bohmann  
Associate Dean for Academic Affairs  
College of Engineering

Mary Raber  
Associate Director, Pavlis Honors College  
Director, Enterprise Program
**Team Members**  
Mareah Meulemans, Arick Lagowski, Brent Myers, Elyssa Furmanski and Tiffany Moore, Biomedical Engineering  
Advisor  
Rupak Rajachar, Biomedical Engineering  
Sponsor  
Medtronic

**Project Overview**  
The primary complications with pacemakers include lead dislodgements, pneumothorax from vein access, pocket hematomas and pocket infections. Over the past few years, Medtronic has created a pacemaker that is implanted directly in the right ventricle which benefits patients who need only pacing. However, for patients with heart failure, pacing the left side of the heart is more advantageous. The goal of this project is to design a fixation system that can attach a 1 cc rectangular pacemaker to the heart. The fixation must be able to be repositioned and it must be delivered at a distance via a small tube. The delivery tool needs to be considered but not the main objective.

**Team Members**  
Rion Mott, Evan Bajek, Michael Spenle, and Daryl Bennet, Electrical Engineering  
Advisor  
John Lukowski, Electrical and Computer Engineering  
Sponsor  
ITC Holdings

**Project Overview**  
ITC Holdings is the nation’s largest independent electricity transmission company. ITC has transmission systems throughout the Midwest and supply a peak load over 25,000 megawatts. Geomagnetically-Induced Current (GIC) is a phenomenon caused when solar winds interact with the earth’s magnetosphere causing DC currents to be created in AC transmission lines that can damage transformers and other equipment. Transformers and GIC mitigation are both expensive. A GIC monitoring system can determine what protection and mitigation is required for ITC’s transmission system. The project is a continuation from last year to further develop a system not only to detect GIC but also communicate this data using the existing ITC networks.

**Team Members**  
Corey Downing, Ben Turner, Jeremy Mims, Stuart Montgomery, and Jordan Kubista, Mechanical Engineering  
Advisor  
Charles Van Karsen, Mechanical Engineering-Engineering Mechanics  
Sponsors  
Fiat Chrysler Automobiles, ArcelorMittal

**Project Overview**  
The team was charged with the design and implementation of a side cargo access and human entry point on a RAM 1500 truck bed. The forward section of the truck bed has limited access for many types of cargo. A forward access system will provide improved usage of this area and allow more efficient load and unload activities. The new design allows ease of access to cargo stored inside and near the front of the truck bed. It allows ease of entry into and out of the truck bed. It meets all functional objectives of a truck bed and door systems such as durability, sag, set, closing efforts. The design accommodates typical customer accessories such as tonneau covers, bed caps, tie downs and cargo dividers.
104 Dynamometer Calibration Device

Team Members
Kristopher Benaglio, Christopher DeGroot, Adam Deibler, Kenneth Smith, Mechanical Engineering
Advisor
Paul van Susante, Mechanical Engineering-Engineering Mechanics
Sponsor
John Deere

Project Overview
This design team is working with John Deere to develop a new dynamometer torque meter calibration device. A dynamometer, commonly referred to as a dyno, is a popular test instrument used to measure variables such as torque, speed, and power output. The current calibration method used by John Deere utilizes a static weight stack attached to a moment arm. This design must be replaced because it exceeds the dynamometer test cell envelope, is difficult to transport from test cell to test cell, requires considerable time and effort for two workers to assemble and disassemble, and requires the repetitive lifting of 40 to 45 pound weights.

105 Wood Chipper Chute Optimization

Team Members
Cameron Knapp and Dirk Van Appledorn, Mechanical Engineering Technology
Advisor
Linda Wanless, School of Technology
Sponsors
Pettibone Traverse, Barko Hydraulics

Project Overview
Our objective is to redesign the existing wood chipper chute of a particular model of Barko and Pettibone's design. We are to improve the material flow within the chute to achieve a further discharge distance.

106 Enhanced High-G Fuze Test Rig Design

Team Members
Beau Barber, Brian Haupt, Ivan Niemi, Brian Page, and David Waters, Mechanical Engineering
Advisor
Charles Van Karsen, Mechanical Engineering-Engineering Mechanics
Sponsor
Air Force Research Labs (AFRL)

Project Overview
Bunker Busters are designed to impact and penetrate hard targets up to 60 ft thick to neutralize enemy threats. The electrical control systems that determine how the bombs fly and when they detonate are termed fuzes. With extreme impact forces needed to penetrate this type of barrier at high velocities, special testing is required to qualify the fuze system. Our team worked with AFRL to redesign and improve the fuze test rig. The team focused on improved maintainability, accuracy, and precision while including environment modification capabilities previously unavailable.
**MacLean-Fogg Component Solutions—Mine Bit Manufacturing Process**

Team Members
Joseph Jendrusina, Sean Kuchta, Michael Larson, and Tyler Nault, Mechanical Engineering

Advisor
William Endres, Mechanical Engineering-Engineering Mechanics

Sponsor
MacLean-Fogg Component Solutions

Project Overview
MacLean-Fogg currently uses a batch and queue process for their mine bit manufacturing. Our team was tasked with generating a one-piece pull system to eliminate work in progress inventory, consignment at customer locations, and increase value added for the process. Our team designed a cellular machine layout incorporating a vertical conveyor and drop gate to achieve a one-piece pull system. Aspects of lean manufacturing were incorporated into the project.

**Alcoa’s airfoil castings are main components of aircraft engines**

Team Members
Alex Reinl, Emily Veltman, Jenna Proctor, and Laura Jewett, Materials Science and Engineering

Advisor
Walt Milligan, Materials Science and Engineering

Sponsor
Alcoa Howmet

Project Overview
Alcoa Howmet is a leading manufacturer of components for the jet aircraft, industrial gas turbine, and other advanced-technology industries. One such technology is casting nominally single crystal parts with a specified orientation for the primary growth direction. Due to the complexity of the parts, this technique is not 100 percent successful and many parts solidify unintentionally into polycrystals. Parts with a misorientation across the grain boundary above a specified value are scrapped, resulting in significant cost to Alcoa. Thus, the objective of this study is to quantify the degradation of mechanical properties relative to grain boundary misorientation between 8 to 15 degrees in order to explore the possibility of expanding the specification.

**Improved Parts Transportation System**

Team Members
Timothy Steinmetz, Nicholas Zochowski, Zachary Karsten, and Jun Zou, Mechanical Engineering

Advisor
Kevin Johnson, Mechanical Engineering-Engineering Mechanics

Sponsor
MacLean-Fogg Component Solutions

Project Overview
MacLean-Fogg Component Solutions requires an improved method of transporting automotive wheel nut blanks from a vibratory feeder bowl to a tapper. The current system is operating at approximately 50 percent efficiency. The primary goal of this project is to boost efficiency to at least 80 percent. This equates to an output rate of at least 16,000 parts per shift. An increase in efficiency would allow MacLean-Fogg to reduce excess shifts involved with the after-hour and weekend production that is currently taking place to keep up with customer demands, thereby reducing costs.
### Design and Development of an Automated Stacker for Highway Products of Nucor Steel Corporation

**Team Members**
- Logan Edwards, Sean Hayes, Stephen Penny, Electrical Engineering Technology; and Shashank Lakshikanth, Mechanical Engineering
- Seyyedmohsen Azizi, School of Technology

**Advisor**
- Seyyedmohsen Azizi, School of Technology

**Sponsor**
- Nucor Steel Corporation

**Project Overview**
In this project, a robotic stacker is designed to enable precise stacking of highway sign posts produced by Nucor Steel Corporation, while complying with the required stacking pattern as well as time constraints. Currently this process relies heavily on a manual work force, introducing many safety hazards as well as inefficiencies and inconsistencies. This project offers a robotic stacker solution using Fanuc robot manipulators, custom-built end-effectors, and a programmable logic controller (PLC) integrated with human machine interface (HMI). This will result in smaller and organized stacks as compared to the current disorganized bundles and removal of a worker from the hazardous position in the process. Organized stacks will also allow for further downstream automation processes.

![Automated stacker including two robotic arms](image)

### GE Aviation Cutter Tool Performance

**Team Members**
- Jacob Demarais and Garrett Dubie, Mechanical Engineering; Justin Nichols, Mechanical Engineering Technology; Robert Lippus, Materials Science and Engineering
- Dan Seguin, Materials Science and Engineering

**Advisor**

**Sponsor**
- GE Aviation

**Project Overview**
The GE Aviation Cutter Tool Performance team has fully designed a controlled experiment that will test the effects of varying the tungsten carbide grain size from 0.3 to 1.5 microns while also varying the cobalt content from 8 wt to 12 wt percent in these cobalt cemented tungsten carbide tools. To test the team’s hypotheses regarding these changes, the tools were worn under varying conditions in a CNC mill and the wear zones analyzed using stereoscope images as well as images from a scanning electron microscope (SEM).

![Cobalt pooling found in SEM analysis of a failed cobalt cemented tungsten carbide cutting tool](image)

### MacLean-Fogg Automated Parts Counting System

**Team Members**

**Advisor**

**Sponsors**
- MacLean-Fogg, ArcelorMittal

**Project Overview**
Lean manufacturing initiatives have led MacLean-Fogg, a producer of fastener components, to investigate the integration of an automated parts counting system. The current weight-based counting system is only 95–97 percent accurate causing inventory discrepancies of millions of parts each year. The goal of an automated counting system is to increase accuracy to 99 percent. The design presented here separates the parts using the parts separator, pictured. As the parts fall from the conveyor onto the separator, they are divided into one of four sections. An optical sensor, mounted at the exit of each section, counts each part as it passes through. The total count is recorded using a Single Board RIO.

![Initial mock-up for part separation testing](image)
Perfusion Bioreactor Chamber with Oxygen Sensing Capabilities

Project Overview
Perfusion Bioreactors are commonly used for 3D construct development in tissue engineering; however, there is currently not a system on the market that allows for the measurement of oxygen concentration in the tissue medium. Oxygen is a key regulator of cell survival and phenotypic expression. The challenge presented to our team was to design and develop a perfusion bioreactor chamber with oxygen sensing capability without location and time constraints.

Team Members
Rebecca Whitney, Benjamin Weyland, and Jessica Walitalo, Biomedical Engineering; Kimberly D’Augustino, Materials Science and Engineering

Advisor
Feng Zhao, Biomedical Engineering

Sponsor
Michigan Technological University

Smart Grid Home Energy Management Application

Outline of application to HAN communication diagram

Project Overview
Over the next several years, Consumers Energy will continue to deploy smart metering technology infrastructure throughout the regions it serves within the state of Michigan. The opportunity exists to employ smart metering infrastructure and mobile devices to benefit households within Consumers Energy’s region of operation. Consumers Energy has challenged our team to develop a smartphone application that provides customers with an interactive way to understand their home energy usage. This application will provide users with the ability to view energy usage statistics over a user-defined time period, connect to a centralized household communication hub to control energy usage within users’ homes, and provide energy saving goals and opportunities.

Team Members
Matthew Alessi, Benjamin Ginnow, Amanda Rueff, and Noah Hagman, Electrical Engineering; Andrew Hanson, Computer Engineering

Advisor
Don Moore, Electrical and Computer Engineering

Sponsor
Consumers Energy

Welding Parameter Refinement for 3D Metal Printing

Project Overview
3D printing has historically been limited to polymer-based parts due to most printing techniques melting the plastic filament at the extruder head. The ability to use aluminum in 3D printing is highly desirable to improve the mechanical properties of the finished product. A printer capable of producing metal-based parts using common welding techniques has been developed at Michigan Tech. The opportunity to refine the welding parameters and the aluminum alloy used during printing has been presented through AME’s partnership with America Makes. Through a series of designed experiments, the filament alloy and welding parameters will be varied to improve the strength, ductility, and resolution of the printed part.

Team Members
Zachary Boyden and Mu Yuan, Materials Science and Engineering; Michael Buhr and Martin Schaub, Mechanical Engineering

Advisor
Tom Wood, Materials Science and Engineering

Sponsors
America Makes, Advanced Metalworks Enterprise

3D model of bioreactor chamber prototype

Outline of application to HAN communication diagram

Michigan Tech’s metal 3D printer
116
User Interface Design for Deep Brain Stimulation Implants in Parkinson’s Patients

Team Members
Hao Zhan, Jessica Thomeke, Keegan Yates, Hunter Bartosik, Joseph Bolsenga, and Timothy Bradt, Computer Engineering

Advisor
Keat Ghee Ong, Biomedical Engineering

Sponsor
Medtronic

Project Overview
Parkinson’s disease (PD) patients with deep brain stimulation (DBS) implanted devices are typically provided with a means of controlling their device. In some cases, conventional touch screen interfaces are unsuitable or difficult to use. This project looked to determine what guidelines and features are desirable for designing a user interface for the DBS controller for PD patients. The general topic is broad because there are no existing guidelines to design user interfaces for this particular patient population. Thus, three main ideas were chosen to study through clinical trials including the size of elements in the user interface, the comparison between three control models, and general preferences for using a user interface.

117
Substation Automation Standards

Team Members
Marc Kohler, Adam Kovach, Britta Anderson, William Gagnon, and Dong Xia, Electrical Engineering

Advisor
John Lukowski, Electrical and Computer Engineering

Sponsor
DTE Energy

Project Overview
Our team has three goals. The first is to develop a password management system for an intelligent electronic device (IED) that will work across multiple vendors. Second, we will create a universal program that can manipulate (upload, download, edit) configured IED description (CID) files. Third, we will also research incorporating the IEC 61850 protocol within traditional bus protection schemes.

118
Catheter Test System Design Improvements

Team Members
Cameron Allen, Kaitlyn Boelter, Mitchell Kirby, Kimberly Stanke, and Jonathon Wheatley, Biomedical Engineering

Advisor
Sean Kirkpatrick, Biomedical Engineering

Sponsor
ACIST Medical Systems

Project Overview
The Navvus MicroCatheter from ACIST Medical, currently in clinical use, allows for a real time fractional flow reserve (FFR) measurement using a fiber optic sensing technique. The FFR is a diagnostic value that quantitatively shows blockage of an artery by measuring blood pressure on either side of the blockage. This Navvus MicroCatheter arrives pre-calibrated and is capable of giving more accurate measurements than traditional pressure wires. The current state-of-the-device calibration methods are slow and costly. Calibration accounts for a large percentage of production time, more than manufacturing the device itself. The goal of this project is to develop a more efficient way to calibrate the device to optimize production and distribution.
119 Software Tool to Develop Equivalent Circuit Motor Parameters

**Team Members**
Zack Browne, Holden Hunt, Michael Martin, and Matt Militello, Electrical Engineering

**Advisor**
Trever Hassell, Electrical and Computer Engineering

**Sponsor**
American Transmission Company (ATC)

**Project Overview**
The purpose of this design project is to assist American Transmission Company (ATC) in the development and creation of a software tool for three phase, single and double squirrel cage induction motors. More specifically, the team will investigate and derive a method and software tool, which can accurately predict an induction motor’s equivalent circuit parameters from a manufacturer-provided torque speed curve and nameplate data in an efficient and non-heuristic approach. This software tool will allow ATC to be more accurate and efficient when describing a motor’s effects during black start conditions.

![Torque speed optimization plot from software tool](image1)

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120 Drive Motor in Dowel Agitation Design Bissell

**Team Members**
Molli Andor, Aaron Dupre, Erik Lemmen, and Teng Ma, Mechanical Engineering; Kyle Stankowski, Electrical Engineering

**Advisor**
Eddy Trinklein, Mechanical Engineering-Engineering Mechanics

**Sponsor**
Bissell Homecare

**Project Overview**
Recent vacuum industry trends have leaned toward smaller, lightweight, and more agile product architectures. The ability to innovate and retain efficacy while reducing product size is important. The design goal was to develop an integrated brush dowel and drive motor assembly to reduce product weight, improve quality, and give the end consumer an innovative cleaning solution. Most brush dowel systems are driven by a belt from an external motor, either dedicated to the brush or driven from a shaft exiting the vacuum motor. This particular brush dowel system is driven directly by an internal motor.

![Expanded view of removable motor-in-dowel system](image2)

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121 Tilt Test Enhancements

**Team Members**
Samantha Wright, Michael Briseno, Christopher Fisher, Jari Sague, and Jasmine Jauquet, Biomedical Engineering

**Advisor**
Orhan Soykan, Biomedical Engineering

**Sponsor**
Aspirus Heart and Vascular

**Project Overview**
In order to improve current tilt testing data acquisition, Aspirus Heart and Vascular requests an integrated continuous monitoring technology and software display. The current procedure is either too slow or too invasive, and there is no good method for data storage and analysis. In response to this, we created a program that will generate and display relative data, which will allow for simple differentiation between various cardiovascular states. To achieve this, we used LabVIEW as the software platform and integrated it with a continuous blood pressure monitoring device, ECG, and goniometer to display the data in a form that the physician can view and manipulate as needed.

![Our product will be used during a tilt table test, such as this one](image3)
122 Composite Rear Suspension—SAE Baja

Team Members
Richard Stevens, Alexander Mittenberger, and Patrick Holzer, Mechanical Engineering; Matthew Brettschneider, Mechanical Engineering Technology

Advisor
Kevin Johnson, Mechanical Engineering-Engineering Mechanics

Sponsor
Michigan Tech Blizzard Baja Team

Project Overview
Our goal is to design and manufacture a rear suspension system from composite materials to provide increased performance to the Michigan Technological University SAE Baja competition vehicle. This system includes a designed trailing arm suspension, rear bearing carrier, shock adapter, and mounting hardware to adapt the rear suspension system to the chassis.

123 John Deere Intake Manifold Design

Team Members
Rebekah Koning, Nicholas Latusek, Jonathon Maley, and Ethan Rautio. Mechanical Engineering

Advisor
Jaclyn Johnson, Mechanical Engineering-Engineering Mechanics

Sponsor
John Deere

Project Overview
Our team was tasked with designing an intake manifold for a John Deere 3 cylinder engine. The intake manifold was designed for uniform flow among cylinders and supports all required sensors, actuators, and positive crankcase ventilation valves. Due to high under-hood temperatures and durability concerns for off-highway applications, a cast iron or cast aluminum manifold material was desired. Aluminum was determined to be the best cast metal due to its structural integrity and casting soundness.

124 B-pillar Revision Project

Team Members
David Daavettila, Nicholas Jensen, Tyler Kuyper, Paul Roehm, and Yakun Wang, Mechanical Engineering Technology

Advisor
Paul van Susante, Mechanical Engineering-Engineering Mechanics

Sponsor
Fiat Chrysler Automobiles

Project Overview
Chrysler needs to produce vehicles with top-end technology and minimum mass at a higher frequency than current design methods permit. A B-pillar is a structural member connecting the rocker panel to the roof panel, located between the front and rear doors of a four-door vehicle. Our team has been asked to create a simple and accurate analysis method for comparing relative B-pillar attributes during initial vehicle design. Efficiency will be improved by using this method.
125
Design of a Production Capable Materials Test to Determine the Toughness of Cast Mill Components

Industrial grinder with cast mill wear component

Team Members
Andrea Paul, Nathaniel Musser, William Price, and Robert Cooley, Materials Science and Engineering
Advisor
Paul Fraley, Materials Science and Engineering
Sponsors
ME Global

Project Overview
ME Global casts mining mill wear components from a variety of metals including pearlitic steels and white irons. These components are experiencing approximately 10 percent failure by brittle fracture rather than wear failure under extreme service conditions. It is believed that this premature failure is due to low fracture toughness, which their current quality control methods do not measure. The objective of this project is to create a fracture toughness test that is quick, reproducible, requires little machining, and is accurate enough to pass or fail parts in a production setting.

126
IC Engine Powered One Man Hovercraft

Frame design with drive components

Team Members
James Henris and Matthew Benzik, Mechanical Engineering Technology
Advisor
John Irwin, School of Technology
Sponsor
School of Technology

Project Overview
Using the Hybrid Hovercraft, half IC engine powered and half human powered, designed by a previous MET senior design team, our goals are to fully power the craft by its internal combustion engine. Also, we were tasked to redesign weak areas of the framework and provide it with a rudder-controlled steering system to allow the craft to maneuver at speeds up to 10 mph. Finally, the team improved the safety systems to completely guard all moving components and keep the operator safe from injury.

127
Treatment of Intra-Cranial Aneurysms Utilizing Flow Diversion

Flow diverting device in blood vessel, reducing flow into the aneurysm

Team Members
Kathleen Ikeda, Alexandria Bartlett, Alexis Alvarez, Mark Keranen, and Kyle Johnston, Biomedical Engineering
Advisor
Jingfeng Jiang, Biomedical Engineering
Sponsor
Materialise

Project Overview
The concept of flow diversion has become a popular treatment option for intra-cranial aneurysms. Our team is using the concept of flow-diverting to explore a novel design approach through virtual prototyping and the use of a physical flow phantom. The design is intended to reduce the flow into the aneurysm, help in clot formation inside the aneurysm, and allow healing. This design presents an advantage over flow-diverting stents by not causing a disruption of the sensitive tissue that surrounds the neck of the aneurysm. The team uses computational fluid dynamics (CFD), finite element modeling (FEM), and technology provided by Materialise to simulate device performance after implementation into patient-specific data.
128 Compliance Keweenaw: Aspirus Keweenaw Hand-washing Compliance System

Team Members
Anna Waller, Jannah Brandt, Drew Markel, Creighton Bradley, and Rebecca Manshaem, Biomedical Engineering
Advisor
Bruce Lee, Biomedical Engineering
Sponsor
Aspirus Keweenaw

Project Overview
Hand hygiene is of importance to hospitals not only for the safety and health of employees but also to reduce the spread of hospital-acquired infections and protect patients. Aspirus Keweenaw recruited our team to create an automated system to track hand-washing compliance among employees to assist them in their goal of 100 percent compliance. We created a system using a microcontroller and RFID readers to detect when a healthcare worker enters a patient’s room and reaches compliance using the sanitizing foam dispenser. This system will be placed near the doorway and communicate with a wristband that identifies the healthcare worker and vibrates as a reminder if compliance is not reached.

129 Kimberly-Clark Smart Bin

Team Members
Louis Bereine, Jake Fiebing, and Yuancheng He, Electrical Engineering; Kaiquan Wang, Mechanical Engineering
Advisor
Don Moore, Electrical and Computer Engineering
Sponsor
Kimberly-Clark

Project Overview
The Smart Bin is a system designed to send wireless data to Kimberly-Clark’s PLC for measurement purposes. It is designed to handle a rough industrial setting and be powered for a long time.

130 Front-End Protection for Data Acquisition

Team Members
Sylvia Ferragut, Caleb Wright, and Ben Veltman, Electrical Engineering; Matthew Zawisza, Computer Engineering
Advisor
Duane Bucheger, Electrical and Computer Engineering
Sponsor
Department of Electrical and Computer Engineering

Project Overview
Often devices under test can behave in erratic ways, resulting in catastrophic damage to expensive test equipment. By designing specifications based on National Instruments’ limitations and typical automotive testing requirements, the team created a buffer box to protect from over-voltage and add layers of isolation. The buffer box, used in conjunction with the $50k–$500k tools being regularly used by the automotive industry, is a simple tool, which can be used by a wide range of people with varying levels of expertise to keep expenses down.
131  
**System to Measure the Effectiveness of a Rail Shunt**

Example testing shunt (Chambers Electronic Co.)

**Team Members**  
Samuel Scott, Alexander Pate, Frank BeFay, and Sean Massey, Electrical Engineering  
**Advisor**  
Duane Bucheger, Electrical and Computer Engineering  
**Sponsors**  
Union Pacific Railroad, Michigan Tech Rail Transportation Program, National University Rail Center (NURail)

**Project Overview**  
Our objective is to develop a system to measure the effectiveness of a rail shunt. Signalmen utilize rail shunts to test functionality of rail systems and calibrate signal equipment. The new system will provide immediate feedback and inform the signalmen when a good shunt is achieved. Railroads use different signals flowing through them to detect existing trains. Rail shunts are used to simulate a train so that an actual train doesn’t enter the area being repaired or calibrated. By retrofitting a rail shunt using custom integrated circuitry and a micro-controller, we’ve developed a tool that not only effectively shunts the line, but also indicates when a good connection has been established.

132  
**School of Technology Venturimeter**

Very early stage of venturimeter project as presented to team sans fittings

**Team Members**  
Nathan Manderfield and Alex Tomasoski, Mechanical Engineering Technology  
**Advisor**  
Sunil Mehendale, School of Technology  
**Sponsor**  
School of Technology

**Project Overview**  
Venturimeters are commonly used in many different industries to measure fluid flow through a system. A venturimeter was designed and built as part of an undergraduate research project. Initial laboratory experiments were conducted to measure different air flow rates by using an adjustable damper to vary the resistance across the blower; however, good agreement was not obtained between the pitot tube and the venturimeter measurements. This project aims to (1) complete accurate validation of the pitot and venturimeter measurements (digital and visual), (2) design a means to measure the air flow velocity profile in laminar and turbulent flow, (3) measure the blower flow-pressure rise characteristics and (4) design flow visualization capability into the unit.

133  
**Stamping FEA Optimization**

Comparison of damage predicted by FEA versus actual test result for a flexural fatigue specimen

**Team Members**  
Kara Bakowski, Jacob Braykovich, and Alexander Kampf, Materials Science and Engineering; Zachary Morgan, Mechanical Engineering  
**Advisor**  
Steve Hackney, Materials Science and Engineering  
**Sponsor**  
Fiat Chrysler Automobiles

**Project Overview**  
Current Finite Element Analysis (FEA) methods used by Chrysler for analysis of the inner decklid of the Dodge Dart give fatigue life predictions that are inconsistent with the performance in the production vehicle. This discrepancy is believed to be a result of inaccurate FEA inputs; the effects of both prior cold work due to stamping and strain hardening due to slamming are not accounted for in the material model. A method to estimate more realistic FEA material inputs is being developed through mechanical testing. These new material properties will then be input back into the FEA model allowing Chrysler to rerun its fatigue analysis of the decklid to determine if the results are more realistic.
134
Heat Recovery Steam Generator Improvement

HRSG black box diagram

Team Members
David Bayer, Jordan Jackola, Jani Lane, and Michael Pristov, Mechanical Engineering
Advisor
Jaclyn Johnson, Mechanical Engineering-Engineering Mechanics
Sponsor
DTE Energy

Project Overview
DTE Energy is partnering with Michigan Tech to create a series of senior design teams. Each team will be researching specific aspects of the design, operation, and maintenance of combined cycle power plants. This project team is the first in a five-team series and is focusing on the thermodynamic and thermo-economic analysis of the heat recovery steam generator performance within the combined cycle. In particular, our team investigated the effects of ambient environmental conditions and load requirements on the plant efficiency and operations. The combined team efforts will be used to improve the design and operations of DTE Energy’s future power plants.

135
Universal Parts Feeder for Nut Tapping Equipment

Assorted nut blanks

Team Members
Izaak Lauer, Colton Wesoloski, Gaosihao Qiu, Jake Bohl, and Michael Kita, Mechanical Engineering
Advisor
Radheshyam Tewari, Mechanical Engineering-Engineering Mechanics
Sponsor
MacLean-Fogg

Project Overview
The purpose of our project is to provide a method of orienting and feeding blanked nuts to a tapping rig to replace the current vibratory bowl feeder, which is costly, loud, and time-consuming to modify and adjust to different sized/shaped nuts, resulting in long down times. The design must be capable of feeding the oriented components at a rate comparable to the current process, and be adjustable to accommodate the different components that can be produced by the forming machinery.

136
Visualization of Biofilms on Orthopedic Implants

Action shot with images showing the aspiration process using a customized dye on a sample seeded with active bacteria

Team Members
Kaleb Horn, Kyle Troutt, David Sproule, and Maxwell Hill, Biomedical Engineering
Advisor
Megan Frost, Biomedical Engineering
Sponsor
Department of Biomedical Engineering

Project Overview
The number of infections on orthopedic implants is increasing as the number of hip and knee replacements required also increases in an aging population. Treatment of these infections requires a lengthy and significantly invasive surgery. Our objective is to develop a quick, reliable and repeatable method to aid in the visualization of biofilms during a surgery. As the surgeon is cleaning the implant to eliminate infection, it is important to use minimal manpower, nontoxic chemicals, and ensure an absence of false negatives. All equipment used must be as small as possible to prevent hindrance of the surgical team.
MAP Determination of Intake Cam Centerline, Phase II

Team Members
Paul Thomas, David Entingh, and Robert Roush, Computer Engineering
Advisor
Duane Bucheger, Electrical and Computer Engineering
Sponsor
Fiat Chrysler Automobiles

Project Overview
The objective of our project is to correlate manifold absolute pressure (MAP) sensor data from a Chrysler Pentastar 3.6L V6 engine with the position of the camshaft through analysis of pressure changes from intake timing variation. Using this data, we have implemented a method to improve deduction of the cam position to allow for precise adjustments in the engine timing leading to increased efficiency in real-time operation.

Chrysler Pentastar 3.6L V6 Engine

Chrysler 300 Split Tailgate

Surgical Power Tool Irrigation Pump Controller

Team Members
Kelly Shanahan, Joshua Yagley, Alex Bancroft, Jerad Marble, and Parry Ragland, Mechanical Engineering
Advisor
Kevin Johnson, Mechanical Engineering-Engineering Mechanics
Sponsor
Fiat Chrysler Automobiles

Project Overview
Our goal is to design, engineer, build, and test a split decklid adapted from the current Chrysler 300 architecture. This decklid system will provide the customer both the access required of typical decklids without the upswing of the lower waterfall area and the added feature of a tailgate style lower swing out panel which will provide a surface for tailgate functions. This feature is rare in the industry and provides an opportunity for segment differentiation creating a unique selling point.

Chrysler 300 Split Tailgate

Stryker’s Consolidated operating room equipment console powers hand tools for ear, nose, and throat surgery

Team Members
Nathan Tromp, Robert Arden, and Karl Schlicker, Mechanical Engineering; Grant Smith, Electrical Engineering
Advisor
Eddy Trinklein, Mechanical Engineering-Engineering Mechanics
Sponsor
Stryker Instruments

Project Overview
Our design team is sponsored by Stryker Instruments to update the irrigation system of the Consolidated Operating Room Equipment (CORE) console. The console was introduced back in 2005 and requires updating to maintain a competitive edge. The project goal is to provide an updated solution for the transport of saline in a surgical power tool console. Proposed updates to the console irrigation system include replacing the microcontroller while maintaining current flow performance, reducing electromagnetic interference (EMI) and audible noise, and providing an FEA model of the pump housing.
**140 dSpace Hardware in the Loop Development and Testing**

**Team Members**
Chen Li, Matthew Hooker, Brian Knapp and Alexandra Roche, Electrical Engineering

**Advisor**
Jeff Burl, Electrical and Computer Engineering

**Sponsor**
Nexteer Automotive

**Project Overview**
This senior design project is a continuation of Nexteer Automotive-sponsored graduate research development of Electric Power Steering dSpace Hardware in the Loop (EPS dSpace HiL). Our goal is to further use the HiL bench for software testing and, if required, motor dyno testing. The team also works on the setup process including dSpace test hardware, dSpace Vehicle Dynamics software, Simulink models of EPS, vehicle driver, sensors, and test wiring harness.

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**141 Mind Trekkers Trebuchet**

**Team Members**
Jebbediah Doebel, Marshall Fox, and Michael Gorman, Mechanical Engineering Technology

**Advisor**
David Wanless, School of Technology

**Sponsor**
Michigan Tech Mind Trekkers

**Project Overview**
Presently, Mind Trekkers does not have an apparatus to demonstrate physics and the laws of gravity to young students interested in physical science. To showcase these topics, we are tasked with constructing a small-scale catapult capable of launching small projectiles up to 100 yards. The catapult must be adjustable to change the angle of trajectory, moment arm, and amount of counterweight. The device must be easy to transport, build, and deconstruct so schools have the option to build one of their own. Given these parameters, a trebuchet-style catapult would provide the safety, reliability, and durability requested to fulfill Mind Trekkers’ goals.

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**142 Wood Gasification**

**Team Members**
Matthew Gasco, Nicholas Samokyszyn, and Richard Thorstenson, Mechanical Engineering Technology

**Advisor**
David Wanless, School of Technology

**Sponsor**
School of Technology

**Project Overview**
The need for a safer, cleaner, and reliable alternative to traditional fossil fuels has become more relevant in recent years. Wood gas has been shown to be a successful substitute to not only gasoline but also natural gas and propane. The goal of this project is to assess the viability of wood gas as an alternative to fossil fuels.
Low Voltage Piezoelectric Bone Sculptor

Proof of concept prototype low voltage piezoelectric bone sculptor (JamJel) for Stryker Instruments

Team Members
James Berry, Electrical Engineering; Michael Braun, Computer Engineering; Alexandra Cereska and Janelle Rupkalvis, Biomedical Engineering; Lee Southerton and Eric Wilkening, Mechanical Engineering

Advisor
Radheshyam Tewari, Mechanical Engineering-Engineering Mechanics

Sponsor
Stryker Instruments

Project Overview
We have partnered with Stryker Instruments to address the market need for improved bone resection instrumentation by developing a proof-of-concept prototype bone resection device, the JamJel. The JamJel operates at a sub-ultrasonic frequency and employs a piezoelectric actuator, or stack configuration to produce oscillatory motion of a cutting accessory. Piezoelectric stacks generate high force, are compact in size, and enable precise longitudinal displacement control by the user. The design incorporates three piezoelectric stacks arranged in a triangular formation around a pivot plate. Mechanical leverage amplifies the 90 μm piezoelectric stack displacement, permitting longitudinal, transverse and rotary motion at the cutting accessory tip, singly or in combination.

Automatic Loading and Unloading Gravity Flow Rack System

Automatic loading and unloading gravity flow rack system designed by mechanical engineering students

Team Members
Jeffrey Baker, Andrew Crepeau, Samantha Kallman, Clay Sekely, and Halley Shawbitz, Mechanical Engineering

Advisor
Paul van Susante, Mechanical Engineering-Engineering Mechanics

Sponsor
Fiat Chrysler Automobiles

Project Overview
We are tasked with the complete design and prototype of a mechanism that couples a material rack to an assembly rack, transfers full containers of parts from the material rack to the assembly rack, and transfers empty containers from the assembly rack to the material rack.

Aluminum Corrosion Study—Automotive Electrical Systems

SEM image of a plated aluminum sample

Team Members
Annie LeSage, Jacob Gerdt, Kyle Myszka, and Alexandra Glover, Materials Science and Engineering

Advisor
Steve Kampe, Materials Science and Engineering

Sponsor
Yazaki North America

Project Overview
The switch from copper to aluminum in automotive electrical systems is advantageous to U.S automakers and automotive component suppliers because it has the potential to decrease vehicle weight and raw materials costs. This switch also poses several challenges. This senior design project characterizes the galvanic corrosion rate of an aluminum substrate with a metallic plating when exposed to an electrolytic solution. This mimics the exposure of electrical components to a fluid containing salts or automotive chemicals. The results of this testing are critical to the success of the copper-to-aluminum substitution in automotive electrical systems. This is because they inform automotive component designers about the expected lifetime of such systems when exposed to a corrosive environment.
146 Bearing Adjuster Lock Ring Test Rig

Team Members
Stephen A. Whalen, Nicolas Lord, Christian Bersano, and Jordon Locher, Mechanical Engineering
Advisor
Kevin Johnson, Mechanical Engineering-Engineering Mechanics
Sponsors
American Axle & Manufacturing, Michigan Technological University

Project Overview
Bearing adjuster lock rings in a pick-up truck front axle are shearing under unknown conditions. This design team was tasked by American Axle & Manufacturing to identify the cause of lock ring failure and design and build a test rig capable of replicating this failure mode. The machine will be used to simulate loading conditions the vehicle may undergo in the field. The machine will also serve as a baseline for lock-ring design validation for future design teams.

147 River Outflow Power Upgrade

Team Members
Brett Dupras, Anthony Russ, Donald Straughen, Erienne Claxton, and Kyle Chomic, Electrical Engineering Technology
Advisor
Weican (Vincent) Xiao, School of Technology
Sponsor
Verso Corporation

Project Overview
Our team was tasked with upgrading a power system for Verso Corporation's Quinnesec mill. The design includes a conversion that will allow more power capacity. While designing the system, we were responsible for producing single line drawings, panel schedules, conduit plans, lighting plans, and a complete construction package. We also had the opportunity to assemble the electrical panels that will be used in the converted system.

148 End of Line Noise Test Certification System

Team Members
Tyler Giddens, Mechanical Engineering; Max Moeller and Jake Bell, Electrical Engineering; Nick Oshaben, Computer Engineering
Advisor
Jeff Burl, Electrical and Computer Engineering
Sponsor
Nexteer Automotive

Project Overview
Nexteer Automotive requires a calibration device that can be implemented into their production line that will allow the testing equipment used to test each final product before distribution to be checked and re-calibrated when an issue arises. This device will be able to produce a vibration that is comparable to what the test equipment reads. Calibration can then be performed and testing resumed without major delays in the production line.
149
Pro-Healing Arterial Graft Scaffold Design

Cross-section of a completed graft showing the arrangement of the layers (FE-SEM)

Team Members
Thomas Brown, Kristin Flickinger, Thaine Fuller, Kyle Jansen, and Daniel Radke, Biomedical Engineering
Advisor
Jeremy Goldman, Biomedical Engineering
Sponsor
Boston Scientific

Project Overview
Inflammation, thrombosis, and restenosis of the implanted section are the major challenges that impede the work being done to reconstruct small diameter arteries. The aim of this project is to optimize the construction of a small-diameter vascular graft that utilizes the biological tissue, elastic lamina, coated in a polymer coating for mechanical strength. The main goal for the optimization of the fabrication process is to reduce and ultimately eliminate the delamination of the polymer and the elastic lamina and the negative host response that was found in a previous project. The efficacy of the resulting grafts will be tested for mechanical integrity and biological viability (in vivo rat model).

150
E357 Alloying to Increase Elongation and Maintain Mechanical Properties

Microstructure of standard E357 alloy

Team Members
Jordan Pontoni, Calvin Nitz, Shane Anderson, and Austin DePottey, Materials Science and Engineering
Advisor
Tom Wood, Materials Science and Engineering
Sponsor
Eck Industries

Project Overview
The regulation of beryllium in A357 makes it desirable to improve the elongation properties of E357 (no beryllium) to make it a practical alternative to A357. Additions of strontium at concentrations of 200, 300, and 400 ppm; cobalt at 0.1 and 0.2 wt percent; and manganese at 0.1 and 0.2 wt percent have been identified as elements that will modify the eutectic silicon and iron-rich intermetallics. Modification of these microconstituents is hypothesized to reduce cracking within the aluminum matrix and improve the elongation properties of E357 while maintaining strength.

152
Evaluation of Production Potential in the Caney Shale Formation, Anadarko Basin, Oklahoma

A typical rig used for horizontal drilling

Team Members
Stephanie Dow, Hannah Altscheffel, Christopher Carefoot, and Elizabeth Seiberlich, Geological Engineering
Advisor
John Gierke, Geological and Mining Engineering and Sciences
Sponsor
Vitruvian Exploration II

Project Overview
The Caney shale is a formation that extends through Oklahoma and is currently being produced by horizontal drilling and hydraulic fracturing in some areas of the state. The structure and properties of this shale vary across the extent, and thus what is a producible formation in one region may not be in another. In the Anadarko Basin of Oklahoma, the Caney shale was evaluated for production potential using an analysis that evaluates structure and isopach thickness of the formation, as well as properties such as porosity and hydrocarbon content. Logs from across the region of interest and surrounding regions were studied.
**153 Olathe Lawn Sweeper Finger Redesign**

*This is the test fixture we designed and built for use on this project*

**Team Members**
Anthony Hella and Jonathan Sanders, Mechanical Engineering Technology

**Advisor**
Mark Johnson, School of Technology

**Sponsor**
Argonics, Inc.

**Project Overview**
The Michigan Tech grounds staff uses the Olathe 48" Lawn Sweeper around campus to clean up debris on the lawns. The sweeper implements two reels in which 88 rubber fingers are mounted. The rotation of these reels and fingers induces a vacuum that will draw unwanted material off the ground into the vehicle's hopper. The problem they are having is that the current design is not very efficient when used according to the manual's instructions. Our team is focusing on redesigning the finger profile and changing the orientation of the fingers to allow proper use of the equipment while also improving performance. Argonics, Inc. is producing our newly-designed fingers.

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**154 Precision Machining Process Design**

**Deformable jaw concept**

**Team Members**
Dustin Cochrane, Travis Teall, Michael Dzwigalski, and Cory Calkins, Mechanical Engineering Technology

**Advisor**
William Endres, Mechanical Engineering-Engineering Mechanics

**Sponsor**
MacLean-Fogg Component Solutions

**Project Overview**
Metform, a division of MacLean-Fogg Component Solutions, is in the business of machining gear blanks for use in 8 and 9 speed transmissions. These gear blanks are produced at a mind-boggling rate with the assistance of highly precise CNC machines. However, after multiple inspections, it was observed that the bore dimension for some of the gear blanks was extending outside of the allowable tolerance. The cause of this was determined to be a product of bore lobing, a common problem in the machining of thin-walled parts. Our task was to design improved lathe jaws that would distribute the clamping load along the entire surface of the gear blank.

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**155 Back Gauging**

**Brake press/shear back gauging design**

**Team Members**
Alex Hischke and Macrae Parks, Mechanical Engineering Technology

**Advisor**
Mark Johnson, School of Technology

**Sponsor**
School of Technology

**Project Overview**
The press brake in the School of Technology machine shop does not have an accurate way to bend or cut sheet metal. Currently a line is scribed on the material and eyeballed to get the bend in the correct location. Back gauging is desired to hold the sheet metal at a precise distance from the press or shear die. It must have precise length adjustment and be cost effective to be built on a small budget and should be easy to manufacture. When completed, the press brake will be fitted with a back stop that will be easy to use and durable enough to withstand frequent shop use.
Modeling a Trichloroethylene Plume in an Antrim County, Michigan Aquifer for Protecting Municipal Water Supplies

Genevieve Ehrhardt works on cross sections in the subsurface model using Groundwater Modeling System (GMS) software.

Team Members
Kaitlyn Voet and Genevieve Ehrhardt, Geological Engineering

Advisor
John Gierke, Geological and Mining Engineering and Sciences

Sponsor
Amec Foster Wheeler

Project Overview
Trichloroethylene (TCE) is the primary groundwater contaminant in an aquifer found in Antrim County, Michigan. TCE entered the groundwater through neglectful handling of the industrial solvent, resulting in a plume that is one of the nation’s largest. The 6-mile long by 2-mile wide plume has already spoiled dozens of residential water wells and is migrating towards municipal wells. The project objectives are to model the groundwater and plume behavior to better understand how the TCE will continue to migrate, determine pumping schemes to protect the municipal wells, and explore options for using new groundwater pumping wells to capture the plume.
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Keja Rowe
Electrical Engineer
Auburn Hills, Michigan, USA
**201 Alternative Energy Enterprise**

Study of snowfall on solar energy production

**Team Leaders**
Kayla Warsko and Lucia Li, Chemical Engineering

**Advisor**
Jay Meldrum, Keweenaw Research Center

**Sponsor**
Keweenaw Research Center

**Project Overview**
The Alternative Energy Enterprise (AEE) is a group concerned with the environment and interested in exploring all forms of alternative energy. AEE has a 10+ year history working on a variety of projects. Projects include solar panel performance in snowy environments, fuel cell powered vehicles, bio-fuel from woody biomass, hydroelectric power and geothermal heating using water from abandoned mine shafts in the Keweenaw. AEE partners with other Enterprises and departments on projects. Currently AEE is partnering with Michigan Tech’s Department of Social Science to explore using mine water for heating in Calumet.

**202 Formula SAE**

Fall validation and testing, Lot 26

**Team Leaders**
Dan Burg and Karl Evenson, Mechanical Engineering

**Advisor**
James DeClerck, Mechanical Engineering - Engineering Mechanics

**Sponsors**

**Project Overview**
Formula SAE is an international student competition sponsored by the Society of Automotive Engineers. Our Enterprise is involved in the development and construction of open wheel race cars under 600cc. Competitions all over the world allow students to show off their technical and creative prowess in static and dynamic events. Since 1994, Michigan Tech has raced cars at Michigan International Speedway. Our team continues to use that experience to develop future technologies and build faster, safer, and more affordable race cars.

**203 Green Campus Enterprise**

**Project Overview**
Green Campus Enterprise acts as a consultant for Michigan Tech to measure and help reduce its carbon footprint while lowering the overall energy cost for the University. Green Campus solicits membership from a wide variety of majors and provides opportunities for active participation through a diversity of projects. This year the enterprise consists of seven teams working on projects ranging from retrofitting Michigan Tech vehicles to run on compressed natural gas to installing and testing solar collectors on campus. Green Campus Enterprise is a growing, young, and excited group of people looking to make a difference.
204
Husky Game Development

Virtual reality and display wall team demonstrate the Vicon Tracking System

Team Leader
Mitch Davis, Computer Science and Ryan George, Computer Network and System Administration
Advisor
Scott Kuhl, Computer Science
Sponsors
Fiat Chrysler Automobiles, Mel Visser (Michigan Tech Alumnus)

Project Overview
Husky Game Development is a growing enterprise that has been developing games for computers, gaming consoles, and mobile devices since 2004. Our mission is to design and develop games for business, education, and fun. We work as an interdisciplinary, student-run enterprise that fosters productivity, creativity, and effective business practices.

205
Blue Marble Security

Teaching middle school students to solder using in-house heart rate monitor kits

Team Leader
Rebecca Gast, Electrical Engineering
Advisor
Glen Archer, Electrical and Computer Engineering
Sponsors
ArcelorMittal, Halla Mechatronics, Oshkosh, Polysink, Dr. Havens, Dr. Lautala

Project Overview
Blue Marble Security is a virtual company of undergraduate students focused on securing the future through thoughtful use of technology. Our student-led company combines a rich educational experience in engineering design, team building, project management, and original product development. Current projects involve the design of an electro-mechanical braking system, stereoscopic image analysis to classify metal fractures, rail system monitoring and security, autonomous ground vehicle development, and outreach at both the community level and larger scale to garner STEM/ECE interest among youth.

206
Aerospace Enterprise

The Oculus-ASR nanosatellite

Team Leaders
Andrew Conley and Nathan Ford, Mechanical Engineering
Advisor
L. Brad King, Mechanical Engineering-Engineering Mechanics
Sponsors

Project Overview
The Aerospace Enterprise is an undergraduate student team where students from all academic programs work to design and build the Oculus-ASR: a winner of the Air Force Research Lab’s University Nanosatellite Program and recipient of launch support. The Oculus-ASR has a mission of interest to the DoD in that it paves the way for the US to observe space objects (even those with malicious intent) and discern important characteristics, such as mission intent. The Oculus-ASR will launch in May of 2016 aboard a SpaceX Falcon Heavy, the largest rocket built since the Apollo era.
207
Cin/Optic Communication and Media

Team Leaders
Alex Flannery, Sound Design and Devin Leonarduzzi, Communication, Culture, and Media
Advisor
Erin Smith, Humanities
Sponsors
USDOT Research Innovative Technology Administration (USDOT-OST/R), Department of Humanities, and Department of Geological and Mining Engineering and Sciences

Project Overview
Cin/Optic Communication and Media provides full-service visual media and communication services from a creative and passionate team of students. Our partnership with USDOT and Michigan Tech Geology/Mining Engineering documents their Geotechnical Asset Management initiative to monitor and predict failure in common assets along transportation corridors. The project includes investigating different techniques to create 3-dimensional models of assets, such as roads, embankments, and retaining walls. These models are studied to observe displacement over time and used to predict how long a structure will stand and if proactive repair is recommended. The project is aimed at producing affordable technology and techniques to be used by other transportation departments across the country.

208
ITOxygen

Team Leaders
Derek Daniels and Austin Browne, Computer Network and System Administration
Advisor
Russell Louks, School of Business and Economics
Sponsors
Target, Ford, Kyocera

Project Overview
ITOxygen is a student-run Enterprise team focused on developing information system and information technology solutions. Our areas of expertise include systems and information analysis, software development, database development, and web-based application development. Projects can be semester- or year-long, or multi-year. We are a cross discipline group, drawing from multiple fields of study. ITOxygen works with Fortune 500 companies, such as Target and Ford, to develop mobile applications, and with Kyocera to analyze big data. Other projects include Android development, web development and IT consulting for local businesses.

209
Wireless Communication Enterprise

Team Leader
Aaron VanGills, Computer Engineering
Advisors
Christopher Cischke, Electrical and Computer Engineering
Sponsors
Ford, Funovation, Kyocera, Open Systems International

Project Overview
Wireless Communication Enterprise (WCE) focuses on providing a friendly, yet business-like, environment for a wide variety of available projects. We pride ourselves on the bonds our members often form over the course of a semester as we all progress through the year and the consistent high quality of our work product. Over the past two years, our enterprise has doubled in size to 68 students. We attribute this to the quality work we do on all of our projects. This year we worked on the Michigan Tech Broomball Scoreboard project, making progress toward a functional electronic scoreboard. We also have two electric vehicle projects with Ford involving scalable battery pack monitoring and driver efficiency training systems. Finally, we are completing a project with Kyocera that integrates wireless technology with multifunction printers to develop a new campus tour application.
210
Supermileage Systems Enterprise

Michigan Tech’s high-efficiency vehicle

Team Leaders
Patrick Loew, Mechanical Engineering and Christian Romans, Chemical Engineering

Advisor
Rick Berkey, Pavlis Honors College

Sponsors

Project Overview
Supermileage Systems Enterprise (SSE) is a multidisciplinary design team of students interested in developing automotive systems. Our mission is to build a newly designed, highly fuel-efficient vehicle for the 2015 SAE Supermileage competition. In parallel, we are developing a battery electric vehicle to compete in the 2016 Shell Ecomarathon Americas competition.

211
Blizzard Baja Enterprise

Bristol, the 2014 national competition car, features the team’s best engineering work to date

Team Leaders
Garrett Mitchell and Ben Limburge, Mechanical Engineering

Advisor
Kevin Johnson, Mechanical Engineering-Engineering Mechanics

Sponsors
3M, Aramco, ArcelorMittal, Continental, EATON, Alcoa, Fiat Chrysler Automobiles, Cummins, DENSO, Ford, General Motors, John Deere, Mitsubishi Electric, Nexteer Automotive, Oskosh, Parker Hannifin, Plascore, Polaris, SC Enterprises, TeamTech Motorsports

Project Overview
Blizzard Baja is a student-led organization that designs, builds, and tests a completely new single-seat off-road vehicle each year to compete in national SAE Baja competitions. The team uses modern engineering and manufacturing processes to enhance vehicle performance by focusing on reduction of vehicle mass, maximization of drivetrain efficiency, improvement of driver visibility and comfort, and optimization of off-road vehicle handling and maneuverability.

212
Consumer Product Manufacturing

Creating packaging prototypes

Team Leader
Paul Hagadone, Chemical Engineering

Advisors
Tony Rogers and Sean Clancey, Chemical Engineering

Sponsors
AFI, BASF Corporation, City of Midland, nanoMAG, Razor Edge Systems, Wisconsin and Southern Railroad

Project Overview
CPM aims to exceed the expectations of company sponsors, improve the lives of consumers through innovation, and develop students into highly marketable professionals. The project goals for our team include improving runoff models to provide advanced flood warning in Midland, designing a kiln for cleaner charcoal production in Benin, using food waste as an alternative energy source at Michigan Tech, developing a water filtration system to cool industrial process streams, curing coatings at lower temperatures using catalysts, integrating high-tech materials into athletic equipment, designing collapsible packaging for a large volume of liquid product, and conceiving and testing an innovative product idea from within CPM.
**General Expedition and Adventure Research (GEAR)**

**Team Leader**
Kent VanSickle, Mechanical Engineering

**Advisor**
Brett Hamlin, Engineering Fundamentals

**Sponsor**
Outdoor Adventure Program—Michigan Technological University

**Project Overview**
GEAR Enterprise is designed to provide students with industry-related projects and team-based learning through the design, testing, analysis, and prototyping of outdoor adventure and expedition equipment. Our first major project has been the Portage Paddle. The Portage Paddle is a paddle which allows the user to portage kayaks and canoes more efficiently by hanging the canoes and kayaks from the paddle and using it as a yoke to focus the weight on the user’s shoulders. As a new enterprise this year, our team has developed greatly and the quality of our work has been superb. We hope to continue to work on fun and interesting projects involving outdoor equipment.

**Advanced Metalworks Enterprise**

**Team Leaders**
Tessa Burgess and Laura Gazza, Materials Science and Engineering

**Advisor**
Paul Sanders, Materials Science and Engineering

**Sponsors**
Gerdau, Waupaca, ArcelorMittal, AIST, Magliner

**Project Overview**
There are five undergraduate teams of 4-5 students. Each team has a different sponsor and therefore a different project for that sponsor. The projects all solve real engineering problems that deal with the mechanical properties and structures of metals.

**International Business Ventures**

**Team Leaders**
Leslie LaLonde and Andrew Clark, Biomedical Engineering

**Advisor**
Robert Warrington, Pavlis Honors College

**Sponsor**
Pavlis Honors College

**Project Overview**
The Infant Heart Annunciator is a small, BandAid-shaped device that detects an infant’s electrocardiogram, producing a visible flash and audible tone. Often in developing countries, those present at birth do not have the training or equipment needed to determine if an unresponsive infant is alive. Our goal is to eliminate this unnecessary loss of life. Our team is also designing a simple, yet reliable, ventilator that can be stockpiled by hospitals. Typically, hospitals maintain sufficient numbers of ventilators; however, an increase of patients resulting from a pandemic could create a shortage of ventilators. The current high cost of most ICU ventilators prevents hospitals from stockpiling these machines.
216
Robotics Systems Enterprise

Kealy Smith working on Afraid-of-the-Dark bot

Team Leader
Kealy Smith, Electrical Engineering
Advisor
Aleksandr Sergeyev, School of Technology
Sponsor
ArcelorMittal

Project Overview
As an enterprise, we foster personal growth. This year, the Robotics Systems Enterprise has developed a learning division. The division consists of two projects, a robot and a submersible. These projects give younger enterprise members a chance to apply knowledge learned in class, and to learn new technical skills from older members that they can use on future projects. The robot is to be controlled remotely by a user through an attached camera showing its surroundings. The submersible will be guided by a user in a similar manner to collect sediment samples from the bottom of lakes.

217
Clean Snowmobile Challenge

The team at work during the SAE Clean Snowmobile Challenge, held annually at Michigan Tech

Team Leaders
William Gielda, Mechanical Engineering and Adrienne Piron, Electrical Engineering
Advisor
Jason Blough, Mechanical Engineering-Engineering Mechanics
Sponsors
3M, Aramco, ArcelorMittal, Continental, EATON, Aloca, Fiat Chrysler Automobiles (FCA), Cummins, DENSO, Ford, General Motors, John Deere, Mitsubishi Electric, Oshkosh, Plascore, Polaris

Project Overview
We compete to reduce the environmental impact of snowmobiling in two categories: internal combustion and zero emissions. Our internal combustion team focused on reducing rolling resistance using a 2014 Yamaha Phazer by implementing a larger idler and bogey wheels, and a belt-drive system, replacing the stock drivers and skid, and developing a new exhaust and calibration system built around the use of an isobutanol-blend fuel and flex-fuel sensor. The zero emissions team converted a 2014 Yamaha Viper to run completely on lead-acid batteries.

219
Efficiency through Engineering and Construction (ETEC)

Alan Prince demonstrates how to properly insulate rim joists to community members

Team Leaders
Matthew Santti and Jon Hawthorne, Construction Management
Advisor
Lynn Artman, School of Technology
Sponsors
Ford Motor Company Fund

Project Overview
ETEC’s current projects include working with communities to implement energy efficient designs into new and existing construction projects, developing a water treatment design for the Village of Alberta, MI, and developing recommendations to improve acoustics in St. Peter and St. Paul Lutheran Church’s multi-purpose room. Our Enterprise team was the 2009 Recipient of a $50K Ford Motor Company Fund C3 Grant for Generations of Energy Winterizations working with high-risk high school students winterizing area homes for the low-income elderly. We were the 2010 Recipient of an Energy Works Michigan Grant that was presented to 11 schools across Michigan. We also developed designs and estimates for a successful $350K NSF grant for the Ford Center.
220  
Forestry and Environmental Resource Management (FERM)

Team Leaders
Bryce Jaquet and Brian Nordstrom, Forestry
Advisors
James Schmierer, School of Forest Resources and Environmental Science
Sponsors
Calumet Township, Lake Linden-Hubbell School Forest

Project Overview
Forest and Environmental Resource Management (FERM) is a repeatable elective course that allows students to work on real land-management projects. The goal is to provide real-world experience in the field and on the ground to implement sustainable forestry and conservation techniques. Two projects underway since 2012–13 on track for completion in 2015 are a red oak canopy gap regeneration treatment and timber sale at the Swedetown Trails for Calumet Township and a pine thinning timber sale at the Lake Linden-Hubbell School Forest. Both of these areas have forest inventories completed and management plans written by seniors in the SFRES Capstone course and have had work done by previous FERM teams.

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BoardSport Technologies

Electric-powered mountain board

Team Leaders
Ryan Grady and Karl Alhem, Mechanical Engineering
Advisor
Ibrahim Miskioglu, Mechanical Engineering-Engineering Mechanics
Sponsor
Department of Mechanical Engineering-Engineering Mechanics

Project Overview
We are an enterprise specializing in engineering skateboards, snowboards, and wakeboards. We use the latest FEA and modeling software to make sure our members are making the best products possible. Currently, we are working on an electric-powered mountain board that will change the sport of mountain boarding. Our sensor board is also interesting because it allows the rider to see the strain running through the board after it has been ridden. One of our greatest accomplishments is the universal press that can press longboards, snowboards, and skateboards.

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Humane Interface Design Enterprise (HIDE)

Distracted driving while using Google Glass

Team Leaders
Stephen Radachy, Computer Science and Seyedeh Maryam “Shabnam” Fakhrhosseini
Advisor
Robert Pastel, Computer Science
Sponsor
Humana

Project Overview
Our team provides students with an opportunity to design, develop, and evaluate interfaces to make daily work more efficient and easier to manage. As a whole, HIDE works together to design and test different applications for our industry partners that can be used on Android, iPhone, and other devices. We accomplish these projects by combining knowledge from multiple disciplines (e.g., computer science, psychology, and human factors). Students can get involved in various stages of the design process, from developing an app by programming to evaluation by designing usability tests and analyzing data.
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Hybrid Electric Vehicle Enterprise (HEV)

Team Members
Cameron Smith, Electrical Engineering and Tim Okkema, Mechanical Engineering

Advisors

Sponsors
General Motors, Engineered Machined Products, Martin Collision, Ididit Inc., American Powertrain, RideTech, InfinityBox, Kramer Metal Fab

Project Overview
The Hybrid Electric Vehicle (HEV) Enterprise is a multi-year program to research, design, build, and test a state-of-the-art hybrid electric vehicle, based on a 1949 Chevrolet truck. Students learn about the performance trade-offs of different types of hybrid powertrain architecture and components, program management, component/subsystem design and testing, and will gain valuable leadership skills, thereby providing them with a substantial advantage in the job market.

1949 Chevy Hybrid Hot Rod

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Velovations

Team Leaders
Ian Connick, Mechanical Engineering and Kyle McGurk, Electrical Engineering

Advisor

Sponsors
General Motors, Engineered Machined Products, Martin Collision, Ididit Inc., American Powertrain, RideTech, InfinityBox, Kramer Metal Fab

Project Overview
Our team is dedicated to working on bicycle and bicycling industry related projects. For the 2014-2015 academic year, Velovations has more than twenty-five students from various majors divided into four projects. The projects are: a pedal that offers the ability to transition from clipped in to a platform and back at the push of a button; a system to allow tire pressure change on the fly; an inexpensive winter commuting tire; and an innovative exercise system for wheelchair users that will allow further physical research. Velovations projects cover the complete product development range, from idea conception, research, and development, to customer communication, testing, and ultimately manufacturing.

A Velovations team member tests a modified tire for improved winter traction

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Open Source Hardware

Team Leaders
Lucas Wilder

Advisor
Joshua Pearce, Electrical and Computer Engineering/Materials Science and Engineering

Sponsors
Department of Electrical and Computer Engineering and Department of Materials Science and Engineering

Project Overview
We are a brand new Enterprise dedicated to the development, advancement, and availability of open-source hardware. Unlike open-source software, hardware development is costly. We are currently split between managing our growing 3D printing business and constructing the first few tools for a Michigan Tech makerspace.

Open Source Hardware team’s induction furnace is used to melt metal in 3D metal printing
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