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More Special Thanks

To the distinguished judges who give of their time and talents to help make the 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.

On the cover, L to R:
Green Campus Enterprise installs a wind tower at Michigan Tech;
WCE’s wireless glove allows user to “write” on a big screen;
Oculus-ASR, a nanosatellite developed by Aerospace Enterprise, won first place in Nanosat 6 and will be launched into orbit by the US Department of Defense in 2013.
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Tim Schulz, Dean, College of Engineering; Bob Warrington,
Codirector, Institute for Leadership and Innovation; and Leonard
Bohmann, Associate Dean, College of Engineering

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Scope
The Undergraduate Expo highlights hands-on, discovery-based
learning at Michigan Tech. Nearly one thousand students in
Enterprise and Senior Design teams showcase their work and
compete for awards. A panel of judges, made up of corporate
representatives and Michigan Tech staff and faculty members,
critique the projects. Many of them are sponsored by industry,
which allows students to gain valuable experience through
competition at the Expo, as well as direct exposure to real
industrial problems. The Expo is a combined effort of the College
of Engineering, the Institute for Leadership and Innovation, and the
Center for Diversity and Inclusion.

Student Awards
Senior Design Awards
Based on poster
First place—$150
Second place—$100
Third place—$75
Honorable Mention—$50 (three to be awarded)

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

Special Guests
Universidad del Turabo, Puerto Rico
Two Enterprise teams from the Universidad del Turabo in
Gurabo, Puerto Rico, will compete this year: The EMCO Energy
Management Co. and EVOLIFE Practical Medical Solutions.
Welcome back to the Expo!

High School Enterprise
Now in its fourth year, the High School Enterprise Program has
fifteen student teams competing in the Expo this year, including one
team from Puerto Rico.

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DISCOVER THE TALENT. REALIZE THE BENEFITS.
SAVE MONEY BY OUTSOURCING WORK TO STUDENT ENGINEERING TALENT AT MICHIGAN TECH.

· Explore new business models
· Execute key business functions efficiently with lower costs
· Maintain stable lower costs
· Sustain quality to challenges of doing work overseas

· Retain control of IP and protect innovations
· Build company loyalty - lower employee turnover
· Address Attrition

· Identify and recruit the best talent
· Impact the development of products with Michigan Tech students
· Access fresh and innovative minds of tomorrow’s engineering landscape
· Increase workforce diversity

Two Great Success Stories
GE Aviation and Ford have opened offices in the MTEC SmartZone and are realizing cost-saving growth and high-quality project outsourcing.

Just a few of the talented students working in the MTEC SmartZone.
Greetings all, and welcome to the tenth annual Undergraduate Expo at Michigan Tech!

The Undergraduate Expo provides a showcase for the talent and creativity of our students, as Enterprise and Senior Design teams come together to present the fruits of their labor.

What a landmark day for our undergraduate students, who, through all their hard work, have become innovative thinkers and effective leaders. They should take tremendous pride in their accomplishments.

The Expo is truly a showcase of education in action here at Michigan Tech. Discovery-based learning, interdisciplinary teamwork, design, innovation and entrepreneurship, working with industry—you’ll experience it all firsthand in the projects on display.

We are grateful to all of our corporate and community sponsors who have so generously supported our educational mission by providing invaluable project experiences, along with mentorship and guidance for our students. The benefits of industry and academia working together as partners in higher education are clearly evident, especially here at the Expo.

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

Sincerely,

Timothy J. Schulz
Dave House Professor and Dean
College of Engineering

Robert O. Warrington
Codirector
Institute for Leadership and Innovation

Leonard J. Bohmann
Associate Dean for Academic Affairs
College of Engineering
HOW THE DIRT UNDER OUR NAILS HELPED US BUILD A FORTUNE 500® COMPANY
101 Creep Behavior of EZACTM Die-Cast Zn Alloy

Team Members
Daniel Young and Dale Goodloe, Materials Science and Engineering
Advisor
Dr. Paul Sanders
Sponsor
Eastern Alloys Inc.

Project Overview
The creep behavior of Eastern Alloys’ Zn Die-Cast alloy, EZACTM, was evaluated using ASM E-8 standard tensile bars, die cast using a repaired and instrumented die-casting machine and tested with an ATS lever arm creep tester. These castings were also evaluated for porosity and correlated to the die-casting parameters during their creation—with the intent on determining the machine settings’ influence on porosity and other related defects. Valuable information regarding the mechanical performance of die-cast EZACTM at elevated temperature was gathered.

102 Table Column Process Optimization

Team Members
Roger Crawford, Drew Schorfhaar, Mike Dettl, Stosh Talaske, Austin Merkel, and Qiayu Liang, Mechanical Engineering
Advisor
Dr. Michele Miller
Sponsor
Grand Rapids Chair Co.

Project Overview
The goal is to redesign Grand Rapids Chair Company’s “Labor Saver” table column while removing the current joining method of welding. An organized manufacturing process for the labor-saving method, along with analytical data, are required for the project.

103 Instrument Panel Attachment BSR Optimization

Team Members
Aaron Valenti, Breanna Cronk, Ross Benner, Troy Schultz, and Craig Reynolds, Mechanical Engineering
Advisor
Charles Van Karsen
Sponsor
Bayer MaterialScience

Project Overview
The goal is to obtain buzz, squeak, and rattle (BSR) test data on the types of fasteners in automobile instrument panels (IP). The team also will design a new fastener to reduce BSR in IPs.
104
Keel Cooler Dynamic Fatigue Resistance

FEA Model of the Fernstrum GRIDCOOLER

105
Salt Delivery System

Assembly of the salt delivery system.

106
Self-Cleaning, Keel-Mounted Cooler

The sample is placed between a heat source and ice bath. Thermal conductivity can be calculated using the temperature differential and amount of watts input to the heaters.

Team Members
Kane Johnson, Jake Mohan, Shawn Bretting, Kayla Tobias, and Matthew Carney, Mechanical Engineering
Advisor
Charles Van Karsen
Sponsor
R.W. Fernstrum

Project Overview
The FERNSTRUM® GRIDCOOLER® unit is a closed-circuit heat exchanger mounted externally on a ship’s hull. The goal is to determine and understand the vibration-induced fatigue failures that occur in a small percentage of the FERNSTRUM GRIDCOOLER units. The project includes testing and modeling the GRIDCOOLER in order to design a solution to the vibration problems, without sacrificing efficiency of the heat exchanger. We conducted data acquisition, modeling, testing, designing, and prototyping.

Team Members
Matthew Baumann, Jason Bernard, Izaak Harvey, Carl Vonck, David Haefs, Viraj Godapola, and Jacob Warden, Mechanical Engineering; Bruce Hall, Mechanical and Electrical Engineering
Advisor
Dr. Josh Loukus
Sponsor
Peterson Salt and Water Treatment Co.

Project Overview
The goal is to design a prototype of an efficient water softener, salt-delivery system suitable for residential and commercial use. The truck system uses pneumatics to blow the salt from the truck to the on-site tank.

Team Members
Max Lent, David Arnold, Ben Ranta, Will Prins, Mechanical Engineering; Karl Warsinski, Materials Science and Engineering
Advisor
Mike LaCourt
Sponsor
R.W. Fernstrum

Project Overview
Keel-mounted coolers are heat exchangers mounted on the outside of a boat hull to expose them to cold seawater. The client has asked us to find a coating that prevents marine growth while maintaining the performance of the coolers. We must find a coating with high thermal conductivity. In order to pinpoint this function, we are building a Guarded Hot Plate test apparatus, from which the thermal conductivity can be experimentally obtained.
107
Chassis Deflection Measurement System

Complexities of modern suspension systems make it difficult to take deflection measurements at attachment points.

Team Members
Andrew Ramsey, Karl Selewski, Paul Shenkosky, Scott Gittins, and Matt Latham, Mechanical Engineering
Advisor
Dr. Michele Miller
Sponsor
Jon Darab, General Motors Foundation

Project Overview
The goal is to create a new concept for taking small-scale deflection measurements on multi-length, vehicle suspension points for the General Motors Vehicle Handling Facility. These measurements allow engineers to determine the stiffness required by the attachment points, allowing for weight to be saved or for an increase in vehicle performance. We will present the design process, prototype testing, and final results of the project.

108
CNC Gun Drill-Sharpening Device

A final concept sketch featuring a three-axis turret system

Team Members
Travis White, Jonathan Johnson, Ravi Shah, Jeff Schumacher, Matthew Heyse, and James Licht, Mechanical Engineering
Advisor
Dr. Josh Loukus
Sponsor
Precision Edge Surgical Products

Project Overview
The goal is to design and build a CNC gun drill-sharpening machine to resharpen a single flute, as well as carbide gun drills, and replace the manual device.

109
John Deere Cab Suspension Design

Alongside a 2011 John Deere tractor, which is parked on blocks used for cab suspension testing

Team Members
Jay Greenberg, Erik Riutta, Beau Ihnken, Jeremy Skjold, and Andrew Wiegand, Mechanical Engineering
Advisors
Mike LaCourt and Charles Van Karsen
Sponsor
John Deere Agricultural Systems

Project Overview
John Deere will be offering a semi-active cab suspension option on their 2011 model year tractors. This design makes controlling the system’s responses difficult, however. The goal is to modify this pneumatic-over-hydraulic suspension system to eliminate those negative responses and improve operator isolation.
**110 Conformal Cam Follower Design**

An example of adhesive wear caused by Hertzian contact stresses (top left); a roller follower in contact with a camshaft (bottom left); the stress distribution at the roller-to-cam interface simulated using finite elements (middle right).

**Team Members**
Michael Rademacher, Brian Sollars, Skyler Teske, Jiongxun Zhang, and Venkatesh Shetty, Mechanical Engineering

**Advisor**
Dr. Gregory Odegard

**Sponsors**
Oliver Bouthier and Carl Musolff, Cummins Mid-Range Applied Mechanics

**Project Overview**
In the ISX 15.0-liter diesel engine, Cummins currently utilizes a convex-to-convex interface between roller followers and cams. The advantage of this design lies in the fact that high stress, due to edge contact, is eliminated. However, the small point of contact at this interface creates high Hertzian stresses. The project investigates the possibility of using a more conformal convex-to-concave interface. Theoretically, this design will create a larger area of contact between the rollers and cams and, therefore, reduce Hertzian stress.

---

**111 Electric Park Brake Design**

Motor on caliper 3-D CAD model

**Team Members**
BShiran Chen, Joshua Howell, Fei Pi, and Jeff Rice, Mechanical Engineering; Brian Thompson and Jared Helminen, Electrical Engineering

**Advisor**
Dr. John Beard, Mechanical Engineering-Engineering Mechanics

**Sponsor**
HB Performance Systems Inc.

**Project Overview**
Design an electric parking brake—to replace the cable-driven parking brake—on Harley Davidson Tri-Glide and Can-Am Spyder three-wheel motorcycles.

---

**112 Instrumentation for Quantitatively Assessing Tremors**

An instrument for quantitatively assessing tremors of the hands

**Team Members**
Cody Alger, Jacob Gombar, Daniel Hirst, Michael Hulway, and Amy Saelen, Biomedical Engineering

**Advisor**
Dr. Keat Ghee Ong

**Sponsor**
Department of Biomedical Engineering

**Project Overview**
Currently there is no effective way to quantify the magnitude and frequency of essential tremors in the hands. Therefore, the goal is to design and build a device that quantitatively assesses these variables. This device must be able to record the frequency and magnitude of the tremor, with minimal interference from outside factors, while remaining cost-effective. In addition, this device must have a high level of precision and accuracy so the results can be compared to previous trials to determine trends in tremor behavior—as well as help determine whether specific treatments are having measurable effects in reducing the tremor.
113 **Hand-Washing Compliance System**

A device to monitor if medical staff are washing their hands before and after patient visits.

**Team Members**
David Michael Smeenge, Cari Steinman, Zichen Qian, and Melinda Ylitalo, Biomedical Engineering; Britney Estola and Jennifer Lounds, School of Business and Economics

**Advisor**
Dr. Seth Donahue, Biomedical Engineering

**Sponsor**
Portage Health

**Project Overview**
The goal is to design a compliance system for hospitals to assess the occurrence of employee hand washing while in a patient’s room. The system must be cost-effective, easy to use, easily implemented, applicable to a variety of rooms, and compatible with the hospital and health care workers.

114 **Jukebox Heroes**

1936 patent for the jukebox’s wooden cabinet.

**Team Members**
Steven Porritt, Kyle Heythaler, and Philip Willis, Industrial Technology

**Advisor**
Linda Wanless

**Sponsor**
Lindell Chocolate Shoppe

**Project Overview**
The project involves the restoration of a 1936 Rockola Rhythm King Jukebox, which is an integral part of the nostalgic atmosphere in the Lindell Chocolate Shoppe located in Lake Linden, Michigan. The project requires interfacing the 1936 mechanical record player with modern electronic technology.

115 **Fixation System Design for a Leadless Pacemaker**

Our team will be testing our pacemaker prototypes using a flow chamber.

**Team Members**
Daniel Dubiel and Natalie Hartman, Biomedical Engineering; Beatrice Burgess and Brian Czech, Mechanical Engineering and Biomedical Engineering; John Kinzinger, Materials Science and Engineering; and Amberlee Lifer, Materials Science Engineering and Biomedical Engineering

**Advisors**
Dr. Rupak Rajachar, Biomedical Engineering, and Dr. Steve Hackney, Materials Science and Engineering

**Sponsor**
Medtronic

**Project Overview**
While traditional pacemakers pose risks of complications and infections, Medtronic's leadless pacemaker is designed to reduce these risks by its sub-cubic-centimeter volume. This size is achieved through increased efficiency by attaching the pacemaker directly to the heart wall. Though effective, one of the greatest challenges associated with this technology can be found in the method of attachment, which served as the focal point for this project. Several attachment designs were developed, and the sponsor chose three of these for testing. Finite element analysis, as well as fluid shear testing and force-displacement testing, were completed on fabricated designs.
**116 Bioabsorbable Metal Stent Degradation Simulation Design**

Team Members
Patrick Bowen and Jesse Gelbaugh, Materials Science and Engineering; Rebecca Franke, Judy Bryne, Ellen Pokorney, Jessica Rhadigan, and Aaron Tauscher, Biomedical Engineering

Advisors
Dr. Jeremy Goldman, Biomedical Engineering, and Dr. Jaroslaw Drelich, Materials Science and Engineering

Sponsor
Boston Scientific

Project Overview
Research has shown that the use of bioabsorbable materials in stents shows great promise in mitigating long-term, stent-related cardiovascular risks, as well as aiding the vascular healing process. Qualitative and quantitative relationships between the relatively slow in vivo degradation and faster in vitro degradation of bioabsorbable materials will be found in order to better understand how to simulate the behavior of these materials in the body. This project is meant to work toward a reproducible, well-defined protocol for conducting evaluations of candidate materials for use in bioabsorbable stents.

---

**117 Economic Recovery of High-Value Elements from Grinding Swarf**

Team Members
Andrew Heikkinen, Mena Klittich, Patrick Luke, Travis Magaluk, and Cameron McNamara, Materials Science and Engineering

Advisor
Dr. Jiann-Yang Hwang

Sponsor
Casting Services Group

Project Overview
The goal is to develop a cost-effective method of separating high-value nickel and cobalt alloys from current, third-party-processed grinding swarf. The swarf is composed of the metal grinding fines from ten production alloys, resulting in varying composition. Physical separation methods were examined and tested based on efficiency and customer feasibility.

---

**118 HMI-Enhanced, AC-Motor-Driven, Two-Part Dispensing System**

Team Members
Jeff Blichmann, Joe Webb, and Wayland Bugg, Electrical Engineering Technology

Advisor
Dr. Aleksandr Sergeyev, Mechanical Engineering Technology

Sponsor
Sealant Equipment

Project Overview
This project is intended to improve a pump operation: reduce the cost of their current system, while also making the design easier for the operator to use. The proposed system will incorporate an HMI, which will allow the operator to simply enter the desired flow rate and the ratio of the two parts.
119
Team Hover

A rectangular center has support assemblies branching from the center to distribute the lift force, supported atop a lightweight Dacron air cushion.

Team Members
Cong Liu and Ryan Smith, Mechanical Engineering Technology; Jared Sella, Mechanical Engineering Technology and Industrial Technology
Advisor
Dr. John Irwin
Sponsor
School of Technology

Project Overview
We are designing and fabricating a human-powered hovercraft to be used as a demonstration of engineering principles and airflow dynamics. The hovercraft will run entirely off of power generated by the rider, who must provide lift and propulsion to the craft.

120
12-Volt Starter System Optimization for Maximum Cranking Speed

Working on a starter system in GM vehicles to start the vehicle in less than 300 millisecond

Team Members
Steve Hook, Qi Ou, and Jinxin Zhao, Electrical Engineering; Amit Samal, Nick Anderson, and Jake Truitt, Mechanical Engineering
Advisor
Dr. Duane Bucheger
Sponsor
Darrell Robinette, General Motors Foundation

Project Overview
The goal is to optimize the twelve-volt starter system for GM vehicles to help improve the fuel efficiency and to execute auto start/stop functionality, while keeping in mind noise, vibration, and harshness (NVH) characteristics.

121
East Jordan Iron Works Water Sensing Device

Microscopic components are cool until you try actually using them.

Team Members
Joseph Graziani, Bochao Li, and Dave Zebarah, Electrical Engineering; Jordan Porter, Mechanical Engineering; and Eric Nietering, Electrical and Computer Engineering
Advisor
Donald Secor
Sponsor
East Jordan Iron Works

Project Overview
The goal is to design a device that can be secured to a fire hydrant and can sense if water is in the bottom or not, and then wirelessly transmit that information to a car that is passing by.
**Power-Assisted Door Safety System for Armored Vehicles**

**Team Members**
Brad Johnston, Alex Puestow, Matt Klotzer, and Callin O’Farrell, Electrical Engineering; Ryan Anderson, Mechanical Engineering

**Advisors**
Donald Secor and Dr. Duane Bucheger

**Sponsor**
BAE Systems-Global Tactical Systems, Sterling Heights, Michigan

**Project Overview**
Extensive armoring on some military ground vehicles makes the doors too heavy to be manipulated by hand. These heavy doors utilize hydraulic or electric actuators to operate. Such systems remove the risk of operators manipulating heavy doors, but people or objects in the path of these doors could still be at risk. The goal is to develop a prototype system that demonstrates different object-detection technologies that could be used as a safety system to stop a power-operated door. The technologies should also be applicable to improving situational awareness around the vehicle.

*The team at work, testing and troubleshooting the electrical control system.*

---

**Mont Ripley AirTech Senior Design**

**Team Members**
Daniel Hamilton, Mechanical Engineering Technology; and Bruce Arnsman, Industrial Technology

**Advisor**
Dr. David Wanless

**Sponsor**
Mont Ripley Ski Area, Michigan Tech

**Project Overview**
Mont Ripley employees occasionally need to complete maintenance and repair tasks in the field, which involve pneumatic powered tools. Prior to this project, there was no system in place to power these tools. The air compressors and the infrastructure to support them already exist on the hill. These air compressors supply 90 psi at a minimum of 20 cubic feet per minute. This project involves designing an air network with automated regulation that will seamlessly integrate with the existing infrastructure. The air network needs to be transportable by snowmobile, snow cat, ski patrol toboggan, pickup truck, and all-terrain-vehicle.

*Dan guides a loaded ski patrol toboggan down the Triangle ski run at Mont Ripley during the first test of the air network.*

---

**The Science of Fit: Pressure Sensing Face Mask System Development**

**Team Members**
Robert Mallow, Matt Little, Yuanfei Min, and Kyle Grundy, Electrical Engineering

**Advisor**
Dr. Duane Bucheger

**Sponsor**
3M

**Project Overview**
The team is creating a sensing system to identify the pressure profile created by the interaction between a facemask and a variety of faces. This system will be used for analytical studies on the science of fit. This involves creating a pressure sensing method, collecting data, and creating a visual representation of a pressure profile.

*Working on data acquisition and development of pressure sensor to fit on mask*
**125 Iron Pulverizer**

The iron nodules are cast in molten zinc as a test of a design concept.

**Team Members**
Joseph Anhalt, Kevin Poppe, Dallas Williams, Stephen Stacy, and Jacob Janiksela, Mechanical Engineering; Taylor Biallas, Materials Science and Engineering

**Advisor**
Dr. Gregory Odegard

**Sponsor**
Cliffs Natural Resources

**Project Overview**
The goal of our project is to design and build a machine/process that will produce cast-iron pucks from iron nodules. The beginning iron nodules have a melting temperature of near 1600 °C. The size of the individual nodules ranges from 5-15 grams, with a total sample size of 500 grams. The iron nodules will be melted using an induction heating furnace. Once the iron is molten, it will be cast into a 39mm diameter, 4mm tall puck. The pucks will then be analyzed to determine their iron, carbon, and sulfur content.

---

**126 Fuel-Metering System and Fuel-Economy Testing**

Laying out the components of the fuel-metering system

**Team Members**
Troy Carlson, Ben Heidfeld, Marc Kubas, Ben Meemken, and Chris Noah, Mechanical Engineering

**Advisor**
Dr. Charles Margraves

**Sponsor**
General Motors Foundation

**Project Overview**
The team has built a fuel-metering system for use in fuel-blend studies. The design is capable of measuring the fuel consumption of the power train in a dyno-cell as well as in a moving vehicle. The long-range objective is to begin to mature the chassis dynamometer test capability at Michigan Tech to perform steady-state, fuel-economy testing, as well as the ability to characterize the performance of various ethanol fuel blends using a flex-fuel vehicle. Recent publications report fuel economy and vehicle performance tradeoffs for various gasoline-ethanol fuel blends, but have conflicting conclusions regarding optimal blend.

---

**127 Keel Cooler Efficiency Optimization**

Redesigned cross section of GRIDCOOLER® tube showing coolant temperature contours

**Team Members**
Mario Bonvini, Brad Gillen, Inkyoung Km, and Tyler Lung, Mechanical Engineering; Logan Janka, Mechanical and Biomedical Engineering

**Advisor**
Dr. Charles Margraves

**Sponsor**
R.W. Fernstrum

**Project Overview**
We were tasked with developing an optimized interior surface morphology for use in the cooling tubes in keel coolers. The goal is a design that would increase the heat-transfer performance of the keel coolers while minimizing pressure drop. An optimized keel cooler is needed to meet the increased cooling demands of modern diesel engines that produce high power output and low emissions. To accomplish these objectives, multiple design concepts were evaluated using computational fluid dynamics. A final design concept was then chosen and its performance was validated through laboratory testing.
**128 Electric Range Shifter Proof of Concept for an HD Truck Transmission**

Sample transmission, linear actuator, and various other equipment being used to simulate system operation

**Team Members**
David Veasy, Christopher Woodruff, and Christina Buckner, Electrical Engineering; Tom Graham, Mechanical Engineering; and Taylor Pashak, Computer Engineering

**Advisor**
Donald Secor

**Sponsor**
Eaton Corporation

**Project Overview**
Currently, a small-stroke, single-rod, double-acting air cylinder actuator forces a mechanical clutch between the high and low gear for gear selection (range shift synchronizer). Confirmation of gear engagement is accomplished through a speed measurement of the rotating gears. The current actuation force using regulated air pressure is approximately 440 lbs. The envisioned system is a 12-volt, low-force, high-speed, brushless DC motor actuator with position feedback and force (current) control to provide shifting without the synchronizer. A key system design parameter: determine what type of force can be developed for the footprint available.

---

**129 Electric Motorcycle**

Disassembling the original bike

**Team Members**
Greg Ellenberger, Logan Mahowald, Bill Dahlgren, and Matt Smith, Mechanical Engineering

**Advisor**
Dr. David Wanless

**Project Overview**
The new trend is “Going Green,” and this team is transforming a 1974 Yamaha DT 250 motorcycle to an electric dirt bike. The goal is to have a fast-moving, long-lasting electric dirt bike that creates zero emissions.

---

**131 Reliability Testing Device**

This is a durability testing mechanism to be used by Pioneer Surgical for its tensioning device.

**Team Members**
Anthony Rossetto and Brittany Potton, Biomedical and Mechanical Engineering; Sam Bredeson and Brian Stetter, Biomedical Engineering

**Advisor**
Dr. Sean Kirkpatrick

**Sponsor**
Pioneer Surgical

**Project Overview**
The goal is to complete a prototype mechanism that can hold and automatically test a tensioning device. Along with automation, test values will be recorded for analysis. The ability to have the tensioner tested automatically will save work hours and preclude employee fatigue.
132 Automated Tie-Rod Load Control System for Performance Evaluations of Electric Power Steering Systems

Fixture designed by the team to hold the components of the system: the magnetic rotary brake is on the left with the tie-rod in the center; and the electric power steering system is on the right.

Team Members
Monica Alger, Computer Engineering; Michael Neuville, Electrical and Mechanical Engineering; Alexander Schlicker, Computer Engineering and Computer Science; and Mingfeng Zhang, Electrical Engineering

Advisor
John Lukowski

Sponsor
Nexteer Automotive

Project Overview
Evaluating the performance of an electric power steering system on a test bench requires accurate replication of steering loads, as seen by the tie-rods. Chassis and suspension geometry result in load profiles that change as a function of steering position. A magnetic rotary brake system is used to apply the load, whose magnitude depends on electrical current supplied to the brake. This project develops an automated load-control system using LabVIEW™ to control the current to the brake based on the position of the tie-rod and a given load profile.

133 Elevated Office Access

The team meeting in one of the student design studios at the ME-EM Cuskie Design and Creativity Center.

Team Members
Daniel Cook, Aaron Andersen, Andrew Breyer, and Max Guel, Mechanical Engineering

Advisor
Dr. John Beard

Sponsor
James De Clerck

Project Overview
The objective is to design a device to enable human access to an elevated office space, and fold out of the way when not in use. The unit must provide a safety barrier to prevent an occupant in an office chair from rolling out of the opening. Also, it should be easily removable, be safe for the range of individuals able to use it, and require minimal effort to operate.

134 Alpha Washer Green Packaging

New top cap design removes wasted material while still protecting the product.

Team Members
Josh Weyburne, Sean Anderson, Andy Brabant, and Patrick Towell, Mechanical Engineering

Advisor
Dr. Gregory Odegard

Sponsor
Brynn Fischer, Whirlpool Corp.

Project Overview
The goal is an improved packaging system for the Alpha washing machine. The current packaging does not effectively protect the product during packaging testing, which results in cracking of the front console and denting in the side panel. We redesigned the extruded polystyrene packaging in order to optimize load paths through the packaging, maximize energy absorption, minimize waste, reduce cost, and improve sustainability.
International Leg Assist Device

Project Overview
The people in India have a need for a low-cost, easy-to-use leg brace. The current design is difficult to use, and it does not allow people to sit cross-legged or squat, both of which are culturally significant positions for the region. The major goals are keeping the cost less than $10 per brace as stipulated by the sponsor to accommodate the financial situation of the end users in India, allowing for the brace to “grow” with the person it is fitted for, and make it easy to operate and build. We will develop several prototypes that are different from the current design.

Reciprocating Gait Orthosis

Project Overview
A reciprocating gait orthosis (RGO) is composed of a pelvic brace, a propulsion system, and bilateral femur-tibia-ankle support with hip and knee locks, and strengthened ankles. These devices are generally used for rehabilitative purposes. The design is geared towards both increasing the metabolic efficiency required of the use, as well as reducing the cost to $600 USD. Another target is range of motion to allow squatting, which is culturally appealing. A propulsion system of handlebars used to lift the leg, as well as adjustable bars for the femur and tibia, have helped facilitate a reduction in cost.

Waste Gate Integration

Project Overview
To meet with the upcoming US Tier 4 off-highway emission standards, the client is integrating a turbocharger waste gate into their existing product line. Using finite element analysis and Pro Engineering CAD software, we designed a prototype system for use as a test bed.
**Corner Cracking**

*Pouring molten iron*

**Aluminizing Bearing**

*Cutting material for experiment*

**Human-Powered Grain Processor**

*The team’s first stone mill prototype will fill a need of African people by allowing them to grind their own corn into flour.*

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**Project Overview**

The client has problems with a certain grade of steel that produces small cracks in the corners. After their steel slabs are rolled into flat sheet for the customer, these small cracks progress into larger ones, making their steel unsellable. We will give suggestions to correct this problem.

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**Team Members**

Jon Sanders and Michelle Loomis, Materials Science and Engineering

**Advisors**

Dr. Paul Sanders and Dr. Mark Plichta

**Sponsor**

ArcelorMittal

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**Project Overview**

The client is the world’s largest steel company, producing nearly 73 million tons of crude steel, nearly 8 percent of the world market. They produce steel sheets, which are coated with aluminum in an aluminizing pot, which contains a stabilizer roll and an aluminizing roll, both made of bearing steel. The bearing for the rolls wears out in the molten aluminum and frequently needs replacement. The purpose of this project is to increase the life of the bearing by 20 percent and decrease the frequency of replacement.

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**Team Members**

Ashwin Vekaria and Mark Twilley, Materials Science and Engineering

**Advisors**

Dr. Paul Sanders and Dr. Mark Plichta

**Sponsor**

ArcelorMittal

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through sponsorship of a Zambian child, the family of mechanical engineering alumnus Terry Woychowski recognized the effort and cost of the process of grinding corn into flour. This process was a great burden on families and inhibited the education of children. The Woychowski Charitable Foundation has tasked us with making improvements to the hammer mill designed and prototyped by a previous Senior Design team. The foundation aims to provide the people of sub-Saharan Africa with an improved way of life and educational success through supplying a less costly and more efficient method to process corn.

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**Team Members**

Megan Beyer, Alex Longe, Casey Wendrick, and Beth Russart, Mechanical Engineering; Chuck Workman, Chemical Engineering

**Advisors**

Dr. William J. Endres, Mechanical Engineering-Engineering Mechanics, Dr. Tony Rogers, Chemical Engineering

**Sponsor**

Woychowski Charitable Foundation
141 Heat Treatment of Creep-Strength Enhanced Ferritic Steel

Team Members
Kyle Anderson, Luke Gilbertson and Chris Heczko, Materials Science and Engineering; Ran Liao, Mechanical Engineering
Advisor
Dr. Calvin White, Materials Science and Engineering
Sponsor
EPRI

Project Overview
Electric Power Research Institute (EPRI) needs specific guidance on heat treatment of Grade 91 steel, a type of creep-strength enhanced ferritic (CSEF) steel used in the power industry for boiler components and piping. This guidance should include the maximum allowable component thickness that, upon air cooling, allows for complete transformation of the Grade 91 steel to martensite. Use of thicker components allows for design at higher temperatures and pressures, leading to more efficient energy production.

142 Die Cast Renovation and Maintenance

Team Members
Chadwich Williams, Andrew Ignasiak, Matt Teasley, and Jacob Nowak, Mechanical Engineering Technology
Advisor
Scott Wagner
Sponsor
Eastern Alloys and Advanced Metalworks Enterprise

Project Overview
We were given the task of designing and machining a die that would be capable of creating tensile bars, which would be used by the Advanced Metalworks Enterprise to acquire material data for Eastern Alloys. We also helped create a troubleshoot manual for the die-cast machine for future operators.

143 Reducing Maintenance Costs through Continuous Monitoring

Team Members
Jeff Sudgen, Computer Engineering; Jordan Bosque and Ethan Grindle, Electrical Engineering; David Brown, Electrical and Computer Engineering
Advisor
Dr. Chee-Wooi Ten
Sponsor
ITC Holdings Corp.

Project Overview
North America Electric Reliability Corp. is releasing an update to the standard for Protection Systems Maintenance and Testing, PRC-005-2. We designed a software solution to assist ITC in meeting the monitoring requirements of PRC-005-2 to maintain the current maintenance periods.
144 Vibration and Acoustic Analysis of High Voltage Transformers

Team Member
Patrick Crego, Industrial Technology
Advisor
Dr. John Irwin
Sponsor
Steve Bethel, Leadfoot Engineering

Project Overview
Located in Chassell, Michigan, Leadfoot Engineering has made it clear that the need of proper engineering analysis within their machine shop for noise reduction on their high-voltage transformers is required. The project focal point revolves around the research of mechanical vibrations and the acoustic signature of high-voltage transformers. Analysis of spectral noise emissions, thermal controls and structure/equipment vibrations have provided in-depth knowledge for establishing educated and very practical solutions for the final implementation of an effective sound-dampening device. The research will be submitted for possible journal publication.

145 Northport Bay Boat Yard Process Improvement

Team Member
Patrick Crego, Industrial Technology
Advisor
Dr. Linda Wanless
Sponsor
Kevin Dyer and Don Thyer, Northport Bay Boat Yard

Project Overview
The industry client is one of the only high-volume boat storage facilities in northern Michigan that maintains a storage capacity of nearly 700 boats, with the ability to handle 70-ton vessels. Recent additions of nearly 200 new boats have made it clear that the need for proper engineering analysis within the storage and removal department is necessary to efficiently handle the larger volume of boats. Storage and removal times are limited between the months of August and November, when process handling and practices of just-in-time delivery allow for zero error to occur.

146 Houghton County Justice Facilities Study and Design

Team Members
Mark Devich, Alex Borton, Hans Hapaala, Colin Singleton, Zane Hyrkas, Chad Hemingway, Wingjing Zhou, Qilong Hu, Ben Sheff, Justin Blake, Nick Peupekke, Mark Edlebeck, Tarris Anderson and Brandt Homik, Civil Engineering
Advisor
Dr. George Dewey
Sponsor
Houghton County

Project Overview
This project has studied and designed options for the Houghton County Courthouse, Sheriff’s Office, and Jail. The current facilities have numerous issues, including safety concerns and overcrowding. We hope to provide the county with an analysis of feasible options to accommodate the county’s needs. For academic purposes, we also selected a site and designed a facility that meets the needs of the county.
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**301 Consumer Product Manufacturing Enterprise**

Welding components for a can depalletizing machine designed, built, tested, and implemented by CPM for the local Keweenaw Brewing Company—something that chemical engineering major Zach Lemieux would not normally get to do outside of the Enterprise Program.

**Team Leaders**
Alex Ash and Zach Lemieux, Chemical Engineering

**Advisors**
Dr. Tony Rogers and Dr. Sean Clancey, Chemical Engineering

**Sponsors**
Keweenaw Brewing Company (KBC), Dow Corning Corp.

**Project Overview**
In the interest of manufacturing efficiency and process improvement, we have developed a custom, automated can-depalletizer for the Keweenaw Brewing Company. The new unit will be used in a canning facility to reduce canning time and manual labor. In a second project, sponsored by Dow Corning, we have worked to implement a novel intermediate bulk container (IBC) to ship silicone sealants. The IBC will dramatically improve shipping logistics and reduce waste and shipping costs.

**302 International Business Ventures**

Clinical testing performed on a newborn in Ghana. Students from the Infant Heart Annunciator team will travel back to Ghana this summer to perform more clinical testing with a new, updated prototype.

**Team Leaders**
Josh Floyd and Christina Ruth

**Advisors**
Dr. Robert Warrington, Institute for Leadership and Innovation; Dr. Michael Neuman, Biomedical Engineering; and Anne Warrington, School of Business and Economics

**Sponsors**
Heyer Medical A.G., J Edgar McAllister Foundation

**Project Overview**
With a focus on biomedical solutions for global markets, we offer a unique opportunity for students to learn how best to work cooperatively with other classmates—as well as students and businesses worldwide—in order to develop and bring to market new products for which a need has been identified.

**303 Nanotech Innovations Enterprise**

Making an atomically sharp tip for a scanning tunneling microscope by electrochemically etching a platinum-iridium wire.

**Team Leaders**
Chris Knoblauch, Electrical/Mechanical Engineering, and Joe East, Biological Sciences

**Advisor**
Dr. John Jaszczak, Physics

**Sponsors**
National Science Foundation

**Project Overview**
We work to further the field of nanotechnology, both at Michigan Tech and across the country. We participate in outreach programs designed to educate college and precollege students about nanotechnology. In addition, we develop educational tools that are used for nanotechnology education across the country. These projects include developing a scanning probe microscope with Lego Mindstorms kits and developing an automated device to chemically etch atomically sharp tips for a scanning tunneling microscope.
**304 Blue Marble Security**

Autobot is a robot created for the intelligent ground vehicle competition (IGVC), sponsored by Oshkosh Truck Corp.

**Team Leaders**
Miles P. Grostefon, Electrical Engineering Technology, and Liz Cloos, Electrical Engineering

**Advisor**
Glen Archer, Electrical and Computer Engineering

**Sponsors**
Oshkosh Trucks, Pall Corp., IRHC, US Department of Energy

**Project Overview**
We are a virtual company that focuses on securing the future through thoughtful use of technology—a rich educational experience in engineering design, team building, project management, and original product development.

**305 ITOxygen**

**Team Leaders**
Adam Gibson, Computer Science and Management Information Systems, and Zack Wheeler, Computer Network and System Administration and Business Administration

**Advisor**
Bob Maatta, School of Business and Economics

**Sponsors**
IBM and Herbert H. and Grace A. Dow Foundation

**Project Overview**
We develop information system and information technology solutions for both corporate and nonprofit clients. Projects include process modeling, software development, database development, information systems analysis, and web-based application development. We develop leading-edge software solutions in a team environment, giving participants the skills and experience they need to land that perfect internship or full-time position.

**306 Advanced Metalworks Enterprise**

In our foundry, members of the enterprise cast iron parts.

**Team Leaders**
Mike Knudsen and Sara Heck, Materials Science and Engineering

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

**Sponsors**
GE Aviation, Alcoa, Howmet, and ArcelorMittal

**Project Overview**
The enterprise is works to solve problems for industry leaders and perfect product development and sales. Specializing in machining and casting methods, AME works with industry sponsors to optimize production and process methods, and improve product quality and customer relations. We have four teams working on different projects—Die Casting, Turbine Group, AM Bearing, and Corner Cracking.
Team Leaders
Andrew Rice and Shawn Range, Mechanical Engineering
Advisor
Dr. James De Clerck
Sponsors

Project Overview
As part of Formula SAE, more than 120 teams from universities around the world build a formula-style race car to compete in both static and dynamic events at the annual world competition held in Michigan.

Two members of the shell team work on shaping the foam plug of the scale model, which was used to model the shell and determine final curvatures.

Our organization works to develop new technologies each semester, including this colored LED display.

Project Overview
We focus on wireless, optical, and biomedical technology, as well as renewable energy, lasers, FPGA prototyping, wind/solar power, PCB design, and embedded systems programming. We operate as a think tank for companies looking to push their product lines to a higher level. Members work as entrepreneurs, taking our own ideas to a level where they can be useful for industry and consumers alike. We are always looking for sponsors to challenge us with projects. Our members come from many majors including electrical, computer, biomedical, mechanical, scientific and technical communication, and business.

We are committed to providing viable solutions to real-world energy problems. We currently have five active projects: direct methanol fuel cell production facility; solid oxide fuel cell cogeneration, biodiesel production for street sweeper, solar car, and stationary solar energy analysis.
Efficiency through Engineering and Construction Enterprise

Team Leaders
Dianna Cacko and Alicia Haydamack, Construction Management

Advisors
Lynn Artman, Construction Management

Sponsors
Ford Motor Company Fund, Ford College Community Challenge Grant, and Energy Works of Michigan

Project Overview
Our goal is to increase the awareness and application of sustainable practices and energy efficiency in the built environment. We increase awareness by educating high school students through interactive, in-class presentations and also by including high school students in our volunteer work out in the field with low income families in need of home winterization. We strive to increase the application of sustainable practices by designing energy-efficient homes for our local chapter of Habitat for Humanity.

SAE Clean Snowmobile Team

Team Leaders
Casey Anderson and Lauren Nasca, Mechanical Engineering

Advisor
Dr. Jason R. Blough, Mechanical Engineering–Engineering Mechanics

Sponsor
General Motors Foundation, 3M, Chrysler, DENSO, Alcoa, ArcelorMittal, Cummins, Ford Motor Company Fund, and Polaris Industries

Project Overview
We compete annually in the Clean Snowmobile Challenge against teams from other universities all around the world. We must engineer and construct a clean, quiet, and efficient internal combustion engine that can run on “flex-fuel.” This sled will be tested on its acceleration, handling, emissions, noise, fuel economy, and endurance. Also, a new challenge for this year is to construct an electric snowmobile that is capable of running for extended ranges while pulling loads, without having to be recharged.

Integrated Microsystems

Team Leaders
Nicholas Oberski and Jared Julien, Electrical Engineering

Advisors
Dr. Paul Bergstrom and Dr. Christopher Middlebrook, Electrical and Computer Engineering

Sponsor
Kimberly-Clark

Project Overview
We specialize in controlling macro systems with microcontrollers such as our motion simulator.

ETEC students are braving cold wet weather to cut and install paneling for a family in need.

A Clean Snowmobile Team member tunes an engine on our dyno stand.

We specialize in controlling macro systems with microcontrollers such as our motion simulator.
Team Leaders
Daniel Mizell and Troy Wiitala, Mechanical Engineering
Advisor
Richard Berkey, Institute for Leadership and Innovation
Sponsors
Mathworks, Pi Shurlok, 3M, DENSO North America Foundation, General Motors Foundation, Oshkosh Corp., BAE Systems, John Deere Foundation, Ford Motor Company Fund, Alcoa, and ArcelorMittal

Project Overview
We develop automotive systems and work as a design team on a super-high-mileage vehicle, which will challenge other engineering schools at this summer’s competition.

Team Leaders
Troy Mackey and Mark Maguire, Civil Engineering
Advisor
Dr. John Gierke, Geological and Mining Engineering and Sciences
Sponsors
Mark Hurley, Tim Rombach, and the Keweenaw Bay Indian Community

Project Overview
We focus on the sustainability and availability of water resources. One of our projects includes determining the effectiveness of applying sparged air to the groundwater of a field used for purifying fruit processing wastes. The goal is to verify if the injection of air will cause the highly concentrated iron and manganese to precipitate back into the soil. Another project involves the analysis of an aquifer to determine its capability of providing the proper recharge rate needed for a local fish hatchery.

Team Leaders
Jian Lu, Mechanical Engineering, Haoyuan Zhang, Operations and Systems Management, Dan Cartwright, Mechanical Engineering, and Ruixi Jiang, Business
Advisor
Dr. Jindong Tan, Electrical and Computer Engineering
Sponsor
Continental AG

Project Overview
We focus on end-to-end product development and project management. We foster new design of autonomous unmanned vehicles, which can find many civilian and military applications for surveillance, rescue, geographical information systems, and more.
316 Green Campus Enterprise

Green Campus Enterprise members and the Michigan Tech Executive Board in April 2010 after our end-of-the-year report

Team Leaders
Jennifer Robinson and Andy McKenzie, Civil and Environmental Engineering

Advisors
Dr. Chris Wojick and Kristine Bradof, Civil and Environmental Engineering

Sponsors
Michigan Tech Dining Services and Housing and Residential Life

Project Overview
Our mission is to help Michigan Tech reduce its carbon footprint. We collaborate with other campus groups; increase awareness of our activities and sustainability in general; engage students, faculty, and staff in possible outcomes and effects of energy savings, both environmental and financial; maintain carbon inventory and use it to support other goals and efforts on campus; and prepare and present an end-of-semester report to the administration detailing progress, recommendations, and plans.

317 Forestry and Environmental Resources Management

FERM students at a timber sale in Mass City

Team Leader
David Kossak, Forestry

Advisor
Jim Rivard, School of Forest Resources and Environmental Sciences

Project Overview
The team will present forestry and natural resources project highlights from 2010.

318 Husky Game Development

Working on the BonzAI project, which is Husky Game Development’s annual AI programming competition

Team Leaders
Gabrielle Myers, Business Management, and Gary Phillips, Computer Science

Advisors
Dr. Robert Pastel and Dr. Scott Kuhl, Computer Science

Project Overview
We design and develop games for business, education, and fun. We stress productivity, creativity, and effective business practices. Our goal is to create quality software that will attract and satisfy industry sponsors.
Undergraduate Expo 2011

319
Automotive Computing Enterprise

A CAN message on the oscilloscope that is sent over the network by our ACE CAN board

Team Leader
Max Leason, Computer Engineering

Advisor
John Lukowski, Electrical and Computer Engineering

Sponsors
General Motors Foundation, Nuance, and the US Department of Energy

Project Overview
Our primary goal is to redesign the way people interact with their vehicles. This includes creating a dynamic instrument cluster that will allow customization of gauges and indicators. We also aim to create a more useful and intelligent center console unit to enhance the driving experience while improving safety—with upcoming technologies like speech recognition. We have expanded to take on a home energy/smart home project that will empower people to track their energy usage and intelligently control their home.

320
BoardSport Technologies Enterprise

Doing a quality check on a snowskate deck freshly pulled out of the press

Team Leaders
Adam Gofton, Industrial Technology, and Clay Kiern, Mechanical Engineering

Advisor
Dr. Ibrahim Miskioglu, Mechanical Engineering-Engineering Mechanics

Sponsors
Altair Engineering and Letherer Truss and Wall Systems Inc.

Project Overview
We develop snowboards, wakeboards, and skateboards. We study the forces involved in breaking boards, how to improve the design to create stronger boards, and experiment with new materials in board construction.

321
Aerospace Enterprise

The Oculus-ASR on display shortly after placing first in the Air Force Research Laboratory’s University Nanosatellite Competition

Team Leaders
Andrew Radford, Business Administration, and Corey Abate, Mechanical Engineering

Advisor
Dr. Lyon King, Mechanical Engineering-Engineering Mechanics

Sponsors

Project Overview
We number more than one hundred students who work together on innovative and relevant aerospace-related projects. We enhance our engineering and aerospace knowledge, as well as develop personal and leadership skills that will provide valuable work experience before graduation. Additionally, students work closely with industry sponsors whose contributions play a vital role in our success.
Project Overview
We are designing a fully autonomous trimaran, which is a sailboat but makes use of two extra hulls which act as outriggers to stabilize the boat. The boat will have a maximum length of 2 meters and will be built mostly out of wood. The control system will be a small computer, running all the adjustments needed onboard for maintaining its course. The computer will also use GPS and input from an array of sensors to plot its own course according to a predefined route. Depending on wind situations, this involves active obstacle avoidance and constant course correction. Furthermore the boat’s design is geared towards long-term independence from port and human control. Some parts of this design include solar cells to recharge and power the onboard electronics, and power-saving mechanical advantages wherever possible.

Team Leaders
Andrew Meyer and Bernhard Walker, School of Technology
Advisor
Aleksandr Sergeyev, Electrical Engineering Technology
Sponsor
BAE Systems

Team Leaders
Joshua Mullins, Brett Schulte and Devan Faust, Mechanical Engineering
Advisor
Dr. Brett Hamlin, Engineering Fundamentals
Sponsors
AMS, Alcoa, Caterpillar, Cummins, DENSO, Ford Motor Company Fund, 3M, Oshkosh Corp., ArcelorMittal, and Undergraduate Student Government

Project Overview
Our main objectives are to design and manufacture a tough, single-seat, off-road vehicle prototype for the off-road enthusiast. This includes rigorously testing the vehicle and preparing it for competition. Additionally, students engage in proper engineering management and project planning that include practice in human and monetary resource management. As well, we use many modern engineering software tools. As an outreach activity, Blizzard Baja hosts the nation’s largest invitational competition, the Winter Baja.

Team Leader
Caitlyn Bodamer, Mechanical Engineering
Advisor
Dr. John Gershenson, Mechanical Engineering-Engineering Mechanics
Sponsors
NCIIA, Cycling out of Poverty, SRAM, Rolf Prima, Cane Creek, Kore, Pearl Izumi, Rocky Mounts, Niner Bikes, and Saris Cycling Group

Project Overview
Velovations collaborates with the bicycle industry to develop new products, new processes, and future industry talent.
325 Transportation Enterprise

Team Leaders
Joshua Steffeck and Katie Hallenbeck, Civil Engineering

Advisors
Dr. George Dewey and Dr. Jacob Hiller, Civil and Environmental Engineering

Sponsors
General Motors Foundation

Project Overview
The Complete Streets group of the Transportation Enterprise has been working with the City of Houghton. Complete Streets allow safe usage for all ages when walking, biking, driving, and using public transit. The group is also looking at installing public electric vehicle recharging stations in the downtown so that the city can beat the demand. The City of Houghton gives a worst case scenario when looking at incorporating recharging stations into a city because of the location and snow in Michigan’s Upper Peninsula. In the process we discovered many items that should be thought of before implementing the recharging stations that we are planning on publishing for all municipalities.

326 Cin-Optic Communication and Media

Team Leaders
Nicole Kirch and Justin Jones, Humanities

Advisor
Dr. Erin Smith, Humanities

Sponsors
Lake Superior Stewardship Initiative, Marquette General Health System, Michigan Tech Annual Giving, and Engineers without Borders

Project Overview
We provide full-service professional communication and media development, including audio, video, writing, web design, technical documentation, and other communication support.

327 EcoCar Enterprise

Team Leaders
Eric Joseph, Business and Mechanical Engineering, and Chris Lucier, Mechanical Engineering

Advisors
Dr. John Beard, Mechanical Engineering-Engineering Mechanics, and Dr. Wayne Weaver, Electrical and Computer Engineering

Sponsors

Project Overview
The EcoCAR Challenge is a three-year collegiate engineering competition. Seventeen North American universities compete to design and build the next generation of advanced-technology vehicles. Each team must reduce the environmental impact of its vehicle—donated by GM—by designing, simulating, and integrating an advanced propulsion system that minimizes fuel consumption and greenhouse gas emissions—while maintaining the utility, safety, and performance of the original vehicle.
**328 EVOLIFE Practical Medical Solutions**

*Working on the wireless sensing platform*

**Team Leader**
Joselyn Carrero Robles

**Advisors**
Dr. Edwar Romero, Universidad del Turabo

**Sponsors**
National Science Foundation and Medtronic Foundation

**Project Overview**
Seven student-employees from industrial and mechanical engineering departments focus on the design and development of medical devices and solutions for the health care industry. It is one of the original two enterprise companies on campus. EVOLIFE projects come from students, faculty, and collaborators’ initiatives.

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**329 EMCO Energy Management Company**

**Team Leader**
Carlos Morales

**Advisor**
Dr. Amaury Malave, Universidad del Turabo

**Sponsors**
National Science Foundation and Puerto Rico Energy Center (PREC)

**Project Overview**
We are dedicated to promote energy efficiency by developing and implementing innovative energy-saving technologies, educational resources for students on energy topics, and tools to integrate renewable energy sources to existing technologies.
**401 Educational Reflection Garden**

Arthur Hill H.S. DIPLOMATS prepare to pour concrete for their project during their summer vacation.

School
Arthur Hill High School, Saginaw, Michigan

Advisor
Celeste Conflitti

Sponsors
National Science Foundation and Bernie Conflitti, community supporter

**Project Overview**
The DIPLOMATS are designing, creating, and constructing an educational reflection garden to host flora as well as area wildlife. The multi-acre parcel, situated on school property, is being converted into green space that will not only feature Michigan species but will utilize solar, water conservation, and composting concepts. Additionally, we will produce grade-level lesson plans to assist teachers in developing biological and environmental educational skills and lessons.

**402 Home Winterizations**

Horizons Alternative HSE team prepares to weatherize an older house in the community.

School
Horizons Alternative High School, Mohawk, Michigan

Advisor
Chris Davidson

Sponsors
Efficiency through Engineering and Construction (ETEC) Enterprise, New Power Tour Inc., Little Brothers Friends of the Elderly, Martineau & Morris Contracting, ThermoAnalytics Inc., and Ford College Community Challenge Grant

**Project Overview**
Each semester, we perform general winterizations (caulking windows, installing insulating, etc.) on five homes of low-income, elderly community members. We also conduct pre-assessment and post-assessment of the homes, including running a blower door test and thermal imaging. The purpose is to make these homes more energy-efficient and lower the home-heating costs during the harsh winters.

**403 Wireless Communication and the Future**

Horizons Upward Bound team takes a break from their study of wireless communication and cell phones.

School
Cranbrook Schools’ Horizons Upward Bound, Bloomfield Hills, Michigan

Advisor
William Grimm

Sponsor
Square One Education Network

**Project Overview**
Students will learn about cell phone technology and the background behind the most exciting form of communication in the past one hundred years. Students will spend the school year learning about the technology and its development since the late 1980s. The students will work in teams of four to five persons, culminating in a summer course on technology in which they will develop marketing plans and business plans to make the application for cell phones a marketable business.
404
Resonance Frequencies of Buildings

Some members of the U.C. Woodlawn HSE team learning new STEM skills on a special holiday project.

School
University of Chicago Woodlawn Charter High School, Chicago, Illinois
Advisor
Assata Moore
Sponsor
Square One Education Network

Project Overview
Students study and research seismology by building an earthquake table and researching the effects of fault slippage on the region near Haiti. Students come up with building designs to withstand such occurrences.

405
Service Learning Through Development of Remotely Operated Vehicles (ROV)

SOAR’s ROV No. 2 stretches out in the halls of Dollar Bay High School during final control tests before deployment into Portage Lake.

School
Dollar Bay High School, Dollar Bay, Michigan
Advisor
Matthew Zimmer
Sponsor
Lake Superior Stewardship Initiative and Michigan Space Grant Consortium

Project Overview
Local and state community organizations present their needs for ROVs to Enterprise members, who select projects and then design, develop, and build ROVs to satisfy those needs. Team members work alongside community organizations to operate the ROVs and assist in reporting of research findings.

406
Autonomous Vehicle

University Prep Science and Math High School students designed and built an autonomous Barbie Jeep, a vehicle that was programmed to drive itself.

School
University Prep Science and Math High School, Detroit, Michigan
Advisor
Ben Luster
Sponsors
National Science Foundation, IBM, and Square One Education Network

Project Overview
Students convert a Barbie Jeep into an autonomous vehicle using GPS and ultrasonic sensors. The jeep can navigate a preprogrammed course and will be used in several applications throughout Detroit.
Students explain the atomic force microscope model to a Chassell teacher.

**Project Overview**
Students improve their Lego NXT model of an atomic force microscope (AFM), based on the work done by the Nanotech Innovations Enterprise. To better represent the AFM, students will construct a stand-alone laser system that uses photo diodes to create a three-dimensional image. To create this image, students will design a computer program to properly translate information.

**School**
Chassell High School, Chassell, Michigan

**Advisor**
Mary Markham

**Sponsors**
Michigan Tech Department of Engineering Fundamentals and the Nanotech Innovations Enterprise

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Students working on an underwater robot project. One of the many ROVs built by the Traverse City Central HSE team explores the local marine environment.

**Project Overview**
Currently little opportunity exists for engineering projects in the marine environment, especially at the high school level. The marine and sub-marine environments truly offer unique engineering challenges that are not addressed in the terrestrial world. Goals include: 1) Increase the use of technology into the ROV system and building process; 2) Design, engineer, build, and evaluate an ROV that is capable of reaching a depth of 200 feet; and 3) Provide a service utilizing ROVs to the surrounding community. It is the vision of this project to create a unique engineering challenge that will allow students to put science, technology, engineering, and mathematics (STEM) into practice within the engineering processes.

**School**
Traverse City Central High School, Traverse City, Michigan

**Advisors**
Keith Forton, Traverse City Central Senior High; Than Dykstra, Traverse City East Middle School; and Norton Bretz, Three Lakes Association

**Sponsors**
National Science Foundation, Square One Education Network, and Traverse City Area Public Schools

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Utica HSE team focuses on how and what they are learning as they work on STEM projects.

**Project Overview**
The electric go-kart project focuses on increasing ergonomics, safety, practicality, and visual appeal (fiberglass shell and cabin optimization). The underwater robot project implements electronic, programmable control of the robot to participate in the Great Lakes Regional Marine Advanced Technology Education (MATE) competition. The team’s overall goal is to record student learning through a yearlong project that develops an interest in the engineering fields—through research and development, oral presentations, hands-on projects, and personal learning journals.

**School**
Utica Community High School, Utica, Michigan

**Advisor**
Geoffrey Clark

**Sponsor**
National Science Foundation
Harvesting Generations of Energy to Build a Sustainable Community

A blower-door test is performed during one of the BRIDGE HSE team’s weatherization projects

**School**
BRIDGE Alternative High School, Hancock, Michigan

**Advisor**
Chuck Palosaari

**Sponsors**
Efficiency through Engineering and Construction (ETEC), New Power Tour Inc., Little Brothers Friends of the Elderly, Martineau & Morris Contracting, and ThermoAnalytics Inc.

**Project Overview**
BRIDGE, Horizons, and the Efficiency through Engineering and Construction (ETEC) Enterprise will complete thirty home winterizations and three attic insulations over the 2009–2011 school years. This simple ten-step winterization program will make a substantial economic and thermal difference in the lives of low-income elderly. The students will use a thermal imaging camera and a blower door to conduct home-energy audits for the homeowners and compare heat loss before and after the work.

Innovating Young Minds

Students learning how to use the gaming program

**School**
Cass Technical High School, Detroit, Michigan

**Advisor**
Ernestine Smith

**Sponsor**
National Science Foundation

**Project Overview**
The goal is to produce an educational activity book for kindergarten through second grade, as well as a comic book and a computerized game for grades three through six to acquaint children with STEM careers and renewable energy—especially solar panels.

Multidisciplinary Approach to the Study of Swedetown Creek

The Hancock PEAK HSE team spends many hours out-of-doors monitoring local ecosystems.

**School**
Hancock High School, Hancock, Michigan

**Advisor**
Brian Rajchl and Stephen Smith

**Sponsors**
Hancock High School and Lake Superior Stewardship Initiative

**Project Overview**
A multifaceted approach to the study of Swedetown Creek, including an audio-visual podcast, a music compilation CD, a bridge redesign, installation of stream-gauging equipment, and continued monitoring of water quality.
413 Alternative Energy Transportation, Innovative Vehicle Design

The Melvindale CyberCards with their solar-charged electric vehicle as they prepare for the 2010 Innovative Vehicle Design Competition near Detroit

School
Melvindale High School, Melvindale, Michigan
Advisor
Randy Thomas
Sponsors
Square One Education Network, IBM, National Science Foundation, and Dassault/Delmia

Project Overview
During the first part of the school year, this team examined the use of solar energy as a possible avenue for powering vehicles. The students developed a vehicle which had a renewable energy source. The team conducted in-depth research about the possible combinations of solar energy, electrical energy, and regenerative energy sources. The students were able to meet the research challenges in designing and building the vehicle. Last fall, the vehicle was tested during the Innovation Vehicle Design Competition. Our team had opportunity to display the vehicle at the SAE Conference. The students walked away with five trophies in the six categories, as well as the Engineering Presentation Trophy. The students showcased quality.

414 Remotely Operated Vehicles in Environmental Studies

Building an ROV in Puerto Rico

School
Manuela Toro Morice High School, Cagua, Puerto Rico
Advisor
Juan Serrano
Sponsors
National Science Foundation

Project Overview
Our team is focused on learning about robotic and mechatronic technologies and using these to create machines that will help us monitor both the land and marine environments on our beautiful island. We have built an underwater ROV and are now building a solar-powered surface watercraft that will be semi-autonomous. We have also started a new project for a land-based hexapod robot.
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