Undergraduate Expo 2010
Innovation Research Entrepreneurship Leadership

MICHIGAN TECHNOLOGICAL UNIVERSITY
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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 our Enterprise, Senior Design, Undergraduate Research, and Independent Research Teams; 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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Tim Schulz, Dean, College of Engineering; Bob Warrington, Codirector, Institute for Global Leadership and Entrepreneurship; 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, Senior Design, and Undergraduate Research 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 Interdisciplinary Studies, and The Center for Diversity and Inclusion.

University Participants
Center for Diversity and Inclusion
College of Engineering
College of Sciences and Arts
Institute for Interdisciplinary Studies
School of Business and Economics
School of Forest Resources and Environmental Science
School of Technology

Student Awards
Undergraduate Research Awards
Based on poster
First place—$100
Second place—$75
Third place—$50

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
No less than seven Enterprise teams from the Universidad del Turabo in Gurabo, Puerto Rico, will compete this year: Encanto Enterprise; Intelligence Network; Fusion Motors; EMCO (The Energy Management Company); Innovatronics Engineering Group; BIOGEN; and EVOLIFE Medical Solutions. Welcome back to the Expo!

High School Enterprise
Now in its third year, the High School Enterprise Program has eleven student teams. All are competing in the Expo this year, including one team from Puerto Rico.

Upper Peninsula high school students
Michigan Tech is honored to host high school students and their teachers from L’Anse and Dollar Bay in Michigan’s western Upper Peninsula.
Greetings all, and welcome to the Expo!

Michigan Tech’s 2010 Undergraduate Expo provides a showcase for the talent, creativity, and accomplishments of our students as Enterprise, Senior Design, and Undergraduate Research teams come together to present the fruits of their labor.

The Expo is truly a showcase of education in action here at Michigan Tech. Discovery-based learning, interdisciplinary teamwork, design and innovation, leadership and entrepreneurship, research, working with industry—you’ll experience it all firsthand in the 100-plus projects on display.

In these pages, you’ll have a chance to explore the breadth and depth of undergraduate project work. The benefits of industry and academia working together as partners in higher education are clearly evident.

If you are attending the Expo, you’ll have a chance to interact with our students, listen to their problem-solving and decision-making approaches, and give them feedback and encouragement. It’s easy to pick up on the excitement, energy, and dedication of tomorrow’s workforce. Perhaps you’ll even walk away with ideas for future projects. We’ll be doing it all again next year and welcome new opportunities.

Very best regards,

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

Robert O. Warrington  
Codirector  
Institute for Global Leadership and Entrepreneurship

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

The Undergraduate Expo highlights the foundations of a Michigan Tech education: experiential learning, teamwork, application of theory, design and innovation, leadership and communication, and multidisciplinary solutions to problems. We strive to deliver an educational experience that prepares our students to create the future. The key to our success is industry’s active support and involvement as a true partner in the process. We invite you to learn more about our programs and the many benefits associated with sponsorship.

Undergraduate Expo
www.expo.mtu.edu

There are many ways to help us recognize and celebrate the accomplishments of our student teams at the Expo. Attend to learn firsthand about our educational programs, campus facilities, and capabilities of student teams. Volunteer as a judge and provide your valued feedback to our students. Sponsor the event and help provide support to sustain and grow the Expo as a true showcase of our students’ talent and creativity.

Senior Design Program
www.engineering.mtu.edu/seniordesign

Industry support of Senior Design enables small teams of highly dedicated students to explore and solve real industry challenges throughout their senior year. Our program is more like a ‘first job’ than a ‘last class’, connecting students and industry through open-ended, industrial projects. Our projects enable teams to follow the complete design process from ideation to realization. Access to extensive design, analysis, fabrication, and test facilities on campus allows a broad range of projects to be completed. Call us today to discuss potential projects for the coming year.

Enterprise Program
www.enterprise.mtu.edu

Industry support of Enterprise facilitates interdisciplinary learning, leadership development, and team-based project work in a businesslike setting. Teams of first- through fourth-year students from diverse disciplines operate like real companies to develop products, processes, and services within their market space. Faculty advisors serve as coaches and mentors, with industry playing a supporting role as mentors and clients. Today, nearly 650 students participate in twenty-nine Enterprise teams to tackle challenges in aerospace, wireless communications, homeland security, sustainability, alternative energy, and much, much more. Industry sponsors can get involved in a variety of ways ranging from in-kind support to sponsorship of an entire Enterprise team. Contact us to explore the options.

High School Enterprise
www.enterprise.mtu.edu

Support of High School Enterprise allows Michigan Tech and partnering K-12 institutions to replicate our signature Enterprise program in the high schools. High School Enterprise aims to expand the pathway into STEM (Science, Technology, Engineering, and Math) post-secondary education and careers, with emphasis on underrepresented groups. You can help by pledging support for HSE’s expansion in your local communities.

CONTACT INFORMATION

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SmartZone™ provides connectivity...

Fortune-100 Companies & Michigan Tech Students

Employed students provide design and development services, including software development, verification, mechanical and hardware design in high-tech, world class facilities.

Students & Entrepreneurial Resources

Student entrepreneurs are creating companies and being provided space, leadership and guidance. Students are starting companies here.

"SmartZone provided the third leg of the stool. We had the work, Michigan Tech had the student talent and MTEC SmartZone provided the opportunity."

Russ Lookie
Ford Motor Company

"SmartZone is helping us do business by being there when we need them... when we have questions, they have answers."

Larry Misk
CPR Mattress

Commitment to Excellence

Integrys Energy Group is a leading Midwestern energy company, focused on providing the best value in energy and related services. We’re committed to achieving operational excellence through the diverse talents and backgrounds our people bring to the job every day.
101
Home Energy Management System

The team pictured along with industry sponsor AEP.

Team Members
Daniel Brinks, Computer Engineering; Matt Drzewiecki, Carrie Grand, Andrew Kolinko, and Jacob McCann, Electrical Engineering; Joe Ruether, Electrical and Computer Engineering

Advisor
John Lukowski

Sponsor
American Electric Power (AEP)

Project Overview
The ultimate goal for this project is to design a system that allows consumers to track their electrical energy consumption and control household devices. By capturing, interpreting, and processing smart meter data, the consumer will have knowledge of their current energy consumption and current time-of-day energy pricing. This information could encourage consumers to shift consumption to off-peak hours to control or minimize their energy costs. The overarching goal is to help with the current mismatch of electrical power generation and demand and delay the necessity of building new generation plants or importing expensive power during peak demand periods.

102
Portable Trap Thrower

Carousel and frame under construction in our secret lab.

Team Members
Sam Handschke, Kevin Moran, Tim Olson, Ryan Szpara, and Ryan Ward, Mechanical Engineering

Advisor
Dr. Chris Passerello

Sponsor
Portage Lake Sportsmen’s Club

Project Overview
The team has designed a portable trap thrower that two club members can maneuver; has little to no downtime during any shooting session; survives the extreme weather conditions of the area; and can hold and launch two cases of birds to within a specified repeatability angle.

103
Radar Hardware Environment Survivability Monitor

Adding code to radar hardware monitoring program.

Team Members
John Carter and William Kohlstrand, Computer Engineering; Anthony Doering, Ben Marshall, and Chris Verhulst, Electrical Engineering

Advisor
Dr. Donald Secor

Sponsor
MIT-Lincoln Laboratory

Project Overview
MIT-Lincoln Laboratory is in the process of upgrading instrumentation radars with state-of-the-art Radar Open System Architecture (ROSA) radar signal and communication back-end processing. The computer racks for the upgraded systems generate a significant amount of heat and contain several heat-sensitive components. Lincoln Labs has requested that we design a Radar Hardware Environment Survivability Monitor (RHESM) that will monitor the environmental conditions and initiate an orderly, automated shutdown of the radar system when specified criteria are met in order to ensure that no damage is done to the hardware.
104 Paraglider Aerial Delivery System

Team Members
Jacob Denison, Steve Lichon, Matt Petr, Ken Shiel, Justin Vanness, and Jerin Varghese, Mechanical Engineering

Advisors
Dr. Chris Passerello and Dr. Gordon Parker

Sponsor
Department of Mechanical Engineering-Engineering Mechanics

Project Overview
The goal is to develop a device to remotely control the attitude of a small paraglider by actuating its lines while attached to a moving vehicle. The device will be used to obtain aerodynamic properties of the paraglider. The device will also be released from the truck to demonstrate its ability to steer the paraglider during free flight. The acquired data will be used by a Michigan Tech graduate student to develop an Autonomous Aerial Delivery System that will be deployed behind a moving boat.

Discussing spool motor wiring.

105 Portable Ergonomic Data Acquisition System

Team Members
Kyle Bowman, Bryan McDiarmid, Paul Pietrowicz, Matt Poppe, Aaron Tetzloff, and Brian Tousignant, Mechanical Engineering

Advisor
Dr. John Beard

Sponsor
General Motors: Daniel Cohen—Human Vehicle Interaction

Project Overview
General Motors (GM) needs a portable, accurate, seat-comfort-testing device designed for a safe, one-person operation. The goal is to test seats in-vehicle in order to reduce set-up time of current testing procedures. The design needs to be capable of meeting GM’s specifications: apply and record a force from 4.5 to 950 Newtons; apply force at a rate from 50 to 200 mm/min, nominally at 150 mm/min; minimum travel of 100 mm; and minimum data resolution of 2 mm. The overall goal is to provide a working prototype that will meet all of GM’s specifications.

This device will reach into cars and measure the deflection in the seat as a force is applied.

106 AMJOCH Observatory Geosynchronous Satellite Tracking

Team Members
Alex Aiello, Russell Andreas, Ashley Copeland, Chris Coverdale, and Kevin Kruse, Electrical Engineering

Advisor
Dr. Mike Roggemann

Project Overview
Each day hundreds of geosynchronous satellites are drifting within close proximity of each other, leaving the possibility for costly collisions. Using the AMJOCH Observatory located in Atlantic Mine, our task for this year was to collect spectral data from these geosynchronous satellites to develop a program that will enable these geosynchronous satellites to be tracked. Along with developing a satellite tracking system, our goal was to also make the AMJOCH Observatory completely automated and accessible through the Internet.

The AMJOCH Satellite tracking crew gathered inside the observatory.
107 Portable Oozeball Court

Team Members
Brandon Armstrong, Zhoamin Dong, Cory Michalec, Brent Pelishek, and Justin Schaut, Mechanical Engineering
Advisor
Dr. James De Clerck
Sponsor
Michigan Tech Student Foundation (MTSF)

Project Overview
The Michigan Tech Student Foundation (MTSF) needs a portable mud volleyball court to play Oozeball, a game of volleyball played during Spring Fling. The need came about when the road construction that occurred during the summer of 2009 in front of the Walker building eliminated the spot where the courts were previously constructed. The project goal is to design and manufacture a portable oozeball court that can contain about a foot of mud and two regulation-size courts. The structure must also be easy to set up and remove.

108 Reduced Iron Box Furnace

UG Model: An exploded view of the Reduced Iron Box Furnace

Team Members
Nathan Eyster, Brandon Fralick, Jim Hueter, Rochelle Prescott, and Charles Thomas, Mechanical Engineering
Advisor
Dr. Charles Margraves and Mike LaCourt
Sponsor
Cliffs Natural Resources

Project Overview
Cliffs Natural Resources needs a laboratory-sized box furnace to replicate and examine various aspects of iron ore processing. The test results can then be implemented on a full-scale basis to increase iron purity for different customers. The team will be making a box furnace for process testing.

109 Visible Extrusion Process and Hollow Part Creation for IDM Lab

Steel die half used for extruding a hollow tube from a solid wax cylinder.

Team Members
Jeff Bladecki, Isaiah Cunningham, Kyle Domagalski, and James Pidgeon, Mechanical Engineering
Advisor
Dr. James De Clerck
Sponsor
Michigan Tech Student Foundation (MTSF)

Project Overview
Students in the IDM lab do not have any way to see what happens inside the extrusion dies during the process. By being able to see inside the die set and extrusion material, students will be able to understand how the extrusion process works more effectively. By producing a hollow part, the students will be able to understand how a material can be split and rejoined inside of a die during the extrusion process.
110  Air-Driven Moped

Trying to combine a bicycle, moped, and scuba tanks into a working vehicle.

Team Members
Adam Bieber, Andrew Bomstad, Jared Recker, Joshua Schmidt, and Benjamin Vindedahl, Mechanical Engineering

Advisor
Dr. James De Clerck and Nick Mastricola (graduate student)

Sponsor
Department of Mechanical Engineering-Engineering Mechanics

Project Overview
The main reasons for pursuing an air-driven moped is due to an increase in fuel costs, as well as emphasis and pressure on renewable energy sources. A major goal for the project is to have a working prototype driven primarily by air with a secondary option of pedal propulsion. Additional goals: similar drivable characteristics and functionality to a gas-powered moped; a target top speed of 20 mph; and a sleek, robust design with minimum monthly preventative maintenance.

111  Optimizing Evaluation Methods for Biomimetic Catheter Coatings

Preparing aliquot quantities of bacteria for testing efficacy of biomimetic coating catheters.

Team Members
Ben Bouman, Ali Sheldon, Eli Vlaisavljevich, and Kate Wold, Biomedical Engineering; Luke Wohlfel, Biomedical Engineering and Mechanical Engineering

Advisor
Dr. Rupak Rajachar, Biomedical Engineering

Sponsor
Greatbatch Medical

Project Overview
The purpose of our project is to create a set of experiments to determine the efficacy of biomimetic coatings developed to prevent catheter-related infections. A set of static and dynamic experiments was designed to test the ability of the biomimetic coatings to prevent bacterial adhesion under physiologically relevant conditions. Our final results will provide an analysis of current Greatbatch Medical catheter coatings; a set of protocols to be used to test future catheter designs; and a novel dynamic flow system to provide a more physiologically relevant analysis.

112  Enhancing the Ventilated Improved Pit Toilet

Designed for the poorest 80 percent: A ventilated improved pit toilet model.

Team Members
Ashley Thode, Civil Engineering; Krissy Guzak, Cara Hanson, and Kim Landick, Environmental Engineering; and Dr. Donna Michalek, Mechanical Engineering-Engineering Mechanics

Advisor
Dr. David Watkins and Dr. Kurt Paterson, Civil and Environmental Engineering; and Dr. Donna Michalek, Mechanical Engineering-Engineering Mechanics

Sponsor
EPA P3 (People, Prosperity, and the Planet) Student Design Competition for Sustainability

Project Overview
Students are improving the cost-effectiveness and health benefits of ventilated improved pit (VIP) toilets by optimizing air flow through the toilet superstructure, pit, and vent pipe for the purposes of vector and odor control. Further improvement of VIP toilets will promote sanitary practices and prevent human waste from contaminating water, food, and the natural environment.
113
CNC Router Table

Team ACE’s CNC Router working 3D model. The CNC Router will be used in Calumet High School’s Pre-Engineering course.

Team Members
Seow Chung Goh, Erik Peterson, and Ashley Step, Mechanical Engineering Technology

Advisor
Dr. John Irwin

Sponsor
Calumet High School

Project Overview
Our project is to design and fabricate a tabletop computer numerical control router. The table will be used as laboratory equipment in an educational setting at Calumet High School. The design was based on our research of current do-it-yourself tables, availability of materials, and budget constraints.

114
Biodegradable Stent Simulation

Team Members
Jake Edick and Nikki Long, Materials Science and Engineering; Donisha Das, Justine Farina, Dan Pierson, and Jonathon Zuidema, Biomedical Engineering

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

Sponsor
Boston Scientific Corporation

Project Overview
Our goal is to develop a test method that will accurately simulate the degradation of metal alloys in a biological system.

115
Expended Cartridge Brass Catcher

Team Members
Kathryn Hill, David Palmer, Phillip Schichtel, Jason Swanson, and Eric Wank, Mechanical Engineering

Advisors
Dr. Chris Passerello and Nick Mastricola (graduate student)

Sponsor
Department of Mechanical Engineering-Engineering Mechanics

Project Overview
The project is a brass catcher for a Colt 1911-style pistol. There are many brass catchers on the market; this team’s goal is to make it cheaper (under $35), with a better sight picture and better pistol balance.
116
Heat Rejection Optimization

Team Members
Josh Cassavoy, Justin Dillon, Joe Horn, Zach Johnson, Brad Mullins, and Danielle Supa, Mechanical Engineering

Advisor
Dr. V. C. Rao Komaravolu

Sponsor
John Deere

Project Overview
In order for John Deere to meet 2014 Tier 4 emission regulations, a proposal is to increase exhaust gas recirculation (EGR). The design project involved integration of a new EGR system into an 8000 series tractor by designing packaging components and cooler geometries to fit the chassis. During design, a major concern was fitting the new low-temperature cooler into the current chassis. Major changes to the chassis were to be avoided, resulting in space and shape constraints for the new components. In addition, serviceability, durability, manufacturability, and cost served as constraints to meet John Deere standards.

117
Hand Washing Detector

Team Members
Beth Geerer, David Heiden, Jenna Joestgen, Liz Pietela, and Sam Wojda, Biomedical Engineering

Advisor
Dr. Seth Donahue

Sponsor
Portage Health

Project Overview
The goal is to design a simple instrument that can detect and record how many times a clinician washes his or her hands (either with hand sanitizer or soap and water) throughout the day. The device should be accurate, have a relatively low cost, and be easily implemented into the health-care setting. Easy implementation includes compatibility with the current information systems and ID badges used in the hospital, ability to attach to current soap and hand sanitizer dispensers, applicability to a variety of rooms in the hospital, and something that doesn’t alter CDC hand-washing protocol. The device must also be HIPAA compliant, should not reveal personal employee information, and should not be used to track employee location.

118
Solar/Wind DC Backup for Power Substations

Team Members

Advisor
Dr. Donald Secor

Sponsor
ITC Holdings

Project Overview
Many power substations across the ITC Holdings Corporation footprint have only a single source of DC power for the substation’s DC power needs. This source of DC power is the substation battery. The battery charge is maintained by a feed from the AC system. The goal is to design a backup system to charge the batteries and keep the critical equipment running in the case of a blackout event.
**119**

**Capillary Refill Time Measurement Device**

This device has an opaque tube to eliminate light, a plunger to apply pressure, and a spring to allow rapid release.

**Team Members**
Danielle Aerts, Jon Congdon, Katie Elicerio, Matt Johnson, and Justine Wiles, Biomedical Engineering

**Advisor**
Dr. Michael Neuman

**Sponsor**
Department of Biomedical Engineering

**Project Overview**
The time it takes to refill a capillary bed after the blood has been depleted is a useful way to measure the dehydration status of a patient. The goal of our project is to design an instrument to measure this time by applying a pressure, releasing it, measuring the rate of blood return, and outputting the information into a graph. Our client, Dr. Robert Danish of the University of Texas Health Science Center, San Antonio, would like to use this device to more accurately assess the level of dehydration in his pediatric diabetic patients.

**120**

**Axial Flux Alternator Test Stand**

The final product.

**Team Members**
Zachary Hitt and Steven Tangney, Mechanical Engineering Technology

**Advisor**
Dr. John Irwin

**Sponsor**
School of Technology

**Project Overview**
Design and fabricate a test stand to demonstrate the amount of current and resulting power curve generated at a given RPM. The design will utilize an axial flux alternator attached to the rear wheel of a stationary bicycle. The unit will be user-friendly to encourage participants from classrooms and lecture hall demonstrations, as well as public gatherings, to pedal the vehicle to see how much energy they can produce. This demonstration should educate users of the amount of energy it takes to create energy.

**121**

**Bristle Design Optimization**

Solid model of a rotary drum design to attach our prototype paddle to the testing rig.

**Team Members**
Zak Cousineau, Glenn Erickson, Stuart Malnor, Ken McCabe, Aaron Sawyer, and Mandy Scott, Mechanical Engineering

**Advisor**
Dr. Bill Endres

**Sponsor**
M-B Companies Inc.

**Project Overview**
This project is to develop a concept that results in an increase in snow removal performance, which is quantified by tons of snow moved per hour at a given torque. This goal is to be met by modifying the bristle elements alone, using the existing broom core and power package. The MB Co. equipment is torque-limited, so the design must improve performance at the same level of torque.
122 Jet Stream

Finding the correct location for the major components, the engine and the jet-pump, is crucial for proper weight distribution in the canoe.

Team Members
Ian Reinders and Jay Vestich, Mechanical Engineering Technology
Advisor
Dave Wanless
Sponsor
Board Sports Technology Enterprise, School of Technology

Project Overview
Install a jet pump in a canoe. The goal is to use a 10-hp small engine and end up with an easy-to-use and safe product.

123 Weld Joint Design Optimization

An FEA model of the Bucyrus weld joint to be tested.

Team Members
Ken Gilkerson, Steven Horst, Cody Larson, Andrew Rames, Jacob Ryneason, and Brian Wichmann, Mechanical Engineering Technology
Advisor
Dr. Greg Odegard
Sponsor
Bucyrus International

Project Overview
Bucyrus International Inc. manufactures draglines used in surface mining. The fatigue life of the welds that are currently being used on the front-end structure cannot accurately be predicted using conventional methods of fatigue class curves (AWS, IIW). Bucyrus desires a more accurate method of fatigue life prediction, and an improved method of testing weld joint designs.

124 FEA Test Stand

Building and programming our own FEA stand.

Team Members
Doug Bradley and Dan Ehlke, Mechanical Engineering Technology
Advisor
Dr. John Irwin
Sponsor
School of Technology

Project Overview
The goal: a finite element analysis (FEA) test stand for the School of Technology for learning purposes. Build and program our own FEA stand for lower cost, higher forces, and variable test subjects.
Tailings Slope Sustainment System

**Team Members**
Jim Boex, Tyler Bushelle, Dave Flessert, Jake Gatien, Brian Skauge, Nate Thomas, Mechanical Engineering

**Advisor**
Mike LaCourt

**Sponsor**
Cliffs Natural Resources

**Project Overview**
The Cliffs Technology Group tailings basin. Soldering together the EKG circuit for the wireless cardiopulmonary monitor.

Wireless Cardiopulmonary Monitor

**Team Members**
Anthony Sonck, Brock Horton, and Andrew Korcal, Biomedical Engineering; Jason Green and Ryan Raymond, Electrical Engineering; Jeff Floyd, Computer Engineering; Andrew DeRouin, Biomedical Engineering/Electrical Engineering

**Advisor**
Dr. Keat Ong, Biomedical Engineering

**Sponsor**
3M

**Project Overview**
The goal is to develop a wireless respiratory and heart rate monitor that can upload the information in real time to a cloud network via the Internet. The information could then be received by a physician, regardless of distance.

Absorbing Pad Moisture Indicator

**Team Members**
Travis Ommodt, Keara Scott, Lindsey Spaude, Stephen Stafford, and Damon Tolhurst, Biomedical Engineering

**Advisor**
Dr. Megan Frost

**Sponsor**
Department of Biomedical Engineering

**Project Overview**
Incontinence is a common problem for the elderly. Adult diapers or moisture absorbing pads are currently used to collect bodily fluids. If such pads are not changed frequently, painful decubitus ulcers and other medical issues could occur. We have developed a sensor to detect the presence of urine and discretely alert medical staff to the patient’s condition. The sensor will eliminate the need to repeatedly check on patients for urine activity, saving time and money for care facilities. Most importantly, patients will no longer experience the uncomfortable effects of prolonged exposure to wet pads.
Undergraduate Expo 2010

128
Hybrid Off-Road Wheelchair

The chair and engine in the shop.

Team Members
Ryan Glaske, Dan Hudak, Chris Rinne, Sam Schneider, and Mason Wellman, Mechanical Engineering

Advisor
Dr. Gregory Odegard and Dr. John Beard

Sponsor
Department of Mechanical Engineering-Engineering Mechanics

Project Overview
The objective is to design and build an automated hybrid power system for an existing electric all-terrain wheelchair, which was designed specifically for the Tech Trails and will be used in Youth Programs. The new system will allow students to modify different settings in the power system and then evaluate the new performance.

129
Intelligent Ground Vehicle Competition (IGVC)

The competition takes place in June 2010.

Team Members
Andrew Carlson, Dave Colville, Matt Gauss, Mitch Knudson, and Mike Mott, Electrical Engineering; Amween AlMattar, Computer Engineering

Advisor
Dr. Jeff Burl

Sponsor
Oshkosh Corporation

Project Overview
A fully autonomous robotic vehicle must traverse an obstacle course under a given time limit while remaining below a 5-mph speed limit and avoiding the obstacles in its path. The vehicle must also travel to a number of waypoints and return to its starting point—given only the latitude-longitude coordinates of the targets. The 2010 IGVC team strives to improve upon last year’s entry and advance to first place. Design goals include improved reliability, enhanced path-finding algorithms, and increased user-friendliness.

130
Powder Metallurgy

Solid model showing the new die design to be used by future lab students.

Team Members
Evan Giusti, Chris Lytie, Ian McChesney, Ryan McKay, and Jon Meeuwsen, Mechanical Engineering

Advisor
Dr. William Endres and Mike LaCourt

Sponsor
Department of Mechanical Engineering-Engineering Mechanics

Project Overview
The current MEEM 2500 powder metallurgy lab is very simplistic and fails to show the students the capabilities of this technology. The major goal for the team is to design a new die that will involve the students in the lab while maintaining their interest in what they are learning. The new design will incorporate an ejection system that eliminates the need for forced reloading. The part produced will be more unique and will show the possibilities of this technology, along with drawing more student interest.
131 Gait Aid Device

Making carbon fiber molds on the CNC mill.

Team Members
Jennifer Diaz, Michael Freundl, Jake Haelfrisch, Kyle Jones and Scott Niemi, Mechanical Engineering
Advisor
Dr. John Beard
Sponsor
Iraq War Veteran

Project Overview
The sponsor, an Iraq War Veteran, has suffered an injury that has left him with the need for a Gait Aid Device (GAD) to stabilize his ankle laterally while allowing plantarflexion and dorsiflexion. He is unable to walk long distances or on uneven terrain. Currently he uses a cane for assistance while walking, but the GAD will allow for unassisted movement. Braces on the market today lack stability and longevity, which are two critical design elements. The goal of the project is to produce a working prototype for the sponsor to use as a long-term solution to the problem.

132 Affecting Factors of Machinability Variance in Ductile Iron

Kohler's ductile iron crank shafts in various stages of testing.

Team Members
Andrew Dickey, Nick Gast, and Thomas McDonough, Materials Science and Engineering; Ryan Heins, Mechanical Engineering
Advisors
Dr. Jiann-Yang Hwang, Dr. Mark Plichta, and Dr. Paul Sanders, Materials Science and Engineering
Sponsor
Kohler Engines

Project Overview
The design team is investigating factors that influence machinability variation in ductile iron crankshafts. The primary objective is to obtain information relevant to the source of machining variation. Conclusive results may lead to a refinement to the specification, which will tighten machining variance. A secondary objective addresses the room temperature aging phenomenon occurring within the first two weeks of casting and its influence on machining. In addition, the method to quantify machinability, developed by last year's team, has been analyzed for improvement.

133 REL Gas Gun Optimization

Solid Model of our optimized gas gun which will use compressed gas to fire.

Team Members
Kevin Crass, Berek Kohl-Kopchinski, John Moyer, Cory Padilla, and Mark Shepherd, Mechanical Engineering
Advisor
Dr. V.C. Rao Komaravolu
Sponsor
REL Inc. of Calumet, Michigan

Project Overview
Lab ballistic testing uses a device that can accelerate projectiles to high speeds. A gas gun (which uses only single-stage gas compression) is desired in many applications. This project aims to maximize the velocity obtained using this type of propulsion. This initiative is based on a maximum attainable pressure in commercially available gas cylinders to ensure safety of users and the facility. Objectives include modeling of the fluid flow, optimizing flow geometry, and prototype testing.
134
Runway Marking Cone

Coneheads hard at work on their project’s steel frame.

**Team Members**
Brett Bradley and William Jahns, Mechanical Engineering Technology

**Advisor**
Dr. Mark Johnson

**Sponsor**
School of Technology

**Project Overview**
Our requirements are to design and build a machine to produce plastic runway marking cones. Along with manufacturing the machine to produce the markers, we need to submit an article to EAA magazine detailing the building process so individuals can reproduce our mechanism and produce the runway marking cones for themselves.

135
Compression Device for Lymphedema Therapy

The battery of tail cuffs, assembled and ready for use.

**Team Members**
John Albin, Jared Cregg, Stephanie Lindstrom, and Stuart Mitkey, Biomedical Engineering

**Advisors**
Dr. Ryan Gilbert and Dr. Jeremy Goldman

**Sponsor**
Department of Biomedical Engineering

**Project Overview**
Surgical resection and radiation therapy are the current clinical modes of targeting cancerous breast tumors. Primary trauma and secondary events (i.e. chronic inflammation) resulting from the targeting therapy lead to disruption of the lymphatic system. Fluid accumulates in subcutaneous tissue, and patients suffer a range of associated impairments, including diminished function of joints, increased extremity weight, pain, and a deficient healing capacity. One approach to the resolution of edema is the use of a pneumatic pump that pushes excess lymphatic fluid towards functional lymphatics; however, these types of therapies are poorly understood. Here, we have developed a cyclic pressure cuff scaled to murine anatomy in order to study interstitial flow mechanisms—with the idea that this understanding will lead to better therapeutic regimens.

136
Remotely Operated Military Vehicle

Testing remote vehicle control during a field test with BAE Systems.

**Team Members**
Matt Borton, Jason Rudden, Ryan Schippers, and Jacob Smith, Electrical Engineering; Tim Cook and Bob Potter, Mechanical Engineering

**Advisor**
Dr. Donald Secor, Electrical and Computer Engineering

**Sponsor**
BAE Systems, GS Engineering

**Project Overview**
The development of remotely operated controlled vehicles offers the potential to reduce loss of human life in military combat. BAE’s family of medium tactical vehicles (FMTV) sets new global tactical vehicle standards for capability, reliability, mobility, and transportability. This project will advance previous design work to successfully control a FMTV remotely. One key design constraint is that any design changes cannot permanently alter the FMTV. The major goals are wireless control of steering, acceleration, braking, and transmission; relatively quick and easy installation; and safety.
137  
Optimizing Efficiency of an Air-to-Air Heat Exchanger

Team Members
Ray Brodowicz and Mitchell Swenson, Mechanical Engineering Technology
Advisor
Dr. Barbara Lograsso
Sponsor
School of Technology

Project Overview
The goal of this project is to improve the efficiency of an existing air-to-air heat exchanger by improving the thermal conductivity between the hot and cold air ducts. This heat exchanger is used on an industrial furnace to heat cold air being taken into the furnace with the hot exhaust leaving the furnace, thus requiring less energy to generate the same performance. Using heat transfer software and physical lab testing, we have evaluated materials that can be placed between the hot and cold air ducts. Each material is evaluated on its ability to effectively improve the performance of the heat exchanger. These performance gains have been compared to their respective initial investment to determine the best solution.

138  
ION Robotic Lawn Mower Competition

Team Members
Tyson Bugis, Albert Genther, Tylor Rogers, and Scott Yager, Electrical Engineering Technology
Advisor
Joel Kimball
Sponsor
School of Technology

Project Overview
Our team will be competing in the ION Robotic Lawn Mower Competition in Beavercreek, Ohio. We must design and fabricate a completely autonomous lawn mower that will navigate and mow a rectangular field. The mower must remain within a given perimeter and avoid an obstacle placed in the mowing field. The mower will be judged on, among other things, performance, cost, and a presentation. Our design approach is to create a cost-effective autonomous mower through the innovative application of technology components and concepts.

139  
Fuel Cell Lab Test Stand

Team Members
Chris Bell and Victor Dahn, Mechanical Engineering Technology
Advisor
Dr. Barbara Lograsso
Sponsor
Surplus Steel

Project Overview
Our goal with this project is to use an existing hydrogen fuel cell platform and design, build, and test a dynamometer that can be used with a RC car. The dynamometer will use a prony brake and a tachometer to be able to show power output of the fuel cell at different levels of hydrogen and oxygen.
**140 Fluid Power Trainer Upgrade**

Looking at initial steps to upgrading the hydraulic fluid power trainers for upcoming courses.

**Team Members**
Chris Frantz and Kyle Konieczny, Mechanical Engineering Technology

**Advisor**
Dr. Samuel Coates

**Sponsor**
School of Technology

**Project Overview**
The basis of this project was to upgrade the current hydraulic power trainers in room SB36 of the EERC to give students a better hands-on activity and more effectively demonstrate real-world hydraulic systems. It was asked of the group to create a device that would attach to the hydraulic trainers and give a constant load to the hydraulic cylinder and motor.

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**141 Automotive Climate Control Device Validation**

**Team Members**
Dan Domski, Caoyang Jiang, and Robert Smith, Electrical Engineering; Nathan Fettinger and Ryan VanTresse, Computer Engineering; Devin McCauley, Mechanical Engineering

**Advisor**
Dr. Duane Bucheger, Electrical and Computer Engineering

**Sponsor**
Behr-Hella Thermocontrol Inc.

**Project Overview**
BHTC patented pulse-count technology, used in automobile climate-control devices, that allow for sensorless positioning of a DC brushed motor. Said system is controlled by an Application-Specific Integrated Circuit (ASIC). BHTC has tasked the team with conducting a Failure Mode and Effects Analysis (FMEA) on production-level, climate-control units. The team will put the ASIC and Pulse-Count system under a series of tests to discover new failure modes of the Pulse-Count system and to generate statistical data on the performance capabilities.

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**142 Machinability and Heat Treatment of AerMet 100**

**Team Members**
Dan Komar, Carey Lutheran, Jacob Marciniak, Scott Nelson, and Ryan Toll, Materials Science and Engineering

**Advisor**
Dr. Calvin White

**Sponsor**
Goodrich Landing Gear Corporation

**Project Overview**
This project deals with the maximization of the machinability of the steel, AerMet 100, through heat-treatment recipes of varying time and temperature.
Display Device

Team Members
Eric Diehr, Matt Peterson, Genevieve Taylor, and Will Whipple, Mechanical Engineering

Advisors
Dr. James De Clerck and Charles Van Karsen

Sponsor
Department of Mechanical Engineering-Engineering Mechanics

Project Overview
Our team is designing a Rube Goldberg-type machine, to be displayed in the ME-EM entrance, that is visually interactive and displays concepts from the core mechanical engineering curriculum at Michigan Tech. The device will also include a computer screen to show readouts of various measurements that are made through the machine's cycle. The device will primarily be used during campus tours and first-year engineering explorations.

The unbalanced wheel, Archimedes screw, and cam elevator from the Rube Goldberg machine.

Biodegradable Clay Pigeon

Team Members
Simon Dezelski, Robert Gisch, Tyler Hendrickson, and Graig Vansickle, Mechanical Engineering

Advisor
Dr. Charles Margraves

Sponsor
Portage Lake Sportsmen's Club

Project Overview
The Portage Lake Sportsmen's Club would like a low environmental impact clay pigeon for use in trap and skeet shooting. The major goals of this project are to maintain American Standard Pigeon specifications while allowing the design to break with minimum shot contact (1-3 pellets) of No. 7 or No. 8 shot. The pigeon must also follow a standard flight trajectory after launch from a conventional swing arm trap. Design of this pigeon has involved an in-depth material selection process, calculation of loads applied to the clay during launch, and FEA analysis of the clay body for this loading.

The first prototype of the latest and greatest biodegradable target.

OpensAll Automatic Can and Jar Opening Device

Team Members
William Donovan, Jonathan Hoyer, Tyler LeRoy, Adrian Simula, and Lisa Staelhin, Mechanical Engineering

Advisor
Dr. V. C. Rao Komaravolu and Thomas Wesa

Sponsor
Department of Mechanical Engineering-Engineering Mechanics

Project Overview
The goal is to design and produce an appliance that can automatically open household jars and cans with minimal user input, specifically targeted towards consumers with limited strength and dexterity in their hands. The concept focuses on minimal size, safety, easy-to-use automatic operation, and adaptability to a wide range of container sizes and types. Additional considerations are given to cost of production, simplicity of design, durability, and the ability of the product to be easily cleaned.

Assembly of the prototype.
Quality Analyzer for Automotive Climate Control Devices

At work in the lab.

Team Members
Daniel Domski, Michael Feys, Steven Kalmar, and Nicholas Lo, Electrical Engineering; Andrew Korzeniewski, Computer Engineering
Advisor
Dr. Duane Bucheger
Sponsor
Behr-Hella Thermocontrol Inc (BHTC)

Project Overview
As the interface between the driver and the vehicle, BHTC’s climate control panels represent the control center of a vehicle’s climate control system. Products range from simple, mechanical panels to semiautomatic and fully automated control panels, which fulfill the needs of all passengers with two, three or even four-zone comfort levels. All control panels share the following features: ergonomically designed turning knobs and buttons; unambiguous pictograms and function symbols; pleasant look and feel; an easy-to-read night design; and extremely simple, intuitive operation. BHTC desires the development of a “Quality Analyzer” which will support its efforts in both new product development as well as in current product support/warranty issues.

Defects in Zinc Die Casting

Operating the die-casting machine.

Team Members
Jessica Reibel, Kamonwad Yangyuenthanasan and Emily Durham, Materials Science and Engineering; Ellison Lenz, Mechanical Engineering Technology; and Charles Hansen, Mechanical Engineering
Advisor
Dr. Mark R. Plichta and Dr. Douglas J. Swenson, Materials Science and Engineering
Sponsor
Eastern Alloys

Project Overview
By finding correlations between defects and process parameters of die casting, a troubleshooting guide has been made for cold shuts and porosity defects. This will allow Eastern Alloys to quickly assess their clients’ problems and allow better customer service.

Carbon Dioxide Sequestration from Steelmaking Exhaust

Monitoring temperature in a flue gas capture apparatus.

Team Members
Ken Brooks, Brett Anderson, Ben Hutton, Jason Sallgren, Reuben Robie, Steve Klinowicz, and Nate Wilkie, Materials Science and Engineering
Advisor
Dr. Stephen Hackney
Sponsor
ArcelorMittal

Project Overview
Our project involves the pursuit of cleaning ArcelorMittal’s steelmaking exhaust of carbon dioxide via mineralization using waste-pickling acid.
149
Quenching of Strip Steel

The team is designing and creating a pilot scale apparatus.

Team Members
Donald Wagle and Nick Johnson, Materials Science and Engineering

Advisors
Dr. Paul Sanders and Dr. Mark Plichta

Sponsor
ArcelorMittal

Project Overview
The rapid quenching of strip steel with dimensions of 1067mm (42") wide by 1mm thick is performed to create a dual-phase microstructure. Due to the dimensions of the strip, the stresses induced by the microstructural transformation distort the sheet during quenching, which must be performed in a manner that prevents this distortion. A pilot scale apparatus is to be designed and created for ease of research and testing of ArcelorMittal's full-scale annealing and quenching line. Research is also being done to determine if the distribution of the different microstructures is uniform through the steel strip.

150
Assessing Service Metrics for Michigan Tech IT Support

Histogram of IT service times that are less than one week, with distribution fit.

Team Members
Nik Chaphalkar, Brian Stawowy and Sara Stewart, Service Systems Engineering

Advisor
Dr. Amlan Mukherjee, Civil and Environmental Engineering

Sponsor
Michigan Tech Engineering IT

Project Overview
Our team is using historical service request data to assess system operations in Michigan Tech’s IT support. Statistic analysis is being done to understand the distributions of ticket arrivals and service times. We are creating operating metrics based on customer feedback and system analysis to suggest improvements to the system. This project covers many areas in the engineering field such as: human factors, statistics, queuing theory, systems design, and computer programming.
201
Attenuation of Osteoblast Apoptosis with Creatinine in Hibernating Bear Serum

Student Researcher
Sarah Gray, Biomedical Engineering
Advisor
Dr. Seth W. Donahue
Sponsor
Michigan Tech Summer Undergraduate Research Fellowship (SURF) Michigan Space Grant Consortium

Project Overview
Currently, forty million Americans are at risk for developing osteoporosis, and this degenerative disease accounts for about $20 billion in health care expenditures annually. Disuse, as in spaceflight, bed rest, and spinal cord injury, causes bone to degrade in response to decreased strains. Bears spend six to eight months out of each year in hibernation, yet these annual periods of disuse do not affect their bones. It is hypothesized that a circulating element in bear serum is attenuating apoptosis of bone-constructing cells. One serum element, creatinine, has been strongly correlated with hibernation, and its apoptosis-inhibiting qualities have been tested in this study.

Plating osteoblast cells to test their response to bear serum.

202
Habitat Classification and Biological Inventory of Pioneer Scout Reservation

Student Researcher
Auriel Van Der Laar, Wildlife Ecology and Management
Advisor
Dr. David Flaspohler
Sponsor
SURF

Project Overview
This project offers a look into the habitats and wildlife that make up the ecosystems of Pioneer Scout Reservation and includes habitat classification transects, mist netting, and point counts. Options for future management were developed to meet different goals for the summer camp property.

Extracting birds from the net for banding.

203
Charcoal Production—Using Partially-burnt Wood in Iron-smelting Furnaces

Student Researcher
Frank W. McGuire, Anthropology/Archaeology
Advisor
Carl Blair
Sponsor
SURF

Project Overview
We have looked at charcoal production from 750 BCE to 500 ACE, mainly in northern Europe, and think that partially burnt wood, not charcoal, was the end product.

Shifting to find that perfect charcoal after digging up the pit.
204
On-ice and Off-ice Graded Exercise Testing in Collegiate Hockey Players

Student Researcher
Angela Guisfredi, Exercise Science and Biological Sciences
Advisor
Dr. Jason Carter
Sponsors
SURF; Dr. John Durocher, Department of Physical Therapy, Saint Francis University; Dr. Darin T. Leetun, M.D., Portage Health Sports Medicine Institute; and Davy Sproule, Houghton-Portage Township Schools

Project Overview
This study compares lactate threshold (LT), maximum heart rate (HRmax), and aerobic capacity (max) during sport-specific skating on-ice and cycle ergometry off-ice in twelve collegiate hockey players. Results showed that both max and HRmax were higher on-ice than off-ice. LT, as a percentage of both max and HRmax, was higher on-ice than off-ice. No correlation existed between max values off-ice and on-ice. These results indicate that off-ice max and LT are not adequate predictors of on-ice max and LT in collegiate hockey players. They also challenge the use of cycle ergometry to assess max at fitness tests at the National Hockey League Draft Combine.

205
Heterologous Production of Alkaline Phytase in the Yeast Pichia Pastoris

Student Researcher
Sarah Hopson, Biochemistry and Molecular Biology
Advisor
Dr. Pushpalatha Murthy

Project Overview
The goal of this project is to optimize the heterologous production of an economically important enzyme, alkaline phytase, with the yeast, *Pichia pastoris*, as the host system. Alkaline phytase is a very important enzyme in the animal feed industry because the supplementation of phytase increases the digestion and absorption of phosphate and essential metals by animals. This enzyme permits the animals to hydrolyze phytic acid. In addition, the introduction of phytase into the feed of animals will alleviate organo-phosphate contamination in soil and water.

206
Aligned, Electrospun Fibers Facilitate Treatment of Lymphedema

Student Researchers
Echod Bouta and Connor McCarthy, Biomedical Engineering
Advisors
Dr. Jeremy Goldman and Dr. Ryan Gilbert
Sponsor
National Institutes of Health

Project Overview
When breast cancer patients undergo a mastectomy, up to 30 percent of patients can develop lymphedema, a chronic swelling of tissue in the arm, due to fluid retention, that leads to pain, disuse of the limb, and poor immune function. While experimental approaches to promote lymphangiogenesis utilize growth factors, few studies utilize topography to direct lymphatic endothelial cell migration. It is believed that aligned, electrospun fibers would assist in the directed migration of lymph endothelial cells. Developing aligned fiber substrates could help facilitate regeneration of the injured lymphatic system.
207
Geomagnetic Field Intensity at the Archean-Proterozoic Boundary

A drill site located at a mafic dyke in the Zebra Hills. The Zebra Hills region is located in the Pilbara craton of Western Australia.

Student Researcher
Danford Moore, Applied Geophysics
Advisor
Dr. Aleksey Smirnov
Sponsor
National Science Foundation

Project Overview
Data on the long-term evolution of Earth’s magnetic field intensity in the Precambrian is crucial for deciphering the history of geodynamo—and for constraining models of the thermal evolution of the Earth. The paleointensity database for the Precambrian remains very limited because of alteration and other factors hampering the applicability of conventional methods used for determining field intensity. We present new rock magnetic and paleointensity results from our ongoing study of two prominent mafic dike swarms. Data includes the ~2.42 Ga Widgiemooltha dike swarm of the Yilgarn Craton, and the ~2.78 Ga Black Range Suite of the Pilbara Craton.

208
Selective Acylation of Symmetric Polyamines with Acid Anhydrides in Water

Injecting a sample into the HPLC machine in the organic chemistry lab.

Student Researchers
Kyrie Pappas, Biochemistry and Molecular Biology with Chemistry Concentration; Xiang Zhang, Organic Chemistry
Advisor
Dr. Shiyue Fang
Sponsors
National Science Foundation, Michigan Universities Commercialization Initiative Challenge Fund, SURF, Jerry Lutz, Shane Crist, and Dean Seppala

Project Overview
Polyamines are widely used as chemical linkers in many areas of chemistry, including pharmaceutical chemistry, solid-phase synthesis, and surface chemistry among many others. The formation of a linker from a diamine molecule is a two-step process, the first step being a selective mono-acylation of one of the two amino groups. However, the preparation of a mono-acylated diamine molecule is difficult. Under past-reported conditions, reaction of a symmetric diamine with an acid anhydride yields exclusively di-acylated products. We found that when using water as the solvent, the reaction can give predominantly mono-acylated products.

209
Incorporation of Dextran and Chitosan Improved Neuron Attachment and Neurite Extension

At work in the Michigan Tech Regeneration and Repair Laboratory.

Student Researcher
Jonathan Zuidema, Biomedical Engineering
Advisor
Dr. Ryan Gilbert
Sponsors
National Institutes of Health and Michigan Initiative for Innovation and Entrepreneurship

Project Overview
The material properties of hydrogels are important for enhancing neuron attachment and neurite outgrowth. Taking this into account, several hydrogel blends were created in order to determine the optimal blend for neuron compatibility. The surface charge, gel stiffness, gelation time, and rate of dissolution of the hydrogels were varied and evaluated. Cortical neurons and dorsal root ganglia from nine-day-old chicken embryos were seeded on top of the different blends, and the different hydrogel blends were then assessed based on neuron attachment and neurite length.
210 Transverse Mechanical Properties of Human Lateral Meniscal Attachments

The research setup. Attached grips hold on to human soft tissue to test for mechanical properties.

**Student Researcher**
John T. Moyer, Mechanical Engineering

**Advisor**
Dr. Tammy Haut Donahue

**Sponsor**
National Institutes of Health

**Project Overview**
The human knee joint bends during any dynamic activity, during which the ligaments and menisci provide joint stability. In the knee meniscus, collagen fibers are aligned specifically to assist with different loading conditions. The human menisci are firmly attached to the tibia by means of ligamentous structures known as meniscal attachments. The load is primarily transferred to the insertion sites which are designed to reduce the stress concentrations caused by the load transfer. The objective of this study is to quantify and compare the mechanical properties of the human meniscal attachment along its transverse direction while in tension.

211 Testing and Refining Rehydroxylation Ceramic Dating

Dig site in Parowan, Utah.

**Student Researchers**
Patrick Bowen and Helen Ranck, Materials Science and Engineering; Jessica Beck, Biological Sciences

**Advisors**
Timothy Scarlett, Social Sciences, and Jaroslaw Drelich, Materials Science and Engineering

**Project Overview**
A team lead by Moira Wilson recently proposed a new chronometric dating tool for archaeology, dubbed Rehydroxylation Dating. It relies upon the fact that fired clays reabsorb water at a constant rate proportional to \( \text{time}^{1/4} \). Our initial study showed that wet environments containing organic chemicals resulted in the samples losing mass over time. We must determine why this mass loss occurred. Temperature is the only significant factor influencing the rehydroxylation rate. Previous researchers simply used a mean temperature in their calculations. We intend to refine this temperature estimation method to reduce error in the calculated sample age.

212 Self-Diagnosed and Self-Powered Structures

Variable cantilevered testing apparatus for the energy-harvesting potential of poled PVDF (piezoelectric polymer).

**Student Researcher**
Gareth Johnson, Mechanical Engineering

**Advisor**
Keat Ghee Ong, Biomedical Engineering

**Sponsor**
SURF

**Project Overview**
This project focuses on the development of a self-diagnosed, self-powered structure based on the magnetoelastic materials. For the self-diagnosed part, the magnetoelastic materials were exposed to a magnetic AC field and their responses at the harmonic frequencies were captured. Results have indicated these materials were able to measure compressive forces, allowing real-time tracking of surface pressure variations. The same material was also coupled with piezoelectric materials to convert magnetic-field induced magnetoelastic vibration into electrical voltages. The experimental results have allowed the continuous development of a smart material that will have important applications in biomedical and industrial areas.
213 Light Filtering Polymers for More Biocompatible Coatings on Medical Devices

In these vials is a polymer vital to creating more compatible implantable devices.

Student Researcher
Genevieve E. Gierke, Biomedical Engineering
Advisor
Dr. Megan C. Frost
Sponsor
SURF

Project Overview
Nitric oxide has been found to reduce the biological response of implantable devices that are in contact with blood and tissue. Incorporating light-controlled nitric oxide-releasing chemicals into polymer coatings can help to decrease the body’s immune response. Levels of nitric oxide release, which can vary according to the wavelengths of light used, can also cater to this response to specific device needs. The ability to control biological response would help to decrease the chance of device failure and undesired complications to patients, making devices more successful and versatile.

214 Prevention of the Athletic Groin Strain

Initial report run from the survey.

Student Researcher
Andrea Taglione, Exercise Science and Biological Sciences
Advisor
Dr. Mark Randell

Project Overview
Although groin strains are one of the most commonly cited injuries in athletes, current literature regarding the athletic groin strain is inconsistent and often controversial. Very limited data is available regarding prevention programs. The purpose of this project was to determine the use and efficacy of programs used by professionals nationwide to prevent the athletic groin strain.

215 Effects of Framing on Risk Taking in Strictly Competitive Games

Game design, mixed strategies for each player, and tournament structure.

Student Researcher
Jizhou Li, Mathematical Sciences
Advisor
Dr. Thomas E. Merz, School of Business and Economics
Sponsor
SURF

Project Overview
The objective of this research is to test a set of hypotheses on how framing affects risk taking in strictly competitive games such as football, tennis, soccer, and others.
216  
**Novel Nitric Oxide Donating Polymeric Material for Biocompatibility of Implanted Devices**

An absorbance spectrum.

**Student Researcher**  
Elizabeth Moore, Biomedical Engineering  
**Advisor**  
Dr. Megan C. Frost  
**Sponsor**  
National Science Foundation

**Project Overview**  
Previous studies have shown that many S-Nitrosothiols (RSNOs) rapidly degrade, with half-lives from minutes to seconds in aqueous solution. The research in this paper presents data that the RSNO 1,3 benzenedinitrosothiol has been relatively stable for over one year. This RSNO still releases nitric oxide when subjected to ultraviolet light and has the same characteristic absorbance peak as a freshly made RSNO. Developing this stable RSNO potentially provides a venue for further investigation into using this nitric oxide donor to improve the biocompatibility of implanted optical sensors.

217  
**6-Aminonicotinamide Releasing Highly Aligned PLLA Electrospun Fibers For Astrocyte Inhibition**

**Student Researcher**  
Nick Schaub, Biomedical Engineering  
**Advisor**  
Dr. Ryan Gilbert  
**Sponsor**  
SURF

**Project Overview**  
Recent inquiry into nerve regeneration using polymeric fiber scaffolding to direct neurite growth has shown promising results. The same technique used to create these polymer nanofibers has also been a point of interest as a drug-delivery mechanism, since drug may be released from these biodegradable fibers. This project combines these efforts to create aligned nanofibers that release the drug 6AN in order to metabolically arrest astrocyte proliferation following spinal cord injury.

218  
**Phytoremediation of Antibiotics in Wastewater Using Vetiver Grass**

**Student Researcher**  
Stephanie Smith, Biochemistry and Molecular Biology  
**Advisor**  
Dr. Rupali Datta  
**Sponsor**  
SURF

**Project Overview**  
The ultimate goal of the study is to develop an inexpensive and sustainable technology to remediate antibiotics in wastewater. Vetiver grass was chosen because of its high biomass, massive root system, noninvasive nature, and known use in constructed wetlands to absorb nutrients, metals, and small organics. The potential for uptake of antibiotics tetracycline and monensin was studied in a hydroponic setup. Results show that both monensin and tetracycline are taken up and metabolized by the plant. Initial results indicate that vetiver grass has the potential to be used for remediation of antibiotics in wastewater.
219
Aligned Electrospun Fibers Foster Axonal Regeneration

Type-1 astrocytes stain positive for glial fibrillary acidic protein (red) in tissue culture.

Student Researcher
Jared Craigg, Biomedical Engineering

Advisor
Dr. Ryan Gilbert

Sponsor
National Institutes of Health

Project Overview
At present, nearly one in fifty people live with paralysis, sustaining average yearly health care costs between $228,566 and $775,567 per person. Currently there is no clinical paradigm for treatment; therefore, emphasis has been placed on understanding injury pathology and developing combination therapeutic strategies. We investigated aligned microfiber matrices as a novel platform for axonal regeneration after a complete transection spinal cord injury in rats. Aligned microfiber matrices fostered robust regeneration of axons into conduit lumen, and, in several animals, permitted serotonergic axons to navigate the lesion over twenty-eight days.

220
Stress, Sleep, Exercise, and Academic Self-Efficacy Among College Students.

Student Researcher
Abrah Maki, Biology and Psychology

Advisor
Dr. Susan Amato-Henderson and Dr. LeAnne Forquer, Cognitive and Learning Sciences

Project Overview
The relationship between stress, sleep, exercise, and academic self-efficacy among college students is investigated. Previous research has shown that stress is associated with sleep deprivation, lower academic self-efficacy, and more-frequent exercise. Therefore, hypotheses state that sleep and academic self-efficacy will be negatively correlated with stress, while stress will be positively correlated with exercise. Approximately one hundred and fifty participants will be recruited using the psychology program’s electronic subject pool. Participants completed four online surveys and received extra credit for their participation.

221
Pre-Wrap Dispenser Design and Development

Initial Pre-Wrap Dispenser design.

Student Researcher
Henry King, Industrial Technology

Advisors
Dr. John Irwin, School of Technology, and Dr. David Orozco, School of Business and Economics

Sponsor
BeMe Athletica

Project Overview
This project is focused on the development of a new product for a potential emerging market. The product will fill a niche for which no current options exist—the dispensing of athletic pre-wrap. It is the culmination of a cooperative effort between an entrepreneurial team and a product design team, which developed a proof of concept and a business plan during a prior semester. The current undergraduate research is invested in refining the product design and bringing it to market.
222
Neurite Response Using Highly Aligned Poly-L-lactic Acid Fibers as Tissue Scaffolding

Dorsal root ganglion neurite extension on a novel silica sol-gel.

Student Researcher
Ryan Young, Chemical Engineering

Advisors
Dr. Ryan Gilbert, Biomedical Engineering, and Dr. Michael Mullins, Chemical Engineering

Sponsor
SURF

Project Overview
Many approaches to studying human spinal cord injuries are currently used in laboratory research. However, virtually every potential treatment is first studied in vitro. This study’s objective is to create a standard in vitro model for studying how injured axons regenerate on aligned topographies. Dorsal root ganglia (DRG) were placed onto aligned fibers, and the neurites from the DRG were allowed to extend for several days. After sufficient neurite extension, regenerating axons were cut, and the regeneration behavior examined. By examining neurite regeneration patterns following transection, it may be possible to better determine when to apply therapeutics for injured neurons.

223
The Role of Carbohydrates in Biosilicification by Bacillariophyceae

Electron microscope image of Thalassiosira pseudonana glass cell walls (scale bar 5 μm).

Student Researcher
Jacob Jaszczak, Biological Sciences

Advisor
Dr. Michael Gretz, Biological Sciences; Dr. Mark Hildebrand, University of California San Diego, Scripps Institute of Oceanography

Sponsor
US Air Force Office of Scientific Research

Project Overview
Diatoms create detailed, nanoscale patterned shells using silica (SiO2). This process of biosilicification occurs at ambient conditions, has not been reproduced by nanotechnology, and offers tremendous potential for use in industry. Proteins have been found to precipitate silica spheres but the mechanisms of pattern formation are still unknown. Cultures of Thalassiosira pseudonana were grown with several polysaccharide synthesis inhibitors to determine the role of carbohydrates in pattern regulation. Electron microscopy images and statistical analysis showed increased structural complexity in inhibited cultures. The glycosyl linkage composition of the frustules was analyzed to measure changes in the carbohydrate metabolism. These results provide evidence for the role of carbohydrates in pattern regulation during biosilicification.

224
Fitness, stress, sleep and academic self-efficacy in college students

Student Researcher
Alison Greene, Psychology

Advisors
Dr. LeAnne Forquer and Dr. Susan Amato-Henderson, Cognitive and Learning Sciences

Project Overview
The relationship between fitness and academic performance has been spotlighted because of the number of overweight children and the pressure placed on children to meet high academic standards. Studies on stress and fitness have shown a negative relationship between levels of exercise and stress levels. Studies on sleep and stress also indicate a negative relationship. However, results on fitness and academic self-efficacy are mixed. The purpose of this study, conducted with undergraduate students, was to determine the possible relationship between fitness, stress, sleep and academic self-efficacy by using four online self-report surveys.
225
Model Gas Turbine Combustor: Development and Current Research

Laser illuminated flame structure in model gas turbine combustor.

Student Researcher
Andrew Ramsey, Mechanical Engineering
Advisor
Dr. Seong-Young Lee
Sponsor
Department of Mechanical Engineering-Engineering Mechanics

Project Overview
This project outlines the development and current research of the model gas turbine combustor (MGTC) utilized in the Combustion Sciences Exploration Lab in the ME-EM department. The MGTC is currently used to investigate combustion instabilities in low-emissions gas turbine engines.

226
Separations of Atmospheric Water-Soluble Organic Compounds

LCQ Fleet, Thermo Scientific LC/MS electrospray ion source analyzer for small organic acids.

Student Researcher
Sandra S. Orlowski, Chemistry
Advisor
Dr. Lynn R. Mazzoleni

Project Overview
Aerosol and/or fine particulate matter (PM2.5) contain products that include water-soluble organic compounds (WSOC). These products can influence the size/production rate of cloud droplets, affecting Earth’s radiative balance and hydrologic cycle. Many WSOC have unique polarity and potential for extensive hydrogen bonding, making them hard to identify with traditional separation and identification methods. This research focuses on implementing chromatographic retention to improve identification and quantification of WSOC. Our model compounds include carboxyl, hydroxyl and nitro functional groups, and creating a single LC separation method is challenging. We compare separations on three columns: polar end-capped C18, pentafluorophenyl, and a zwitterionic hydrophilic.

227
Carbon Variation in Organic Matter through the Soil Profile

Soil samples for carbon analysis.

Student Researcher
Jill Smith, Forestry
Advisor
Dr. Marty Jurgensen
Sponsor
SURF

Project Overview
The sequestration of carbon by soils is often overlooked or given a simple estimate. However, using one standard conversion factor for estimating soil carbon is likely to result in erroneous carbon sequestration estimates, especially when expanded to global scales. The proportion of carbon in soil organic matter has been shown to vary by different soil types. This research was directed at addressing how the proportion of carbon in organic matter varies with depth in different soil profiles, how these proportions further vary with different cover vegetation types and soil textures, and, lastly, if there are clear changes existing with soil depth that affect carbon stability.
228
Parametric Study of an Artificial Heart Using Finite Element Analysis

Finite element model of artificial heart containing the case, sac, and pusherplate.

Student Researcher
Daniel Dubiel, Biomedical Engineering
Advisor
Dr. Tammy Haut Donahue, Mechanical Engineering
Sponsor
Penn State University Hershey Medical School, Artificial Organs Group

Project Overview
The goal: create a 3-D finite element model to predict concentrated stresses in a complete artificial heart. Components used within the model include a pusher plate, blood sac, and case. A parametric study was conducted for the blood sac where stresses hinder longevity of the current artificial heart. Pressure loads created during the normal systolic ejection were utilized, along with constant refinement of element mesh convergence between components to further the optimization of the artificial heart model. The final outcome of the work will dictate the geometry that minimizes the stresses in the blood sac of the artificial heart, furthering implant longevity.

229
Characterization of Secondary Organic Aerosols from the Complex Reactions of alpha-Pinene and Ozone

Standing next to the Fourier Transform Ion Cyclotron Resonance Mass Spectrometer at Woods Hole Oceanographic Institute.

Student Researcher
Annie Putman, Environmental Chemistry
Advisor
Dr. Lynn Mazzoleni
Sponsor
Los Alamos National Laboratory

Project Overview
Secondary organic aerosols (SOA) are suspended organic compounds, originating from biological or anthropogenic sources. The atmosphere oxidizes organic compounds through a variety of multistep pathways. Although it is known SOA act as cloud nuclei and scatter radiation, the total effect on global climate change is unclear, as most of the species are uncharacterized. The SOA under investigation is formed from complex reactions involving alpha-pinene, ozone, and intermediate products. The laboratory generated SOA was obtained from Dr. John Offenberg, an EPA collaborator, simulating the systems found in the troposphere. Our analysis uses ultrahigh resolution mass spectrometry for identification.

230
Combined Heat and Mental Stress Alters Neurovascular Control in Humans

This subject is performing five minutes of mental arithmetic while wearing a tube-lined heating suit.

Student Researcher
Jenna Klein, Exercise Science and Biological Sciences
Advisors
Dr. Jason Carter, Exercise Science; Dr. Craig Crandall, Texas Health Presbyterian Hospital; and Dr. Matthew Brothers, Texas Health Presbyterian Hospital
Sponsors
American Physiological Society, National Institutes of Health

Project Overview
This study examined the effect of combined heat and mental stress on neurovascular control in humans. Five minutes of mental stress were performed during normothermic and heat-stressed conditions. Our results indicated that mental stress caused mean arterial pressure (MAP) to increase during both thermal conditions, but the increase was blunted during heat stress compared to normothermia. This blunted MAP increase occurred even though combined heat and mental stress elicited greater increases in muscle sympathetic nerve activity and cutaneous vasoconstriction. These findings may have significant importance for individuals exposed to mentally taxing situations in hyperthermic environmental conditions (i.e. soldiers, firefighters, athletes).
Terra Preta Working Group at Michigan Tech

Biochar is a process and product that may help mitigate climate change.

Student Researchers
Michelle Rombach, Biological Sciences and Premed; Troy Cogan, Civil Engineering; Amanda Taylor and Josh Nikolai, Chemical Engineering; Timothy Veverica, Biochemistry and Molecular Biology; Justin Slis, Biomedical Engineering; and Hillori Mitchell, Electrical Engineering

Advisors
Dr. Kurt Patterson, Environmental Engineering, and Evan Kane, School of Forest Resources and Environmental Science

Project Overview
The project was started and is being run by Michigan Tech students as a working group. The impetus and commitment of the project are reciprocal with the local community, with shared access to resources, planning, and participation. Currently, Terra Preta is a framework for exploring the historical, archeological, anthropological, scientific, and indigenous aspects of “dark earth.” We think of biochar as a process and product that may be used as a soil amendment; that may dramatically help increase soil fertility; and that may help mitigate climate change via its carbon-negative sequestration qualities.
THE FASTER THE BURN, THE BETTER THE BURN.
E3 Spark Plugs’ patented DiamondFire technology deliver the most complete combustion possible, and they’re backed by a 5-year/100,000 mile warranty. Switch to E3 Spark Plugs and get more power, better gas mileage and a cleaner burn. Learn more at E3SparkPlugs.com.
301 Supermileage Systems Enterprise (SSE)

Supermileage Competition Run—1140MPG taking 2nd Place.

Team Leaders
Justin Angelow, Electrical and Computer Engineering, and Stacey Stanley, Mechanical Engineering

Advisor
Richard J. Berkey, Institute for Global Leadership and Entrepreneurship

Sponsors
Robert Bosch Corporation, Agilent, the MathWorks, Garmin, Viking Electric, Square D, Homestead Graphics, Flight Works, and Pi Shurlok

Project Overview
SSE is interested in developing automotive systems and working as a design team. Our current mission is to design a single-person, super-high-mileage vehicle that will challenge other engineering schools at the next year’s competition. Vehicles are powered by a small four-cycle engine. The vehicles will run a specified course, with the vehicle obtaining the highest combined miles per gallon rating plus design segment points, winning the event. Students have the opportunity to set a world fuel economy record and increase public awareness of fuel economy.

302 Michigan Tech Clean Snowmobile Challenge

The team along with an engineered 2008 Polaris FS Switchback snowmobile.

Team Leaders
Josh Ball, Mechanical Engineering Technology, and Jeff Levine, Civil Engineering

Advisor
Dr. Jason Blough, Mechanical Engineering-Engineering Mechanics

Sponsors
Team Industries, Polaris Industries, 3M, V-converter, Castle Sales, Keweenaw Motorsports, Cummins, A.E.D. Motorsports Products, Camoplast, Soundown, Bombardier, Alcoa, and National Instruments, Ford Motor Company Fund, DENSO, ArcelorMittal, Oshkosh Corp., and Undergraduate Student Government

Project Overview
The overall design strategy for Michigan Tech involves extensive engineering design and testing on a 2008 Polaris FS Switchback to reduce noise and emissions. Since fuel economy has been introduced into the competition, reduction of weight became a main focal point in the design of this year’s snowmobile. Refinement of the 2009 competition snowmobile allowed for extensive testing and added a new dimension to the education and engineering experience for each team member.

303 International Business Ventures (IBV)

IBV students work hard to create low-cost biomedical products.

Team Leaders
Josh Floyd and Danielle Linna, School of Business and Economics

Advisors
Dr. Robert Warrington, Institute for Global Leadership and Entrepreneurship; Anne Warrington, School of Business and Economics; Michael Neuman, Biomedical Engineering; and Edwar Romero, Mechanical Engineering

Sponsors
McAllister Foundation, Heyer America

Project Overview
IBV was established in 2003 as a multidisciplinary Enterprise team with students from biomedical, electrical, mechanical, computer engineering, and business. Engineering students work on team projects (infant heart annunciator, pandemic ventilator, and anesthesia blower) with business students (grants, financial analysis, business plans, recruitment) to create low-cost biomedical solutions for global markets. The team collaborates throughout the United States, Canada, Germany, and Puerto Rico (with the Universidad Del Turabo), and it offers a unique opportunity for students to learn how best to work cooperatively with other classmates—as well as students and businesses worldwide.
304
Alternative Fuels Group (AFG)

Members of AFG show off “Little Brother” to young minds at the Yes! Expo in Detroit, Michigan.

Team Leaders
Joe Rushing, Electrical and Computer Engineering, and Jacob Boes, Chemical Engineering

Advisor
Dr. Jason Keith, Chemical Engineering

Sponsor
Michigan Tech Keweenaw Research Center

Project Overview
The Alternative Fuels Group Enterprise is committed to providing an opportunity for young professionals in multiple academic disciplines to interact with industry and faculty and to provide viable solutions to real-world energy problems.

305
IT Oxygen

Members of IT Oxygen gather around a workstation to figure out a problem.

Team Leaders
Todd Reid, Sound Design, and Nathan Atteberry, Computer Network and System Administration

Advisor
Robert Maatta, School of Business and Economics, and Dr. James Frendewey, School of Technology

Sponsors
IBM Corporation and Marquette General Health System

Project Overview
We develop information system and information technology solutions. Our areas of expertise include systems and information analysis, software development, database design, and web-based application development. Our projects can be semester-long, yearlong, or even longer. Our goal is to provide real-world projects that allow our members to build leading-edge software development and information technology skills that will make them more marketable when looking for jobs after graduation.

306
Husky Game Development

Second Life Team Leader Adam Eidelsafy overseeing production of the Michigan Tech island and preparing it for demonstration.

Team Leaders
Corey Cousino and Ryan Wilson, Software Engineering

Advisor
Dr. Robert Pastel, Computer Science

Project Overview
HGD fosters high professional standards, creativity, productivity, effective personal communication, and a burning desire to learn. We create projects that can compete in the ever-changing, fast-paced video game industry and in other interactive entertainment culture. Industry professionals enrich the educational and professional experience of team members. Industry partners benefit from our teamwork on design, prototypes, or testing of new ideas and new products. They gain access to outstanding students for co-ops and permanent employment; access to the campus community through seminars and classroom visits; and potentially thousands of hours of student development work, as well as shape the future of young video game enthusiasts.
Aqua Terra Tech is a water resources Enterprise that focuses on environmental and geophysical consulting work and research. We currently have several projects that span different disciplines. They include designing a gravity-fed water distribution system, conducting geophysics surveys to find water-bearing fractures, monitoring the watershed of Swedetown Creek (with Hancock High School), and designing a rain garden to filter parking lot runoff.

**Team Leaders**
Briana Drake and Nick Nathan, Environmental Engineering

**Advisor**
Dr. John Gierke, Geological and Mining Engineering and Sciences

**Sponsors**
National Science Foundation, Keweenaw Bay Indian Community, and Thrivent Financial for Lutherans

**Project Overview**
Aqua Terra Tech is a multidisciplinary team dedicated to improving products and processes. We firmly believe in the value of hands-on experience to identify and solve real-world engineering problems, accomplished by developing and applying technical, professional, and entrepreneurial skills. CPM has involved itself with a broad spectrum of sponsors—including Kimberly-Clark, the Keweenaw Brewing Co., 3M, and others—to provide support in product development, process design, and quality assurance. Team members are able to engage in thought-provoking discussions in an environment that is friendly, challenging, and rewarding.

**Team Leaders**
Charlie Ciarkowski, Chemical Engineering, and Ben Kusterer, Mechanical Engineering

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

**Sponsors**
De la Terre Bistro, Bakery, and Saloon and Keweenaw Brewing Co.

**Project Overview**
CPM is a multidisciplinary team dedicated to improving products and processes. We firmly believe in the value of hands-on experience to identify and solve real-world engineering problems, accomplished by developing and applying technical, professional, and entrepreneurial skills. CPM has involved itself with a broad spectrum of sponsors—including Kimberly-Clark, the Keweenaw Brewing Co., 3M, and others—to provide support in product development, process design, and quality assurance. Team members are able to engage in thought-provoking discussions in an environment that is friendly, challenging, and rewarding.

**Team Leaders**
Dianna Cacko and Markus Manderfield, Construction Management

**Advisor**
Lynn Artman, School of Technology

**Sponsors**
Ford Motor Company Foundation, Michigan Tech Rail Transportation Program, Sweetwater Cafe, and De la Terre Bistro Bakery and Saloon

**Project Overview**
We are committed to sustainable and energy-efficient engineering and design as it relates to construction. Our projects include railroad redesign and analysis, designs for Habitat for Humanity, and weatherization of homes. These real-world projects will increase students’ knowledge of construction and engineering practices.
310
Nanotech Innovations

One of the best ways to explain nano is to show it, since the science behind it is complex.

Team Leaders
Echoe Bouta, Biomedical Engineering, and Greg Teeters, Mechanical Engineering
Advisor
Dr. John A. Jaszczak, Physics
Sponsor
National Science Foundation

Project Overview
Nanotech Innovations is Michigan Tech’s nanotechnology Enterprise. We are a team of interdisciplinary undergraduate students working to further the field of nanotechnology both at Michigan Tech and across the country. In addition to educational outreach, we develop nanotechnology-related materials and products for research and development. We currently have five different teams within the Enterprise.

311
BoardSport Technologies (BST)

Applying an ABS sidewall to the core of the snowboard during layup.

Team Leaders
Wayne Schwind, Chemical Engineering, and Greg Petty, Mechanical Engineering
Advisor
Dr. Ibrahim Miskioglu, Mechanical Engineering-Engineering Mechanics
Sponsor
Altair and Letherer Truss Inc.

Project Overview
BST consists of the Wake Team, Snow Team, and Skate Team. Each operates as a separate entity and is responsible for its own management, operation, and productivity. The Wake Team primarily focuses on wake-related sports (wakeboarding, wakeskating, etc.); the Snow Team focuses on snow sports (snowboarding, skiing, etc.); and the Skate Team, new this year, focuses on manufacturing skateboards.

312
Noise, Vibrations, Harshness (NVH)

Setup for validation testing in Ashville, NC.

Team Leaders
Adam Gerth and William Atkinson, Mechanical Engineering
Advisor
Dr. James DeClerck, Mechanical Engineering-Engineering Mechanics
Sponsor
Volvo

Project Overview
NVH is an industry term that stands for noise, vibration, and harshness. Noise is unwanted sound; vibrations are the oscillation that is typically felt then heard; harshness is generally used to describe the severity and discomfort associated with unwanted sound and or vibration—especially from short duration events. Although most noise and vibration are unwanted, many times products and systems need to be tuned or engineered to posses certain sound and vibration characteristics at particular frequencies to sound and feel “right.” This is the area of design for NVH.
313  
**Blue Marble Security Enterprise (BME)**

Wildlife camera—a monitoring system for ground nesting birds to study nest viability and predator activity.

**Team Leaders**
Josh Ericson, Electrical and Computer Engineering, and Dave Thunes, Mechanical Engineering

**Advisors**
Glen Archer, Electrical and Computer Engineering, and Amber Roth (graduate student), Forest Resources and Environmental Science

**Sponsors**
ERT Systems and Department of Energy

**Project Overview**
Blue Marble teams work on internally and externally funded projects focused primarily in the areas of defense and national security. Teams are comprised of students from electrical and computer engineering, computer science, and mechanical engineering. Externally sponsored projects include creating an automated image-capture system for monitoring ground-nesting birds, as well as a wireless, radio-frequency remote for use by the athletic department. Internal projects consist of an omni-directional robotic platform, an autonomous ice resurfacing vehicle, projects in digital image processing, radar, and teams competing in the National Security Innovation Competition and the Intelligent Ground Vehicle Competition.

314  
**Automotive Computing Enterprise (ACE)**

Pulling the motor out of a Chevy S10 in preparation of the making of an electric vehicle.

**Team Leaders**
Dustin Drumm, Electrical Engineering, and Max Leason, Computer Engineering

**Advisors**
John Lukowski and Jeremy Boss (graduate student), Electrical and Computer Engineering

**Sponsors**
General Motors, Nuance

**Project Overview**
ACE is developing wireless communication with a test vehicle, including the ability to control vehicle functions from mobile phones. Text-to-speech will give the driver a more absorbing experience while improving overall safety. We have also developed a dynamic instrument cluster. Another project involves retrofitting a Chevy S10 to be a fully electric vehicle with the major constraint of cost. We hope to achieve a fully designed system and are well into the implementation phase of the project.

315  
**Michigan Tech Formula Car**

Designing and building a race car for competition in May 2010.

**Team Leaders**
Peter Piper and Mike Tiry, Mechanical Engineering

**Advisors**
Dr. William Shapton (faculty emeritus), Dr. James DeClerk, and Dr. Jeffrey Naber, Mechanical Engineering-Engineering Mechanics

**Sponsors**

**Project Overview**
The concept behind Formula SAE is that a fictional manufacturing company has contracted a design team to develop a small Formula-style race car. The prototype is to be evaluated for its potential as a production item. The target market for the race car is the nonprofessional weekend autocross racer. Each student team designs, builds, and tests a prototype based on a series of rules whose purpose is both to ensure on-site event operations and to promote clever problem solving. Formula SAE encompasses all aspects of the automotive industry, including research, design, manufacturing, testing, developing, marketing, management and finances.
316 Velovations: The Bicycle Design Enterprise

At work in the Velovations bike lab.

Team Leaders
Caitlyn Bodamer, Mechanical Engineering
Advisor
Dr. John Gershenson, Mechanical Engineering-Engineering Mechanics
Sponsors
Pearl Izumi, SRAM, Rocky Mounts, Niner Bikes, Saris Cycling Group, and Rolf Prima

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

317 Cin/Optic Communication and Media

Setting up lights and camera equipment for an interview with the green screen backdrop.

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 based on the needs of our clients.

318 Integrated Microsystems Enterprise (IME)

One of the IME boards, the DAC.

Team Leaders
Marc Robertson and Nick Oberski, Electrical Engineering
Advisor
Dr. Paul Bergstrom, Electrical and Computer Engineering
Sponsors
V.I.O. and Center for Wireless Integrated Microsystems

Project Overview
IME is an undergraduate research and development organization within the College of Engineering. Funded primarily by the Engineering Research Center of the Wireless Integrated Microsystems, our mission is to serve as a vehicle for undergraduate engineers with a desire to participate in meaningful technological research and development.
Team Leaders
Leonard Britz and Mark Maxwell, Electrical Engineering
Advisor
Christopher (Kit) Cischke, Electrical and Computer Engineering
Sponsors
American Time & Signal Co., Fulton Innovation, and Michigan Tech Research Institute (MTRI)

Project Overview
WCE is a student-led virtual company focused on wireless, optical, renewable energy and biomedical technology. WCE has competent project experience in lasers, RFID, wind/solar power, PCB design, and embedded systems programming. We work as a think tank for companies looking to push their product lines to a higher level. We also 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. WCE members come from many majors, including electrical, computer, biomedical, mechanical, STC, and business.
322 Pavement Design, Construction and Materials Enterprise

The Paradise Road realignment team out surveying, fall 2009.

Team Leader
Derek MacKenzie, Environmental Engineering, and Andrew Mansfield, Civil Engineering

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

Sponsors
Bob Thompson and Michigan Tech’s Materials in Sustainable Traffic Infrastructure (MiSTI).

Project Overview
Pavement team members are working on four different projects during the spring 2010 semester. The projects include two external competitions and two internal research projects. The external competitions are sponsored by the American Concrete Institute and the Federal Aviation Administration. One of the internal projects is focused on research regarding aggregate properties and pavement friction; the other is working with the City of Houghton to gather sign inventory and reflectivity data. The competitions and research opportunities provide team members with great learning and networking experiences.

323 Green Campus Enterprise

Team Leaders
Jennifer Robinson, Chemical Engineering, and Rachael Barlock, Environmental Engineering

Advisor
Dr. Chris Wojick, Civil and Environmental Engineering

Sponsor
Michigan Tech, Michigan Tech Dining Services

Project Overview
Our mission is to help Michigan Tech’s administration effectively engage the University community in reducing our carbon footprint. Our project groups include Saving Energy in Computing Services and Buildings; Feasibility of a Wind Turbine; Campus Culture and Dorm Competition; and Cool Air, Cool Planet Carbon Calculator Team.

324 FIRST Robotics Enterprise (FRE)

Teams have six weeks, imposed material and size restrictions, and a limited budget with which to build a competition robot.

Team Leaders
Jeremy Egger and Lauren Schaffer, Mechanical Engineering

Advisor
Dr. Barbara Lograsso, School of Technology

Sponsors
BAE Systems, GM, and PTC

Project Overview
We work to connect grade school, high school, and college students with the professional world through robotic education. FRE stimulates students’ interests in the fields of science and technology by mentoring local teams for the annual FIRST Robotics Competition, FIRST Vex Challenge, and FIRST Lego League. FRE also reaches outside of the FIRST community by promoting projects such as this year’s MATE International ROV Competition, a college underwater robotics competition. It is our duty to promote teamwork and leadership throughout every aspect of our Enterprise with gracious professionalism.
325
Forestry and Environmental Resource Management (FERM)

The team at the Monster Pine from the Dow Tract.

Team Leader
Matt Manders, Forestry and Applied Ecology

Advisors
James Rivard and James Schmeirer, Forest Resources and Environmental Science

Sponsor
US Forest Service

Project Overview
For the spring 2010 semester, several projects are underway. At the Ford Forestry Center (FFC), our maple syrup operation is set to produce dozens of gallons this year and provide an educational experience for local school children. In the greenhouse, students are propagating Canada yew, eastern hemlock, and white spruce seedlings. Wildlife students are using motion cameras to monitor wildlife activity. Forestry students are gaining experience with cruising and marking at several Michigan Tech properties in addition to monitoring timber-harvesting operations. Other projects include writing management plans, marking property boundaries for the Michigan Nature Association, and monitoring wildlife trees.

326
Advanced Metalworks Enterprise (AME)

Machining a core box that will be used to sand cast aluminum mugs.

Team Leaders
Kyle Deane and Becky Price, Materials Science and Engineering

Advisors
Dr. Mark Plichta and Dr. Paul Sanders, Materials Science and Engineering

Sponsors
ArcelorMittal, Chrysler, and Eastern Alloys

Project Overview
AME is a diverse collection of mechanical engineers and material scientists working together 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. As well, AME works with on-campus projects and persons when interest arises. Previously two separate Enterprises, AME was formed out of ICE and PrISM to close the gap between product design and fabrication.

327
Blizzard Baja

Winners of the Mike Schmidt Memorial Iron Team Award with the most combined points after all three North American Baja SAE events.

Team Leaders
Joshua Mullins, Bret Schulte, and Devan Faust, Mechanical Engineering

Advisor
Dr. Brett Hamlin, Engineering Fundamentals

Sponsor
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, the team uses many modern engineering software tools. As an outreach activity, Blizzard Baja hosts the nation’s largest invitational competition, the Winter Baja.
ONE WORLD TRADE CENTER AND NUCOR STEEL.

RED, WHITE AND BLUE, AND GREEN.
328
Encanto Enterprise

Team Leader
Miguel Angel Cotto Morales, International Design

Advisor
Dr. Aurorisa Mateo, Universidad del Turabo

Sponsor
National Science Foundation

Project Overview
This initiative was begun by a group of five students
from the Universidad del Turabo International
School of Design to provide innovative ergonomic
and aesthetic design solutions to several projects
of the Hispanic Entrepreneurial Program For
Innovation (HEPI), a Universidad del Turabo
program. The most remarkable projects are
the body of the Formula car of Fusion Motors
Enterprise at Turabo and the case of a heart
monitor for infants, developed in alliance with Tech's
IVB Enterprise.

329
Intelligence Network

Team Leader
Oswaldo Rodriguez, School of Business and
Entrepreneurship

Advisor
Dr. Alizabeth Sanchez and Dr. Maribel Ortiz,
Universidad del Turabo

Sponsor
National Science Foundation and Medtronic
Foundation

Project Overview
This enterprise is dedicated to help organizations
to improve their decision-making processes
by providing affordable and reliable information
technology-based tools. The first project consists
of developing a new marketing, web-based tool
that addresses the needs of nonprofit corporations
focused on the promotion of new business
ventures.

330
Fusion Motors

Team Leader
Andres Calvo, Mechanical Engineering

Advisor
Dr. Pedro Zayas, Universidad del Turabo

Sponsor
National Science Foundation, Pfizer, and Medtronic
Foundation

Project Overview
Our goal is to design and build innovative vehicle
prototypes for international college design
competitions of the Society of Automotive
Engineers (SAE). Our first two projects were a
Formula 1 and a Mini Baja. The suspension,
chassis, and motor of the Formula car were
completed and the electrical system was designed
and is being implemented. The design of the
Mini Baja project was completed and it is in the
construction phase. The team expects to complete
both vehicles in summer 2010.
Innovatronics

Team Leader
Jorge Castro, Computer Engineering

Advisors
Dr. Jose L. Colon and Dr. Idalides Vergara, Universidad del Turabo

Sponsors
National Science Foundation and Medtronic Foundation

Project Overview
We specialize in the development of software and electronics solutions for “smarter living.” Our current projects include the development of a human/computer interface for the blind and a car maintenance system.

Biogen

Team Leader
Jose Luis Torres, Mechanical Engineering

Advisor
Dr. Gerardo Carvajal, Universidad del Turabo

Sponsors
National Science Foundation and Medtronic Foundation

Project Overview
Biogen is focused on providing innovative technological solutions to environmental and nature conservation problems, and it was initiated as a result of an invitation from Puerto Rico’s State Department of Natural Resources (DNA), specifically the Maricao Office in the western area of the country. The inquiry addresses the needs of a fish farm.

Evolife Medical Solutions

Team Leader
Andrea Morales, Electrical Engineering

Advisors
Dr. Jannette Perez and Dr. Jose Deliz, Universidad del Turabo

Sponsors
National Science Foundation and Medtronic Foundation

Project Overview
Evolife focuses on the design and development of medical devices and solutions for the health-care industry. Students, faculty, and other collaborators have developed a prototype for a self-inflatable, portable, cervical collar.
334
EMCO (Energy Management Company)

Department
School of Engineering

Advisor
Dr. Amaury Malave, Universidad del Turabo

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

Project Overview
EMCO is dedicated to promote energy efficiency by developing and implementing innovative energy-saving technologies, educational resources for school students on energy topics, and tools to integrate renewable energy sources to existing technologies.
US Forest Service

An Employer of Choice

For more information, contact:
Leon LaVigne
US Forest Service
Region 9
llavigne@fs.fed.us
414-297-1313
www.fs.fed.us/r9
401
The Reflection Garden

Having the vision, creating the model, and seeing the dream come true.

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 and creating an educational garden space on school property. We are converting a quarter-acre area into a garden featuring not only species of native plants, in hopes of attracting natural wildlife, but also utilizing solar energy, water collection/conservation techniques and the writing of formative lesson plans to assist in the educational component.

402
Harnessing Generations of Energy to Build a Sustainable Community

Winterizing a basement door to save energy in Hancock, Michigan.

School
BRIDGE Alternative High School, Hancock, Michigan
Advisor
Chuck Palosaari
Sponsors
Efficiency Through Engineering and Construction (ETEC), Michigan Tech Summer Youth Program, BRIDGE and Horizons High Schools, Little Brothers Friends of the Elderly, Martineau & Morris Contracting, ThermoAnalytics, Inc., and New Power Tour Inc.

Project Overview
This project harnesses the energy, enthusiasm, and talents of community residents from multiple generations in a service-learning project. Undergraduate students from Michigan Tech and at-risk high school students from local alternative schools will be trained by professional engineers and skilled tradespeople to provide free home winterization and energy audit services for low-income elderly.

403
Model Lego Atomic Force Microscope

School
Chassell High School, Chassell, Michigan
Advisor
Mary Markham
Sponsor
Nanotech Innovations Enterprise and Department of Engineering Fundamentals

Project Overview
We are creating a model of an atomic force microscope using Lego Mindstorms. We plan on using the design given to us by the Michigan Tech Nanotech team and improve it. The original design uses a probe to scan the top of the blocks, but we will attempt to use a laser for the scanning.
**404**
Underwater Remotely Operated Vehicle (ROV) Engineering

School
Traverse City Central High School, Traverse City, Michigan

Advisors
Keith Forton and Than Dykstra

Sponsors
National Science Foundation, Traverse City East Middle School; Morton Bretz, Three Lakes Association; Traverse City Area Public Schools; and Square One Education Network Network

**Project Overview**
Currently, little opportunity exists for engineering projects in the marine environment, especially at the high school level. The marine and submarine environments truly offer unique engineering challenges that are not addressed in the terrestrial world. Our goals include infusing a high level of technology, developing an affordable and effective ROV optical system that can be easily replicated, and providing a service, utilizing ROVs, to the surrounding community. Our vision is to create a unique engineering challenge that will allow students to put science, technology, engineering and mathematics (STEM) into practice within the engineering processes.

**405**
Plug-in Electric Go-Kart/Underwater Robotics

School
Utica High School, Utica, Michigan

Advisors
Geoffrey Clark and Scott Spry

Sponsor
National Science Foundation

**Project Overview**
The TURRET team’s goal is to create a marketable and profitable submarine that is efficient and relatively easy to make for real-world companies. The Go-Kart team’s goal is to build a safe electric, plug-in go-kart that can reach 30 mph.

**406**
Let’s Go Green

School
Detroit Institute of Technology at Cody, Cody, Michigan

Advisor
Jeffrey Boykin

Sponsors
American Society of Mechanical Engineers (ASME) Detroit Section, National Science Foundation, IBM, and Square One Education Network

**Project Overview**
We are taking a gas-powered, radio-controlled vehicle and converting it to electric.
407
Home Winterization

School
Horizons Alternative High School, Mohawk, Michigan

Advisor
Brad Wickstrom

Sponsors
Efficiency Through Engineering and Construction (ETEC), Michigan Tech Summer Youth Program, BRIDGE and Horizons High Schools, Little Brothers Friends of the Elderly, Martineau & Morris Contracting, ThermoAnalytics, Inc., and New Power Tour Inc.

Project Overview
Our project involves the winterization of homes of elderly, low-income people in the local area. The project harnesses the energy, enthusiasm and talents of community residents, high school students, and college students, and it aims to strengthen the foundations of a sustainable community while teaching students lessons involving science, technology, engineering, and math.

408
Watershed Analysis for Swedetown Creek

School
Hancock High School, Hancock, Michigan

Advisor
Brian Rajdl and Steve Smith

Sponsors
National Science Foundation, Lake Superior Stewardship Initiative, and AT&T

Project Overview
We are conducting student-led research to gather baseline watershed data for Swedetown Creek, including riparian habitat analysis, water quality, flow rates, and stream channel measurements. Students are working toward a comprehensive watershed management plan by identifying stakeholder groups, pinpointing potential threats to the watershed, and creating a water-quality board to address watershed concerns.

409
The Cards

School
Melvindale High School, Melvindale, Michigan

Advisor
Randy Thomas

Sponsors
National Science Foundation, Square-One Education Network, IBM, and Dassault/Delmia

Project Overview
The team will address a major issue facing us all. The question at hand is our dependence on foreign oil resources. We are using up natural resources at an alarming rate. Will these resources be available in the future? Our team will address the need for the development of renewable energy sources. We are examining the development of a hybrid vehicle. The team is part of the Innovative Vehicle Design with the Square-One Foundation. The students have established high expectations and objectives to meet the challenges of this project. The students’ objectives are to research, design, build, modify, and establish a final product to be driven on the roadways of Michigan.
410 Solar Energy-Renewable Energy Use

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

**Advisor**
Ernestine Smith

**Sponsors**
American Society of Mechanical Engineers (ASME) Detroit Section and National Science Foundation

**Project Overview**
Our goal is to introduce the power of the sun to young readers so they can discover how its heat and light can be harnessed to make energy. Educational project-based learning comic books will be designed to educate and excite elementary students about STEM careers and to show the role solar electric power and renewable energy can play in providing clean energy for homes, schools, and workplaces. It is the goal of the group to complete the project in three years.

411 Remotely Operated Vehicles

**School**
Manuela Toro Morice, Puerto Rico

**Advisors**
Juan Serrano Mentor, Raymond Borges, Sandra Pedraza

**Sponsors**
Caguas Municipality Government, National Science Foundation

**Project Overview**
An ROV is an underwater robot to be used in marine inspections. The robot is a mechanical device adapted with motors and an image system to inspect underwater environments. The priority in the first stage has been for the robots to work in underwater environments. The team developed the concepts, creation, designs (aesthetic and mechanical), construction prototypes, and the final robots. The team also decided the materials, shapes, sizes, and technical requirements. In the end, two robots made of PVC tubes were constructed: the THROV (Trash Hunter ROV) and the EVO (Evolution).
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As one of America’s great public research universities, Michigan Tech is aggressively engaged in serving the community—locally, regionally, and nationally. The primary focus of Michigan Tech’s outreach is on promoting education and careers focused on science, technology, engineering and mathematics (STEM). Michigan Tech works with many of America’s largest companies and numerous government agencies that share this commitment to promoting STEM with our K-12 students. Michigan Tech is a nationally recognized leader in this area and can be a powerful partner in helping your organization promote K-12 STEM education.

At Michigan Tech, our focus is on cutting-edge research and innovative, discovery-based education that will help our partners create the future. We would welcome the opportunity to meet with you and explore the possibilities for creating the future together.

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