IMAGINATION • COLLABORATION • INNOVATION • SOLUTIONS

design expo 2019

Michigan Technological University

A SHOWCASE OF ENTERPRISE
AND SENIOR DESIGN
STUDENT PROJECTS

ITC is proud to sponsor Michigan Tech's 2019 Design Expo

Welcome to Michigan Tech's Design Expo.

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

– Jon E. Jipping, PE

Executive Vice President and Chief Operating Officer
ITC Holdings Corp.

MTU class of 1991 – MS, Electrical Engineering

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Table of Contents

Scope

Design Expo highlights hands-on, discovery-based learning at Michigan Tech. More than 1,000 students on Enterprise and Senior Design teams showcase their work and compete for awards. A panel of judges—made up of corporate representatives, invited guests, Michigan Tech staff, faculty members, and graduate students critique student projects. Many team projects are sponsored by industry, which allows students to gain valuable experience through competition, as well as direct exposure to real industrial problems. Design Expo is hosted by the College of Engineering and Pavlis Honors College.

Sponsor Design Expo 2020

mtu.edu/expo/sponsor

Design Expo Awards

Senior Design Awards
Based on poster

- First place–$200
- Second place–$100
- Third place–$75
- Honorable mention–$50 (three to be awarded)

Enterprise Awards
Based on poster and presentation

- First place–$400
- Second place–$200
- Third place–$100

Design Expo Image Contest
Photo or non-photo graphics

- First place–$100
- Second place–$50

Design Expo Innovation Awards
Based on application

- First place–$250
- Second place–$150
- Third place–$100

Enterprise Awards
Based on nominations–$100 each

Student Awards
- Outstanding Leadership
- Rookie Award
- Innovative/Sponsor Relations

Faculty/Staff/Sponsor Awards
- Outstanding Enterprise Advisor
- Outstanding Sponsor
- Behind the Scenes
- Module Master

More Special Thanks

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

Tomorrow needs new solutions and agile thinkers. It needs champions of the unknown. Tomorrow needs technology—inventors, artists, engineers, innovators, and coders. Tomorrow needs integrators. Visionaries who design for the human race, who maximize the potential of both mind and machine, who optimize the value of the person in the process.

Design Expo brings student teams, industry partners, campus mentors, and the community together to explore a year's worth of developments—the products, processes, and breakthroughs that tomorrow needs.

mtu.edu/tomorrow-needs

ENERGIZING MICHIGAN'S

Future

Energy is essential to the way we live, work and play.

ITC operates, builds and maintains the region's electric transmission infrastructure. We're a Michigan-based company working hard to improve electric reliability, increase electric transmission capacity, and keep efficient, reliable energy flowing to homes and businesses across the state.

Building the electric transmission infrastructure that will power the *future*.

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On behalf of our faculty, staff, and students, welcome to Design Expo 2019!

Today marks our 19th annual Design Expo, where we showcase the work of nearly 1,000 students enrolled in our Enterprise and Senior Design programs. Today provides a glimpse into the future, where the motivation, innovation, and accomplishments of our students give optimism for a better tomorrow.

Our Senior Design program challenges teams of highly-dedicated, senior-level students to address practical, open-ended design challenges—a "capstone" experience where teams must apply prior coursework as well as develop new knowledge and skills. Teams follow the complete design process from ideation to realization, many working directly with industry sponsors. At Michigan Tech, Senior Design is not a "last class"—it's a "first job."

The Enterprise program is open to all majors and fosters interdisciplinary problem solving, leadership development, and team-based project work. Diverse organizations of first-year through graduate-level students develop products, processes, and services within their market space. Faculty advisors coach and guide, while industry sponsors serve both as clients and mentors. Multi-year participation in a business-like environment provides students in Enterprise a unique opportunity to maximize personal and professional growth.

Design Expo is generously supported by industry and university sponsorship. We are pleased to welcome ITC Holdings as Directing Partner for the eighth consecutive year. Collaborating Partners include Code Blue, Michigan Tech's Innovation Center for Entrepreneurship, Miller Electric Manufacturing Company, Nexteer, and Nucor. Our Innovating Partners this year are Challenge Manufacturing and Kimberly-Clark.

We would like to take this opportunity to express our sincere appreciation to the more than 120 partners and sponsors who have made investments in our educational mission. The benefits of industry, government, and academia working together as partners are clearly evident at Michigan Tech's Design Expo. Thank you.

Enjoy your Design Expo experience, and Go Huskies!

Rick Berkey
Director
Enterprise Program

Leonard Bohmann
Associate Dean
College of Engineering

101
Blizzard Baja

Team Leaders
Jake Fedie and Eric Bauer, Mechanical Engineering

Advisor
Kevin Johnson, Mechanical Engineering Technology

Sponsors
Aramco, Denso, General Motors, FCA, Magna, 3M, Altair, Ford Motor Company, Halla Mechatronics, Henkel, IPETRONIK, John Deere, Meritor, Nexteer, Michigan Scientific Corporation, Milwaukee Tool, ArcelorMittal, Cummins, Oshkosh Corporation

Background
Michigan Tech's Blizzard Baja Enterprise builds a single-seat, off-road competition vehicle to compete in the SAE Collegiate Design Series-Baja SAE events held in various locations across the US. The team prepares and presents a written design report, cost analysis, and sales presentation for a panel of SAE judges. After passing a rigorous safety and technical inspection, the team competes with other collegiate teams on acceleration, hill climb, maneuverability, suspension, and endurance. The Blizzard Baja Enterprise also organizes and hosts the Winter Baja Invitational event, a long-standing University tradition dating back to 1981.

Overview
We custom fabricate an entire off-road vehicle to improve performance and driver experience to ultimately make an affordable alternative to the existing side-by-side industry. We strive to push the boundaries to make the car faster, more responsive, and lighter. With the help of an engine dyno, wheel force transducers, and finite element analysis, we can acquire real-life loads and performance curves to tune and improve our current components. Through research, development, and continuous testing, we have successfully created a car to compete at the national level.

Meet our 2019 comp car, Hornet.

102
Clean Snowmobile Challenge

Team Leaders
Josh Carpenter and Logan Eide, Mechanical Engineering

Advisor
Jason Blough, Mechanical Engineering-Engineering Mechanics

Sponsors
Aramco, Denso, General Motors, FCA, Magna, 3M, Altair, Ford Motor Company, Halla Mechatronics, Henkel, IPETRONIK, John Deere, Meritor, Nexteer, Michigan Scientific Corporation, Milwaukee Tool, ArcelorMittal, Yamaha, Kohler, Arctic Cat, Camso, V-Converter, Bosch, PCB Piezotronics, TE Connectivity, Simscale

Background
Michigan Tech's Clean Snowmobile Challenge Enterprise builds snowmobiles to compete in the SAE Collegiate Design Series Clean Snowmobile Challenge held at the Keweenaw Research Center in Houghton, Michigan. As part of the competition, the team submits an engineering design paper, determines a justified MSRP (Manufacturer's Suggested Retail Price), and presents an oral design presentation outlining its approach to the clean snowmobile conversion. Following a comprehensive technical inspection, the vehicles undergo dynamic testing including acceleration, handling, cold start, noise, and emissions. Michigan Tech's Clean Snowmobile Challenge Enterprise typically competes in both the Internal Combustion (IC) and Zero Emissions (ZE) classes.

Overview
Our team works to reduce snowmobile emissions and noise, while increasing fuel economy and maintaining an enjoyable riding experience. For the 2019 season, we entered both gasoline and diesel utility classes. Our entry into the gasoline class was a 2016 Yamaha RS Venture with custom engine calibration, a catalytic converter, noise treatments including intake and exhaust quarter-wave resonators, and chassis stiffening. Our entry into the diesel utility class was a 2016 Arctic Cat Bearcat powered by a three-cylinder Kohler diesel engine. Our diesel entry featured an electronic CVT clutch assist system for increased performance, an exhaust system with DPF and DOC emissions controls, custom fuel control and mapping, and a custom muffler for exhaust noise control.

Diesel and gasoline snowmobiles from 2018-19.

103
Formula SAE

Team Leaders
Austin Arenz and Mark Wenzel, Mechanical Engineering

Advisor
James DeClerck, Mechanical Engineering-Engineering Mechanics

Sponsors
Aramco, Denso, General Motors, FCA, Magna, 3M, Altair, Ford Motor Company, Halla Mechatronics, Henkel, IPETRONIK, John Deere, Meritor, Nexteer, Michigan Scientific Corporation, Milwaukee Tool, Simscale, TE Connectivity, Mercury, SKF USA, PartSolutions, ArcelorMittal, McLaren, AVL

Background
Michigan Tech's Formula SAE Enterprise builds a competition vehicle based on the concept of an affordable race car geared towards the weekend autocrosser. The team competes in SAE Collegiate Design Series Formula SAE events held in various locations across the country. For the competition, the team prepares a written design report, a cost analysis, and a business case to present to a panel of judges. After passing a technical inspection, the vehicle competes in a series of dynamic events, including acceleration, skid pad, autocross, endurance, and efficiency. Michigan Tech Formula SAE has a long history of top-performing cars and has gained a reputation for developing cutting-edge designs that help shape the future of racing.

Overview
Formula SAE has been incredibly busy this year. We continued to work with our upgraded suspension models to better develop future vehicles and have been collecting moving-vehicle data through our donated Ipetronik DAQ system. In addition, we have implemented SimScale to develop an aerodynamic body and wing set for increased downforce and reduced drag. By implementing these projects and many more, we are confident that our Formula SAE car will be the fastest in our team's history.

F222 Fall Testing.

104
Supermileage Systems Enterprise

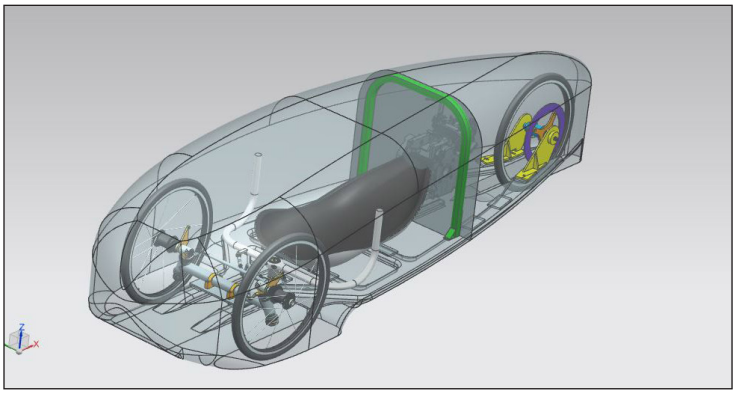
Team Leaders
Adam Kurdelski and Connor Stark, Mechanical Engineering

Advisor
Rick Berkey, Pavlis Honors College

Sponsors
Aramco, Denso, General Motors, FCA, Magna, 3M, Altair, Ford Motor Company, Halla Mechatronics, Henkel, IPETRONIK, John Deere, Meritor, Nexteer, Michigan Scientific Corporation, Milwaukee Tool, ArcelorMittal, Saginaw Controls & Engineering

Background
The Supermileage Systems Enterprise builds a single seat, high efficiency vehicle that competes in either the SAE Collegiate Design Series or the Shell Eco-marathon. The powertrain utilized by the vehicle is determined by the competition and is either a small displacement internal combustion engine or a battery electric design. Regardless of the event, the team must engineer a competitive vehicle and submit a written report detailing the vehicle design. The team must also deliver an oral presentation that demonstrates understanding of the engineering principles that support the design. Following a technical inspection, the vehicle completes a dynamic performance event where miles per gallon (MPG) or mile per gallon equivalent (MPGe) is measured.

Overview
This year, Supermileage built a completely new competition vehicle, with a new body, electronic system, and engine design. The body team manufactured the carbon fiber body, which is smaller and lighter than last year's and incorporates an integrated load structure and composite pucks for subsystem mounting. The engine team has multiple projects focusing on reducing fuel consumption through thermal management, closed loop tuning via an oxygen sensor, and the addition of an engine encoder. By the end of spring 2019 semester, the efficiency goal is to reach 1,000 miles/gallon.



CAD rendering of the 2019 Supermileage competition vehicle.

105
Advanced Metalworks (AME)

AME
ADVANCED METALWORKS ENTERPRISE

Team Leaders
Oliver Schihl, Mechanical Engineering Technology; Sidney Schroeder, Mechanical Engineering

Advisor
Paul Sanders, Materials Science and Engineering

Sponsors
Mercury Marine, Eck, ArcelorMittal, Gerdau, Clean TeQ, AIST

Background
Advanced Metalworks Enterprise (AME) is composed of a diverse team of students who execute research and development projects for industrial sponsors. Interdisciplinary teams of four to five students model, fabricate, and characterize metallic systems such as aluminum, iron, zinc, titanium, and nickel-based alloys. AME helps industry sponsors increase productivity, identify causes of material failures, design near net castings, develop advanced material modeling techniques, and more.

Overview
We are working on several projects this year, including: research on modifying a welder and a mill to create a metal 3D printer, investigating internal stresses in high pressure die castings, quantifying the effects of CrN coatings in high pressure die castings, and optimizing the metal degassing process.

Members of the Advanced Metalworks Enterprise pour ductile iron in the Michigan Tech Foundry.

MERCURY
ArcelorMittal
GERDAU

Bronze Husky statue by sculptor Brian Hanlon.

106
Aerospace Enterprise

Team Leader
Ethan Parker and Marcello Guadagno, Mechanical Engineering

Advisor
L. Brad King, Mechanical Engineering-Engineering Mechanics

Sponsors
NASA, Air Force Research Laboratory

Background
The Aerospace Enterprise was established to provide hands-on aerospace education and experience to Michigan Tech undergraduate students. The Enterprise works together on innovative and relevant aerospace related projects with all members contributing towards achieving specific project goals. The Aerospace Enterprise places an emphasis on space mission design and analysis, vehicle integration, systems engineering, and comprehensive ground-testing and qualification.

Overview
The Stratus mission demonstrates an inexpensive, upwardly scalable architecture, capable of imaging clouds in the infrared spectrum and generating usable data for validating and improving existing climate and weather models. Accomplishing the Stratus mission with a cubesat form factor will prove the validity of the concept, while doing so at a relatively low cost. Auris is a pathfinder mission whose goal is to demonstrate a low-cost platform capable of determining the interference potential of GEO satellites. Auris will map satellite RF footprints and determine their locations on a cubesat platform. Doing so could allow telecommunication providers insight into their satellite's actual beam pattern projected onto the Earth.

Render of the Aerospace Enterprise's Stratus Cubesat contracted by NASA.

107
Alternative Energy Enterprise (AEE)

Team Leaders
Sean Smith, Environmental Engineering; Jacob Orlando, Chemical Engineering

Advisor
Jay Meldrum, Keweenaw Research Center

Sponsors
Keweenaw Research Center, Oshkosh, and Traverse Solar

Background
Alternative Energy Enterprise (AEE) provides opportunities for students in multiple academic disciplines to research and develop alternative energy sources. Projects, research, and development are done in conjunction with industry sponsors to produce viable solutions to real-world energy problems. Each team is interdisciplinary and receives a rewarding hands-on experience while working on challenging problems and seeking innovative solutions.

Overview
AEE is retrofitting the former president's residence as our sustainable demonstration house. We are working on a transportable source of renewable energy fitted with a folding blade wind turbine, folding solar panel array, rechargeable battery pack, and integrated generator. Our microbial fuel cell is a redox reaction that uses microbes to breakdown wastewater and release electrons. We are working on a fast pyrolysis reactor to convert poplar wood chips into bio-oil to be used as a drop-in fuel or additive to hydrocarbon based fossil fuel. Our solar team is creating a solar tracker to automatically follow the sun across the sky daily. Our geothermal team is improving the utilization of abandoned mine shaft water as a thermal reservoir to heat and cool the Gates Tennis Center. We are also developing a bio-gas and fertilizer generator through the composting of food waste from the Michigan Tech dining facilities.

Sustainable Demonstration House (SDH).

108
Blue Marble Security (BMS)

Team Leaders
Rachel Savat, Mechanical Engineering; Cristina Reyes, Computer Engineering

Advisor
Glen Archer, Electrical and Computer Engineering

Sponsors
General Motors, Oshkosh Corporation, ArcelorMittal, Systems Engineering Research Center (SERC)

Background
Blue Marble Security (BMS) Enterprise is a student-led Enterprise that focuses on securing the future through the thoughtful use of technology. The team specializes in engineering design and product development. BMS has developed a culture that fosters high professional standards, creativity, and productivity. BMS defines the word "national security" through the provision of technological support to the defense, the corporate economy, and the personal well-being of the nation and all of its people

Overview
BMS Enterprise continued its trend of taking on a multitude of projects, currently tackling eight different projects in a variety of sectors. Members on the Oshkosh team worked on designing and modeling a suspension system for the Oshkosh Baja LCTV vehicle. Two projects, sponsored by SERC, entail the research, design, and prototype of a new back-packable power system for the Army, and the research and design of an amphibious side-by-side vehicle for use in a variety of applications. The GM team worked to develop a commercial off the shelf (COTS) vision system for unexpected part detection in manufacturing processes. The ArcelorMittal team worked to predict line stoppages through data mining and data analytics principles. Our other project teams adapted old monitor technology to scanning electron microscopes, provided outreach to local schools by hosting STEM activities, and completed an autonomous vehicle to compete in the Intelligent Ground Vehicle Competition.

Charlie, the autonomous robot built by our Autobot team.

109
BoardSport Technologies (BST)

Team Leaders
Davin Wiitanen and Ethan Johnson, Mechanical Engineering

Advisor
Ibrahim Miskioglu, Mechanical Engineering-Engineering Mechanics

Sponsors
ArcelorMittal, Enterprise Manufacturing Initiative funded by General Motors, Pavlis Honors College

Background
BoardSport Technologies (BST) focuses on the engineering, design, and manufacturing of skis, snowboards, skateboards, longboards, wakeboards, and other boardsport related products. Through integration of composite materials and creative design approach, the team strives to refine existing boardsport technology and to produce new and innovative products.

Overview
The BST skate team designed, manufactured, and tested a non-industrial skateboard press that will enable the average consumer to manufacture custom skateboard decks from home. The press is intended to have an easy assembly and disassembly process using designed components combined with standard hardware and fasteners. The press has been designed using 3D modeling software and has been subjected to Finite Element Analysis (FEA) to confirm the design will work as intended. The press is currently in the manufacturing phase, with plans to complete manufacture and testing by the end of spring 2019 semester.

Figure 1. Carbon Fiber Hydrofoil

Figure 2. Sit Ski from Snow Team

Figure 3. Mobile Skate Press

Figure 4. BlizzardBoard concept influence from 14-15 senior design

Concepts and models of current spring 2019 Boardsport projects.

Pavlis Honors College

ArcelorMittal

GENERAL MOTORS

110
Built World Enterprise (BWE)

Team Leaders
Tristan Tarsa, Civil Engineering; Skylar Callis, Civil Engineering and Applied Mathematics

Advisor
Audra Morse, Civil and Environmental Engineering

Sponsors
Airport Cooperative Research Program University Design Competition

Background
The Built World Enterprise (BWE) addresses challenges typically solved by civil and environmental engineers, including designing infrastructure and solving waste management problems.

Overview
In their inaugural year, BWE students will compete in the Airport Cooperative Research Program (ACRP) University Design Competition, contributing innovative ideas and solutions to issues facing airports and the National Airspace System. The Enterprise will also take on suitable sponsored projects from industry partners seeking to support project work.

Built World Enterprise is new to the program, but is excited to participate in the 2019 Design Expo.

ACRP
AIRPORT COOPERATIVE RESEARCH PROGRAM

111
Cin/Optic Communication and Media

CinOptic Enterprise

Team Leaders
McKenzy Rehfus, Communication, Culture and Media; Sarah Lindbeck, Scientific and Technical Communication

Advisor
Erin Smith, Humanities

Sponsors
International Research Experience for Students (IRES), Department of Mechanical Engineering-Engineering Mechanics, School of Technology, Community Solar

Background
The Cin/Optic Communication and Media Enterprise enables students to develop skills in video design and production. By balancing the creative and technical aspects of video, the primary goal is to focus on client needs and expectations, while developing artistically engineered products. Capitalizing on team member creativity and technical strengths, Cin/Optic provides an opportunity for those involved to broaden their education in the media industry through real-world business experiences.

Overview
We are a diverse team tackling many different projects this year. We have an ongoing project through the National Science Foundation with the International Research Experience for Students (IRES) grant, where for the past two years, a team member has traveled abroad to Denmark and Singapore documenting the research being done by students. In addition, we are also in collaboration with Community Solar in L'Anse and Baraga to create informational videos for public energy utilities and the public to better understand solar energy in both the Upper Peninsula and nationwide.

The CinOptic team focuses on being creative in new and unique ways.

Michigan Technological University
Mechanical Engineering-Engineering Mechanics

Michigan Technological University
School of Technology

112
Consumer Product Manufacturing (CPM)

Team Leaders
Robert Dupont and Korri Baird, Chemical Engineering

Advisors
Tony Rogers and Sean Clancy, Chemical Engineering

Sponsors
Avery Wilson, General Motors, Kohler Company, Libbey Inc., Yanfeng Automotive Interiors, Robert Carnahan, Schmohz Brewing Company, Keweenaw Brewing Company, ArcelorMittal

Background
Consumer Product Manufacturing (CPM) Enterprise aspires to empower students with the entrepreneurial, technical, and professional skills to conceive, develop, and market successful products in a company-like setting. Students on the team come from many disciplines and use hands-on experiences to identify and solve real-world engineering problems. CPM aims to exceed the expectations of company sponsors, improve the lives of consumers through innovation, and develop our team members into highly marketable professionals.

Overview
This has been an exciting year for CPM. The nanoMAG team completed their hockey blade project. The Biogas team began pilot plant experiments on their small-scale anaerobic digester. The Yangfeng Ultrasonic Welding team created DOEs to optimize surface welding. CPM has two new projects this year, including teams partnered with Libbey Inc., with the goal of improving commercial silverware, and General Motors, investigating waste disposal of paint sludge. The Kohler team continues to research and develop resin recycling techniques and products derived from resin waste streams. Another project is developing an automated keg washer for small breweries, with help from Schmohz Brewing Company and Keweenaw Brewing Company. Other projects include prototyping basalt roofing tiles and low-cost prostheses.

Commercial Keg Washer Unit.

113
General and Expedition Adventure Research (GEAR)

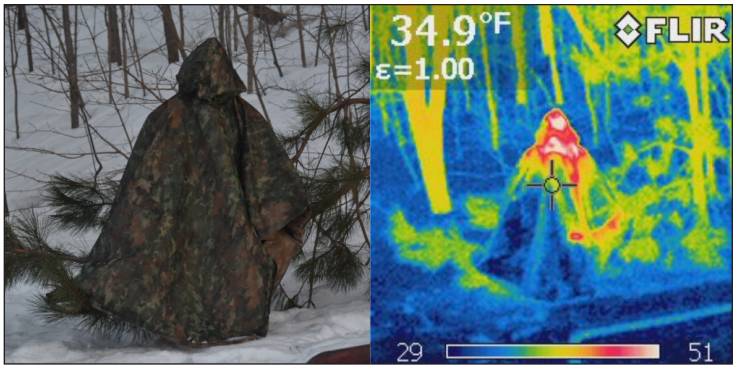
Team Leaders
Gabrielle Heinz and Nate Regan, Mechanical Engineering

Advisor
Brett Hamlin, Engineering Fundamentals

Sponsors
Systems Engineering Research Center (SERC), Enterprise Manufacturing Initiative funded by General Motors

Background
The focus of the General and Expedition Adventure Research (GEAR) Enterprise is to design, model, test, prototype, and manufacture a wide variety of goods and equipment used in recreational outdoor and commercial expedition endeavors. Team members analyze and develop innovative solutions on both internal and industry-sponsored projects. GEAR has worked on soft and hard goods related to backpacking, camping, climbing, snowshoeing, kayaking, canoeing, mountaineering, and military applications.

Overview
GEAR Enterprise is currently working on two projects: a personnel recovery hydration system and a personal signature reduction system. The hydration system utilizes metal-organic frameworks (MOFs) to absorb water vapor from the air, which is then released by creating a temperature differential. The system is designed for a downed pilot with the ability to be used in multiple environments, especially the desert. The Personal Reduction Signature Project is a team based project that is aimed at developing and testing possible solutions for reducing the overall signature of a downed fighter pilot in an adversary's territory. This device will help a downed airman reduce their infrared radiation, visual, sound, and scent signatures to aid in remaining undetected by surveillance systems and personnel. The overall objective of the project is to ensure the safety and successful rescue of a downed airman.



Blanket Prototype for the Signature Reduction Team.

GENERAL MOTORS

114
Green Campus

Team Leaders
Jaclyn Roeske and Benjamin Mohrhardt, Environmental Engineering

Advisor
Christopher Wojick, Civil and Environmental Engineering

Sponsor
Michigan Technological University

Background
Green Campus Enterprise is an organization of students working to make Michigan Technological University's campus more sustainable through both low and high profile projects. Green Campus Enterprise annually measures the carbon footprint of Michigan Tech, and designs and implements projects to improve the sustainability of the Michigan Tech campus. Green Campus works closely with the Michigan Tech administration to effectively engage the University community in reducing its carbon footprint.

Overview
We are collaborating with University personnel on many of our projects and gaining professional experience and leadership skills. The ultimate goal is to help Michigan Tech's administration effectively engage the University community in reducing our carbon footprint. The Enterprise's many design projects were created to improve the integration of sustainability into Michigan Tech's research and education.

Feasibility Studies and Design Work being conducted on Tiny Home Communities and Wind Energy.

Michigan Technological University

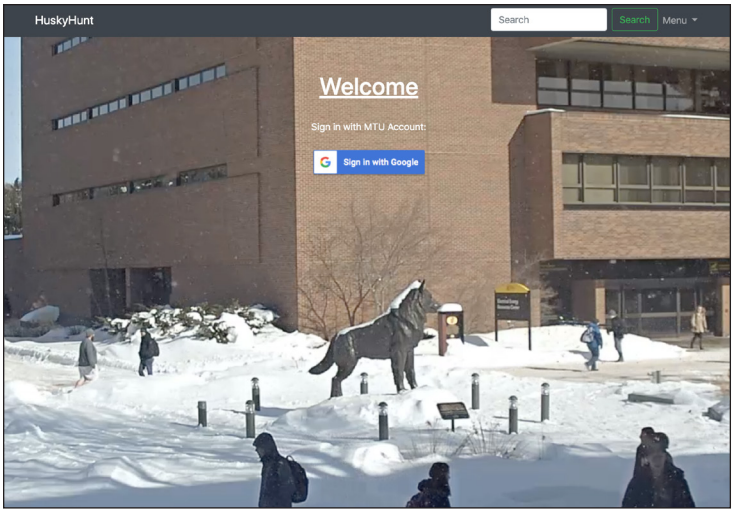
115
Humane Interface Design Enterprise (HIDE)

Team Leaders
Daniel Rutkowski and Will Kirkconnell, Computer Science

Advisor
Robert Pastel, Computer Science

Background
The members of Humane Interface Design Enterprise (HIDE) come together to design, develop, and evaluate user interfaces. The goal is to make daily work more efficient and easier to manage. As a whole, the team works together to design and test different applications for industry sponsors that can be used on Android, iPhone, and other devices. HIDE accomplishes these projects by combining knowledge from multiple disciplines such as computer science, psychology, and human factors. HIDE team members can get involved in various stages of the design process, from developing an app by programming, to evaluation by designing usability tests and analyzing data.

Overview
HIDE members worked on four different projects over the past two semesters. The first includes the development of an easy, do-it-yourself temperature and climate sensor that can be used to track microclimates around the world. Our team was also charged with creating a usable website to upload and log the data. Another HIDE subteam focused on increasing the efficiency of learning centers by making scheduling of appointments and student tracking easier. The third subteam focused on creating a customizable survey/voting application for Michigan Tech Undergraduate Student Government and Michigan Tech Career Services, so student feedback can be attained at a higher response rate. Another team is developing a website to serve as an online marketplace for students on campus, similar to Craigslist.



Homepage of HIDE's HuskyHunt Project, An Online Marketplace for Michigan Tech.

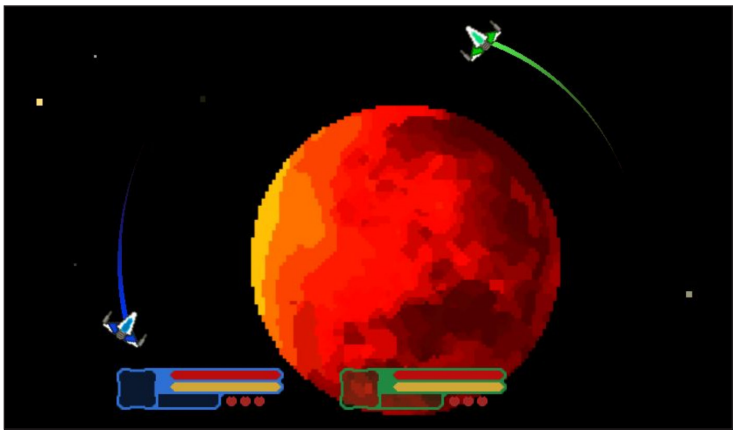
116
Husky Game Development (HGD)

Team Leader
Vincent McClintock, Computer Engineering; Sydney Micklas, Software Engineering

Advisor
Scott Kuhl, Computer Science

Background
Husky Game Development (HGD) is a student-run Enterprise focused on developing video games. Each year, HGD breaks up into sub teams of around six students, who experience a full game development cycle including ideation, design, and end product. HGD explores a wide-variety of video game engines and platforms including Windows, Android, Xbox, and an experimental Display Wall.

Overview
Orbital Command is a 2D Player vs Player competitive space shooter developed in Unity. The game will have gravity-based physics around planets and large space objects. Players will have to destroy the enemy player with lasers, missiles, and other projectiles to achieve victory. Careful planning and quick thinking will be necessary to plan shots and avoid their enemy.



A screenshot from the game.

117
Innovative Global Solutions (IGS)

INNOVATIVE. GLOBAL. SOLUTIONS.

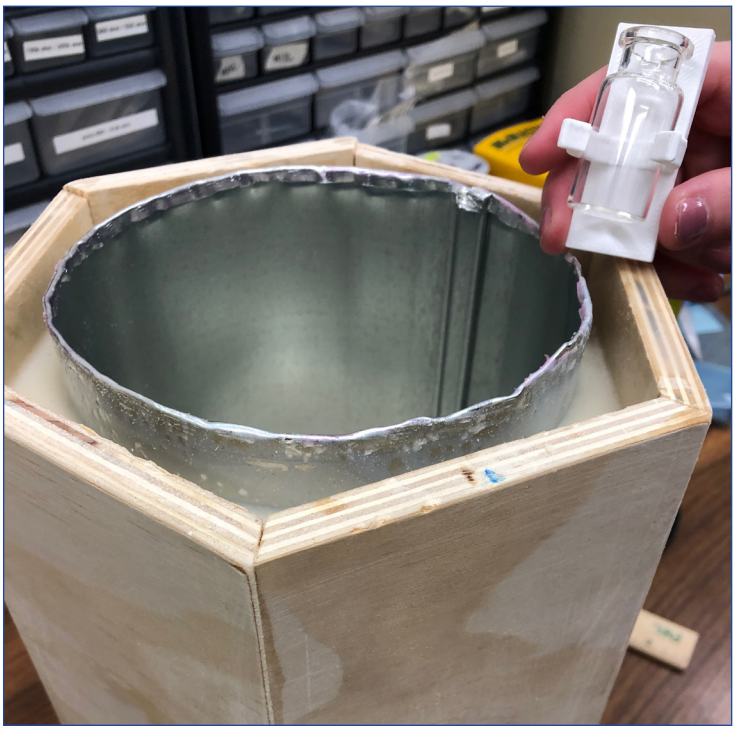
Team Leaders
Maria Wait, Biomedical Engineering; Nathan Tetzlaff, Mechanical Engineering

Advisors
Radheshyam Tewari, Mechanical Engineering-Engineering Mechanics; Nathan Manser, Engineering Fundamentals and Geological and Mining Engineering and Sciences

Sponsor
Pavlis Honors College, the Enterprise Manufacturing Initiative funded by General Motors

Background
Innovative Global Solutions (IGS) pursues solutions for the needs of developing countries, making contributions towards solving Grand Challenges. Team members improve technical skills and gain hands-on experience with an international engineering project. Typical project areas focus on energy, water, health, education, entrepreneurship, transportation, infrastructure, and more.

Overview
IGS found a need for storing and transporting vaccines in remote areas where extreme heat harms vaccine effectiveness. The Vaccine Cold Transport Team designed, manufactured, and tested a reliable transport container to safely deliver vaccines to those in need. The container was developed to reduce cost and increase storage efficiency. The Vaccine Cold Storage Team researched, designed, and built a vaccine refrigerator that focuses on long term reliability and uses locally sourced materials. The team implemented a cost effective design with a backup car battery bank in the event of power outages.



First steps of manufacturing the vaccine container with a 3D printed vial holder.

Pavlis Honors College

GENERAL MOTORS

118
ITOxygen

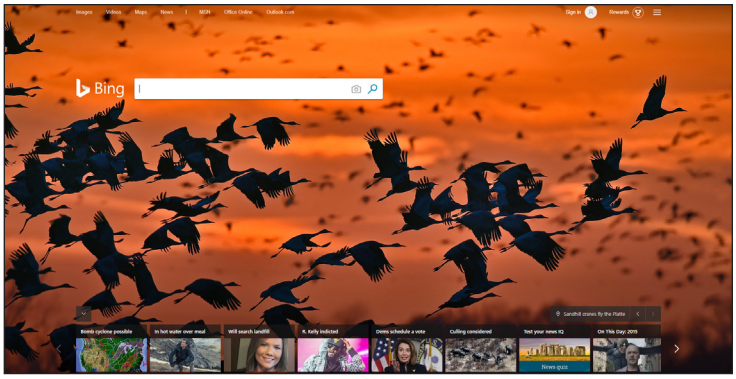
Team Leaders
Zack Metiva, Computer Network and System Administration; Amanda Kloepfer, Management Information Systems

Advisor
Russell Louks, School of Business and Economics

Sponsors
Microsoft, 24G, Denso, Pavlis Honors College

Background
ITOxygen is a cross-disciplinary, student-run Enterprise that specializes in Information Technology (IT) for student organizations and businesses, with a focus on developing Information System and Information Technology solutions. Team members work on real-world projects that foster skill development and utilize business intelligence. Areas of interest include systems and information analysis, software development, database design, data sciences, cyber security, and web-based application development.

Overview
This year the ITOxygen Enterprise is working on projects with Microsoft, 24G, and Pavlis Honors College. Working alongside master's students in the Data Sciences Master's Program, IT Oxygen teams have been utilizing data analytics to build predictive models and implement statistical analysis to find the drivers for student success—thanks to sponsorship by DENSO. For Pavlis, a team has been working to develop a website template to be utilized across all Enterprises, which will ensure congruity, security, and unified program branding. Meanwhile, the 24G team is developing a machine learning program and a powerful interface for predicting bowling scores down to each throw. Hosted with AWS, there is a custom algorithm for each player to accurately reflect individual performance.



Updated Bing Homepage.

119
Mining INnovation Enterprise (MINE)

Team Leaders
Andrew Watson, Chemical Engineering; Sequoyah Swiercz, Computer Science

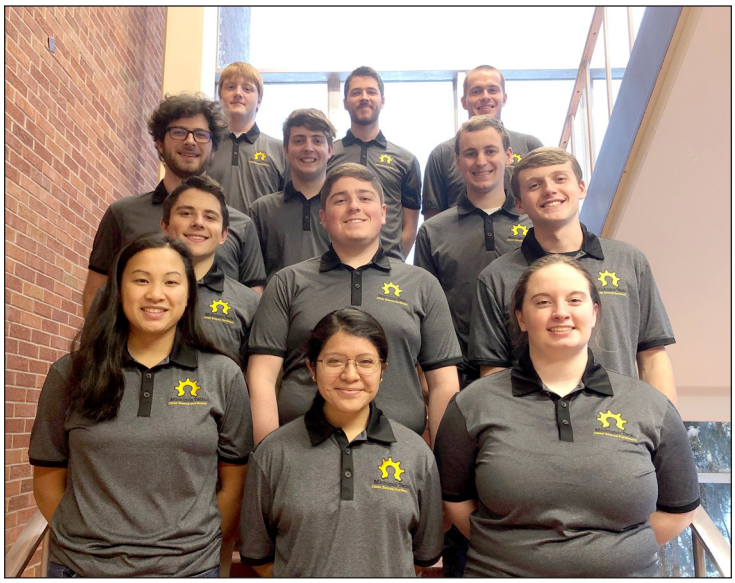
Advisor
Paulus Van Susante, Mechanical Engineering-Engineering Mechanics

Sponsor
NASA

Background
The Mining INnovation Enterprise (MINE) seeks to design, test, and implement mining innovation technologies for industry partners. MINE works in interdisciplinary subteams to solve current and future challenges in the traditional mining industry as well as the emerging mining fields of deep sea and space mining. Opportunities include the improvement of safety and working conditions, increasing productivity and efficiency, as well as mine and equipment design and optimization.

Overview
MINE's primary project this year included a feasibility study aiming to extract a net positive amount of water from gypsum rock using a high pressure water jet. The project includes a rover to carry the gypsum processing equipment payload. The project will be reviewed in 2020 and compared to similar water extraction projects from other teams around the country and a decision will be made on the best process to go forward.

MINE Team putting the finishing touches on the rover.



120
Open Source Hardware

open source hardware

Team Leader
Zach Arnold, Electrical Engineering; Sean Scsavnicki, Mechanical Engineering

Advisor
Joshua Pearce, Materials Science and Engineering

Sponsors
Enterprise Manufacturing Initiative funded by General Motors, ArcelorMittal, Pavlis Honors College

Background
Open Source Hardware specializes in building low-cost alternatives to expensive hardware/software, and then sharing the designs in the commons, so that collaborative improvements can be rapidly made. Anyone who so desires can make changes or updates to the designs the Enterprise team creates and through this process, designs are improved at a much higher rate than would be possible within the Enterprise alone. Open Source is all about collaboration.

Overview
The team has been working on a variety of projects to benefit the Open Source Community. The three main projects are the Automation of a 3D printer with a robotic arm, redesign of the filament extruder to make it modular and controllable from a phone app, and the design of a High Temperature 3D printer for engineering grade plastics. Other projects are the laser cutter and plastic shredder to help make 3D printing sustainable.

Recyclebot.

GENERAL MOTORS

ArcelorMittal

Pavlis Honors College

121
Robotic Systems Enterprise (RSE)

Michigan Tech
Robotic Systems Enterprise
Electrical and Computer Engineering

Team Leaders
Katelyn Rhue, Electrical Engineering; Camden Maxey, Mechanical Engineering

Advisor
Jeremy Bos, Electrical and Computer Engineering

Sponsors
General Motors, SAE International, Continental, Intel, MathWorks, Velodyne

Background
The Robotic Systems Enterprise (RSE) focuses on seamlessly integrating exceptional knowledge in electronics, robotics, and programming to solve real-world engineering problems. All majors are welcome—the team depends on more than just the skills and talents of engineering and science majors. RSE produces solutions that contribute to industry, recreation, and medical research.

Overview
RSE has been working on several projects this year, including an introductory project for new members called Aurora Minor. On this team, students learn to program robots and use tools that will be helpful as they progress in the Enterprise and move to other teams. We also have a number of new projects, including: a soil sampling remote-operated vehicle, a T-shirt cannon to be used at Husky sporting events, and turning a gas powered RC car into an electric vehicle. Our largest project encompasses several teams within RSE: the AutoDrive Competition sponsored by SAE. We built an autonomous vehicle for the competition that includes eight colleges and several challenge events. We are currently in year two of a three-year cycle.

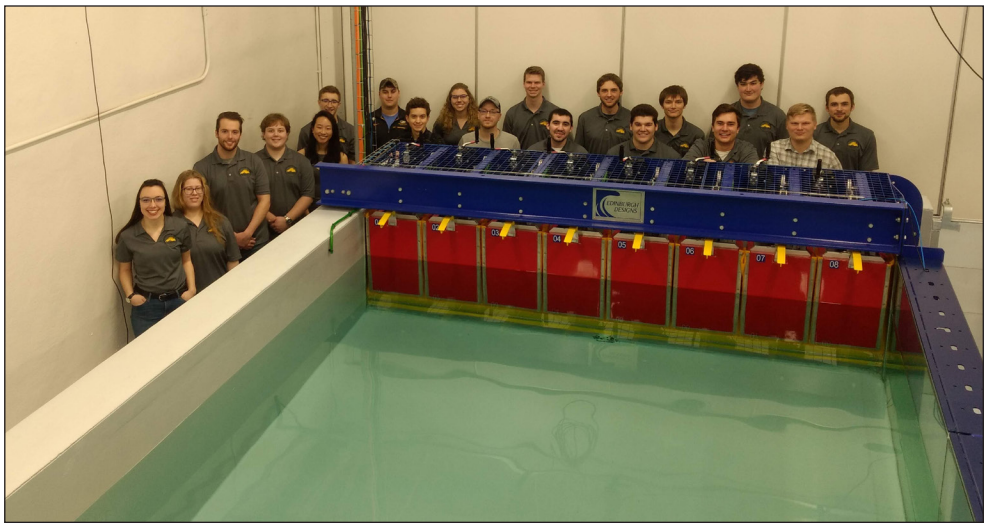
SAE AutoDrive Competition Bolt.

GENERAL MOTORS

Continental

SAE INTERNATIONAL

intel



122
Strategic Education through Naval Systems Experiences (SENSE)

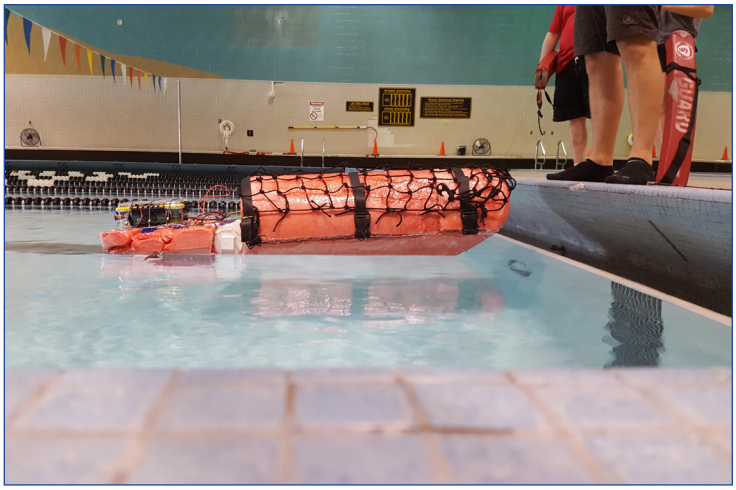
Team Leaders
Sean Wilde, Mechanical Engineering; Jake Soter, Electrical Engineering

Advisor
Andrew Barnard, Mechanical Engineering-Engineering Mechanics

Sponsors
Keweenaw Bay Indian Community (KBIC), Systems Engineering Research Center (SERC), Office of Naval Research (ONR)

Background
The Strategic Education through Naval Systems Experiences (SENSE) Enterprise's mission is to enable the workforce of tomorrow to redefine the boundaries for air, land, sea, and cyber supremacy through experiential learning and discovery. Students will design, build, and test engineering systems with a focus on Navy applications in all domains: space, air, land, sea, and undersea. Get hands-on experiences with cutting-edge defense technologies that directly impact the safety and success of the armed forces. Prepare for civilian employment opportunities in Department of Defense (DoD) research labs or with DoD contractors.

Overview
Riptide drownings in the Great Lakes have been a continuous problem year to year. We have been working on a low-cost flotation device we call the NERD (Nautical Emergency Rescue Device) that can propel itself to a drowning victim. Poorly lit and murky water can prohibit divers from seeing obstacles while swimming. We are developing a sonar heads-up display for increased situational awareness. Coast Guard helicopters are currently unable to effectively rescue large numbers of people in the water due to the mass rescue life rafts weighing too much. Our goal is to create a lightweight mass rescue device that can be easily carried by small aircraft to help in these scenarios.



Mass Rescue Device.

123
Velovations

velovations

Team Leaders
Max Ellingson and Calvin Kraydich, Mechanical Engineering

Advisor
Steve Lehmann, Mechanical Engineering-Engineering Mechanics

Sponsors
AK Tube LLC, ArcelorMittal, Boss Snow Plow, Churning Rapids Snow Bike Trail, Pavlis Honors College

Background
Velovations is a bicycle design Enterprise dedicated to collaborating with the bicycle industry to develop new products and processes. The goal is to educate team members in the fundamentals of product development–from customer need through product and process design and testing, manufacturing, supply chain management, marketing, and distribution. Velovations leverages multiple majors including mechanical, electrical, business, and technical communications to deliver product and process innovations to the bicycle industry.

Overview
Velovations has worked on several bicycle-related projects this year. The first project is a snow bike groomer called a Multiple Implement Grooming System (MIGS), which include an improved V plow and a simpler, lighter grader implement. The second project is utilizing a new high strength steel for bike frames that offers a greater strength to weight ratio than what has been possible in the past. The third project is an electronic shifting system, which is becoming more and more popular on new bikes. However, they are very expensive and difficult to install on an existing bike. Our goal is to create a hybrid system that will allow current mechanical shifting bikes to upgrade to electric shifting. Our last project is a simple, robust "dropper" seat post for mountain bikes. Dropper posts are often expensive, complicated, and prone to various failures. Our goal is to make a dropper post that is reliable and inexpensive.

Testing the Groomer with the V Plow Implement.

Pavlis Honors College

THE BOSS

ArcelorMittal

AK Tube LLC
A Subsidiary of AK Steel Corporation

124
Wireless Communication Enterprise (WCE)

wireless communication enterprise

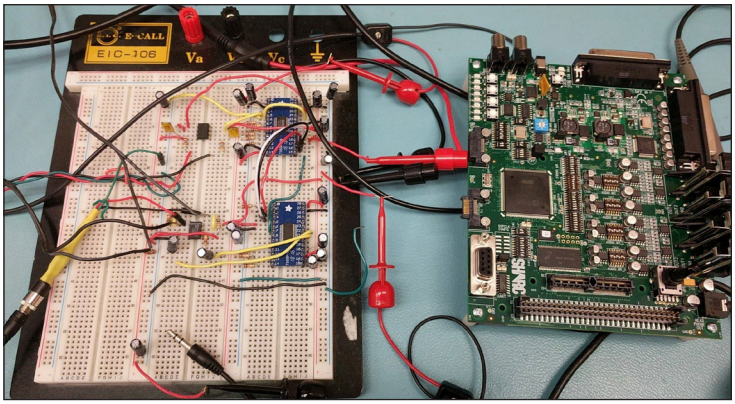
Team Leaders
Yannick Christensen, Electrical Engineering; Sam Celani, Computer Engineering

Advisor
Christopher Cischke, Electrical and Computer Engineering

Sponsors
Ford Motor Company, Systems Engineering Research Center (SERC), Department of Electrical and Computer Engineering, and Department of Visual and Performing Arts

Background
The Wireless Communication Enterprise (WCE) focuses on wireless, optical, renewable energy, user interface, and biomedical technologies. WCE functions much like an engineering company with a variety of different projects teams. These small project teams allow team members to be very involved in project work and provide ample opportunity to gain technical skills, business presentation skills, and leadership experience.

Overview
WCE is a sandbox Enterprise hosted in the electrical and computer engineering department that has projects for almost every major. We take projects from sponsors such as Ford Motor Company and the Department of Defense to projects that students come up with themselves. Notable recent project work includes a wireless bird window sensor to detect bird window strikes, repairs to the broomball score boards and website, our third sponsored project from Ford, and a Bluetooth speaker with a built-in audio visualizer.



An audio DSP unit currently in the prototyping phase.

Michigan Technological University
Electrical and Computer Engineering

Michigan Technological University
Visual and Performing Arts

Ford

125
High School Enterprise–Dollar Bay School SOAR

Team Leaders
Meg Keranen and Tanner Banfield

Advisor
Matt Zimmer, Dollar Bay High School

Sponsors
DBTC Area Schools, Lake Superior Stewardship Initiative

Overview
The SOAR Enterprise team designs, builds, and deploys underwater remote operated vehicles (ROVs), provides technical solutions to water related research challenges, and serves as a resource for additive manufacturing investigations for local businesses. As a placed based service learning Enterprise, SOAR partners with local community organizations to monitor, research, and improve the local watershed. They support local businesses with rapid prototype and small quantity part runs. Clients of SOAR present their needs and requirements to the Enterprise, and SOAR works to exceed the expectations with the delivery of the product. Current clients include Isle Royale National Park, Delaware Mine, OcuGlass, and Michigan Tech's Great Lakes Research Center.

SOAR's SSROV Royale deployed summers on Isle Royale National Park as part of the enterprise partnership.

design expo

201
Remote Switching Station Power

From Left: John Lukowski (Advisor), Matthew Sunde, Samuel Bilot, Nakita Menke, Jacob Lille, Nathan Fox

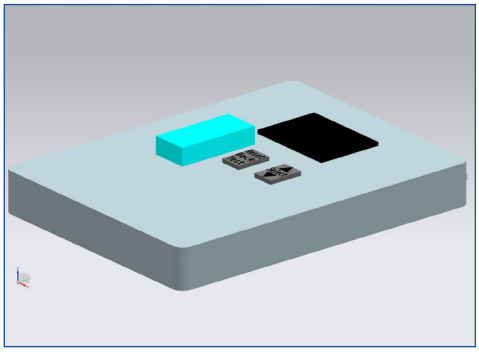
Team Members
Samuel Bilot, Nakita Menke, Nathan Fox, Jacob Lille, and Matthew Sunde, Electrical Engineering

Advisor
John Lukowski, Electrical and Computer Engineering

Sponsor
ITC Holdings Corp.

Project Overview
ITC is considering construction of switching stations that are located in geographically remote areas where distribution level power is not available. Our project is to design a renewable energy powered micro-grid to supply continuous power to the switching station. This project is being designed for operation in the southwest United States; however, the solution will also be scalable to any area in the world. Additionally, this system must be safe, reliable, and cost effective.

202
Automated Functional Testing Device for Logic Devices



3D rendering of the current design

Team Members
Alexis Schroeder, Spencer Banaszak, Abhilash Vinod, Electrical Engineering; Derek Wing and Stephen Ardanowski, Computer Engineering

Advisors
Aref Majdara and Tony Pinar, Electrical and Computer Engineering

Sponsor
Department of Electrical and Computer Engineering

Project Overview
Michigan Tech's Department of Computer and Electrical Engineering is always looking for ways to optimize the lab environment and better students' understanding of lab equipment and electrical components. Many labs in the electrical engineering department require the use of devices utilizing basic logic gates in order to do various tasks. The functionality of these logic gates are tested at the end of each lab cycle by the department's lab supervisor. Reusing electrical components is cost-effective and preferable to replacing logic gates at the end of each lab session. However, the current testing process is tedious and requires long sessions in order to properly test for the functionality of each logic gate. Each gate has to be tested individually so as to account for all types of basic logic gates. If any anomalies are found, the faulty parts are thrown away. This team has been given the opportunity to design a device that will expedite the process, while retaining the proper testing functionality.

203
Boat HUD

Team working on simulation testing of microcomputer

Team Members
Matthew Radloff, Electrical Engineering; Zachary Nedzlek, Karan Desai, and Jamie Docka, Computer Engineering

Advisor
Trever Hassell, Electrical and Computer Engineering

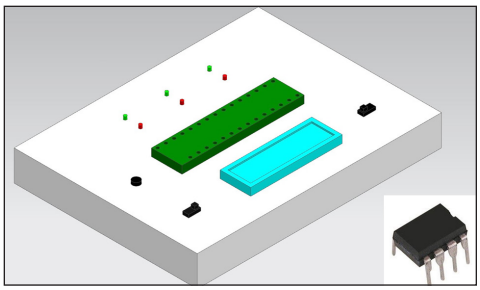
Sponsor
Systems Engineering Research Center (SERC)

Project Overview
Although current technology exists for heads-up displays (HUD) in many applications today, especially considering the expanding market for virtual reality, a marine application has not yet appeared. The opportunity exists for a boat heads-up-display that allows the user to view applicable information as an overlay on the environmental surroundings. Currently, marine operators need to trade their view between dash instruments and activity around them. Specifically to this project, our team's goal is to develop software that will transmit navigational information from a data bus (NMEA 2000) to a display output in a predetermined layout.

ITC

Michigan Technological University
Electrical and Computer Engineering
1885

204
Automated Functional Testing Device for Operational Amplifiers



Concept design of the automated functional testing device for operational amplifiers

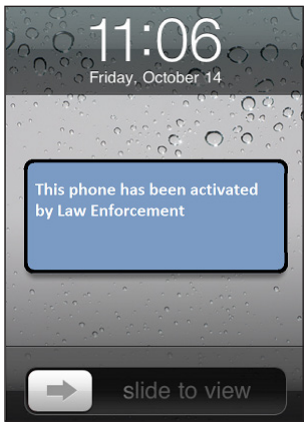
Team Members
Dustin Powell and Nick LaBelle, Electrical Engineering; Miles Lefevre, Xilun Song, and Erik Madson, Computer Engineering

Advisor
Aref Majdara, Electrical and Computer Engineering

Sponsor
Department of Electrical and Computer Engineering

Project Overview
The Automated Functional Testing Device for Operational Amplifiers is a device designed to test two operational amplifiers: the LM741 and LF356. The electrical and computer engineering (ECE) department's lab uses many operational amps, and sometimes broken ones get accidentally reused or working ones accidentally get thrown away. This device provides rapid feedback to the user if the operational amplifier is working properly and up to ECE department lab standards. The goal of this device is to save good operational amplifiers from being thrown away, as well as save student's and lab instructor's time from troubleshooting bad ones during lab.

205
Mobile Active Threat Emergency System (MATES)



Cell phone user application prototype

Team Members
Kevin Edlebeck, Thomas Richards, Olivia Smith and Riley McMichael, Mechanical Engineering

Advisor
Paul van Susante, Mechanical Engineering-Engineering Mechanics

Sponsor
Air Force Research Labs

Project Overview
Our goal is to help first responders better handle active threat situations by researching and prototyping a solution.

206
Electrostatic Precipitator Inspection Device

Rooftop view of Belle River ESP units

Team Members
Alexander Hubble, Electrical Engineering; Colton Kettelhut, Jeremy Whitman, Landon Jakubos, and Luke Olari, Mechanical Engineering

Advisor
Paul van Susante, Mechanical Engineering-Engineering Mechanics

Sponsor
DTE Energy

Project Overview
DTE Energy utilizes a series of four Electrostatic Precipitators (ESPs) to remove ash particulates from flue gasses. Our team is creating a new device and method to inspect units and identify broken electrodes that can reduce unit efficiency. The team's goal was to replace and improve upon the current inspection process requiring timely setup and large inspection crews. By utilizing a camera equipped crawling robot, the team has created a functional prototype that can be used to identify broken electrodes. The created prototype can operate without the need for long setup times and can be operated with a crew of two people. The team will make further recommendations to improve the device, allowing for inspection of more ESP area at once.

Michigan Technological University
Electrical and Computer Engineering

AIR FORCE RESEARCH LABORATORY

DTE Energy

design expo

207
Hydro Generating Plant Black Start

Norway hydro generation plant

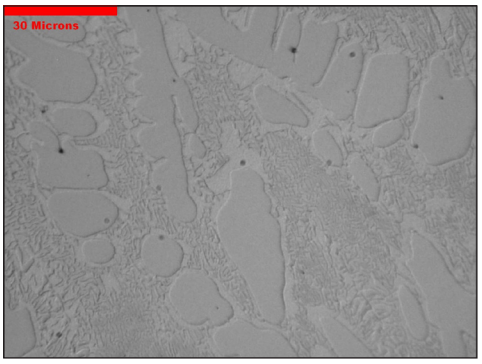
Team Members
Thomas Cauley, Lee Heckel, and Joe Larson, Electrical Engineering Technology

Advisor
Zakariya Al Hamouz, School of Technology

Sponsor
FDS Engineering & Electrical Services

Project Overview
Our project is meant to be able to provide smaller distribution generation stations the ability to run on their own without causing damage/harm and violating given standards in case the main grid network goes out. The project itself has three parts all designed and performed at a proof of concept level: First, is sesigning an islanding detection system based on the actual hydro-generation system. This will detect the loss of the grid and isolate the given station. Next, is proposing a black start procedure in case the generation station has a total power loss. Last, is designing a stable PID controller to handle voltage fluctuations when isolation has occurred.

208
Cobalt Reduction in Tribaloy T-400



Microstructure of arc melted Tribaloy T-400

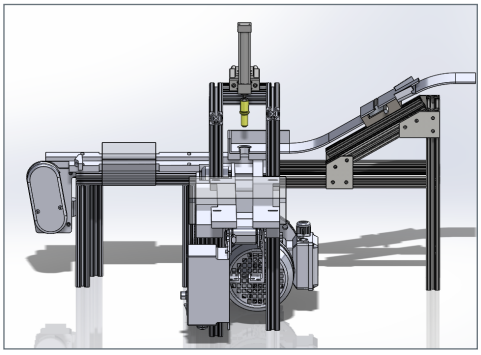
Team Members
Lucas Itcue, Kyle Hrubecky, Jacob Thompson, and Erin VanDusen, Material Science and Engineering

Advisors
Paul Sanders and Walt Milligan, Materials Science and Engineering

Sponsor
Winsert Inc.

Project Overview
Winsert Inc., currently uses an alloy similar to Tribaloy T-400, a cobalt based alloy, in the production of internal combustion engine valve seats. Cobalt is an expensive element with a rapidly fluctuating price due to political instability in the primary supplier country, the Democratic Republic of the Congo. As Tribaloy T-400 contains approximately 60 wt. percent cobalt, it is a highly expensive alloy; therefore, decreasing the amount of cobalt in T-400 is a direct way to reduce cost. Through thermodynamic modeling, replacement of cobalt with other transition elements such as iron, nickel, and aluminum will be investigated. Tribaloy T-400 contains a C14 Laves phase, with a MgZn2 structure, and a cobalt solid solution with an FCC structure. The microstructure includes the primary C14 Laves phase and eutectic microconstituent of C14 Laves phase plus a cobalt solid solution. By volume, the C14 Laves phase accounts for 35-45 percent of the microstructure. The C14 Laves phase provides much of the high temperature wear resistance for the alloy, therefore, retaining a similar amount of this phase in new alloys is paramount to maintaining mechanical and wear properties.

209
Assembly Cell Changeover



3D CAD model of our design

Team Members
John Bailey, Gabrielle Fung, Dylan Lauscher, Rachel Palen, and Zachary Schultz, Mechanical Engineering

Advisor
William Endres, Mechanical Engineering-Engineering Mechanics

Sponsor
MacLean-Fogg Component Solutions

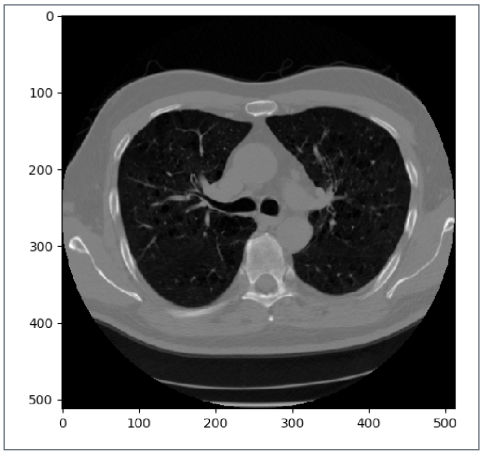
Project Overview
Our project goal is to develop a new part handling system that requires less time to changeover across six-part numbers while staying in the original machine's footprint. The handling system transports nuts and washers from separate vibratory bowls, aligns them, and brings them to a hydraulic press to be swaged together. The current system's track is made of spring steel and swapped for each part configuration; this requires numerous adjustments resulting in an unnecessary five-hour changeover time. Our solution employs two conveyors with adjustable guide rails and a gravity slide to transport these parts. With the new design, the machine's footprint will stay the same, changeovers will be easily repeatable, and the changeover time will be drastically reduced.

FDS Engineering & Electrical Services

Winsert Inc. Innovative Alloy Solutions™

MacLean-Fogg Component Solutions

210
Cancer Detection



CT scan image of a lung

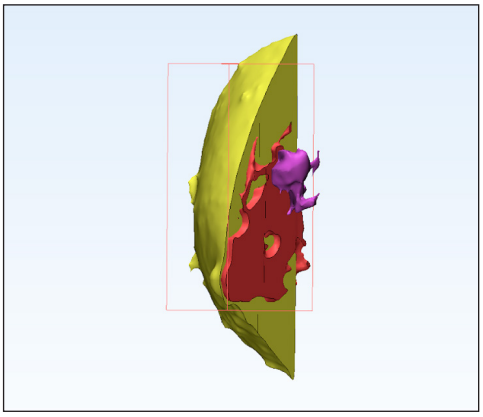
Team Members
Erin McCarthy, Electrical Engineering; Andy Kirkum, Joshua Stauffer, and Jonathan Lehto, Computer Engineering

Advisor
Tony Pinar, Electrical and Computer Engineering

Sponsor
Barzin Moridian

Project Overview
The Lung Cancer Diagnostic System project aims to create an application prototype to help diagnose lung cancer in computed tomography (CT) scans. Machine learning algorithms will make predictions and highlight suspicious areas on the CT scan. A set of diagnosed CT scans will be used to train the machine learning algorithm, allowing for new predictions on new CT scans. Image processing makes it possible to get data from each scan in a format that an algorithm will be able to use. Then, the findings will be displayed on a clear and intuitive user interface (UI).

211
Rapid Prototyping of Ultrasound Elastography Breast Phantom for Ductile Carcinoma Diagnosis



3D image capture using Materialise 3-M`atic software highlighting internal structure of breast tissue with benign carcinoma

Team Members
Stephanie Jewell, Claire Langfoss, Madeline Gust, and Travis Altmeyer, Biomedical Engineering

Advisor
Jingfeng Jiang, Biomedical Engineering

Sponsor
Materialise

Project Overview
Breast phantoms are used to test ultrasound machines to ensure they are getting an accurate image and able to correctly detect tumors in breasts. Ultrasound elastography is a means to detect lesions in women with more dense breast tissue, which is considered both cost-effective and non-invasive. The primary goal of this project is to design an imaging phantom based on 3D printing technology for a repeatable and rapid prototype using tissue-mimicking material. Using 3D imaging processing and design software created by Materialise, Mimics, and 3-Matics, it was possible to create a phantom design using the average woman's breast anatomy of adipose and fibroglandular tissue sections. This project aims to build off previous teams' work through combining 3D printing technology and molding techniques to create a single phantom.

212
Sorting of Bar Ends and Slugs from Hot-Formed

Team with Hatebur Hot-Forging Machine

Team Members
Noah Dobrzelewski, Dakota Carpenter, Jake Evilsizer, Logan Stetsko, and Logan Brunette, Mechanical Engineering

Advisor
Paul van Susante, Mechanical Engineering-Engineering Mechanics

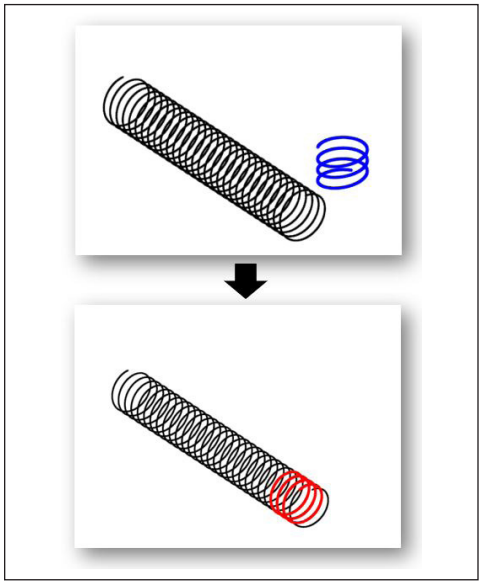
Sponsor
MacLean-Fogg Component Solutions

Project Overview
MacLean-Fogg Component Solutions has a hot-forging process that creates hot-formed parts and byproducts. This process is supposed to separate and remove byproducts from parts, but occasionally lets byproducts through, causing damage to machines further in the process. MacLean-Fogg Component Solutions is looking for a device that separates byproducts from parts to accommodate for their machine.

Materialise
innovators you can count on

MacLean-Fogg
COMPONENT SOLUTIONS

213
Ball Nut and Ball Screw Inspection Data Post-Processing



Assembly of ball nut and ball screw data for clearance analysis

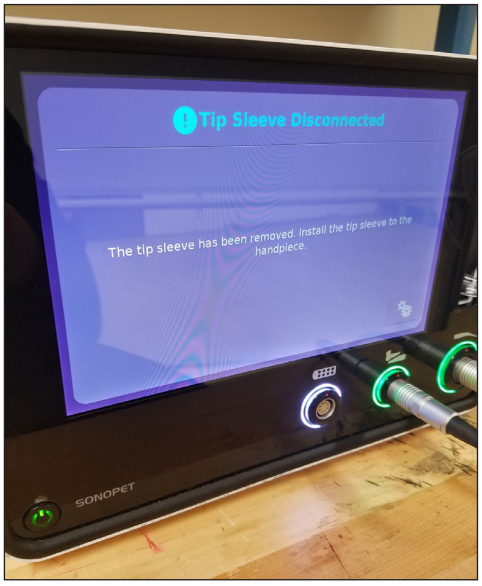
Team Members
Patrick McFall, Liz Bergh, Josh Kemppainen, Vilnis Stumbris, and Jason Dvorscak, Mechanical Engineering

Advisor
Steven Ma, Mechanical Engineering-Engineering Mechanics

Sponsor
Nexteer Automotive

Project Overview
Our team created a digital software tool for Nexteer Automotive, which post processes inspection data of a ball nut and ball screw assembly from an electric power steering system. The purpose for developing such a tool was that the clearance values of real assembled parts were unknown, and Nexteer's engineers were unable to visualize the interaction of the ball nut and ball screw during use. Nexteer uses a Coordinate Measuring Machine (CMM), which collects profile data from a real ball nut and ball screw. The software tool imports the data from these two components, mathematically assembles them, and allows the end user to analyze the interaction of the ball nut and ball screw.

214
Peripheral Tool Simulation for an Ultrasonic Aspirator Console



Sonopet iQ console showing a possible error message

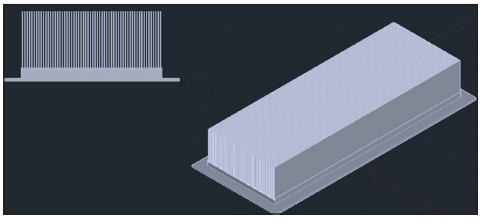
Team Members
Lauren Fallu, Stephen Berridge, and Sarah Lorenz, Biomedical Engineering; Aaron Ortiz, Electrical Engineering

Advisor
Orhan Soykan, Biomedical Engineering

Sponsor
Stryker

Project Overview
The Sonopet iQ console is a reusable, non-sterile device that supplies power, aspiration, suction, and irrigation to connected sterile peripheral tools, used during soft tissue (brain) and bone surgeries. Testing potential failure modes and peripheral tool system states can be a challenge, and creating an automated simulator system can allow more testing to be conducted in a shorter amount of time. The objective of this project is to create an automated system that will simulate both the normal function and error states of the peripherals connected to the console for the handpiece, foot switches, and hand controller. The system allows inputs using a graphical user interface (GUI) to simulate multiple predetermined errors of the Sonopet iQ peripheral tools.

215
Air Cooled Inverter Heatsink



Optimized heatsink design

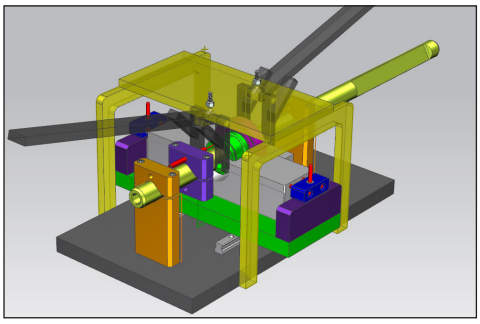
Team Members
Anson Mannes, John Blanchard, Zach Tibbits, Paul Jacks, and Dominic Fusco, Mechanical Engineering

Advisor
Jeremy Worm, Mechanical Engineering-Engineering Mechanics

Sponsor
US Army TARDEC

Project Overview
Using modern heatsink designs, computational fluid dynamics, and elementary thermodynamic equations, our team developed a design tool for TARDEC. TARDEC will utilize the design tool to select a final heatsink configuration for their air cooled inverter. Our team manufactured and tested a heatsink to validate the data presented on the design tool.

216
EPS Ball Screw Lash Measurement



Nexteer EPS ball screw assembly linear lash measurement gage fixture

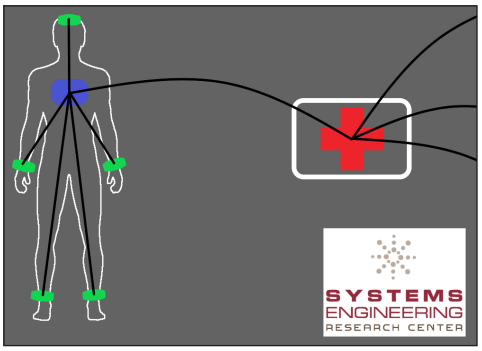
Team Members
Blake Tiber, Sarah Jones, Alex Keit, Mike Werthman, and Cole Stout, Mechanical Engineering

Advisors
William Endres and James DeClerck, Mechanical Engineering-Engineering Mechanics

Sponsor
Nexteer

Project Overview
We were tasked with designing and manufacturing a fixture to accurately measure the lash between the ball screw and ball nut of the steering mechanism in vehicles.

217
SERC MARSOC Improved Life Support for Casualties at Point of Injury



An overview of the design using its sensors, microcontroller, and user interface

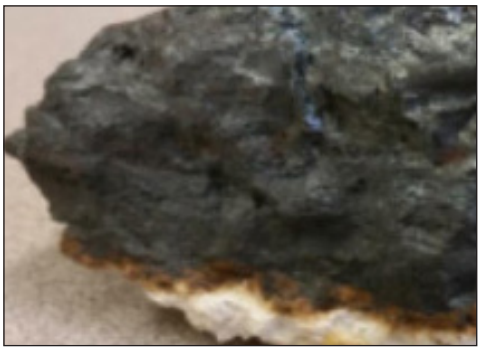
Team Members
Jacob Formolo, Zach Drexler, and Sarah Melbow Biomedical Engineering; Nathan Schlorke, Electrical Engineering

Advisors
Feng Zhao and Rupak Rajachar, Biomedical Engineering

Sponsor
Systems Engineering Research Center (SERC)

Project Overview
Our team will develop a lightweight, portable device that can be used to reduce casualties and increase medical efficacy on the battlefield immediately after injury, preferably using monitoring or physician assistant technology.

218
Nodule Reduction on Steel Reheat Furnace Refractory



An example of hercynite nodule found on hearth refractory in reheat furnace

Team Members
Eric Olson, Pat Ricchi , Matt Thomas, and Casey Vadnais, Material Science and Engineering

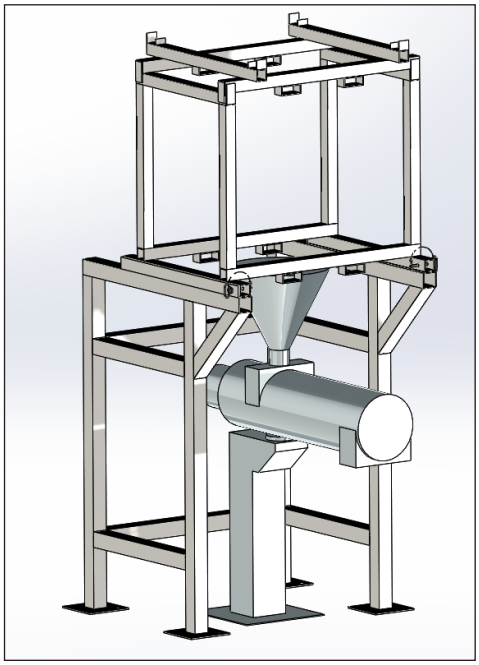
Advisor
Paul Sanders, Materials Science and Engineering

Sponsor
ArcelorMittal

Project Overview
The reaction between an alumina based refractory and wustite produces a hercynite nodule on the hearth refractory, causing tears in steel slabs as they are pushed across in the reheat furnace. An attempt to reduce pores acting as nucleation sites for nodule growth was performed by utilizing a non-reactive and bondable coating on the hearth refractory.

design expo

219
Tinker Omega Sand Delivery System



Main assembly ISO view

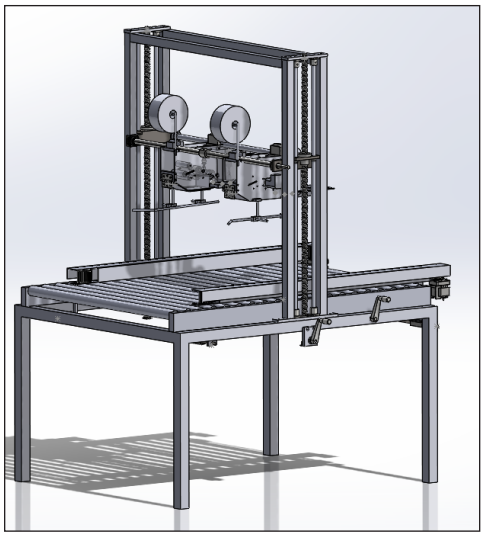
Team Members
Nicholas Hilliard, Justin Mondeik, Mitch Rucinski, and Nicholas Wylin, Mechanical Engineering Technology

Advisor
David Labyak, School of Technology

Sponsor
Department of Materials Science and Engineering

Project Overview
Our team will design a sand delivery system to supply 3,000 lbs. of sand from a bulk bag safely and efficiently into the Tinker Omega 125's hopper. This design must eliminate the manual loading aspect of the current sand delivery system. The design must follow strict dimensional, weight, and safety restrictions to be used in Michigan Tech's foundry.

220
Automatic Case Sealer



3D parametric Solidworks model of the automatic case sealer

Team Members
Christopher Thormodson, Aaron Curtiss, Christian Elsesser, Cal McCarty, Tania Demonte Gonzalez, and Jacob Wenzlick, Mechanical Engineering

Advisor
Eddy Trinklein, Mechanical Engineering-Engineering Mechanics

Sponsor
Fapco, Inc.

Project Overview
Our team has been engaged to design an automatic case sealer for fully overlapped (FOL) cartons using water activated tape for Fapco, Inc. Currently, the production staff uses two different methods to close FOL boxes. The first is a manual machine to activate and cut custom tape lengths and apply the tape by hand. The second method for closing the carton includes stapling the carton before a label is applied to the finished package. The team looks to improve this process by using a conveyor system in conjunction with a water-activated tape (WAT) mechanism to seal cartons. In addition, the design will accommodate multiple different carton sizes to increase versatility of the machine, which in turn will increase production rates.

221
Gerdau Inclusion Solidification Prevention

Team is pictured at Gerdau after enjoying a tour of the steelmaking process at their Monroe Mill

Team Members
Katie Amar-Fox, Yani Beeker, John Falecki, and Claudia Smale, Material Science and Engineering

Advisor
Paul Sanders, Materials Science and Engineering

Sponsor
Gerdau–Monroe Mill

Project Overview
Our team is working with Gerdau to better understand how inclusion phases change as alloy compositions change, temperature changes, and oxygen levels fluctuate. The objective is to successfully model inclusions in molten steel at temperatures from 1,500°C to 1,600°C. Major goals include using thermodynamic modeling software data to create an optimal composition where the inclusions are in a liquid state above the calcium aluminate saturation line but below the calcium sulfide curves. The second phase is validating the created model through an experimental design conducted in the foundry.

Michigan Technological University
Materials Science and Engineering
1885

GERDAU

222
Fuel Economy Impact Tool

MFCS three-sided reduced mass lug nut design

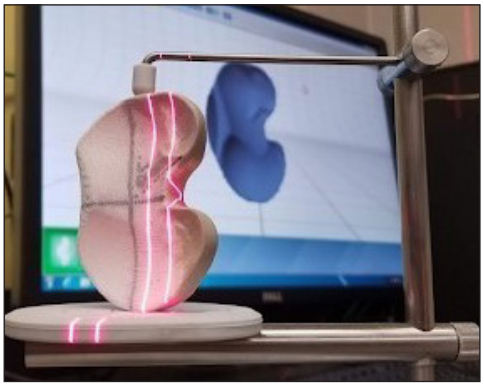
Team Members
Jess Gering, Matthew Kenney, Eric Kostreva, Lily Kraft, and Michael Ostlund, Mechanical Engineering

Advisor
Steven Ma, Mechanical Engineering-Engineering Mechanics

Sponsor
MacLean-Fogg Component Solutions

Project Overview
A software tool that will evaluate the fuel economy impact of mass on a vehicle. The purpose of the fuel economy impact tool is to instantaneously evaluate the impact of mass of a vehicle on fuel economy and energy usage. While the initial project scope focuses on the additional mass of lug nuts, the program calculates the effects of various additional masses, stationary or rotating. Through AmeSim simulations and Solidworks models, it was possible to correlate basic relationships between mass and energy usage of a vehicle over various drive profiles, which serve as the basis for a graphical user interface within Microsoft Excel. The user is able to select a variety of parameters, including vehicle and lug nut mass and drive profiles.

223
Full Flexion Knee



3D scanning of tibial insert

Team Members
Chelsie Tischer, Jack Hendrick, Emily Weidensee, Nehemiah McIntyre, and Marianne Preston, Biomedical Engineering

Advisors
Jeremy Goldman and Keat Ghee Ong, Biomedical Engineering

Sponsor
Department of Biomedical Engineering

Project Overview
The normal range of motion for a healthy knee allows the knee to achieve flexion past 120 degrees. Commercially available knee implants do not allow for this degree of flexion, thus prohibiting the patient from achieving healthy motion of the knee after total knee replacement surgery. This can cause discomfort in patients due to the inability to return to activities they previously enjoyed. The goal of this project was for the team to design a new generation knee implant, with the knee motion controlled in a manner that allows the full flexion of the knee. Upon creation of this design, a digital model will be created and through FEA, the geometry of the design will be validated.

224
Data Analysis Methods to Improve Treatment of Chronic Pain

Team and sponsors at Medtronic site visit

Team Members
Jessica Benson, Leigh Schindler, Tristan Fourier, and Sue Kim, Biomedical Engineering

Advisor
Keat Ghee Ong, Biomedical Engineering

Sponsor
Medtronic

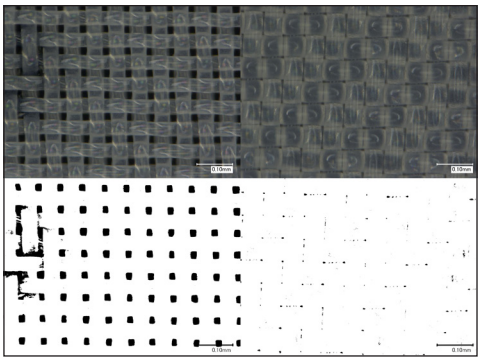
Project Overview
For patients with chronic pain, there are no objective ways to measure pain or change in pain that an individual is experiencing. Due to this, most pain treatments are done based off the subjective feedback that an individual gives to the physician or researchers through different scales, such as the SF36, ASK, and ODI scales. The lack of an objective measurement can cause imprecise treatment methods, such as medication that is too powerful and has the potential for addiction. The team has analyzed large data sets from patients with chronic pain and explored possible methods to describe patient condition in a more objective way. Using data on the patient activity levels, treatment utilization, and self-reported pain levels, the team attempts to provide useful insights into a predictive modeling, clinical decision making, medical device designs, and research activities.

MacLean-Fogg Component Solutions

Michigan Technological University Biomedical Engineering

Medtronic

225
Transcatheter Single Ventricle Device



Examining polymer porosity

Team Members
Chad Cannon, Lauren Markham, Lauren Sandy, and Sonja Welch, Biomedical Engineering

Advisors
Smitha Rao and Jeremy Goldman, Biomedical Engineering

Sponsor
Spectrum Health Innovations–Helen DeVos Children's Hospital

Project Overview
Hypoplastic Left Heart Syndrome (HLHS) is a congenital heart defect where the left ventricle of the heart is critically underdeveloped or deformed. Current treatment methods include a series of three open heart surgeries, where the first surgery occurs within the first few days of life. The transcatheter single ventricle device aims to replace the first open heart surgery through a stent-based design with a polymer sheath. The goal for this phase was to find the optimal fenestration size in the polymer to reduce blood flow to the pulmonary arteries. This was done through various flow tests and MATLAB simulations.

226
SERC AFRL 05 Personnel Recovery–Power

From Left: Brody Sundquist, Liz Adams, Nick Gagalis, Kayla Kent, Blake Lindeman

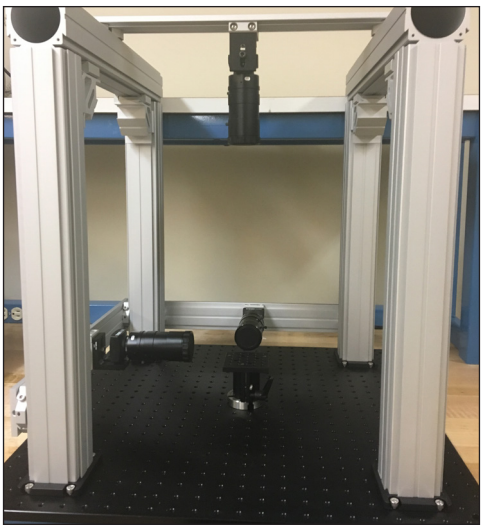
Team Members
Brody Sundquist, Liz Adams, Nick Gagalis, Kayla Kent, and Blake Lindeman, Electrical Engineering

Advisor
John Lukowski, Electrical and Computer Engineering

Sponsor
Systems Engineering Research Center (SERC)

Project Overview
The US Air Force contracted Michigan Tech with the task of creating a charging device that will aid military pilots in emergency situations. The main focus concerns extending the life of their Combat Survivor Evader Locator (CSEL) radio battery. The CSEL radio is a communication device that provides secure two-way over-the-horizon, near real time data communications, precise military Global Positioning System (GPS), and increased radio frequencies and modes of communications over existing radios. The device must extend the amount of battery life from the current 84 hours to 28 days. The design will incorporate one active energy harvesting device and one passive energy harvesting device. The device will feature a USB input, hand crank operated induction motor, and a photovoltaic cell to charge an internal battery. That internal battery will then have a USB output to a cradle designed to hold the CSEL battery and potentially other device's batteries. The cradle will contain any charge management circuitry necessary to safely recharge the CSEL battery.

227
Micro-Pistoning Immobilization



Three camera rail system to measure catheter movement in the XYZ planes

Team Members
Margaret Clay, Megan Donovan, Michael Hernandez, and Ryker Miles, Biomedical Engineering

Advisors
Bruce Lee and Feng Zhao, Biomedical Engineering

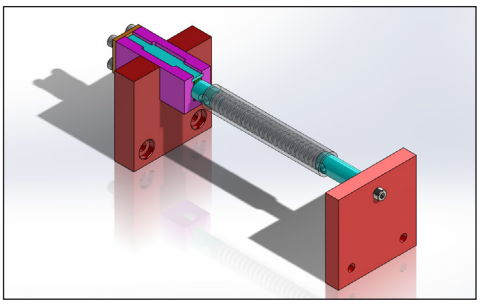
Sponsor
3M

Project Overview
3M has developed a new hydrogel padded IV dressing, Tegaderm™ CHG. Catheter related bloodstream infection (CRBSI) studies have shown that Tegaderm™ significantly reduces infection compared to the non-hydrogel IV dressing Biopatch®. The CRBSI studies did not conclude if the improvements were due to the CHG antimicrobial properties or to the properties of the hydrogel that could reduce catheter motion. Our project measures the movement of a catheter relative to the insertion site and compares the frequency and magnitude of the displacement between the Tegaderm™ CHG dressing and the Biopatch® dressing, to determine if there is a significant reduction in motion observed using the Tegaderm™ dressing.

SPECTRUM HEALTH Innovations

3M

228
Load Sensor and Calibrator for Crane Control



CAD model of proposed calibration fixture

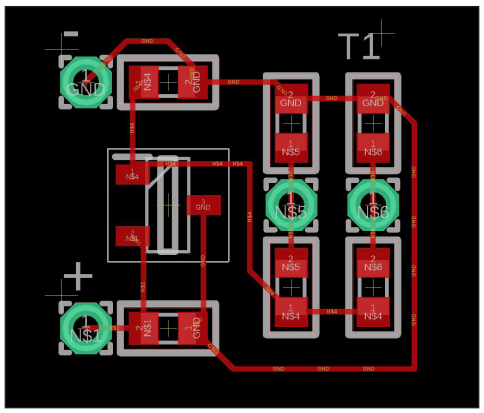
Team Members
Juan A. Espinoza-Birruete, Christian M. Kniat, Peter D. O'Mara, Alex J. Voigt and Taylor C. Warren, Mechanical Engineering

Advisor
Fei Long, Mechanical Engineering-Engineering Mechanics

Sponsor
Department of Mechanical Engineering-Engineering Mechanics

Project Overview
For our project, we intend to identify an off-the-shelf load sensor for the specified loading range. Then we will integrate it into the crane tension-compression measurements and design a calibrator for load-cell calibration.

229
Temperature Sensing of Implanted Medical Device Shields



Generation 4 board design with voltage regulator and thermistor

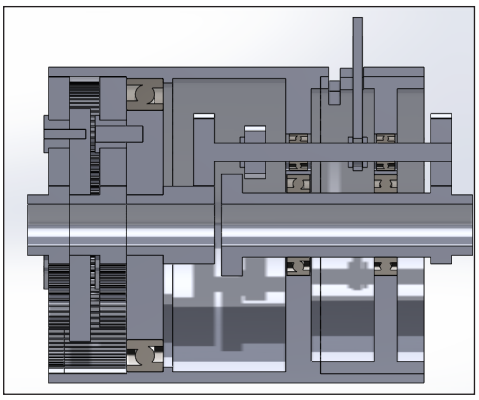
Team Members
Ryan Bancroft, Katherine Gingras, and Chance Sherretz-Hayes, Biomedical Engineering; Evan Torrey, Electrical Engineering

Advisor
Keat Ghee Ong, Biomedical Engineering

Sponsor
Medtronic

Project Overview
Rechargeable implanted medical devices utilize induction charging which results in device heating. This heating is directly related to charging rate. Patients desire short recharge times and this results in higher device shield temperatures. This excess heat can lead to irreversible tissue damage and subsequent patient harm. As such, there is an essential need for the monitoring of this heat on devices implanted within patients to ensure the health of the surrounding tissue. This project entailed the development of a system, which can monitor the temperature on the exterior shields of implanted devices. This allows for the collection of data to generate a deeper understanding of the real-world surface temperatures of these implanted devices. Ultimately, this will aid in both current operation and in the development of future devices.

230
Universal Driver Gear Train



Gear Train Cross Section

Team Members
Ryan Connolly, Yolanda Anderson, Ethan O'Driscoll, and Heather Marker, Biomedical Engineering

Advisor
Smitha Rao, Biomedical Engineering

Sponsor
Stryker

Project Overview
The universal driver is a surgical tool used in orthopedic surgery to drill, ream, and screw into bones. All of these different functions require different torques and speeds, otherwise there can be damage to the bone. Currently, there is just one output speed and torque per input speed. This limits the usage of a single drill, because surgeons must switch drills to accomplish each of these functions. There is a need in the market for a universal driver that has the ability to switch between two or more different outputs of speed and torque. A gear train will be developed such that it will be able to drive screws, ream, and drill with the ability to switch between these modes. The gear train that will be developed will operate with a single input speed, a single input torque, and will offer the ability to switch between two different output speeds and torques.

Michigan Technological University
Mechanical Engineering-Engineering Mechanics

Medtronic

stryker®

design expo

231
Canister Wipe Auto Pre-Thread

Convenience, innovation, disinfected, and lemon scented

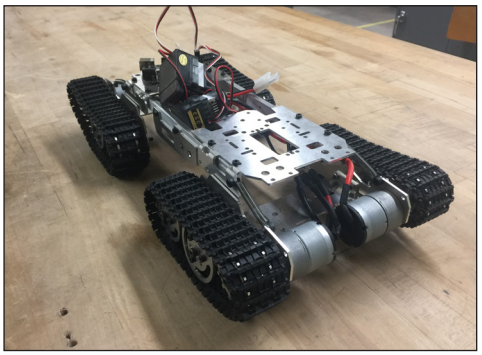
Team Members
Stefan Koerner and Clinton Andrews Electrical Engineering; Jacob Erickson, Mechanical Engineering; Christopher DeWidt, Computer Engineering

Advisor
Trever Hassell, Electrical and Computer Engineering

Sponsor
Leading Disinfectant Wipes Producer

Project Overview
Our team was tasked to create a solution to pull out the first wipe of a package of wipes to improve the initial consumer interaction. This must be done without adding much cost to the product and effecting the current defect rate. The solution must be integrated into a highly automated environment with a high production rate. To determine an appropriate solution, the team broke up the problem by type of feature, how the process will work, and where the process is placed.

232
AFRL–MATES



Chassis assembly for mobile active response countermeasure operative

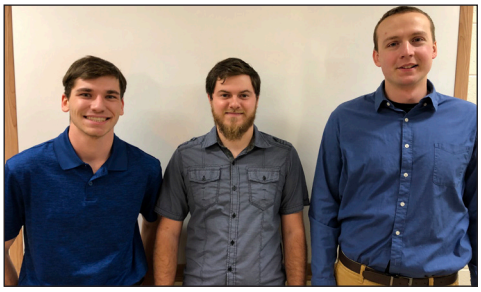
Team Members
Zachary Kendziorski, Alec Stilwell, and Justin Niemi, Mechanical Engineering

Advisor
Cam Hadden, Mechanical Engineering-Engineering Mechanics

Sponsor
Air Force Research Labs

Project Overview
Our team will design and prototype a personnel location system usable during active threat situations.

233
Flow Meter for Power Plant Water Quality Analysis Equipment



From Left: Michael Pugh, Devon DeVriendt, Andrew Johnson

Team Members
Michael Pugh, Devon DeVriendt, and Andrew Johnson, Mechanical Engineering Technology

Advisors
John Irwin and Sunil Mehendale, School of Technology

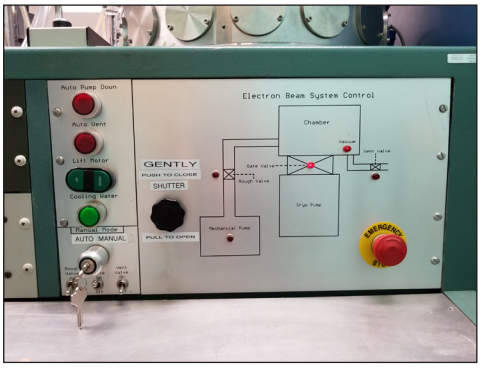
Sponsor
Sentry Equipment

Project Overview
The flow meter team, comprised of three mechanical engineering technology seniors, has been tasked by Sentry Equipment to develop a small electro-mechanical device to be used in the process of water quality sampling within a steam power plant generation system. The meter will be used to ensure that no minerals or other contaminants have settled or adhered to the piping system while the water is on its way to be analyzed. The lack of commercially available flow meters that meet the requirements set forth by Sentry Equipment have presented an opportunity to formulate potential solutions to this dilemma.

AIR FORCE RESEARCH LABORATORY

Sample. Monitor. Measure.
SENTRY
Any Application. Anywhere.

234
Deposition System GUI



Physical buttons our team is automating

Team Members
Natalie McGrath, Tyler Terteling, Shane Skalski, Thomas DeVoe, and Daniel Yan, Computer Engineering

Advisor
Tony Pinar, Electrical and Computer Engineering

Sponsor
Chito Kendrick

Project Overview
Our project involves the automation of thin film deposition system in the Minerals and Materials Thin Films Lab. The system we are working with uses chemical deposition to apply a thin layer, in the order of nano- to micrometers, of material onto a substrate surface. The process uses a series of pumps and vents to ensure the pressure in the machine's chamber is controlled. Along with automating the system, we are tasked with implementing safety measuring into our project.

235
TRIP Steel Additive Manufacturing

From Left: Nate Stancroff, Rene Teufack, Jacob Coulson, and Mackenzie Keefer

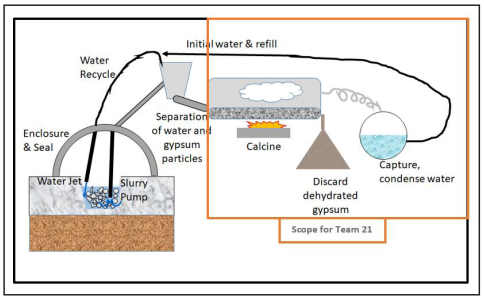
Team Members
Mackenzie Keefer, Jacob Coulson and Rene Teufack, Material Science and Engineering; Nate Stancroff, Mechanical Engineering

Advisor
Paul Sanders, Materials Science and Engineering

Sponsor
ArcelorMittal

Project Overview
Wire arc additive manufacturing (WAAM) was employed to produce multi-layer three dimensional parts made from transformation induced plasticity (TRIP) steel. The process of drawing and additive manufacturing TRIP steel was optimized. This process will make prototyping more affordable, and introduce flexible deposition that could allow for structures to be added onto pre-existing parts.

236
Gypsum Water Extraction



Scope for team project

Team Members
Gordon Brinkman, Kyle Tolman, John Matcheck, Emeke Esemonu, and Jacob Hubert, Mechanical Engineering

Advisor
Paul van Susante, Mechanical Engineering-Engineering Mechanics

Sponsor
Michigan Tech's MINE Enterprise

Project Overview
Our team will design, build, and test a system to extract water from gypsum, demonstrating an Earth version as a step toward a Mars version ultimately needed.

ArcelorMittal

Michigan Tech
Mining INnovation Enterprise

237
Laser Safety Proposal for Minerals and Materials Room 329

Efficient vaporization

Team Members
Margaret Miko and Timothy Ingram, Mechanical Engineering Technology

Advisors
John Irwin, School of Technology; Russell Stein, Paul Sanders, Materials Science and Engineering

Sponsor
Department of Materials Science and Engineering

Project Overview
Due to the presence of a new laser, there are increased risks and hazards introduced to Michigan Tech, which results in the need for additional safety precautions and equipment in order to isolate the laser beam, protect the operator, and protect bystanders. Upon receiving the laser, there was a lack of information concerning the operation and functionality of components, which will need to be assessed prior to implementation of laser specific safety features.

238
Effects of Scandium on Cast Iron

From Left: Katherine Russell, Mason Coy, and Erin Heidelberger

Team Members
Katherine Russell, Mason Coy, and Erin Heidelberger, Material Science and Engineering

Advisor
Paul Sanders, Materials Science and Engineering

Sponsor
CleanTeQ

Project Overview
Spheroidized graphite (or nodules) in ductile iron often form when the growth rate is not impeded by melt impurities. Treatment with magnesium with the addition of rare earths, is believed to remove sulfur and oxygen which enables growth of nodules. This project will explore the effectiveness of scandium treatment of cast iron to form ductile iron.

239
Clean TeQ Aluminum-Scandium Additive Manufacturing Alloy Development

WAAM manufactured airplane compartment panel (Image source: Stelia Aerospace)

Team Members
Alex Malliet, Joe Vermeylen, Chelsey Rock, Sam Byrne and Craig Ekstrum, Material Science and Engineering

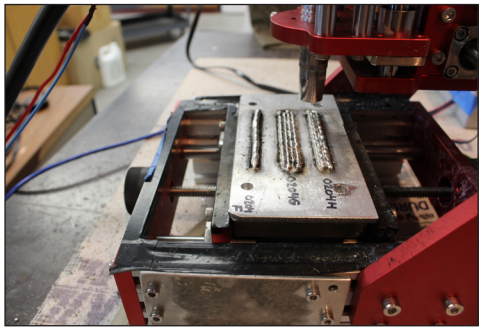
Advisor
Paul Sanders, Materials Science and Engineering

Sponsor
Clean TeQ

Project Overview
Aluminum-scandium alloys for additive manufacturing (AM) of metal structural components are an undeveloped market despite scandium being the most potent known strengthener of aluminum alloys. Additionally, scandium imparts improved weldability to welded aluminum alloys by preventing recrystallization and hot cracking. This project involves the design of an aluminum-scandium alloy for wire arc additive manufacturing (WAAM), focusing on the impact of silicon, magnesium, and scandium on the mechanical properties of 5000-series aluminum alloys.

Michigan Technological University
Materials Science and Engineering

240
Thermal and Mechanical Effects of Power Modalities on Surrounding Tissue



Aluminum welds via wire arc additive manufacturing (WAAM)

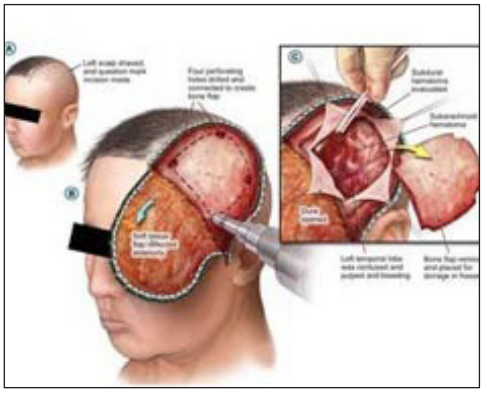
Team Members
Timothy Kolesar, Marshael Ryan, Trevor Simmons, and Xinlin Zhang, Electrical Engineering

Advisors
Sean Kirkpatrick and Orhan Soykan, Biomedical Engineering

Sponsor
Stryker

Project Overview
The project goal is to explore the thermal and mechanical effects of the Stryker Sonopet Ultrasonic Aspirator on nearby tissues. When the device is utilized in surgery, ultrasound propagates past the tissue of focus and diffuses into surrounding brain tissue. By experimenting with the propagation of the thermal heat generated by the device that is emitted throughout the brain, the thermal effects on surrounding brain tissue will be addressed. Other parameters are taken into consideration throughout a surgery, besides just the direct application of the device, including the effects of the ultrasound as it emits from the handpiece directly to the surrounding brain tissue, which is an off-target effect of device use.

241
Disposable Cranial Perforator System



Current craniotomy procedure image

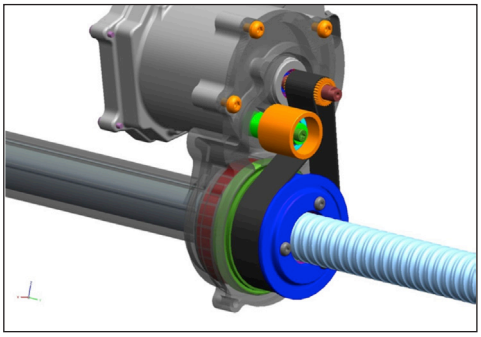
Team Members
Gabrielle Hummel, Jake Lindsay, and Evan Kostenko, Biomedical Engineering; Krista Fog Mechanical Engineering

Advisors
Jingfeng Jiang and Bruce Lee, Biomedical Engineering

Sponsor
Stryker

Project Overview
Our team will develop a market viable, sterile, handheld, disposable, cordless power tool capable of drilling up to five holes in a human cranium for use in an emergency room.

242
EPS Belt Drive Analytical Method to Predict Thrust Forces



Belt drive system

Team Members
YuXin Chen, Wesley Gratz, Clay Nadolsky, and Robbie Tian, Mechanical Engineering; Max Dalzell, Computer Engineering

Advisor
Aneet Narendranath, Mechanical Engineering-Engineering Mechanics

Sponsor
Nexteer Automotive

Project Overview
Our team will develop an analytical model to predict thrust forces of a belt drive power steering system.

design expo

243
FCA Advanced Hood Architecture–Structural and Attachment Team

Front clip of the Chrysler Pacifica used for testing the attachment methods of the hood

Team Members
Adam Daavettila, Andrew Schunter, Austin Kastel, Max Tervo, Stanley Peterson, and Steve Ramfjord, Mechanical Engineering

Advisor
Cam Hadden, Mechanical Engineering-Engineering Mechanics

Sponsor
Fiat Chrysler Automobiles

Project Overview
The introduction of the electric vehicle along with the reduced need for the consumer to access the under hood components themselves has created the opportunity to redesign how the hood is attached. Our team was tasked with the design problem to create a fixed hood that would no longer use the hinging and latching mechanism in order to save weight and manufacturing costs. By fixing the hood to the frame of the vehicle, it could also be used as a structural member in the event of a frontal collision. Our team has designed sets of brackets that will use a leaf spring method to apply a clamping force to hold down the back of the hood while the front will be bolted through access point in the grille of the vehicle. This new design will be fully removable to allow access to larger under hood components, while also having access ports to fill fluids such as oil and windshield washer fluid without the need to remove the hood. The current scope of the project is focusing on redesigning the attachment points on the Chrysler Pacifica, but it could be implemented on other vehicles in the future.

FCA
FIAT CHRYSLER AUTOMOBILES

244
Catheter Hydrophilic Lubricious Coating Measurement Challenge

Boston Scientific catheter

Team Members
Alexander Oliver, John Brinley, and Jalen Adams, Biomedical Engineering; Devin Stowe, Computer Engineering

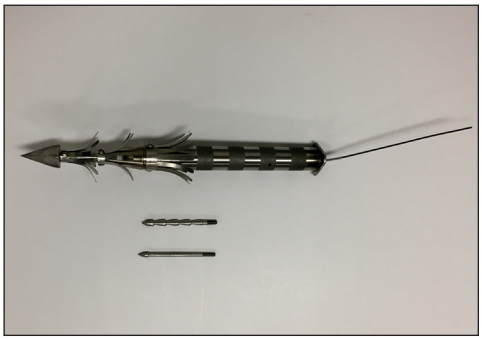
Advisor
Sean Kirkpatrick, Biomedical Engineering

Sponsor
Boston Scientific

Project Overview
Hydrophilic lubricious coatings (HPC) are applied to minimally invasive interventional cardiology and peripheral vascular interventional polymer catheter shafts to aid in passing the catheter through the arterial system to the surgical treatment site. HPCs applied to catheters must be adherent and durable, so that they remain on the catheter to provide lubricity and to avoid liberation of coating particulates into the circulatory system. The Food and Drug Administration has released guidance to medical device companies requiring they provide test data in submissions to demonstrate coating integrity. When applied to a catheter, HPCs are a challenge to visualize (coating coverage) and measure (coating thickness). In current practice, coating thickness is measured by mechanically cross-sectioning a coated sample, and examining it in a scanning electron microscope. The challenge for the technician is to not alter the coating chemically or mechanically during these coverage and thickness evaluations. Our team was tasked with designing an objective, robust, and repeatable HPC coverage and mean thickness methodology for the evaluation of hydrophilic coated catheters.

Boston Scientific

245
Development of a Blubber-Only Whale Tag Anchoring System



Current full scale tag shown with miniature control and prototype tags

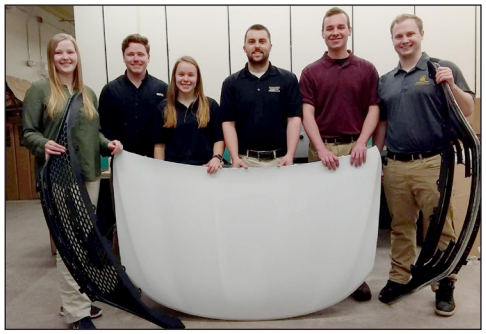
Team Members
Autumn Good, Emil Johnson, and Matthew Benz-Weeden, Biomedical Engineering; Dirk Deckinga, Mechanical Engineering Technology

Advisor
Rupak Rajachar, Biomedical Engineering

Sponsor
Dr. Alexandre Zerbini

Project Overview
Our team will develop a blubber-only implantable tag to increase retention and minimize tissue damage for use in whale conservation efforts.

246
Advanced Vehicle Hood Architecture and Design



Team is focused on end-user accessibility to under hood components

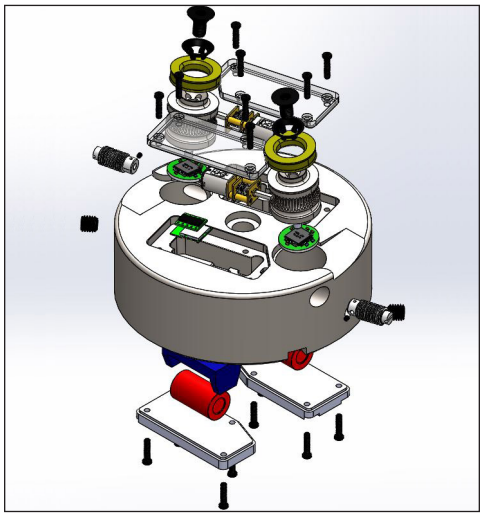
Team Members
Alex Emmes, Michael Ferron, Alyssa Knoester, Mitchell Menard, Jaime Modolo, and Travis Zuleger, Mechanical Engineering

Advadvisor
Jeremy Worm, Mechanical Engineering-Engineering Mechanics

Sponsor
Fiat Chrysler Automobiles

Project Overview
Our team will design and prototype a fixed hood for IC engine, PHEV, BEV vehicle architectures. Our goal is to take advantage of the many potential benefits (i.e., structure, pedestrian protection, over slam clearance, aerodynamics, styling, cost, etc.) while minimizing detractors (i.e., maintenance and ease of use).

247
Automatic Rotary Indexer with Visual Feedback System for Fine Finish Tooling



Exploded view of the components for the engineered system

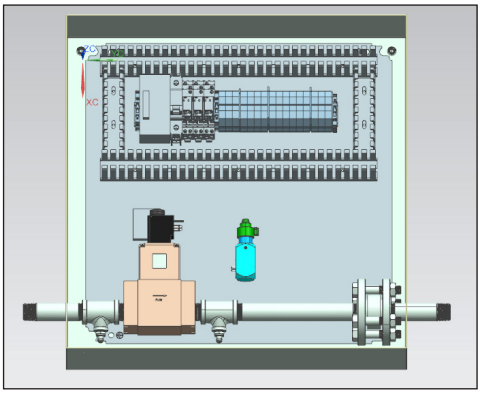
Team Members
Jacob Bennett, Alex Sutton, Cody Chartier, and Sean McCann, Mechanical Engineering; Tyler Nelson and Jacob Oquist, Electrical Engineering.

Advisor
Eddy Trinklein, Mechanical Engineering-Engineering Mechanics

Sponsor
Endres Machining Innovations, LLC

Project Overview
In order to reduce downtime and extend tool life, our project is to design and implement a system that can automatically index our customer's cutting tool. Using a visual feedback system, the machine operator can now interface with the device and allow the system to index it. Once the cycle is complete, the visual feedback will inform the user and the operator can safely run the machine.

248
Pneumatic Flow Totalizer



Pneumatic flow totalizer CAD assembly model

Team Members
Matthew Olson, Jacob Hendrickson, and Bradley Larson, Mechanical Engineering; Samuel LaMarche and Owen VanTiem, Electrical Engineering

Advisor
Jeremy Worm, Mechanical Engineering-Engineering Mechanics

Sponsor
Donald Engineering

Project Overview
Our team built a pneumatic device that can be plumbed to the inlet of a machine and determine the total quantity of compressed air that the machine uses during a predetermined period of time. The goal is to have the end user apply this totalizer and determine compressed air usage of a system. By quantifying air usage of an apparatus employing current components and the usage of the same apparatus employing higher quality components, potential dollar savings can be clearly demonstrated.

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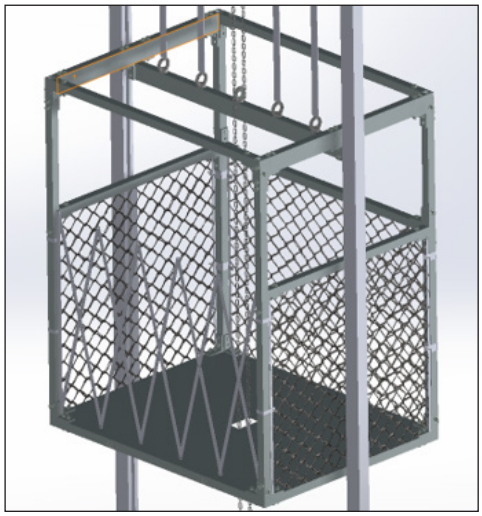
design expo

249
Sand Point Tower and Boardwalk



Representation of the elevator car

Team Members
Ryan Baumann, Kaleb Glowacki, Erik Lemmen, Jared Meyer, and Alex Stine, Mechanical Engineering

Advisor
Steven Ma, Mechanical Engineering-Engineering Mechanics

Sponsor
Keweenaw Bay Indian Community

Project Overview
Our team is designing and prototyping a mechanical elevator to be installed in a bird watching tower for the Keweenaw Bay Indian Community.

250
John Deere Gator XUV835 Exhaust Redesign

John Deere Gator XUV835 (atv.com/manufacturer/john-deere/2018-john-deere-gator-xuv835-and-xuv865-review-first-drive)

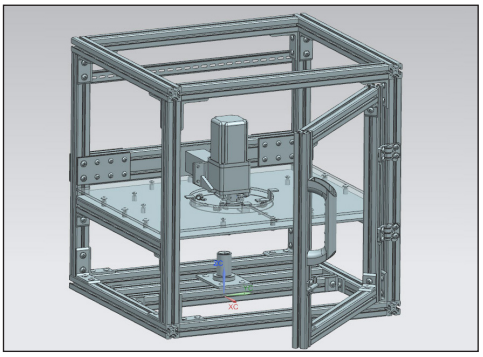
Team Members
Tyler Wells, Trevor Marvin, Thomas O'Hotzke, Austin Bittner, Daniel Ellsworth, and Josh Loiselle, Mechanical Engineering

Advisor
James DeClerck, Mechanical Engineering-Engineering Mechanics

Sponsor
John Deere

Project Overview
Our team will redesign the current exhaust system on the John Deere Gator XUV835. The current system on the John Deere Gator XUV835 was designed for a previous Gator model in 2010; since this design, customer expectations and needs have changed. The new design improves on overall weight of the system, complexity, exhaust noise level, sound quality, and maintain or improve upon the rear hitch accessibility.

251
Red Laser Inspection Device Improvement



Red laser wheel-nut inspection system

Team Members
Alex Lautenbach, Brody Berry, Brian Messman, Joe Jarvi, John Medley, and Becca Ratkowski, Mechanical Engineering

Advisor
Eddy Trinklein, Mechanical Engineering-Engineering Mechanics

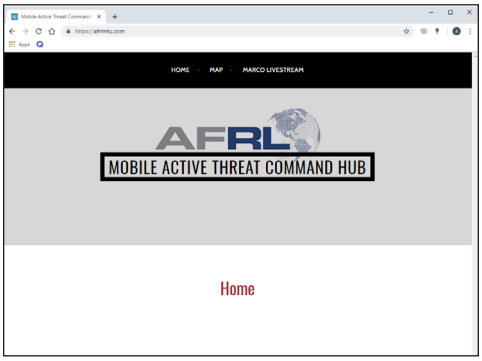
Sponsor
MacLean-Fogg Component Solutions

Project Overview
Our team will design and prototype a red laser inspection device and accompanying process for the quality of wheel nut internal threads for MacLean-Fogg Component Solutions–Royal Oak. The problem is that current automated inspection processes lack the capability to locate and sort out several common defects seen due to machining. MacLean-Fogg would like to end third-party defect hand sorting and integrate automated laser inspection onto their line(s).

JOHN DEERE

MacLean-Fogg
COMPONENT SOLUTIONS

252
Mobile Active Threat Emergency System



Command center website homepage

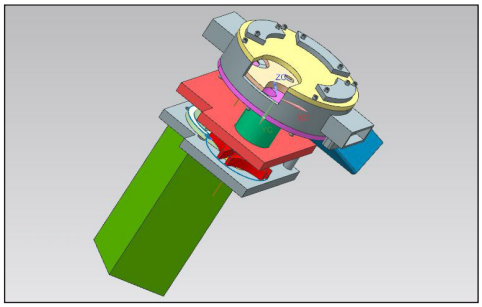
Team Members
Aaron Eskola, Electrical Engineering; Jordan Kieltyka, Computer Engineering; Quinn Kaspriak, Ryan Washington, and Rebecca Spencer, Mechanical Engineering

Advisor
William Endres, Mechanical Engineering-Engineering Mechanics

Sponsor
Air Force Research Labs

Project Overview
Tasked with designing and prototyping a personnel location system usable during active threat situations, our team created a remotely operated device that would analyze the environment around it and relay it to the operator. Combustible gas, carbon monoxide, oxygen, smoke, and temperature sensors are assembled on the device along with a cell phone, which is used to give the user "eyes" from the camera when driving the device.

253
Eddy Current Inspection In-line Integration



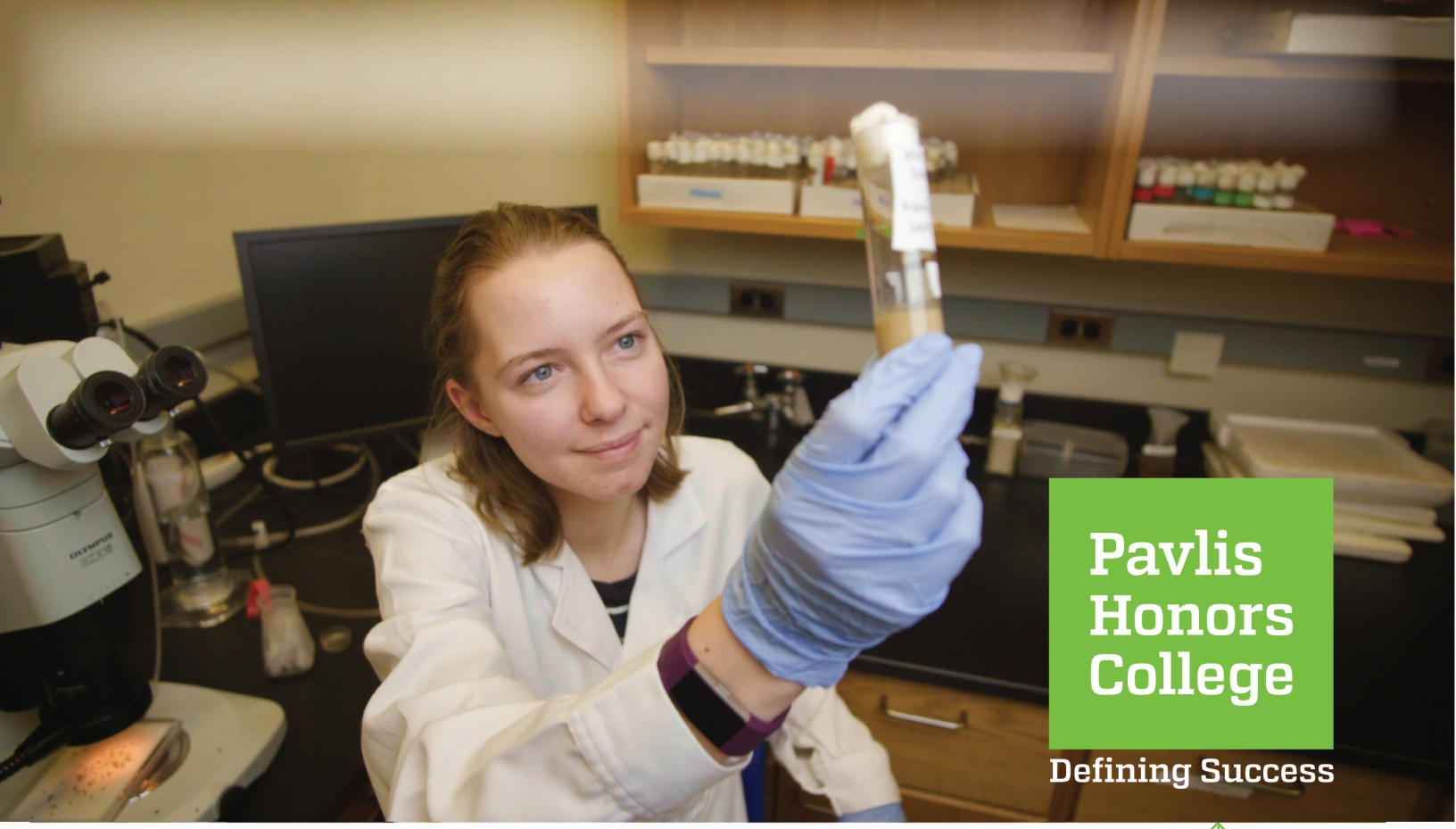
Redesigned mechanism for indexing washers, with opening for ECT (top) and drive mechanism (below)

Team Members
Kathryn Keen, Sean Lusk, Wiley Thomas, Ryan Quigg, Christopher Thompson, and Ethan Prehoda, Mechanical Engineering

Advisor
William Endres, Mechanical Engineering-Engineering Mechanics

Sponsor
MacLean-Fogg Component Solutions–Metform

Project Overview
MacLean-Fogg Component Solutions is a leading manufacturer of fastener components, engineered components, engineered plastics, and linkage and suspension components for automotive, heavy truck, and other diverse industries. The MacLean-Fogg-Metform facility focuses on horizontal hot forging, machining, and light assembly of components primarily for transportation industries; one of which is the wheel nut. These assemblies are comprised of a washer and a nut, which are staked together in an assembly cell. Currently, the washers are taken to an offline Eddy Current Tester (ECT) before staking, which inspects the parts for cracking that may lead to failure. Washers flow into an indexing table, are rotated and tested by the ECT, and based on the result, are passed or failed. The purpose of this project was to eliminate handling between inspection and assembly by integrating inspection into the assembly process. A smaller version of the existing indexing table was designed, so that it can fit in-line with the assembly cell, along with the ECT.



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Pavlis Honors College students make an impact.

Within one year at Michigan Tech, Tessa Steenwinkel went from working as an undergraduate research assistant in Thomas Werner's genetics lab to co-authoring their book, *Drosophilids of the Midwest and Northeast*. Now she's working on her own study that examines the effects of nutrition on fertility and life expectancy.

Pavlis defines success.

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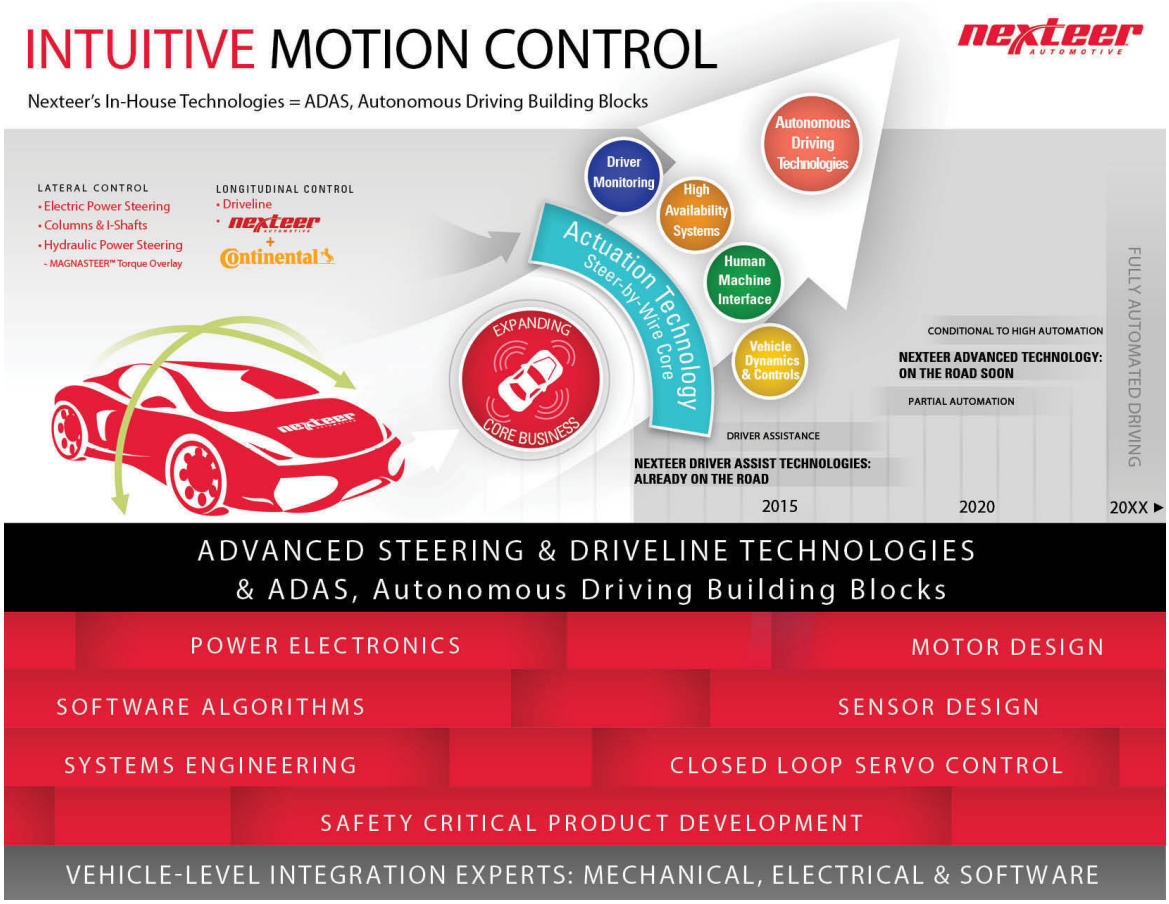

"When I was struggling as an undergraduate, and trying to figure out my goals, I found mechatronics and robotics. Now whenever I do something related to automation, I always think of Iron Man doing experiments in his lab."

Prince Mehandiratta
Mechanical Engineering
Graduate Student

Inspired by comics, Prince Mehandiratta found his calling. He assists in an engineering lab that uses open-source software and industrial robots to help students from diverse backgrounds move into engineering careers. The technology makes day-to-day applications and assembly possible—food, medicine, cars, building materials.

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Tomorrow needs Michigan Tech.

mtu.edu/magazine/mechatronics

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