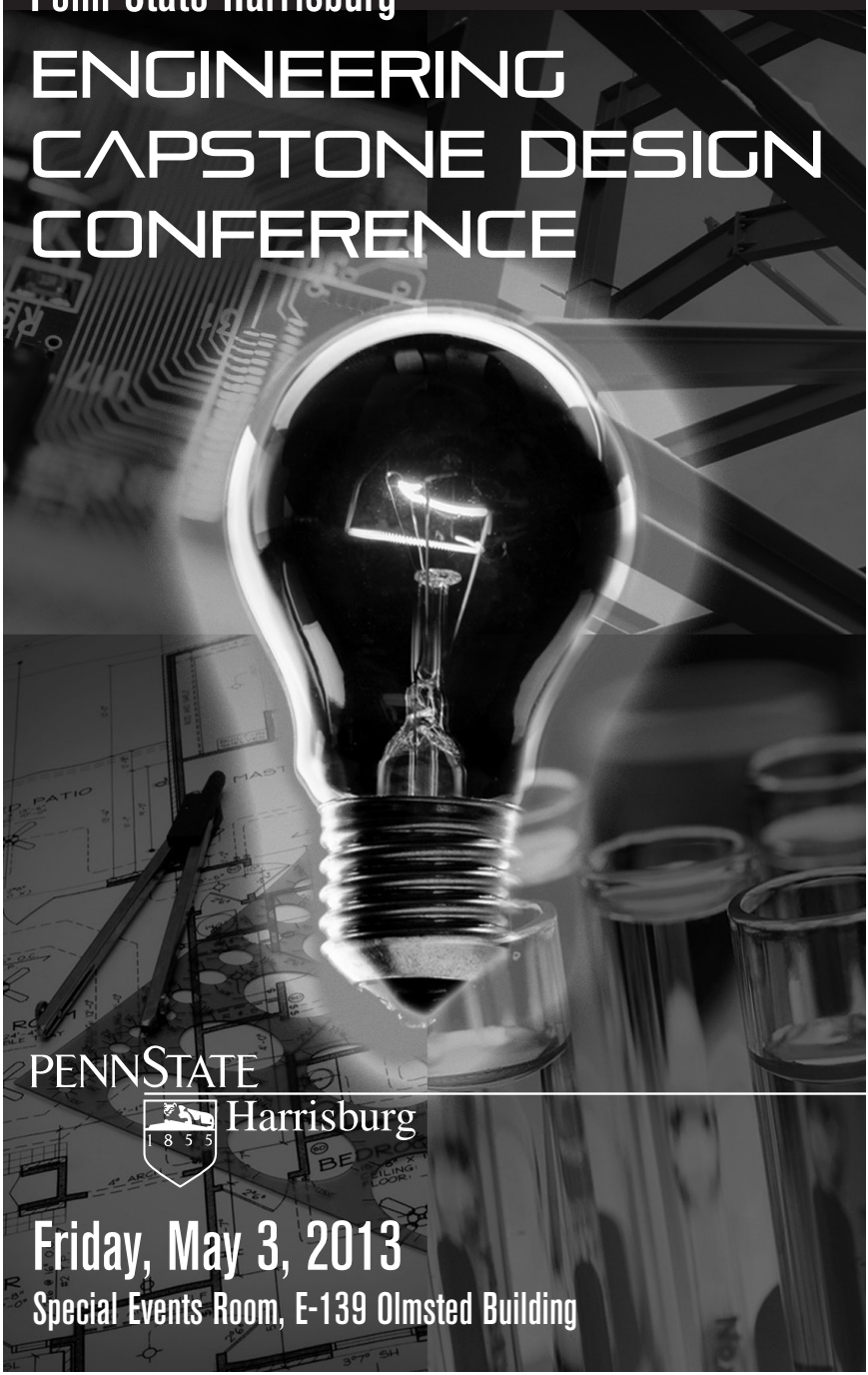
Penn State Harrisburg

ENGINEERING CAPSTONE DESIGN CONFERENCE



PENNSTATE Harrisburg 1855

Friday, May 3, 2013

Special Events Room, E-139 Olmsted Building

ENGINEERING CAPSTONE DESIGN CONFERENCE

SCHEDULE OF EVENTS

8:00 a.m. **Breakfast**

8:30 a.m. **Featured Speaker:** Kurt Slacik
Division Manager of Operations Support
ArcelorMittal Steelton LLC

9:00 a.m. **Presentations Begin**

Rooms for Presentation

Mechanical Engineering

E-253 Olmsted Building
E-254 Olmsted Building
E-258 Olmsted Building
E-265 Olmsted Building

Electrical Engineering

C-211 Olmsted Building
C-212 Olmsted Building

After presentations, attendees may view projects in the Engineering Technology Laboratory Building and the Electrical Engineering Lab (E-206 Olmsted Building)

FEATURED SPEAKER

Kurt Slacik

Division Manager of Operations Support, ArcelorMittal Steelton LLC

Kurt Slacik, division manager of operations support for ArcelorMittal Steelton LLC, is the conference featured speaker. One of North America's top rail producing facilities, ArcelorMittal Steelton is part of the Long Carbon North America division of ArcelorMittal, a global steel manufacturer. Slacik joined ArcelorMittal Steelton in 2010 and has since assumed a variety of roles including management of Steelton's procurement department, strategic planning, and budgeting and labor contract negotiations. The majority of his 25-year career in corporate finance has focused on the manufacturing industry, previously serving as CFO of Long Carbon North America and ArcelorMittal's stainless steel wire division. ArcelorMittal is represented on the Penn State Harrisburg Board of Advisers.

MECHANICAL ENGINEERING AND TECHNOLOGY PROJECTS

E-253 Olmsted Building

9:00-9:25 a.m.

Project: Biodiesel Reactor
Group Members: Jesse Holmes, Josh Bitner, S. Kamyar H. Khorrami
Faculty Advisor: Dr. Ganesh Bal

The project team made a biodiesel reactor for Craig Frey, a farmer who wanted to use the fuel for his equipment. The biodiesel is made from waste vegetable oil that is collected from a local school, then mixed with alcohol and lye, and allowed to settle. After settling, the final products are biodiesel and glycerin. The reactor produces 150 gallons of clean biodiesel per day, along with 30 gallons of glycerin, which Mr. Frey uses as a degreaser and floor cleaner. Mr. Frey donated various tanks and motors for the team to use, as well as space for the reactor to be built.
In addition, Philadelphia Mixing Solutions, Ltd. donated mixers, shafts, and propellers to the project team.

9:25-9:50 a.m.

Project: 3D Scanner
Group Members: Marwan Alkassir, David Lane, Alyssa Lawall
Faculty Advisor: Dr. Ganesh Bal

A 3D scanner is used to analyze three-dimensional objects and collect data such as shape, size, texture, etc. The data can then be utilized in many different ways. For example, it can be imported into a CAD software package for modifications. There are several ways to build a homemade 3D scanner; each method involves using a light transmitter and receiver. The method used in this project was the structured light method. Structured light 3D scanning can be accomplished using an overhead projector and a machine vision camera. Three-dimensional scanning can be useful for engineers in need of a simplistic reverse engineering process.

9:50-10:15 a.m.

Project: Harley Bobber
Group Members: Steven D. Hughes II, Aaron Pavlik, Christopher Kidd, Chad Derrick
Faculty Advisor: Dr. Ganesh Bal

The objective of this project was to convert a stock 2009 Harley Davidson Nightster into what is commonly known as a "bobber bike." A bobber motorcycle is a style of bike on which fenders are shortened for aesthetic reasons. Each team member worked together in graphic design, engineering, machining, and assembly of specific parts to achieve the final objective. Designing and selling aftermarket parts is a very successful industry in which companies make immense profits. Fabricating parts from personalized designs reduces the cost of buying the parts from aftermarket competitors. The project provided practical experience in designing and fabricating components relevant to the mechanical engineering discipline.

10:15-10:30 a.m.

BREAK

10:30-10:55 a.m.

Project: The Wild Banshee
Group Members: Mitch Powers, Matt Pribilla, Jordan Small, Christopher Janke
Faculty Advisor: Dr. Ganesh Bal

The goal of this project was to build a go-kart. Instead of purchasing a frame and bolting together parts, the team made a frame using 1.5 inch, square tubing. In addition, the team designed and built a unique racing seat. While working on this project, each group member learned how to TIG weld, improve a prototype design, and create a lighter frame. As a result, the go-kart was made from less material, which enhanced the performance of the finished product.

10:55-11:20 a.m.

Project: Utility RAT Rod
Group Members: Brandon Palmer, Robert Holloway, Katryna Stegmeier, Corey Duesler
Faculty Advisor: Dr. Ganesh Bal

The team designed and built an all-purpose utility vehicle for use on a farm. The vehicle was designed and FEA tested using Pro-E. The frame was custom built, and many pieces of the utility vehicle came from different types of vehicles, hence the name "RAT Rod." The RAT Rod is used on a farm for everyday work, so it was designed to handle the different stressors that accompany a work vehicle. It also needed to be able to haul material, pull wagons, and travel the varied types of terrain that can be found on a farm.

E-254 Olmsted Building

9:00-9:25 a.m.

Project: Beverage Brewing System
Group Members: Adam Sensenig, Amadou Mangara, Jaime Valverde, Ethan Koval
Faculty Advisor: Dr. Ganesh Bal

In the world of micro brewing, replication and efficiency are key. The group expanded upon an already successful, yet inferior, brewing system. More specifically, the objectives were to design and build a brewing system that efficiently produces a nonalcoholic beverage, make it semi-automated so that process temperatures can be maintained accurately, and use gas and water as economically as possible. The frame, burners, plumbing, electrical components, and testing of the system were built from scratch.

9:25-9:50 a.m.

Project: Logarithmic Spiral Trebuchet
Group Members: Christopher Strauss, Vincent Lomonaco, Evan Lawrence
Faculty Advisor: Dr. Ganesh Bal

The main reason for naming this project the Logarithmic Spiral Trebuchet, is the rope on the throwing arm, which follows an exact logarithmic spiral during launch. Another unique aspect of the trebuchet is that rather than using one set of weights that are dropped, a pair of weights are dropped simultaneously on each side of the throwing arm. The prototype was successfully built, and trial runs were made. Running tests on the prototype saved trial and error work and money when the full-scale trebuchet was built. The team successfully launched a golf ball from the prototype trebuchet. Once satisfied with the efficiency of the prototype, the full-scale model was built.

9:50-10:05 a.m.

BREAK

10:05-10:30 a.m.

Project: Hovercraft
Group Members: Frank Misuraca, Joshua Tucker, Nayan Patel, Saqib Mirza
Faculty Advisor: Dr. Ganesh Bal

The main goal of this project was to produce an all-terrain hovercraft that acts as a wheel barrow/sled. With the basic combination of a self-constructed sled and inflatable skirt, a leaf blower and/or engine propelled fan is used to lift the craft and its cargo, allowing it to glide across a variety of surfaces. The sled was constructed in such a way that the blown air was channeled into the skirt underneath the craft. The skirt then balloons with air, builds up pressure, and thus lifts the craft. The build-up of pressure then causes the air to leak out from under the skirt, eliminating friction between the craft and the terrain. This concept allows considerable amounts of weight to be moved with significantly little effort.

10:30-10:55 a.m.

Project: Educational Solar Panel System
Group Member: Vincent Doyle
Faculty Advisor: Dr. Ganesh Bal

The Educational Solar Panel System is easily transportable and is an easy overview of how solar panels receive energy. The panels are able to retract and extend to the full length, allowing for easy transport. The system shows the increase and decrease in the amount of energy based on the angle of the solar panel system. When the system is retracted it is easily moveable, allowing the instructor easy storage.

E-258 Olmsted Building

9:00-9:25 a.m.

Project: Repulsive Attractive Bi-directional Inductance Drive (RABID)
Group Members: Timothy Svirbly, Justin Matkov, Charles Capuano
Faculty Advisor: Dr. Issam Abu-Mahfouz

The RABID project is a centerless, inductive drive system that both simultaneously pushes and pulls the rotor via an induced magnetic field. The drive system operates through the utilization of pulse width modulation running through wire wound electromagnets positioned on the stator. The centerless design allows the motor to be used in applications that cannot use a conventional drivetrain. Another benefit of the motor being centerless is that it allows the circuitry of the motor to be away from high temperature environments, allowing for a longer and more efficient life span of the system.

9:25-9:50 a.m.

Project: Process Control Trainer
Group Members: Faical Rachak, Tyler Enterline,Wayne Thompson
Faculty Advisor: Dr. Issam Abu-Mahfouz

The Process Control Trainer is used for classroom instruction at Penn State Harrisburg. A programmable logic controller (PLC) was implemented with many solenoid valves, pumps, mixers, and sensors to control the level of fluid in two, three, or four connected tanks. In addition, a closed loop temperature control system that uses an electric water heater and a radiator was introduced to one of the tanks.

9:50-10:15 a.m.

Project: HVAC Automated Cold Trap for TRANE
Group Members: John Linn, Vincent Gu, Michael Zitsch
Faculty Advisor: Dr. Issam Abu-Mahfouz

TRANE had an existing cold trap that was used to evacuate water from their chiller units. The cold trap utilized a vacuum pump in combination with a smaller chiller unit that trapped the water vapor and cooled it into ice within the dryer shell. The cold trap unit was manually operated and took roughly two days for a full freeze-thaw cycle. The goal of this project was to optimize and automate the cold trap device used by TRANE to reduce the time cost needed for the freeze/thaw cycle.

10:15-10:30 a.m.

BREAK

10:30-10:55 a.m.

Project: Gas to Electric Motorcycle Conversion
Group Members: Scott Marks, Pierce Sube, Chris Topper
Faculty Advisor: Dr. Issam Abu-Mahfouz

The objective of this project was to convert a Honda motorcycle from an internal combustion engine powered by gasoline to an electric motor powered by batteries. The focus was on the efficiency of the design so to maximize the range of the vehicle. Components from different machines (like golf carts and other motorcycles) were reused in this design. The motorcycle includes a system monitor that shows parameters like speed and battery capacity.

10:55-11:20 a.m.

Project: The Spokeless Bicycle
Group Members: Jeffery Angeli, James Bieda, Justin Chopack
Faculty Advisor: Dr. Issam Abu-Mahfouz

The Spokeless Bicycle pushes the boundaries of typical bicycles by implementing a spokeless rear wheel. This was be achieved by having a rear tire and rim revolve around stationary tube frames and through a series of bearings and shafts. An assembly of chains and sprockets were attached to the bike frame, which powers the rear wheel. This project was chosen to apply learned engineering concepts and provide other alternatives to the basic idea of the wheel.

E-265 Olmsted Building

9:00-9:25 a.m.

Project: Automatic Control Conveyor System Trainer
Group Members: Sachin George, Nathan Gower, Brian Tate
Faculty Advisor: Dr. Issam Abu-Mahfouz

The main objective of this project was to update an existing conveyor system. The team identified the programmable logic controllers, sensors, and motors to confirm which parts could be used and which needed to be replaced. Some of the newly added capabilities to the conveyor system were variable speed and direction motor drives for the conveyor system, a material detection station, and new control software and hardware. These features enabled the students to gain experience in programming and using automation systems and sensors.

9:25-9:50 a.m.

Project: Stair Climbing Crutches
Group Members: Steve Fernandes, Nick Bauldaff, Rob Schmucker
Faculty Advisor: Dr. Harris Imadojemu

The objective of this project was to provide the ability to safely go up and down stairs with traditional crutches. These stair climbing crutches compress by the height of a step and then return to the original height for the next step. With a simple push of a button the crutches extend back to the original length, thereby assisting the user up the stair. This was accomplished by using a lockable gas spring, which has the benefit of dampening to avoid a painful quick release. This project provides safe mobility up and down steps for those who are incapable of doing so by themselves.

9:50-10:15 a.m.

Project: Standing Assisted Wheelchair
Group Members: William Fike, Michael Gobrecht, James Kerns, Josh Stewart
Faculty Advisor: Dr. Harris Imadojemu

Standing up from a seated position can be a nearly impossible task for a paraplegic or someone without the use of their lower extremities. With the assistance of a standing wheelchair, daily tasks can be accomplished safely. This project encompassed many aspects of engineering, some of which include FEM analysis, manufacturability, cost and time budgeting, creativity, abiding by standards, research about health benefits for the user and those interacting with the user, combining electrical and mechanical systems, and the design process from start to finish with the consumer in mind.

10:15-10:30 a.m.

BREAK

10:30-10:55 a.m.

Project: Shopping Cart Dryer
Group Members: Jeffrey Scott Malosiecki, Cody Kerr
Faculty Advisor: Dr. Harris Imadojemu

When it rains and snows, the moisture that remains on shopping carts can damage the goods they hold and be inconvenient for shoppers. The team designed a shopping cart dryer that removes the snow and rain from carts as they are pushed into the store. The design includes a pressure switch that turns on the dryer as soon as any carts are pushed underneath it. Air is directed towards the ground and away from the store so that any moisture removed from the carts stays out of the building.

10:55-11:20 a.m.

Project: Voice Operated Refrigerator Opener
Group Members: Arsène de Condé, Michael Paul, Matthew Sibio
Faculty Advisor: Dr. Harris Imadojemu

The objective of this project was to implement a voice recognition system to operate a refrigerator door. This mechanism consists of a linear solenoid, a passive infrared sensor, stepper motor, and voice recognition hardware. All these components are controlled by an Arduino. The purpose of this project was to enable people with disabilities to easily open refrigerator doors. Additionally, users with their hands full will find this system very practical.

ELECTRICAL ENGINEERING AND TECHNOLOGY PROJECTS

C-211 Olmsted Building

9:00-9:30 a.m.

Project: Boat Leveling Sensor
Group Members: Charles Hyson, Ryan Williams, Logan Brady
Faculty Advisor: Dr. Robert Gray

The objective of this project was to design and build a boat-leveling sensor to detect the angle, to one-degree accuracy, at which a pleasure boat is tilted. Water left in the hull of a boat during the off-season can result in damage. During the storage process, care must be taken to level the boat so all the water drains from the hull. Generally, during the process of storing a boat, someone judges the tilt of the boat by eye. The sensor developed in this project attaches to the deck of a boat and has an LED display that hangs over the side of the boat. By providing a rapid and more accurate indication of tilt, the sensor improves and expedites the boat storage process. The sensor employs a microcontroller and an accelerometer. The microcontroller drives the LED display board, which indicates the angle of boat tilt.

9:35-10:10 a.m.

Project: Hot Tub Occupancy Sensor System
Group Members: Abdoulkarim Laouali, Kyle Glessner, Cory Beard
Faculty Advisor: Dr. Dwight Macomber

The average hot tub has a water pump driven by a motor that is typically from 1.5 to three horsepower, with some larger tubs approaching five horsepower. Today, many local gyms and spas have public tubs that run for hours or all day long, often with no occupants. Leaving the jets on and the motor running while there are no occupants in the tub is a significant waste of electricity, since one horsepower is about 746 watts. The goal of this project was to design a sensor system that provides for the hands-free, convenient, and energy-efficient use of any public or private hot tub. The team's system uses an external PIR motion sensor that detects the presence of a person entering or exiting the tub. The sensor's signal is analyzed and differentiated to determine the direction of motion and whether or not the user is entering or exiting the tub. This allows the system to electronically count the number of tub occupants, so that the first person entering the tub activates the jets. When the last person exits and no occupants remain, the jets automatically turn off.

10:10-10:25a.m.

BREAK

10:25-10:55 a.m.

Project: Volvo-Sponsored RF Proximity Detection
Group Members: Benjamin Fox, Jairus Martin
Faculty Advisor: Dr. Robert Gray

The project objective was to design an active, RFID-based detection system to recognize the presence of co-workers in close proximity (approximately one meter) to large construction vehicles. The system alerts the operator when workers are present in the vehicle's blind spots. Directional information is also provided.

11:00-11:30 a.m.

Project: Volvo-Sponsored Electronic Window Tinting
Group Members: David Nguyen, Jonathan Shilling
Faculty Advisor: Dr. Robert Gray

This group was tasked with developing a system that would monitor the intensity of ambient light and proportionally change the transparency of the cab windows of construction vehicles. The purpose of tinting the windows was to reduce both the visible and infrared light, which are responsible for both the glare in the operator's vision and increased air temperature in the cab. Using the output of a solar cell to sense the ambient light level, the microcontroller computes an appropriate control voltage to adjust the opacity of a "smart" tinting film made from polymer-dispersed liquid crystals. To prevent the tint from obstructing the view of the operator, a magnetic rotary sensor was attached to the operator's swivel seat. The sensor signal is interpreted by the microcontroller to determine which windows require tint.

C-212 Olmsted Building

9:00-9:30 a.m.

Project: Quadrotor
Group Members: Yasin Demir, Jaimin Patel, Ihab Salet
Faculty Advisor: Dr. Hossein Jula

Small, unmanned, four-rotor helicopters, commonly known as quadrotors, were the subject of this project. Designing and controlling these airborne vehicles is challenging and requires the application of many principles of electrical and mechanical engineering. The team focused on developing a quadrotor with the required sensors and controllers to stabilize the platform in the air—in a hovering mode. To avoid collisions and other incidents during testing, the team created a test stand to constrain the hovering vehicle. Achieving stable hovering is a significant engineering feat. The functional hardware and test results of this project can easily be utilized to motivate future students in control systems and robotics courses.

9:35-10:10 a.m.

Project: Autonomous Drone
Group Members: Tenzin Gyurmey, Adrain Niba
Faculty Advisor: Dr. Hossein Jula

The words "eyes in the sky" are becoming more common these days. Today more than ever, unmanned aerial vehicles (UAVs), are being used for various activities by entities ranging from the government and business to civilians who fly them as a hobby. Applications for UAV technology in the civilian and hobbyist market can range from individuals looking to provide security for their property to simply flying them as a passtime. With a growing need for and increased interest in UAV technology, the objective of this project was to design and build a UAV that combines applications which differentiate it from others in the market. The four main applications were: autonomous flight, prolonged flight, a system fail-safe, and an onboard camera.

10:10-10:25 a.m.

BREAK

10:25 – 10:55 a.m.

Project: Voice-to-Braille Translation
Group Members: Nate Archibald, Dat Vo, Tyler Derr (Computer Science)
Faculty Advisor: Professor Cheryl Ebel

The objective of the Voice-to-Braille Translation project was to design an electronic system that facilitates easy communication between individuals who are both blind and deaf and those who are non-disabled. The system accomplishes this by electronically translating voice to written text. The text is then converted to Braille and displayed on a refreshable mechanical system. Existing software embedded in mobile operating systems is modified for the speech-to-text conversion. The display consists of an array of electromechanically-actuated refreshing Braille dots. An embedded microcontroller and programmable logic devices were used to bridge the software and mechanical portions of the system.

11:00 – 11:30 a.m.

Project: Energy Harvesting
Group Members: Jennifer Lauzus, Joseph Malek, Jasper Silknetter
Faculty Advisor: Dr. Aldo Morales

This project was a feasibility study on combining two energy-harvesting devices into one system. The first device was a thermoelectric module, which was used to harvest energy from the temperature differentials existing between the interior and exterior of a building. The second device was a piezoelectric plate embedded in a floor mat that captured kinetic energy from footsteps. The outputs of both of these devices were then input to a microcontroller that summed and displayed the amount of energy collected on an LCD screen for the consumer.

SPONSOR A PROJECT

The purpose of the Capstone Design Engineering Project is to help bring the real-world into the classroom by providing engineering students with practical, hands-on experience.

PARTNERSHIPS WITH INDUSTRY: WIN-WIN

This program was instituted following recommendations from our industry partners, who recognized the need for graduates who are well-trained in the engineering fundamentals and professional skills necessary to effectively compete in today's marketplace, such as teamwork, project management, cross-functional networking, communications, and design.

For small companies, Capstone Design Engineering Project teams can be a boost to an engineering workforce. For larger companies, these teams help develop new ideas or improve current practices, both of which can positively impact a company's bottom line.

Cooperative projects are a great way for companies to get to know students when looking for new employees, and they are also helpful in training junior-level engineers and managers by providing project management experience in a low-cost, low-risk, potentially high-payoff setting.

SPONSOR BENEFITS

Some of the benefits of sponsoring a Capstone Design Engineering Project are:

1. Low-risk, low-cost investment with high potential ROI (return on investment)
2. Work on "back burner" projects and help refine ideas
3. Help start-up and small companies with prototyping and development work (while fleshing out a business plan through collaboration with a team of business students)
4. Direct access to some of the best Penn State students (15-week interview)
5. Newly hired employees (i.e. Penn State students) are better trained as a result
6. Company liaison overseeing the project gains valuable project management experience
7. Increase company brand awareness among Penn State students and faculty
8. Entry point (and guide) into the Penn State network
9. Network with other companies through events and cross-promotions
10. Opportunity to give back to the college and influence the education and careers of many students

SPONSOR RESPONSIBILITIES

Sponsors are expected to make a tax deductible contribution of $2,500, submit a proposal explaining the scope of the project, identify an industry liaison to serve as the team's point of contact for the project, interact regularly with the student team, review reports and provide feedback, and evaluate the students' performance at the Capstone Design Conference.

ADDITIONAL DETAILS

For additional information and details on how sponsoring projects can work for your company, please contact the Penn State Harrisburg Development Office at 717-948-6316.

Penn State Harrisburg

would like to thank the following companies for their sponsorship and/or contributions to this year's capstone projects:

Dr. Peter Alagona, Jr.

ArcelorMittal

Craig Frey

Dr. Gautam Ray and family

Philadelphia Mixing Solutions, Ltd.

Walter Swistak

TRANE

Volvo