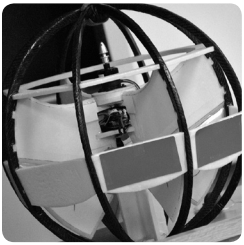
SCHOOL OF SCIENCE, ENGINEERING, AND TECHNOLOGY

CAPSTONE DESIGN CONFERENCE










PENNSTATE Harrisburg
1855

FRIDAY, MAY 8, 2015

SCHOOL OF SCIENCE, ENGINEERING, AND TECHNOLOGY

CAPSTONE DESIGN CONFERENCE

SCHEDULE OF EVENTS

7:30 a.m.	**Breakfast** (Gym, Capital Union Building)
8:00 a.m.	**Welcome:** Dr. Rafic A. Bachnak, Director, Penn State Harrisburg School of Science, Engineering, and Technology
8:10 a.m.	**Featured Speaker:** Peter Tubolino Mid Atlantic Area Manager, Siemens Industry, Inc.
9:00 a.m.	**Student Presentations** *Civil Engineering* Auditorium, Olmsted Building *Structural Design and Construction Engineering Technology and Civil Engineering (Environmental)* C211 Olmsted Building *Computer Science* E244 Olmsted Building *Electrical Engineering and Technology* E265 Olmsted Building *Mechanical Engineering* E209 Olmsted Building E252 Olmsted Building E244 Olmsted Building E258 Olmsted Building For a list of projects, visit: http://harrisburg.psu.edu/calendar/event/sset-capstone-design-conference
Noon	**Lunch** (Gym, Capital Union Building)
12:30 p.m.	**Featured Speaker:** Michael J. Sullivan, P.E. Senior Vice President, Operations and Engineering, Pepco Holdings, Inc.
1:00 p.m.	**Student Project Exhibition and Demonstrations** (Educational Activities Building, EAB and Engineering Technology Laboratory)
3:00 p.m.	**Awards Ceremony** (EAB 102)
4:00 p.m.	**Order of the Engineer Ring Ceremony** (EAB 102)

SCHOOL OF SCIENCE, ENGINEERING, AND TECHNOLOGY

CAPSTONE DESIGN CONFERENCE SPEAKER

Michael J. Sullivan, P.E.
Senior Vice President, Operations and Engineering
Pepco Holdings, Inc.

Michael J. Sullivan is senior vice president of operations and engineering for Pepco Holdings, Inc., (PHI), a regional energy holding company that provides utility service to approximately 2 million customers. PHI is the parent company of Potomac Electric Power Company (Pepco), an electric utility serving Washington, D.C. and suburban Maryland; Delmarva Power, an electric and gas utility serving Delaware and the rest of the Delmarva Peninsula; and Atlantic City Electric, an electric utility serving southern New Jersey.

In his role, Sullivan is responsible for engineering, operations, and maintenance and construction activities for PHI's three electric utilities. He also has responsibility for the company's gas utility in Wilmington, Delaware, emergency preparedness, environmental activities and real estate.

Sullivan is a native of Nanticoke, Pennsylvania. He earned a B.S. in electrical engineering technology from Penn State Harrisburg in 1980 and an M.B.A. from Marymount University in 1987. He is also a licensed professional engineer in Washington, D.C.

Sullivan serves on the boards of the Better Business Bureau for Washington, D.C. and Eastern Pennsylvania and the Electrical Engineering and Energy Technology Advisory Board at Penn State Harrisburg. He is also a 2004 graduate of Leadership Greater Washington and a member of the Greater Washington Board of Trade.

He lives in Ellicott City, Maryland, with his wife, Laura, and their three children.

SCHOOL OF SCIENCE, ENGINEERING, AND TECHNOLOGY

CAPSTONE DESIGN CONFERENCE SPEAKER

Peter Tubolino
Mid Atlantic Area Manager
Siemens Industry, Inc.

Peter Tubolino is the Mid Atlantic Area Business Manager at Siemens Industry, Building Technologies, Inc. in Blue Bell, Pennsylvania. Tubolino is responsible for the overall management and P&L of a $120+ million building technologies business in the Mid Atlantic area with multiple branch locations and over 300 employees. The business area includes building automation, energy, life safety and security. His responsibilities include: primary leadership for overall business plans; accountability for financial performance and reporting; strategic planning; business development; implementation of productivity improvement programs; management of employee and customer satisfaction; and functional management responsibility including sales, engineering, execution, and service operations.

He has over 35 years of industry experience including engineering, sales, sales management marketing, P&L, strategic planning and business development.

Tubolino received his B.S. in industrial engineering technology from the State University of New York at Buffalo. He is currently a board member for Philadelphia Works and a member of American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) and the International Society of Pharmaceutical Engineers (ISPE).

Civil Engineering Capstone Design Presentation

Auditorium, Olmsted Building

Moderator: Dr. Shashi Marikunte
Project: Student Enrichment Center – Student Perspective

Sponsor: Bohlin Cywinski Jackson-Architecture Planning Interior Design; Penn State University Faculty Advisers: Dr. Shashi Marikunte and Dr. Sofia Vidalis

The Student Enrichment Center (SEC) at Penn State Harrisburg is a new 70,000 gross square foot (GSF) three-story building with an estimated cost of $30 million. This new facility will provide student activity and meeting spaces, food services, auditorium space (375 seats), and administrative office spaces. Bohlin Cywinski Jackson, the architecture planning and interior design firm, is providing professional architectural services to design the Student Enrichment Center. Students in the Civil Engineering Capstone Design class had the opportunity to review the drawings and specifications for the proposed project. They were then challenged to design this building using the learned skills in their undergraduate studies in civil engineering at Penn State Harrisburg. Students worked on this project in small groups to provide alternate designs and compete with other groups. The main focus was to provide an opportunity for students to work on a real project. The project enabled students to work in teams of experts, similar to a typical design/construction company, and were encouraged to think "outside-the-box" to come up with innovative solutions to improve the functionality of the building. Six teams diligently worked on this project in true competition style to incorporate changes through value engineering, sustainability, energy efficiency, and other modern tools to improve the functionality or other aspects of the proposed project. In today's presentation, teams will disclose for the first time their approach to make the SEC a "state-of-the-art" construction project.

9:00-9:30 a.m.

Group #1
Group Leader: John Minchoff
Members: Carson Au, Richard Bernard, Stephen Hamel, Joseph Hochstetler, Joseph Murphy, Tyler Smith

9:30-10:00 a.m.

Group #2
Group Leader: James Faircloth
Members: Natalie Boyer, Timothy Fitzpatrick, James Rashaad, Corey Matz, Sevon Navarro, Evan Westerlund

10:00-10:30 a.m.

Group #3
Group Leader: Timothy Newcamp
Members: David Blackman, Tyler Culhane, Billy Goodlett, Ryan Hauser, Stanley Hughes, Kevin McGuire

10:30-11:00 a.m.
Group #4
Group Leader: Bryce Annino
Members: Jeffery Burdge, Joshua Hockenberry, Danielle Johnson, Oluwafisayo Johnson, Pooja Murali

11:00-11:30 a.m.
Group # 5
Group Leader: Alyssia Deutsch
Members: Benjamin Byers, Raymond Cruse, Faiyad Haider, Stephan Rawles, Ryan Trees, Steven Ziegler

11:30 a.m.-Noon
Group # 6
Group Leader: Kelsey Szablowski
Members: Zarley Binder, Dimo Hristozov, Mark Kalusz, Ahmad Matar, Ricardo Quintana Verga, Bryce Romberger

Structural Design and Construction Engineering Technology Capstone Design Presentation

C211 Olmsted Building

Moderators: Dr. Joseph Cecere and Dr. Pedram Sadeghian

Project: Multi-functional Sports Complex of Penn State Harrisburg
Faculty Advisers: Dr. Joseph Cecere and Dr. Pedram Sadeghian

Students will report their design for a multi-functional sports complex on the Penn State Harrisburg campus. The complex serves primarily as an indoor tennis facility with four standard tennis courts, however, it could be used for other indoor sports, especially during winter months. The possibility exists for use during campus gatherings with the accessibility for large equipment. It is a one-story structure with a mezzanine area containing office areas, storage, bathrooms, locker rooms, and viewing area. Students from both the structural and construction teams will present their proposed layout, structural design, construction schedule, and cost estimation.

9:00-9:30 a.m.
Group #1
Structural Team: Robert Daughtry, David Sube, Laura Wroblewski
Construction Team: Amber Grimm, Tracy McHenry, Frank Procopio, Jonathan Shoemaker

9:30-10:00 a.m.
Group #2
Structural Team: Zachary Cerankowski, Patrick Densmore, David Thomas
Construction Team: Branden Rutt, Dusten Rutt, Bradley Sweimler, Anthony Verdiglione

Civil Engineering (Environmental) Capstone Design Presentation

C211 Olmsted Building

Moderator: Dr. Yuefeng Xie

Project: Middletown Drinking Water Treatment Plant Design
Faculty Adviser: Dr. Yuefeng Xie

Students will report a preliminary design for a conventional water treatment plant for the Borough of Middletown, Pennsylvania. The design includes selection of raw water source, plant site, pumping station, treatment processes, storage and distribution facilities. Students will also present their design and operating criteria, calculation, and cost estimates for these facilities. The layout of various treatment units and their hydraulic grade line will be presented as well.

10:00-10:30 a.m.
Group #1
Members: Randall Sourbeer, Matthew Bloom, Jeanette Miller

10:30-11:00 a.m.
Group #2
Members: Jordan Coldsmith, Angela Ayscue, Adam Bell

11:00-11:30 a.m.
Group #3
Members: Courtland Hoffman, James Chamness, Patric Destevens

Computer Science Capstone Projects

E244 Olmsted Building

Moderator: Dr. Jeremy Blum

9:00-9:20 a.m.
Project: Long-Wave Logger
Group: Chris Becker, Dave Hartman, Isaac Polinsky
Faculty Adviser: Dr. Jeremy Blum

The application enables long wave radio enthusiasts to log radio conversations. Once conversations are logged the application will provide a means to summarize all communication with a particular responder as well as summarizing communications with all users. Users will be able to view various statistics, graphs, and geographic data of their conversations. This application will be available as a Windows application with no need for the internet.

9:20-9:40 a.m.
Project: BUNDL
Group: Craig Messinger, Solomon Shockley, Yan Zavatsky, Jesse Miller
Faculty Adviser: Dr. Jeremy Blum

BUNDL is a management website designed to integrate the information and features of various social media outlets. Its primary goal is to give people an efficient and user-friendly way to post information as well as monitor replies and messages in a single cohesive application.

9:40-10:00 a.m.

Project: Computer Science and Math Website Redesign
Group: Colton Gerhart, Stephanie Shoff, Greg Matsick, Krishna Kendre
Faculty Adviser: Dr. Jeremy Blum

A user-friendly redesign of the computer science and mathematics website will allow easy access to useful links for prospective and current students. New features include, but are not limited to, dynamic content, a newsfeed, an events column, and a mobile friendly design.

10:00-10:30 a.m.

Project: Nebulock
Group: Connor Slaybaugh, Ross Owen, Brandon Lewis, Gal Yaroslavsky
Faculty Adviser: Dr. Jeremy Blum

Nebulock is an Android application designed to securely store passwords and other sensitive information. In addition, Nebulock will allow the user to share this information with any other registered users.

10:30-11:00 a.m.

Project name: Bot!Battle!
Group: Austin Barket, Randall Hudson, Steven Erb
Faculty Adviser: Dr. Jeremy Blum

Bot!Battle! is an application designed to support and encourage students to gain an early enthusiasm for computer science and programming. Students will write small "bots", or simple programs that are designed to play a game. Bot!Battle! will host tournaments in which the students' bots will compete for the title of most awesome bot. In addition, students will be able to test their bots, both against themselves or against another bot, via a publicly accessible portal where they can watch their bots play the game. Also, Bot!Battle! is extensible in that it allows new games to be developed and then uploaded for use in new tournaments.

11:00-11:30 a.m.

Project: Book a Space
Group: Zach Schultz, Michael Toole, Yasmine Williams
Sponsor: Office of the Budget, Commonwealth of Pennsylvania; Office of Administration, Commonwealth of Pennsylvania
External Adviser: Sandra Mateer, Director
Faculty Adviser: Dr. Jeremy Blum

Yearly leases are incredibly expensive; renting employee workspace as needed is an opportunity for huge savings. The Book a Space application allows employees to reserve workspaces including cubicles, offices, and conference rooms. The application handles workspace scheduling, reservation confirmation, billing and receipt generation. Book a Space features calendar views for workspaces, easy administration, and usage reports.

11:30 a.m.-Noon

Project: Blueplate
Group: Skylar Jesse, Sujay Kallamadi, Kyle Melton, Matt Houseman
Sponsor: Department of General Services, Commonwealth of Pennsylvania; Office of Administration, Commonwealth of Pennsylvania
External Adviser: Sarah Shaffer, IT Project Manager
Faculty Adviser: Dr. Jeremy Blum

The focus of the project is to provide a reliable and easy-to-use software solution to fit the needs of the Commonwealth of Pennsylvania. The application seeks to provide simple and accessible location

services for Pennsylvania state employees to locate nearby vehicle services (e.g. gas stations, rental facilities, and service stations). The application will provide driving distance and relevant information about individual services, as well as providing directions based on the user's GPS location.

Electrical Engineering and Technology Projects

E265 Olmsted Building

Moderator: Dr. Wolfram Bettermann

9:00-9:30 a.m.

Project: ICE Box
Group: Terry Opila, Justin Geiger
Faculty Advisers: Dr. Sedig Agili and Dr. Mohammed-Reza Tofighi

Have you ever been listening to a CD in your car and it begins to skip? Has your phone been charging and you hear a whining noise through the speakers under acceleration? "ICE Box" will solve these problems. Utilizing a hard drive to store digital music files, and a Bluetooth capable smartphone as a remote control, your entire music library is at your fingertips while traveling in your car.

9:30-10:00 a.m.

Project: Remote Power Monitoring System
Group: Bill Lucas, Hajir Razlansari
Faculty Adviser: Dr. Aldo Morales

The Remote Power Monitoring System will improve consumers' products by providing remote monitoring of the renewable energy that is being conserved in their household through any mobile device. Homeowners using sustainable electric power sources and companies involved in environmental technology will find this product indispensable by allowing consumers easy access and also real time feedback of the system.

10:00-10:30 a.m.

Project: Phoenix Contact Energy Harvesting
Sponsor: Phoenix Contact
Group: Kyle Goble, Anthony Smith
Faculty Advisers: Dr. Seth Wolpert and Dr. Mohammed-Reza Tofighi

Energy harvesting can be used to provide power to low wattage rating devices, by using an external source such as radiofrequency or thermal energy. Phoenix Contact is interested in improvement in this area so it can be used for future designs. Each student will employ an energy harvesting system of their choice and compare results to see which route the company should take. The device being powered for our application is a small radio transceiver.

10:30-11:00 a.m.

Project: Phoenix Contact Surge Protector
Sponsor: Phoenix Contact
Group: Daniel Nelson
Faculty Adviser: Dr. Seth Wolpert

This project is for the design of a voltage measurement and display addition to the current TRABTECH line of surge protectors offered by Phoenix Contact.

11:00-11:30 a.m.

Project: Phoenix Contact Burn-In System
Sponsor: Phoenix Contact
Group: Larry Rupp
Faculty Adviser: Dr. Seth Wolpert

The objective of this project was to design and build a new burn-in system with an electronic resistor load bank for Phoenix Contact that will allow the testing and conditioning of the circuit boards they assemble in a more efficient and affordable way. This system will allow a modified testing length with some of the sensors that will also be implemented into equipment.

11:30 a.m.-Noon

Project: Olmsted Classroom Automation
Group: William Hood, Mireille Mballa, Brandon Miller, Chad Summy, Ramy Zaki, Casey Eide, Jonathan Schauer
Faculty Adviser: Dr. Scott van Tonningen

The classroom automation project is an effort to update the lighting and electrical systems in Olmsted's existing room E213 by using modern automation techniques. This project is the platform for future classroom updates across all Penn State campuses. The primary areas of improvement are upgrading the lighting and energy efficiency in the classroom. The new technology used for this project is Desigo (Siemens Automation software) and BIM (Building Information Modeling).

Desigo is an advanced, Siemens commissioning tool, which is in the process of replacing Siemens' Insight program. The program is used to design, test, manage, and document the functions of building automation systems. Desigo is the successor to the Insight program because the new program is more technologically advanced making it more efficient and user friendly. This is achieved with a more reliable interface that involves less knowledge of higher level programming. The interface does not require advanced programming knowledge to maintain the system. Instead, it uses basic design tools to maintain the system. Desigo uses an interactive user interface to easily control and display system settings, such as air pressure, air temperature, lighting outputs, and humidity levels.

C212 Olmsted Building

Moderator: Dr. Robert Gray

9:00-9:30 a.m.

Project: Appliance Cost Meter (ACM)
Group: Daniel Allen, Gregory Pray
Faculty Adviser: Dr. Seth Wolpert

Energy cost analysis for individual large appliances is not easily available to the average homeowner. Appliance Cost Meter (ACM) meets this need. The ACM can be used by an average homeowner to determine the individual power usage/cost of multiple appliances using inductive loop measurement. Measurement of energy cost is currently available only for plug-in devices and minimally for inductive loop measurement at circuit breaker panels. The ACM will allow the homeowner to measure the power/cost of any plug-in or hardwired household appliance without requiring installation inside the circuit breaker panel.

9:30-10:00 a.m.

Project: Fully Automated Chessboard
Group: Matthew Hyson, Khoa Pham, Jacob Fish
Faculty Adviser: Dr. Seth Wolpert

The Fully Automated Chessboard allows chess players around the world to compete against each other while having the experience of moving physical pieces on a board. It can be used in either a casual or competitive setting. This utilizes the full capabilities of a micro-controller, internet networking, electromagnetic theory, and control-system modeling.

10:00-10:30 a.m.

Project: Smart Security System
Group: Guriqbal Singh, Ibrahim Rogers, Viktar Rybaltouski
Faculty Adviser: Dr. Robert Gray

Almost all home security systems available to consumers require monitoring by an outside party such as ADT and ESCO. These outside parties usually charge an installation fee and a recurring monthly fee. The design, called The Smart Security System (SSS), will allow home and business owners to monitor their homes and businesses via their smartphone. Activating and deactivating the sensors will be done via their smartphone wirelessly using wi-fi technology. This allows them to have control of the system regardless of where they are. Our system will include a motion sensor, gas/smoke detector, temperature sensor and built in camera.

10:30-11:00 a.m.

Project: Square Bale Moisture Tester (BMT)
Group: Michael Bride, Mark Rogers
Faculty Adviser: Dr. Seth Wolpert

Hay production is a vital part of the agricultural economy of Pennsylvania and the United States. In order for safe storage and quality of hay, each bale produced should have a moisture content of no more than 13 percent for grass species and 18 percent for alfalfa. The price of hay can vary greatly due to quality. If hay is stored at a moisture level that is too high, mold can form.

The square bale moisture tester (BMT) and bale counter will be a useful tool for producers of hay. Producers of hay will be able to monitor moisture levels to within +/- 2 percent, and keep count of the number of bales produced. This will assist the producer by allowing him or her to stay seated on the tractor and monitor the moisture levels as the bales of hay pass through the baler. If the moisture level goes above a desired level the producer wants, they then can stop production to allow the hay to dry more.

The counter is another added tool that will keep track of the number of bales produced in the field and throughout the hay season. This will help free up time by not having to count every individual bale.

11:00-11:30 a.m.

Project: DataGrow
Group: Ken Carignan, Justin Agraviador
Faculty Adviser: Dr. Seth Wolpert

DataGrow is an automated system to make growing plants at home simple and easy. Using a micro-controller and the latest horticulture research, plants are easily grown indoors with maximum efficiency through constant control of the plant's environment. Temperature and humidity are kept ideal while water and nutrients are automatically fed to the plant as needed. A smart energy efficient LED array provides light with optimal wavelengths and light cycles specifically catered to the desired species of a

plant. Using a simple LCD interface, or through the smartphone app, DataGrow can automatically use its online database of ideal conditions for hundreds of different plants to take all the guess work out of gardening for the customer. Even edible plants like spices, lettuce, and tomatoes can now be grown in the home easily without large equipment.

11:30 a.m.-Noon

Project: Blood Perfusion Microwave Radiometer
Group: Tim Fager
Faculty Adviser: Dr. Mohammed-Reza Tofighi

The purpose of this project was to build a proof-of-concept radiometer to measure blood perfusion. Artificial tissue will be heated slightly above normal body temperature from liquid using a hot plate with a magnetic stirrer. The temperature decay rate will be measured by microwave sensing after the heating has stopped.

Noon-12:30 p.m.

Project: Wireless Home Automation/Security Project (WHASP)
Group: Vance Drawbaugh
Faculty Adviser: Dr. Scott van Tonningen

Home automation/security equipment is dropping in price thanks to the newest microcontroller technology. The Internet of Things (IoT) era is setting in and will also play a role in shrinking prices. IoT refers to the ability of household peripherals to connect with the user and convey information or receive control instructions. This project will automate lights and temperature by using low-power and scalable sensors along with pre-existing external systems. The security portion will come in the form of controlling a closed caption television system through the use of relays.

Mechanical Engineering and Technology Projects

E209 Olmsted

Moderator: Dr. Gautam Ray

9:00-9:30 a.m.

Project: Indoor Batting Cage Design
Sponsor: Penn State Harrisburg Athletic Department
Group: Christian Aquino, Travis Crammer, Cody Miller, Lewis Mills
Faculty Adviser: Dr. Richard Ciocci

The Penn State Harrisburg Office of Intercollege Athletics expressed the need for a new indoor batting enclosure. The current batting cage requires the use of ten team members to deploy the enclosure for use. It also requires a minimum of ten minutes to be fully deployed. The goal of the design and build is to reduce the time and manpower used. After researching multiple designs, the final system deploys the netting from the rafters via a wall-mounted winch. The enclosure is supported by a network of cables that are directly linked to the rafters. This ensures that if the winch system were to fail, the net would only descend slowly and not injure any persons below. The net is designed with a weighted bottom to keep the material in tension while deployed. This will also keep baseballs from escaping from the inside of the enclosure during use.

9:30-10:00 a.m.

Project: Weather Data Collection System
Sponsor: Al Peterlin and ERREx, Inc
Group: Christopher Barnes, Benjamin Ruane, Bryan Shambaugh
Faculty Adviser: Dr. Richard Ciocci

The purpose of this project was to create a weather recording device that is compact, runs completely autonomously, has proper housing to protect it from severe weather conditions, can accurately record various types of data to be used for weather predictions, and can send this data to the client for processing. Currently, radar is used in reporting weather conditions and gives a general overview of cloud coverage over a given area. A more accurate weather reporting system was developed through the collection and delivery of real-time data. To accomplish this, an individual raspberry pi unit was fitted with temperature, pressure, and humidity sensors and programmed to automatically collect and send hourly data reports to the project sponsor. Control testing was performed to ensure accurate data readings were taken under continuous use. This unit will ultimately serve as a baseline on which a larger, more comprehensive, collection network can be built.

10:00-10:30 a.m.

Project: Ear Bud Case Design
Group: Michael Anderson, Joshua Desauliners, David McClintock
Faculty Adviser: Dr. Richard Ciocci

Earbuds today are manufactured in many different styles and shapes to accommodate for the diverse and growing needs of the customer. More often than not however, earbuds are designed, manufactured, and sold without a case to store them, leaving them vulnerable to premature wear, knotted cords, dirt, and bacteria. The goal of this project was to design a universal case that would be used to store and protect as many varying types of earbuds from these issues. During the project additive manufacturing (3D printing) was used for rapid prototyping, which aided greatly in design progression, testing, and usability. Finally, research was done in the areas of materials selection and manufacturing processes, with the intent of having a final deliverable case design and suggested material and manufacturing process in order for the case to potentially be mass-produced.

10:30-11:00 a.m.

Project: Testing and Analysis of 3D Printer Materials
Sponsor: TE Connectivity
Group: Erin Conway, Ryan Flattery, Malachi Seilhamer
Faculty Adviser: Dr. Richard Ciocci

TE Connectivity, an international, electronic connector and components provider, needed reliable material property data for the 3D printing materials they use. The project involved 3D printing of dog-bone specimens in both x and y print orientations and multiple colors. It also involved tensile and bending testing to obtain material properties for each specimen, such as stress, strain, and modulus of elasticity. Once the data was collected, the results were simulated in ANSYS, a computer program used for finite element analysis. In order to prove the data, a latching device was designed, 3D printed, and evaluated. The evaluation featured data obtained from breaking the mechanism and seeing how well it correlated to an ANSYS simulation of the part. This project helped to determine the reliability of the 3D printing materials used for prototypes and production grade products, as well as determined the influence of print orientation and color dye on the strength of the materials.

11:00-11:30 a.m.

Project: Development of a Lubrication Compatibility Matrix
Sponsor: TE Connectivity
Group: Larson Beckner, Matthew Frey, Andrew Moore
Faculty Adviser: Dr. Richard Ciocci

TE Connectivity identified the need to characterize different lubricant material properties. A matrix of lubricant properties would assist customers when selecting a lubricant. These lubricants were tested in temperature life, as well as durability to determine which lubricants perform the best in resistivity. For this test sample, a low power, data connector was used to define the lubricant characteristics. With the completion of the lubrication matrix, the customer will have access to lubricant material and mechanical properties as well as cost.

11:30 a.m.-Noon

Project: Classroom HVAC Redesign – Controls System
Sponsor: Siemens; Penn State Harrisburg Maintenance & Operations
Group: Clint Hicks, Patrick Holden, Ashley Lovett, Matthew Page, Gabrielle Wolfe
Faculty Adviser: Dr. Richard Ciocci

Penn State Harrisburg's Office of the Physical Plant requested assistance in redesigning an existing HVAC system in the Olmsted Building. Two teams of students were asked to look at the existing room design in conjunction with a room remodel design of the heating, ventilating, and air conditioning (HVAC) system. This redesign considered replacing the existing system with a more efficient system as well as new possibilities to be used not only in the project room, but eventually throughout the whole building. Along with the redesigned mechanical system, the two teams incorporated a new controls system designed under the guidance of Siemens. This control system will assist the mechanical system with operation schedules for occupied and unoccupied situations. The primary goal is to design a system that is more efficient while staying on budget.

Noon-12:30 p.m.

Project: Classroom HVAC Redesign – Components
Sponsor: Siemens; Penn State Harrisburg Maintenance & Operations
Group: David Amrhein, Nicholas Hunt, Steven Kinney, Donald Morgan
Faculty Adviser: Dr. Richard Ciocci

Siemens and the Penn State Harrisburg Office of the Physical Plant partnered with engineering students to renovate Olmsted Building room E209. This project featured the mechanical engineering heating, ventilating, and air conditioning (HVAC) design portion of the renovation. The HVAC system had to be redesigned with either a new type or an updated replacement of the existing system. The chosen system needed to fit within the existing space, be easy to use and maintain, and be energy and cost effective. The final HVAC system that was designed and chosen was able to meet most of the aforementioned goals and was an upgrade on the previously existing system.

E252 Olmsted Building

Co-Moderator: Dr. Esfakur Rahman; Daniel Massey

9:00-9:30 a.m.

Project: Turbocharger Conversion
Group: Patrick Maff, Ben Steele, Michael Torcaso
Faculty Adviser: Daniel Massey

The goal of this project is to twin turbocharge a 2011 V6 Ford Mustang. As no bolt-on kits exist for the vehicle, an entire turbo system had to be developed and fabricated. In doing so, the hope is to

demonstrate that turbocharging is a fuel efficient and cost effective solution for increasing engine power without increasing engine size.

9:30-10:00 a.m.

Project: Deck-Over Trailer Ramp Reconfiguration
Group: Tyler Adcock, Zachary Russo, Devin Sheldon
Faculty Adviser: Daniel Massey

The traditional wedge ramps found on a deck over trailer have been reconfigured to incorporate flip out extensions and heels. The extensions decrease the angle while in use and the heels add extra support. When the ramps are folded in the transportation position, they hold true to the wedge ramp style and extend the deck portion of the trailer by almost four feet.

10:00-10:30 a.m.

Project: The Effect of Roof Color on Ambient Temperature (Continuation)
Sponsor: Carlisle Construction Materials (CCM)
Group: Jeremy Kuykendall, John Phan, Steven Marrero, and Matt Adams
Faculty Adviser: Dr. Esfakur Rahman

Urban environments can become hotter than their surroundings, known as the "heat island effect." The color of a commercial roofing system has a direct effect on surrounding building temperature, roof subsurface moisture content, internal building temperature regulation, building energy use, greenhouse gas emissions, and ultimately human health.

The current general consensus in the commercial roofing community is that a white roof will cut energy costs by decreasing internal building temperature, and also decrease roof surface temperature, therefore decreasing temperatures in the urban environment. Upon preliminary investigation, Carlisle Construction Materials believes there may be a flaw in this logic.

The primary goal of this project will be to set up a rooftop experiment to monitor temperature, heat flow, and weather conditions above the surface of a black and a white roofing system, to determine which roof color contributes to increased air temperatures, and report any findings. The secondary goal, will be to set up another rooftop experiment to monitor roof subsurface moisture levels for a black and a white roofing system. All data will be collected and logged wirelessly via HOBOware software so that it can be transferred to spreadsheets and graphed for further analysis. Both experiments will collect data for the duration of one year, after which a determination of which color roofing system contributes more to heat islanding can be declared.

10:30-11:00 a.m.

Project: Biodiesel
Group: Michael Muhammad, Ryan Borger, Joseph Patton
Faculty Adviser: Dr. Esfakur Rahman

Used cooking oil is useless to most households or commercial businesses. Current methods of disposal are simply throwing it away or freezing. Some commercial businesses sell or donate it to biodiesel companies in order to convert the used oil into biodiesel fuel. The design objectives are to process the used cooking oil, monitor the quality of oil, monitor the levels of filtration when mixing chemicals, find uses for non-used materials and construct an easy disassembly method, all while maintaining a clean and safe work environment. The main constraint is to keep the system at a small scale with easy disassembly. This biodiesel project is intended to create an automation process that will successfully turn used cooking oil into biodiesel fuel. The group will assemble a system that can intake cooking oil through a filter mounted on the reaction drum. With the introduction of heat, chemicals, and circulation, the cooking oil will be refined into useable bio diesel.

E224 Olmsted Building

Moderator: Michael Dideban

9:00-9:30 a.m.

Project: Raspberry Pi Monitored Chemical Scrubber
Sponsor: TE Connectivity
Group: Jason John, Sarah Shehata, and Kyle Lewis
Faculty Adviser: Dr. Brian Maicke

This project is focused on adding monitoring capabilities to an existing chemical scrubbing system at TE Connectivity. The chemical scrubber system consists of three tanks, an incoming water system, a reverse osmosis water filtration system, and two pumps. Unpredictable evaporation rates have caused the water level in the tanks to lower and for pumps to occasionally run dry. In order to fix these problems, level sensors, pump controls and fault sensors will be added to the system and controlled with a Raspberry Pi microcomputer. The monitoring system will warn a user before levels become critical and give controlling capabilities to take care of any issues.

9:30-10:00 a.m.

Project: Optimizing Heat Transfer in Industrial Mixers
Sponsor: Readco Kurimoto LLC.
Group: Angelia Folkenroth, Shaynia Guerriero, Timothy Cassel, and Derek Leaman
Faculty Adviser: Dr. Brian Maicke

Readco Kurimoto LLC, in York, Pennsylvania, designs and manufactures continuous process mixing machines for a variety of markets including pharmaceutical, cosmetic, food, and pigment companies. When mixing dry ingredients into liquids throughout a continuous process, a homogeneous stage is achieved more readily and with more variety of materials when heat is added. The primary goal of the project is to examine this process and optimize the heat transfer through the barrel. To achieve this goal, the heat transferred through the metal and into the center barrel is analyzed and a redesign is proposed to optimize the heat transfer while minimizing computer numerical control labor costs.

10:00-10:30 a.m.

Project: Buell Cyclone Analysis Fixture
Sponsor: Emtrol-Buell Technologies
Group: James Shaffer, Andrew Callaghan, and Tyler Weber
Faculty Adviser: Dr. Brian Maicke

In spring 2014, a test stand was built to analyze the performance of a cyclone separation system. During initial testing, several issues arose with the fixture design involving some of its components. The goal for this semester is to redesign and rebuild the fixture for improved performance. The support structure will be rebuilt to provide a more solid base for the blower assembly, cyclone, and data acquisition equipment. The inlet duct will be reconfigured to improve the velocity profile of the air entering the cyclone. The adjustable length outlet tube will be controlled by computer via a motor and chain drive system to ensure accurate movement and control. The catalyst feed system will be reconfigured to provide a more consistent catalyst incorporation into the inlet air flow. All hardware will be monitored and controlled through a touch screen display. Several test runs will be performed to ensure the equipment operates as planned.

10:30-11:00 a.m.

Project: The Future of Mars Habitation
Group: Peter McGowan, Nick Navetta, Brian Jaeger, and Tom Chaney
Faculty Adviser: Dr. Brian Maicke

This project is based off of the NASA Revolutionary Aerospace Systems Concept – Academic Linkage (RASC-AL) competition. The project goal is to design a self-sufficient human habitat on Mars, capable of hosting up to 24 inhabitants. After 2054, the habitat must be capable of operation without any support from Earth. All aspects of the mission must be accounted for in the project including transportation, scientific research, and in situation resource utilization. The proposed solution uses a modular base to house astronauts and equipment during construction of the permanent outpost.

E254 Olmsted

Moderator: Dr. Harris Imadojemu

9:00-9:30 a.m.

Project: Powered Exoskeleton
Group: Jon Troutman, Luke Hoffman, and Zack Wakefield
Faculty Adviser: Dr. Amit Banerjee

The objective of the project is to build a pneumatically assisted elbow joint to help in lifting heavy objects over an extended period of time. The metric used is lifting endurance with and without the joint. The goal is to increase endurance (amount of repetitions) by 50%. The exoskeleton is a robotic arm that is fixed underneath the user's arm. The arm employs a kill safety switch in case of emergency.

9:30-10:00 a.m.

Project: Characterization of Flexible Materials
Sponsor: TE Connectivity
Group: Mike Ninh, Mohammad Ibrahim, Osman Eltayeb, Thomas Tallett
Faculty Adviser: Dr. Amit Banerjee

The purpose of this project is to perform compression tests of fluorosilicone rubber samples to collect data, analyze the mechanical properties and use them as input to FEA simulations using ANSYS workbench. The datasheet for fluorosilicone rubbers, as provided by suppliers, does not provide enough detail for accurate prediction of behavior in the real world using computer simulations. By performing tests of the material to achieve a higher accuracy in mechanical property estimation, a methodology is created to allow for repeatability in simulation.

10:00-10:30 a.m.

Project: Hand Tool Force Monitor
Sponsor: TE Connectivity
Group: Donald Baker, Carly Ann Strawn, Laura Gindlesperger, Jacob Baum
Faculty Adviser: Dr. Amit Banerjee

The objective of this project is to design and prototype a device that attaches to an existing hand crimping tool to alert users whether or not the tool produced enough force to complete a conforming crimp. The prototype must be functioning, incorporated into the hand tool, durable, portable, and easy to use. Users must have easy access to crimp performance data and tool cycle count. This technology can be used to improve customer crimp quality and ensure hand tools in service are being properly maintained.

10:30-11:00 a.m.

Project: SAE Mini Baja
Sponsor: TE Connectivity; Enders Insurance Associates; Polaris; Penn State Harrisburg School of Science, Engineering, and Technology
Group: William Dempster, Seth Fisher, Mike Neiswender
Faculty Adviser: Dr. Amit Banerjee

The Baja SAE® project simulates real-world engineering design projects as students are tasked to design and build an off-road vehicle that will survive the severe punishment of rough terrain. The project involves design, planning and manufacturing tasks found when introducing a new product to the consumer industrial market. Students must function as a team to design, build, test and race a vehicle within the limits of the rules.

11:00-11:30 a.m.

Project: University Rover Challenge
Sponsor: Penn State Harrisburg School of Science, Engineering, and Technology
Group: Aaron Lua, Ali El Atrash, Roger Casado, Daniel Fischer
Faculty Adviser: Dr. Amit Banerjee

The objective of this project is to conceptualize, design and build a wirelessly controlled, standalone, off-the-grid, mobile platform capable of cruising hazardous environment. The vehicle will utilize power and propulsion systems that are applicable to operation on the surface of Mars. A secondary objective is the creation of the first University Rover Club (URC) chapter at Penn State Harrisburg that would enable further development of the program for research and testing until suitable requirements for competition are met.

11:30 a.m.-Noon

Project: Restoration of Hershey Trolley
Sponsor: Friends of Hershey Trolley (FOHT)
Group: Steven Kline, Josh Troxell, Michael Smith, John D'Agostino
Faculty Adviser: Dr. Amit Banerjee

The objectives of this project are to restore Hershey Trolley's propulsion and braking systems to working order. The trolley was originally a third rail electrically powered passenger amusement ride located on the south side of Hersheypark that ran from 1910 to 1971. It was recently discovered in a storage unit and the Friends of Hershey Trolley (FOHT) wanted to have it restored. The redesign needed to be completely independent of any outside power source while keeping the original cosmetic look and patented mechanical brakes from the original design. The redesigned drive and braking systems fit on the Hershey Trolley in its current configuration.

E258 Olmsted Building

Moderator: Dr. Issam Abu-Mahfouz

9:00-9:30 a.m.

Project: Hirschmann Automation and Control Console Protection Module
Sponsor: Hirschmann
Group: Cole Osborne, Shawn Harry, Zachary Light
Faculty Adviser: Dr. Ma'Moun Abu-Ayyad

The objective of this project is to design and develop a working model of a protection unit for the Hirschmann vScale D2 and D3 display modules. A protection model will be designed and developed for the D3 model, however, this design will be scaled down for the smaller D2 model as well. The first

phase of the project will be to research and develop potential designs to solve the current problem Hirschmann is having with these units. These modules have been implemented inside the cab of many cranes for some time, however, they have only recently been introduced to the weather and elements on external crane control panels. Not only is the effects of being exposed to the elements reducing the lifetime of the product, but the sun's glare is making it difficult for the operator to see the LED screen when using the display module. Potential designs that we are proposing will need to include a solution to one if not both of these dilemmas. Solidworks renderings will be made of the potential designs. The second phase will consist of construction and testing of design prototypes. Following the testing phase, improvements will be made in these designs.

9:30-10:00 a.m.

Project: Hirschmann Crane Control Unit
Sponsor: Hirschmann
Group: Ryan Houpt, Jason Smith, Carl Baxter, Michael Schisselbauer
Faculty Adviser: Dr. Ma'Moun Abu-Ayyad

This project is being completed for Hirschmann Automation and Control; a Belden brand. Belden is a large corporation that includes the brands of GarrettCom, Lumberg Automation, Grass Valley, and Hirschmann. Hirschmann specializes in the areas of automation and networking. Their services include industrial Ethernet, industrial connectors, fiber interfaces, and mobile machine controls. This project will be focusing on the aspect of mobile machine controls. In the area of mobile machine controls, Hirschmann develops sensors and control units for machinery, the applications of which involve cranes. The sensors are used to monitor the load weight, boom angle, wind speed, and other important factors for large scale overhead lifting. The sensor inputs are monitored through control units that can be integrated like the cScale, dedicated, such as the iScout series, or stand-alone. Cranes may also use safe load indicators (SLI), which can employ a CANbus system to monitor the sensor inputs on one screen. The two stand-alone control units currently distributed by Hirschmann are the D2 and D3. These two units are programmed using CODESYS, and can be used to perform operations of the crane through user input via the function keys and the rotary dial.

10:00-10:30 a.m.

Project Title: ArcelorMittal Cross Table Transfer
Sponsor: ArcelorMittal
Group: George DeRitter, Joe Samsell, Tylor Vosburgh, Andrew Chan
Faculty Adviser: Dr. Ma'Moun Abu-Ayyad

The project was proposed to Penn State Harrisburg over the past two years. The current problem is that the cross table transfer that is in place is causing mechanical and visual defects during the process of transferring the steel rails from 16 table to 16A. This is due to the fact that the rails are being pushed over 42 skid rails spaced out along the length of the steel rail. These skids, over time, are moving and changing elevation; this is causing some skids to carry more weight than others. The more pressure certain parts of the steel skids carry leads to mechanical defects on the side of the head and base of the rail. These mechanical and visual defects in the rail are not up to the customers' standards and may cause failure in the steel rails.

10:30-11:00 a.m.

Project: ArcelorMittal – 16 Table Cross Transfer
Sponsor: ArcelorMittal
Group: Andrew Kline, Andrew Metzker, Kyle Heintzelman, Scott Kramer
Faculty Adviser: Dr. Ma'Moun Abu-Ayyad

The ArcelorMittal steel plant, located in Steelton, Pennsylvania, produces steel railroad rails for different companies and applications nationwide. The steel is transferred through various roller lines and extruders during its manufacturing process. At one point during the manufacturing process, the rail must be transferred across the mill on a table from one extruder to another. The rails (at high temperature) are pushed over several skid rails on the table by a simple electric pushing mechanism. Over time, the skid rails of the table have moved and changed elevation which creates marks in the steel rails. The blemished surfaces are causing some rails to be recalled which is costing the company money and lost production time.

SPECIAL THANKS

On behalf of the School of Science, Engineering, and Technology, I would like to extend a special thanks to the Capstone Design Conference committee for their hard work and dedication in organizing this conference.

Dr. Rafic A. Bachnak, P.E.
Director; Science, Engineering, and Technology

Capstone Design Conference Committee

Dr. Shashi Marikunte, P.E.
Committee Chair

Lori Ricard

Mandy Thompson

Dr. Amit Banerjee

Dr. Robert Gray

Dr. Brian Maicke

Dr. Jeremy Blum, D.Sc.

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, 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 Return On Investment (ROI)
2. Work on "back burner" projects and help refine ideas
3. Help start-up and small companies with prototyping and development work (while flushing 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.

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Area businesses interested in sponsoring a project for next year's conference may find more details and submit a proposal at http://harrisburg.psu.edu/webform/capstone-design-engineering-proposal.