PROJECTS DAY 2016

SEATTLE U
COLLEGE OF
SCIENCE AND ENGINEERING

REAL WORK
REAL OUTCOMES

The Seattle University Project Center partners with businesses, government agencies and nonprofit organizations to bring challenging engineering design projects to our senior-level students. Over the course of the academic year, teams from the College of Science and Engineering work on industry-led projects in the fields of civil and environmental engineering, computer science and software engineering, electrical and computer engineering, environmental science and mechanical engineering.

The student teams are responsible for project management, scheduling and budgeting—plus design and delivery of a prototype, software application or proof of concept. Each team dedicates nine months and over 1,000 hours of work to the project. The students consult with their industry liaison weekly and present quarterly status updates in person.

The students gain valuable real-world experience in their fields and hone the project management and communication skills that place them ahead of their peers. Projects Day is the culminating event for the students, and it is our opportunity to thank the Project Center sponsors and faculty advisors.

If you'd like to learn more about sponsoring a project, please call (206) 296-2822 or email ProjectCenter@seattleu.edu.

WELCOME TO PROJECTS DAY 2016

For an entire academic year, the Seattle U students you're about to meet have applied their fundamental knowledge and skill in order to solve engineering design problems posed by sponsors from regional industry. Today's event is the culmination of their hard work.

The Project Center is one of the jewels in the crown of the College of Science and Engineering. The students gain valuable on-the-job experience, and it's clear that companies like what they see. Many of the students are offered full-time positions with the sponsoring companies. And many of our industry partners return with new projects for our students, year after year.

I encourage you to look through this booklet and identify some projects that interest you. Attend the team presentations and ask questions. Talk to the students and their industry liaisons during the poster session. I'm confident you'll be impressed with our graduates' ability to think on their feet and discuss technical issues.

I wish to thank the institutional sponsors who make this wonderful educational experience possible. I also want to thank the individual project liaisons and the faculty advisors who have worked with the teams throughout the academic year. Our ongoing relationship with our industry partners helps us prepare a new generation of engineers, computer scientists and software engineers, ready to step into the many exciting jobs awaiting them in the Puget Sound region and beyond.

Michael J Quinn

Michael J. Quinn, PhD
Dean, College of Science and Engineering

"The Seattle University engineering senior design project was an incredible opportunity to expand and apply my technical knowledge. It allowed me to utilize the skills I had developed in my coursework, research, and internships in order to successfully work with a team of fellow engineering students and complete a challenging, technically rigorous design project. Though our team faced many challenges, we discovered that we often learned new skills as we developed solutions. I plan to take the lessons I have learned from this project into my future career, where I am sure they will prove to be invaluable."

SARA BEERY, '16, ECE, MATH

"The SU engineering students come to the table with impressive problem-solving skills. They know how to get to the root of the problem. They start off at the beginning of the year with an unknown and they evolve into subject matter experts. We have built at least half a dozen of these SU team projects."

DAN O'SULLIVAN, PE,
SENIOR CIVIL ENGINEER
SEATTLE CITY LIGHT

SCHEDULE

MASTER OF SOFTWARE ENGINEERING PRESENTATIONS

THURSDAY JUNE 2ND, 6-9PM
STUDENT CENTER 130

6:00 PM—SOCIAL
6:30 PM—KEYNOTE SPEAKER, STEVE TOCKEY,
    Principle Consultant at Construx Software
    "What is Code?"
7:30 PM—STUDENT PRESENTATIONS

MSE 16.1 COSTCO Development Operations (DevOps) Dashboard
MSE 16.2 CRAIG SOFTWARE DEVELOPMENT GROUP PantryExpress
MSE 16.3 REI Big Data/Hadoop—Modeling the Impact of Weather on Sales Across Geographies

UNDERGRADUATE ENGINEERING AND COMPUTER SCIENCE PRESENTATIONS

FRIDAY JUNE 3RD, 11:45AM-6PM
SULLIVAN HALL, LAW SCHOOL

11:45AM-12:30PM—Check-in and Registration

12:30PM-12:40PM
Welcome to Projects Day 2016
Father Stephen Sundborg, S.J., President
Dean Michael Quinn, College of Science & Engineering

12:45 – 1:45 PM | PRESENTATION SESSION 1

ROOM C5
CEE 16.5 SISTERS OF MARY, MOTHER OF THE CHURCH AND COUGHLIN PORTER LUNDEEN Skagit Design of Self-Realization and Skills Development Center in Uganda for Early Mothers
CEE 16.2 SEATTLE CITY LIGHT Replacement and Retrofit Options for the Diablo Powerhouse Tailrace Bridge
CEE 16.1 SEATTLE CITY LIGHT Preparation of Post-Earthquake Inspection Manuals for Selected Buildings

ROOM C6
ME 16.1 FLOW INTERNATIONAL A-3000 Attachment
ME 16.2 INGERSOLL RAND Digital Air Flow Hour Meter
ME 16.3 THE LIGHTHOUSE FOR THE BLIND Set-Screw Assembly Station

ROOM 109
CS 16.8 PUBLIC RADIO INTERNATIONAL (PRI) Digital Platform and Infrastructure
CS 16.2 ASTRONICS SpecTRE (Specification Tool Reconfiguration Editor)
ECE 16.2 ASTRONICS Specification Engine

ROOM 110
ECE 16.1 GENERAL ELECTRIC Microgrid Model Demonstration with Raspberry Pi
ECE 16.3 SEATTLE UNIVERSITY Smart Solar Charging Kiosk for Less Economically Developed Countries
ECE 16.5 KILOWATTS FOR HUMANITY Remote Metering for Rural Electrification in Less Economically Developed Countries

1:45–2:00 PM—Break

2:00–3:00 PM | PRESENTATION SESSION 2

ROOM C5
CEE 16.7 ALDERWOOD WATER & WASTEWATER DISTRICT Picnic Point Wastewater Treatment Facility Outfall Upgrade
CEE 16.3 KING COUNTY, DEPARTMENT OF NATURAL RESOURCES AND PARKS Auburn Narrows: Process Based Restoration on the Green River
ENSC 16.1 SEATTLE PUBLIC UTILITIES Lake City Pond Restoration

ROOM C6
ME 16.4 MCKINSTRY Administration Building HVAC System Upgrade Analysis
ME 16.5 ROMAC INDUSTRIES, INC. Alpha 2.0
ME 16.6 MIKE LARSON Bicycle Comfort and Efficiency

ROOM 109
CS 16.3 AVALARA HS Code (Tariff Codes) Search Capabilities
CS 16.1 ASIAN COUNSELING & REFERRAL SERVICES (ACRS) DRAGON (Daily Record-keeping for ACRS's General Operational Needs)
CS 16.5 EXPEDIA Hotels-Now

ROOM 110
ECE 16.4 GRAKON, LLC BLE-Enabled Ambient Lighting for Truck Cabins
ECE 16.6 PACCAR Semi-trailer to Truck Communication
ECE 16.7 TACOMA POWER 12.5kv Power Cable Monitoring

3:00–3:15 PM—Break

3:15–4:15 PM | PRESENTATION SESSION 3

ROOM C5
CEE 16.4 SNOHOMISH COUNTY PUBLIC WORKS Snohomish County Bridge #214 Replacement Design
CEE 16.6 COVINGTON WATER DISTRICT Condition Assessment and Feasibility Study for Two Water Tanks

ROOM C6
INT 16.1 BROOKS RAND INSTRUMENTS Redesign and Improve Gold Trap Desorption Module
INT 16.2 KENWORTH TRUCK COMPANY Tractor/Trailer Coupling System

ROOM 109
CS 16.6 FRED HUTCHINSON CANCER RESEARCH CENTER Fred Hutch Interactive Campus Tour
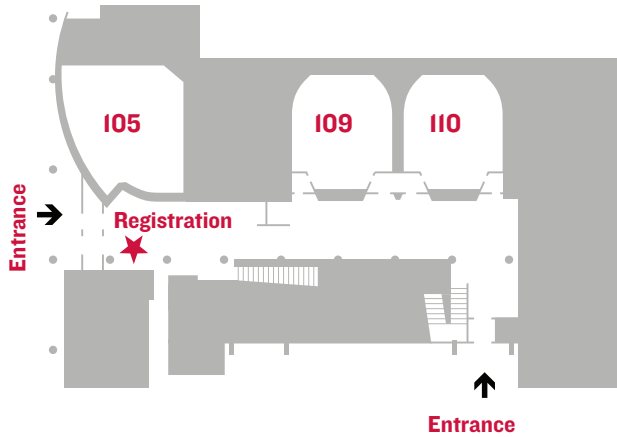**CS 16.7 MICROSOFT** Corporate Assistant Using Cortana
CS 16.4 COMMERCEHUB CommerceHub Feed Auditor
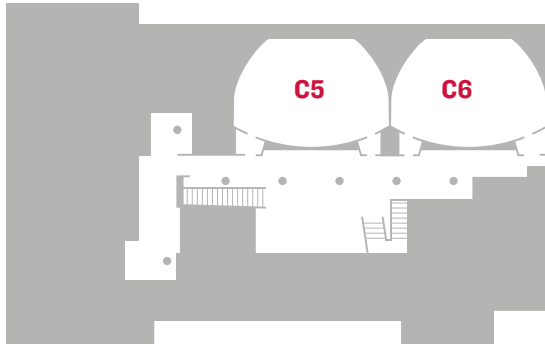
4:15–5:00 PM—Poster Session

5:00–6:00 PM—Reception

SULLIVAN HALL MAP

MAIN LEVEL

105

109   110

Entrance →

Registration ★

↑
Entrance

LOWER LEVEL

C5   C6

PROJECTS

MASTERS OF SOFTWARE ENGINEERING

MSE 16.1 | DEVELOPMENT OPERATIONS (DEVOPS) DASHBOARD
SPONSOR: Costco

SPONSOR LIAISONS: Shrikant Palkar, Lee Johnson
FACULTY ADVISOR: Prof. Israel Hilerio, PhD
STUDENTS: Jayasree Ammanabrolu, Laura Chang, Craig Colomb, Firoozeh Mehri Kalantari, Hasnath Naseer Umul

Costco utilizes a wide variety of tools across their IT division, which provides an opportunity for managers to view statuses. Unfortunately, these tools are not integrated and do not give managers a unified view of all of their IT projects. Our project, the Costco Dashboard, is an integrated IT operations console developed to provide a consistent, unified view of Costco's IT projects to Costco managers, directors, and vice presidents. The dashboard aims to automate the gathering of statuses from multiple DevOps tools and presents a unified view of all of their projects. This enables managers to view the status of all their projects from a single location.

Our solution provides an Azure deployed Software as a Service (SaaS) dashboard that integrates with Costco DevOps systems via REST API adapters and email adapters. It leverages Google credentials to provide a Single Sign-On authentication solution.

MSE 16.2 | PANTRYEXPRESS
SPONSOR: Craig Software Development Group (CSDG)

SPONSOR LIAISONS: Ken Craig
FACULTY ADVISOR: Prof. Michael Koenig
STUDENTS: Jyotsnasudha Fanidam, Justin Pirtle, Manasa Sandhya, Ashwatha Reddy, Mark Schuerman

Our MSE team is building PantryExpress (formerly ClientCardFB4), a web-based, cloud-based application to help food pantries (food bank) distribute, track, and report on services provided to the community. The long-term goal of the project is to replace the ClientcardFB3 solution deployed at over 150+ food pantries across the state of Washington. Our project scope is a Phase 1 release towards this goal, with features defined in our product roadmap including food service disbursements and tracking, food donor registration, food donation tracking, and reporting. These capabilities are the lifeblood of any food pantry as they allow the pantry to seek funding from different sources, receive food disbursements from larger food distribution networks, and continue to operate.

MSE 16.3 | BIG DATA / HADOOP—MODELING THE IMPACT OF WEATHER ON SALES ACROSS GEOGRAPHIES
SPONSOR: REI

SPONSOR LIAISONS: Derek Chavez, Ashmita Patnaik, Vasu Sharma, Sarah Schukantz, Vijaya Vaddireddy
FACULTY ADVISOR: Prof. Michael Koenig
STUDENTS: Fahad Ahmed, Rekha Choudhary, Sukhman Ghumman, Sreelakshmi Kotagiri, Lyza Thenumkal

REI generates huge amounts of valuable clickstream data from its retail and online operations. Their business intelligence team wants to model and analyze the impact of weather on sales across different geographies by processing and finding correlation between huge clickstream data and weather data. The focus is on utilizing Hadoop technology and big data analytics to provide useful insights for the business to have the power of informed decision making.

The MSE 16.3 team divided the project into three phases. In the first phase, the team carried out requirements gathering and rigorous research to set up the hardware required for the project. The team selected two KPI's important to REI: Sales Conversion and Average Order Value. In the second phase, the team concentrated on running an end-to-end scenario for the sales conversion KPI. This was done by finding correlation between sales conversion and weather for cities in the U.S. The raw clickstream file was fed into a Hadoop cluster (Cloudera virtual machine) and stored in Hive data warehouse. A weather extraction job extracts weather data from an open source weather API and stores it in Hive. Hive Query language was used to find correlations. Results were visualized in Tableau by creating interactive dashboards. In the third phase, the team intends to find correlations between average order value and weather. To promote scalability, the team will also be working to correlate between clickstream data and forecasted weather data.

CIVIL AND ENVIRONMENTAL ENGINEERING >>>>

CEE 16.1 | PREPARATION OF POST-EARTHQUAKE INSPECTION MANUALS FOR SELECTED BUILDINGS
SPONSOR: Seattle City Light

SPONSOR LIAISON: Robert Cochran, PE, SE
FACULTY ADVISOR: Prof. Jhon P Smith, PhD, PE
STUDENTS: David Clapp, Jessica Lim, Jacob Locke, Connor Moore

Seattle City Light (SCL) requested the team to create building-specific inspection manuals for four of their main operation facilities; Systems Operation Center, North Service Center, and South Service Center Building A and Building B. The manuals will be used by trained employees on site to conduct a preliminary building inspection following an earthquake to determine if each building is safe for occupancy and operations. Although similar to the Applied Technology Council's, ATC-20 inspection procedures, the manuals will guide the user to inspect critical components previously identified through the implementation of American Society of Civil Engineer's, ASCE-41 seismic evaluation process. In addition to the inspection manuals, SCL asked the team to develop conceptual-level seismic retrofits for the South Service Center's Building B.

CEE 16.2 | REPLACEMENT AND RETROFIT OPTIONS FOR THE DIABLO POWERHOUSE TAILRACE BRIDGE
SPONSOR: Seattle City Light

SPONSOR LIAISONS: Dan O'Sullivan, PE, Nancy Chin, PE
FACULTY ADVISOR: Prof. Joshua Pugh, PhD, PE
STUDENTS: Jorge Esparza, Skyler Frasier, Constance Kuney, Michael Miller II

A recent inspection of the Diablo Powerhouse Tailrace Bridge found that the bridge's lead-based paint is failing and some structural members are showing signs of corrosion. Seattle City Light (SCL) requested the design team to address these issues in a cost-effective and timely manner. The Diablo Powerhouse is a part of the Skagit Hydroelectric Project, which supplies 20% of Seattle's electricity. The Tailrace Bridge is the only way to cross the Skagit River into the Reflector Bar area, where the equipment entrance to the Diablo Powerhouse is located. The bridge spans across the outflow from the Powerhouse. The lead paint falling into the river could adversely impact the environment. The team explored three potential solutions to removing the lead paint and dealing with the corrosion: rehabilitating the bridge, replacing the bridge, and repurposing the existing bridge while constructing a new bridge in a different location. They developed each option to 30% design. The team then took SCL's preferred option to 60% design. The final deliverables included drawings, calculations, a cost estimate, and a basic construction plan.

CEE 16.3 | AUBURN NARROWS: PROCESS BASED RESTORATION ON THE GREEN RIVER
### SPONSOR: King County, Department of Natural Resources and Parks

SPONSOR LIAISONS: Alex Hallenius, PE and Todd Hurley, LEG
FACULTY ADVISOR: Prof. John Wesley Lauer, PhD, PE
STUDENTS: Alex Buescher, Kelsey Hopkins, Natasha Howe, John Lasley

Over the past century, human development has strongly influenced the Green River. Floodplain development, channel bank armoring, and operation of the Howard Hansen Dam have severely limited the natural processes that historically maintained riparian habitat. Regional declines in populations of chinook salmon and steelhead trout have led to the listing of these species as threatened under the Endangered Species Act. Over the past 15 years, King County's Department of Natural Resources and Parks, Water and Land Resources Division has undertaken efforts to improve the degraded habitat by restoring natural processes along the river. As part of these efforts, the design team CEE 16.3 was tasked by King County to develop a preliminary restoration plan for the river and surrounding floodplain at Auburn Narrows Park. The team studied the site to identify design alternatives that would re-initiate natural and sustainable habitat-forming processes. Alternatives evaluated included levee removal, engineered log jam construction, and side channel modification. The design team completed a site characterization, generated criteria to rank design alternatives, identified design alternatives, and developed a 30% design of the selected alternative.
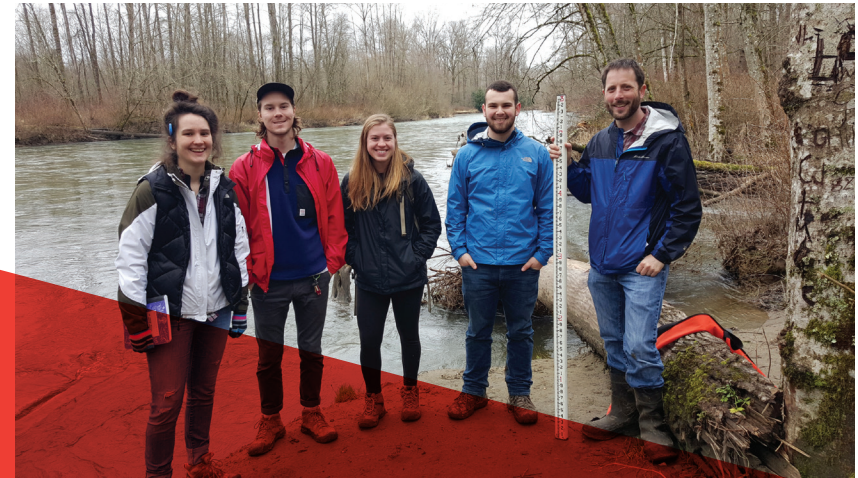
CEE 16.4 | SNOHOMISH COUNTY BRIDGE #214 REPLACEMENT DESIGN
SPONSOR: Snohomish County Public Works

SPONSOR LIAISONS: Max Phan, PE, Anh Tuan Dinh
FACULTY ADVISOR: Prof. Mark Siegenthaler, PE
STUDENTS: Adam Fecher, Nataya Rakpanitmanee, Thomas Sandri, Greg Wise

Snohomish County Public Works Department requested the design team to create a type, size, and location (TS&L) report for the replacement of Snohomish County Bridge Jordan Creek Bridge #214. The bridge is located on Jordan Road, connecting Arlington and Granite Falls, Washington. Due to its narrow lane width, inadequate stopping sight distance of the bridge approaches, and posted load restrictions, the structure has been identified as functionally obsolete. The design team provided Snohomish County with three replacement options, including an in-depth analysis of the recommended alternative. The TS&L report includes a hydraulic analysis of Jordan Creek, potential scour depth, proposed utility relocations, preliminary drainage design, substructure and superstructure options and analysis, and preliminary cost estimation of the bridge replacement. The new bridge complies with the 2016 Snohomish County Engineering Design and Development Standards, and will minimize the realignment of Jordan Road. In addition, a prefabricated detour bridge was recommended to temporarily accommodate the traffic during construction.

CEE 16.5 | DESIGN OF SELF-REALIZATION AND SKILLS DEVELOPMENT CENTER IN UGANDA FOR EARLY MOTHERS
SPONSORS: Sisters of Mary, Mother of the Church and Coughlin Porter Lundeen

SPONSOR LIAISONS: Cory Hitzman PE, SE, LEED A.P, Rachel Vranizan EIT, Sr. Elizabeth Namazzi
FACULTY ADVISOR: Prof. Nathan Canney, PhD, PE
STUDENTS: Trevor Coffman, Andrew McAferty, Steven Millett

In Uganda, women who become pregnant out of wedlock often face expulsion from their family and community. To help them, Sister Namazzi along with the Sisters of Mary, Mother of the Church, plan to build facilities where the women can receive medical treatment, housing, education, and a supportive community. The Self-Realization and Skills Development Center is composed of three buildings: a health clinic, a dormitory, and an education center. Sister Namazzi provided conceptual floor plans for the center. The design team completed the structural design of the roof, walls, and foundation for the three buildings. The design was based on locally available materials and practices. Deliverables for the project included: architectural models for each building; truss design including final geometry, member sizing, and supporting analysis; wall design including shear wall locations and design to resist lateral loads; and foundation design including detailed connections to walls and bearing calculations.

CEE 16.6 | CONDITION ASSESSMENT AND FEASIBILITY STUDY FOR TWO WATER TANKS
SPONSOR: Covington Water District, Gray and Osborne Inc.

SPONSOR LIAISON: Tom Keown, PE, Russ Porter, PE, Myron Basden PE, SE, Lance Porter, PE
FACULTY ADVISOR: Prof. Nima Ala, PhD, PE
**STUDENTS:** Trad Alroweilly, Jonathan Cracolici, Sean Hayter, Taylor Spencer

Covington Water District (CWD) provides water to more than 50,000 consumers in southern King County, WA. Over a decade ago, CWD concluded that several of their nine storage reservoirs were structurally deficient and likely to fail in the occurrence of a seismic event. The design team performed a structural analysis of the two existing reservoirs, Tanks 1A and 1B, and developed economical structural retrofit solutions in compliance with current seismic design code. Furthermore, in order to size the tank appropriately, the team used the Department of Health (DOH) Water System Design Manual and the CWD Water System Plan data to effectively size the design of a new tank with a larger capacity of approximately 4 million gallons. In addition to structural design, the design process for the new tank also included site plan tasks related to storm water management and wetland mitigation.

CEE 16.7 | PICNIC POINT WASTEWATER TREATMENT FACILITY OUTFALL UPGRADE
### SPONSOR: Alderwood Water & Wastewater District
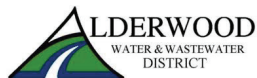
SPONSOR LIAISONS: Jeff Clarke, Paul Richart, PE, Josiah Hartom
FACULTY ADVISOR: Prof. Michael Marsolek, PhD
STUDENTS: Larissa Grundell, Abbie Lorensen, Kristin Ramey, Isabella Schwartz

Alderwood Water & Wastewater District requested the team to evaluate the current condition and capacity of the Picnic Point Wastewater Treatment Plant's aging marine outfall. The outfall conveys treated wastewater effluent from the plant to a diffuser that evenly distributes flow into the Puget Sound. Given the material and age of the pipe, it was uncertain if its condition or capacity would be sufficient to support the growing service area and concurrent increased flowrate. The existing conditions were assessed via an internal and external inspection of the outfall. This information was incorporated into computer models that determined the flow capacity of the outfall, pipe condition and diffuser performance. Based on these results, the team developed preliminary design alternatives and a preferred option for the outfall and diffuser that would accommodate increased flows and comply with local and federal regulations.
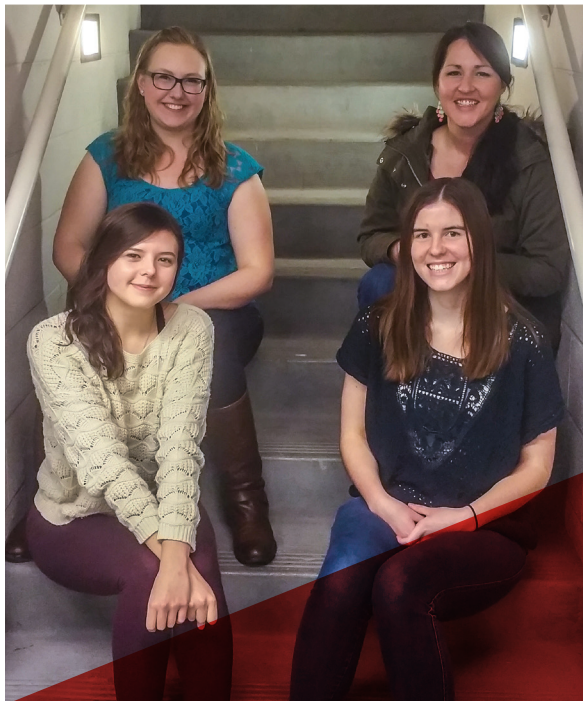
COMPUTER SCIENCE

CS 16.1 | DRAGON (DAILY RECORD-KEEPING FOR ACRS'S GENERAL OPERATIONAL NEEDS)
SPONSOR: Asian Counseling & Referral Service

SPONSOR LIAISONS: Hai Ton, Ty Trang, Tracee Lee
FACULTY ADVISOR: Prof. Sheila Oh
STUDENTS: Stuart Evans, Jolie Kawasaki, Sheng-Hao Lin

Asian Counseling and Referral Service (ACRS) is a non-profit organization that supports Asian Americans, Pacific Islanders, and other underserved communities in King County. As part of their operations, ACRS manages several food banks and a senior center, called Club Bamboo, located throughout the Seattle area. Detailed attendance records of daily activities at the food banks and Club Bamboo help plan for future events and provide information to funders for continued support. The previous process of taking attendance across all locations has been hard to manage due to inconsistencies resulting from no centralized set of data.

ACRS asked for a scheduling and attendance application that has low set-up costs, easy use, and can seamlessly integrate into their current system. This new system, DRAGON (Daily Record-keeping for ACRS's General Operational Needs), is a mobile-first web application that unifies the data and uses barcode scanners to expedite the attendance taking process across the food bank locations and Club Bamboo.

CS 16.2 | SpecTRE (SPECIFICATION TOOL RECONFIGURATION EDITOR)
SPONSOR: Astronics

SPONSOR LIAISONS: Douglas Brown
FACULTY ADVISOR: Prof. Aditya Mishra, PhD
STUDENTS: Joseph Bjorkman, Matthew Jordan, Andrew Miller, Elizabeth Phippen

Astronics designs and programs electrical systems for aircraft. Frequent changes in a customer's requirements for their specific application are Astronics' biggest cost and time expense as each requirement change warrants a recertification of the software for the whole system. Astronics wishes to isolate changes in customer's requirements from the certified software running the electrical system. In order to meet this need, our research project has been to develop a desktop application that allows an engineer to implement customer requirements through a series of logic gates that have access to the real-time state of the electrical components on the aircraft and can in turn update the state of other electrical components based on the customer's desired logic (requirements). With our tool, Astronics cuts down on the cost and engineering time associated with changing requirements by containing the requirement changes within the tool. To accommodate our tool, our partner ECE team is developing the certified software that interfaces between the output of our desktop application and the hardware on the aircraft.

CS 16.3 | HS CODE (TARIFF CODES) SEARCH CAPABILITIES
SPONSOR: Avalara

SPONSOR LIAISON: Jonathon Wiggs
FACULTY ADVISOR: Prof. Yingwu Zhu, PhD
STUDENTS: Hunter Hammond, Tyler Hartje, Kevin Inamasu, Joshua Oliphant

We are working with the tax company Avalara to create a search engine for the Harmonized System of tariff nomenclature (HS codes). HS codes are tax codes needed to calculate the correct tariff and tax amounts when shipping items internationally. It is challenging to find the right HS code ("needle") from thousands of HS codes ("haystack") for a user's query (often simple with a few words, yet ambiguous). For example, a brown female cow used specifically for milking and a black spotted female cow raised for meat could have vastly different codes, given a simple query "cow". Currently, there is no streamlined and accurate way to search through these codes for small to medium sized business owners. Based on the code base currently used by Avalara, team 16.3 aims to improve the search quality for the HS Code search engine by using machine learning techniques.

The search engine will be web-based and hosted on Avalara's network. In this project, Microsoft SQL Server 2012, C#, and ASP.net MVC, as well as the open source library WordNet, are used for data storage and software development. A naïve Bayes classifier will be employed to improve search accuracy from 20-30% to 80% or above. Moreover, a nested set structure for HS codes will be used to enhance search latency, e.g., within 1 ms.

CS 16.4 | COMMERCEHUB FEED AUDITOR
SPONSOR: CommerceHub

SPONSOR LIAISONS: Christopher Farah, Michael Cohen, Brett Duclos, Jared Stiff
FACULTY ADVISOR: Prof. Roshanak Roshandel, PhD
STUDENTS: Dennis Levin, Alexander Silverman, Samantha Spears, Christopher Watanabe

CommerceHub is an online transactional market service and demand-generation based company that specializes in helping retailers reach more potential customers through an online market, sell greater volumes of product, and offer retailers an expanded item catalogue beyond what they could achieve on their own. CS Team 16.4 built a web application that will afford CommerceHub's internal support teams the ability to access historic product data in a timely and intuitive manner to assess changes in the sales of specified products over time. The team developed the application using Node.js. The team then placed the application on Amazon's Elastic Beanstalk to allow the application to automatically scale based on the information stored within it.

CS 16.5 | HOTELS-NOW
SPONSOR: Expedia

SPONSOR LIAISONS: John Ostlund, Sundeep Bhatia, Lauren Sedillo, Ben Ha, Bianca Flaidar
FACULTY ADVISOR: Prof. Lin Li, PhD
STUDENTS: Emma Ogilvie, Ye Li, Lloyd Lopez, Joseph Valmonte

Our senior capstone project is a web application called Hotels-Now, developed for Expedia. It enables a user to input a location and retrieve back a map view of the nearest hotels. Each hotel displays its name as well as the lowest cost for a room in that hotel. Upon clicking a hotel, a user is transported to an informational page where details are provided about the chosen hotel. Additionally, there are boxes for the user to input their name, email, and check-in/check-out date if they are interested in booking that hotel. If filled out and submitted, the application will automatically check until the check-in date if the price has gone down and send an email notification back to the interested customer if the price does decrease.
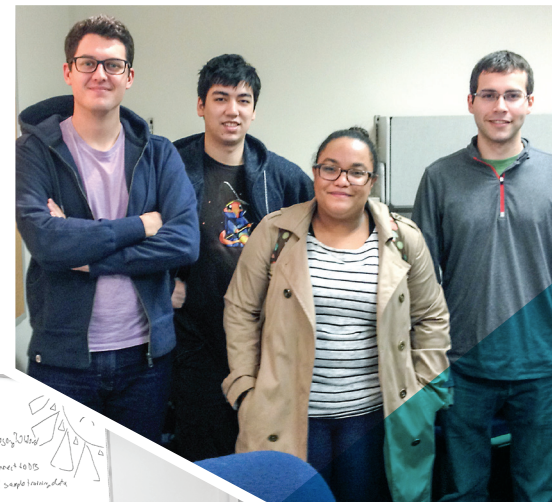
CS 16.6 | FRED HUTCH INTERACTIVE CAMPUS TOUR
SPONSOR: Fred Hutchinson Cancer Research Center

SPONSOR LIAISONS: Celeste Bernard, Sean Downing, Jeremy Fisher, Ieva Gaurys, Ian Schempp
FACULTY ADVISOR: Prof. Eric Larson, PhD
STUDENTS: Alec Branch, Jacob Newberry, Hannah Ostrander, Cody Pitts

Our project team has developed an interactive virtual tour of Fred Hutch's Seattle campus. This web application provides a 3D virtual environment that allows users to explore the Fred Hutch campus in a simple and intuitive manner. Users will be able to navigate through the exterior of the campus by clicking on various "hot zones" that encompass a geographical cluster of buildings. When a hot zone is clicked, the 3D environment will traverse to another view, showing the cluster of buildings in greater detail. In this new view, users will be able to click on various points of interest that contain images, text, and hyperlinks to give users more information about what the Fred Hutch campus has to offer. Through this 3D virtual tour, Fred Hutch hopes to showcase their vibrant and expansive campus to potential new employees, donors, and visitors.

CS 16.7 | CORPORATE ASSISTANT USING CORTANA
SPONSOR: Microsoft

SPONSOR LIAISONS: Fernando Hernandez, Martin Lammers, Nathan Orona, Mahendra Kumar Arvapalli, Anna Kotyk, Niharika Naidu
FACULTY ADVISOR: Prof. Ben Tribelhorn, PhD
STUDENTS: Bich Diep, Matthew Juskelis, Hai Tran

The Real Estate and Facilities (RE&F) department at Microsoft serves more than 42,000 employees and contractors throughout Redmond, Bellevue, and surrounding cities. Due to a large number of commutes every day, Microsoft sees the amount of gas consumption and the high demand of parking garages as a problem. Five transportation services are provided by the corporation for its employees: internal services (shuttle and commuter), Stita Taxi, RideShare, Luum, and King County Transportation. Although the services have covered most of the Puget Sound area, only 30% of the employees are utilizing them on a daily basis. This project, a collaboration between RE&F and Microsoft Finance and Professional Services IT, aims to unify and simplify the user experience based on the five disparate systems. The expected outcome is to reduce single occupancy vehicles, decrease the ecological impact, and ultimately improve both individual and community productivities.

CS 16.8 | DIGITAL PLATFORM AND INFRASTRUCTURE
SPONSOR: Public Radio International

SPONSOR LIAISONS: Lukas Dickie
FACULTY ADVISOR: Prof. Adair Dingle, PhD
STUDENTS: Nicholas Simons, Erik Thorne, Justin Trimachi, Jackson Van Dyck

Public Radio International (PRI) is a global non-profit media organization that strives to support content development across web, mobile and social media platforms. Its software infrastructure enables the creation and distribution of news and stories as well as the marketing of similar content produced by other media organizations. Currently, the Story Container component used for writing and editing stories is difficult to maintain and is not easily enhanced. The present application also cannot be open-sourced for other non-profit news organizations to use. Using Javascript, JQuery and HTML5, our team built a new Story Container—making embedding media content into new articles and editing of current articles a much easier task.

ELECTRICAL & COMPUTER ENGINEERING

ECE 16.1 | MICROGRID MODEL DEMONSTRATION WITH RASPBERRY PI
SPONSOR: General Electric (formerly Alstom Grid)

**SPONSOR LIAISONS:** Nhung Tran, Tommy Wong
FAULTY ADVISOR: Prof. Shiny Abraham, PhD
STUDENTS: Benjamin George, Loren Klemesrud, Ignatius Siaputra, Steve Wilson

General Electric (GE) offers services that transform the ways in which electrical grids are managed. Seeking ways that innovative technologies can be applied to an evolving utility industry, GE tasked team ECE 16.1 with creating a microgrid monitoring system that interfaces with their proprietary e-terracontrol software using a Raspberry Pi in conjunction with an Android smart watch application. For this project, our team constructed a model of Seattle University's Bannan Building, consisting of six floors lit independently using LEDs, 12V battery and solar power channeled through a system of regulators and relays. The Raspberry Pi is in constant communication with e-terracontrol using the DNP3 communications protocol. When a fault is detected in the system, e-terracontrol sends an alarm message to the Android app, which alerts the user with visual and audio notifications.
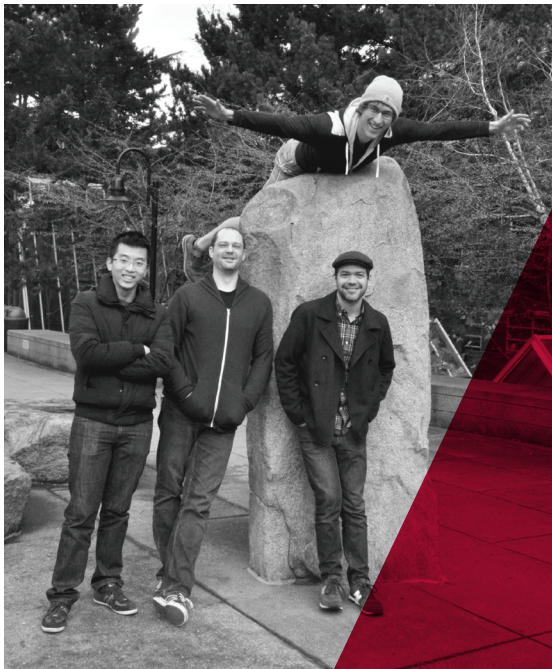
ECE 16.2 | SPECIFICATION ENGINE
SPONSOR: Astronics

SPONSOR LIAISON: Doug Brown, John Haynes
FACULTY ADVISOR: Prof. Maren Nelson
STUDENTS: Sara Beery, Tor Brueckmann, Edwin Liam, Balin Lusby

Currently the certification authorities require recertification of in-flight software applications any time their operable code is modified. This requires great expense and time for the company producing avionic solutions. The goal of this project is to move towards more generic "specification driven programming" that will not require recompilation every time the customer decides to make a change to their requirements. We will shift the burden of changes of the system away from the hardware manufacturer and onto the customer. Because changes to overall layout specification will not impact the development schedule of Astronics, it will give them a competitive advantage. The project minimizes the required number of prototype builds per project, decreasing material consumption and lowering cost and environmental impact. The cost to Astronics is further decreased because of the versatility of the system, which can run on any hardware platform. It will impact the greater community by ensuring that Astronics customers can design to their own requirements internally without the risk of introducing errors when communicating those requirements clearly and accurately back to Astronics. Astronics will be able to provide superior cost and flexibility, which we anticipate could increase its market share.

ECE 16.3 | SMART SOLAR CHARGING KIOSK FOR LESS ECONOMICALLY DEVELOPED COUNTRIES
SPONSOR: Seattle University

SEATTLEU

SPONSOR LIAISON: Prof. Henry Louie, PhD, Matthieu Bach
FACULTY ADVISOR: Prof. Steve Szablya, PE
STUDENTS: Dave Goldsmith, Sergey Russu, Keiko Schleicher, Natalie Swope

Seattle University requested that team 16.3 work with the non-profit organization KiloWatts for Humanity (KWH) to design: 1) a 2.25kWsolar powered microgrid system for Chalokwa, a rural African village in southern Zambia that has no access to electricity, and 2) an improved Data Acquisition System (DAS) that monitors and communicates the health of the microgrid in real time. The microgrid will operate as an energy kiosk during the day—offering clean, reliable energy to the community. The DAS will send data packets to a cloud server in one-minute intervals and then translate the data to a dashboard, where the health of the system will be displayed graphically. The team designed the energy kiosk and then designed and built a DAS that is capable of transmitting data from 14 microgrid sensors. It can also send alerts when the DAS predicts that the microgrid is in trouble. The DAS is well documented with a user manual that includes installation instructions. Upon request, it will be distributed to other microgrid energy projects around the world. The data collected from these projects will allow the operators to know the real time health of the system. The data will also be used to assess the sustainability and long-term impact to identify the success factors for the constant improvement of best design practices.

ECE 16.4 | BLE-ENABLED AMBIENT LIGHTING FOR TRUCK CABINS
SPONSOR: Grakon, LLC

Grakon

SPONSOR LIASON: Dr. Kaustuva Acharya, Kevin Hay, Thomas Major
FACULTY ADVISOR: Prof. Robert Heeren, PhD
STUDENTS: Jason Andersen, Timothy Linscott, Thuy Nguyen

As a leader in commercial vehicle lighting, Grakon wants to stay at the frontier of technology, pushing the boundaries of customer expectations by bringing new and intuitive lighting solutions to the industry. Grakon requested team ECE 16.4 to develop a next-generation Android-based personalized lighting system for the commercial vehicle cab interior. The lighting system is controlled by an application on the cab operator's Android device where operators can modify and save their preferences for each lamp's color and intensity. These preferences are then automatically uploaded hands-free via Bluetooth Low-Energy (BLE) to the system upon the operator entering the cab. The system is built on a complete Printed Circuit Board package with a custom chip solution installed inside the truck dashboard. Our model controls four separate RGB LED lamps positioned throughout the interior of the cabin to allow the operator to maximize their comfort throughout the day.

ECE 16.5 | REMOTE METERING FOR RURAL ELECTRIFICATION IN LESS ECONOMICALLY DEVELOPED COUNTRIES
SPONSOR: KiloWatts for Humanity

KWH

SPONSOR LIAISON: Steve Szablya, PE
FACULTY ADVISOR: Prof. Kevin Lybarger
STUDENTS: Eli Gatchalian, Alex Kvenvolden, Yin Mak, Emily Morris

Kilowatts for Humanity (KWH) is a nonprofit organization that works toward systemizing electrification projects in less economically developing countries through small-scale power grids. Presently, this organization combines a centralized energy kiosk and Portable Battery Kits (PBKs) to distribute energy throughout a community. However, KWH has been exploring the need for electrical distribution from the centralized energy kiosk directly to the customer's household, which would require a smart metering system. Commercial smart metering systems exist; however, commercial options for low-power micro grids in economically developing areas are limited. The requirements of the requested smart metering system entails measuring, calculating, and recording of each household's energy usage. To successfully accommodate the system requirements, a meter at the generation station and one at each household will be designed. The meter stationed at the generation station will be responsible for sending information to a server once per hour, storing a year's worth of time-stamped energy readings, texting capabilities, and communication with the customer's meters. The meters stationed at the individual's household will record their personal energy consumption. The smart metering system must provide energy usage statistics through a web-based application. This will provide the ability to remotely monitor and control the system.

## ECE 16.6 | SEMI-TRAILER TO TRUCK COMMUNICATION
SPONSOR: PACCAR

PACCAR Inc

SPONSOR LIAISON: Jerry Ross
FACULTY ADVISOR: Prof. Scott Bright
STUDENTS: Larisa Brown, Souliyo Vongdala, William Wright, Shiyi Zhang

PACCAR is a global truck company that specializes in premium light-, medium-, and heavy-duty truck design, manufacturing, and customer support. One area of improvement in the trucking industry is to increase driver awareness of the state of their trailer and cargo. Improved driver awareness facilitates faster response times addressing undesirable conditions in the trailer. PACCAR requested team ECE 16.6 to gather, process, and relay data from sensors they are installing on the trailers. The team developed an Android-based app for displaying the sensor data to the truck's driver. The app's users will have control over how the sensor data are collected, processed, and displayed through interaction with a central processing hub installed in the trailer. The system will help to empower drivers and provide analysis tools for PACCAR.
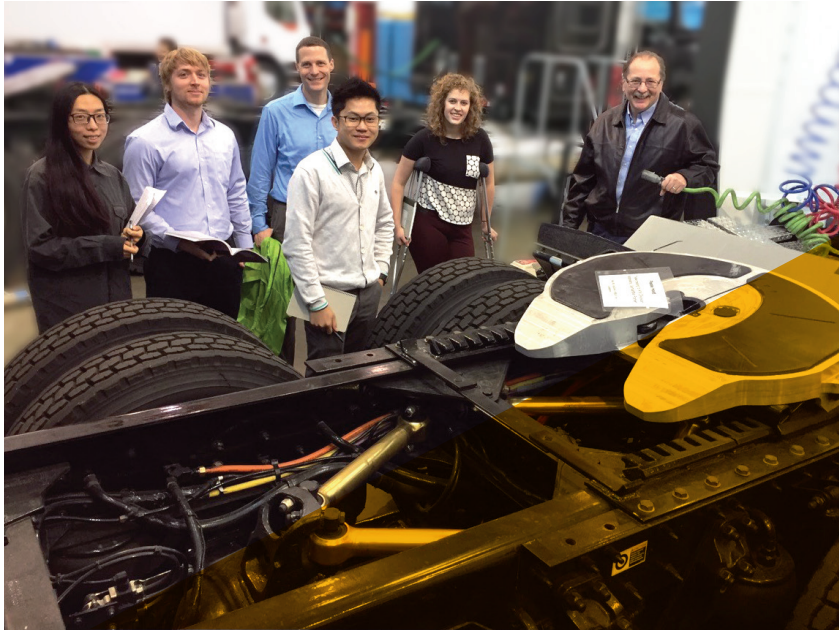
ECE 16.7 | 12.5KV POWER CABLE MONITORING
SPONSOR: Tacoma Power

TACOMA POWER
TACOMA PUBLIC UTILITIES

SPONSOR LIAISON: Rich Barrutia
FACULTY ADVISOR: Prof. Xusheng Chen, PhD
STUDENTS: Cameron Carlson, Andrew Dotson, Joshua Gilmore, Elizabeth Sblendorio

Tacoma Power uses underground cables to deliver power to the Tacoma metropolitan area. While the cables are underground, they are safe from most hazards such as inclement weather and car accidents. However, they are vulnerable to overheating; especially if the system is stressed. Tacoma Power has asked team ECE 16.7 to design a dynamic temperature sensing system to help with this vulnerability. Such a system consists of two primary building blocks; a hardware component and a predictive software package. Our team has identified both elements. The hardware component is a fiber optic-based distributed temperature sensing (DTS) system that uses Raman reflectometry. The predictive software is a real time thermal rating (RTTR) solution that employs complex differential equation algorithms to predict and model heat dissipation.

ENSC 16.1 | LAKE CITY POND RESTORATION
SPONSOR: Seattle Public Utilities

Seattle Public Utilities

SPONSOR LIAISON: Jonathan Frodge, PhD
FACULTY ADVISOR: Prof. Josephine Archibald, PhD
STUDENTS: Michael Bussiere, Eric Kennedy, Julia Moravec, Abigail Wells, Gabe Wheeler

In the northern Seattle neighborhood of Lake City, Seattle Public Utilities (SPU) constructed a detention pond to handle stormwater surges on Littlebrook Creek. Since construction in 1997, sediment and invasive Reed Canary Grass (RCG) have built up on the bottom of the pond, decreasing its flood capacity. This endangers homes in the area, as well as the newly revived salmon runs on Thornton Creek and Meadowbrook Pond downstream. SPU tasked team ENSC 16.1 with designing a plan to restore the pond's effectiveness and increase its value to the community, with particular focus on removing the buildup of sediment and RCG. The team conducted extensive depth probing to produce a GIS layer characterizing the buildup at the site. With this, the team presented a plan to SPU for removal of the sediment that details manpower, access, disposal, and invasive species containment. Water quality data upstream and downstream of the site were also collected to determine the pond's role in retaining or remobilizing water quality contaminants, and as a snapshot to compare after restoration. A review of literature on wetland construction and invasive species management informed a recommendation for redesign of the pond, including a method to increase sedimentation of particulate contaminants and institute regular sediment removal and pond maintenance.

INT 16.1 | REDESIGN AND IMPROVE GOLD TRAP DESORPTION MODULE
SPONSOR: Brooks Rand Instruments

SPONSOR LIAISONS: Ben Bloss, Gretchen Zelle
FACULTY ADVISOR: Prof. Yen-Lin Han, PhD
STUDENTS: Brent Campbell, Lawrence Lau, Robert Nesting, Derek Oh, Matthew Waltzer, Zu Pong Wu

Brooks Rand Instruments (BRI) designs and manufactures trace-level mercury analysis systems. BRI tasked team INT 16.1 with designing, prototyping, and testing an updated, gold trap desorption module, the TDMIII, to work with their latest mercury detector, the Model IV. The TDMIII is an improvement over its predecessor due to the addition of automatic modes of operation, improvements in the overall system durability, and improvements in the user safety. A notable mode of operation added to the TDMIII provided automatic air sampling functionality. The team designed a custom enclosure that houses all the selected components and matches the footprint of the Model IV. For the user interface, an LCD screen, buttons, and switches were integrated to allow direct access to functionality and relevant information.

INT 16.2 | TRACTOR/TRAILER COUPLING SYSTEM
SPONSOR: Kenworth Truck Company

SPONSOR LIAISONS: Stan Delizo, Ted Scherzinger
FACULTY ADVISOR: Prof. Yen-Lin Han, PhD
STUDENTS: Randip Bhachu, Jeff Derenthal, Rajinal Kumar, Abhinav Prasad, Corey Quan, Philip Sheridan

Accidents and damages can occur during the truck/trailer coupling process due to the operator's inability to see behind the tractor. Kenworth tasked team INT 16.2 with creating a semi-autonomous system to aid the operator in the coupling process. The coupling process requires the driver to align the fifth wheel, located at the back of the tractor, with the kingpin, located underneath the trailer. The fifth wheel is a circular ring with an opening to let the kingpin slide in and latch on. The solution uses an image processing camera and sensor system to measure the height and distance of the tractor in relation to the trailer. The data from the sensors and camera are processed through an onboard computer and used to adjust the tractor's speed, suspension height, and braking. Tractor steering is handled by the driver. A graphical interface lets the driver know how much they should turn the wheel to guide the tractor to the trailer and align the fifth wheel and kingpin.

MECHANICAL ENGINEERING ⟩⟩⟩

ME 16.1 | A-3000 ATTACHMENT
SPONSOR: Flow International

SPONSOR LIAISON: Sam Oyen
FACULTY ADVISOR: Prof. Joshua Hamel, PhD, PE
STUDENTS: Darryl Appelgate, Devin ball, Chester Lee, Jason Morin

Flow International develops ultrahigh-pressure waterjet technology for manufacturing and cleaning applications. The A-3000 Handtool is an ultrahigh-pressure cleaning tool used to remove paint, rust and contaminates from industrial metal surfaces. When in use, the A-3000 creates a mist that can decrease the operator's visibility. This reduced visibility decreases productivity and can increase operator fatigue. Flow International asked team ME 16.1 to design and prototype a fan attachment for the A-3000 to improve visibility for the operator by displacing the obscuring mist. The fan will be powered by the rotational energy of the pneumatic motor. Numerous fan designs were tested to find the optimal fan geometry that maximizes visibility while minimizing energy taken from the pneumatic motor and satisfying geometric and operations constraints.

ME 16.2 | DIGITAL AIR FLOW HOUR METER
SPONSOR: Ingersoll Rand

SPONSOR LIAISONS: Anthony Jones, PE, Eric Lentz, Wayne Osborne PE, Stephen Snider PE
FACULTY ADVISOR: Prof. Matthew Shields, PhD
STUDENTS: Andy Hardesty, Sam Heard, Ariana Mendible, Thanh Tran

Ingersoll Rand manufactures pneumatic tools that are known for their ability to operate in harsh environments. Recommended maintenance schedules are provided, however, users have no way to measure their tools' operating hours. To solve this problem, an air flow hour meter was designed and built to count and display the number of hours a pneumatic tool has been used. The team built a Venturi nozzle that attaches to the air line, creating a measurable pressure differential when the flow rate is above two cubic feet per minute. A microcontroller measures the signal from the differential pressure sensor and triggers the counter. A small display shows the total operating hours of the pneumatic tool. The device will be used in dirty, corrosive, high humidity environments where flammable gases could be present, so robust materials and sensors were selected. In using low power levels, the device has a long battery life and is intrinsically safe for hazardous environments. Ingersoll Rand can later market this device for various air tools, assisting users in prolonging the lifespan of their durable tools.

ME 16.3 | SET-SCREW ASSEMBLY STATION
SPONSOR: The Lighthouse For The Blind

SPONSOR LIAISONS: Doug Hintz, Brent Weichers
FACULTY ADVISOR: Prof. Bob Cornwell, PhD, PE
STUDENTS: Gaven Backman, Alaina Bever, Randell Ersoz, John Kobelak, Matthew Kobelak

The Lighthouse for the Blind, Inc. is a manufacturing company that hires blind, deaf-blind, or blind with other disabilities employees. The Lighthouse for the Blind asked team ME 16.3 to design and build a device to automate the assembly of a set screw for a tactical military shovel. The current epoxy and press-fit operation is a bottleneck step in the assembly process and requires a sighted operator. ME 16.3 designed and built a device consisting of two stations that use a simple pneumatic control system. The device can complete the operation in less than 60 seconds and is safe for an employee to operate who is blind or blind with other disabilities.

ME 16.4 | ADMINISTRATION BUILDING HVAC SYSTEM UPGRADE ANALYSIS
### SPONSOR: McKinstry

SPONSOR LIAISONS: Michael Beckett, Brent Hecker, Kristina Sing
FACULTY ADVISOR: Prof. Keith Elder, PE
STUDENTS: Benson Altamira, Elias Baker, Stuart Jehn, John Kerns, Will Topp

The Administration Building is an iconic building at Seattle University. The building houses the offices of the President and the Provost, 30 classrooms, and a small chapel. The building uses the original heating and ventilation system installed in the 1940s, which includes hydronic radiators, operable windows for ventilation, and no cooling capabilities. To increase the building's energy efficiency and improve occupancy comfort, McKinstry, a construction and engineering company, proposed two options for upgrading the current HVAC system. One option uses a hydronic hot and chilled water system coupled with a dedicated outdoor air system (DOAS). The second option uses a variable refrigerant flow system also coupled with a DOAS. The team created energy models of the building and the two upgrade options. Using the results from the energy models, a life cycle cost analysis was performed for both options. Based on performance, an upgrade option has been selected and a schematic design package, including flow diagrams and equipment sizing, was prepared. The final package was submitted to Seattle University Facilities Services for consideration.
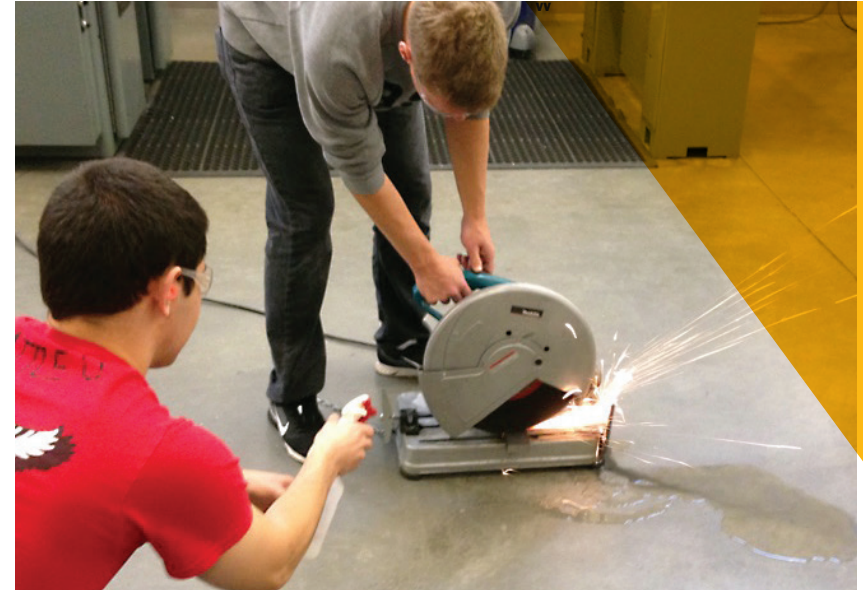
ME 16.5 | ALPHA 2.0
SPONSOR: Romac Industries, Inc.

SPONSOR LIAISON: Lee Getzewich
FACULTY ADVISOR: Prof. Frank Shih, PhD
STUDENTS: Nathan Braaten, Peter Brown, Michael Prier. Michael Roberts

Romac Industries designs and produces innovative pipe couplers and sleeves for use with water distribution and wastewater systems. The company currently manufactures the Alpha pipe coupler, which drastically reduces installation time relative to traditional pipe couplers. Romac asked team ME 16.5 to make further improvements to the Alpha design. The new design will allow the Alpha coupler to work with a greater variety of pipe sizes and materials, including those with larger outer diameters. A new internal-compression pipe gripping system was introduced and all welded joints were replaced with a more robust wire-based system. To enhance product competitiveness, excess material was removed and the new Alpha coupler was optimized for manufacturability. The redesigned Alpha coupler has a greater reliability, a lower manufacturing cost and an increased range of pipe sizes that can be accommodated.

ME 16.6 | BICYCLE COMFORT AND EFFICIENCY
SPONSOR: Mike Larson

SPONSOR LIAISON: Mike Larson
FACULTY ADVISOR: Prof. Greg Mason, PhD, PE
STUDENTS: Zyad Bamarouf, Anthony Rock, Tyler Sales, Matthew Walsh

For cyclists, ride length is not always limited by fatigue or muscle soreness, but instead by numbness caused by vibrations due to road roughness. The anecdotal belief is that narrow, high-pressure tires produce a faster ride, while wide, low-pressure tires are more comfortable. The goal of ME 16.6 was to gather quantitative data that describes the relationship between tire size, pressure, and rider comfort. ME 16.6 modified hardware previously developed by ME 15.5 last year to measure rider comfort, and also developed new hardware to measure changes in bicycle tire efficiency. ME 16.6 also gathered vibration data from test bicycles. Industry standards for vibration discomfort were then used to determine whether a significant change in comfort was achieved. Additionally, tests were conducted to determine the changes in rider energy expenditure corresponding to different tire width and pressure configurations. The results of ME 16.6's work will be made available to the greater bicycling community.


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SENIOR ADMINISTRATIVE ASSISTANT ....LILY KING
PROJECTS DAY PROGRAM DESIGN ....TERESA BEERY

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....PROF. GREG MASON, PhD, PE (WQ)
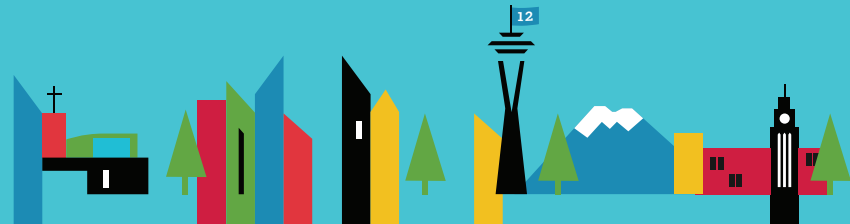
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