PROJECTS DAY 2015

SEATTLE UNIVERSITY

JUNE 5, 2015 | SULLIVAN HALL

SEATTLEU
COLLEGE OF
SCIENCE AND ENGINEERING

REAL PROJECTS REAL WORLD

The Seattle University Project Center is pleased to partner with businesses, government agencies and nonprofit organizations regionally and nationally to bring hands-on projects to our students. Student teams from the College of Science and Engineering and the Albers School of Business and Economics work on projects in the fields of civil and environmental engineering, computer science and software engineering, electrical and computer engineering, environmental science and mechanical engineering, as well as marketing, management, financial analysis, economics, international business, sustainable business and new business ventures.

Our students graduate with real-world experience in their fields, along with invaluable teamwork and communication skills that place them ahead of their peers. Projects Day is the culminating event of the Project Center experience for the students, as well as an opportunity to thank Project Center sponsors and faculty. This event also offers an introduction to the Project Center program for potential sponsors.

WELCOME MESSAGES

Welcome to Projects Day 2015! We are glad that you are here to join the celebration. Today, you'll see for yourself what employers already know: our graduates have a strong understanding of fundamental principles and are excellent communicators. We are able to achieve these enviable results here at Seattle University because we keep our class sizes small, we give our students lots of rigorous homework and we ask them to make presentations often. Capping it all off is the Project Center experience, where our seniors work in teams, engage with external organizations and apply the engineering skills they've learned to "real-world" projects. It's clear that companies like what they see in Seattle University engineering, computer science, and environmental science students, because many of our graduates take full-time positions with the companies that sponsored their senior projects.

We are proud of our students and what they have accomplished. I encourage you to look through this booklet, identify some projects of interest and attend the team presentations. If you have a question, fire away! I'm confident you'll be impressed with the ability of our graduates to think on their feet and talk about technical issues. The Project Center is one of the jewels in the crown of the College of Science and Engineering.

I want to thank the project liaisons and the faculty advisors who have worked with the teams throughout the academic year. Most especially, I want to acknowledge the institutional sponsors who make it possible for us to provide our students with this terrific educational experience. Thanks to generous support from our sponsors, we've created a strong tradition of excellence that will continue to serve our students, our partners and the workforce needs of the State of Washington.

Michael J. Quinn, Ph.D.
Dean, College of Science and Engineering

On behalf of the Albers School of Business and Economics, I want to welcome you to Seattle University's Projects Day 2015.

Like Science and Engineering students, Albers business students undertake real-world projects as part of their programs. Their experiential learning comes in the form of consulting, market research, and various other business projects for organizations such as Costco Wholesale, Glass Distillery and many more. Sponsors want to solve problems, identify new processes and target opportunities for growth. Albers MBA students, working in teams with faculty oversight, deliver top-notch findings and recommendations to the company.

While these projects have been part of the Albers MBA curriculum for many years, the Albers connection to the Project Center began in 2008 when the two schools agreed to collaborate as one central point for building partnerships linking Seattle University with businesses, government agencies and nonprofit organizations throughout the Puget Sound region. We look forward to continuing cooperation between the schools and our community partners.

The business projects you will see were undertaken in our Business Consulting classes. These projects represent over 20 that have been completed at Albers during this academic year.

Thank you for your support for these projects. Enjoy learning about them and getting to know the students involved.

Joseph M. Phillips, Ph.D.
Dean, Albers School of Business and Economics

SCHEDULE

11:45AM – 12:30PM
Check-in and Registration
Sullivan Hall, SU Law School

12:30PM – 12:40PM
Welcome to Projects Day 2015
Father Stephen Sundborg, President
Dean Michael Quinn, College of Science & Engineering
Dean Joseph Phillips, Albers School of Business & Economics

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

ROOM C5

CEE 15.7 CATHOLIC COMMUNITY SERVICES AND PARSONS CORPORATION Skagit Valley Migrant Worker Housing-Civil Site Development of a Cultural Village
CEE 15.8 CATHOLIC COMMUNITY SERVICES AND PARSONS CORPORATION Skagit Valley Migrant Worker Housing-Code Revisions and Structural Design Development
CEE 15.2 PIERCE COUNTY Decant Water Reuse Study

ROOM C6

ME 15.1 BOEING Energy Absorbing Cabin Partition
ME 15.2 FLOW INTERNATIONAL Kerf Analyzer and 3D Dynamometer
ME 15.3 INGERSOLL RAND Radial Piston Air Motor Diagnostics System

ROOM 109

CS 15.1 AVALARA API Explorer
CS 15.2 WASHINGTON STATE DEPARTMENT OF LICENSING Point-In-Time Project
CS 15.3 EXPEDIA Expedia Room Rental System (“Exbedia”)

ROOM 110

ECE 15.1 ALSTOM GRID EMS Augmented Reality with Google Glass™
ECE 15.2 GRAKON Personalized Control of Vehicle Lighting
ECE 15.3 HONEYWELL Data Recovery Diagnostics and Support Tools for Crash Recorders

1:45 – 2:00 PM
Break

2:00 – 3:00 PM PRESENTATION SESSION 2

ROOM C5

CEE 15.1 KING COUNTY North Fork Snoqualmie Hazard Mitigation: Feasibility and Design
ENSC 15.1 KING COUNTY Chinook Salmon Restoration Monitoring in the Cedar/Sammamish River Watershed
CEE 15.5 SEATTLE PUBLIC UTILITIES Storage Pond Optimization in the Densmore Basin

ROOM C6

ME 15.4 ROOT CARBON Design of System to Transform Used Plastic Bottles into Roofing Tiles
ME 15.5 MIKE LARSON Onboard Data Acquisition System to Measure Road Surface Roughness for Bicycle Rider Comfort
INT 15.2 BROOKS RAND Automated Mercury Accumulator and Detector Analyzer (AMANDA) Phase II

ROOM 109

CS 15.4 MERCENT Image Analysis Program
CS 15.5 PHILIPS MEDICAL SYSTEMS Philips DICOM to Movie
CS 15.6 POINT INSIDE AND COSTCO Map Based Employee Task Manager

ROOM 110

ECE 15.4 PACCAR INC. Acoustics-Based Vehicle Diagnostics
ECE 15.5 PHYSIO-CONTROL Using Accelerometer Data to Determine Mode of Transportation
ECE 15.6 SEATTLE UNIVERSITY Evaluation and Design of Fast Charging Circuits for Portable Battery Kits in Developing Countries

3:00 – 3:15 PM

Break

3:15 – 4:15 PM PRESENTATION SESSION 3

ROOM C5

CEE 15.3 SEATTLE CITY LIGHT Seismic Evaluation and Retrofit Design of the Diablo Powerhouse
CEE 15.4 SEATTLE CITY LIGHT Mitigation of Liquefiable Soils at Seattle City Light's South Service Center
ENSC 15.2 SEATTLE CITY LIGHT Mapping of Non-native Trees

ROOM C6

INT 15.3 KENWORTH TRUCK COMPANY Autonomous Driving of a Semi-truck
INT 15.4 REDC Design and Prototype of a Small Generator for Inline Flow Applications

ROOM 109

CS 15.7 SERVALOT Carhop Virtual Drive Through
MSE 15.1 SEATTLE UNIVERSITY CENTER FOR SERVICE AND COMMUNITY ENGAGEMENT eServe System
MSE 15.2 THE SSE GROUP LLC Scientific Systems Engineering Requirements Authoring Tool

ROOM 110

ECE 15.7 TACOMA POWER Medium Voltage Distribution Line Protection Analysis — Fusing Practices
INT 15.1 ASTRONICS Analog Electronic Circuit Breaker with I^2T
CEE 15.6 SEATTLE UNIVERSITY FACILITIES Services Design and Feasibility Study of Anaerobic Digestion at Seattle University

4:15 – 5:00 PM

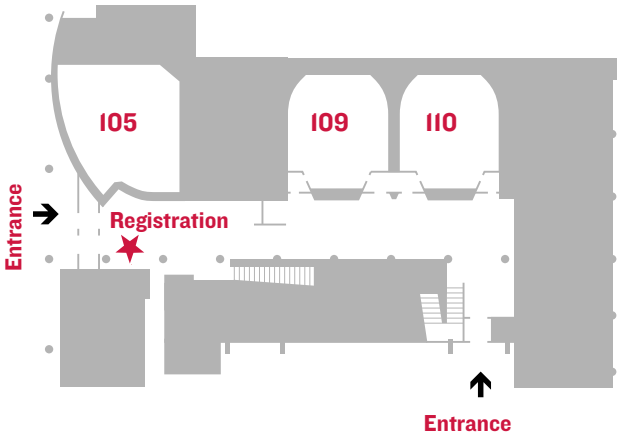
Poster Board Session

5:00 – 6:00 PM

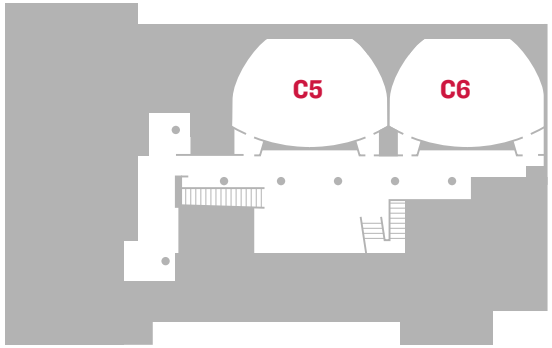
Reception

SULLIVAN HALL MAP

MAIN LEVEL



LOWER LEVEL



PROJECTS

CIVIL AND ENVIRONMENTAL ENGINEERING

CEE 15.1 // NORTH FORK SNOQUALMIE HAZARD MITIGATION: FEASIBILITY AND DESIGN

SPONSOR: King County Department of Natural Resources & Parks, Rivers and Flood Plain Management

SPONSOR LIAISONS: Clint Loper, PE, Mark Ruebel, PE, Mary Lear, PE
FACULTY ADVISOR: Prof. John Wesley Lauer, PE
STUDENTS: Kalika Caley, Kaitlyn Hammond (Biology), Mark Lovrin, Ross Starkey, Valerie Wu

King County's Department of Natural Resources and Parks, Rivers and Floodplain Management Section is sponsoring a risk and hazards analysis and restoration planning project for an approximately one-mile long stretch of the North Fork Snoqualmie River near North Bend, Washington. Bank erosion, channel position change, and sediment accumulation over the past decade has damaged training levees, increasing geomorphic and flood risk to the North Fork Bridge and 428th Ave SE. The risk will increase as the channel continues to migrate. The purpose of this project is to address risk at the North Fork Bridge while improving the natural environment and reducing long term costs. Proposed risk mitigation alternatives include components such as buried wood, engineered log jams, buried revetments, bank planting, and rock armor along 428th Ave SE. Team CEE 14.6 (2013-14) performed an extensive analysis of erosion and sediment transport at the site and developed several conceptual design alternatives to protect the North Fork Bridge and improve the natural environment through feasible construction and permitting. Team CEE 15.1 advanced the work of CEE 14.6 by evaluating alternatives, selecting a preferred alternative and developing a 30% engineering package for the preferred alternative.

CEE 15.2 // DECANT WATER REUSE STUDY

SPONSOR: Pierce County Public Works and Utilities Road Operations

SPONSOR LIAISON: Jeff Rudolph
FACULTY ADVISOR: Prof. Glen Boyd, PE
STUDENTS: Ames Fowler, Abdi Kenan, Alisa Ly, Ellen Shih

Pierce County Public Works and Utilities Road Operations (PCPWURO) are investigating the reuse of water used to clean roadway catch basins. Currently, potable water is used to flush solids from storm water drainage structures into vactor trucks. The wastewater is taken to a decant facility where the solids are separated from the decant water. Decant water is typically polluted with low levels of heavy metals, petroleum hydrocarbons, and carcinogenic polycyclic aromatic hydrocarbons (cPAH). To reduce the use of potable water and volume discharged to the sanitary sewer, PCPWURO requested team CEE 15.2 to develop a water reuse treatment plan. The team conducted a literature review of available treatment technologies and discussed decant water reuse regulations with Washington State Department of Ecology staff. Four potential treatments were investigated: granular activated carbon (GAC) adsorption, organoclay (OC) adsorption, ultrafiltration (UF), and plate separation. Laboratory testing was performed with GAC, OC, and UF; and field testing with an on-site plate separator. Based on the evidence gathered through literature review and experimental studies, a final recommendation was provided to PCPWURO.

CEE 15.3 // SEISMIC EVALUATION AND RETROFIT DESIGN OF THE DIABLO POWERHOUSE
SPONSOR: Seattle City Light

SPONSOR LIAISONS: Robert Cochran, PE, SE, Dan O'Sullivan, PE
FACULTY ADVISOR: Prof. Jhon Paul Smith, PE
STUDENTS: Bianca Casem, Man Seng Fong, Armando Mendoza, Otti Okello, Mikhail Russu

Seattle City Light (SCL) requested team CEE 15.3 to perform a structural seismic evaluation and develop preliminary retrofit designs for the Diablo Powerhouse building. Located in Whatcom County, the facility is a part of the Skagit River Hydroelectric Project, which produces about 25 percent of the electrical power consumed in the City of Seattle. The reinforced concrete structure was built in the 1930s at a time when seismic code provisions did not exist. The structure has never been evaluated or upgraded. Given its importance to the City of Seattle, and considering the moderate seismic hazard level of the project site, team CEE 15.3 assessed the vulnerability of the building to earthquake damage based on the American Society of Civil Engineers (ASCE) Standard 41-13, Seismic Evaluation and Retrofit of Existing Buildings. The evaluation consisted of a two-tiered process that included the completion of a checklist and structural analyses. The team provided conceptual mitigation designs that addressed the deficiencies found in the analyses. A final report was provided to SCL with a list of the structural deficiencies, calculations, and preliminary drawings, along with cost estimates.

CEE 15.4 // MITIGATION OF LIQUEFIABLE SOILS AT SEATTLE CITY LIGHT'S SOUTH SERVICE CENTER
SPONSOR: Seattle City Light

SPONSOR LIAISON: Paul Larson PE, SE
FACULTY ADVISOR: Prof. Michael Wright PE, SE
STUDENTS: Tyler Daniels, John Dickey, Rory Jens, Brian Wilson

The South Service Center (SSC) is a 25-acre maintenance and distribution facility owned and operated by Seattle City Light (SCL). The SSC is located in South Seattle and was constructed in the historic Duwamish River tidal flats. The subsurface soil conditions beneath the SSC pose a risk from a major earthquake causing liquefaction beneath the SSC, which could potentially render the site inoperable, and hinder SCL's ability to respond to a major disaster. Team CEE 15.4 was asked to provide a solution, or combination of solutions, which would maintain a drivable surface on the SSC during and after a major design level (475 year return period) earthquake. Team CEE 15.4's proposed geotechnical and structural solutions will take advantage of soil improvement techniques such as pile foundations, reinforced concrete slab design, and other options currently available. These solutions would allow SCL to continue operations after a major earthquake, enabling them to restore power to critically important infrastructure quickly and efficiently.

CEE 15.5 // STORAGE POND OPTIMIZATION IN THE DENSMORE BASIN
SPONSOR: Seattle Public Utilities

SPONSOR LIAISONS: Dave Jacobs Jr, PE, Naomi Chechowitz, PE
FACULTY ADVISOR: Prof. Glen Boyd, PE
STUDENTS: Fahad Al-Deghaither, Garret Anderson, Derek Bell, David Bushnell

In North Seattle's Densmore Basin, Seattle Public Utilities (SPU) manages three stormwater ponds to minimize localized flooding during extreme storm events. Although these three ponds are hydraulically connected in series, they have passive controls and operate independently of each other. SPU asked team CEE 15.5 to explore the feasibility of integrating the operations of the three ponds using active real-time controls to achieve additional flood mitigation benefit. The project involved calibration and validation of an existing hydrologic and hydraulic model of the Densmore Basin by comparing model simulated data to observed flow monitoring data. The calibrated and validated model was then used to design three different hydraulic control strategies using three types of synthetic design storms. The designs included dynamic control of weir and orifice sizes within the inflow and outflow structures to each pond, allowing the ponds to work in conjunction with each other. SPU will use the products of the feasibility study, the calibrated model and hydraulic control designs, to further develop options for improved flood mitigation in the basin.

CEE 15.6 // DESIGN AND FEASIBILITY STUDY OF ANAEROBIC DIGESTION AT SEATTLE UNIVERSITY

SPONSOR: Seattle University Facilities Services

SPONSOR LIAISONS: Thom Sullivan, Matthew Benedict
FACULTY ADVISOR: Prof. Phillip Thompson, PE
STUDENTS: Jessy Marie Hardy, Chang Liu, Tim Murphy, Pakissiba Rodrigue Silga

As a charter signatory of the American College & University President's Climate Commitment, Seattle University (SU) is actively looking to demonstrate leadership in sustainable practices. Team CEE 15.6 partnered with SU Facilities Services to study the feasibility of implementing an anaerobic digester for the campus' post-consumer, compostable waste. In fulfilling SU's commitment to environmental sustainability, the implementation of an anaerobic digestion system has the potential of generating energy from waste while reducing the current carbon emissions and expenses associated with disposal. The team designed an anaerobic digestion system based on site constraints, waste generation projections, and the availability of staff to monitor and operate the system. They also completed a regulatory compliance report, performed an economic analysis, and surveyed neighboring businesses about contributing organic waste materials to the digester facility.

CEE 15.7 // SKAGIT VALLEY MIGRANT WORKER HOUSING – CIVIL SITE DEVELOPMENT OF A CULTURAL VILLAGE

SPONSORS: Catholic Community Services and Parsons Corp.

SPONSOR LIAISONS: Jeffrey Dye, PE, Haritha Venna, PE
FACULTY ADVISOR: Prof. Nathan Canney, PE
STUDENTS: Amabella Bernardino, Kelsey Rau, Demetria Swendseid, Evan Yamamoto

Catholic Community Services (CCS) seeks to provide an alternative housing model for migrant farm workers and their families in Washington State. The current migrant farm worker traditionally lives in farm-owned housing that is managed by the owner for the benefit of the owner. This relationship can lead to many housing and life-style deficiencies compared with typical state living standards. The alternative model is being envisioned as a cultural village, striving to improve worker quality of life through better housing and living conditions. As part of this design, team CEE 15.7 developed a 30% civil site plan and cost estimate. Design elements included access and roadway, emergency vehicle access, grading, drainage, and utility space planning. CCS requested that the site design include twenty housing units, a community center, recreational areas, and parking spaces. The site location for this model is in Burlington, Washington; however, the ultimate goal is for a cultural village approach to serve as a model for other temporary worker housing sites across Washington State.

CEE 15.8 // SKAGIT VALLEY MIGRANT WORKER HOUSING – CODE REVISIONS AND STRUCTURAL DESIGN DEVELOPMENT FOR SUSTAINABLE MIGRANT WORKER HOUSING

SPONSORS: Catholic Community Services and Parsons Corp.

SPONSOR LIAISON: Jeff Dye, PE, Eric Kelley, PE, SE
FACULTY ADVISOR: Prof. Nathan Canney, PE
STUDENTS: Robert Long, Svyatoslav Rubashka, Jordan Sewell, Hillary Tervet

Every year thousands of workers travel to Washington State to manually harvest fruits and vegetables such as blueberries and apples. Traditionally the farm owners provide the housing for these temporary workers. Because these dwellings are not occupied year round, they need only to meet the requirements of the current Washington Temporary Worker Housing (TWH) code, which results in inferior living conditions compared with the requirements of typical state residential building codes. The TWH code is currently being reviewed and revised by the state. Catholic Community Services (CCS) requested that Seattle University senior design team CEE 15.8 determine the cost of implementing code revisions and their health benefits to migrant workers. Team CEE 15.8 also developed an alternative housing model that aims to improve housing and community conditions for the migrant workers and their families. The cultural village includes housing for twenty families, as well as a community center with classroom space and a marketplace located in Burlington, WA in the Skagit Valley. The team executed the architectural and structural design of these buildings, which include elements of sustainability such as alternative building materials, renewable energy, and passive solar techniques.

COMPUTER SCIENCE

CS 15.1 // AVALARA API EXPLORER
SPONSOR: Avalara

SPONSOR LIASONS: Stephen Prockow
FACULTY ADVISOR: Prof. Yingwu Zhu
STUDENTS: Shouhan Cheng, Michael Greenberg, David Liao, Shuai Miao

Avalara provides end-to-end sales and use tax management solutions to many accounting, ERP, ecommerce, and retail POS systems. Avalara is rolling out its next generation API services, Ava Tax, which customers will use to access Avalara services. Avalara wants its customers to be able to learn, practice and integrate Ava Tax easily with a minimal learning curve. To facilitate this, our team built a platform, the API Explorer, to help reduce the learning curve and help developers adapt Ava Tax quickly. To shorten development time and improve user experience, the team constructed the application based on an open source API management platform Mashery with modern web application technologies such as Node.js and jQuery.

CS 15.2 // DOL POINT-IN-TIME PROJECT
SPONSOR: Washington State Department of Licensing

SPONSOR LIASONS: Trent Spangler, Stephen Kvavle, Nancy Schmidt, Derek Fleener
FACULTY ADVISOR: Prof. Adair Dingle
STUDENTS: Elison Deungria, John Hager, Frank Leitz, Thanh Ong

The CS 15.2 team has been working closely with the Washington State Department of Licensing to implement a system that provides efficient retrieval of driver record statuses. Given a specific 'point in time', the status of any Washington state driver can be retrieved and displayed in an easily read manner. By so eliminating the dependency on human interpretation of historical driver record data (an inefficient and complicated process), this project provides the means to support those who need timely retrieval of driver records. By helping to identify reckless drivers and keep them off the road, this project will save lives and thus supports the Washington state initiative Target Zero - zero fatal traffic accidents by the year 2030. This project is built on top of the existing WADOL driver record system using C#, Microsoft VisualBasic, and SQL.

CS 15.3 // EXPEDIA ROOM RENTAL SYSTEM ("EXBEDIA")
SPONSOR: Expedia, Inc.

SPONSOR LIAISONS: Ben Ha, John Ostlund
FACULTY ADVISOR: Prof. Ben Tribelhorn
STUDENTS: Bianca Flaidar, Jiaming Luo, Shakeel Mohamed, Kim Nguyen

Expedia, Inc. is one of the largest travel companies in the world with an extensive portfolio featuring some of the world's leading travel brands. Expedia has always worked closely with the hotel industry but now it wants to explore a different room rental channel. Expedia wanted a web application to allow managers of independent properties (e.g., vacation homes, cabins) to list their properties on the Expedia web site. Team CS 15.3, has built a mobile application "Exbedia" that allows customers to find these independent properties and rent them from their mobile devices. Our mobile application is built with HTML, CSS, and JavaScript using the Ionic and Cordova frameworks. During the development process we tested our app on Android tablets and iPads provided by Expedia.

CS 15.4 // MERCENT IMAGE ANALYSIS PROGRAM
SPONSOR: Mercent

SPONSOR LIASONS: Christopher Farah, Rod LaCour
FACULTY ADVISOR: Prof. Lin Li
STUDENTS: Richard Leary, Harrison MeCey, Eric Nguyen, Colin Overbay

Mercent has issues with discovering unusable product photos before they are sent to various online advertising networks. Team CS 15.4 built a web application that is hosted on Amazon's cloud system that allows Mercent to automatically test the images before sending them out. The team developed the application using C#, with help from the OpenCV library, which is an open source library specially designed for real-time image processing, and then placed the images on Amazon's Elastic Beanstalk to allow the application to automatically scale based on how often it is in use.

CS 15.5 // PHILIPS DICOM TO MOVIE
SPONSOR: Philips Medical Systems

SPONSOR LIASONS: Robert Trahms, Craig von Land
FACULTY ADVISOR: Prof. Richard LeBlanc
STUDENTS: John O'Connor, Andrew Wilson, Tyler Witt, Patrick Ying

Philips' Healthcare division manufactures sonography units that capture images using ultra-sound to visualize human body structures. These images are stored as a complex file format called DICOM. A common interest amongst sonographers is to make these images viewable across portable devices such as laptops and tablets. CS 15.5 has developed a media conversion utility that interfaces with the sonography units to perform movie conversion from DICOM format to commonly read formats. The team developed the application utilizing Visual Studio for C#, the NReco video converter and the Fellow Oak DICOM library for .NET.

CS 15.6 // MAP BASED EMPLOYEE TASK MANAGER
SPONSOR: Point Inside, Costco

SPONSOR LIAISONS: Shrikant Palkar, Geary Eppley, Ernie Lou
FACULTY ADVISOR: Prof. Sheila Oh
STUDENTS: Sherry Chang, Leonard Lie, Philip Tanoto, Rick Yang

Costco needed a system where store employees can keep track of their duties and correlate tasks to the geographic layout of a store. This system would ensure maintenance of a high level of productivity and performance. The CS 15.6 team created a mobile solution that provides employees with store layout and helps organize their daily tasks. Additionally, the application

records time spent for specific tasks and generates reports on what is meaningful and relevant to improve store operation. This application is designed in Android Studio and uses Point Inside's indoor mapping technology and their extensive Point Inside Maps Library.

CS 15.7 // CARHOP VIRTUAL DRIVE THROUGH
SPONSOR: Servalot

SPONSOR LIASONS: Peter Crossley, Jay Vandewark
FACULTY ADVISOR: Prof. Roshanak Roshandel
STUDENTS: Jordan Appling-Marx, Kwun Sang Fok, Patrick Weisensee

Servalot Corporation is a Washington State company created to help businesses to provide better customer service. Their latest project, Carhop, seeks to provide businesses with a virtual drive-through application. The application allows customers to login, find a specific business, place an order, pay for the order, and pick-up the order at the retailer who has been alerted that the customer is arriving. This will allow the retailer to meet the customer curbside with their purchase providing the virtual drive through. The team's objective was to design and create a client-user interface for the merchant and customer sides of the CarHop application. The ultimate goal of CarHop is to bridge the gap between customer convenience and merchant customer service with a cross-platform and user-friendly app. The team built a hybrid mobile application, which will run on phones, tablets, and desktops. The application demonstrates the entire customer and client experience from order placement to order pick-up. This proof of concept application will allow Servalot to present CarHop to businesses and customers to test the product's viability in the marketplace.

ELECTRICAL & COMPUTER ENGINEERING

ECE 15.1 // ALSTOM GRID EMS AUGMENTED REALITY WITH GOOGLE GLASS™
SPONSOR: Alstom Grid

SPONSOR LIAISONS: Nhung Tran, Tommy Wong
FACULTY ADVISOR: Prof. Henry Louie
STUDENTS: Tyson Heo, Brandon No, Jonathan West, Vincent Yang

Alstom Grid provides services that revolutionize how the electrical grid is managed. Seeking ways that innovative technologies can be applied to the utility industry, Alstom Grid tasked ECE 15.1 with creating an application for Google Glass™. The team identified problems that in-field electric utility employees typically encounter during their job. The application lists the location of various electrical components, primarily utility poles, relative to the position given by the user. Once geo-located, the user can select a specific item from a list of nearby items, view its attributes, and read or take notes for that particular item. This is all done through voice recognition and with the simple swipe navigation exclusive to the Google Glass™. Development of the application for Google Glass™ was done using Android programming.

ECE 15.2 // PERSONALIZED CONTROL OF VEHICLE LIGHTING
SPONSOR: Grakon

SPONSOR LIAISONS: Kaustuva Acharya, Kevin Hay, Tom Major
FACULTY ADVISOR: Prof. Paul Neudorfer
STUDENTS: Cedar Cloyd, Alex Delp, Miles Hille, Thomas Truong

As a leader in commercial vehicle interior 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 15.2 to develop a next-generation smartphone-based personalized lighting control system for the commercial vehicle cab interior. The lighting system is controlled by an application on the cab operator's smartphone and has the capability of modifying each lamp's color and intensity. Operators are able to save their own personalized lighting pattern onto their phone. These preferences are automatically uploaded to the system upon the operator entering the cab. The process occurs hands-free as an operator's phone autonomously connects to the system and turns on their desired settings as they enter the vehicle. The system controls an exterior rear work lamp, which enables the operator to maintain visibility when exiting the vehicle and approaching the trailer hitch.

ECE 15.3 // DATA RECOVERY DIAGNOSTICS AND SUPPORT TOOLS FOR CRASH RECORDERS
SPONSOR: Honeywell

SPONSOR LIAISONS: Sharon Eaglestone, Karim Farraj, Kendall McAdams
FACULTY ADVISOR: Prof. Paul Neudorfer
STUDENTS: James Johnson, Garry Murayama, Thien Vo, Trevor Youngquist

Honeywell's aerospace branch provides vital technologies to commercial, private, and military aircraft, including flight data and cockpit voice recorders. Maintenance processes for these recorders are currently performed manually and data are displayed in a vague, unintuitive format. Honeywell asked team ECE 15.3 to create a troubleshooting application to aid technicians by displaying relevant data in a clear, straightforward fashion, along with suggested solutions to faults when appropriate. The team used several software packages to create a troubleshooting application that allows the user to navigate the recorder data in an intuitive manner. The new application improves on Honeywell's current troubleshooting procedures by providing the user with options that sensibly organize data into an easy- to-use format.

ECE 15.4 // ACOUSTIC-BASED VEHICLE DIAGNOSTICS
SPONSOR: PACCAR Inc.

SPONSOR LIAISON: Danny Godbout, Jerry Ross
FACULTY ADVISOR: Prof. Robert Heeren
STUDENTS: Erica Flores, Chao Huo, Sirous Seifalian, Tony Truong

PACCAR Inc. is a global truck company that specializes in premium light-, medium-, and heavy-duty truck design and manufacturing. Part of the company's goal is to improve the design of its trucks to meet its customer demands. One area of improvement that is being researched is vehicle diagnostics. Current vehicle diagnostics in PACCAR trucks are limited in their prognostic capabilities, and as such, undetected issues often occur without warning. One solution would be to implement an acoustic-based diagnostic system. PACCAR asked team ECE 15.4 to develop an acoustic-based diagnostic system that is capable of monitoring parts of the truck engine, and determine if any parts are failing. The team was able to develop a diagnostic system using sound transducers and a MATLAB® fault-detection algorithm. The system is to receive and store the acoustic signals emitted from a simulated engine environment, and process the signals to determine whether a fault would occur.

ECE 15.5 // USING ACCELEROMETER DATA TO DETERMINE MODE OF TRANSPORTATION
SPONSOR: Physio-Control

SPONSOR LIAISON: Erick Roane
FACULTY ADVISOR: Prof. Maren Nelson
STUDENTS: Michael Chinn, Kyle Cote, Tim Dukhnovskiy, Patrick Dullenty, Andrew Seaman

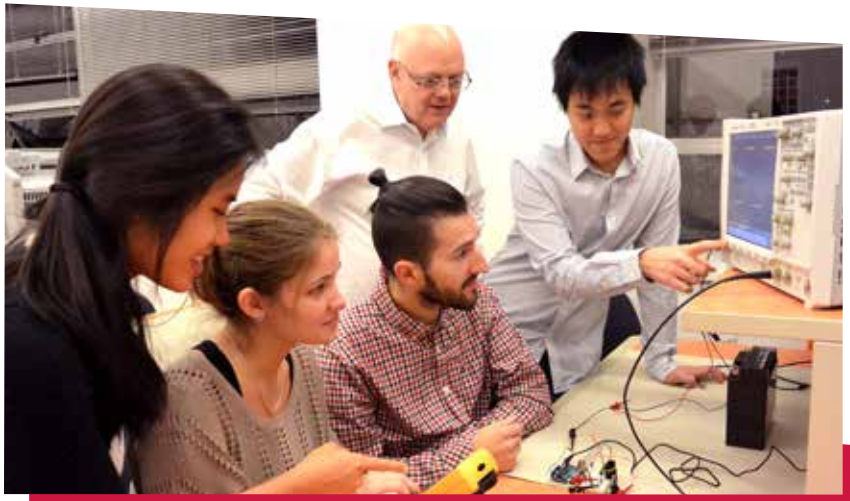
Physio-Control is a world leader in the design and manufacturing of external defibrillators and emergency medical response products. The company would like to improve the precision and safety of some of their products by being able to accurately determine the transportation environment. Using a development board, team ECE 15.5 designed and implemented an algorithm to use accelerometer data to determine mode of transportation—such as walking, running, cycling and driving—in real-time through numerous firmware iterations, accumulation of transportation specific data, and post data-collection analysis.

ECE 15.6 // EVALUATION AND DESIGN OF FAST CHARGING CIRCUITS FOR PORTABLE BATTERY KITS IN DEVELOPING COUNTRIES

SPONSOR: Seattle University

SPONSOR LIAISON: Prof. Steve Szablya, PE
FACULTY ADVISOR: Prof. Steve Szablya, PE
STUDENTS: Ana Hernandez, Ryan Kondo, Jeffrey Miller, Nicole Ng

As part of its mission to serve the under-served, Seattle University requested that team ECE 15.6 investigate various methods of fast charging batteries in developing countries. Solar-powered community charging stations offer portable battery kit (PBK) charging services to people living in developing areas without electrical grid access. Currently, the charge time for the sealed lead-acid (SLA) batteries used in PBKs is from eight to ten hours. Based on customer feedback it has been determined that a charge time of no more than four hours is necessary to maximize customer satisfaction. Life-cycle degradation due to charge time reduction is a major factor to consider when designing fast charging circuits. To reduce the charge time, high amounts of current must be used, which can significantly reduce the life cycle of a battery. To prevent this, we analyzed the Rapid Partial Charging algorithm and tested it with several different recovery charge schemes. This algorithm can be used to charge a battery in less than four hours without reducing its life cycle. The testing of SLA batteries shows that it is possible to charge a battery in less than four hours without reducing the useful life of the batteries.



ECE 15.7 // MEDIUM VOLTAGE DISTRIBUTION LINE PROTECTION ANALYSIS - FUSING PRACTICES

SPONSOR: Tacoma Power

SPONSOR LIAISON: Lee Henslee , John Merrell, PE, Ruly Parikesit, PE
FACULTY ADVISOR: Prof. Xu-Sheng Chen
STUDENTS: Mark Berg, Hoang Yen Dang, Mohammed Pirbhai, Devinsen Purwanegara, Addison Wong

Tacoma Power is an innovative, publicly-owned electric utility that provides energy to over 160,000 customers in Tacoma and the surrounding areas through various distribution networks. Protection of these distribution networks are vital since approximately 75% of all customer hours lost are due to faults (i.e., abnormal electrical current). To mitigate these incidents, robust protection schemes are needed. In a power system network, fuses and fuse coordination play a very important role and need to be considered in any protection scheme. Optimizing fuse coordination helps to reduce the outage size (i.e., fewer customers without power) when a fault occurs. Team ECE 15.7 has been tasked to analyze various scenarios for Tacoma Power and develop a new fusing standard from our findings. This standard will effectively act as guidelines for new service and line engineers to consult before contacting a protection engineer. The team conducted research and extensive analysis via simulation to develop a set of new fusing coordination guidelines and resolve issues in Tacoma Power's current fusing coordination standard. The new guidelines will lead to efficiency in Tacoma Power's distribution network protection and ultimately more optimized and reliable power for their customers.

ENVIRONMENTAL SCIENCE

ENSC 15.1 // CHINOOK SALMON RESTORATION MONITORING IN THE CEDAR/SAMMAMISH RIVER WATERSHED

SPONSOR: King County Department of Natural Resources and Parks: Water and Land Resources Division

SPONSOR LIAISON: Scott Stolnack
FACULTY ADVISOR: Prof. Josephine Archibald
STUDENTS: Irma Gomez, Adrianna Hennessey, Nathan Lind, Brooke Winslow

Chinook salmon are an integral part of Pacific Northwest ecology, culture, and economy. In 1999, the U.S. Environmental Protection Agency (EPA) listed the Puget Sound Chinook salmon as threatened under the Endangered Species Act (ESA). In response to this listing, King County established a restoration plan to address the problem of declining Chinook populations in the Cedar/Sammamish River watershed. King County provided the team with a list of high priority indicators of salmon habitat health such as forest cover, floodplain characteristics, and water temperature. The team researched metrics and methods to quantify each of the indicators, which will be used by King County to inform monitoring goals and restoration projects. Using scientific papers and data collected from several monitoring organizations, the team reviewed literature and prepared a final report that identified data gaps and habitat quality goals for each of the indicators.

ENSC 15.2 // MAPPING OF NON-NATIVE TREES

SPONSOR: Seattle City Light

SPONSOR LIAISON(S): Scott Luchessa, Colleen McShane
FACULTY ADVISOR: Prof. Lyn Gualtieri
STUDENTS: Aaron Cleborne, Polly Lentz, and Katie Stick

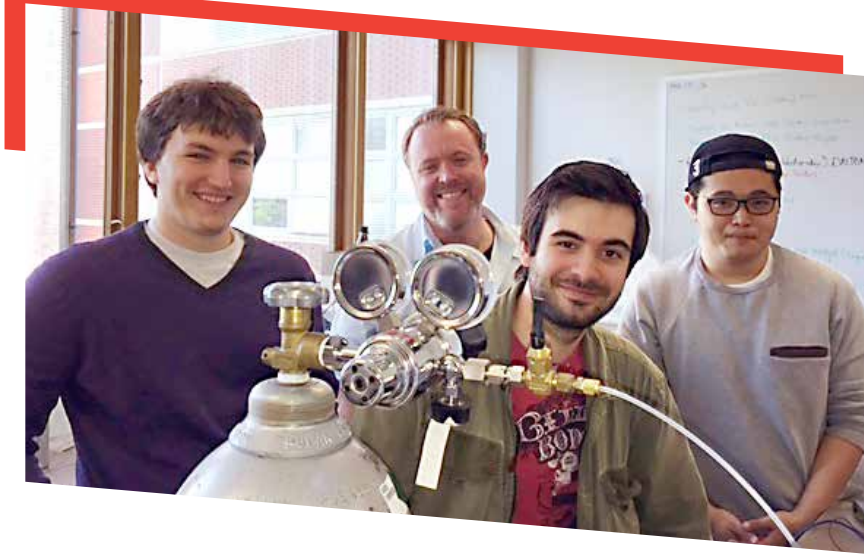
In the 1920s, Seattle City Light (SCL) began developing a hydroelectric project along the upper Skagit River. The town of Newhalem, WA was established by SCL for construction workers and their families and over time, a variety of trees were planted to provide landscaping. Most of the trees planted in the town were non-native species commonly found in parks and landscaped areas throughout the United States. Several species, sycamore maple (Acer pseudoplatanus) in particular, are prolific seed-producers and have now spread beyond the town and into the adjacent riparian corridor of the Skagit River. Team ENSC 15.2 established fourteen belt transects to estimate the density of both native and non-native tree species in the riparian area adjacent to Newhalem. Transects locations were determined using a stratified random approach. Reconnaissance surveys in the riparian corridor, downstream locations, and in disturbed areas underneath the power lines outside of Newhalem were conducted to determine the spatial extent of non-native tree colonization. Literature on target species life history, dispersal pathways, and potential remediation methods was reviewed to develop a plan for ecosystem restoration. Management alternatives to control the non-native species were developed, taking into account aesthetic concerns, the effectiveness of removing the seed source, and the ability to restore and maintain the ecological integrity of the riparian corridor. Deliverables including survey data, a GIS map of transects, a data analysis report, and three recommended management alternatives.

INTERDISCIPLINARY

INT 15.1 // ANALOG ELECTRONIC CIRCUIT BREAKER WITH I²T
SPONSOR: Astronics Corporation

SPONSOR LIAISONS: Todd Morris, Igor Parkman
FACULTY ADVISOR: Prof. Kevin Lybarger
STUDENTS: Carina Pham, Jagdeep Singh, Matt Scanlan, Stefan Whitley

Astronics Corporation is a supplier for aerospace and defense industries that manufactures high performance lighting, power distribution systems, and cabin power systems. The Airborne Power and Control division currently manufactures software-assisted Electronic Circuit Breaker (ECB) units. Astronics requested an evaluation of an analog ECB concept. The team designed a software-free, analog circuit that mimics the I²T response curve of a thermal circuit breaker with 50A rated current at 28VDC to protect electrical circuits from fault and overload conditions.



INT 15.2 // AUTOMATED MERCURY ACCUMULATOR AND DETECTOR ANALYZER (AMANDA) PHASE II
SPONSOR: Brooks Rand Instruments

Sponsor Liaison: Joel Creswell
Faculty Advisor: Prof. Yen-Lin Han
Students: Blake Bozlee, Carlin Cheng, Erik Olson, Tyler Toutonghi

Brooks Rand Instruments (BRI) designs and manufactures trace-level mercury analysis systems. Currently, the company only produces lab-based equipment, but is in the process of designing a portable model of their total mercury analyzer. In 2013, BRI tasked team ME 14.2 with designing a portable sample collection module that could be equipped with the company's portable analyzer, to create a fully functional portable system for total mercury detection. While team ME 14.2 made significant progress on the project, the AMANDA Phase I needed further refinement. BRI returned to Seattle University in 2014 and tasked team INT 15.2 with redesigning the AMANDA system's flow system, control system, and enclosure. The team designed a compact sample collection system powered by a lithium-ion battery. The entire system is enclosed in a hard-shell backpack, fitted with a sample wand, and is controlled with an app running on an Android phone.

INT 15.3 // AUTONOMOUS DRIVING OF A SEMI-TRUCK
SPONSOR: Kenworth Truck Company

SPONSOR LIAISON: Stan DeLizo
FACULTY ADVISOR: Prof. Yen-Lin Han
STUDENTS: Alex Govan, Zachary Powers, Alex Schacht, Joseph Young

Kenworth Truck Company, a PACCAR subsidiary, is a manufacturer of medium- to heavy-duty semi-trucks. Kenworth performs durability driving tests on a rough track with many of their trucks as a part of their development process. To improve the repeatability of these tests, Kenworth tasked the team with the development of a bolt-on, autonomous driving system. The team designed a set of subsystems to control the truck's steering, throttle, and braking. Computer software provides instructions to these subsystems based on a navigation algorithm using GPS and video image processing. The autonomous driving system is capable of driving the truck three laps around PACCAR's durability track without any intervention from a human operator.

INT 15.4 // DESIGN AND PROTOTYPE OF A SMALL GENERATOR FOR INLINE FLOW APPLICATIONS
SPONSOR: Renewable Energy Design Concepts

SPONSOR LIAISON: Kelly Fetters
FACULTY ADVISOR: Prof. Steve Szablya, PE
STUDENTS: Aklilu Biniam, Adam Carter, Ben Klontz, Conner McQueen

REDC Energy is a renewable energy company that specializes in micro and small hydropower installations. The company is currently investigating methods for harnessing hydrokinetic energy from rivers and streams. REDC Energy requested that team INT 15.4 develop a power generation system that could easily be implemented in the United States and in less economically developed countries. More specifically, team INT 15.4 designed and built a working prototype of an environmentally friendly, hydrokinetic power generation system capable of producing 50-200 W. Such a system allows for on- and off-grid applications. The prototype was tested in the Cowlitz River in Washington State.

MECHANICAL ENGINEERING

ME 15.1 // ENERGY ABSORBING CABIN PARTITION
SPONSOR: The Boeing Company

Sponsor Liaison: James A. Fullerton
Faculty Advisor: Prof. Frank Shih
Students: Vittorio del Rosario, Phu Mai, Chi Heng Pan, James Pentz

The Boeing Company has been the world's largest manufacturer in the aerospace industry. With over 12,000 commercial airplanes in service, passenger safety is a primary concern of the company. Most commercial aircraft are equipped with cabin partitions that act as class dividers, doorways and cross aisle walls. Because these partitions are very rigid and are not designed to absorb impact energy, passengers sitting directly behind this partition may be at risk of suffering incapacitating head injury during extreme landing situations. The Boeing Company requested that the team develop solutions that show potential to increase passenger safety. Team ME 15.1's concept is to redesign the cabin partition by replacing some components with materials that have greater energy absorption properties. This new partition will absorb at least 100% more energy when compared to the existing partition. The team designed and built a test device that was used to gather quantifiable data for each possible candidate material. These test data along with a new partition were provided to Boeing for further analysis.

ME 15.2 // KERF ANALYZER AND 3D DYNAMOMETER
SPONSOR: Flow International Corporation

Sponsor Liaison: Max Cerami
Faculty Advisor: Prof. Josh Hamel, PE
Students: Drew Cameron, Chase Fields, Derek Goetz, Viviana Gonzalez

Flow International Corporation commissioned Seattle University senior design team ME 15.2 to design a device that measures forces and characterizes kerf (the width of a cut) produced by a waterjet on a sample material. This measuring device is a self-contained unit that will be used for research and development by Flow International. The device measures the forces exerted on the sample material as it is being cut. This is accomplished by positioning force sensors around the sample material. The measuring device also obtains information about the type of kerf that the waterjet produces on the sample material. This information is measured using digital images of a piece of material after it has been cut by a waterjet. The digital images are processed to quantify the kerf characteristics such as angles, depth, and surface finish. Once the device is delivered to Flow International's Research and Development team, they will use force and kerf measurement data to further study the performance of their products.

ME 15.3 // RADIAL PISTON AIR MOTOR DIAGNOSTICS SYSTEM
SPONSOR: Ingersoll Rand

Sponsor Liaison: Eric Lentz, Anthony Jones, Wayne Osborn
Faculty Advisor: Prof. Matthew Shields
Students: Jacob Inouye, Lisa Leng, Handerson Pranoto, Rachel Sanders

Ingersoll Rand is an international company which, among other things, manufactures radial piston air motors. To monitor the quality and performance of their motors, Ingersoll Rand wants to conduct more rigorous testing on their motors. The company tasked team ME 15.3 with designing and building a test stand to measure motor performance curves, including torque and flow rate vs rpm. The team built a diagnostics system and test stand, based on LabVIEW, for testing an Ingersoll Rand motor (Model BU), which produces a maximum of 1.7 hp. The team tested multiple Model BU motors and generated a nominal performance curve for that motor, including confidence bounds for the key parameters of the motor. Using these nominal performance data, the test stand can be used to test a motor and determine if its performance falls within the confidence bounds of the nominal curve. In addition to a pass/fail report, the test stand displays performance curves for the motor being tested.

MEGR 15.4 // DESIGN OF SYSTEM TO TRANSFORM USED PLASTIC BOTTLES INTO ROOFING TILES
SPONSOR: Root Carbon

Sponsor Liaisons: Lee Loveland and Donald Thomson
Faculty Advisor: Prof. Robert Cornwell, PE
Students: Michael Hughes, Dustin Klepper, Ben Levy-Wendt, David Livingston

Root Carbon is a regenerative packaging start-up that manufactures specially designed water bottles that can be up-cycled into roofing tiles to reduce the amount of litter on beaches. Root Carbon also plans to create jobs in Costa Rica for people interested in up-cycling bottles in their home. ME 15.4 has been tasked with designing the equipment required to transform used bottles into roofing tiles. This equipment must be manually operated, easy to maintain, and capable of processing at least 5 bottles per minute. The team developed a small-scale assembly line with three individual processes. The first process uses a piston driven by a threaded rod to fill bottles with composite cement if the user desires an opaque roofing tile. The second process uses a crank mechanism to fold the bottles into the desired shape using a specially contoured crimp die. The final process uses a rigid structure to hold the bottles in a folded shape while the composite cement cures. This new assembly line can be manufactured for less than $1,500 and easily used in a private home.

ME 15.5 // ONBOARD DATA ACQUISITION SYSTEM TO MEASURE ROAD SURFACE ROUGHNESS FOR BICYCLE RIDER COMFORT
SPONSOR: Mike Larson

SPONSOR LIAISON: Mike Larson
FACULTY ADVISOR: Prof. Greg Mason, PE
STUDENTS: Marie Pahlmeyer, Dalton Reed, Nicholaus Wright, Jayce Yahata

In the high-end bicycle community, ride length is not usually limited by fatigue or muscle soreness, but rather numbness at the handlebars and seat caused by the vibrations generated when riding over a rough road. There is some sense in the cycling community that these vibrations can be reduced by adjusting the tire size and pressure, but there is little to no empirical evidence to back up these claims. Team ME 15.5 designed and built a self-contained data acquisition system that mounts on the bicycle and collects vibration data. The device is comprised of accelerometers to collect vibration data, a data acquisition board to read in and analyze the data, and a smartphone that communicates with the board via Bluetooth to serve as the user interface. Data collected using this system was analyzed to produce empirical recommendations regarding optimal tire size and pressure for various riding conditions. Additionally, this system can be distributed to local bicycle enthusiasts and used to collect information about road and trail conditions around the Puget Sound area.

MASTERS IN SOFTWARE ENGINEERING

MSE 15.1 // eSERVE SYSTEM
SPONSOR: Seattle University Center for Service and Community Engagement

SPONSOR LIAISONS: Elizabeth O'Brien
FACULTY ADVISER: Prof. Jeffrey Gilles
STUDENTS: Jyoti Thakur, Tsun Tsai, Xiaoqing Wang

The Center for Service and Community Engagement (CSCE) at Seattle University was founded in 2004 and connects classroom and community to promote a more just and humane world. CSCE serves as the headquarters to help over 1,000+ students, staff or faculty to find opportunities to serve and learn in the local community. CSCE had a computerized system that allowed community partners, students, CSCE and faculty to manage opportunities and signups. This legacy system had several issues and was missing some core functionality. Our team re-wrote and enhanced the legacy system and created eServe, a cloud based web platform. eServe will provide the following services to support the service-learning volunteering opportunities; 1) Community partners can manage their volunteering opportunities and monitor student volunteer activity, 2) Students can sign up for opportunities, enter volunteer hours, create reflections, and manage their profiles, 3) CSCE can manage all aspects of the system and view a range of activity reports, and 4) Professors can track student volunteer hours and community partner feedback.

MSE 15.2 // SSE REQUIREMENTS AUTHORING TOOL
SPONSOR: SSE Group, LLC

SPONSOR LIASONS: Doug Brown, Greg Scallon
FACULTY ADVISOR: Prof. Mike Koenig
STUDENTS: Carrie Rule, Anisweta Sinha, Richa Sinha, Andy Smith

SSE wants to automate their requirements generation process. The process includes analyzing structured diagrams. Team MSE 15.2 built a requirements generation tool called 'SSE Tool'. This tool allows the author to create these diagrams and perform the analysis automatically. To promote consistency of the diagrams, the team built a custom Windows Forms UI, which constrains the author to make only valid changes. To promote extensibility, the team designed a modular architecture so that development can be continued in the future.

THANK YOU TO OUR 2015 SPONSORS

Alstom Grid
Astronics Corporation
Avalara
The Boeing Company
Brooks Rand Instruments
Catholic Community Services and Parsons Corporation
Expedia, Inc.
Flow International
Grakon
Honeywell
Ingersoll Rand
Kenworth Truck Company
King County Department of Natural Resources & Parks, Rivers and Flood Plain Management
King County Department of Natural Resources and Parks: Water and Land Resources Division
Mercent
Mike Larson
PACCAR Inc.
Philips Medical Systems
Physio-Control
Pierce County Public Works and Utilities
Point Inside and Costco
REDC Energy
Root Carbon
Seattle City Light
Seattle Public Utilities
Seattle University
Seattle University | Center for Service and Community Engagement
Seattle University | Facilities Services
Servalot
Tacoma Power
The SSE Group LLC
Washington State Department of Licensing

PROJECT CENTER STAFF

Project Center Director ..... Prof. Jean Jacoby
Corporate Relations Manager ..... Ernie Lou
Senior Administrative Assistants ..... Arielle Fissmer & Lily King
Projects Day Program Designer ..... Teresa Beery

PROJECTS DESIGN COORDINATORS

Civil & Environmental Engineering ..... Prof. Nirmala Gnanapragasam
Computer Science & Software Engineering ..... Prof. Jeffrey Gilles
Electrical & Computer Engineering ..... Prof. Henry Louie
Environmental Science ..... Prof. Wesley Lauer
Masters of Software Engineering ..... Prof. Roshanak Roshandel
Mechanical Engineering ..... Prof. Yen-Lin Han

SEATTLEU

SEATTLE UNIVERSITY PROJECT CENTER seattleu.edu/projectcenter
901 12th Avenue P.O. Box 222000 Seattle, WA 98122-1090 (206) 296-2822