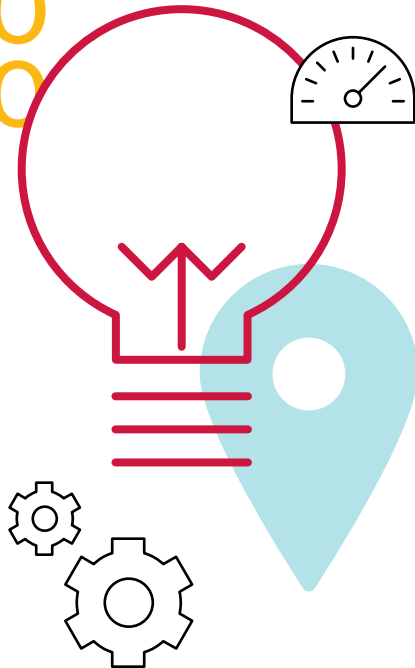
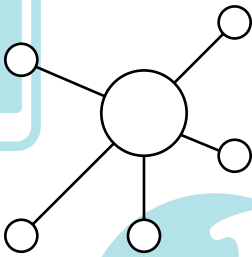
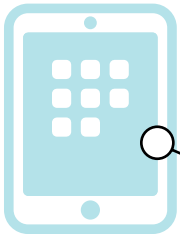




PROJECTS

DAY 20 20





WELCOME

“Together we are preparing a new generation of engineers and scientists who are uniquely equipped to face unprecedented global challenges with the support of leading external partners”

Welcome to Projects Day 2020! We are pleased that you can participate in this important end-of-year celebration. In September, each student team received a challenging, real-world assignment from a local external partner. As the students worked throughout the year on their projects, they applied the technical knowledge gained in their coursework and gained skills in project management, teamwork, budgeting, technical writing, and oral communications. Projects Day is the culmination of their experience.

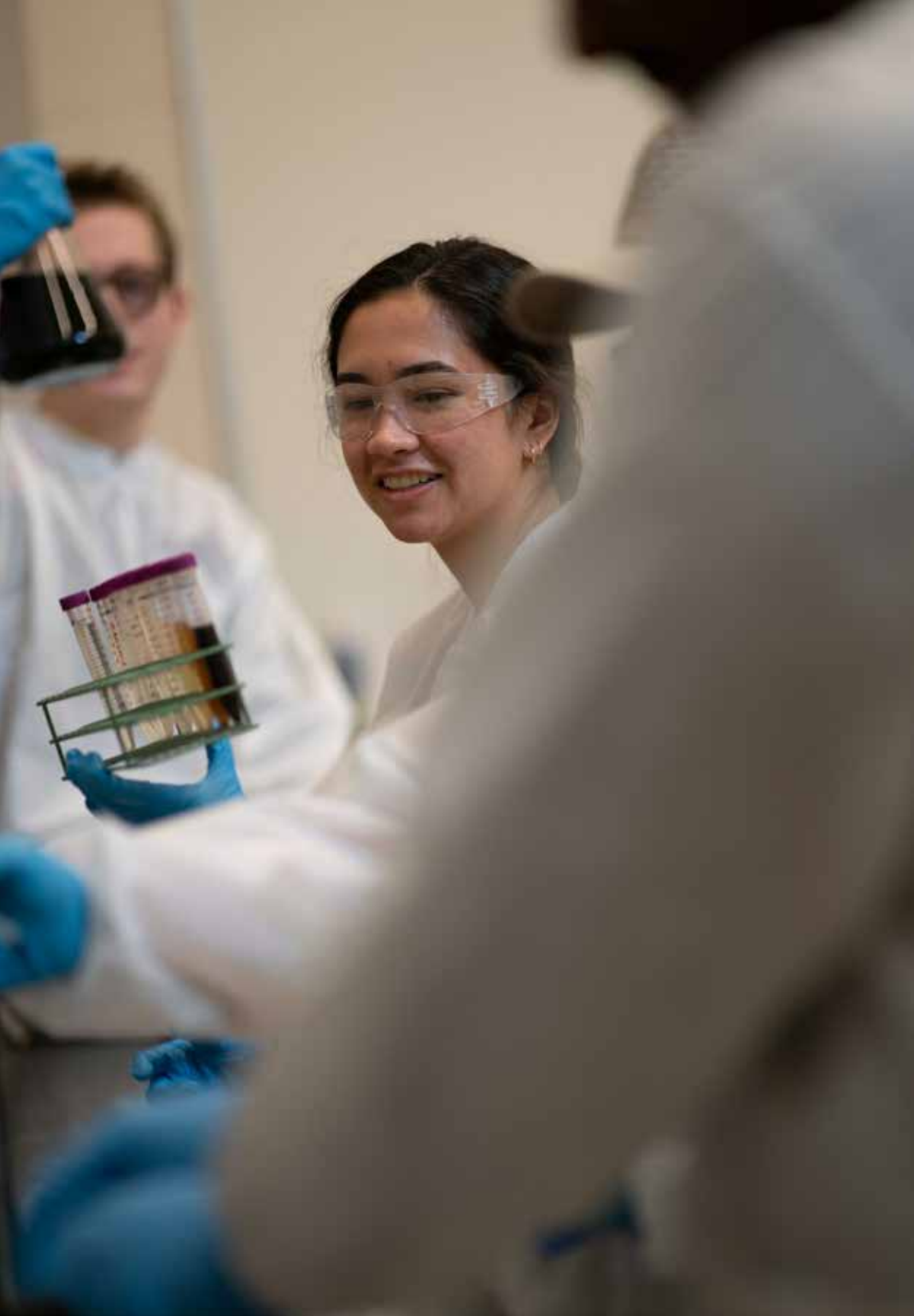
This year, our students faced the added challenge of completing their projects remotely after COVID-19 prevented them from working on campus together and with their sponsors. We are proud of how the students quickly pivoted and adapted work plans to meet sponsor expectations. The resilience and creativity of these student teams demonstrates their ability to apply their educational experiences in a professional context and their formation as responsible engineers and scientists. At this first virtual Projects Day, you will see more than 150 students from 36 teams present their amazing projects. You will have the opportunity to interact with them after their presentations and during the networking sessions that follow.

We are grateful to the companies, government agencies, and non-profits who partner with us to make possible this important, award-winning educational experience. As we end the 33rd year of the Project Center in the midst of disruptions due to the pandemic, we would like to give special thanks to the sponsor liaisons, faculty advisors, and staff who provided unfailing support to the student teams in the completion of their projects.

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

Jean Jacoby, PhD
Associate Dean and Project Center Director
College of Science and Engineering





SCHEDULE	4
CIVIL & ENVIRONMENTAL ENGINEERING	6
COMPUTER SCIENCE	9
ELECTRICAL & COMPUTER ENGINEERING	16
ENVIRONMENTAL SCIENCE	18
INTERDISCIPLINARY	20
MECHANICAL ENGINEERING	22

PROJECTS DAY 20 20 EVENT FRIDAY, JUNE 5 SCHEDULE



→ ENGINEERING, ENVIRONMENTAL SCIENCE,
AND COMPUTER SCIENCE VIRTUAL PRESENTATIONS

12:45 P.M. – 1:45 P.M. PRESENTATION SESSION 1

ROOM 1

- ME 20.3 **Kenworth Truck Company** Kenworth Automation
- ME 20.2 **Kenworth Truck Company** Kenworth Floodlight
- CS 20.9 **Kenworth Truck Company** Battery Cable Expert (BCE)

ROOM 2

- CEE 20.5 **Snohomish County Public Works** Barr Creek Bridge #158 Replacement
- CEE 20.4 **Seattle City Light** Seismic Assessment and Retrofit for the Cedar Falls Powerhouse
- CEE 20.1 **BLOCK Architects** The BLOCK Project

ROOM 3

- CS 20.8 **F5** QKView
- CS 20.6 **F5** Skills-based Routing
- CS 20.7 **F5** Monarch

ROOM 4

- INT 20.2 **T-Mobile** Mobile Device UI Response and Battery Current Data Acquisition
- INT 20.3 **T-Mobile** Rain Chamber Hardware Validation Robot

1:45 P.M. – 2:00 P.M. BREAK

2:00 P.M. – 3:00 P.M. PRESENTATION SESSION 2

ROOM 1

- ME 20.4 **The Lighthouse for the Blind** Canteen Top Installation Device
- ME 20.5 **The Lighthouse for the Blind** Valve Assembly and Inspection
- ME 20.7 **Puget Sound Energy** Protocol for Energy Modeling of Industrial Sites

ROOM 2

- CEE 20.2 **Catchment Solutions** APTsorb Media Design Guidelines
- CEE 20.3 **Covington Water District/Kennedy Jenks** Covington Water District's 600/650 Zones Water System Evaluation
- ENSC 20.2 **US Forest Service** Integrating Infrastructure and Ecosystem Services to Improve Aquatic Habitat

ROOM 3

- CS 20.5 **Baus Systems** DSD Web Utilities
- CS 20.11 **SDI Engineering** GearSim Cloud Management
- CS 20.4 **Astronics** Vertical Power Planner

ROOM 4

- CS 20.12 **Seattle University Information Technology Services** Virtual Assistant
- CS 20.10 **Kilowatts for Humanity** Data Acquisition and Inventory Management (DAIM)

ROOM 5

- ECE 20.1 **Chelan County PUD** Generator Instrument Power Supply
- ECE 20.3 **Mercer Island Telecom** Collaborative Calculus
- ECE 20.4 **Panthera** Project Spot Check

3:00 P.M. – 3:15 P.M. BREAK

3:15 P.M. – 4:15 P.M. PRESENTATION SESSION 3

ROOM 1

- ME 20.6 **NIC Global** Automated Inspection Apparatus
- ME 20.8 **Sound Transit** Sound Transit Light Rail Catenary
- ME 20.1 **The Boeing Company** Hydraulic Rotary/Piston Type Actuator

ROOM 2

- CS 20.13 **Thump/Fernando Hernandez** Thump
- CS 20.14 **Vrbo** Vrbo Traveler Companion

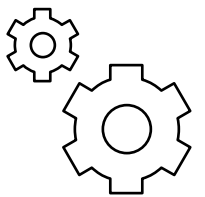
ROOM 3

- CS 20.1 **Amazon** Transparency and Trust
- CS 20.2 **Amazon** Video Call Analysis System (VCAS)
- CS 20.3 **Amazon** EC2 Profiler

ROOM 4

- ECE 20.2 **Overcast Innovations** Control for Cloud Appliance
- INT 20.1 **Space Needle, LLC** Rain and Wastewater Harvesting
- ENSC 20.1 **McKinstry** Monitoring Instream Habitat Change after Large Wood Augmentation, Swauk Creek, Washington

4:15 P.M. – 5:15 P.M. NETWORKING SESSIONS



THE BLOCK PROJECT CEE 20.1



SPONSOR: BLOCK Architects
SPONSOR LIAISON: Jenn LaFreniere
FACULTY ADVISOR: Michael Wright, PE, SE
STUDENTS: Alissa Capuano, Alexis Elles, Derek Manaka, Jacob May, Alex Roderic

Homelessness in Seattle is a worsening crisis that leaves people living in bleak conditions and excludes them from much of society. The BLOCK Project's mission is to integrate people facing homelessness into supportive neighborhoods by building self-sufficient 125 ft² detached accessory dwelling units on every Seattle residential block to provide safe shelter and a community of support. The current BLOCK Home design uses traditional wood framed construction, which requires skilled labor and can generate excessive onsite waste and disruption. CEE Team 20.1 redesigned the BLOCK Home using cross-laminated timber (CLT) panels sourced from the CLT manufacturing waste stream. After months of research and calculations on CLT and the CLT manufacturing waste stream, the team designed a BLOCK Home that adheres to the Living Building Challenge, uses CLT's offsite manufacturing capability, and is easily assembled by volunteers to decrease the cost of skilled labor.



“The exposure and knowledge I’ve gained from working with my team and Snohomish County has provided me with the confidence and experience needed for my future as an engineer.”
THEA FOLK '20 CEE



APTSORB MEDIA DESIGN GUIDELINES CEE 20.2



SPONSOR: Catchment Solutions, LLC
SPONSOR LIAISONS: Chad Wiggins, PE
FACULTY ADVISOR: Jon Polka, PE
STUDENTS: Eli Magnan, Chris Parent, Devin Robichaux, Fitihi Shiwaye, Alan Sompie

Stormwater regulations for industrial facilities limit effluent concentrations of heavy metals including zinc and copper. Catchment Solutions, LLC sponsored the explorative study of a pelletized peat filter media from American Peat Technology (APT), APTsorb*Na, for reducing zinc and copper concentrations in industrial stormwater. This study physically characterized APTsorb*Na and determined duration of stormwater exposure (i.e., contact time), bed-depth service time curves, and percolation velocity at various heads. Column tests on APTsorb*Na were conducted with synthetic stormwater to determine treatment performance. Finally, based on ideal contact times and heads from initial tests, a downspout filtration unit was designed and scaled for use at industrial facilities.

COVINGTON WATER DISTRICT'S 600/650 ZONES WATER SYSTEM EVALUATION CEE 20.3



SPONSOR: Covington Water District, Kennedy Jenks
SPONSOR LIAISONS: Bobbie Gilmour, EIT, Mackenzie Hagan, PE, Thomas Keown, PE, PMP, Steve Lee, PE, Chris Stoll, PE, PMP, ENV-SP
FACULTY ADVISOR: Se-Yeun Lee, PhD
STUDENTS: Dylan Fong, Kelvin Kong, Jimmy Lim, Koa Sakamaki

Covington Water District has partnered up with Kennedy Jenks and the team to develop multiple design alternatives to mitigate the transient pressure problem within the district's Pressure Zone 650. Built in 2000 and retrofitted in 2013, Covington Water District's Tank 3 Booster Pump Station (BPS) provides the required pressure and flow to the residents within Pressure Zone 650. However, there are daily transient pressure events at the Tank 3 BPS, causing the pumps to start too often and making them more prone to premature failure. To mitigate the transient pressure, the team proposed four different design alternatives: an adjustment of pressure reducing valves, alteration of pump settings, an installation of a pressure tank, and a no-action alternative. Using an Options Analysis Evaluations Criteria (OAEC) based on cost, constructability, effectiveness, stakeholder consideration, and legal constraints, the team selected a preliminary design to mitigate the problem. Additionally, the team created a memorandum of potential impacts regarding changes in pressure, flow, and customer consumption.



SEISMIC ASSESSMENT AND RETROFIT FOR THE CEDAR FALLS POWERHOUSE CEE 20.4



SPONSOR: Seattle City Light
SPONSOR LIAISON: Robert Cochran, PE, SE
FACULTY ADVISOR: J. Paul Smith, Ph.D., PE, SE
STUDENTS: Hiba Farag, Kevin Hernandez, Kelvin O'Gorman, Patricia Paulino, Quan Banh (Gwen)

The Cedar Falls Powerhouse plays a vital role in the operations that deliver safe drinking water to millions of Greater Seattle residents. Constructed in 1905, the Cedar Falls Powerhouse project was built during a time where seismic provisions were practically non-existent. Due to the area's high seismic risk and the building's age, there are concerns about the structural integrity and ability to withstand a major earthquake. Seattle City Light requested that Team CEE 20.4 conduct a seismic assessment of the powerhouse to identify potential deficiencies and design appropriate retrofit alternatives in accordance with ASCE 41-17: Seismic Evaluation and Retrofit of Existing Buildings. Following the completion of a multi-tier analysis, the team delivered a final report to Seattle City Light containing a list of identified deficiencies as well as supporting calculations, computer models, mitigation alternatives, and cost estimates.

SNOHOMISH COUNTY BARR CREEK BRIDGE #158 REPLACEMENT CEE 20.5



Snohomish County

SPONSOR: Snohomish County Public Works
SPONSOR LIAISONS: Nolan Anderson, PE, Larry Brewer, PE, Mike Randall, PE
FACULTY ADVISOR: Mark Siegenthaler, PE, PLS
STUDENTS: Thea Foulk, David Jenkins, Nisha Mandanas, Han Phung, Debra Tseng

Snohomish County Public Works Department requested that the team develop a Type, Size, and Location (TS&L) Report for the replacement of Barr Creek Bridge 158. The bridge, located on Ben Howard Road in unincorporated Snohomish County, is classified as functionally obsolete due to its narrow lane width and high traffic volume. The team proposed three bridge alternatives, selected their preferred alternative with an evaluation matrix including superstructure, substructure, and traffic barrier components, and developed the preferred alternative to 30% design. The team recognized the multidisciplinary nature of the project and worked to ensure the optimization and coordination of design elements, including hydraulic capacity, fish habitat improvements, appropriate foundation types, horizontal and vertical stopping sight distances, and traffic maintenance during construction. Particular challenges included analysis of Skykomish River flooding impacts, and design of the stream channel for local salmon species. The new bridge design complies with 2018 Snohomish County standards and prioritizes vehicle driver safety, structural efficiency, and minimization of environmental impacts.



“I’m very grateful to have had the opportunity to work with Seattle City Light. Being able to work on a real world problem has allowed me cultivate my professionalism and gain immeasurable knowledge and experience.”

HIBA FARAG '20 CEE



TRANSPARENCY AND TRUST CS 20.1



SPONSOR: Amazon
SPONSOR LIAISONS: Emir Barucija-Hodzic
FACULTY ADVISOR: Lin Li, PhD
STUDENTS: Virmel Gacad, Mohammad Ibraiwesh, Bikram Pannu, Ian Persson

Amazon’s Trust and Transparency team developed a dynamic risk modeling application, Rosebread, to aid Amazon’s Social Responsibility team in assessing risks of working with certain third-party vendors. However, the Social Responsibility team needed a more efficient and accessible way of conducting their searches and audits of manufacturing sites, so as to capture sites that are performing unethical behavior regarding work practices, environmental impact, health, and safety. To address this need, our team worked closely with the Trust and Transparency team to improve the risk modeling application so that there are more detailed features incorporated for the Social Responsibility team. Vital features that we integrated within the web application included product information, countries of sites, and the standards that must be upheld by the vendors. The aggregation of any of these parameter values produced a dynamic visualization tool used to model the given values and to alert the Social Responsibility team.



VIDEO CALL ANALYSIS SYSTEM (VCAS) CS 20.2



SPONSOR: Amazon
SPONSOR LIAISONS: Patrick Denton, Sai Jonnala
FACULTY ADVISOR: Lisa Milkowski, PhD
STUDENTS: Tate Brasel, Matthew Harrison, Devin Lim, Justin Nguyen

In 2019, Amazon launched a pilot version of its virtual health clinic, Amazon Care, for its Washington employees and their dependents. This virtual clinic provides Video Care, a service that connects patients to clinicians via video calls so that they may receive advice, diagnoses, treatment, and referrals. The Video Care development team requested an automated system that could collect and analyze information from individual calls to assist in improving the service. Our team was able to provide this for the Video Care development team by developing VCAS, a robust multi-component AWS system that processes and categorizes calls by quality in real-time. This categorization is performed by analyzing call connection statistics as well as video quality metrics derived from frame-by-frame comparison techniques. VCAS was designed to be easily connected to a video call application and automatically start generating call quality summaries to be displayed on a web dashboard. The modular structure of our solution accommodates future additions and enhancements to the system if other quality metrics are desired.

EC2 PROFILER CS 20.3



SPONSOR: Amazon Web Services
SPONSOR LIAISON: Peter Beardshear, Kevin Halliday, Les Lamprecht
FACULTY ADVISOR: David Lillethun, PhD
STUDENTS: Hannah Chang, Nicholas Jones, Rohan Panuganti, Hiba Salama

Amazon Web Services (AWS) is the world's most comprehensive and broadly adopted cloud platform, offering services such as the Amazon Elastic Compute Cloud (EC2). To provide customers with customizable cloud computing resources, over 190 different AWS EC2 hardware configurations are currently offered. Because over-provisioning can lead to unnecessary costs and under-provisioning can lead to poor workload performance, the decision of which instance configuration to use has a major impact on the customer. However, the current process of going about this decision is very tedious, requiring manual monitoring or custom software to observe utilization over time. AWS data scientists are training models to do the work of determining which configuration is best suited for a given workload, but their efforts are slowed by the manual process of data collection. To solve this, our team developed AWS Cumulus, a highly configurable benchmarking API suite for AWS EC2. With a small collection of API endpoints, users can manage and deploy workload configurations, request benchmarks to be run on as many EC2 variations as they would like, and retrieve the utilization data once it has been generated. By consolidating potentially hundreds of repetitive steps into as few as one, Cumulus allows for more rapid collection of meaningful utilization data, giving AWS data scientists more time to build robust machine learning models.



VERTICAL POWER PLANNER CS 20.4



SPONSOR: Astronics
SPONSOR LIAISON: Doug Brown, Randy Kwong, Adam Lew
FACULTY ADVISOR: Susan Reeder
STUDENTS: Sasank Kanuri, Xavier Martinez, Jonathan Pangelinan, Thao Thi Truong

More than 4,000 Astronics customers use the online Vertical Power Planner web tool to configure the electrical power distribution setup of their aircraft. Since its inception in 2014, the web application has been running on a Ruby On Rails framework and hosted on an Amazon Web Services platform. Now, with Astronics' decision to move from hosting on AWS to Microsoft Azure, several of their AWS-hosted applications, including the Vertical Power Planner, will need to be ported to the new Microsoft hosting environment. Our team refactored the original Ruby on Rails application to be supported in a Microsoft development environment. The team also rebuilt the application using several Microsoft technologies, including ASP.Net Core for the web server back-end, Angular for the application front-end, and Microsoft SQL Server for the application database. The two primary objectives for this project were enhancing software sustainability and to provide a similar user experience to the original application. To accomplish this, we designed the refactored version of the application to maintain the Model-View-Controller architectural pattern so Vertical Power developers have ease of maintenance and support in the future. The user interface of the refactored application was improved so that users of the Vertical Power Planner can continue to utilize the web tool with familiarity and ease.



DSD WEB UTILITIES CS 20.5

Baus Systems

SPONSOR: Baus Systems
SPONSOR LIAISON: Mark Baus, Steve Baus
FACULTY ADVISOR: Mike McKee
STUDENTS: Jack Arnold, Ashley Decolibus, Audrey Routt, Ben Smith

Baus Systems provides Route Accounting solutions to Direct Store Delivery Distributors. Their customers range from single-route owner/operators to multi-state, multi-warehouse distribution companies. Baus Systems began developing their route accounting software, DSD Office Utilities, in the 1990s. Since then, some of its core components have become technologically outdated. This team was tasked to begin phasing out DSD Office Utilities by building the foundation of a cloud-based application. While the team delivered a small subset of the core DSD-specific features, such as tools to manage Products, Customers, and Discounts, the bulk of the foundation contains the behind-the-scenes features that a web application needs to be production-ready. Baus Systems can use this foundation to develop additional features that replace DSD Office Utilities, allowing them to continue providing effective DSD Route Accounting solutions to their customers.



“Working with F5 has been amazing! I have grown a ton as a software developer thanks to this experience. Being able to work so closely with professionals has been an invaluable learning and networking opportunity.”

JONATHAN KIMRAY '20 CS



SKILLS-BASED ROUTING CS 20.6



SPONSOR: F5 Networks
SPONSOR LIAISONS: Nick Ferguson
FACULTY ADVISOR: Steven Hanks, PhD
STUDENTS: Lina Chung, Samantha Fisher, Jonathan Kimray, William Lathrop

F5 Networks takes hundreds of service requests a day regarding troubles or questions about their products. These service requests are routed to Network Support Engineers by a Queue Lead whose job it is to manage and keep track of workload distribution as well as to correctly send service requests to teams or individuals skilled in the product referenced. This is currently done using several Excel spreadsheets and manual cross referencing. Our team has developed a single tool, “One Tool” that unites all of the data needed in one location. It offers the Queue Lead the best available options for Network Support Engineers for each service request. The goal of our project is to reduce the time needed to route a service request which will allow for faster response time. Our team built the application using React combined with a backend built in Express and a PostgreSQL database.

MONARCH CS 20.7



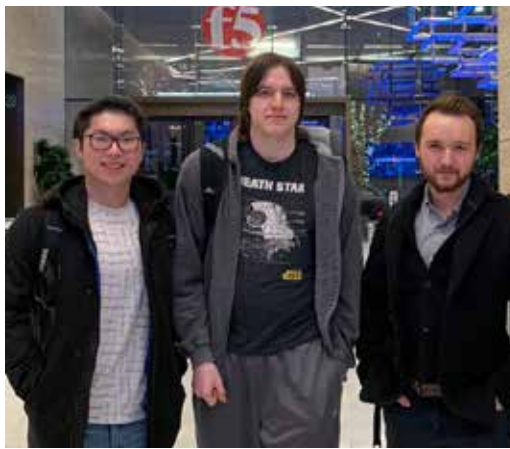
SPONSOR: F5 Networks

SPONSOR LIAISONS: Rick Mitchell

FACULTY ADVISOR: Sheila Oh

STUDENTS: Thomas Chin, Yunxing Liu, Allie O'Young, Michelle Simoni

F5 Networks is making a transition in their bug tracking software, moving from Mozilla's Bugzilla to Atlassian's Jira software. During this transition period, issue tickets are housed on separate data servers, requiring tedious, manual synchronization. Under the name Project Monarch, our team has been tasked to develop a Mapper tool that integrates and synchronizes information from F5's Jira and Bugzilla databases. In addition, a front-end application will allow F5 users to configure synchronization settings and will remove the need to manually create or update issues on the two servers. This project will improve workflow, code coherency, and communication for F5 engineers. The team used Python to build an API set for transferring Jira issues to Bugzilla servers and used Django, PyCharm, and Docker for Bugzilla to Jira transfers.



QKVIEW CS 20.8



SPONSOR: F5 Networks

SPONSOR LIAISONS: Kavya Chunduri, Aalap Doshi, Dinesh Malhotra

FACULTY ADVISOR: Yingwu Zhu, PhD

STUDENTS: Richard Charczenko, Matthew Brian Darmadi, Sean Dempsey, Nolan Orloff

F5's BIG-IP system runs on a wide range of product versions and configurations among its clients. QKView log files collect information about currently enabled features, logs, and other details of each client's configuration. This data can be very useful; however, many processes within F5 do not use this data to full effect. This project leverages QKView data to streamline some of these processes by creating a feature matrix, which allows F5 to get a big-picture view of features being used by clients, as well as a Bugzilla mapper that links features to specific bugs, where they were previously only mapped at the less granular component level. With the help of the feature matrix and Bugzilla mapper, we used information retrieval techniques to implement a performant bug prediction algorithm that determines whether upgrading to a new version of BIG-IP potentially results in any bugs. This project will help F5's clients to make informed decisions on upgrading and thus take respective measures to smoothen the upgrading process.



"I was really very impressed with this team of students. Looking at what they have accomplished, they took a very mature approach to the problem and how to reach their goals. SU has plenty of reason to proud of this program and their students."

RON RUNYON F5 VP, GLOBAL SERVICE DELIVERY

BATTERY CABLE EXPERT (BCE) CS 20.9



A **PACCAR** COMPANY

SPONSOR: Kenworth Truck Company

SPONSOR LIAISONS: Walt Brewer, Dustin Davis, Neil Rogers, Alex Russell

FACULTY ADVISOR: Richard LeBlanc, PhD

STUDENTS: Kin Yuk Chan, Ben Gruher, Jacob Keenan, Raydi Tjuandi

Kenworth Truck Company specializes in the design, manufacture and customer support of high-quality light-, medium-, and heavy-duty trucks. Our team, in coordination with the Kenworth sponsors, developed the Battery Cable Expert application, which is a robust, comprehensive cross-divisional web application utilizing .Net Core and cloud technologies that can be leveraged by engineers. This application allows engineers the ability to enter truck component data along with other various engineering specifications, which enables the program to generate the most optimal battery cable configuration for every truck that is designed at Kenworth. This new application allows the engineers to streamline their processes and automate much of the battery cable design process.



DATA ACQUISITION AND INVENTORY MANAGEMENT (DAIM) CS 20.10



KILOWATTS FOR HUMANITY

SPONSOR: KiloWatts for Humanity (KWH)

SPONSOR LIAISONS: Dave Goldsmith, Jeremiah Kalmus, Daniel Nausner

FACULTY ADVISOR: Wan Bae, PhD

STUDENTS: Jesse Dufresne, Audrey Kan, Dalena Le, Ben Targan

KiloWatts for Humanity (KWH) is a volunteer-run nonprofit organization that provides improved access and infrastructure to electrification in energy impoverished villages overseas through renewable energy solutions. KWH's Raspberry Pi-based data acquisition system (DAS) used sensors to measure the electric current between two Victron components. Over time, these sensors tend to drift, incurring additional costs for on-site maintenance. We built an embedded software utility that extracts data output from the Victron inverter and charge controller. By using Victron cables to connect these devices to the DAS, the embedded utility eliminates reliance on the sensors, improves reliability of data extraction, and provides consistent and accurate data for KWH. Our work on the DAS will positively impact the organization by decreasing maintenance costs and helping KWH better aid the populations they serve. KWH also asked the team to build a web application to manage their inventory of DAS components across implementation projects. Our web app, built on the .NET Framework with C#, establishes an organization-wide inventory management system that centralizes information. Both of our solutions will be put into practice this fall as KWH embarks on an implementation trip to Kanchomba, Zambia to install our modified DAS.

GEARSIM CLOUD MANAGEMENT CS 20.11



SPONSOR: SDI Engineering
SPONSOR LIAISON: Andrew Erickson, Dr. Phillip Richards
FACULTY ADVISOR: Michael Koenig
STUDENTS: Finnegan Carroll, Margery Carlos, Samrit Dhesi, Isaac Ortega

SDI Engineering Inc. is a specialist provider of engineering services and software tools in the aeronautical, aerospace, and other related industries. SDI has 25 years of experience supporting industry partners such as Boeing, Airbus, Cobham, and Atkins Aerospace, and conducting cutting-edge research for the U.S. Navy, U.S. Air Force, and NASA through the Small Business Innovation Research (SBIR) program. This project focuses on GearSim, SDI's landing gear loads, dynamics, and subsystem analysis software package. As SDI's user base grows, they have encountered the need to modernize and streamline their software licensing method. The current licensing method uses a specialized Wibu-Systems USB device that authenticates their GearSim application. Clients are required to have the USB device plugged into their system before accessing SDI's software. This licensing approach presents certain challenges, as a physical USB is difficult to track, distribute, and replace. The student team provided a cloud alternative to authorizing users of the GearSim application. The cloud alternative provides valuable software usage telemetry, which was previously lacking. By integrating several systems such as Azure AD and Azure Application Insights, the team has eliminated the need for USB licensing and developed a telemetry system that provides complex usage data to SDI software engineers.



VIRTUAL ASSISTANT CS 20.12

SEATTLE UNIVERSITY.

SPONSOR: Seattle University IT Services
SPONSOR LIAISONS: Heather Logan, Travis Nation
FACULTY ADVISOR: Hidy Kong, PhD
STUDENTS: Fisher Harris, Ana Taylor, Connor Wilding

Information Technology Services (ITS) strives to provide fast and efficient technical support to the university's diverse community of students, faculty, and staff but faces limited resources and staffing constraints. Their task is further complicated by the vast number of products and services deployed across campus that people ask about. This information is difficult to locate on the SU's website due to the complexity of its structure. By creating an intuitive virtual assistant, we aim to alleviate some of the burden on ITS Desk staff and provide the SU community with helpful technical support that is available 24/7. We have created an application that is maintainable and extensible. In the future, our virtual assistant could have expanded functionality on topics beyond technical support such as recruitment, admissions, academics, student affairs, and others.

THUMP CS 20.13



SPONSOR: Thump/Fernando Hernandez
SPONSOR LIAISONS: Fernando Hernandez
FACULTY ADVISOR: Pejman Khadivi, PhD
STUDENTS: Rakan Alsagoor, Purevmaa Damdinsuren, Mark McKinnon, Megan Nguyen

The goal of this project was to create a mobile application that can control a physical device to perform a feeling in different features within messages from senders. The basic concept of the app is similar to other messaging applications currently available. A user can create a profile with their unique username to connect and communicate with other users. When the communication is established between two users, the app will provide some features of feelings that can be attached with the message to senders such as, heating as a warm hug, a fun pattern of lights as emojis, and a metaphorical touch as a Thump. A device that performs these features will be connected to the application via Bluetooth and the application is built on the Android platform. We conducted research on Bluetooth processes and gathered basic requirements before jumping into designing the application architecture and building a prototype that can perform these features.



VRBO TRAVELER COMPANION CS 20.14



SPONSOR: Vrbo
SPONSOR LIAISONS: Abhishek Nath
FACULTY ADVISOR: Jason Wong
STUDENTS: Jocelin Darma, Grady Diakubama, Joseph Tseng, Gangyi (Mark) Yu

Vrbo is a subsidiary of the Expedia Group that helps owners and customers in the vacation home rental business. Vrbo's mission is to bring people together wherever they travel. To help further Vrbo's goal, the Vrbo Traveler Companion App enables travelers to foster greater communications and community with local residents if they do not understand the native language. By using the Vrbo Traveler Companion App, users will have the ability to select the language they want the application to translate to by selecting from the drop-down list on the top of the screen. The application works by waiting for a speech input, which is invoked by touching the microphone icon. Once the input is finished, the application will automatically translate the speech into the selected target language, and voice out the translated output. The speech recognition and text-to-speech (TTS) is done using the built-in Android APIs and the natural language processing is done by utilizing Amazon Translate. On most devices, the Android APIs make use of Google's speech recognizer and synthesizer, which are available in both online and offline versions.

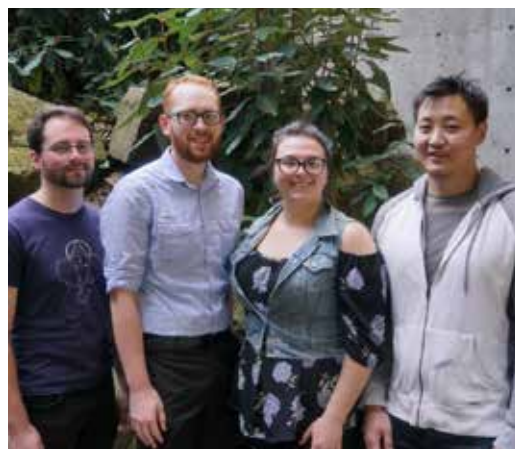
"The students working on our project are amazing! They are well organized, thoughtful, skilled, and passionate. If they represent the other students involved in these projects, Seattle University is doing a fantastic job of educating these future leaders to professional formation."
TRAVIS NATION ASSOCIATE CHIEF INFORMATION OFFICER, SEATTLE UNIVERSITY

GENERATOR INSTRUMENT POWER SUPPLY
ECE 20.1

CHELAN COUNTY

SPONSOR: Chelan County PUD
SPONSOR LIAISONS: John Yale, PE
FACULTY ADVISOR: Paul Kostek
STUDENTS: Kalana Agampodi, Ihman Antonio, Edwin Arciaga, Kyle Cass

Since 1947, Chelan County PUD has been providing electric service through the operation of multiple sets of hydroelectric generators stationed at three dam facilities across the county. Chelan County PUD is looking to incorporate Hydroelectric Monitoring Systems (HMS) on their generators to collect real-time data allowing them to monitor the conditions of their generator components along with its performance. However, these monitoring systems are battery-powered and require the generator to be stopped in order to replace its batteries. During this downtime, Chelan County PUD estimates a loss of about \$10,000 worth of power. The team was tasked with replacing the battery pack with an alternative power supply in order to power the HMS continuously, using stray magnetic flux within the generator. The magnetic flux can be harnessed by using a core and copper coil windings which, when placed within a magnetic field, induces an AC voltage within the copper coil. With the use of an AC-DC converter, the voltage produced from the core and coil is converted to DC voltage. The DC voltage produced is not enough to power the HMS. Instead, a DC-DC boost converter will take the small DC voltage and produce a larger DC voltage of about 5V to power the HMS. Through a combination of lab results and simulations using MATLAB and Multisim, ECE 20.1 will demonstrate the practical feasibility of the proposed solution.

**CONTROL FOR CLOUD APPLIANCE** ECE 20.2

SPONSOR: Overcast Innovations
SPONSOR LIAISON: Tony Larson, Andie Philip
FACULTY ADVISOR: Scott Bright
STUDENTS: Zachary Chandler, Jordan Fraser, McKenzie Kay, Lee McCarroll

Overcast Innovations has developed a new, modular ceiling appliance. The Cloud is an all-in-one lighting and HVAC control solution. A modular design aids in cleaner building design and efficient construction. It allows for greater control over building management utilizing preinstalled sensors to gather indoor climate conditions. Overcast Innovations has asked the SU ECE 20.2 team to develop a platform that allows tenants, owners, and users to access and control the Cloud in preparation of their first major deployment in Eastern Washington University's Catalyst building. Per Overcast's specifications, the team designed a web application that allows users to access their local Cloud. On a dedicated server, a web server and a database facilitates network communication and data storage. A Raspberry Pi has been fitted with sensors and actuators to simulate Overcast's Cloud. The ECE 20.2 team's web application pulls data from and sends control requests to the Raspberry Pi system. This project serves as research, and therefore contributes to the continued development and improvement of Overcast Innovation's Cloud solution.

COLLABORATIVE CALCULUS ECE 20.3

SPONSOR: Mercer Island Telecom
SPONSOR LIAISON: Carlos Luis Obando
FACULTY ADVISOR: Shiny Abraham, PhD
STUDENTS: Theo Fattah, Don-Thuan Le, Michel Mugisha, Samuel Van Nes

Cloud-native technologies are innovating at an accelerating pace and as a result they are disrupting many different industries. Yet the education industry has seen limited adoption of these new technologies. As EdTech tools are developed and tested, studies have shown that the use of technology enables increased student understanding of a variety of topics, including mathematics. EdTech tools not only enable a deeper conceptual understanding of a given topic, but devices such as computers and mobile devices give students the ability to constantly collaborate. The team developed a platform, 345pi.com, with two key features: curriculum created based on collaboration in the classroom, and enhanced communication and cooperation through Zoom Video Communications. The website incorporated a social media interface with individual users having the ability to create forums, groups, and after collaborating with others, allows for a rating system. Through this platform, Collaborative Calculus strives to create a community of collaborators who are able to reach out and help others around the world.

**PROJECT SPOT CHECK** ECE 20.4

SPONSOR: Panthera
SPONSOR LIAISON: Rana Bayrakçismith, Agnieszka Miguel, PhD
FACULTY ADVISOR: Paul Kostek
STUDENTS: Sultan Alneif, Anthony Caballero, Philip Schmeichel, Amudhan Sekar

The Panthera organization is dedicated to the research and conservation of all wild cat species. They wish to estimate a population of snow leopards in a study area. Panthera asked team ECE 20.4 to continue the development of a software program that will help their biologists sort and identify individual snow leopards in a given image set. The team has utilized machine learning techniques to improve accuracy and optimize the Python program. The program used Mask R-CNN to identify and create a template surrounding snow leopards in an image. Using a computer vision package called OpenCV, the program identifies key spots on the leopard's body, giving them a series of numerical values. The program then applied two machine learning clustering algorithms, k-means and Markov clustering, to sort the data and determine the number of snow leopards. The team used cloud computing services provided by Microsoft Azure to run the snow leopard recognition program on multiple operating systems. Cloud computing also significantly increases the speed at which the program runs. This enables Panthera to quickly and more accurately estimate the population and study the behavior of snow leopards in their captured images.

MONITORING INSTREAM HABITAT CHANGE AFTER LARGE WOOD AUGMENTATION, SWAUK CREEK, WASHINGTON ENSC 20.1



SPONSOR: McKinstry

SPONSOR LIAISONS: Ashton Bunce, Yakama Nation Fisheries Scientist, Alex Cordas

FACULTY ADVISOR: Lyn Gualtieri, PhD

STUDENTS: Shelby Brodman, Sebastian Espinosa, Emma Gloekler, Lisa Kysar

Swauk Creek, a historically overdeveloped tributary of the Yakima River near Cle Elum, Washington, has been the site of several aquatic habitat restoration projects. In August of 2019, Yakama Nation Fisheries installed approximately 200 logs within a 0.4-mile reach of the creek immediately upstream from the confluence. The logs were placed with the goals of increasing flood-plain inundation frequency, improving the complexity of the channel bed and providing in-stream cover for fish. Yakama Nation Fisheries has tasked ENSC 20.1 with monitoring the restoration project by performing field surveys of streambed morphology, sediment size and patchiness, and wood position in October/November of 2019 and again in April/May of 2020. Due to the COVID-19 pandemic, the data collected in the fall 2019 were instead used to determine baseline conditions of the restored area for future researchers to monitor the results of the wood augmentation. The baseline conditions of the variables measured can be used to determine the effectiveness of the wood restoration in improving critical habitat for endangered and threatened salmon. The team used their field data to create a GIS map including log and cross-section locations, along with a sediment characterization map. The team characterized streambed morphology by taking cross-sectional depth measurements and analyzing them graphically to monitor changes that may have occurred due to deposition or erosion. The team used the results of this project to recommend future stream monitoring efforts by establishing baseline data for long term monitoring of Swauk Creek.



INTEGRATING INFRASTRUCTURE AND ECOSYSTEM SERVICES TO IMPROVE AQUATIC HABITAT ENSC 20.2



SPONSOR: U.S. Forest Service

SPONSOR LIAISON: Robert Deal, PhD, Doug Osterman (King County/WRIA 9)

FACULTY ADVISOR: Wesley Lauer, PhD, PE

STUDENTS: Nathaniel Blue, Emma Knudsen, Anisha Patel, Jolie Wiseman

The Desimone Oxbow, a ~45 acre privately owned lot on the west bank of the Duwamish River in Tukwila, WA, provides a unique opportunity for large-scale urban habitat restoration. In partnership with the U.S. Forest Service (USFS) and Watershed Resource Inventory Area 9 (WRIA 9), the Seattle University team evaluated conceptual designs for habitat restoration on the property. The site is located on the first channel bend upstream from the dredged and straightened lower Duwamish Waterway. Tidal action brings water from Puget Sound upstream through the industrial waterway to the oxbow, where salinities rise and fall with the tides. Shallow water habitat surrounding this “transition zone” is integral for juvenile salmon to successfully survive their migration from the freshwater river to the saltwater ecosystems of Puget Sound. The team evaluated the potential habitat value of several restoration alternatives at the site. Their analysis addressed the extent and type of shallow water habitat produced as well as the potential for funding through development of mitigation bank credits. The team also documented salinity dynamics at other restored wetlands in the transition zone.



RAIN AND WASTEWATER HARVESTING INT 20.1



SPONSOR: Space Needle, LLC
SPONSOR LIAISON: Luis Quintero
FACULTY ADVISOR: Kirk MacLearnsberry, PE
STUDENTS: David Barker (ME), Brian Jong (ME), Eunice Lubemba (ECE), Tom Vang (ECE)

The Space Needle is one of the most iconic landmarks in Seattle, Washington. Built for the 1962 World's Fair, the Space Needle's timeless design continues to serve as an inspiration for innovation. The Seattle Space Needle seeks to continue that legacy by commissioning the design of a pico-hydro turbine generator to capture energy from rain and wastewater conveyed down from the structure's top level. The team designed a hydraulic turbine system including a generator and battery energy storage component. The system will provide power for a charging station that houses mobile battery packs, which will be available to rented by Space Needle visitors. The team has given the Space Needle a turbine blade design, wiring diagram, material list, equipment data sheets and manuals, lab test results, and charge controller settings. This project serves as a complete turbine and electrical design that can be used to build a pico-hydro turbine generator to capture energy from rain and wastewater at the Space Needle.



MOBILE DEVICE UI RESPONSE AND BATTERY CURRENT DATA ACQUISITION INT 20.2



SPONSOR: T-Mobile
SPONSOR LIAISON: Ross Hartley, Zachary Powers
FACULTY ADVISOR: Alvin Moser, PhD, Jason Wong
STUDENTS: Ahmed Alsaif (ECE), Mitch Downey (CS), Brigid Kelly (ECE), Grant Ludwig (CS), Amal Mohamed (CS), Lauren Molina (ECE), Kyle Sharp (ECE)

T-Mobile US, Inc. (T-Mobile) is dedicated to complete customer satisfaction. A major component of that satisfaction is the performance of the devices offered for use on their mobile network. In order to reduce customer remorse, T-Mobile employs rigorous testing of all mobile devices they offer. Two of those criteria are battery life and UI speed. Using only open-source and bespoke designs, the team has developed an integrated testing system to monitor, log and analyze these two important performance metrics. This system includes custom-designed circuitry using discrete electronic components, computer vision software, a secure server, and a graphical user interface capable of connecting to and remotely controlling the testing system.



“SU students can compete on the big stage. They have the tool kit, information, abilities, experiences to do that.”

JOHN HOOPER '81, MAGNUSON KLEMENCIC ASSOCIATES



RAIN CHAMBER HARDWARE VALIDATION ROBOT INT 20.3



SPONSOR: T-Mobile
SPONSOR LIAISON: Eric Christie
FACULTY ADVISOR: Yen-Lin Han, PhD
STUDENTS: Thomas Ekstrom (ME), Hunter Mason (ECE), Bradley McDonald (ME), Brenna Murphy (ME), Ashish Rana (ECE), Ngoc Tran (ECE)

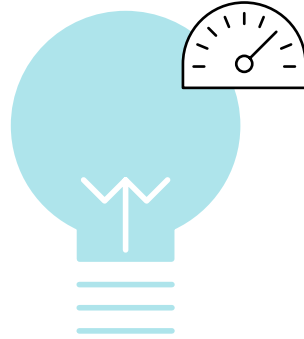
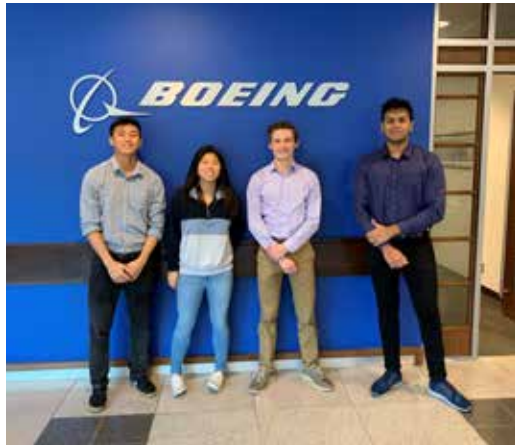
In addition to providing mobile data and cellular service, T-Mobile sells mobile devices purchased from equipment manufacturers. To ensure customer satisfaction and reduce device return rates, T-Mobile performs various tests on samples of these devices to ensure that their functionality, usability, and durability meet T-Mobile's standards. Water ingress testing, based off IPX2 ratings, is one of these tests and it is conducted in a rain chamber. To improve repeatability, T-Mobile tasked the team to design, build, and test an automated robotic manipulator to be used in the rain chamber. The robotic manipulator uses waterproof servos and was integrated with T-Mobile's existing rain chamber. The manipulator uses a rotary joint across which control signals and power are distributed to the servos. The embedded Raspberry Pi uses low-cost electronic hardware and open source Python packages to control the manipulator servos and other components. The manipulator is controlled via wired or wireless local networking, for which a C# library has been made for easy integration into existing T-Mobile codebases. The T logo and the magenta color are registered trademarks of Deutsche Telekom AG.

HYDRAULIC ROTARY/PISTON TYPE ACTUATOR ME 20.1



SPONSOR: The Boeing Company
SPONSOR LIAISONS: Bryan Miller
FACULTY ADVISOR: Eric Gilbertson, PhD
STUDENTS: Peter Griff, Swapnil Patel, Kaitlen Tanaka, Dillon Yamamoto

The Boeing Company is the world's largest aerospace manufacturer of commercial and government aircraft. Aircraft wing designs are constantly being developed to address aerodynamic drag effects, which relate to fuel consumption and operating costs. This will continue to push the cross section of wings to be thinner on future aircraft and reduce housing space for control mechanisms such as actuators. The goal of this project is to design a rotary hydraulic actuator that fits within this smaller housing envelope. This actuator will control the rotational motion of the aileron, a flight control surface located on the trailing edge of the aircraft's wings. The ailerons are necessary components responsible for producing the plane's rolling motion. A rotary piston rather than the current linear piston actuator would keep the actuator completely contained inside the wing, eliminating the bulge that covers the linear actuator, which creates a significant drag penalty for the aircraft. The team used SolidWorks, ANSYS, and MATLAB software to iterate the design and determine its feasibility. The design features multiple hydraulic dual-piston actuators capable of producing the load requirement during flight.



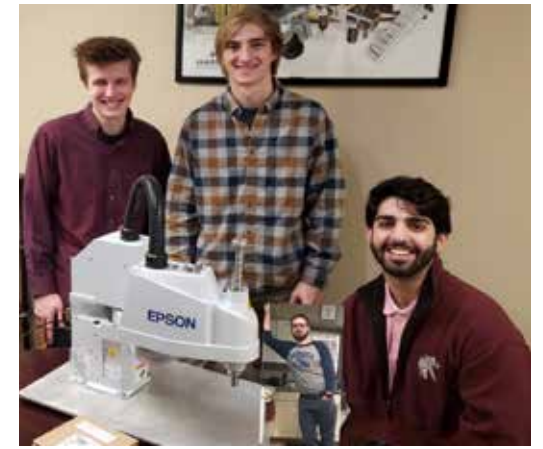
KENWORTH FLOODLIGHT ME 20.2



A **PACCAR** COMPANY

SPONSOR: Kenworth Truck Company
SPONSOR LIAISONS: Osmar Galvan
FACULTY ADVISOR: Mohsen Dadfarnia, PhD
STUDENTS: Nate Birchard, Christian Hubbell, Katey Murphy, Kendric Roberts

Kenworth Truck Company is a major manufacturer of both on-highway and vocational trucks for the North American market. Kenworth's vocational customers (such as tow truck and cement mixer operators) desire a user-adjustable lighting system to illuminate the sides of their trailers and workspace. Kenworth seeks to meet this demand by developing an outboard mounted floodlight system for day cab customers, specifically those driving T680, T880 and W990 model trucks. The system must illuminate a wide variety of aftermarket vocational trailers, while minimizing impact on manufacturing time and complexity as well as avoiding interference with other cab options (vertical exhaust, grab handles, etc.). To meet this need, our team designed an arm and bracket system to mount an LED floodlight outboard of the truck body. The position of the floodlight was confirmed to meet illumination requirements via computer modeling of the illuminance profile. Finite element analysis and physical testing at Kenworth facilities were used to ensure the system meets durability standards. The team provided Kenworth with a CAD model of the system and a working prototype of a new outboard floodlight mounting system compatible with T880, T680 and W990 day cabs.



KENWORTH AUTOMATION ME 20.3



A **PACCAR** COMPANY

SPONSOR: Kenworth Truck Company
SPONSOR LIAISON: Stan DeLizo
FACULTY ADVISORS: Yen-Lin Han, PhD
STUDENTS: Ben Cross, Trevor Hart, Sahm Noorfeshan, Owen Van Valkenburgh

Kenworth is an industry leader in the design and manufacturing of medium- and heavy-duty trucks. Driver assist vehicles are poised to revolutionize the freight industry. It is in Kenworth's interest to be at the forefront of the development of driver assist technology to launch options that make economic sense to the vehicle owners. Along with the technical challenges inherent to driver-assist applications in any vehicle, semi-trucks have additional operational requirements, including but not limited to the connection and disconnection of air and electrical lines between the tractor and trailer. The team was tasked with designing a prototype system capable of engaging and disengaging the electrical plug connector that supplies power to the trailer lighting systems. The prototype system uses a custom-designed end effector optimized to operate the power-line assemblies. The end effector is permanently attached to a 6 degrees of freedom robotic arm that will be mounted on the chassis of the truck. The end effector and an existing trailer air coupler was revised to work seamlessly with this power coupler. During operation, the robotic arm with end effector attached, picks up each assembly off the truck and attaches them to the trailer individually. The system is also capable of disconnecting each assembly from the trailer and returning them to their resting position on the tractor.

CANTEEN TOP INSTALLATION DEVICE ME 20.4



The Lighthouse for the Blind, Inc.

SPONSOR: The Lighthouse for the Blind, Inc.
SPONSOR LIAISONS: Doug Hintz, Brent Weichers
FACULTY ADVISOR: Bob Cornwell, PhD, PE
STUDENTS: Carson Huseby, Kevin Kim, Noe Meza, Scott Redfield

The Lighthouse for the Blind (LFTB), Inc., is a non-profit organization that provides employment and training opportunities for people who are blind, deaf-blind, or blind with other disabilities. Currently, one of the products LFTB produces is a military canteen. During production, an employee must screw on the canteen cap by hand. They have had a number of injuries due to the repetitive nature of this process in recent years. Hand injuries are especially serious for the employees since their hands are how they interact with the world. LFTB requested an alternative to the employees screwing the caps on by hand. Two important requirements that LFTB set for the project were to complete a bottle every 15 seconds and the machine must not remove any jobs, as the goal of LFTB is to create jobs. The team developed a four-station rotary design to address the production problems identified by LFTB. The first station is where the employee loads the canteen. The canteen then rotates 90 degrees to the second station where the label is applied. Following labeling, the canteen rotates to the third station where the cap is screwed onto the bottle. The final station is where the canteen is removed for the system for shipping.



VALVE ASSEMBLY AND INSPECTION ME 20.5



The Lighthouse for the Blind, Inc.

SPONSOR: The Lighthouse for the Blind, Inc.
SPONSOR LIAISON: Doug Hintz, Brent Weichers
FACULTY ADVISOR: Joshua Hamel, PhD, PE
STUDENTS: Erica Goodman, Stephanie Merwin, Thomas Mickoski, Roslynn Rux

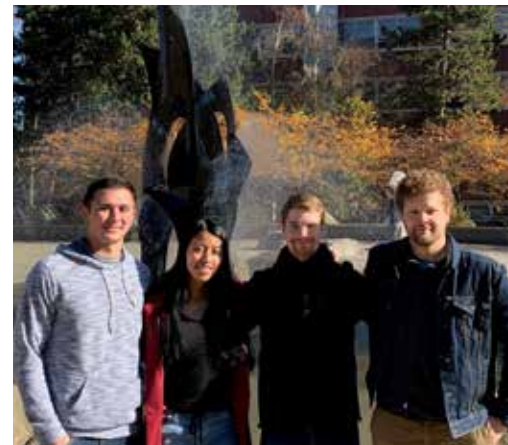
The Lighthouse for the Blind, Inc., is a non-profit organization that provides employment and training opportunities for people who are blind, deaf-blind, and blind with other disabilities. They currently have a contract with the federal government to assemble a multipurpose hydration system (MPHS) for the military. The focus of this project was the inspection of the valve on the MPHS bladder. The student team was tasked with designing and building a system that could be operated by an employee who is blind or deaf-blind that both inspects the valve and installs an O-ring onto it. The team designed a device that utilizes a rotary table and O-ring expander to install the O-ring and a computer vision system to inspect the O-ring placement. After inspection, the device alerts the operator of any defects via sound and tactile vibration, while also logging the reason for failure into a database. This new system can inspect 1,150 valves per day with zero failure acceptance, makes the installation of an O-ring much simpler, reduces the possibility of human error in the failure detection process, and provides an employment opportunity to a person who is blind, deaf-blind, or blind with other disabilities.

AUTOMATED INSPECTION APPARATUS ME 20.6



SPONSOR: NIC Global
SPONSOR LIAISONS: Spencer Morse, Ted Wirsching
FACULTY ADVISOR: Greg Mason, PhD, PE
STUDENTS: Jeimmy Barbosa, Nicholas Kennedy, Thomas Masters, Miles Urband

NIC Global is a sheet metal fabrication and manufacturing company based in Woodinville, WA. One of the products they manufacture is the HD24 shear wall hold-down, a component of Simpson Strong Tie's shear wall products. These hold-downs are used in building construction to resist earthquake forces, so strict quality control is required. The goal of this project was to redesign NIC's manual quality control process with an automated system to improve reliability. The team designed and manufactured an automated inspection apparatus that uses physical probes and an online database to measure and store the critical dimensions of the hold-downs in under 5 minutes per part. The apparatus measures critical dimensions with a tolerance of ± 0.001 ". The data are analyzed using statistical process control to find trends that indicate decreasing manufacturing quality so the operator can adjust tooling before parts fail quality control.



"The student engineering team had a totally fresh perspective and looked at all kinds of solutions. They contributed energy and ideas that invigorated our engineering team. And they came up with a solution that we believe will work."

BRIDGET BREWER '88 President, NIC Global Solutions

PROTOCOL FOR ENERGY MODELING OF INDUSTRIAL SITES ME 20.7



SPONSOR: Puget Sound Energy
SPONSOR LIAISON: Chao Chen, Alex Cimino-Hunt
FACULTY ADVISOR: Claire Strebinger, PhD
STUDENTS: Robyn-Ashley Amano, Amber Mirafuentes, Jasmina Omerovic, Diego Rojas

Puget Sound Energy (PSE), the largest utility company in the state of Washington, is a pioneer for energy efficiency programs in industrial sites. With industrial buildings accounting for a third of annual energy consumption in the United States, PSE's Industrial Strategic Energy Management (ISEM) and Industrial Systems Optimization (ISOP) programs help industrial customers identify low cost ways to reduce energy consumption. As the Puget Sound area continues to grow, low cost and carbon neutral actions help delay the need for PSE to construct new power plants. PSE has tasked the team with creating uniform guidelines that determine the best practices for developing whole-facility building energy models that (a) forecast an industrial site's energy usage had they not enrolled in PSE's programs and (b) use this energy forecast to verify energy savings. Informed by ASHRAE Guideline 14, the guidelines developed by the team walk PSE engineers through the iterative



process of predicting energy consumption through multivariable linear regression, given metered data of possible site energy drivers (i.e. temperature, operational units). Additionally, the guidelines introduce novel statistical metrics previously unused by PSE's energy engineers to better validate the energy modeling process. Technical details behind model validation using model fit statistics (e.g. R^2), and savings validation using model uncertainty calculations (e.g. confidence intervals) are detailed in a report to PSE engineers. The guidelines and supporting documentation developed in this project provide PSE engineers with a uniform method and structure to determine energy savings in industrial sites.

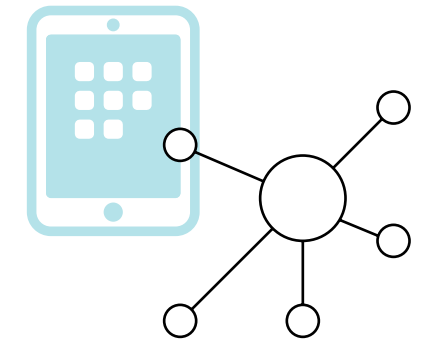


SOUND TRANSIT LIGHT RAIL CATENARY ME 20.8



SPONSOR: Sound Transit
SPONSOR LIAISON: Craig Delalla, PE
FACULTY ADVISOR: Eric Gilbertson, PhD
STUDENTS: Delmar Ching, Funsho Kufile, Marcus Jjaks Reyes

Sound Transit, a public transit agency serving the Seattle metropolitan area, is building the world's first light rail system over a floating bridge. This light rail expansion will run from the International District station to Bellevue, crossing the I-90 floating bridge. A transition assembly must be used to extend the overhead catenary system (OCS) of the light rail across the I-90 floating bridge expansion joints. Because the bridge floats on Lake Washington, its height changes by season and a new OCS transition must be implemented to ensure that the contact between the OCS and pantograph is maintained. Sound Transit will be performing off-site testing to simulate all operating conditions. The team created a dynamic model of the overhead transition assemblies and the pantograph, starting from 150 ft before the transition to 150 ft after it to predict pantograph behavior and establish force thresholds and expectations for the testing. The model accounts for the controlled change in lake levels and all train speeds. The model accurately demonstrates the train interaction on the new gliding transition and predicts under which conditions the force between the pantograph and OCS is outside the allowable range of 18-20 lbs. The team also submitted a technical report and made recommendations regarding the instrumentation that can be used to experimentally validate the model and to experimentally detect failure.





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