



Projects Day

JUNE 7, 2002

Science and Engineering Project Center
Senior Design Projects 2001-2002

WELCOME



This is the fifteenth year of the Science and Engineering Project Center. I congratulate all those within the School and outside for making this Project Center the success it is today. Welcome, all of you, and thank you for your participation.

On this, Projects Day 2002, we present the results of student work sponsored by industry, government, and other agencies, and developed by senior students in the science and engineering design program at Seattle University. This is a wonderful opportunity for our students to share with you the results of their hard work.

We are grateful to our sponsors – those who are veterans at sponsoring our projects and those who are new this year. It is a tribute to your faith in our students, and in the quality of their work, that you choose to invest your time and resources in these projects.

This senior capstone experience is perhaps the most important learning experience for our students in culminating their careers at Seattle University. Working in small groups, solving open-ended problems that may not have a unique solution, and being responsible to strict timelines, budgets, and the needs of outside agencies, are excellent preparations for the professional positions our students will soon fill.

Congratulations to our faculty, students, and professional mentors for bringing these challenging projects to fruition and to success.

George Simmons, Dean
School of Science and Engineering



On behalf of our faculty and students, I also welcome you to Projects Day 2002, our annual presentation of design team results to sponsoring organizations, visitors, and friends. I am grateful for the encouragement and assistance provided by our Science and Engineering Advisory Board and the Project Center Advisory Committee in promoting the external sponsorship of our projects. I would also like to acknowledge the coordination efforts of professors Rolf Skrinde and Nirmala Gnanapragasam in Civil and Environmental Engineering, Al Moser in Electrical Engineering, Teodora Rutar Shuman in Mechanical Engineering, Everaldo Mills in Computer Science, as well as Sheridan Botts, contracts manager, and Kathy Fletcher and Whitney Johnston, administrative assistants for the Project Center.

Special thanks go to the students in our engineering organizations who are your hosts today and who volunteer to carry out many of the tasks associated with our Projects Day celebration. These student societies are the American Society of Civil Engineers (ASCE), American Society of Mechanical Engineers (ASME), Institute of Electrical and Electronics Engineers (IEEE), National Society of Black Engineers (NSBE), Society of Environmental Engineers and Scientists (SEES), Society of Women Engineers (SWE), and Tau Beta Pi.

Patricia D. Daniels, Director
Science and Engineering Project Center

SCHEDULE

8:45 AM LEMIEUX LIBRARY FOYER

Projects Day Registration

8:45 AM – 2:00 PM READING ROOM

Projects Day Displays

9:00 AM LEMIEUX LIBRARY FOYER

Welcome, President Stephen V. Sundborg, S.J. and Dean George Simmons

Concurrent Sessions

9:10 AM – 11:10 AM SCHAFFER AUDITORIUM

ALSTOM ESCA Corporation

Amazon.com

Boeing Commercial Airplane Group

Boeing, Phantom Works

PNNL – Battelle

PNNL – Battelle

SMP Automated Testing Tool

Java-Based Messaging

Interface Control Database Tool Development

Quick Look Processor

Web Agent Interface System

Aviation Safety

9:10 AM – 11:10 AM STIMSON ROOM

Kenworth Truck Company

Kenworth Truck Company

SRAM Corporation

AT&T Wireless

ELDEC Corporation

Honeywell Aerospace

Dynamic Cab Extender

Vision Enhancement System

Torque-Sensing Power Assist

Mobile Load Test Bank

Statistical Process Control Monitoring

Digital Radio Receiver

11:10 AM - Break

Concurrent Sessions

11:15 AM – 12:15 PM SCHAFFER AUDITORIUM

Microsoft, Visio Development

WISDM Corporation

WISDM Corporation

XML Schema Drawing Type

WISDM Requirements Software

MicroARMR OLE DB Provider

11:15 AM – 12:55 PM STIMSON ROOM

David Evans & Associates

Harris Group/Masada

NOAA/Appia Engineering

Parsons Brinckerhoff

Seattle Public Utilities

Skagit Manufacturing Site Access

Product Enhancement and Development

Pedestrian Skybridge Seismic Analysis

14th/16th Ave South Bridge

Bitter Lake Stormwater Quality

1:00 PM LEMIEUX LIBRARY FOYER

Buffet Lunch

SCHAFFER AUDITORIUM MORNING

TITLE: SMP Automated Testing Tool
NUMBER: CSSE 02.1
SPONSOR: ALSTOM ESCA
SPONSOR LIAISONS: Rob St. Andre, Kevin Cheung, Carson Cook
FACULTY ADVISOR: Prof. Barbara Endicott-Popovsky
STUDENTS: Marlon R. Acincid, Christine F. Tamayo, Yang Ly, Timotius A. Lindra, Bao T. Nguyen, Ana K. Torgerson

ALSTOM ESCA sells the SMP (SCADA Management Platform) to the power industry so that companies can monitor and control electrical power devices. The SMP is undergoing continual development. When this product was first being implemented, no automated testing tool existed. Each new release required hours of an engineer's time for regression testing in order to ensure that it functioned properly. The team wrote an automated testing tool that allows an engineer to select which functions need to be tested. The testing tool performs all required testing and stores all results in a log, which can then be viewed and used to determine what changes, if any, need to be made.

TITLE: Java-Based Messaging
NUMBER: CSSE 02.2
SPONSOR: Amazon.com
SPONSOR LIAISONS: Alan Robbins
FACULTY ADVISOR: Prof. Barbara Endicott-Popovsky
STUDENTS: Elizabeth Hedges, Kamran Jafri, Stacey Kaneta, Teresa McCulloch, Steve Mead, Daniel Porter

Amazon.com is a leading, high-volume online retailer with a complex computer network. The various applications on this network must be able to talk to each other (send messages) reliably and efficiently. Amazon's current messaging abstraction is written in C++, but Amazon.com is interested in also providing a Java implementation. Amazon asked our team to explore the JMS messaging abstraction written by Sun Microsystems. To recreate an Amazon environment, we set up a Linux-based five-computer network with Sun's JMS loaded onto it, wrote a test-bed of applications to use/test JMS, altered the JMS implementation to account for certain Amazon configuration policies, tested the resulting system for throughput and scalability, and documented how certain vital functionality is performed within the JMS. As a last step, we then tested a different version of JMS written by a third-party vendor to compare general operating characteristics.

TITLE: Airplane System Interface Control Database Tool Development and Data Validation
NUMBER: CSSE 02.3
SPONSOR: Boeing Commercial Airplane Group
SPONSOR LIAISON: Robert C. Kircher, Jr.
FACULTY ADVISOR: Prof. Susan Reeder
STUDENTS: Stephen Sullivan, Eric Hodel, Quynh Ha, Dave Chavez, Denver Miles

Boeing Commercial Airplane Group is the world's largest manufacturer of passenger aircraft. Boeing does comprehensive tests of electronic airplane components to ensure the safety and reliability of passenger aircraft. Testing mechanisms have been developed where each component has a set of specific I/O configuration files that are stored in the Interface Control Database (ICD). The ICD has out-of-date information and, because the format varies for each file, no current software tool exists to update it. The team was asked to create tools for updating the ICD system with new or altered configuration files. The team created a software tool to allow the information in the ICD to be up-to-date and accurate.

TITLE: Quick Look Processor
NUMBER: CSSE 02.4
SPONSOR: The Boeing Company, Phantom Works
SPONSOR LIAISONS: Dale Karr
FACULTY ADVISOR: Prof. Everaldo Mills
STUDENTS: Daniel Alicuben, John Bianchi, Michelle Manlangit, Alex Muck, Erik Steinfeld

Boeing's Phantom Works creates hardware and software products for military use. The Quick Look Processor is a visualization and testing tool for the Single Integrated Air Picture (SIAP), which combines data from several radar sites to create a unified air picture. The team was asked to expand on the previous team's accomplishments by integrating more functionality. The team did this by integrating Boeing's Infosphere (a platform of protocols, processes and common core services that permit applications and users to submit, discover, and share information over a network) along with creating a test bed for driving simulations to test algorithms for sensor tracking systems. The upgraded system gives Boeing greater power, flexibility, and extensibility in the Quick Look Processor.

TITLE: Web Agent Interface System
NUMBER: CSSE 02.5
SPONSOR: Pacific Northwest National Laboratory – Battelle
SPONSOR LIAISON: Dr. Judi Thomson
FACULTY ADVISOR: Prof. Mitchell Spector
STUDENTS: Michela Hammond, Scott Hoogerwerf, Roy Kuwahara, Tara Matthews, Patrick Putnam, Erwin Suparno

The Web Agent Interface System project is sponsored by the Pacific Northwest National Laboratory (PNNL). PNNL performs cutting-edge research and development in information technology and other scientific fields. Currently, PNNL uses Intelligent Information Agents to perform various tasks; however PNNL has no way of easily managing the agents' activities. PNNL asked the team to create a Web Agent Interface System to control and monitor the many agents of various types. The Web Agent Interface System developed by the team meets PNNL's specifications and criteria, ensuring compatibility with ongoing agent software research. The system is portable and easily extensible. The Web Agent Interface System provides the functionality which will allow a wider array of users to explore the virtually limitless possibilities of agent technology.

TITLE: Aviation Safety
NUMBER: CSSE 02.6
SPONSOR: Pacific Northwest National Laboratory – Battelle
SPONSOR LIAISON: Dr. Thomas Ferryman
FACULTY ADVISOR: Prof. Bruce Duba
STUDENTS: Ajay Ayyagari, San Lian, Kyle Nakamoto, Angela Ou, Fionna Shriane, Esco Strong

Pacific Northwest National Laboratories (PNNL) delivers breakthrough science and technology to meet key national needs in the areas of environment, energy, health, national security, and economy. The Aviation Safety effort attempts to create safer skies for everyone by analyzing the numeric data collected by flight recorders. The team was asked to research different methods of analyzing these millions of data points to find subtle patterns (relationships) in the data. The team produced a Windows-based application and MATLAB prototype that allows data analysts (such as statisticians) and non-data analysts (such as air traffic controllers) to use and test the different algorithms to find and display the patterns identified. The application was designed with modularity as an essential component so that it can continue to incorporate new methods to find patterns, evaluate patterns found, and display the patterns.

STIMSON ROOM MORNING

TITLE: Dynamic Cab Extender: Design, Construction, and Testing
NUMBER: INT 02.1 (ME/EE)
SPONSOR: Kenworth Truck Company
SPONSOR LIAISONS: Alec Wong, Ted Scherzinger
FACULTY ADVISOR: Prof. Teodora Rutar Shuman, Prof. Alvin T. Moser
STUDENTS: Brian Dressler, Timothy Hudson, Steven Kirner, Noelle Parlier, David Roni

The Kenworth Truck Company is a leading truck designer and manufacturer. They seek to improve the aerodynamics of their tractor-trailer combination by adding a dynamic self-adjusting cab extender. Kenworth requested that the cab extender reduce aerodynamic drag to conserve fuel and reduce vehicle-operating costs. The team designed, drafted, built, and successfully tested a cab extender. The innovative product is automatically controlled, covers both sides of the gap between the tractor-trailer combination, and is regulated by vehicle speed and road conditions. The dynamic cab extender improves the aerodynamics of the tractor-trailer combination and conserves fuel by reducing the overall drag by 5%.

TITLE: Vision Enhancement System
NUMBER: INT 02.2 (ME/EE)
SPONSOR: Kenworth Truck Company
SPONSOR LIAISONS: Ted Scherzinger
FACULTY ADVISOR: Prof. Greg Mason, Prof. Alvin T. Moser
STUDENTS: Santiago Durango, Mansoor Al-Najjar, James Hoelscher, Michael Babcock

Blind spots pose a serious safety hazard on large tractor-trailer combination trucks. Even using multiple mirrors, there are several critical areas around the tractor-trailer which the driver cannot see. The team was asked to design and build a video camera system which would eliminate the blind spots. The system uses four cameras mounted around the tractor and trailer. Video signals from these cameras are transferred to the cab through a novel 13-pin connector which provides backward compatibility with existing systems. The driver can view the camera images in a dash-mounted display. A custom logic circuit automatically switches the image on the display from camera to camera based on the current driving conditions. The driver can also manually select an individual camera to view or can set the display to simultaneously show the view from all four cameras.

TITLE: SPARC – Torque-Sensing and Activation of Power Assist
NUMBER: INT 02.3 (ME/EE)
SPONSOR: SRAM Corporation
SPONSOR LIAISON: Michael W. Larson
FACULTY ADVISOR: Prof. Ananda Cousins, Prof. Alvin T. Moser
STUDENTS: Marween Ibanez, Laurent LaPorte, Angela Okuribido, Nevin Singh, Benjamin Yen

The SRAM Corporation produces an electric power assist bicycle hub called SPARC that can be affixed to any standard bicycle. The current SPARC system is based on a speed-controlled configuration. SRAM wishes to improve their existing SPARC hub by incorporating a system based on a torque-controlled configuration. After extensive research on a torque-controlled configuration that would best meet SRAM's requirement, the team designed a system based on an indirect torque-controlled configuration. The proposed system relies on dynamic modeling of the entire bicycle system to determine the applied rider torque. The bicycle is instrumented with pedal and wheel speed sensors, an accelerometer, and a motor current sensor. Data from the accelerometer and sensors are read by a handheld computer (PDA) mounted on the bicycle. Based on the received data the PDA sends an appropriate control signal to vary the electric motor torque.

TITLE: Mobile Load Test Bank
NUMBER: EE 02.1
SPONSOR: AT&T Wireless Services
SPONSOR LIAISONS: Ian King
FACULTY ADVISOR: Prof. Robert Heeren
STUDENTS: Feri Feerdianto, Matthew Rust, Paul Shibuya, Gaël Viette

AT&T Wireless (AWS) asked the team to develop an instrument case and interface to house cellular phone modules to provide a signals test bed for radio-based elements on their network, AWS will use the tests to improve the quality of their service, increase customer satisfaction, and keep up with changing technology. Specifications include designing a case to hold 24 modules, attaching a printed circuit board to each module, and including a power supply and a heat reduction device, all to fit in a volume of 19"x 7"x 30". The team designed a case that met the criteria and connected the modules to a terminal server via printed circuit boards, converted the data stream from the test program, and detected and controlled the modules.

TITLE: Real Time Statistical Process Control Monitoring Software Module
NUMBER: EE 02.2
SPONSOR: ELDEC Corporation
SPONSOR LIAISONS: Andrew V. I. Siguenza, Oliver Oshiro
FACULTY ADVISOR: Prof. Alvin T. Moser
STUDENTS: Mathew Paco, Amy Reyes, Cedric Vamour

To evaluate the production and evolution of their proximity sensors, ELDEC needs statistical data from the testing of the sensors. By evaluating their products, ELDEC can make changes necessary to the production methods to keep their proximity sensors within certain standards. ELDEC asked the team to develop software to assess the products under test. To generate the data charts, the team designed a Lab Windows CVI software application using standard statistical process control methods. The data are displayed in convenient formats.

TITLE: Digital Radio Receiver
NUMBER: EE 02.3
SPONSOR: Honeywell Aerospace
SPONSOR LIAISONS: Keith Bayern, Walt Devensky
FACULTY ADVISOR: Prof. Paul Neudorfer
STUDENTS: Momday Dok, Joe Hubley, Kun Tong Lo

Honeywell Aerospace designs and manufactures Instrument Landing Systems (ILS) receivers that are used by military and commercial aircraft during landing. As an improvement to their present receiver design, Honeywell wishes to replace an existing Digital Signal Processor (DSP) chip with a Field Programmable Gate Array (FPGA) to enhance reliability and make the system easily upgradeable. The design team was asked to develop a proof of concept for this change. The team developed an algorithm that analyzed ILS signals, implemented the algorithm in an FPGA, and tested the algorithm using simulated signals sent from a PC. The project used Visual Basic, MATLAB, and WebPACK software provided by Xilinx Corporation.

SCHAFFER AUDITORIUM AFTER MORNING BREAK

TITLE: XML Schema Drawing Type in Visio
NUMBER: CSSE 02.7
SPONSOR: Microsoft Corporation, Visio Development Group
SPONSOR LIAISONS: Fergal Burke, Heidi McAllister
FACULTY ADVISOR: Prof. Jeff Gilles
STUDENTS: Olivia Ortega-Marshall, Timothy Yao, Ivonne Tjung, Pablo Trevizo, Herbert West, Gurjit Basi

Microsoft produces a technical drawing application called Visio. The application is capable of many different kinds of drawings, such as software design diagrams, electrical circuit diagrams, and business management diagrams. XML has become a popular universal format for structured documents and data. Microsoft would like to add another component to the Visio software that allows the user to view an XML formatted schema file as a visual drawing. The team designed a Visio template with a software add-on that allows the user to view an XML schema in a straightforward and easy to use way. Different layers can be toggled on the screen to allow various levels of complexity to be displayed. The add-on is able to read schema files that conform to the standard syntax as defined by the World Wide Web Consortium.

TITLE: WISDM Requirements Software Version 3.2
NUMBER: CSSE 02.8
SPONSOR: WISDM Corporation
SPONSOR LIAISON: Dr. H. Blair Burner
FACULTY ADVISOR: Prof. Jay Kim
STUDENTS: Paul Magno, Roman Rozhavsky, Jae Peel Sul, Brent Tamaru, Nina Tan, Tho Tran

WISDM Corporation conducts requirements analysis workshops for companies that need assistance in planning software development projects. WISDM uses stand-alone, Windows-based requirements gathering software. WISDM asked the team to add some new features to their requirements gathering tool. In addition, the team was asked to create proper documentation for the software, which was omitted when it was originally developed. The team used C++ to add the new features and functionality and provided a fully documented version of the software. This allows WISDM to utilize the requirements gathering software with added features and functionality.

TITLE: MicroARMR OLE DB Provider
NUMBER: CSSE 02.9
SPONSOR: WISDM Corporation
SPONSOR LIAISON: Dan Kranz
FACULTY ADVISOR: Prof. Gene Carpenter
STUDENTS: Khalid Alshafei, Michael Cannon, Sean Chapman, Michael Divina, Aman Ghag, Alan Talanoa

WISDM produces a project management and requirements software package that utilizes the Oracle relational database management system. MicroARMR is a smaller, more efficient, restricted-functionality relational database management system developed by WISDM. In order to use MicroARMR with WISDM's software, an interface, an OLE DB Provider, was required to transfer data and commands between the software and MicroARMR. Further, another component was needed between the OLE DB Provider and MicroARMR to translate SQL (a standard relational database query language used by Oracle) to database queries that MicroARMR implements. The team used C++, Microsoft ATL, and well-established translator software to construct an OLE DB Provider and SQL translator. This OLE DB Provider has allowed WISDM to replace Oracle with MicroARMR. The system meets SQL-92 Minimum Grammar rules (not fully SQL-92 compliant), and has been designed to help ease a future transition to full compliance.

STIMSON ROOM AFTER MORNING BREAK

TITLE: Skagit Manufacturing Site Access and Signalization Feasibility Project
NUMBER: CEE 02.1
SPONSOR: David Evans and Associates, Inc.
SPONSOR LIAISONS: David Horn, Manuel L. Feliberti, Anna-Trang Nguyen
FACULTY ADVISORS: Prof. Rolf Skrinde, Prof. Nirmala Gnanapragasam
STUDENTS: Catherine DesJardin, Janessa Donato, Brian Eng, Zachary Hustad

The Skagit Manufacturing Facility in Sedro Woolley, Washington has only limited access to SR-20. David Evans and Associates asked the team to develop several alternatives and select a preferred alternative for redesigning the existing roadway in the vicinity of the facility. The team developed alternatives that addressed rerouting traffic and modifying channelization to provide enhanced safety on SR-20, mobility to the adjacent F&S Grade Road, emergency vehicle access onto SR-20, and efficient access to the manufacturing site.

TITLE: Product Enhancement and Development for the Masada Oxynol Process
NUMBER: CEE 02.2
SPONSOR: The Harris Group Inc. and Masada OxyNol
SPONSOR LIAISONS: John Lukas, Dr. Jeff Ranney
FACULTY ADVISOR: Prof. Phillip Thompson
STUDENTS: Derek Miller, Christina Osborn, Alison Wong, Amie Roshak

The Harris Group is contributing to the development of a state-of-the-art technology that converts municipal solid waste to fuel-grade ethanol. The team was asked to investigate anaerobic biological treatment methods for a high-strength industrial wastewater originating from the ethanol production process. The team characterized critical components of the wastewater via analytical laboratory methods and designed bench-scale laboratory experiments to optimize the anaerobic conditions for maximum methane production. Experimental reactors were designed, constructed, and monitored over a period of several months. The results may have significant beneficial economic impacts on the solid waste processing facility.

TITLE: Pedestrian Skybridge Seismic Analysis
NUMBER: CEE 02.3
SPONSOR: National Oceanic & Atmospheric Administration (NOAA) and APPIA Engineering Consultants
SPONSOR LIAISON: David B. Winandy
FACULTY ADVISOR: Prof. Jeff Dragovich
STUDENTS: Judd Anderson, Tony Chiang, William Edralin, Brian Greathouse, Luc Lamarche

The National Oceanic & Atmospheric Administration (NOAA) requested a structural/seismic analysis of four pedestrian skybridges and associated covered walkways that provide primary ingress/egress to three buildings. NOAA has noticed visible damage to their facility after the Nisqually earthquake in February 2001, and expressed concern about the performance of the bridges during a major seismic event. The team performed the analysis by modeling the buildings and skybridges in SAP 2000, a non-linear dynamic structural analysis program. After subjecting the model to dynamic loading, the team evaluated the serviceability, strength, and stability of the skybridges for conformance with the 1997 Uniform Building Code (UBC). The team suggested retrofitting options for enhancing the seismic performances of the skybridges in accordance with the 1997 UBC.

STIMSON ROOM AFTER MORNING BREAK (cont.)

TITLE: 14th/16th Ave South Bridge
NUMBER: CEE 02.4
SPONSOR: Parsons Brinckerhoff Quade and Douglas, Inc.
SPONSOR LIAISONS: Samir Chudgar, Yuhe Yang
FACULTY ADVISOR: Prof. Richard Schwaegler
STUDENTS: Peachy Lorenzo, Eric Rupp, Tengker Tohan, Marissa Trias, Tim Ulmen

The 14th/16th Ave. South Bridge in the South Park area of Seattle was designed and built during the 1930's. For several years the bridge has been classified deficient due to both structural and mechanical problems that require constant repair, and the bridge is not in full compliance with today's safety standards. Seismic damage sustained from the Nisqually earthquake in February 2001 has further weakened the bridge. King County contracted with Parsons Brinckerhoff to design a replacement for the damaged and outdated bridge. Parsons Brinckerhoff asked the team to submit a preliminary design for the main crossing of the replacement bridge, which consists of a 3-span continuous steel plate girder structure. The team designed the new structure to meet the 1996 Standard Specifications for Highway Bridges, 16th edition of the American Association of State Highway and Transportation Officials (AASHTO), as well as all interim updates, and the 2000 Washington State Department of Transportation (WSDOT) Bridge Design Manual (BDM) criteria.

TITLE: Bitter Lake Stormwater Quality Preliminary Engineering Study
NUMBER: CEE 02.5
SPONSOR: Seattle Public Utilities
SPONSOR LIAISONS: Beth Schmoyer, Dr. Darla Inglis
FACULTY ADVISOR: Prof. Jean Jacoby
STUDENTS: Janet Gonzalez, David Jacobs Jr., Amanda Prakoso

Seattle Public Utilities (SPU) is responsible for maintaining city-owned storm drains throughout the City of Seattle. The Greenwood Avenue North drain is the largest city-owned storm drain discharging water to Bitter Lake. Citizens of the Bitter Lake community have voiced concerns that stormwater contaminants flowing into the lake are degrading the water quality. SPU has acknowledged the community's concerns and wishes to assess and, if necessary, reduce the pollution from the Greenwood Avenue North drain to improve the water quality of the lake. SPU asked the team to monitor this drain, identify and assess stormwater contaminants, delineate the Bitter Lake watershed, and evaluate options for treating runoff. The team evaluated several treatment technologies to determine the most cost effective and efficient method for removing target contaminants. Based on this evaluation and the monitoring data, a preliminary engineering analysis of two alternative stormwater treatment systems was conducted. The team designed and sized the systems using City and Washington State Department of Ecology guidelines as well as site constraints and performance goals.

SPONSORING ORGANIZATIONS AND LIAISONS

We want to acknowledge with special thanks the organizations that sponsored projects in 2001-2002, and especially the liaisons representing the sponsors, who worked with the students throughout the year. The time these liaison representatives spent in consultation with our teams is much appreciated by the students and their faculty advisers. It is the liaisons who provide the history and background of each project, its relationship to other work in the sponsoring organization, and much of the technical direction that makes a project successful.

ALSTOM ESCA Corporation, Rob St. Andre, Kevin Cheung, and Carson Cook

Amazon.com, Alan Robbins

AT&T Wireless, Ian King

The Boeing Company, Commercial Airplane Group, Robert C. Kircher, Jr.

The Boeing Company, Phantom Works, Dale Karr

David Evans and Associates Inc., David M. Horn, Manuel L. Feliberti, and Anna-Trang Nguyen

ELDEC Corporation, Andrew V. I. Siguenza and Oliver Oshiro

Harris Group Inc., John Lukas and Jeff Ranney

Honeywell Aerospace, Keith Bayern and Walt Devensky

Kenworth Truck Company, Ted Scherzinger and Alec Wong

Microsoft Corporation, Visio Development Group, Fergal Burke and Heidi McAllister

NOAA, David B. Winandy

Pacific Northwest National Laboratory – Battelle, Judi Thomson and Thomas Ferryman

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CIVIL AND ENVIRONMENTAL ENGINEERING

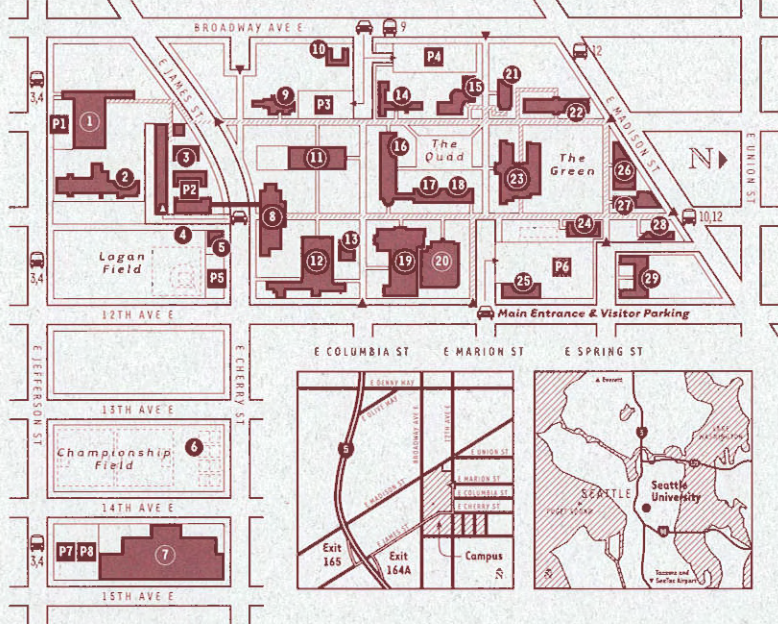
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| 1 Campion Residence Hall | 28 Lynn Building | 20 University Services Building |
| | 15 Matteo Ricci College | 29 Xavier Residence Hall |

- P1 10th and E. Jefferson Lot F, S
 P2 11th and E. Cherry Garage D, F, S, V
 P3 10th and E. Columbia Lot D, J, S

- P4 Broadway and E. Columbia Garage C, F
 P5 12th and E. Cherry Lot S
 P6 12th and E. Marion Lot C, D, S, V

- P7 14th and E. Jefferson South Lot S
 P8 14th and E. Jefferson North Lot F

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