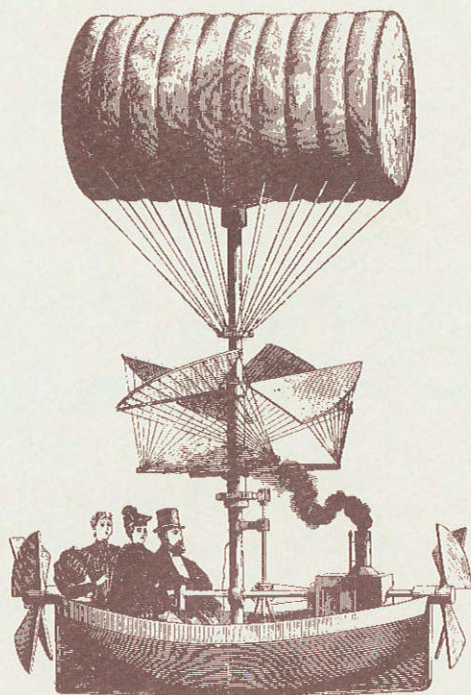


SEATTLE UNIVERSITY
School of Science and Engineering
Science and Engineering Project Center



PROJECTS DAY
JUNE 6, 1997
10TH ANNIVERSARY

Senior Design Projects 1996-97

WELCOME

Welcome to the tenth year of the Science and Engineering Project Center. I congratulate all those both within and outside of Seattle University for the success the Project Center has achieved in its first ten years. I welcome also our computer science students who have this year begun to work in sponsored teams, and our first exchange students from Ecole Supérieure d'Ingénieurs en Electrotechnique et Electronique in France.

Today we present the results of student work sponsored by industry and government, and developed by senior students in the science and engineering design program at Seattle University. We are most grateful to our sponsors—those who are old hands as project sponsors, and those who are new sponsors. It is a tribute to your faith in our students, the quality of their work, and the education at Seattle University that you invest your time, people and resources in these student projects.

Let me pay tribute, too, to the hard work of the students in problem solving, teamwork, responsibility to timeliness and budgets, and general persistence in the accomplishments you will see during the talks and displays today. And let me pay tribute, in advance, to the next ten years of the Project Center when we will see more interdisciplinary projects, more national and international focus in our students and in our projects, and more contributions from students in areas other than engineering and computer science.

Congratulations to all for ten successful years, and welcome to Projects Day 1997!

*Kathleen Mailer, Dean
School of Science and Engineering*

On behalf of our faculty and students, I also welcome you to Projects Day 1997. I am grateful for the encouragement and assistance provided by our Science and Engineering Advisory Board, and especially its Project Center Advisory Committee, in promoting the external sponsorship of our projects. I would also like to acknowledge the coordination efforts of professors Art Benedict and Rolf Skrinde in Civil and Environmental Engineering, Al Moser in Electrical Engineering, Ananda Cousins and Dennis Wiedemeier in Mechanical and Manufacturing Engineering, Everaldo Mills in Computer Science, and Sheridan Botts, contracts officer for the Project Center.

Special thanks go to the members of our student professional 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 Association for Computing Machinery (ACM), 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*

PROJECTS DAY

9 a.m. LEMIEUX LIBRARY FOYER

- Projects Day registration and tours

9:30 a.m. SCHAFFER AUDITORIUM

- Boeing Environmental Affairs Geographic Information Systems Feasibility Study
- Universal Avionics Systems Corporation Lab Simulator
- K2 Corporation K2 Inline Skate Frame Assembly Fixturing
- United States Public Health Service Environmental Database Design and Implementation
- Port of Seattle Habitat Restoration at Turning Basin No. 3
- Boeing Information and Support Services JAVA Query Manager
- Boeing Defense and Space Group Comparison of Graphite Composite Versus Aluminum
- Father Wood Chair: Appropriate Technology Electrification of Village Home

12:30 p.m. LEMIEUX LIBRARY FOYER

- Buffet Lunch

1:30 p.m. SCHAFFER AUDITORIUM

- King County Surface Water Management Winterwood Estates Drainage Study
- Parsons Brinkerhoff Quade and Douglas ... Skokomish River Bridge Seismic Retrofit
- King County Facilities Management Sammamish River Tolt Pipeline Bridge
- SvR Design Company Ferncliff Avenue Improvements: Conceptual Design

1:30 p.m. STIMSON ROOM

- Wave Consulting Group Waveware
- Cascade Design Automation Nanocrane Microcontroller
- Hewlett Packard Company Extensible Document Manager System
- GTE Northwest Time Report Management System

PROJECT NUMBER: CEE 97.1
PROJECT TITLE: The Feasibility Study of Geographic Information Systems for Environmental Monitoring
SPONSOR: The Boeing Company, Environmental Affairs
SPONSOR LIAISONS: Al Sugino, Valerie Monsey
FACULTY ADVISORS: Prof. Art Benedict, Prof. Rolf Skrinde
STUDENTS: Khalid Falemban, Dave Keil, Nandez Miller, In-Young Yeo, Yun-Liang Yen

DESCRIPTION:

The team conducted a study to determine the environmental monitoring information applicable to a geographic information system (GIS). Implementation included identification and evaluation of GIS software, environmental data evaluation and collection, system analysis and recommendations, and pilot database construction for stormwater and wastewater monitoring. Due to the size of Boeing's facilities, a large amount of environmental data is produced, recorded, and utilized in various forms. The team's project will help Boeing streamline their existing environmental data storage and recovery system.

PROJECT NUMBER: CSC 97.3
PROJECT TITLE: Lab Simulator
SPONSOR: Universal Avionics Systems Corporation (UASC)
SPONSOR LIAISON : Paul Warren
FACULTY ADVISOR: Prof. Everaldo Mills
STUDENTS: Tom Clark, Hoang Nguyen, Mike Pizzuto, Donna Smith

DESCRIPTION:

Universal Avionics Systems Corporation (UASC) produces Flight Management Systems (FMS) as well as other avionics products for the private and commercial aviation industries. The primary function of the FMS is to process data received from various aircraft sensors to determine flight information such as present speed, position, and heading—and to then calculate guidance data for the aircraft to follow based on the pilot's intended flight plan. In order to develop and evaluate an FMS, a lab simulation tool is needed to provide simulated aircraft data to the FMS in an intelligent manner. The joint SU-UASC team developed a high quality and well planned working engine for UASC's lab simulator program. Using either the guidance data provided from the FMS, or course instructions manually entered via the lab simulator's visual user interface, the program continuously recalculates the simulated aircraft sensor data and directs it to the appropriate FMS communication lines while adhering to industry protocol standards. UASC will integrate this simulator into their engineering development system and build upon its functionality.

PROJECT NUMBER: MME 97.2
PROJECT TITLE: K2 Inline Skate Frame Assembly Fixturing
SPONSOR: K2 Corporation
SPONSOR LIAISON: Tom Sauter
FACULTY ADVISOR: Prof. Gregory Mason
STUDENTS: Foad Aboulbaghael, Robert Dooley, Mark Flohr,
Brian Gillespie, Zach Nelson

DESCRIPTION:

K2 is a world leader in the manufacture and sales of high performance inline roller skates. High production rates, combined with increased competition from major sporting equipment manufacturers, have caused K2 to initiate research into automating the assembly process. K2 asked the team to research and report on: full assembly automation; design recommendations for future incorporation into the skate design that will enhance full automation ability; review of current manual assembly process; and design, development, and supply of 'simple' fixturing to improve the efficiency of the manual assembly process. To this end, the team submitted the required reports and has developed two simple fixture prototypes for K2's offshore manufacturing sites. These two fixtures are a flexible frame holding fixture and a wheel insertion/alignment gage. The fixtures were tested and found to decrease the manual assembly process of the complete frame sub-assembly by 25 percent.

PROJECT NUMBER: INT 97.1
PROJECT TITLE: Design and Implementation of Novel Environmental Database
SPONSOR: United States Public Health Service
SPONSOR LIAISONS: Thomas Bonifield, Linda Huber
FACULTY ADVISORS: Prof. Al Moser, Prof. Rolf Skrinde
STUDENTS: Charles Adams, Jason Axley, Tamara Doxtater, Cindy Hummel, Anna Mariano, Anna-Trang Nguyen, Michael Stark

DESCRIPTION:

Development of a knowledge base system capable of monitoring environmental factors worldwide is the ultimate goal of our sponsor, the United States Public Health Service. Our project is the design and creation of a unique and expandable semantic network knowledge base system with accompanying hardware and software. The three-phase design project was launched last year. This year's Beta Phase has included recruiting a team of civil and environmental engineering students and electrical engineering students to form the first interdisciplinary team of the Science and Engineering Project Center. The Beta Phase has been continued by modifying the Data Acquisition Board (DAB) and incorporating a Structured Query Language (SQL) database to the user interface. This has enabled laptop-controlled data retrieval from various external devices in addition to storage of these manual entry data values in a database. In addition to the DAB and the SQL database, the team will present the sponsor with an expanded version of the Windows-based user interface program and an expandable UNIX-based knowledge base system. This system has the capability of recommending region-specific monitoring protocols and is accompanied by a reference manual containing protocol descriptions, environmental standards and regulations to aid the user.

PROJECT NUMBER: CEE 97.5
PROJECT TITLE: Habitat Restoration at Turning Basin No.3
SPONSOR: Port of Seattle
SPONSOR LIAISONS: Jack Hendrickson, George Blomberg
FACULTY ADVISOR: Prof. Rolf Skrinde
STUDENTS: Galen Hon, David Huang, Bryce Jones,
Haim Strasbourger

DESCRIPTION:

Development plans by the Port of Seattle will alter some marine habitat in the mouth of the Duwamish river at the west waterway. This must be mitigated by restoring the same number of acres of habitat so that it is suitable for migrating fish and birds. The most effective nearby choice is Turning Basin No. 3, situated 5.3 miles up the river. This site was filled in approximately 1917 and has been used for industrial purposes. To request mitigation bids to restore the required 1.3 acres, the Port of Seattle asked the design team to determine the specifications for completing this task and an overall cost estimate. Specifications include excavation, some dredging, slope stabilization, re-vegetation, irrigation, and monitoring.

PROJECT NUMBER: CSC 97.1
PROJECT TITLE: JAVA Query Manager
SPONSOR: The Boeing Company, Information and Support Services
SPONSOR LIAISONS: Robert Abarbanel, Prabhu Ram
FACULTY ADVISOR: Prof. Peter Mark
STUDENTS: Tuan Dinh, Ian Hergert, Jaquie Mirzaie,
Robert Mobbs, Tony Patterson

DESCRIPTION:

The JAVA Query Manager project team is working with The Boeing Company's Information and Support Services group to develop a database exploration tool which implements the "Query by Reformulation" paradigm. A graphical user interface will allow a user to explore a database and discover interesting and meaningful information. The interface allows a user to view a relational database as "object oriented," and allows the user to repeatedly refine and restructure queries based upon past query results, and an exemplar from the previous result sets. This allows the user to construct complex relational queries with no knowledge of SQL, primarily by using "point and click" build options.

PROJECT NUMBER: MME 97.1
PROJECT TITLE: Comparison of Graphite Composite Versus Aluminum Electronics Boxes
SPONSOR: The Boeing Company, Boeing Defense and Space Group
SPONSOR LIAISON: Devin Hersey
FACULTY ADVISOR: Prof. Anand Cousins
STUDENTS: Nezar Al-Mutawa, Raed Bourisli, Dustin Diemert, Jodi Schaaf, Erich Wiener

DESCRIPTION:

Electronics boxes provide cooling and containment of electronics circuitry. Historically, electronics boxes have been fabricated in aluminum, but the aerospace industry has shown an increasing interest in the use of graphite composites which are lighter than aluminum. Composite Optics Incorporated claims they have fabricated a graphite composite heat exchanger with thermal performance superior to a comparable aluminum one. The team designed and produced a heat exchanger testing apparatus, and then tested the original graphite composite heat exchanger for fin thermal conductivity and contact resistance between the card and the rails. A finite element model (FEM) was correlated to the heat exchanger test results. The material properties in FEM were modified for a comparable aluminum heat exchanger in order to directly compare the performance of the graphite composite and the aluminum heat exchanger.

PROJECT NUMBER: EE 97.2
PROJECT TITLE: Appropriate Technology —The Electrification of a Village Home
SPONSOR: The Fr. Francis P. Wood, S.J. Boeing Chair
SPONSOR LIAISON: Fr. Bert Otten
FACULTY ADVISOR: Fr. Bert Otten
STUDENTS: Mohammed Al-Jasser, Chris Brown, Cynthia Gilbert, Bjorn Jansson, Stephan Olsen, Jake Reidt, Phil Stewart

DESCRIPTION:

Villagers in rural Zambia do not have access to a power grid. Instead, they create their own low-voltage power systems based on salvaged lead-acid automobile batteries and other electrical components such as lights, switches, wire, and fuses. The team was primarily concerned with the design of a reliable method of safely discharging and recharging these systems. The team also investigated alternative sources of energy including photo-voltaic, steam, pedal power, and wind-up generation, and evaluated them according to cost, technological compatibility with existing equipment, and availability of local materials.

PROJECT NUMBER: CEE 97.3
PROJECT TITLE: Winterwood Estates Drainage Study
SPONSOR: King County, Surface Water Management Division
SPONSOR LIAISONS: Steve Foley, Gary Reinke
FACULTY ADVISOR: Prof. Nirmala Gnanapragasam
STUDENTS: James Allen, Dan Eggers, Loren Jennings,
 Denise Rae Pirolo, Arthur Will

DESCRIPTION:

Winterwood Estates is located in eastern King County, near Covington, along the Covington-Lake Sawyer Road. In recent years, flooding has occurred in this residential area, threatening homes and limiting property access for extended periods of time. Worried that nearby development had led to an apparent increase in flooding occurrence and severity, area residents complained to King County. The Seattle University student team was asked to study the problem and identify causes and solutions. In the course of investigation, the team researched and compiled data, developed base maps, surveyed major hydraulic features, conducted hydrologic modeling, investigated alternative solutions, and finally assembled the work into a final report. Key to the project was the development of a computer model, simulating expected water flow patterns in pre- and post-developed conditions.

PROJECT NUMBER: CEE 97.4
PROJECT TITLE: Skokomish River Bridge Partial Seismic Retrofit
SPONSOR: Parsons Brinkerhoff Quade and Douglas, Inc.
SPONSOR LIAISONS: Gina Hidalgo, Jerzy H. Szymeczek, Kareem M. Greiss
FACULTY ADVISOR: Prof. Nirmala Gnanapragasam
STUDENTS: Arthur Batuna, Bryce Falkin, Pierre LaRochelle,
 Kilin Widjaja, John Wilson

DESCRIPTION:

In order to maintain emergency lifelines in the event of a high magnitude earthquake, the Washington State Department of Transportation (WSDOT) has begun a process of retrofitting bridges across the state. Parsons Brinkerhoff is the engineering consulting firm for some of these bridges, and requested the student design team to come up with an economical partial seismic retrofit for the Skokomish River Bridge on Highway 101. To reduce its seismic vulnerability, the team developed several conceptual designs. The final design included longitudinal and transverse restrainers and bearing seat extensions. Drawings and details of the partial seismic retrofit were prepared by the team on AutoCAD.

PROJECT NUMBER: CEE 97.2
PROJECT TITLE: Sammamish River Tolt Pipeline Bridge
SPONSOR: King County, Facilities Management Division
SPONSOR LIAISON: Steve Massey
FACULTY ADVISOR: Prof. Richard Schwaegler
STUDENTS: Richard Denison, Layne Hazama, Cory Hitzemann,
George Ming-Yuan Lo, Karl Thierbach

DESCRIPTION:

The King County Facilities Management Division requested that the team develop designs for a bridge crossing over the Sammamish River on the Tolt Pipeline trail right of way along 150th Avenue NE in Woodinville, Washington. The bridge will accommodate different types of trail users, such as horseback riders, bicyclists, and pedestrians as well as a 6 ton maintenance vehicle. In addition, the Seattle Water Department required a minimum of 15 feet clearance between the bridge and the Tolt Pipeline. The design process included developing alternatives that deal with these criteria, determining site constraints, and meeting the design standards set by governing agencies. The final deliverables included a set of design specifications and drawings for bridge construction.

PROJECT NUMBER: CEE 97.6
PROJECT TITLE: Ferncliff Avenue Improvements: Conceptual Design
SPONSOR: SvR Design Company
SPONSOR LIAISONS: Paul Dedyo, Jeff Lamoureux
FACULTY ADVISOR: Prof. Jean Jacoby
STUDENTS: Kit Chan, Michael LaVielle, David Matsumoto,
Brenda O'Neill, Michael Young

DESCRIPTION:

SvR Design Company is designing road improvements for multi-modal traffic flow and safety on Ferncliff Avenue in the city of Bainbridge Island, Washington. The team was asked to develop three conceptual designs meeting the following criteria: safety for pedestrians, bicyclists, and drivers; low maintenance requirements; cost effectiveness; preservation of rural character; feasibility of right-of-way acquisition; and community acceptance. To accomplish this, the team performed a literature review, brainstormed concepts, and created a matrix grading system for design selection. The team evaluated various roadway design alternatives. The final report to SvR Design Company included drawings of alternative roadway designs with cut and fill sections, and plans for detention facilities, water quality treatment systems, and right-of-way acquisitions. The team also submitted cost estimates for each conceptual design.

STIMSON ROOM AFTERNOON

PROJECT NUMBER: CSC 97.4
PROJECT TITLE: Waveware
SPONSOR: Wave Consulting Group
SPONSOR LIAISON: Steve Schroeder
FACULTY ADVISOR: Prof. Everaldo Mills
STUDENTS: Dean Brandenburg, Joe Giannini, Tony Giannini, Ted White

DESCRIPTION:

The purpose of this project was to develop a document transfer system for field users of wireless data communications and the Internet. The project sponsor was the Wave Consulting Group. The resulting product is Waveware, which is a wireless document transfer system which eliminates the need for re-entering the data back at the office. The Waveware client (software) immediately updates any open database connectivity (ODBC) compliant server database. The system employs efficient data passing, economizing the data transferred, and allows the user to create, view, edit and delete data on the database.

PROJECT NUMBER: EE 97.1
PROJECT TITLE: Nanocrane Microcontroller
SPONSOR: Cascade Design Automation
SPONSOR LIAISON: Martin Scoones
FACULTY ADVISOR: Prof. Paul Neudorfer
STUDENTS: Samer Moury, Ian Oliver, Ageel Shaheen, Dan Phi Thai, Boris Dezier

DESCRIPTION:

Cascade Design Automation asked the team to design a microcontroller for the computerized operation of a small crane (nanocrane). The design includes control of crane and boom positions and lifting functions. The microcontroller has two modes of operation. In programming mode, the user can input a set of commands via an auxiliary key pad. In run mode, the microcontroller feeds a sequential script of preset commands from memory to the nanocrane. The microcontroller is designed as an application specific integrated circuit (ASIC). At various stages in the design process, the microcontroller's operation was checked with a suitable set of test vectors to ensure proper functionality.

PROJECT NUMBER: CSC 97.2
PROJECT TITLE: Extensible Document Manager System
SPONSOR: Hewlett Packard Company
SPONSOR LIAISONS: Mike DeLaurentis, Bridget Dwyer
FACULTY ADVISOR: Prof. Ihsin Phillips
STUDENTS: Tom Graf, Norman Hamer, Glenn Henke,
Flavien LeBarbé, Becky Pedersen, Lucas Standaert

DESCRIPTION:

With a computer on every desk, the production and maintenance of documents is tightly coupled to quickly changing and difficult-to-manage technology. Conventional filing and storage methods are no longer adequate for controlling documentation. Because there are so many disks, users, directories and organizational styles, collecting volumes of files developed under various applications in one central location is often difficult. The project team participated in a Hewlett Packard Company sponsored project to address this issue. The team created a document management system that provides intuitive organization of documents into topical categories. These logical categories provide an alternate view of the physical system. This electronic filing cabinet allows the user to view document summary information, print copies of files, search for specific documents based on a variety of criteria, and mail files via the Internet. The system as implemented has adopted the interface of Microsoft Windows 95 Explorer to enhance usability. The completed prototype has extensible functionality to accommodate unforeseen customer requirements and new industry-standard file types.

PROJECT NUMBER: EE 97.3
PROJECT TITLE: Time Report Management System
SPONSOR: GTE Northwest
SPONSOR LIAISONS: Ralph Yunker, Steve Johnson, Jim Falkner, Earl Jones
FACULTY ADVISOR: Prof. Margarita Takach
STUDENTS: Michael Bosland, Ying Chen, Andrew Patzwald

DESCRIPTION:

GTE Northwest sought an alternative to their work time reporting methods for the Central Office Equipment Installers (COEI) group. Time cards used to be filled out by hand and sent to a central office for processing. Administrators would spend most of their time on Fridays entering this information into a mainframe system called the Report Distribution Module (RDM). The team came up with the Time Report Management System (TRMS) to eliminate this overhead processing. This system is a collection of web pages and programs that manages and automates the time card process. Employees enter time card information through interactive web pages on their computer. TRMS stores this data and notifies that employee's manager of a submitted timecard. Once approved by that manager through another web page, TRMS exports the timecard straight to RDM. As a result, TRMS effectively streamlines the old timecard process and cuts back the amount of overhead processing once required by GTE staff.

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SPONSORING ORGANIZATIONS AND LIAISONS

We want to acknowledge with special thanks the organizations who sponsored design projects in 1996-97, 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 design 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.

The Boeing Company, Information and Support Services: Robert Abarbanel,
Prabhu Ram

The Boeing Company, Defense and Space Group: Devin Hersey

The Boeing Company, Environmental Affairs: Valery Monsey, Alan Sugino

Cascade Design Automation: Martin Scoones

GTE Northwest: Jim Falkner; Steve Johnson, Earl Jones, Ralph Yunker

Hewlett Packard Company: Mike DeLaurentis, Bridget Dwyer

King County Facilities Management Division: Steve Massey

King County Surface Water Management Division: Steve Foley, Gary Reinke

K2 Corporation: Tom Sauter

Parsons Brinkerhoff Quade and Douglas, Inc.: Gina Hildago, Kareem Greiss,
Jerzy Szymeczek

Port of Seattle: George Blomberg, Jack Hendrickson

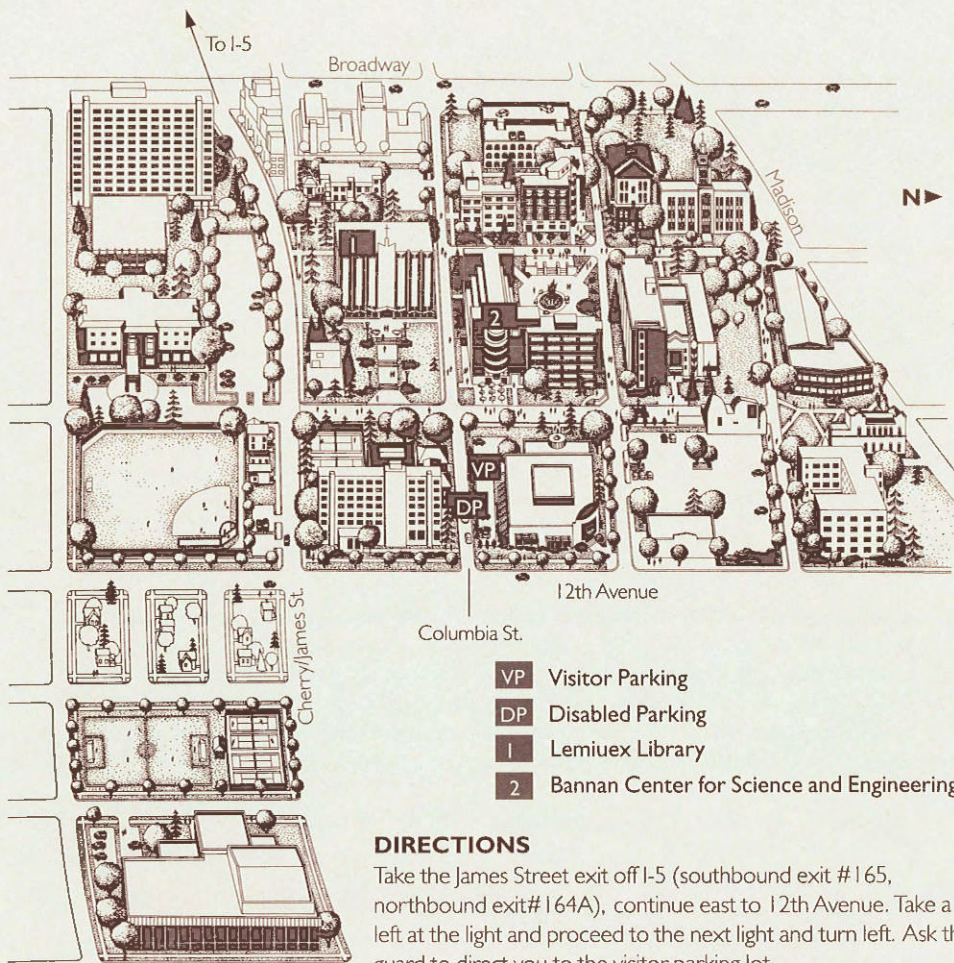
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Universal Avionics Systems: Paul Warren

United States Public Health Service: Thomas Bonifield, Linda Huber

Wave Consulting Group: Steve Schroeder



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 Seattle University
 Broadway and Madison
 900 Broadway
 Seattle, WA 98122-4340