

**Seattle University
School of Science and Engineering
Engineering Design Center**

**PROJECTS DAY
MAY 31, 1991**



Welcome

Today is *Projects Day for the Engineering Design Center* — a time for presenting publicly the projects sponsored by industry and developed by seniors in the engineering programs at Seattle University. We hope you will enjoy this opportunity for these students to share with you the results of their labors over the past academic year.

Under the supervision of its founding director, Dr. Rolf T. Skrinde, the Engineering Design Center has provided an excellent opportunity for making the students' design experience a fruitful adventure in cooperation with corporate and government counselors, with supervising faculty, and with other students. The results of their successful projects can provide useful information to the sponsors and valuable experience for all the participants.

We are indeed grateful to Dr. Skrinde, his colleagues and the sponsoring corporations for making this important learning experience a valuable part of engineering education at Seattle University. We are appreciative, too, for the strong support provided by the Engineering and Science Advisory Council and the Departmental Advisory Boards. And, of course, your presence at this event is an important part of what makes this a most rewarding day for everyone. Thank you for joining us.

Dale A. Carlson, Dean
School of Science and Engineering

On behalf of our engineering faculty and students, may I welcome you to *Projects Day 1991*, our fourth annual reporting of design project results to sponsoring organizations, visitors and friends. For academic year 1990-91 we are pleased that all of our 23 senior engineering design projects are sponsored by local industry and other organizations. We are grateful for this fine support.

I would like to take this opportunity to acknowledge the support and assistance provided by our Engineering and Science Advisory Council, as well as the Engineering Department Advisory Boards in promoting the sponsorship of projects. Within our Seattle University team I would also like to acknowledge the design coordination efforts provided by Professors Robert Heeren in Electrical Engineering and Ray Murphy in Mechanical Engineering.

As you participate with us during the day we invite you to visit our engineering classrooms and laboratory facilities, including the renovated Electrical Engineering laboratories in the Bannan building and our biology facilities in the Thomas J. Bannan Center for Science and Engineering. We thank you for your support and encourage your feedback so that we can continue to improve our engineering design program.

Rolf T. Skrinde, Director
Engineering Design Center

Projects Day

May 31, 1991
Engineering Design Center

7:30 a.m.Engineering and Science Advisory Council

10:00 a.m.Projects Day Registration and Tours

11:00 a.m.Project Presentations

Wyckoff Auditorium

- Underground Electrical Distribution System Design - First Hill and Capitol Hill Area
- Portable Telephone RF Propagation In An Urban Environment
- Digital Signal Processing Interface Board
- Duty Cycles of Two-Way Radio Systems

Bannan Auditorium

- Traffic Analysis/Interchange Design
- Hanford Waste Disposal Design
- Terminal Transfer Span Analysis

12:00 p.m.Lunch in the Engineering Building Gallery

1:15 p.m.Project Presentations

Wyckoff Auditorium

- Flow Test Unit for LRUs
- Composite Materials Thermal Cycling Test Program
- Non-Intrusive Hydraulic Flow Measurement
- Static Hub Test Fixture
- Circumferentially Supported Fan
- Motion Sensing Device
- Development of Tactile Sensor for Segment Erector

Bannan Auditorium

- Interface Monitor for Proximity Sensing Electronics Unit
- Interface from a Monitor Defibrillator to a Fax Machine
- Microcomputer Monitor for U.S. Public Health Service Equipment
- T₁ Channel Signalling Access/Indicator
- Central Office CAD Database
- Logic Card Tester
- Multi-Standard Calibrator
- Data Encryption Chip Design
- Digital Signal Processing to T₁ Communication Interface Board

Refreshment break between 2:30 and 3 p.m., as appropriate, in the Engineering Building Gallery.

Bannan Auditorium

11:00 a.m.

Project Title: Traffic Analysis/Interchange Design
Sponsor: Parsons, Brinkerhoff, Quade and Douglas — Seattle, Washington
Liaison Engineer: Stan Ching
Faculty Advisor: Prof. Mary Rutherford
Students: Susan Heutmaker, Parry Rekers, Kevin Roberts, Neil Watts

Description:

The team evaluated alternatives for the installation of a new interchange on U.S. I-5 to provide major access for the growing city of Dupont, Washington. A truck weigh station at this location, Burlington Northern railroad tracks adjacent to I-5, and limited right-of-way for any improvements were key issues considered in the alternatives analysis. Four alternative interchange configurations were analyzed for capacity, weaving and turning. Cost estimates for each alternative were made.

Project Title: Hanford Waste Disposal Design
Sponsor: Westinghouse Hanford — Richland, Washington
Liaison Engineers: Jerry Scott, Charles Ripley, Rory McBeath
Faculty Advisor: Prof. Rolf Skrinde
Students: Jim Feider, Jake Hollopeter, Tim Hower, Craig Koegel

Description:

High Efficiency Particulate Air (HEPA) filters are used at Hanford to contain airborne particles resulting from routine handling, testing, and processing of radioactive materials. The design team developed conceptual designs for a shredding and grouting program to dispose of the filters, and carried out laboratory tests to determine the effects of paraffin based fixing agents on the engineering characteristics of the concrete grout product.

Project Title: Terminal Transfer Span Analysis
Sponsor: Washington State Department of Transportation Marine Division — Seattle, Washington
Liaison Engineers: Joel Colby and Ron Paananen
Faculty Advisor: Prof. Richard Schwaegler
Students: Ahmed Al-Hosni, Tom Bertucci, Mark Dohrinen, Nam-Chau Tran

Description:

A computer program was developed to analyze the effects of overweight vehicle loads at specified ferry terminals, given the axle loads and axle spacing of a vehicle. The program calculated the stresses in all the critical members of the transfer span and provided a listing of actual stresses and allowable stresses in the members for a given vehicle. The program will improve the processing of overweight permits by saving time and providing for a more thorough and documented analysis.

Wyckoff Auditorium

11:00 a.m.

Project Title: **Underground Electrical Distribution System Design — First Hill and Capital Hill Area**
Sponsor: Seattle City Light — Seattle, Washington
Liaison Engineers: Laurie Hammack and Ashok Nayuda
Faculty Advisor: Prof. Xusheng Chen
Students: Mark Milacek, Phillip Nguyen, Mike O'Neal, Steve Spyridis, Heng Dee Ting

Description:

This project consisted of engineering analyses for safely, reliably and economically placing overhead electrical distribution facilities underground in a system of vaults and ducts (First Hill and Capital Hill areas of Seattle). Once the analysis was completed, a plan was developed for designing and installing the underground electrical primary cabling system.

Project Title: **Portable Telephone RF Propagation in an Urban Environment**
Sponsor: McCaw Cellular Communications — Seattle, Washington
Liaison Engineer: Vernon Perryman
Faculty Advisor: Prof. Patricia Daniels
Students: Dennis Deguzman, Jeff Stone, Jennifer To, Tri Tran

Description:

The team developed an improvement of cellular telephone systems through a study of the characteristics of radio frequency (RF) propagation in an urban environment. The effects of reflection, multi-path reception and attenuation by building materials were investigated and quantified. Field measurement data were compared with predictive models, and correction factors were determined.

Project Title: **Digital Signal Processing Interface Board**
Sponsor: Sundstrand Data Control — Redmond, Washington
Liaison Engineers: Steven Grlj and Mark Zeid
Faculty Advisor: Prof. Patricia Daniels
Students: Song Lim, Diane Milton, Karl Tharalson, Xuong Tran

Description:

The project consisted of designing an interface board to convert resonant beam accelerometer (RBA) frequency outputs to digital words to be processed by an IBM PC using a Texas Instrument digital signal processing (DSP) board as the signal processing engine. Control software was written in the "C" programming language to control the DSP board, interface board data acquisition, compensation coefficient data storage and monitor display.

Project Title: **Duty Cycles of Two-Way Radio Systems**
Sponsor: Puget Sound Power and Light Company — Bellevue, Washington
Liaison Engineer: Robert St. Andre
Faculty Advisor: Prof. Gary Erickson
Students: Tron Chang, Jim Eley, Tony Nguyen,
Dennis Reforsado, Donna Smith

Description:

The project consisted of instrumenting a system to correlate operation of three Puget Power transmitters with wind speed, rainfall and temperature in the Puget Sound area. The weather information was accessed from the University of Washington weather program via a modem at Seattle University. The design team built circuitry to carry the transmitter duty cycle information on a leased phone line between Puget Power and Seattle University, as well as the circuitry to input it from the phone line into a computer, where it was correlated with weather information.

Bannan Auditorium

1:15 p.m.

Project Title: **Interface Monitor for Proximity Sensing Electronics Unit**
Sponsor: Eldec Corporation — Bothell, Washington
Liaison Engineers: John Conley and Mark Waechter
Faculty Advisor: Prof. Robert Heeren
Students: Ali Al-Abdullah, Ali Al-Fadhel, James Cole, Jeff Pfof

Description:

The design updated an existing design of the Eldec Serial Interface Monitor (SIU) so that it will communicate with the latest configuration of the model 8-410 Proximity Sensing Electronics Unit (PSEU). Project tasks included: hardware design, fabrication and integration; software design, coding, and debugging; and documentation of drawings, schematics, software and operating instructions.

Project Title: **Interface From a Monitor Defibrillator to a Fax Machine**
Sponsor: Physio-Control Corporation — Redmond, Washington
Liaison Engineer: Steve Firman
Faculty Advisor: Prof. Robert Heeren
Students: Tina Baicy, Sam Guevara, Tom Martyn, Chris Muller, Ahmed Somali

Description:

The project consisted of developing an interface from a Physio-Control LIFEPAK 10 monitor-defibrillator to a standard telephone fax machine. The team was responsible for determining appropriate electronic protocols to send data to a fax machine. They evaluated the data available from the Physio-Control product, and developed, with assistance from staff engineers, an interface that allowed direct transmission of data over telephone lines.

Project Title: Microcomputer Monitor for U.S. Public Health Service Equipment
Sponsor: U.S. Public Health Service — Seattle, Washington
Liaison Engineers: Tom Bonifield and Roger DeRoos
Faculty Advisor: Prof. Alvin Moser
Students: Roy Morris, Rick Mutter, Long Nguyen, Susan Schudie

Description:

The Public Health Service is developing a new medical informatics system (POIS) that will process an enormous amount of medical data. Under this project, four sophisticated medical instruments with serial RS-232 data paths were interfaced to the 386-based host computers on which POIS runs. Hardware and data format requirements were analyzed, and software was designed and written to capture data from the instruments, display it, and transfer it to the appropriate file entries in the POIS database. The software was written in the MUMPS programming language and interfaced with the V.A. Fileman database management system.

Project Title: T₁ Channel Signalling Access/Indicator
Sponsor: US WEST Communications — Seattle, Washington
Liaison Engineer: Jack Tang
Faculty Advisor: Prof. Alvin Moser
Students: Rod Chard, Hong Do, John Spak, Sam Wilson

Description:

The project team designed and built a handheld instrument to monitor and display information captured from a T1 D4 signal line, a 24-channel communications link between central offices of the telephone system. The device will display channel condition information on all near-to-far and far-to-near channels simultaneously (a total of 48 channels) and will be able to select information from a single channel to go to a chart recorder. Indicators will also show loss of signal, loss of synchronization, and low battery conditions. The device will be battery powered and inexpensive.

Project Title: Central Office CAD Data Base
Sponsor: GTE Northwest — Everett, Washington
Liaison Engineer: David Phifer
Faculty Advisor: Prof. Paul Neudorfer
Students: Anita Chan, Trinh Do, Mike Reynolds, Michael Schleicher

Description:

GTE is developing a COEMOD (Central Office Modeling) system to be standardized throughout the entire organization. The project includes modification of the existing database for use with a commercially-available engineering design software package. Student involvement will focus on redesigning database handling routines and developing the interface between the database and design software packages.

Project Title: **Logic Card Tester**
Sponsor: Eldec Corporation — Bothell, Washington
Liaison Engineer: Andrew Siguenza
Faculty Advisor: Mr. H. Ward Silver
Students: Mark Ausmus, Hank Graham,
Boonrat Kitichotpanit, Chester Wilson

Description:

The objective of this project was to develop an IBM PC - controlled automated test station for logic cards which actuate aircraft flight control subsystems. The automated system will replace a cumbersome, manual system relying on wire jumpers and switches. Test data was stored, with output in report form for integration with existing QC programs at Eldec.

Project Title: **Multi-Standard Calibrator**
Sponsor: John Fluke Mfg. Company — Everett, Washington
Liaison Engineer: Stephanie Subak
Faculty Advisor: Mr. H. Ward Silver
Students: Mike Malocha, Silp Panthurangsee, Waled Sahoh, Donald Siegel

Description:

The team designed a replacement for an existing electrical standard system in Fluke's automated hand-held meter test facility. Resistive and Capacitive Standards were switched to the meter- under-test controlled by a Master Computer System via an RS-232 serial data link. Calibration data were stored in non-volatile memory in each standard. The team developed both firmware and hardware.

Project Title: **Data Encryption Chip Design**
Sponsor: Seattle Silicon — Bellevue, Washington
Liaison Engineer: Geoff Jones
Faculty Advisor: Prof. Margarita Takach
Students: Fletcher Castillo, Teng Feng, Fred Roberts, Liman Zhuang

Description:

The team designed a chip capable of encrypting data using the Data Encryption Standard algorithm of the National Institute of Standards and Technology. The chip will operate on 64-bit text words using a 56-bit user specified key to produce 64-bit cipher words. The chip was designed on Seattle Silicon's Chipcrafter CAD program and tested, compared and verified with a software rendition of the encryption algorithm and with the test results of a similar validated encryption chip. This chip module will then be a part of Seattle Silicon's Chipcrafter library.

Project Title: **Digital Signal Processing to T₁ Communication Interface Board**
Sponsor: Applied Voice Technology — Bothell, Washington
Liaison Engineer: Rocky Nibert
Faculty Advisor: Prof. Francis Wang
Students: Gary Anselmo, Patrick Baxter, Jiwan Hayre, Luong Nhan, Satyawati Satyawati

Description:

The project team designed and implemented a high speed digital signal processing (DSP) to T₁ digital carrier interface board to provide the capability for any of the 24 T₁ channels to talk with any other of the channels, to store audio signals from the T₁ on a hard disk, and to play back the audio on either of the two channels provided as output. The interface board will also provide synchronous and asynchronous communications with the T₁ link, signalling in both directions, as well as drop and insert capabilities. Software and hardware were designed and implemented concurrently. Final deliverables included prototype interface board, all software modules and a complete set of documentation.

Wyckoff Auditorium 1:15 p.m.

Project Title: **Flow Test Unit for LRUs**
Sponsor: Boeing Company — Seattle, Washington
Liaison Engineer: Rich Hernandez
Faculty Advisor: Prof. Stephen Robel
Students: Ghazi Eidi, Alan Frisby, Steven Kim, Patrick O'Neill

Description:

Boeing Electronics Division designs and assembles electronic control cards in standardized boxes (LRU). Depending on wattage dissipated from the cards, specific amounts of cooling air must be supplied for a given supply pressure. To control the temperature, air enters a plenum at the bottom of the boxes at 1 psi and is distributed past the cards, exiting to ambient pressure. The team designed and built a test unit to verify that the specified flow for a given supply pressure is actually being delivered. It is a self-contained, portable unit in which the flow can be varied and measured, along with the temperature and pressure drop through LRU.

Project Title: **Composite Materials Thermal Cycling Test Program**
Sponsor: Boeing Company — Seattle, Washington
Liaison Engineer: Dodd Grande
Faculty Advisor: Prof. Jack Mattingly
Students: Abdulaziz Al-Ghamdi, Simon Smith, Floyd Stredwick, Mehdi Tahsili

Description:

The task of the design team was to design and evaluate a system which subjects composite material samples to the thermal histories encountered during supersonic flight. The control of the thermal device must create both the temperature extremes and rates of temperature change encountered in an actual flight cycle.

Project Title: **Non-Intrusive Hydraulic Flow Measurement**
Sponsor: Boeing Company — Seattle, Washington
Liaison Engineer: Arun Trikha
Faculty Advisor: Prof. Jack Mattingly
Students: Adil Al-Yafey, Brian Baker, Gordon Carey

Description:

The project consisted of designing and constructing a calibration stand to verify the accuracy of a "time in transit" ultrasonic flowmeter. The calibration stand was required to have an accuracy of plus or minus one percent of a 15 gallon per minute flow rate. The calibration stand must be capable of maintaining a flow rate of 15 gallons per minute through a 0.896 inside diameter stainless steel tube to simulate an aircraft hydraulic piping run.

Project Title: **Static Hub Test Fixture**
Sponsor: Consolidated Metco — Portland, Oregon
Liaison Engineers: Rob Edstrom and Jeff Morgan
Faculty Advisor: Prof. Ray Murphy
Students: Nathan Ayres, Edmond Cordero, Miguel Gahan, Korbiat Meechan, Tim Swanson

Description:

The team had the task of designing and building a device that will apply both vertical and lateral loads either singularly or in combination on an aluminum hub made specifically for heavy duty vehicles. The vertical load will peak at 37,500 pounds and the lateral load will peak at 25,000 pounds. The device will be capable of using existing test axle and spindles, and accept all standard tire and wheel sizes, both single and tandem. The device will make use of hydraulic actuators, load cells and readouts and all other necessary components to apply the static loads.

Project Title: **Circumferentially Supported Fan**
Sponsor: Kenworth Truck Company — Kirkland, Washington
Liaison Engineers: Richard Sedgley and Iner Jorgensen
Faculty Advisor: Prof. Lewis Filler
Students: Ali Al-Shammari, Michelle Eggert, Scott Schorn, Abdul Turkistani

Description:

Kenworth Truck Company has designed and applied for a patent on a circumferentially supported fan. The team designed a method of mounting the fan on the radiator of a Kenworth truck. This mounting should hold the fan in place, but permit it to turn freely.

Project Title: **Motion Sensing Device**
Sponsor: PACCAR Technical Center — Mount Vernon, Washington
Liaison Engineer: Jim Kelley
Faculty Advisor: Prof. Dennis Wiedemeier
Students: Mubarak Al Dossary, Mike McCutcheon, Stephen Taylor

Description:

PACCAR truck components of the brake system must demonstrate the ability of the emergency brake to hold the vehicle stationary while a given load is applied. The team designed and developed a brake rotation sensor to measure the circular motion of a brake drum relative to the brake shoe during drawbar pull tests. The device will easily attach to the truck and provide accurate displacement data which can be plotted against the force applied to the truck.

Project Title: **Development of Tactile Sensor for Segment Erector**
Sponsor: Robbins Company — Kent, Washington
Liaison Engineers: Michael Stapleton and Peter Stricker
Faculty Advisor: Prof. Pierre Gehlen
Students: Kevin Brewer, Brian Frohardt, Alexander Hart, James Miller

Description:

The objective of the project was to design and produce the software and hardware required to operate a segment erector in a fully automatic mode. After a new segment is picked up by the erector, it is brought manually close to its final position. The precise alignment of the new segment is then performed automatically by the team design. Segment erection is rate controlling in tunnel boring, and it is anticipated that the design scheme will reduce the time required by a factor of two. The design uses the information gathered by several beams, flexing as they come in contact with previously positioned segments, to control appropriate proportional hydraulic valves.

Seattle University

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In addition, the chair and vice chair of each departmental advisory board are members of the EAC.

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