

SEATTLE UNIVERSITY

School of Science and Engineering
Science and Engineering Project Center

PROJECTS DAY

JUNE 5, 1998



SENIOR DESIGN PROJECTS 1997-98

WELCOME

This is the eleventh 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 joining us today.

On this, Projects Day 1998, 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. This is a wonderful opportunity for our students to share with you the results of their hard work.

We are most grateful to our industrial and government sponsors — those who are old hands at sponsoring our projects, and also those who are new sponsors. It is a tribute to your faith in our students, and in the quality of their work, that you choose to invest your time, people, and resources in these projects.

The senior design experience is perhaps the most important learning experience of our students' careers at Seattle University. Working in small groups, solving problems that don't have a unique solution, and being responsible to strict timelines, budgets, and outside agencies, are good preparations for the professional positions our seniors will soon fill.

This year we have two teams integrated from two engineering departments. This experience will give students greater understanding for working with different disciplines. We also have three exchange students from France. We welcome them and look forward to exchanges in the future.

Kathleen Mailer, Dean
School of Science and Engineering

On behalf of our faculty and students, I also welcome you to Projects Day 1998, 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 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 Rolf Skrinde in Civil and Environmental Engineering, Robert Heeren in Electrical Engineering, Ananda Cousins in Mechanical and Manufacturing Engineering, Mitchell Spector in Computer Science, Sheridan Botts, contracts officer, and Rachael Mendonsa, administrative assistant 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

PROJECTS DAY

9 a.m. LEMIEUX LIBRARY FOYER

- Projects Day Registration and Tours

9:30 a.m. - 12:30 p.m. SCHAFFER AUDITORIUM

- Fluke Corporation Dust Chamber
- Boeing Aviation Information Services ... Live TV Quick Connect for Airplane Seats
- SvR Design Company Holly Park Storm Water Drainage Design
- U.S. Public Health Service CDC Epidemiology Distance Education Web Site
- Boeing Information, Space and Defense Solder Fatigue Life Predictive Methods
- ELDEC Corporation ... Modification of ELDEC's Type 6 Driver: Design Simulation and Testing
- Parsons Brinckerhoff Quade and Douglas Sunset Interchange Eastbound Off Ramp Bridge
- Visio Corporation Graphical User Interface for CVS Source Control System

12:30 p.m. LEMIEUX LIBRARY FOYER

- Buffet Lunch

1:30 p.m. - 3 p.m. SCHAFFER AUDITORIUM

- Francis P. Wood S.J./Boeing Chair Electrification of an African Village
- Boeing Research and Technology KAoS Java
- Duet Cascade Content Addressable Memory: Design and Simulation
- Seattle University Pulse Code Modulation
- Valberg Corporation Non-Intrusive Capacitative Fluid Level Sensor

1:30 p.m. - 3 p.m. STIMPSON ROOM

- King County, Water and Land Resources King County Infiltration Pond Assessment
- Kenworth Truck Company Kenworth Hood Latch
- Washington State Department of Transportation Bear Creek Fish Passage Culvert Retrofit
- Vietnam Veterans of America Foundation Bamboo Wheelchair
- Waste Management, Inc. Final Cover Maintenance Project for Greater Wenatchee Regional Landfill and Recycling Center

PROJECT NUMBER: INT 98.2
PROJECT TITLE: Dust Chamber
SPONSOR: Fluke Corporation
SPONSOR LIAISON: Mark Ausmus
FACULTY ADVISOR: Prof. Greg Mason
STUDENTS: Elisabeth Boyd, Steve Brooks, Corey Short

DESCRIPTION:

The Fluke Corporation manufactures hand-held multimeters. These instruments must be capable of withstanding a myriad of adverse conditions. Fluke assigned Design Team INT 98.2 with the task of constructing a chamber that will allow Fluke to test their multimeters for dust resistance. The chamber, built by the team, was based on an existing design and modified to improve reliability, safety and operator usability.

PROJECT NUMBER: EE 98.1
PROJECT TITLE: Live TV Quick Connect For Airplane Seats
SPONSOR: Boeing Aviation Information Services
SPONSOR LIAISON: Mark Hinz, Wayne Yutani
FACULTY ADVISOR: Prof. Xusheng Chen
STUDENTS: Forest Bigenho, David Charbonneau, Shannon Inkpen, Rachael Viets

DESCRIPTION:

Boeing Aviation Information Services is creating an interactive, live television system to be implemented on all Boeing aircraft. This system, when completed, will allow passengers access to a wide variety of entertainment programs. One integral part of this live television system is the connection point between the signal control device and the personal monitor. Our team has designed this connector to meet the following requirements: The connection itself must be located in the armrest of the passenger seat and allow access for maintenance personnel. It will link individual monitors that require a 12 Volt DC power supply to the signal control device. The connector must allow an input data signal (400 M Hz of bandwidth) into the personal monitors and conform to Boeing and Federal Aviation Agency (FAA) safety regulations.

PROJECT NUMBER: CEE 98.3
PROJECT TITLE: Holly Park Storm Water Drainage Design
SPONSOR: SvR Design Company
SPONSOR LIAISONS: Marc Errichetti P.E., Jeff Lamoureux P.E.
FACULTY ADVISOR: Prof. Nirmala Gnanapragasam
STUDENTS: Jonathan Batara, Eric Darmanto, Grizelda Sarria,
Shawn Williams

DESCRIPTION:

In accordance with city and state requirements, the team designed the storm water drainage system for a 33 acre residential area of Seattle. This design not only includes determining the location of the piping system, catch basins, inlets, and detention system but also calculating the required diameter of the pipes, the volume of the detention tank, and the type and size of the discharge structure that discharges the storm water from the detention tank to the combined storm water-sewage system.

PROJECT NUMBER: CSSE 98.2
PROJECT TITLE: CDC Epidemiology Distance Education Web Site
SPONSOR: U.S. Public Health Service Region 10 Centers for Disease Control and Prevention
SPONSOR LIAISONS: Van Chase, Richard Lyons, M.D., Steve Scott, M.D.
FACULTY ADVISOR: Prof. Adair Dingle
STUDENTS: Dana Borgmann, Leyla Ghassemi, Jennifer Halterman,
Alan Papen, Jesse Rice, Carmen Sarro

DESCRIPTION:

Distance education is necessary to provide people, living in remote areas, with the tools they need to improve their quality of life. To accommodate Tribal health and environmental workers, the Centers for Disease Control requested an introductory level learning site on epidemiology. Epidemiology is the study of the distribution and determinants of health-related states or events in specified populations at a given place and time. Hence, this project team designed and implemented a web course that teaches an introductory level of epidemiology. This course complements the Biostatistics of Epidemiology web course, which was developed by Seattle University graduate students last year. The team researched the subject of epidemiology and gathered examples of Native American case studies to be used for the course content. Most importantly, the team designed the layout of the website, in view of its intended uses and the possibility of additional courseware, and implemented it.

PROJECT NUMBER: MME 98.1
PROJECT TITLE: Solder Fatigue Life Predictive Methods
SPONSOR: Boeing Information, Space and Defense Systems
SPONSOR LIAISON: Mostafa Rassaian, Ph.D., P.E.
FACULTY ADVISOR: Prof. Dennis Wiedemeier
STUDENTS: Yasir Bahzad, Mark Lamprecht, Joe Liu, Tyler Schorn

DESCRIPTION:

On electronic circuit boards, chips are attached to the board using solder joints. These solder joints experience temperature fluctuations throughout their lifetime. Thermal expansion leads to stress in the solder joint. After a certain number of these thermal cycles, the joints will fail. The goal of the project is to predict the thermal fatigue life of the solder joints. This is a relatively new field of study, so the project required much research. The scope of the project included utilizing a finite element analysis model created on a software package called ALGOR, applying theoretical life prediction methods, and running experiments in which samples were thermally cycled until failure.

PROJECT NUMBER: EE 98.3
PROJECT TITLE: Modification of ELDEC's Type 6 Driver: Design, Simulation and Testing
SPONSOR: ELDEC Corporation, A Subsidiary of CRANE Co.
SPONSOR LIAISON: Andrew Siguenza
FACULTY ADVISOR: Prof. Robert Heeren
STUDENTS: Anthony Cavagnaro, Lawrence Paulman, Linda Rosevold, Sebastien Zimmermann

DESCRIPTION:

ELDEC electronics units provide discrete outputs which drive amplifiers, solenoids, and other electronics packages on an aircraft. A discrete output unit is a solid state single-pole-single-throw switch which interfaces an off/on state to the aircraft. Off is defined as a non-conducting circuit, on as conducting. Our team has modified the design of one of ELDEC's driver units, called a Type 6 Driver, to meet new specifications. These modified units are able to determine two different load conditions during the Driver's Built-in-Test (BIT). The first condition determines whether or not the load is open while the driver is on; the second establishes whether or not the load is shorted while the driver is off. The results of this project will improve the current Type 6 Driver for enhanced commercial use in the aerospace industry.

PROJECT NUMBER: CEE 98.2
PROJECT TITLE: Sunset Interchange Eastbound Off Ramp Bridge
SPONSOR: Parsons Brinckerhoff Quade & Douglas, Inc.
SPONSOR LIAISONS: Kareem Greiss, Stan Ryter, P.E.
FACULTY ADVISOR: Prof. Richard T. Schwaegler
STUDENTS: Florendo Cabudol Jr., Chris Duvall, Keith Kruger, Louis Lau

DESCRIPTION:

The design team was commissioned to conduct an analytical study to determine what bridge type and layout would be best suited for an eastbound I-90 off-ramp leading onto the Sammamish Plateau Access Road. The bridge type selections are: precast prestressed concrete girders, steel plate girders, and cast-in-place concrete box girders. Strength, economic, and environmental analysis matrices were implemented to select the final bridge alternative. Each analysis complied with WSDOT and AASHTO bridge design specifications. The final bridge selection will be submitted to Parsons Brinckerhoff Quade & Douglas, and reviewed for possible use in the South Sammamish Plateau Access Road Project.

PROJECT NUMBER: CSSE 98.3
PROJECT TITLE: Graphical User Interface for CVS Source Control System
SPONSOR: Visio Corporation
SPONSOR LIAISONS: Peter Kron, Lori Pearce
FACULTY ADVISOR: Prof. Peter Mark
STUDENTS: Matt Burton, Alex Bo Ki Cheng, Danny Chou, Spencer Jaffy, Lan Nguyen

DESCRIPTION:

Visio Corporation, a Seattle-based company that produces software for creating diagrams for business and technical applications, uses CVS, a program that controls revisions in software source code. However, CVS has a text-only interface which is difficult to learn and awkward to use. Using Microsoft Foundation Classes, the team developed a graphical user interface (GUI) that serves as a Windows-type front end to CVS. The GUI offers more informative and better organized controls and it automates the coding of CVS commands. The new GUI also filters and highlights critical output information, and it can present the information in several different forms. The GUI also adds new functions requested by Visio staff, and it lets users customize the interface to individual preferences. The old operations of CVS remain available within the new GUI, so that it can meet the needs of both new and old users. The basic principles employed in this project could also be applied to developing GUIs for other command-line applications.

PROJECT NUMBER: INT 98.1
PROJECT TITLE: Electrification of an African Village
SPONSOR: Francis P. Wood S.J./Boeing Chair
SPONSOR LIAISON: Fr. Bert Otten
FACULTY ADVISOR: Fr. Bert Otten
STUDENTS: Avery DeMarr, Aluzzine Konteh, Jew Jong Lee,
 Bill West, Audrey Willyounard

DESCRIPTION:

In developing world countries, often people do not have access to a local power station. People instead can set up a power system based upon 12-volt car batteries. Our team has investigated and implemented some alternate sources of energy. Some of the devices are used to store power in the batteries while others are to supply power to lights, radios, or other low voltage devices. The team has investigated and built prototypes of : a treadle device to power lights, a bicycle generator to charge batteries, a radio powered by gravity, a photo-voltaic system to power small devices or charge batteries, and a steam engine that runs off a pre-existing device that Fr. Otten has already set up in Zambia, Africa. Six SU engineering students will go to Africa this summer to implement some of the technology.

PROJECT NUMBER: CSSE 98.1
PROJECT TITLE: KAoS Java
SPONSOR: The Boeing Company, Research and Technology,
 Information and Support Services
SPONSOR LIAISON: Jeffrey Bradshaw, Ph.D.
FACULTY ADVISOR: Prof. William Bricken
STUDENTS: Dave Brownell, Justin Cole, Neil Olson, Robert Paris,
 Carlo Villongco

DESCRIPTION:

The team worked in conjunction with the KAoS graduate student project team to provide an Activity Graph Editor to be used by their KAoS Planner Lite (KPL). After evaluating several graph tools found on the web, the team chose one to modify for the Activity Graph Editor. The main requirement of the chosen graph tool was that it be JDK 1.1.5 compliant. The Activity Graph Editor will provide a Graphical User Interface (GUI) for users to create and edit Activity Graphs used by the graduate students' KPL. The Activity Graph Editor includes graphic export features, optimal performance for average-sized Activity Graphs, an intuitive and modern GUI, and is written entirely in Java 1.1.5.

PROJECT NUMBER: EE 98.2
PROJECT TITLE: Content Addressable Memory: Design and Simulation
SPONSOR: Duet Cascade
SPONSOR LIAISONS: Chi Do, Steve Gittings
FACULTY ADVISOR: Prof. Paul Neudorfer
STUDENTS: Chris DeForeest, Melissa Degen, Alexandre Plombin, Tom Thomas

DESCRIPTION:

The project sponsored by Duet Cascade consists of designing a static Content Addressable Memory (CAM) integrated circuit. A CAM is a computer memory device that accelerates any application requiring fast searches of a database, list, or pattern. CAMs supply a performance advantage over other memory searching techniques because data is searched in parallel instead of in series. The designed CAM consists of approximately a million transistors and can search and store up to 1024 16-bit words.

PROJECT NUMBER: EE 98.4
PROJECT TITLE: Pulse Code Modulation
SPONSOR: Seattle University
SPONSOR LIAISON: Prof. Robert Heeren
FACULTY ADVISOR: Prof. Robert Heeren
STUDENTS: Sukhjot S. Basi, Edwin Chang, Jared Ellerbrock, Tri Trinh

DESCRIPTION:

The team designed and built a Pulse Code Modulation baseband system to process human voice and audio signals. This system will be used as a teaching tool in signals laboratories at Seattle University's Department of Electrical Engineering. Pulse Code Modulation technique is used in various parts of the communication industry such as telephony, audio CD players, etc., to process signals. It was developed in 1930s; in the 1970s it was implemented in telephone systems.

PROJECT NUMBER: EE 98.5
PROJECT TITLE: Non-Intrusive Capacitive Fluid Level Sensor: Design and Testing
SPONSOR: Valberg Corporation
SPONSOR LIAISON: Briggs Lewis
FACULTY ADVISOR: Prof. Margarita Takach
STUDENTS: Mathew Davis, Erick Fredrickson, Charles Snader, Amanda Tratar

DESCRIPTION:

The Valberg Corporation is seeking to improve on their existing prototype for a non-intrusive capacitive fluid level sensor. These sensors are used to measure the liquid level in marine and recreational vehicle tanks. The sensors are applied to the outside of the polystyrene tanks and sense fluid level capacitively. As the fluid level rises past a given sensor, the capacitance measured increases. The team worked on improving the reliability of the sensor and reducing interference.

PROJECT NUMBER: CEE 98.1
PROJECT TITLE: King County Infiltration Pond Assessment
SPONSOR: King County, Water and Land Resources Division
SPONSOR LIAISONS: Steve Foley, Gary-Paul Reinke
FACULTY ADVISOR: Prof. Jean Jacoby
STUDENTS: Keith Hume, Stacey Rush, Toni Turner

DESCRIPTION:

Urban development in watersheds removes native vegetation and replaces it with impervious surfaces such as roads, roof tops, and parking lots. Instead of infiltrating into the ground, precipitation on impervious surfaces is quickly carried to streams as surface water runoff causing higher peak flows. One way to manage these flows is through the use of infiltration ponds, which are designed to store storm water until it infiltrates into the ground. This study assessed the effectiveness of six infiltration ponds located on the Sammamish Plateau in storing and reducing storm water runoff from housing developments. Crest gauges were installed to monitor pond water levels over a four-month period. Total suspended solids, percolation rates, and soil character were measured. A neighborhood survey was conducted to obtain anecdotal information and specific concerns from nearby residents. The final report includes an analysis of collected data and suggestions for potential retrofits and future design parameters for infiltration ponds in King County.

PROJECT NUMBER: MME 98.2
PROJECT TITLE: Kenworth Hood Latch
SPONSOR: Kenworth Truck Company
SPONSOR LIAISONS: Larry Orr, Mike Russell
FACULTY ADVISOR: Prof. Jack Mattingly
STUDENTS: Khalid Al-Muzaini, Tim del Rosario, Hani Ibraheem, Eric Leonard

DESCRIPTION:

The Kenworth Truck Company has been a leader in the trucking business since 1917. The existing hood latching system on the T2000 truck, Kenworth's most aerodynamic truck, is an exterior rubber latch which provides little security and hinders the aerodynamics of the truck. To keep in step with a competitive trucking market, a new hood latching mechanism is required for the new T2000 truck. Criteria for the latch design require that the latch be inexpensive, easy to engage, be fail-safe, and hold the hood down through expected harsh road conditions. The problem was originally offered to an outside engineering company but price considerations deemed their complex design too expensive and consequently it never made the production date. Utilizing existing components the design team has engineered an under-hood latching mechanism which provides a safe, reliable, and secure locking mechanism to hold down the 180 pound hood.

PROJECT NUMBER: CEE 98.4
PROJECT TITLE: Bear Creek Fish Passage Culvert Retrofit
SPONSOR: Washington State Department of Transportation
SPONSOR LIAISON: Paul Wagner
FACULTY ADVISOR: Prof. Nirmala Gnanapragasam
STUDENTS: Thomas Earl, Jeffery Jensen, Michael Panlasigui, Sabry Tozin

DESCRIPTION:

Road drainage structures, such as culverts, pose a variety of potential obstacles to fish during their up stream migration for spawning. Among the obstacles are water velocities well exceeding the swimming capabilities of fish, inadequate water depth during low flow conditions, and excessive water level drop at culvert outlets beyond the jumping capabilities of certain fish species. Washington State Department of Transportation (WSDOT) in cooperation with Washington Department of Fish and Wildlife has a program whereby existing culverts that pose a potential handicap to fish passage are retrofitted to allow an unobstructed route to spawning grounds. WSDOT requested that an existing culvert at the Bear Creek Highway 112 intersection on the Olympic Peninsula be retrofitted for fish passage. The team designed a fish ladder, and performed a cost and feasibility analysis.

PROJECT NUMBER: MME 98.3
PROJECT TITLE: Bamboo Wheelchair
SPONSOR: Vietnam Veterans of America Foundation
SPONSOR LIAISONS: Robert Eaton, John O'Brien
FACULTY ADVISOR: Prof. Ananda Cousins
STUDENTS: Dakheel Al-Dakheel, Russell DeVlieg

DESCRIPTION:

Due to the large number of armed land mines in Southeast Asia and surrounding regions, crippling disabilities to innocent people are occurring at an alarming rate. The need for wheeled mobility is high; however, so is the price of a wheelchair. The Vietnam Veterans of America Foundation (VVAF) asked the team to produce a wheel chair that is inexpensive, durable, lightweight, and made from materials that are readily available in these regions of the world. In the previous year, our engineering liaison, John O'Brien, designed and built a prototype wheelchair made from bamboo, and our team is expanding upon this idea. Our team built and thoroughly tested the prototype chair, performed analysis of the design, redesigned and rebuilt a new improved bamboo wheelchair, and ultimately gave VVAF a useful, durable product.

PROJECT NUMBER: CEE 98.5
PROJECT TITLE: Final Cover Maintenance Project for Greater Wenatchee Regional Landfill and Recycling Center
SPONSOR: Waste Management, Inc.
SPONSOR LIAISON: Michael L. Peterson, P.E.
FACULTY ADVISOR: Prof. Phillip Thompson
STUDENTS: Po-Chang, John Harmsen, David Murphy

DESCRIPTION:

The Greater Wenatchee Regional Landfill (GWRL) is a 46 acre municipal landfill located outside the city of Wenatchee on a natural plateau region. Eastern Washington's climate is arid, with as little as 9 inches of rainfall per year. This low annual precipitation makes the region an ideal location for a landfill since the amount of leachate produced is limited. Waste Management, Inc., has constructed a final cover on 7 to 12 acres of the landfill. Our project evaluated and determined the best vegetation for the site. Five species of native grasses were tested, Sheep Fescue, Nezpar Rice Grass, Secar Bluebunch, Joseph Idaho Fescue, and Critana Thickspike. We determined the nutrient demands and the soil's ability to support this native vegetation. We examined growing conditions with the application of digested sludge as an alternative nutrient enhancement and landfill leachate as an irrigation source. Two-tailed t-tests were performed on all data comparing germination and plant growth in both tap water and leachate moistened soil. A two-tailed t-test was also performed comparing nutrient enhanced soil versus sludge enhanced soil to determine the best medium for plant growth. In addition, an extended growth evaluation was done on initial control species to evaluate root density and growth in non-nutrient enhanced soil. The Hydrologic Evaluation of Landfill Performance (HELP) computer model was used to assess water infiltration and runoff on the landfill cap, based on vegetative growth. The final product of our efforts was a protocol/procedure guideline for planting and care of vegetation on the final cover of a closed landfill.

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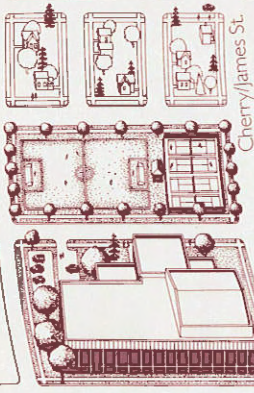
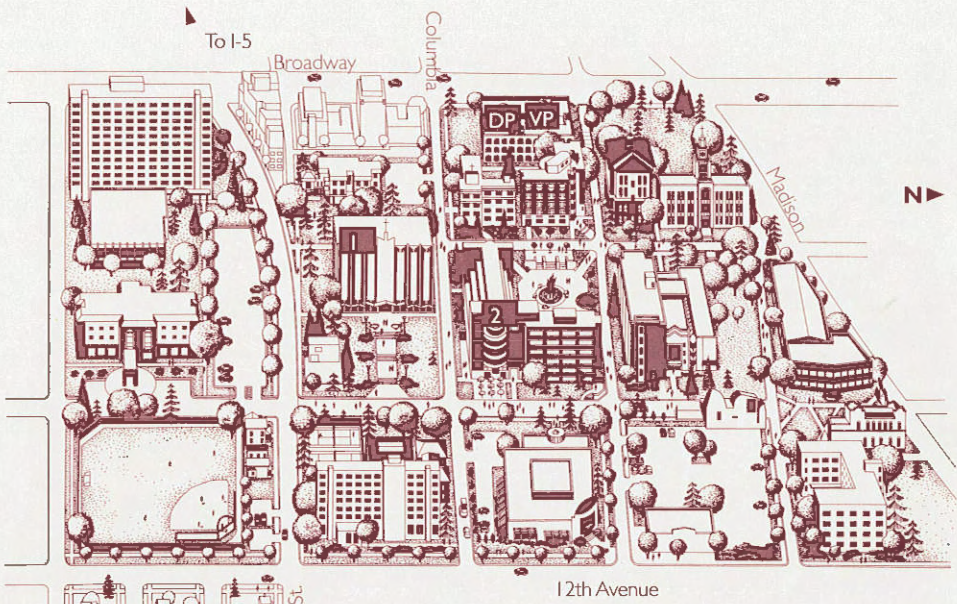
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SPONSORING ORGANIZATIONS AND LIAISONS

We want to acknowledge with special thanks the organizations who sponsored engineering design projects in 1997-98, 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, Aviation Information Services: Mark Hinz, Wayne Yutani
The Boeing Company, Space and Defense: Mostafa Rassaian, Ph.D., P.E.
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- 2** Bannan Center for Science and Engineering

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