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COLLEGE OF ENGINEERING

*Research  
Activities  
Annual Report  
1985-1986*



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Engineering Experiment Station*

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College of Engineering  
Research activities annual

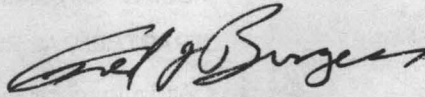
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# Preface

A vigorous program of engineering research is essential for the vitality of the teaching program of the College of Engineering. Good teaching and good research are mutually supportive. Faculty working on the leading edge of technology are those who are best equipped to prepare students for the challenges they will face after graduation, and those encountered as they proceed through their professional careers. More than half of the College's faculty is able to devote part of its time to investigations outside normal classroom teaching responsibilities. The result is a more diverse and highly qualified group of teaching and research engineers in the various engineering disciplines, and higher quality educational programs at both the undergraduate and graduate levels. Instructional laboratories for students benefit from the research program when research equipment is used for teaching. Oregon State University has long been known as a quality institution. Continuing research involvement by a strong nucleus of active research engineers is vital to maintenance and enhancement of this reputation.

This report summarizes important data concerning our research and graduate programs. It serves as a vehicle to answer frequently asked questions from industry, government agencies, private businesses, and prospective students. In the report you will find information about our record in research funding and our current research interests, along with a listing of our research faculty and their 1985-86 publications. We have also provided current data on graduate programs and enrollments, and certain financial assistance for graduate students. Additional information concerning academic programs and degrees may be found in the Oregon State University Graduate Catalog or obtained from the academic department. We welcome inquiries, addressed to me or to the appropriate individual or department listed in the Directory of Research Faculty.



Fred J. Burgess  
Dean of Engineering



## College of Engineering Research Award

Robert E. Wilson, Professor of Mechanical Engineering, received the 1985-86 College of Engineering Research award at the College's Annual Research Seminar in April. The award recognizes "outstanding and sustained research leadership." Wilson presented the keynote address at the seminar. He has been at Oregon State since 1957.

Wilson's research has focused on developing energy from the wind over the last decade. Emphasis has been on aerodynamic analysis of wind turbines. His work has been supported by grants and contracts from the National Science Foundation, ERDA, Rockwell International, Sandia, and NASA, and has brought more than \$750,000 in research income to OSU. His work continues with a three-year, \$225,000 grant from SERI. Wilson has been a consultant to government agencies and private interests on matters related to wind energy generation during this period, and is a national leader in the American Society of Mechanical Engineers. He has published some 40 technical articles related to his research, and is the co-author of a widely used textbook, Fundamentals of Momentum, Heat and Mass Transfer. He has served as a member of the Corvallis City Council.



# Engineering Research: An Overview

The research administrative structure for engineering at Oregon State University is illustrated in Figure 1. Key elements of the programs are concentrated in the academic departments, including six departments in the College of Engineering, and the engineering departments in the College of Agricultural Sciences and the College of Forestry. Faculty within each department constitute the research staff, and each of these faculty members has instruction-related duties. Graduate students in the departments assist with the research work. The Engineering Experiment Station has no technical research staff, but provides administrative support service and a central administrative focus. Several institutes and centers are associated with the academic departments or other elements of the University. These units are typically interdisciplinary in nature or service-oriented. They have strong ties with engineering, but operate independently from the affiliated departments.

## Research Expenditures

Table 1 provides a breakdown of actual research expenditures by department, within the College of Engineering, and by Agricultural Engineering. Totals of separate expenditures by certain other units include

Forest Engineering	\$ 684,932
Water Resources Research Institute	85,300
Oregon Productivity Center	121,323
Extension Energy	1,194,969

Details for these expenditures are provided in the DEPARTMENTAL RESEARCH AND GRADUATE STUDY and RESEARCH CENTERS AND INSTITUTES sections of this report. Expenditures by the Transportation Research Institute and the Radiation Center are reported with the departmental data in Table 1. The total of engineering research and extension energy expenditures for the

year was \$5,146,353. The distribution of these expenditures is shown in Figure 2.

## Research Funding Trends

Engineering research at Oregon State University is supported by grants and contracts obtained on a competitive basis from government agencies and business. No regularly budgeted State of Oregon funds are available for direct research support. Figure 3 summarizes research funding trends over the years since 1970 and shows that new grants and contracts this past year are up over last year and considerably above funding levels over the last several years. The State of Oregon appropriation for instructional programs in the College for 1985-86 was \$6.3 million. The new research budget of \$4.0 million, therefore, represents a very significant contribution to the overall effort of the College of Engineering. The Federal Government is the leading source of research support.

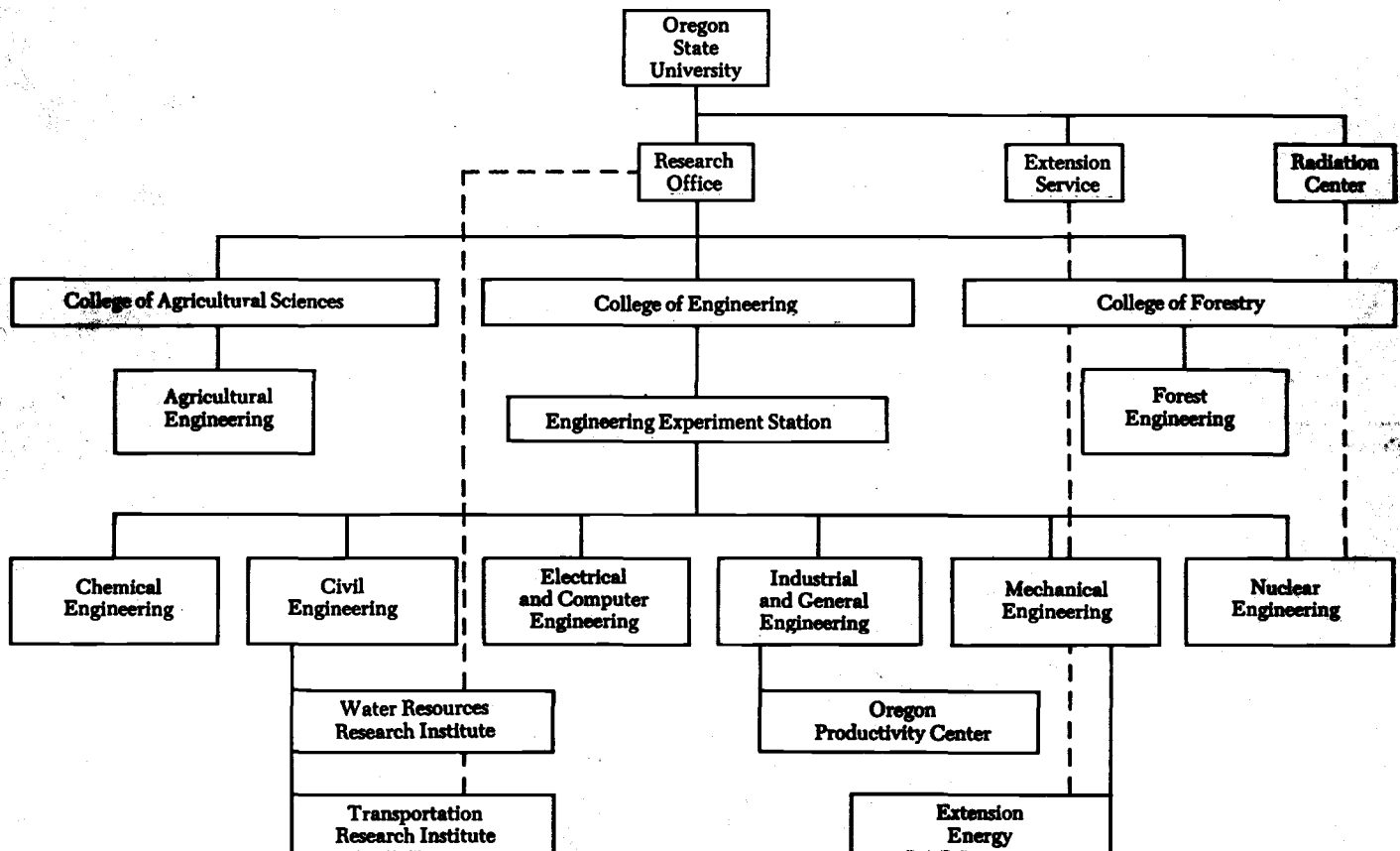


Figure 1. Engineering Research Administration

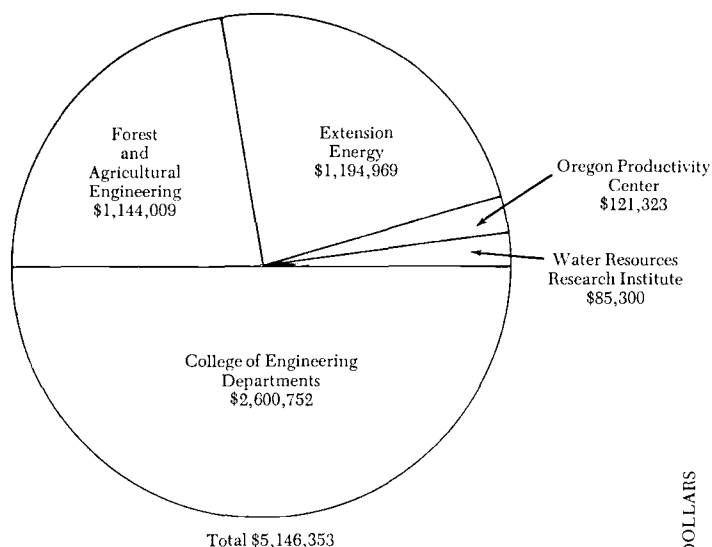


Figure 2. Expenditures for Engineering Research and Energy Extension: 1985-86

#### Education Support Grants

In addition to funds for specific research grants, the graduate programs of the College of Engineering received supplemental funding of \$95,073 this past year in the form of fellowships for support of graduate education. Details are provided on page 18.

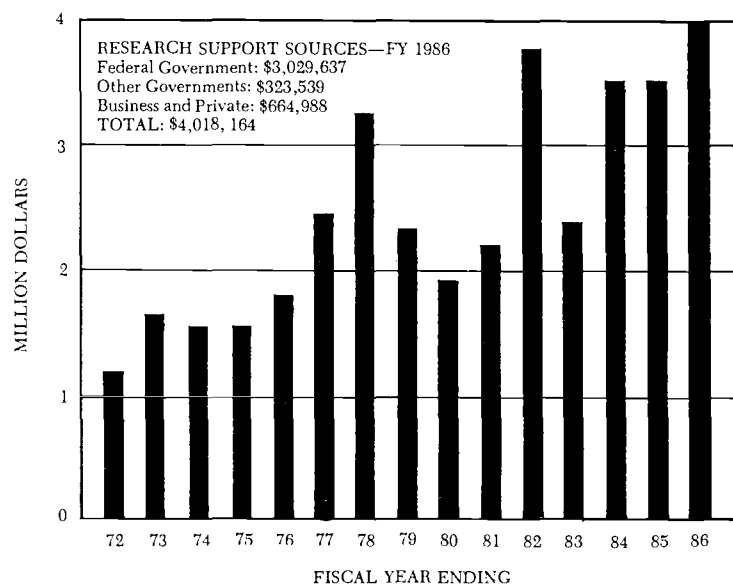


Figure 3. New Research Funding—OSU College of Engineering

Table 1. Actual Research Expenditure Distribution, Dollars, 1985-86.

Expenditure Category	Agricultural Eng.	Chemical Eng.	Civil Eng.	Electrical & Computer Eng.	Industrial Eng.	Mechanical Eng.	Nuclear Eng.	Engineering Experiment Station	Total
Personnel	275,927	42,775	446,803	246,293	64,624	238,453	57,774	67,803	1,440,452
Payroll Assessments	66,995	4,325	86,324	37,122	16,920	44,723	5,414	10,334	272,157
Supplies & Services	67,633	8,430	137,277	23,176	10,490	20,375	16,370	17,435	301,186
Equipment	11,866	335	33,205	234,180	2,947	23,057	0	124,399	429,989
Computer	18,068	124	5,597	1,297	0	2,561	0	908	28,555
Graduate Tuition	14,070	4,575	31,795	17,277	2,460	4,920	5,535	0	80,632
OSU Indirect Costs	4,315	10,798	144,269	86,886	8,013	38,271	21,313	0	313,865
Consultants	0	0	0	0	0	0	0	0	0
Subcontractors	203	0	0	9,525	0	134,523	0	0	144,251
Travel	0	1,160	17,972	11,742	4,516	12,537	581	234	48,742
<b>TOTAL</b>	<b>459,077</b>	<b>72,522</b>	<b>903,242</b>	<b>667,498</b>	<b>109,970</b>	<b>519,420</b>	<b>106,987</b>	<b>221,113</b>	<b>3,059,829</b>

# Special Feature: Ocean Engineering Program

On 26 June 1986, Secretary of Defense Casper Weinberger announced that the Ocean Engineering Program at Oregon State University was one of 70 organizations in the United States to be awarded a new University Research Initiative (URI). DoD reviewed nearly 1000 URI proposals in 86 research programs from 175 universities. This is the first year of the URI which is designed to strengthen the ability of universities to conduct research and to educate scientists and engineers in ten technologies important to national defense. The OSU-URI award was made through the Environmental Science and Engineering Program of the Office of Naval Research for a total of \$8.6 million over a period of five years. In addition to the quality and relevance of the science proposed in the URI, final selection was based on the strength of the proposed plan for awarding research assistantships to graduate students that must be U.S. citizens; on the proposed plan for the acquisition of state-of-the-art instrumentation for ocean engineering; on the proposed plan for substantial interaction and technology transfer with Navy/DoD laboratories; and on the quality of a management plan to provide responsible stewardship of the federal funds. Over the next five years, the OSU-URI will support a total of 197 months of faculty effort, 95 years of graduate student training to U.S. citizens; and 139 months of technician support.

Of significant importance to the OSU Ocean Engineering Program will be the acquisition of three state-of-the-art facilities that will make OSU a unique institution in the world for conducting both basic and applied research in Ocean Engineering. Included in these new facilities will be the following:

- 1) A dynamic tow carriage for the existing 342 ft long by 12 ft wide by 15 ft deep wave channel. This existing flume generates 5 ft high waves that are the largest laboratory generated waves in the U.S. The carriage will support large models for simulated wave loads on ocean vehicles and structures.
- 2) A directional wave basin that is 60 ft wide by 90 ft long by 5 ft deep. This basin will facilitate examination of ocean and coastal structures with complex geometries. The U.S. Army Corps of Engineers Coastal Engineering Research Center at Vicksburg, Mississippi, has the only comparable, noncommercial facility in the U.S.
- 3) A unique 50 ft diameter by 5 ft deep circular wave basin that will generate spiral waves. This will be

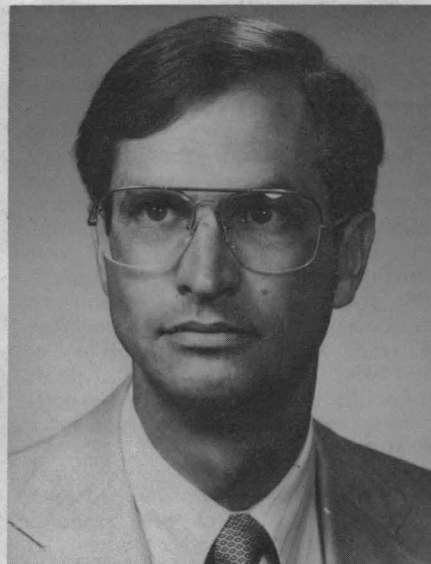


Robert T. Hudspeth  
Professor, Civil Engineering

the largest circular wave basin in the world and will be especially important for conducting research on coastal and nearshore processes. The unique circular design and spiral waves model a continuous beach and avoids the end effects that contaminate research conducted in conventional rectangular basins.

The new directional and circular wave basins and a new micro-Vax computer system will be sited in a new 100 ft by 125 ft building constructed by OSU. The existing 342 ft wave channel will receive a 375 ft by 100 ft environmental enclosure under the URI grant. These three unique wave basins and associated computer systems for data processing will be sited in over 50,000 square feet of newly constructed buildings.

The fundamental research to be conducted over the five years under the OSU-URI will center on the nonlinear interaction between stochastic waves and compliant offshore structures. Six separate research topics have been funded which are strongly interdisciplinary involving faculty and graduate students from the Colleges of Engineering and Science and from the School of Oceanography. In order to coordinate these complex research tasks and to manage the personnel and budgets, a management council was formed by the Vice President for Research and Graduate Studies, Dr. George H. Keller; the Dean of Engineering, Fred J. Burgess; and the URI Director, Dr. Robert T. Hudspeth. The principal investigators from the the College of Engineering are



C.K. Sollitt, Director  
O.H. Hinsdale Wave Research Laboratory

Drs. John W. Leonard, William G. McDougal, John H. Nath, and C.K. Sollitt; from the College of Science, Drs. Ron B. Guenther, John W. Lee, and Robert Higdon; and from the School of Oceanography, Drs. John Allen and Rob Holman. An advisory committee made up of personnel from five Navy laboratories, from a Naval Systems Command responsible for Ocean Engineering, from seven other federal/DoD agencies and laboratories, and from national defense contractors will assist in coordinating the technology transfer between OSU and the Navy/DoD laboratories, agencies and defense contractors.

Three of the six research topics focus on primarily deep water compliant structures. The first topic will develop a unified field theory for predicting wave forces on compliant structures based on the theory of chaotic dynamic systems. The second topic will develop new theories for modeling the dynamic response of highly deformable bodies in random seas. The third topic will develop new theories for the time-dependent phenomenological behavior of cable systems.

The remaining three research topics focus on wave dynamics in coastal and laboratory environments. The first topic will develop a unified theory for the parametric dependency of wave groupiness effects on the design of ocean structures. The second topic will address the coupling between coastal structures and edge wave dynamics in nearshore coastal processes. The third topic will calibrate the circulation dynamics in the three wave basins at OSU.

# Departmental Research and Graduate Study

Table 2 shows the number of professorial faculty and academic degree production in each department having ABET-accredited undergraduate engineering programs at Oregon State University. New research grant funding received in 1985-86 is also shown, and illustrated in Figure 4. Table 3 shows the numbers of personnel holding research appointments in the College. More than half of the faculty were partially supported by research grants during the year, 84 graduate students held research appointments, and another 108 held teaching assistantships or fellowships. Of the total 384 students enrolled in graduate programs exactly one-half received financial support for their work.

This section is supplemented by a departmental listing of new research grants and contracts, and statements of current research objectives and interests. We have included research data for Forest Engineering because of its close affiliation with our research programs.

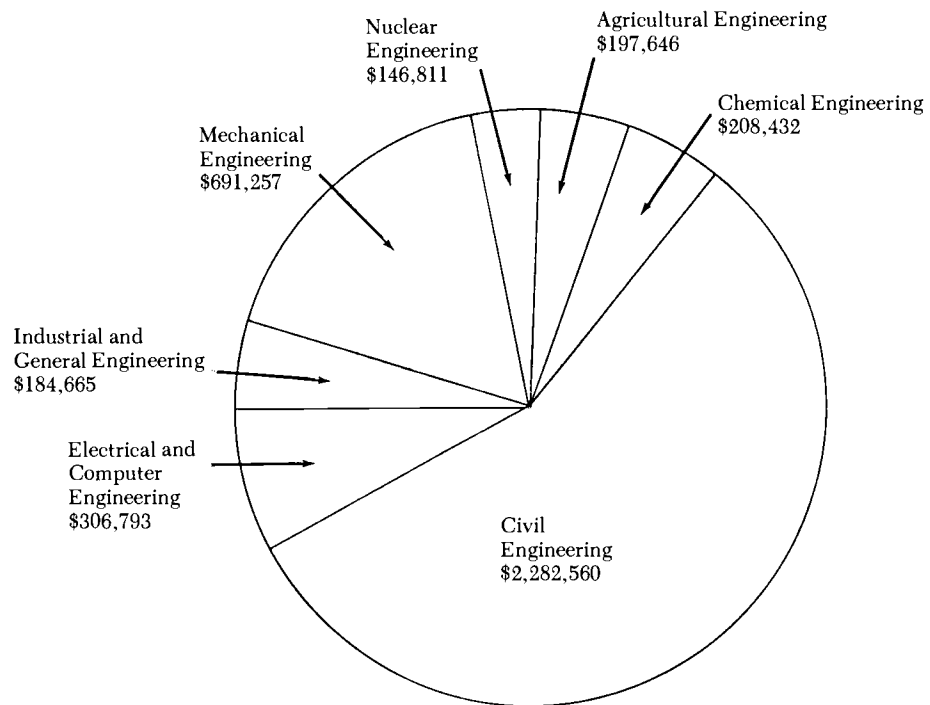


Figure 4. New Research Grants and Contracts—  
OSU College of Engineering: 1985-86

Table 2. Faculty, Degrees Granted, and New Research Dollars, 1985-86

Degree Program	Degrees Granted, 1985-86				New Research \$
	Faculty	Undergraduate	Master's	Doctorate	
Agricultural Engineering*	13	9	4	0	\$ 197,646
Chemical Engineering	6	41	6	0	208,432
Civil Engineering	21	72	25	2	2,282,560
Construction Engineering Management*	3	27	0	0	0
Electrical & Computer Engineering	24	75	35	5	306,793
Engineering Physics*	1	17	0	0	0
Industrial Engineering	7	45	6	0	184,665
Mechanical Engineering	19	71	33	4	691,257
Nuclear Engineering	7	16	5	1	146,811
TOTAL	101	373	114	12	\$4,018,164

\*Agricultural Engineering is a department in the College of Agriculture, and offers ABET accredited undergraduate engineering degrees. Engineering Physics is a department in the College of Science which offers only undergraduate degrees. Construction Engineering Management is a separate program with faculty in the Civil Engineering Department.

Table 3. College of Engineering Research Appointments by Rank: 1985-86

	Professor	Associate Professor	Assistant Professor	Instructor	Post-Doctoral Fellow	Graduate Research Assistant	Undergraduate Students	Research Assistant
Agricultural Eng.	6(6)	5(5)	3(3)	0(0)	0	8	4	1
Chemical Eng.	2(4)	1(1)	0(1)	0(0)	0	6	2	0
Civil Eng.	8(15)	4(6)	3(3)	0(6)	1	34	8	7
Electrical & Computer Eng.	4(8)	4(12)	2(4)	0(2)	0	16	3	1
Industrial & General Eng.	1(1)	2(4)	2(2)	0(5)	0	5	2	0
Mechanical Eng.	2(8)	4(7)	0(4)	0(3)	0	10	4	0
Nuclear Eng.	2(3)	1(2)	1(2)	0(1)	0	5	0	0
TOTALS	25(45)	21(37)	11(19)	0(17)	1	84	23	9

Numbers in parentheses indicate the total number of personnel. Instructors do not normally hold research appointments, but generally are doctoral level students with significant instruction duties.

## Agricultural Engineering

Agricultural Engineering has ongoing research projects in the following areas:

- \* Irrigation—development of operational guidelines and procedures for optimal management and operation of sprinkler systems and utilization of irrigation water.
- \* Harvesting Machinery—design and development of specialized harvesting equipment for uneven ripening seed crops requiring multiple periodic harvests.
- \* Post Harvest Fruit and Vegetable Preservation and Storage—development of an energy analysis and

storage environment computer model for designing containers and managing in-transit movement of fresh produce to Pacific Rim markets.

- \* Post Harvest Conditioning of Seed Crops—development of new approaches and equipment for threshing, cleaning, grading, and storage of small seed crops.
- \* Agricultural Waste Management—movement and control of bacteria emanating from animal waste is being studied in order to develop management techniques for livestock facilities and rangeland operations to prevent surface water contamination.

- \* Energy Management and Alternative Energy Sources—farm structure modifications to reduce operating energy requirements and development of alternative energy sources from agricultural biomass and waste products.

- \* Fish Engineering—designs developed to improve refrigeration of steel fishing vessels and to process and store restructured fish products.

- \* Analyzing Groundwater Quality—numerical methods are being developed for analyzing and documenting pesticide concentrations in groundwater.

## NEW RESEARCH GRANTS AND CONTRACTS: 1985-86

Principal Investigator	Project Title	Agency	Amount
Cuenca, R.H.	Canopy Resistance Terms for Penman Method—Carrijo Thesis	Purdue	2,500
Matanga, G.B.	Development of a Three-Dimensional Finite Element Model with Mixed Isoparametric Elements	Fred McLaren	61,440
Matanga, G.B.	Computer Model for Contaminant Transport Through Porous Media	Fred McLaren	13,166
Moore, J.A.	Improvement of the Model to Evaluate Coliform Concentration in Runoff from Various Animal Waste Management Systems	USDA-SCS	41,000
Moore, J.A. Miner, J.R. Buckhouse, J.C.	Evaluating the Water Quality Impacts of Six Rangeland Management Systems	USDA-S&E	79,540

## Chemical Engineering

The Department of Chemical Engineering research programs reflect not only the traditional chemical engineering fields but also new technologies important to the Northwest industries. Significant contributions have been made in chemical reactor engineering, heat transfer, mass transfer, fluidization, and thermodynamics. With the addition of new faculty members, research activities have expanded into areas of computer-aided design and control of chemical processes, biomass conversion and evaluation of pulp and paper processes.

Current research projects include:

- \* Heat Transfer: Scaling characteristics in cooling tower waters;

fouling of heat transfer surfaces during evaporation of spent pulping liquor; scale deposition under boiling conditions.

- \* Chemical Reactor Engineering: Performance equations for various kinetics and contacting patterns; cellulose degradation kinetics.
- \* Biomass Conversion: Production of furfural from hemicellulose hydrolyzate, continuous fermentation of glucose to ethanol. Solubility of natural polymers in solvent/cosolvent systems; separation of natural products by ultrafiltration.
- \* Process Control: Distributed control of chemical processes; design and robustness of multivari-

able controllers; control of staged fluidized beds.

- \* Computer-Aided Design: Modeling and design of complex separation processes; integrated fuel/chemical plant for complete utilization of biomass.
- \* Thermodynamics: Solubility of naphthalene in supercritical carbon dioxide; temperature dependence of ionic activity coefficients in aqueous solutions; modeling chemical equilibrium in aqueous, ionic solution.
- \* Mass Transfer: Absorption with simultaneous chemical reaction; use of ozone in wastewater treatment.

### NEW RESEARCH GRANTS AND CONTRACTS: 1985-86

<u>Principal Investigator</u>	<u>Project Title</u>	<u>Agency</u>	<u>Amount</u>
Frederick, W.J.	Non-Process Element Behavior in Chemical Pulp Mills	Pulp-Paper Industries	30,000
Knudsen, J.G.	Fouling Characteristics of Cooling Tower Water	HTRI	49,993
Levenspiel, O.	A Critical Experiment in Fluidized Bed Heat Transfer	NSF	54,311
Levenspiel, O.	The Development of a Magnetic Filter for Fine Slurry Solids	NSF	74,128

## Civil Engineering

The Civil Engineering Department faculty is significantly involved in a wide range of basic and applied research activities. A recently awarded \$8.6 million grant from the Office of Naval Research to the Ocean Engineering Program is being used to develop the most modern and comprehensive large-scale laboratory facilities in the United States. These facilities will be used to expand wave research investigations into coastal processes, wave dynamics, forces on marine structures, and many other marine-related areas of focus.

Water resources faculty are involved in sediment transport studies, as well as mathematical modeling of groundwater transport phenomena. The groundwater studies relate to the prediction of transport of radioactive substances that could enter the groundwater from nuclear waste containment facilities.

Environmental engineering faculty are active in the handling, disposal, and fate of hazardous substances in the environment. Other studies involve novel wastewater treatment methods, acid rain, and the susceptibility of water supply facilities to contamination by hazardous substances.

Transportation engineering faculty are studying the effect of high tire pressure on asphalt pavements, overlay design of highway pavements, and the application of weigh-in-motion data on highway engineering.

Structural engineering faculty are undertaking a study of tension structures, such as cables and membranes, exposed to the marine environment, a study on the use of wire mesh as reinforcing steel in concrete and a variety of studies dealing with dynamic loads on structures.

### NEW RESEARCH GRANTS AND CONTRACTS: 1985-86

<u>Principal Investigator</u>	<u>Project Title</u>	<u>Agency</u>	<u>Amount</u>
Bell, C.A.	Evaluation of Asphalt Properties and Their Relation to Pavement Performance	OSDT	44,903
Bell, C.A.	Procedures for Controlling the Effect of Increased Tire Pressures on Asphalt Concrete Pavement Damage	OSDT	15,500
Bell, C.A. Schauburg, F.D.	Assignment of Dr. Christopher A. Bell to the USAE Waterways Experiment Station	USAE	13,335

Hicks, R.G.	Development of a Mix Design Procedure for Cold In-Place Recycled Asphalt Pavement	ODOT	40,000
Hicks, R.G.	Development of an Improved Overlay Design Method	Alaska	27,761
Hicks, R.G.	Development of an Improved Overlay Design Procedure	OSDT	49,772
Hicks, R.G.	Study of Alternative Systems for Surfacing Forest Roads	USDA-USFS	600
Hudspeth, R.T.	Sea Wave Groups	USDA	70,852
Hudspeth, R.T. McDougal, W.G. Guenther, R.	U/DOE Lab Coop Program—Faculty Research & Training Appointment	UW	96,334
Hudspeth, R.T.	Fundamental Dynamics of Ocean Structures and Near Shore Circulation	ONR	1,087,127
Leonard, J.W.	Guyed Ocean Towers Under Seismic and Other Stochastic Loads	NSF	29,995
Nath, J.H.	Hydrodynamic Coefficients for Marine-Roughened Cylinders-85	API	35,000
Nath, J.H.	Breaking Waves—Their Influence on Wave Spectra	ONR	62,114
Nelson, P.O.	Major Ions, Acid-Based and Dissolved Aluminum Chemistry of Selected Lakes in Mt. Rainier National Park	USDI-NPS	15,000
Schaumburg, F.D.	Research Fellowship for Katharine Mary Hunter-Zaworski	USDT	22,664
Schaumburg, F.D.	Professional Training in Pollution Control/Water Supply	EPA	8,000
Schaumburg, F.D.	Assignment of J.W. Leonard to NCEL	Navy	30,440
Sollitt, C.K.	OSU Wave Tank Tests-Buoy, Meter, Mooring	WHOI	15,462
Sollitt, C.K.	Study of Dredge Material Disposal Sites on the Oregon Coast	Army	240,797
Vinson, T.S.	Reliability of the DMSO (Dimethyl Sulfoxide) Method to Determine the Degradation Characteristics of Rock Used in Highway Construction (Supplement)	OSDT	4,000
Vinson, T.S.	Determination of Fines Produced During Crushing, Handling, and Placement of Aggregates Employed in Roadway Construction	Alaska	28,944
Williamson, K.J.	Bioaccumulation of Particulate- and Cosolvent-Bound Toxicants by Benthic Marine Organisms	EPA	152,900
Williamson, K.J.	Heterotrophic Oxidation, Nitrification, Denitrification and Anaerobic Fermentation in a Substratum-Aerated, Biofilm Process for Wastewater Treatment	NSF	81,060
Woods, S.L.	Presidential Young Investigator Award to Study Sequential Biodegradation of PCB's	GE	55,000
Woods, S.L. Schaumburg, F.D.	Presidential Young Investigator Award (Hazardous Waste Management and Control) (Supplement)	NSF	55,000

## Electrical and Computer Engineering

Research in the department is concentrated in the four areas of energy systems, computer engineering, solid state electronic materials and devices, and systems and control.

In energy systems, new solid state power electronic converters are used to develop variable speed generators and drives. With support from the Bonneville Power Administration the department has focused its research into demonstrating the effectiveness of modern electrical machines in increasing efficiency and reducing energy losses when incorporated into electric systems.

In computer engineering, faculty are engaged in research in digital signal

processing, microprocessor applications, VLSI design, computer architecture, and in switching and coding. Very close liaison is maintained between the faculty and the computer industry within the State of Oregon.

For some years the department has enjoyed an international reputation for its work carried out in systems and control. This work is supported by extensive background studies in bilinear systems theory and engineering applications, and has recently concentrated on filtering and tracking research, on sub-optimal control of stochastic dynamic systems, on immune system response in collaboration with the Oregon Health Sciences Center, and in lymphatic dynamics.

The custom-designed solid state laboratories, which will become available when our new building is occupied during the 1987-88 academic year, will enable the electronic materials and device research to expand its experimental efforts. Several faculty in this group enjoy international reputations in devices based on silicon, III-V and II-VI materials. State-of-the-art research in molecular beam epitaxy, superlattices, quantum-well devices, microdefects in silicon, InP MISFET's, a.c. electroluminescence, fast optical detectors, traveling wave structures, defect thermodynamics, semiconductor interfaces, and GaAs MESFET's is conducted, with excellent cooperative efforts involving industry and other universities. The department plans expansion of this effort into femto-second optical spectroscopy and optoelectronics.

### NEW RESEARCH GRANTS AND CONTRACTS: 1985-86

<u>Principal Investigator</u>	<u>Project Title</u>	<u>Agency</u>	<u>Amount</u>
Arthur, J.R.	Growing Layers of AlInAs and InGaAs	OGC	13,666
Arthur, J.R.	High Speed Electronic Devices	Teledyne MMIC	35,000
Arthur, J.R. Plant, T.K.	Waveguides	Tek	38,000
Engle, J.F.	Metal Oxide Arrester Diagnostic Test	USDE-BPA	49,518
Forbes, L. Burke, P.	Influence of Substrate and Epitaxial Materials on Dram Design and Yield	Intel	60,310
Jensen, L.C.	Design and Fabricate Ground Fault Locator	USDE-BPA	24,872
Lauw, H.K.	Variable-Speed Generation Research	USDE-BPA	84,234
Mohler, R.R.	Nonlinear Statistical Analysis in Ocean Surveillance	ONR	64,574
Plant, T.K.	Planar PSEC Photodetectors for Coherent Optical Communications	NSF	10,365
Wallace, A.K.	A Study of the Performance of Adjustable Speed Drives with Emphasis on a Practical Application (Supplement)	USDE-BPA	5,927

## Industrial and General Engineering

The Department of Industrial Engineering is involved in research in the design of new systems integrating robotics and computer-aided manufacturing and in the improvement of productivity in existing organizations. The development and installation of new systems involves the integration of many critical elements. Product design, equipment evaluation and selection, production scheduling, inventory management, information systems, process control, and the assurance of high quality are all concerns of the

industrial engineer. Recent research activities within the Department have involved the development of hardware for both robotic materials handling systems and automatic test equipment along with the design of decision support systems for operators and maintenance personnel. Currently, work is being performed in areas concerned with the automatic assembly of electronic components, interactive control systems for robots, and the design of operator-computer interfaces involving artificial intelligence. With the recent acquisition of additional computer-aided design equipment, the development of an inte-

grated manufacturing laboratory is progressing. Future research will make use of this facility to investigate the optimum configuration and content of manufacturing cells designed to minimize production costs.

## NEW RESEARCH GRANTS AND CONTRACTS: 1985-86

<u>Principal Investigator</u>	<u>Project Title</u>	<u>Agency</u>	<u>Amount</u>
Fichter, E.F.	Mechanics of Walking in Arthropods	NSF	29,765
Funk, K.H.	Intelligent Air Attack System: Aircrew Interface Module	Computer Science Corp	39,900
McDowell, E.D.	An Investigation of the Technical and Economic Feasibility of Inserting Non-Standard Components Into Printed Circuit Boards	Tektronix	30,000
Riggs, J.L.	Oregon Productivity Center	USDC-EDA	85,000

## Mechanical Engineering

Oregon State University's Department of Mechanical Engineering conducts a strong research program in the traditional areas: design, mechanics, materials, thermal sciences, and fluid mechanics. Over the years, the specific applications to which research is directed changes and the funding available for research in a specific area fluctuates, but the fundamental research areas have remained relatively constant, and significant research activity has continued in each area. At the start of the past decade, the overwhelming research application area was "energy." While energy research still plays a major role in the department, with significant projects in wind, biomass, and fluidized beds, there has been increased activity in other areas, particularly design, fundamental combustion, mechanics, and materials.

Current research thrusts include:

- \* Design: machine design, design methodology, Computer-Aided Design (CAD), and expert systems;
- \* Materials: fatigue and fracture, wear resistance, corrosion, electronic materials, and bone replacement;
- \* Mechanics: composites, micro-polar, and nonlocal elastic solids, laser/material interactions, dynamics of mechanical systems (specifically mechanical manipulators, cable systems, and rotors), stability analysis and digital control; and
- \* Thermal Sciences and Fluid Mechanics:

Fluid Mechanics—aerodynamics of wind turbines, buoyant jets, fluidization of particle beds, and ink-jet printers.

Heat Transfer—convection studies including gas fluidized beds, electronic circuit board cooling, and liquid metals.

Thermodynamics—heat pump and power plant design, ice and frost formation, and second law analysis.

Combustion—solid, liquid, and gas fuel burning, stabilization and quenching phenomena, experimental investigation of ionic and atomic species of combustion, and biomass combustion

## NEW RESEARCH GRANTS AND CONTRACTS: 1985-86

<u>Principal Investigator</u>	<u>Project Title</u>	<u>Agency</u>	<u>Amount</u>
Burke, P. Forbes, L.	Influence of Substrate and Epitaxial Materials on Dram Design and Yield	Intel	60,310
Calder, C.A.	Stress Wave Propagation in Engineering Materials	Livermore Lab	14,988
Peterson, R.P.	Research Initiation: Study of the Plasma Jet By Direct Sampling Impact Fluorimetry	NSF	70,000
Ullman, D.G. Dietterich, T.G.	Toward Improved Models of Mechanical Design Methodology	NSF	310,354
Welty, J.R.	Assignment as Engineer—Office of Basic Energy Sciences (IPA)	USDE	194,860
Wilson, R.E.	Aerodynamic Transient and Yaw Effects on HAWT Loads and Performance	SERI	71,900

## Nuclear Engineering

Current areas of research interest in Nuclear Engineering include nuclear reactor design, reactor thermal hydraulics, two-phase flow and heat transfer, nuclear fuel management, computational methods, neutron radiography, nuclear instrumentation applications, radiation shielding, environmental monitoring, nuclear waste management, radioactive materials transportation, nuclear reactor materials, and fusion engineering and design.

The Nuclear Engineering Department is well-equipped with state-of-the-art nuclear instrumentation and compu-

ter facilities. The Department is housed in the Radiation Center.

The Radiation Center is a unique facility which was designed and established to accommodate all types of internal and off-campus instructional programs involving nuclear engineering, nuclear science, radiation protection and related areas; to support research, development and service programs involving nuclear science and engineering; to provide a place especially designed for the use and handling of radioisotopes and other sources of ionizing radiation; and to provide a variety of sources of ionizing radiation including fast and thermal neutrons, beta, X-rays, and gamma radiation.

The Center currently incorporates 45,553 square feet and is equipped with such major facilities as a 1 MW TRIGA research reactor with pulsing and nuclear studies, including multichannel analyzers with associated Ge(Li) detectors, and a Compton suppression detector system; an instrument calibration facility for radiation protection instrumentation; a neutron generator; an X-ray facility; a  $^{60}\text{Co}$  irradiator; a remote job entry terminal linked with major computer facilities throughout the nation; and a high speed (20,000 frames per second) neutron radiography facility. The Center is also equipped to package radioactive materials for transportation to both national and international destinations.

### NEW RESEARCH GRANTS AND CONTRACTS: 1985-86

<u>Principal Investigator</u>	<u>Project Title</u>	<u>Agency</u>	<u>Amount</u>
Anghaie, S. Robinson, A.H.	Thermalhydraulic Simulation and Transient Analysis of PWR Plants	PGE	44,499
Anghaie, S.	Flaw Detection, Sizing and Location by Differential Gamma Scattering Spectrum Technique	FNA	5,000
Anghaie, S. Robinson, A.H.	Transient Thermalhydraulic Analysis of a Pressurized Water Reactor	PGE	3,000
Dodd, B.	Nuclear Reactor Operating Training-Disadvantaged Americans	U of VA	13,825
Dodd, B.	University Reactor Use Sharing Program	USDE	10,000
Dodd, B.	Radioactive Material Transportation Accident Analysis and Effects	DOE	29,388
Robinson, A.H.	Gadolinium Burnout Rates in Light Water Reactors (Supplement)	Exxon	7,500
Robinson, A.H.	High Speed Neutron Radiography-Ten High Speed Movies	Army	21,295
Wang, C.H.	Reactor Use Charges	Battelle	12,304

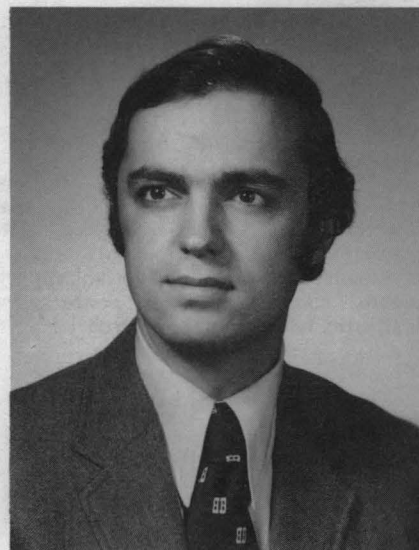
# Forest Engineering

## College of Forestry

Research activities in the Forest Engineering Department focus on harvesting methods, logging technology, road construction, and the environmental impacts of forestry activities upon soil and water. The primary goal of the Forest Engineering research program is to provide new knowledge about forest operations and how they perform technologically, economically, and

environmentally. A companion goal is to prepare scientists for careers in research through graduate education and the application of research results. Research programs tend to focus on problems and practices related to forested lands of Oregon and the Pacific Northwest. In addition to the undergraduate degree program in Forest Engineering, the department offers graduate degrees with specialties in logging engineering and forest hydrology. The department also has an active extension program dealing with forest harvesting and environmental impacts.

R.L. Beschta, Acting Head  
Forest Engineering



## RESEARCH EXPENDITURES: 1985-86

Faculty	Subject Area	State* of Oregon	Research Grants
Adams, P.W.	Soil and Water	\$ 2,000	\$ 4,552
Beschta, R.L.	Channel Characteristics	41,639	17,928
Beschta, R.L.	Hillslope Processes	0	30,282
Brown, G.W.	Administration	56,437	0
Froehlich, H.A.	Stream Protection	38,016	15,000
Froehlich, H.A.	Soil Ravel	0	75,000
Kellogg, L.D.	Harvest Young Stands	19,211	80,000
Mann, J.W.	Skyline Mechanics	0	144,000
Olsen, E.D.	Logging Labor Force	0	24,000
Olsen, E.D.	Road Construction Costs	27,590	0
Pyles, M.R.	Slope Stability	41,138	8,179
Sessions, J.	Transportation Systems	22,052	0
Sessions, J.	Roads and Landslides	37,908	0
	Totals	\$285,991	\$398,941
	TOTAL		\$684,932

\*Forest Research Laboratory

# Research Centers and Institutes

Programs for the centers and institutes shown in Figure 1 are described in this section, along with research and extension budgets that are administered outside the normal departmental channels. These centers and institutes have a public interaction role,

or are multidisciplinary in nature. They typically are advised by a governing board of directors drawn from both outside and within the University itself. Their role is an important one because of the direct tie provided between the University and the public it serves.

## Water Resources Research Institute

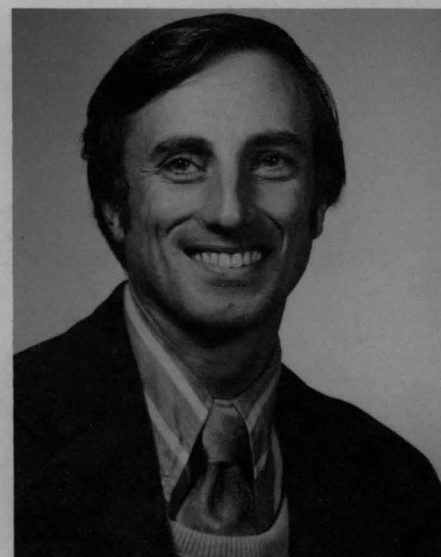
The Water Resources Research Institute was organized to coordinate multidisciplinary efforts necessary for solution of critical water problems. The Institute goal is to foster, encourage, and facilitate research and education related to all factors that affect the quantity and quality of water available for beneficial use. The Institute is administered under the Vice President for Research and Graduate Studies, through the Colleges of Agricultural Sciences,

Engineering, and Forestry. The membership, which includes all people in higher education in Oregon who are engaged in water resources research and training, currently numbers about 200 persons in 30 different departments.

Extensive facilities are available to Institute members and students for research and training. These include forested watershed lands and associated

field equipment, soils laboratories, water and waste treatment facilities, freshwater and marine science laboratories including oceanographic research vessels, experimental streams, an electronic computing center, a hydraulics laboratory, and a radiation center. Research assistantships and fellowships are available through many of the member departments. The Institute provides support for selected portions of the research and training programs in water resources at Universities in Oregon.

The Institute works closely with federal and state agencies. Seminars are sponsored during fall and spring terms to address water issues. Research reports are given wide distribution through the Institute's information dissemination program. Research projects are conducted in the areas of water supply and quality, planning and management, systems analysis, legal and institutional complexities, and water uses and use impacts.



Peter C. Klingeman, Director  
Water Resources Research Institute

### RESEARCH EXPENDITURES: 1985-86

Faculty	Subject Area	Research Grants
Anderson, N.H.	Regulated Flows and Stream Invertebrates	\$14,043
Beschta, R.L. Pyles, M.R.	Culvert Effectiveness in Mountainous Streams	13,794
Eddleman, L.E. Miller, R.F.	Water Budget Model of Western Juniper	13,427
Li, H.W.	Juvenile Salmonid Flow Needs	13,791
Sanders-Loehr, Joann Oregon Grad Center	Iron Limitation in Eutrophic Lakes	15,145
Woods, S.L. Williamson, K.J.	Bacterial Metabolism of Trace Toxicants in Groundwater Aquifers	15,100
	TOTAL	\$85,300

# Oregon Productivity Center

The Oregon Productivity Center (O/P/C) is a nonprofit institute associated with the College of Engineering at Oregon State University.

O/P/C operates with a full-time staff, primarily engaged in service projects for businesses large and small, in both manufacturing and service sectors, and for nonprofit and government organizations. The Center has access to all resources of the University system which contribute to its research capabilities. The primary purpose of the Center is to develop better tools to improve productivity and to prove the value of those tools through application in the "real" world.

O/P/C is one of only a dozen or so productivity centers in the nation, and among those, it has a unique mission: to develop more effective means to improve productivity, and to guide organizations in the use of such practices in order to test their value. In its brief six years of existence, this research focus has resulted in three principal developments.

## Productivity Interfirm Comparison

The Center currently coordinates the exchange of productivity information between most of the major food processing companies in the Pacific Northwest. Comparing such measures as raw-product recovery, pounds per labor hour, energy efficiency, safety, and many others, the comparison program has contributed to heightened awareness of productivity throughout the industry, and to impressive gains in performance.

A similar comparison program has recently been established for the major electrical utilities in the Northwest

United States and Western Canada. Proposals are being considered by a number of other industries and governmental organizations to enable establishment of additional comparison projects.

## Objectives Matrix

Literally hundreds of organizations have adopted this O/P/C tool that combines all of a unit's important determinants of productivity into one easily communicated format. Within this framework quantitative objectives are established for each of the productivity criteria, and weighted in relation to each other in a way that clearly defines the mission of the unit. A single productivity index that summarizes the net results of all actions contributed to productivity in the operation of interest is established for each rating period.

Numerous governmental agencies are in the process of preparing objective matrices with assistance from the O/P/C in response to President Reagan's directive of February 1986 calling for increased productivity in governmental agency operations.

## Productivity Audit - PROD-5

This is a fifth-generation tool that is used to examine the potential for improvement within an organization from the point of view of the work force. Over a hundred organizations (and 10,000 employees) have tried PROD-5, and more are administered monthly. Now being tested is PROD-5m, a survey of managers designed to obtain their input to productivity evaluation.

The O/P/C staff writes articles for journals and other periodicals regularly, and prepares how-to-do-it manuals and other books on an annual basis. In accomplishing this, a respectable



Robert R. Safford, Acting Director  
Oregon Productivity Center

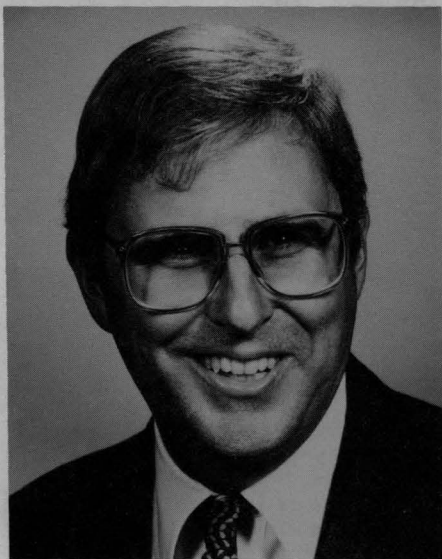
resource library has been developed that enables the Center to effectively fill requests for informational assistance. O/P/C presents seminars, short courses, and conferences throughout the year. These presentations have earned a reputation for conciseness and practicality. Topics cover the broad spectrum of subjects associated with productivity, with special emphasis on measurement. For more information about these and other services, one should contact: Oregon Productivity Center, Oregon State University, 100 Merryfield Hall, Corvallis, Oregon 97331, (503) 754-3249.

## RESEARCH EXPENDITURES: 1985-86

Faculty	Subject Area	Research Grants
Airth, Gerald	Northwest Electric Utilities Productivity Interfirm Comparisons	\$35,000
Airth, Gerald	Northwest Food Processors Association Productivity Interfirm Comparisons	7,594
Ten Pas, Lorraine	Productivity Auditing	44,773
Felix, Glenn	Short Courses, Seminars, Conferences	20,337
Riggs, J.R.	Partners for Productivity	13,619
	TOTAL	\$121,323

## Transportation Research Institute

The Pacific Northwest has continually been faced with a need to develop more efficient transportation. This need includes not only the development and evaluation of transport systems, but also the development of better techniques to plan, design, construct and maintain these systems. To help meet these needs



R.G. Hicks, Director  
Transportation Research Institute

the Transportation Research Institute (TRI) was established in 1962 by Oregon State University.

The Institute includes highly qualified academic and professional staff from the Colleges of Agriculture, Business, Engineering, Forestry, Liberal Arts, Oceanography, and Science. Currently, the Institute provides a means of enhancing research and interaction within the University and serves as a link to other universities, industry and government on transportation-related issues. Specific objectives of the Institute include: 1) Identifying and pursuing research on transportation issues and problems; 2) Developing educational and technology transfer packages which bring together information related to transportation issues and needs into forms usable by practitioners; 3) Encouraging interdisciplinary teams consisting of OSU faculty members and representatives from other universities and industry to undertake research on a broad range of issues; and 4) Providing continuing education opportunities for professionals who need to keep current in transportation issues and techniques.

TRI is organized into seven major disciplines; Transportation Systems Economics— Regulation and Manage-

ment, Geotechnical Engineering and Materials Testing, Transportation Systems Planning Operations and Safety, Facility Design, Construction and Maintenance, Transportation for Resource Development, Social Impacts of Transportation, and Environmental and Energy Issues. An advisory committee of professionals who are familiar with the transportation issues and problems of the Northwest provides policy advice and guidance. The advisory committee meets periodically with the TRI staff to offer feedback and suggestions for both research and technology transfer goals.

Major activities over the past two years have been in the area of research and technology transfer. During this period over one million dollars has been expended on research by members of the TRI staff. Research clients include the Oregon Department of Transportation, National Science Foundation, USDA Forest Service, Federal Highway Administration, Oregon Log Truckers Association, and the Alaska Department of Transportation.

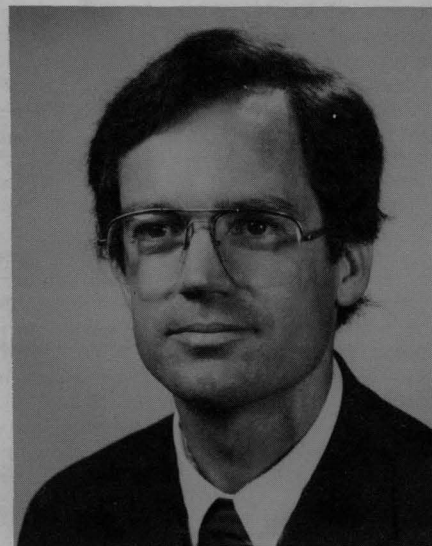
Efforts in technology transfer have been sponsored by the Oregon Traffic Safety Commission and the Federal Highway Administration.

A wide variety of facilities is available to support research and technology transfer efforts both on and off the campus. TRI has access to OSU laboratory facilities capable of complete geotechnical and materials testing, which includes static and dynamic evaluation of soils, asphalt, aggregates, asphaltic materials, portland cement, concrete and geotextiles. Several electrical hydraulic, closed-loop test systems and a walk-in cold room are located in Apperson Hall. The cold room for testing frozen soils and materials also includes a frost heave and freeze-thaw chamber.

The laboratories are supported by a microcomputer network in the Department of Civil Engineering. The network is used for both research and instruction and can be linked with other computers as needed. TRIS, a computer-based national information retrieval system is extensively used in TRI research activities.

## Extension Energy Program

The OSU Extension Energy Program is a cooperative effort of the College of Engineering, the OSU Extension Service, and the Oregon Department of Energy. It is one of seven program areas making up the Oregon State University Extension Service.



David A. Philbrick, Director  
Extension Energy Program

Extension Energy specialists and agents help solve energy-related problems for homes and businesses. Staff in six locations provide service throughout Oregon: Central Oregon (Bend); Southern Oregon (Medford); Southwestern Oregon (Coquille); the southern Willamette Valley (Eugene); Northwestern Oregon (Portland); and Northeastern Oregon (La Grande). Three faculty members in OSU's Mechanical Engineering Department provide technical support for the field staff.

Since the program began in 1980, Oregon's Extension Energy Program has provided information and technical assistance to more than 46,000 Oregonians. It has developed a strong reputation based on responsive service and high quality education materials and programs.

Major program thrusts occur in five areas.

**Low Income:** Training is provided to help meet the housing needs of low-income individuals. Specific programs include training for community action weatherization crews, workshops to support self-help projects, and information and training for social agency staff who directly help low-income households in Portland, the Willamette Valley, and Central and Eastern Oregon.

**Professional Training:** Programs and materials are developed to update the expertise of professionals who provide energy-related services to the commercial sector. Activities include organizing a monthly Commercial Energy Forum at which up-to-date information on energy-related products and designs is presented to engineers, architects, utility energy auditors, and other professionals. Video tapes of these programs are distributed statewide to others interested in the information. A self-guided workbook and video training tape produced by the program is being used by code officials, engineers, and architects to learn how to comply with revisions in Oregon's commercial lighting code.

**New Home Construction:** The Extension Energy Program has been particularly successful in developing programs and materials to improve the quality and comfort of new homes constructed in the Northwest. One- and two-day workshops presented by Extension Energy Staff reach over 500 builders annually. New techniques have been introduced that improve the performance of new homes while making them easier to build. Examples include methods for using the existing wall to form a continuous air barrier, strategies for improving typical framing practices, and increasing the awareness of improved building products. Over 4000 copies of manuals written by OSU to support these pro-

grams have been printed and used throughout the Northwest. Extension Energy staff have received additional grants to update these materials, to develop a video-tape-based training program on how to build energy efficient homes, and to prepare similar training manuals on energy efficient HUD-code manufactured homes.

**Small Businesses:** Program personnel provide assistance to help small businesses remain competitive and efficient. Restaurants, groceries, and other small businesses along the coast, in Southern, Central, and Eastern Oregon have taken advantage of site visits and training programs to understand where they are using energy and their options for controlling energy-related costs. Farms in Eastern Oregon are benefiting from improved access to weather information and technical help from agents on ways to improve water management and irrigation system efficiency.

**Wood Use:** Workshops are hosted to provide woodstove dealers and users the information they need to comply with the state's new woodstove requirements. Other programs help woodstove owners use their stoves in a manner that is both safe and as efficient as possible.

OSU Extension Energy staff work with students and other faculty to con-

duct applied research on the performance of energy-related products in the Northwest. Examples have included monitoring the performance of woodstoves, batch solar collectors, and different glazing materials. These studies have frequently led to recommendations to the manufacturers on ways to improve their products.

Funds for the OSU Extension Energy Program are provided by the Bonneville Power Administration, the U.S. Department of Energy, and the State of Oregon. In addition, special project specific grants have been received to support the development of training materials and the delivery of specific training programs. Such grants have been received from private utilities, the Northwest Public Power Association, and the Bonneville Power Administration.

The Extension Energy staff present seminars, workshops, and conferences throughout the year. Topics cover a broad spectrum of subjects associated with energy in homes and businesses. For more information about these programs, available information materials, and other services, one should contact: OSU Extension Energy Program, Oregon State University, 303 Batcheller Hall, Corvallis, Oregon 97331, (503) 754-3004.

#### EXTENSION ENERGY EXPENDITURES: 1985-86

<u>Subject Area</u>	<u>Granting Agency</u>	<u>Grant Amount</u>
Energy Efficient New Home Video Training Tapes	USDOE-Bonneville Power Admin.	\$ 98,725
Weatherization Marketing Assistance	Oregon Utilities	44,898
Utility Super Good Cents Workshops	Northwest Public Power Association	48,548
Oregon Extension Energy Service Program	Oregon Department of Energy	821,942
Oregon Extension Energy Program - Super Good Cents	Oregon Department of Energy	4,844
Oregon Extension Energy Program - Commercial Manual	Oregon Department of Energy	22,571
Oregon Extension Energy Program - Mobile Homes	Oregon Department of Energy	79,982
Residential Construction Demonstration Project	Washington State Energy Office	40,786
Basic Energy Program	State of Oregon	32,673
<b>TOTAL</b>		<b>\$1,194,969</b>

# *Educational Support Grants: 1985-86*

Various outside interests annually give financial and other resources which support College of Engineering programs. Those related principally to research and graduate education are listed here.

## College of Engineering

Burgess, F.J.	Boeing Engineering Education Fellowships	Boeing Co.	25,000
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## Agricultural Engineering

Cuenca, R.H.	Food and Agricultural Sciences National Needs Graduate Fellowships	USDA	15,048
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Miner, J.R.	Fellowship—Adre 85-86	USOE	2,905
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## Chemical Engineering

Levien, K.L.	Initiating Graduate Program	3M	11,000
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Sproull, R.	Initiating Graduate Program	Union Oil	7,000
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Wicks, C.E.	Graduate Program Unrestricted	Shell	10,000
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## Civil Engineering

Schaumburg, F.D.	Fellowship—Grilley 85-86	USOE	1,060
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## Electrical and Computer Engineering

Owen, S.J.T.	Fellowship—Bate 85-86	USOE	1,060
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## Mechanical Engineering

Reistad, G.M.	Fellowship—Woodring	Weyerhaeuser	13,000
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## Nuclear Engineering

Smith, C.V.	Fellowship in Nuclear Engineering—Benjamin	INPO	9,000
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# Research Faculty

## AGRICULTURAL ENGINEERING



H.J. Hansen, Acting Department Head  
Gilmore Hall 116  
(503) 754-2041

Hansen, Hugh Justin 1974 Prof, Acting Head of Department; Extn Agricultural Engineer. BS North Dakota State 1951; MS Cornell 1952.

Booster, Dean Emerson 1956 Prof. BS Oregon State 1954, MS 1956.

Brooks, Royal Harvard 1967 Prof International Agriculture. BS Utah State 1952; MCE Colorado State 1960, PhD 1965.

Cavaletto, Richard Alan 1985 Asst Prof, Extn Agricultural Engineer. BSAE Cal Poly 1981; MS California-Davis 1983, PhD 1986.

Cuenca, Richard H. 1978 Assoc Prof. BS California State Polytechnic 1971; MS California State-Sacramento 1975; PhD California-Davis 1978.

Davis, John Rowland 1971 Prof. BS Minnesota 1949, MS 1951; PhD Michigan State 1959.

English, Marshall Joseph 1978 Assoc Prof. BS San Jose State 1965; MS California 1974, PhD 1978.

Hansen, Herbert Eugene 1974 Assoc Prof. BS Iowa State 1952, MS 1970, PhD 1971.

Hellickson, Martin Leon 1975 Assoc Prof. BS North Dakota State 1968; MS South Dakota State 1972; PhD Minnesota 1975.

Istok, Jonathan David 1986 Asst Prof. BS Ohio State 1978; MS Oregon State 1981, PhD 1986.

Kolbe, Edward Robert 1974 Assoc Prof. BME Rensselaer Polytechnic Institute 1964; MSE Case Western Reserve 1966; PhD New Hampshire 1975.

Miner, John Ronald 1972 Prof. BS Kansas 1959; MSE Michigan 1960; PhD Kansas State 1967.

Moore, James A. 1979 Extn Agricultural Engineer, Prof. BS California Polytechnic 1962; MS Arizona 1964; PhD Minnesota 1975.

Trimmer, Walter Lee 1983 Extn Irrigation Specialist, Asst. Prof. BS Colorado State 1974, MS 1975, PhD 1984.

## CHEMICAL ENGINEERING



C.E. Wicks, Department Head  
Chemical Engineering 103  
(503) 754-4791

Wicks, Charles Edward 1954 Prof, Head of Department. BS Oregon State 1950; MS Carnegie Institute of Technology 1952, PhD 1954.

Frederick, William James Jr. 1983 Assoc Prof. BS Maine 1967, MS 1969, PhD 1973.

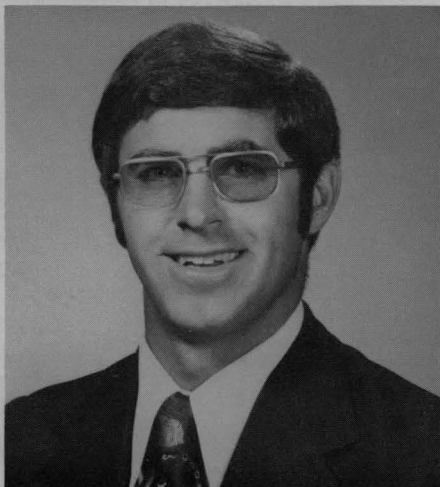
Levenspiel, Octave 1968 Prof. BS California-Berkeley 1947; MS Oregon State 1949, PhD 1952.

Levien, Keith Lester 1985 Asst Prof. BS Iowa State 1970; BS Wisconsin 1975; PhD Wisconsin 1985.

Mrazek, Robert Vernon 1960 Prof. BS Purdue 1957; PhD Rensselaer Polytechnic Institute 1960.

Sproull, Robert D. 1986 Asst Prof. BS Purdue 1973, PhD 1986.

## CIVIL ENGINEERING & CONSTRUCTION ENGINEERING MANAGEMENT



F.D. Schaumburg, Department Head  
Apperson Hall 206  
(503) 754-4934

Schaumburg, Frank David 1967 Prof., Head of Department. BSCE Arizona State 1961; MSCE Purdue 1964, PhD 1966.

Bell, Christopher A. 1981 Assoc Prof. BS U of Nottingham 1972, PhD 1978.

Bell, J. Richard 1962 Prof. BSCE Purdue 1952; MSCE 1956, PhD 1963.

Bella, David Andrew 1967 Prof. BS Virginia Military Institute 1961; MS New York U 1964; PhD 1967.

Burgess, Frederick Joseph 1953 Dean of College of Engineering, Prof. BS Oregon State 1950; MS Harvard 1955.

Hicks, R. Gary 1975 Prof, Director of Transportation Research Institute. BS California-Berkeley 1963, MS 1965, PhD 1970.

Hudspeth, Robert Turner 1974 Prof. BS U.S. Naval Academy 1963; MSCE Washington 1966; PhD Florida 1974.

Klingeman, Peter Clayton 1966 Prof, Director of Water Resources Research Institute. BS Northwestern 1957, MS 1959; PhD California-Berkeley 1965.

Laursen, Harold Ivan 1963 Prof. BS Oregon State 1958, MS 1960; PhD California-Berkeley 1964.

Layton, Robert Davis 1972 Assoc Prof. BSCE Colorado State 1959; MSCE Kansas State 1965; PhD California-Berkeley 1970.

Leonard, John William 1979 Prof. BS Tufts 1962; MS Illinois 1963, PhD 1966.

McDougal, William G. 1981 Assoc Prof. BS Humboldt State 1976; MCE Delaware 1977; PhD Oregon State 1981.

Nelson, Peter Oliver 1975 Assoc Prof. BS Cornell 1968, MS 1972, PhD 1975.

Peterson, John 1964 Assoc Prof. BS South Dakota State 1951; MS Illinois 1959; PhD Wisconsin 1964.

Phelps, Robert Elton 1968 Assoc Prof. BS Alaska 1957; MS Stanford 1958.

Pritchett, Harold Duane 1957 Prof. BS Oregon State 1957, MS 1961; DE Stanford 1965.

Rogge, David F. 1982 Asst Prof. BS Nebraska 1970, MS 1971; PhD Texas 1981.

Schroeder, Warren Lee 1967 Prof, Assoc Dean of Engineering. BSCE Washington State 1962, MSCE 1963; PhD Colorado 1967.

Schultz, Robert James 1962 Prof. BSCE Worcester Polytechnic Institute 1955, MSCE 1960; Professional Engineer, Massachusetts 1959, Oregon 1963, Professional Land Surveyor Oregon 1974.

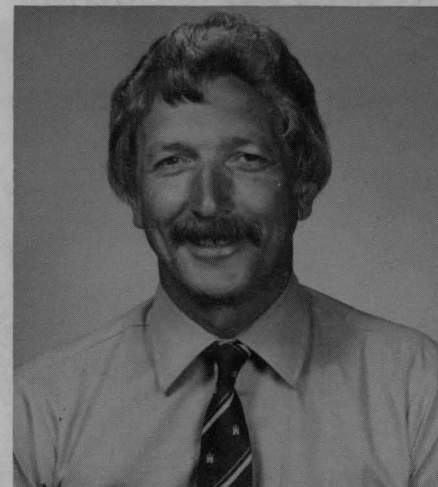
Sollitt, Charles Kevin 1972 Assoc Prof. BSCE Washington 1966, MSCE 1968; PhD MIT 1972.

Vinson, Ted Stephen 1976 Prof. BS California-Berkeley 1966, MS 1967, PhD 1970.

Williamson, Kenneth Jay 1973 Prof. BS Oregon State 1968, MS 1970; PhD Stanford 1973.

Woods, Sandra L. 1984 Asst Prof. BS Michigan State 1976; MS Washington 1980, PhD 1984.

## ELECTRICAL & COMPUTER ENGINEERING



S.J.T. Owen, Department Head  
Dearborn Hall 303  
(503) 754-3617

Owen, Sydney John Thomas 1975 Prof, Head of Department. BSc Nottingham (England) 1957, PhD 1961.

Alexander, Gerald Corwin 1955 Assoc Prof. BS Oregon State 1951; ScM MIT 1959; PhD California-Berkeley 1973.

Amort, Donald Louis 1959 Assoc Prof. BS Oregon State 1954, MS 1960.

Arthur, John Read 1983 Prof. BS Iowa State 1954, PhD 1961.

Bucolo, Richard J. 1974 Asst Prof. BS California State Polytechnic University-Pomona 1967; MS U of Southern California 1968, PhD 1975.

Chamberlin, Martha J. 1984 Instr. BS Utah 1981.

Engelbrecht, Rudolf S. 1977 Assoc Prof. BSEE Georgia Institute of Technology 1951, MSEE 1953; PhD Oregon State 1979.

Forbes, Leonard 1983 Prof. BS Alberta at Edmonton 1962; MS Illinois 1963, PhD 1970.

Goodnick, Stephen Marshall 1986 Asst Prof. BS Trinity 1973; MS Colorado State 1977, PhD 1983.

Herzog, James Herman 1967 Assoc Prof. BS Northwestern 1962; MS Michigan 1963, PhD 1967.

Jensen, Leland Christian 1955 Assoc Prof. BS Oregon State 1954; MS Illinois 1963.

Kolodziej, Wojciech J. 1980 Asst Prof. MS Technical U of Warsaw 1974; PhD Oregon State 1980.



T.M. West, Acting Department Head  
Covell Hall 211  
(503) 754-2365

Laauw, Hian 1978 Assoc Prof. BSEE Delft U (Holland) 1966, MSEE 1968, PhD 1977.

Looney, James Chester 1957 Assoc Prof. BS Oregon State 1954, MS 1960, EE 1963.

Mohler, Ronald Rutt 1972 Prof. BS Penn State 1956; MS Southern California 1958; PhD Michigan 1965.

Nichols, Kathleen Marie 1984 Asst Prof. BS Pittsburgh 1977; MS California-Berkeley 1981, PhD 1984.

Plant, Thomas Kent 1978 Assoc Prof. BS Kansas State 1968; MS Iowa State 1969; PhD Illinois 1975.

Rathja, Roy C. 1977 Assoc Prof. BS California-Davis 1969; MS Oregon State 1973, PhD 1980.

Saugen, John Louis 1964 Assoc Prof. BSEE Washington 1955, MSEE 1958, PhD 1964.

Stone, Solon Allen 1956 Assoc Dean of Engineering, Prof. BS Oregon State 1952; Professional Engineer 1960.

Tripathi, Vijai Kumar 1974 Prof. BSc Agra U 1958; MSc Tech Allahabad U 1961; MSEE Michigan 1964, PhD 1968.

Van Vechten, James A. 1985 Prof. AB California-Berkeley 1965; MA Chicago 1976, PhD 1969.

Wager, John Fisher III 1984 Asst Prof. BS Oregon State 1977; MS Colorado State 1978, PhD 1981.

Wallace, Alan Keith 1984 Assoc Prof. BEng Sheffield (England) 1963, PhD 1966.

Weber, Leonard Joseph 1954 Prof. BS Oregon State 1952; MS Washington 1962.

## ENGINEERING PHYSICS

O.A. Boedtke, In Charge  
Kidder Hall 128  
(503) 754-4811

Boedtke, Olaf Alexander 1963 Assoc Prof Physics, Director Engineering Physics, Head Adviser College of Science. BS Swiss Federal Institute of Technology 1949; MS California Institute of Technology 1958, PhD 1961.

West, Thomas Moore 1976 Assoc Prof, Acting Head of Department. BS Tennessee-Knoxville 1963, MS 1965; PhD Oregon State 1976.

Airth, Gerald Lee 1979 Instr. BS Utah State 1967; MS Stanford 1971.

Beck, William F. 1982 Instr. BA Wyoming 1960; MS Arizona State 1967.

Fichter, Eugene Frank 1977 Assoc Prof. BME Rensselaer Polytechnic Institute 1967; MS U of New Brunswick 1973; PhD Monash U 1977.

Funk, Kenneth H. II 1980 Asst Prof. BA Taylor U 1975; MS Ohio State 1977, PhD 1980.

Harlan, Susan Ferrell 1983 Instr. BS Oregon State 1982, EdM 1984.

McDowell, Edward David 1974 Assoc Prof. BS Ohio State 1965; MS Ohio U 1970; PhD Ohio State 1974.

Petersen, Gary Paul 1982 Instr. BS Oregon State 1976, MEd 1980.

Randhawa, Sabah Uddin 1983 Asst Prof. BS U of Engineering and Technology (Pakistan) 1976; MS Oregon State 1980; PhD Arizona State 1983.

Ruyle, Kim Ernest 1985 Instr. BS Winona State U 1983.

Safford, Robert Reese 1985 Assoc Prof. BIE Ohio State 1964, MSc 1965, PhD 1971.

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G.M. Reistad, Department Head  
Rogers Hall 204  
(503) 754-3441

Reistad, Gordon M. 1970 Prof, Head of Department. BS Montana State 1966; MS Wisconsin 1967, PhD 1970.

Baker, Warren Stannard 1980 Extn Energy Specialist, Asst Prof. BA Illinois 1964; PhD Edinburgh 1976.

Burke, Peter M. 1981 Assoc Prof. BS Stanford 1956, MS 1957, PhD 1968.

Bushnell, Dwight J. 1976 Assoc Prof. BS Utah 1967, MS 1968; PhD Brigham Young 1974.

Calder, Clarence Andrew 1978 Assoc Prof. BSME Oregon State 1960; MS Brigham Young 1962; PhD California-Berkeley 1969.

Davis, Lorin Richard 1969 Prof. BA Brigham Young 1958, BSME 1959; MSME Purdue 1961; PhD Illinois 1964.

Kanury, A. Murty 1985 Prof. BEng Andhra U Waltair (India) 1961; MS Minnesota 1963, PhD 1969.

Kennedy, Timothy Christopher 1976 Assoc Prof. BS SUNY at Buffalo 1968; MS Stanford 1969, PhD 1972.

Larson, Milton Byrd 1952 Prof. BS Oregon State 1950; MEngr Yale 1951; MS Oregon State 1955; PhD Stanford 1961.

Olas, Andrzej 1984 Asst Prof. MS Warsaw Technological U 1962; PhD Polish Academy of Sciences 1973.

Onwubiko, Chinyere 1986 Asst Prof. BS Mississippi State 1977; MS Southern Methodist 1978; PhD Mississippi State 1982.

Peterson Richard B. 1985 Asst Prof. BS Nevada-Reno 1979; MS California-Berkeley 1982, PhD 1984.

Philbrick, David Alan 1983 Assoc Prof. AB Brown U 1970; PhD California-Berkeley 1976.

Rawers, James C. 1982 Asst Prof. BS Ohio State 1965; MS U of Dayton 1967; MS Notre Dame 1969; BS Oregon State 1975, MS 1977, PhD 1979.

Smith, Charles Edward 1961 Prof. BSME Oregon State 1955; MSME Rensselaer Polytechnic Institute 1958; PhD Stanford 1962.

Ullman, David G. 1984 Assoc Prof. BS Cincinnati 1968, MS 1970; PhD Ohio State 1978.

Welty, James Richard 1958 Prof. BSME Oregon State 1954, MSME 1959, PhD 1962.

Wheeler, George MacGregor 1980 Extn Energy Specialist, Asst Prof. BS MIT 1967; MS California-Berkeley 1970, PhD 1972.

Wilson, Robert Elliot 1957 Prof. BS Oregon State 1955; MS Illinois 1956; PhD Oregon State 1963.

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A.H. Robinson, Acting Department Head  
Radiation Center A108  
(503) 754-2341

Robinson, Alan Hadley 1966 Prof, Acting Head of Department. BS Swarthmore 1956; MS Stanford 1961, PhD 1965.

Anghaie, Samim 1984 Asst Prof. BS Pahlavi (Shiraz) U 1972, MS 1974; PhD Penn State 1982.

Binney, Stephen Ellis 1973 Assoc Prof. BS Oregon State 1964; MS California-Berkeley 1966, PhD 1970.

Dodd, Brian 1978 Assoc Prof., Asst Reactor Administrator, Radiation Center. BS U of London 1969, PhD 1973.

Johnson, Arthur Guy 1966 Prof, Prof Radiation Health (General Science); Acting Director and Health Physicist, Radiation Center. BS Missouri 1956, MS 1958.

Klein, Andrew C. 1985 Asst Prof. BS Penn State 1977; MS Wisconsin 1979, PhD 1983.

Ringle, John Clayton 1966 Assoc Dean Graduate School, Prof. BS Case Institute of Technology 1957, MS 1959; PhD California-Berkeley 1964.

Woods, W. Kelly 1978 Prof. BA Stanford 1934; MS MIT 1936, DSc 1940.



Arthur G. Johnson, Acting Director  
Radiation Center

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