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RESEARCH ACTIVITIES 1980—1981

ENGINEERING EXPERIMENT STATION

CIRCULAR NO 56

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SPONSORED RESEARCH*

1978-1981

	<u>Feb 1978</u>	<u>Aug 1978</u>	<u>Feb 1979</u>	<u>Aug 1979</u>	<u>Feb 1980</u>	<u>Aug 80</u>	<u>Feb 81</u>
Agricultural Engr	\$ 160,156	\$ 172,156	\$ 93,135	\$ 65,993	\$ 202,188	\$ 129,200	\$ 209,300
Chemical Engr	559,784	200,180	200,180	218,529	627,736	647,400	564,000
Civil Engr	636,731	856,052	516,019	555,075	94,800	447,800	348,800
Electrical Engr	450,257	525,165	449,744	364,461	422,788	344,900	271,500
Engr Experiment Station	73,940	53,000	53,000	53,000	53,000	-	-
Industrial Engr	-	-	-	-	-	-	100,000
Mechanical Engr	698,881	616,437	455,990	544,438	344,469	576,600	241,600
Nuclear Engr	136,145	192,492	304,838	172,054	191,372	243,600	255,900
Water Resources Research Inst	147,485	147,485	151,109	211,609	199,640	89,640	171,100
Misc.**	<u>423,916</u>	<u>485,535</u>	<u>441,840</u>	<u>221,879</u>	<u>194,862</u>	<u>473,000***</u>	<u>492,600***</u>
TOTAL	\$3,287,295	\$3,248,502	\$2,665,855	\$2,407,038	\$2,330,855	\$2,952,140	\$2,654,800

* Based on data from the Office of the Dean of Research.

** Fellowships, chairs, training grants, equipment, facilities, institutes.

*** Includes Oregon Energy Extension Grant of \$355,000.

RESEARCH ACTIVITIES

1980-1981

AGRICULTURAL ENGINEERING

J. R. Miner, Department Head

HYDRAULIC PROPERTIES OF EARTH MATERIALS AS AFFECTED BY CLAY-WATER INTERACTION

Sponsor: NSF

Personnel: R. H. Brooks, Principal Investigator

Objective: The objective of this project is to establish quantitative relationships among hydraulic variables in earth materials as affected by clay-water interaction. Changes in parameters of the functional relationships brought about by clay-water interaction are investigated.

Measured hydraulic data include: 1) Water content as a function of fluid pressure. 2) Permeability to water as a function of fluid pressure. 3) Permeability to air as a function of water content.

These measurements are made on both the wetting and drying cycles.

Variations in clay-water interaction as affected by type and quantity of clay and concentration of electrolyte are determined. Samples of earth materials include soils and semi-consolidated sediments containing a wide range of types and quantity of clay. Distilled water and calcium chloride solutions of 0.02 N and 0.2 N are used to promote maximum, intermediate and minimum clay-water interactions respectively.

The information obtained is intended to account for clay-water interactions in simulation modeling of infiltration and drainage.

COMBINED ENERGY AND ECONOMIC ANALYSIS OF OPTIMIZED IRRIGATION SYSTEMS

Sponsor: USDA-SEA

Personnel: R. H. Cuenca, Principal Investigator

Objective: Although this project was approved on 4/81, expenditures from this phase of the project will not begin until 01 July 1981. This will allow us one fiscal year to complete the project. In reality, this project is a continuation of a previous project on energy use coefficients for different materials and computerized energy analysis for which a final report will be submitted to USDA-SEA/AR during June 1981. Present action for the new project includes recruiting of one assistant at the GRA or RAU rank.

THE EFFECT OF IRRIGATION FREQUENCY ON CROP YIELD

Sponsor: USDA-SEA

Personnel: M. J. English

Objective: This project is concerned with deficit

irrigation and irrigation frequency. Deficit irrigation is the practice of deliberately under-irrigating a crop. Under some circumstances this practice can be economically advantageous. Furthermore the benefits of deficit irrigation may be significantly enhanced by irrigating at either high or low frequencies rather than at normal frequencies. However a critical question must be answered before the merits of deficit irrigation can be accurately assessed: Does irrigation frequency affect crop yields independently of water deficits? This project will address that question.

The proposed research will test the hypothesis that at least one category of crop production functions (those based on evapotranspiration) can be used to predict yields equally well under either high or low frequency irrigation regimes, regardless of the frequency under which the production function was derived. This research will only pertain to a single crop in a single location for a single year. However, if the hypothesis is rejected, this effort will provide a basis for establishing a new approach to research on crop production functions. If the hypothesis is accepted, it will serve to reinforce confidence in existing crop production functions that are based on ET.

IRRIGATION SYSTEMS

Sponsor: USDI-OWRT

Personnel: H. J. Hansen, Principal Investigator

Objective: A coordinating group has been formed of personnel involved in pump test programs in Oregon, Washington and Idaho. This group will standardize data recording and analysis procedures for field test data requisition, evaluation and reporting. A data bank of pump tests being conducted in the three-state area is being collected at Oregon State University.

AGRICULTURAL STRUCTURES DESIGN UTILIZING ALTERNATE ENERGY SYSTEMS

Sponsor: AERF

Personnel: M. L. Hellickson, Principal Investigator

Objective: This research effort was initiated with the following specific objectives: 1) Purchase, install and summarize a complete cost of materials for a solar collector system to heat water to a temperature suitable for use in a dairy milking parlor. 2) Purchase, install and summarize a complete cost of materials for a water-cooled condenser system to capture waste heat from the milk refrigeration system. 3) Determine energy savings attributable to each system.

RESEARCH ON SEED HARVESTING AND PROCESSING AT CORVALLIS

Sponsor: USDA

Personnel: J. R. Miner, Principal Investigator

Objective: To increase efficiency and reduce

losses in harvesting and processing of seeds. To develop new approaches and better equipment for mechanical operations such as screening, pneumatic separating, and handling.

CHEMICAL ENGINEERING

C. E. Wicks, Department Head

SCALED BED MODELING FOR FLUIDIZED BED COMBUSTORS

Sponsor: USDE

Personnel: T. J. Fitzgerald, Principal Investigator

Objective: The purpose of this project is to investigate a method of predicting the hydrodynamics of a large hot fluidized bed by measurements made on a smaller room temperature fluidized bed scale model. The technique could be used for predicting solids circulation and gas-solid contacting patterns in large beds and would enable the results from pilot scale units to be used with confidence in predicting the performance of full scale units. No publications to date on this project.

INVESTIGATION OF FLUIDIZED BEDS WITH IMMERSED HEAT EXCHANGE TUBES

Sponsor: Babcock & Wilcox

Personnel: T. J. Fitzgerald, Principal Investigator

Objective: This project involves experimental studies of solids and gas movement in a cold scaled-model of a fluidized bed coal combustor. The problems being investigated are: 1) bypassing of coal volatiles (to burn after the bed), 2) bypassing of unburnt char fines, 3) spread of coal away from feed-points, 4) dynamics of defluidizing and re-fluidizing a portion of the fluid bed (a technique which would be useful for load following).

MEASURING AND MODELING SOLIDS MOVEMENT IN A LARGE FLUIDIZED BED TEST FACILITY

Sponsor: USDE

Personnel: T. J. Fitzgerald, Principal Investigator

Objective: We proposed to develop a complete instrumentation system for the six foot by six foot cold fluidized bed at Morgantown, West Virginia for collection of data on solids movement in a fluidized bed combustor. The system will consist of a system for capture and release of ferrite tracer and one hundred independent inductor probes for monitoring the presence of ferrite throughout the bed.

A prototype system will be built and tested using the three foot by three foot cold fluidized bed at Oregon State University

In the experiments at OSU and in the experiments to be conducted at Morgantown, the size of the dummy heat transfer tubes as well as the sizes and density of the bed material will be scaled so that the hydrodynamic performance of the bed is similar to that of a fluidized bed combustor

operating at high temperature. The effect of tube spacing, of bed depth and of superficial air velocity will be tested. We will attempt to fit the data to a diffusion type model which can be used for calculating the allowable distance between solid feed points in a fluidized bed combustor.

Two years will be necessary to complete the project. During the first year, inductor probes, similar to those in use at OSU, will be built for use at Morgantown Energy Research Center. Also, a prototype ferrite injection and removal system will be built and tested at OSU. Following the successful operation of this prototype system, a larger system will be built for ferrite tracer injection and removal in the six foot by six foot facility at Morgantown.

Construction and testing of electronic instruments and probes will be done at OSU and the finished system will be shipped to Morgantown for installation. The component parts necessary for fabricating the ferrite removal system will be purchased by OSU to be assembled by personnel at Morgantown according to engineering drawings and specifications provided by OSU.

MEASURING SOLIDS AND GAS FLOW IN THE VICINITY OF A COAL FEED PORT

Sponsor: Aerospace Corporation

Personnel: T. J. Fitzgerald, Principal Investigator

Objective: To determine how gas and solids move in the vicinity of a simulated coal feed port. Our responsibility is the collection of raw data for analysis by the Aerospace Corporation.

KINETICS OF SPECIES FORMATION IN THE PYROLYSIS OF WOOD AND CELLULOSIC MATERIAL

Sponsor: NCASI

Personnel: F. Kayihan, Principal Investigator

Objective: This research project involves the investigation of the kinetic rates of reactions occurring during the pyrolysis of wood chips. Direct energy conversion from wood in terms of combustion and indirect conversion through pyrolysis gases both involve the thermal degradation step which is called devolatilization. Accurate characterization of wood and forest residue utilization processes require sound understanding of this devolatilization step. The rates of chemical and physical changes taking place are relatively high where most of the changes are complete in a few seconds. For this reason, the present approach is utilizing techniques which will allow investigation of the pyrolysis kinetics under high heat and mass transfer rates.

FOULING CHARACTERISTICS OF COOLING TOWER WATER

Sponsor: NSF

Personnel: J. G. Knudsen, Principal Investigator

Objective: This is an investigation of the scaling characteristics of cooling tower water. Cooling tower water contains dissolved minerals which have inverse solubility characteristics. When the water comes into contact with a hot surface, scale consisting of calcium carbonate, magnesium carbonate, or various silicates is deposited. The apparatus simulates an industrial cooling tower.

The parameters being investigated are flow rate, heater surface temperature, and water quality. The various water quality parameters include total and calcium hardness, alkalinity, total dissolved solids, and pH. The goal is a systematic study of the various parameters which influence the scaling characteristics of cooling tower water in order to develop a model for the prediction of such scaling characteristics.

PROBLEMS IN GAS/SOLID CONTACTING

Sponsor: NSF
Personnel: Octave Levenspiel
Objective: This project plans to study three problems: a) How to efficiently harvest and remove large particles from a fluidized bed. This is an important problem for processes where particles are being grown, by deposition, in fluidized beds; b) To develop an efficient counterflow gas/solid contactor based on the recently invented concept of magnetically stabilized fluidized bed, by judicious choice and control of bed geometry and magnetic field distribution; c) To come up with an improved raining solids contactor with long residence time of solids by properly hindering the flow of solids. The experimentation for these three problems will share the same experimental set-up, a large solid circulation system capable of accommodating a large range of particle sizes.

CIVIL ENGINEERING

F. D. Schaumburg, Department Head

EFFECTS OF WEATHERING ON GEOTECHNICAL PROPERTIES OF MT. ST. HELENS ASH

Sponsor: NSF
Personnel: J. R. Bell
Objective: The proposed study is to locate and preserve test sites covered by fresh Mt. St. Helens ash deposits suitable for long term studies of the effects of weathering on geotechnical properties and to establish baseline engineering characterization data including strength and consolidation test data. The Mt. St. Helens eruption provides a unique opportunity to study the formation of the unusual clay minerals derived from the weathering of volcanic ash in humid climates from the initial state and to document the effects on geotechnical properties. This study will 1) select and establish protection for suitable sites for long term studies, 2) collect appropriate representative and undisturbed samples, 3) perform index, strength, moisture-density, and consolidation tests to establish baseline data, and 4) produce a report containing the study results and recommendations for future tests.

BIOLOGICAL/PHYSICAL INTERACTIONS

Sponsor: Science Appl.

Personnel: D. A. Bella/ D. R. Hancock
Objective: The project is to assist in the integration of results from a large multi-team, interdisciplinary study on the Columbia River Estuary. At present, it does not appear that the last year of funding for the study will be provided and thus it is not likely that data collection, interpretation and integration will be completed.

IMPACT OF VARIATIONS IN MATERIAL PROPERTIES ON ASPHALT PAVEMENT LIFE

Sponsor: OSDT
Personnel: R. G. Hicks, Principal Investigator; J. Walter
Objective: During the past three years (1974-77), several problems have been noted during and after construction of asphalt pavements in Oregon and other parts of the states. Several factors, including new asphalt sources, new technical developments and non-compliance with existing specifications have been blamed for this problem. The purpose of this project is to evaluate the impact of variations in mix characteristics (non-compliance) on pavement life. The variables to be evaluated are the amount of materials passing No. 200 and No. 10 sieves, the asphalt content and the mix density. All tests will be performed on standard laboratory samples using the repeated load diametral testing device to determine the elastic and fatigue characteristics of the mix tests after accelerated aging. The results will then be processed statistically, and used to develop suitable pay adjustment factors for mixes not meeting specifications.

TEST METHODS AND USE CRITERIA FOR FILTER FABRICS

Sponsor: FHWA/USDOT
Personnel: R. G. Hicks, J. R. Bell, Principal Investigators
Objective: This project is concerned with: 1) the identification of criteria for the engineering use of filter fabrics for subdrainage, erosion control and soil reinforcement applications, and 2) the evaluation of test methods or development of new tests to determine the properties of filter fabrics.

WILLAMETTE RIVER SEDIMENT TRANSPORT INVESTIGATION

Sponsor: Army
Personnel: P. C. Klingeman
Objective: Supplemental velocity data at winter streamflow levels is needed to permit verification of sediment transport within the Willamette River between river miles 135-137. Contractor is asked to determine the average velocity at 50-foot intervals across the Willamette River. Velocity data should be obtained for as high a streamflow discharge as possible, ideally 20,000 cfs., but at a lower flow if insufficient storm runoff occurs.

WATER ASSESSMENT OF ENERGY TECHNOLOGIES

Sponsor: PNRBC
Personnel: P. C. Klingeman
Objective: 1) To determine the supplies of water available to support development of energy technologies considering competing purposes, present

and planned management and development of resources, and pertinent legal and institutional factors.
2) To determine the collective and individual impacts of possible commitment of water supplies to development of technologies including a) cost of water supplies, b) changes in streamflow, c) changes in water quality, d) cost of water quality management, and e) environmental, economic and social impacts associated with changes in water utilization and other water resources conditions.

STURGEON LAKE RESTORATION: PHASE I DIAGNOSTIC/ FEASIBILITY STUDY

Sponsor: Multnomah
Personnel: P. C. Klingeman
Objective: Characterize Sturgeon Lake with respect to sedimentation, shoaling and water quality; Identify the specific problem and its severity; Identify alternatives for coping with problem; Evaluate the alternatives (benefits, costs, impacts); and Select and develop the most effective plan.

WATER-RELATED AFTEREFFECTS OF THE MT. ST. HELENS ERUPTION

Sponsor: WSU
Personnel: P. C. Klingeman
Objective: The specific objectives of this project are: 1) Identify and prioritize water resources-related research needs arising as a result of the Mt. St. Helens eruption; 2) preparation of a report to identify and describe those research needs; 3) a coordination of funding for research projects addressing the prioritized needs as determined under step one; 4) a preparation of a final report which will describe the studies undertaken and summarize the results of the research for general use by the public, Congress, and the scientific professions; and 5) the development and conduct of a regional conference on water-related problems arising from the Mt. St. Helens eruption.

INFORMATION PROGRAM TO FACILITATE SMALL SCALE HYDROELECTRIC DEVELOPMENT

Sponsor: USDE
Personnel: P. C. Klingeman/L. S. Slotta
Objective: The specific objectives of the proposed program are to: 1) Develop an information program on small-scale commercial-size hydroelectric development in Oregon, based upon the assembly, analysis, evaluation and dissemination of information regarding the resource potential, technical problems, environmental constraints, available governmental programs, project financing, benefit/cost economics, power marketing arrangements, licensing and related institutional matters, and applicable federal and state legislation and regulations; 2) Develop an information center to house the above-listed information for easy access and use; 3) Prepare synopses of relevant information for public information and dissemination in response to inquiries; 4) Conduct a workshop in Oregon designed to inform dam owners, developers, equipment manufacturers, and others of the above-listed information, the workshop to serve both as

a means for information dissemination and as a tool for identifying barriers to potential small-scale hydroelectric development.

TRAFFIC ENGINEERING AND HIGHWAY SAFETY FUNDAMENTALS SHORT COURSE.

Sponsor: OTSC
Personnel: R. D. Layton
Objective: Many local jurisdictions in Oregon, both counties and cities, do not have personnel who are trained in basic traffic engineering and highway safety fundamentals, even though they have responsibility in these areas. Further, there is a continual need to provide training on new techniques and developments for technicians and engineers working in traffic analysis, operations, intersection and roadway design, highway safety and highway planning.

The objective of this project is to teach short courses that will acquaint and instruct participants from local jurisdictions with basic fundamentals, latest principles, current research results and instrumentation to solve traffic and safety problems in their jurisdictions.

Courses taught four times at four locations include: Traffic Engineering Fundamentals; Highway Safety Fundamentals; Traffic Engineering Fundamentals; Highway Safety Fundamentals.

STUDENT ASSISTANCE WHILE ATTENDING OSU

Sponsor: USDT-FHA
Personnel: R. Layton
Objective: This is a fellowship for Mr. Robert Oakes who is supported under this National Highway Institute Grant to do graduate study in transportation engineering with emphasis in transportation planning.

FOREST SERVICE SHORT COURSE

Sponsor: UCB
Personnel: R. D. Layton
Objective: This course provides forest transportation analysts with the minimum knowledge and skills required to specify, analyze, and evaluate transportation alternatives in connection with land management planning, for both large and small land areas. While road design and logging systems engineering are considered from the perspective of formulating practical alternatives, this course is not intended to train individuals in either preconstruction engineering or timber sale layout. The course is intended to train individuals to determine the types, standards, and general locations of transportation facilities to serve land management objectives, and to determine the economic and level of service consequences of such facilities.

The course consists of seven instructional modules which may be taken together or individually. Each module deals with a particular aspect of transportation analysts' job requirements.

Instruction is provided by individuals from throughout the United States, of whom approximately one-third are Forest Service personnel representing different regions. Other instructors are from academic institutions and industry. The course

deals with material common to all Forest Service regions.

ASSIGNMENT TO THE NAVY (IPA)

Sponsor: Navy
Personnel: J. W. Leonard
Objective: The objective is to develop algorithms for a two-step identification process for improving dynamic structural models. A basic finite element program (FEP) with an element or elements capable of triaxial bending plus axial load will be provided. FEP will be suitable for dynamic analysis including effects of structural damping. To provide an algorithm that will iteratively relate changes in parameter values to changes in the system response the Bayes rule of probability and statistics will be applied (Bayesian Technique). The technique will involve searching for a minimum difference between measured and predicted model response. The measured response will be provided through existing experimental data.

COMPUTER MODELING OF FLEXIBLE MEMBRANE INTERACTION WITH OCEAN WAVES

Sponsor: Sea Grant
Personnel: J. W. Leonard
Objective: The primary objective is to determine the technical feasibility and economic advisability of using inflatable membrane shells in the coastal zone. We propose to develop a computer simulation technique for the nonlinear fluid-structure interaction problem of a deformable inflatable shell with coastal waves. The ability to predict the dynamic interaction of such systems will be a necessary first step toward the primary objective. Parametric studies and design criteria can then be developed for safe, as well as economic, component design.

STOCHASTIC ANALYSIS OF CABLE SYSTEMS AND CABLE-REINFORCED MEMBRANES

Sponsor: NSF
Personnel: J. W. Leonard, Principal Investigator
Objective: The objective of this research is to study the response of nonlinear cable systems and of cable-reinforced membranes subjected to extreme dynamic loads. Finite element models of the deterministic static and dynamic behavior of cable systems will be modified so as to incorporate oceanic hydrodynamic loads. A similar modification will be made to an existing finite element model of a reinforced membrane subjected to static loads and dynamic load analysis capability will be added.

LARGE SCALE MODEL TESTING OF COAST GUARD BUOYS

Sponsor: Coast Guard
Personnel: J. H. Nath
Objective: Wave Research Facility use charges.

HYDRODYNAMIC COEFFICIENTS FOR CYLINDERS WITH PRONOUNCED MARINE GROWTHS

Sponsor: API

Personnel: J. H. Nath, Principal Investigator
Objective: The purpose is to determine the hydrodynamic coefficients for smooth, sand-roughened and macro-roughened cylinders in steady and wavy flows. The smooth and sand-roughened work is for comparison with the work of others. The main thrust of the research is to determine the hydrodynamic coefficients for macro-roughened cylinders in a few specific flows with relatively high Keulegan-Carpenter numbers and Reynolds numbers.

HYDRODYNAMIC ROUGHNESS OF MARINE GROWTHS ON CYLINDERS

Sponsor: NSF
Personnel: J. H. Nath
Objective: Considerable information exists on the hydrodynamic force coefficients for smooth and sand covered cylinders in steady state and oscillatory flow. This research concentrates on very heavy marine growths that create roughnesses much greater than even the heaviest sand covered cylinders in the past. The major emphasis is on horizontal cylinders in wave flow and tests have been made in the OSU Wave Research Facility. One publication is: "Hydrodynamic Coefficients for Macro-Roughnesses", OTC Paper 3989, May 4-7, 1981.

DRIFTING BUOY NUMERICAL MODEL IMPROVEMENT

Sponsor: USDC-NOAA
Personnel: J. H. Nath
Objective: A numerical model has been developed to predict the motions of a buoy-tether-drogue system that is used in the ocean to measure oceanographic and atmospheric parameters. The main purpose of the model is to be able to predict the forces within the system for structural design. Secondary purposes are to predict drift speeds and maximum motions of the various components. It is desired to modify the model to handle specific changes in the attachment point, the degree of buoyancy in the tether, and the shape and motion characteristics of different buoys.

ENGINEERING ROUGHNESS OF MARINE GROWTH ON STRUCTURES

Sponsor: Sea Grant
Personnel: J. H. Nath
Objective: Much information exists on smooth and sand covered cylinders in steady state and oscillatory flow with respect to the forces transmitted from the fluid to the cylinder. However, no information exists as to the modification of these forces from the dense growths of kelp or seaweed as exists in nutrient rich waters. Basic data have been gathered from structures in Canadian waters. Models have been made and tested in the large OSU Wave Research Facility. A publication is in progress and will be available in about six months.

DEVELOPMENT OF CURRICULUM IN CONSTRUCTION ENGINEERING TECHNOLOGY

Sponsor: AGC (Oregon Columbia Chapter)
Personnel: H. D. Pritchett, Principal Investigator;

G. B. LaBaun, R. E. Phelps, N. L. Peterson
Objective: These funds come to us in support of our efforts in educating and training young men and women for careers in the construction industry.

GRADUATE TRAINING IN WATER POLLUTION CONTROL

Sponsor: EPA
Personnel: F. D. Schaumburg
Objective: This is a traineeship program in Environmental Engineering. It provides stipend and tuition and fees support for two masters level students.

GRADUATE TRAINING IN WATER SUPPLY AND POLLUTION CONTROL

Sponsor: EPA
Personnel: F. D. Schaumburg
Objective: This is a traineeship program in Environmental Engineering. It provides stipend and tuition and fees support for two masters level students.

ENGINEERING BEHAVIOR OF FOREST SOILS IN SOUTHEAST ALASKA

Sponsor: USDA-USFS
Personnel: W. L. Schroeder
Objective: This is an extension of the original grant. We are completing testing of soils from 10 sites where we did sampling work last summer.

COOS BAY OFFSHORE DISPOSAL SITE INVESTIGATION

Sponsor: Army
Personnel: Sollitt, C. K.; Hancock, D. R.; Nelson, P. O.; Williamson, K. J.
Objective: Oregon State University will investigate the feasibility of at-sea disposal of dredge material from Coos Bay. The material will come from river miles 12 to 15 of the Coos Bay channel. This material has historically been considered polluted and requires special care for safe disposal. The biological, chemical and physical characteristics of the dredge material and the general offshore area around the Coos Bay entrance will be examined for the purpose of selecting the optimum ocean disposal site. Field examinations will include offshore measurements of currents due to waves and tides, sediment engineering investigations, biological surveys, solids and dissolved chemical analyses.

GEOTEXTILE APPLICATIONS IN OCEAN AND COASTAL ENGINEERING

Sponsor: Sea Grant
Personnel: C.K. Sollitt; J.R. Bell; T.S. Vinson
Objective: Geotextiles are synthetic fabrics which may be substituted for graded aggregate to protect ocean and coastal structures from erosion and soil instability adjacent to the structure. They are commonly used as a filter and as a structural membrane between an undisturbed sediment surface below and an erosion resistant coarse aggregate above. Geotextiles provide a cost effective

alternative to graded aggregate in marine foundations. The need for rational design procedures has led to a theoretical description of the combined soil-geotextile behavior which quantifies failure potential and facilitates optimum geotextile selection. A two-dimensional analytical model has been developed for a three-layered system: two soils separated by a geotextile. The soil response is modeled by Biot consolidation theory and an unsteady form of Darcy's law in which the soils are considered homogeneous, isotropic and linearly elastic. The soil layers are coupled through the geotextile which acts as a permeable, elastic membrane. Soil displacements, stresses, strains, excess pore water pressure and pore fluid flows are analytically determined. Potential failure conditions are identified using a Mohr-Coulomb stress analysis. The model is developed for simple harmonic surface waves but is extended to random waves through linear superposition. A series of laboratory experiments were conducted at the Oregon State University Wave Research Facility to verify the model.

DYNAMIC PROPERTIES OF NATURALLY FROZEN SOILS

Sponsor: NSF
Personnel: Ted S. Vinson
Objective: The proposed research will evaluate the dynamic properties of naturally frozen soils over a very great range of material and test conditions associated with frozen ground wave propagation problems. Specimens cored from undisturbed samples taken in situ from Alaska will be tested with both resonant column and cyclic triaxial equipment. Parameters that might influence the dynamic properties of naturally frozen soils such as soil type, soil density, nature of the ice phase, anisotropy, temperature, confining pressure, and amplitude and frequency of dynamic loading will be investigated. Design equations or curves to evaluate the dynamic properties of frozen soil based on a knowledge of index and classification parameters will be developed.

EFFECT OF DISSOLVED OXYGEN CONCENTRATION ON ATP VIABILITY OF ACTIVATED SLUDGE

Sponsor: NSF
Personnel: K. J. Williamson

BACTERIAL BIOASSAY FOR LEVEL I TOXICITY ASSESSMENT

Sponsor: EPA
Personnel: K. J. Williamson

ESTUARINE SEDIMENTS

Sponsor: USDI-OWRT
Personnel: K. J. Williamson

ELECTRICAL & COMPUTER ENGINEERING

S. J. T. Owen, Department Head

ELECTRICAL PROPERTIES OF ANNEALED AND IMPLANTED GALLIUM ARSENIDE

Sponsor: NSF
Personnel: P. K. Bhattacharya/S.J.T. Owen
Objective: Ion-implantation and subsequent annealing has emerged as an important technique to doped active regions of small-scale and monolithic devices. The objective of this program is to identify the origin of dominant defects created or removed during the implant-and-anneal process. This includes detailed electrical and optical characterization of the starting semi-insulating or VPE material (GaAs or InP) and the processed layers. Finally an attempt will be made to correlate the actual performance of devices such as field-effect transistors with the material characteristics. The annealing after implantation can be done either thermally or with a high-power laser. The effects of laser annealing on several III-V semi-conductors will be studied.

ELECTRICAL AND OPTICAL PROPERTIES OF ORGANO- METALLIC VAPOR PHASE

Sponsor: USDE
Personnel: P. K. Bhattacharya
Objective: The research is concerned with the electrical and optical characterization of undoped and intentionally doped $\text{Ga}_{1-x}\text{Al}_x\text{As}$ layers and $\text{Ga}_{1-x}\text{Al}_x\text{As}/\text{GaAs}$ interfaces grown by the organometallic vapor phase epitaxial growth technique. The measurements will extend over the entire mixed alloy composition range of the ternary alloy with particular emphasis on the indirect bandgap region ($x \geq 0.43$) which are being used for concentrator heterostructure solar cells. The electrical characterization will include a detailed study of the deep trapping centers in the bulk layers and the interface regions and the transport properties in these regions as a function of alloy composition and temperature. The optical characterization will include a study of the optical characteristics of the deep states and luminescence measurements. The measurement techniques to be employed are Deep Level Transient Spectroscopy, Double Source Differentiated Photocapacitance techniques, capacitance-voltage measurements, Hall-effect and velocity-field measurements, and photoluminescence measurements, Hall-effect and velocity-field measurements, and photoluminescence. Such detailed material characterization of organometallic VPE $\text{Ga}_{1-x}\text{Al}_x\text{As}$ and heterostructure interfaces in solar cell structures have not been previously reported. The material required for the proposed program will be obtained from Varian Associates, Palo Alto, who has an ongoing program for solar cell fabrication by organometallic growth. It is expected that the proposed work will lead to a better understanding and improvement of multilayered semi-

conductor solar cells. Concurrently, similar investigations will be initiated on other advanced quaternary solar cell materials such as GaAlAsSb and GaAlInAs .

DEVELOPMENT AND TESTING OF A MICROPROCESSOR BASED SYSTEM

Sponsor: UO Health Sciences Center
Personnel: R. Bucolo, Principal Investigator
Objective: To develop necessary hardware and computer software for a reliable noninvasive and economical system of respiratory monitoring based upon microcomputer technology. To develop a control system to provide accurate and responsive control of oxygen delivered to neonates.

FUEL IGNITION OF FUEL-AIR MIXTURES

Sponsor: USDE-BPA
Personnel: J. F. Engle
Objective: The objective of this contract is to investigate and determine the probability of ignition of the gasoline vapor-air mixture during the refueling of vehicles or equipment when they are parked near a transmission line. The testing program will be designed to simulate the realistic conditions that exist in the field relative to vehicles, electric field intensities, refueling apparatus and atmospheric conditions.

LOAD MODELING METHODOLOGY USING INSTANTANEOUS PARAMETRIC STOCHASTIC REPRESENTATION

Sponsor: USDE
Personnel: P. A. Frick, Principal Investigator
Objective: Consumer behavior is depicted as the sample functions of one or more parametric stochastic process in representing the instantaneous electrical power load in distribution networks.

INVESTIGATION OF LABORATORY CHARACTERISTICS THAT AFFECT ACCURATE MEASUREMENT OF CORONA GENERATED AUDIBLE NOISE

Sponsor: DOE-BPA
Personnel: L. C. Jensen
Objective: It has been found that the corona generated audible noise as measured in high-voltage laboratories differs significantly from the noise actually encountered in the vicinity of high-voltage transmission lines. This study is to investigate and identify laboratory characteristics that affect the accurate measurement of corona generated noise and to recommend methods for obtaining and analyzing laboratory data such that the information may be used in the design of high-voltage transmission lines.

MODELING AND ANALYSIS OF WIND ENERGY-CONVERSION

Sponsor: USDE-BPA
Personnel: H. K. Lauw
Objective: To investigate the feasibility of a capacitor-excited induction generator to accomplish the electromechanical energy-conversion process for the electric power generation from wind. The

type of generator has several attractive potentials with regard to the erratic nature of the wind energy supply, such as the ability for self-synchronization, the ability to withstand relatively large rotor-speed changes, and the robust, low cost, design of the rotor windings. Detailed studies will be concerned with the exploitation of these features, the interface requirements and the control strategy to attain optimal operation while maintaining the system integrity.

MODELING, CONTROL, AND IDENTIFICATION OF BILINEAR SYSTEMS

Sponsor: NSF
Personnel: R. R. Mohler, Principal Investigator
Objective: Emphasis will be placed on the partially-observable filter and controller design for a bilinear-class of nonlinear stochastic systems. It is intended to extend the theory of Lipster and Shirayev to solve the optimal filtering problem. Then the separation principle will be proven, and the optimal feedback controller will be derived. While the step-by-step derivation relies on the general concept of the principle of optimality, it is not limited to the traditional quadratic performance index and continuity assumptions so convenient for a direct solution by dynamic programming.

CHAired PROFESSORSHIP IN ELECTROPHYSICS

Sponsor: Tektronix
Personnel: S. J. T. Owen, Principal Investigator
Objective: This chaired professorship is jointly funded by Tektronix, Inc. and the Tektronix Foundation. The objective of the chaired professorship is to liaise with the electronics industry within the State of Oregon and elsewhere, and to conduct research in modern topics in solid state electronics. During the past year several projects have been continued in the fields of semiconductor heterojunctions, III-V based semiconductor materials and devices, and a.c. thin-film electroluminescent devices.

STUDY OF DEEP LEVELS IN ION-PLANTED GALLIUM ARSENIDE

Sponsor: NSF
Personnel: T. K. Plant, Principal Investigator
Objective: This work is concerned with identifying and electrically characterizing the deep level traps in ion-implanted GaAs. Although much data is available on deep level in bulk-grown or epitaxial GaAs, no work has been done on the implanted material. Implants of O, Cr, and Mn in high purity GaAs substrates will be electrically characterized using C-V, I-V, Hall effect and deep level transient spectroscopy measurements for temperatures from 4.2°K-300°. Effects of thermal and laser annealing of the implanted layers will also be studied. Information on the changes in deep level trap concentrations, energy levels and capture cross sections with annealing should be useful in identifying sources of degradation in ion implanted GaAs FETs and other devices based on GaAs technology.

DEVELOPMENT AND TESTING OF MACRO-MODELS OF OCEANOGRAPHIC ACOUSTIC SIGNAL SYSTEMS

Sponsor: U.S. Navy
Personnel: J. L. Saugen, Principal Investigator; R. C. Rathja
Objective: Computer processing of acoustic signals and others arising during undersea system testing is being studied. Currently being investigated is the applicability of the array processor as a means of prescreening data so as to reduce the storage required for analysis. Because of the vast amount of data, it is essential that effective and fast data storage reduction algorithms be developed and incorporated into the data collection system. Analysis procedures and display methods (including color graphics) for the examination of test data are being developed.

DEVELOPMENT OF MORE USABLE TECHNIQUES FOR ANALYZING PERFORMANCE OF COMPLEX SYSTEMS

Sponsor: NSF
Personnel: J. D. Spragins, Principal Investigator; R. Maneshi
Objective: This project is exploring approximate techniques for analyzing and predicting the performance of complex systems such as computer networks. The aim is that the techniques developed be readily usable by persons responsible for the design, development, selection or tuning of such systems. The approach being pursued is to explore the relationships between the various approaches already documented and others being developed with particular emphasis on the advantages and limitations of the various approaches. Experimental verification is planned.

REALISTIC RELIABILITY MODELS FOR DATA COMMUNICATIONS NETWORKS

Sponsor: NSF
Personnel: J. D. Spragins, Principal Investigator
Objective: This research program is concerned with reliability of data communication networks. The work focuses on two important problems: 1) the tendency of different communications lines to fail in a dependent manner, and 2) the variability in important reliability parameters, such as percentage downtime, between different lines. Initial, rather simple mathematical models are available for each of these problems. Better models are being explored to apply to more general types of data communication networks including distributed networks. Better techniques for designing reliable communication networks are sought and the impact of communications reliability on network design is assessed.

INDUSTRIAL & GENERAL ENGINEERING

J. L. Riggs, Department Head

OREGON PRODUCTIVITY CENTER

Sponsor: USDC-EDA
Personnel: J. L. Riggs
Objective: Tentative-Anticipated Activities of the Oregon Productivity Center. One-to-one consultations for small businesses. Assistance to larger businesses in organizing special productivity programs, such as our own version of quality circles. Presentation of in-house programs on a one-time only, or continuing basis. Short courses and seminars to be provided both for productivity orientation, and for specific improvement tools and techniques. A monthly (or bi-monthly) newsletter highlighting productivity efforts in the Pacific Northwest, both Center and Business initiated. Cooperating with civic groups and schools to present the productivity picture.

MECHANICAL ENGINEERING

J. R. Welty, Department Head

THE RADIATIVE CONTRIBUTION TO HEAT TRANSFER BETWEEN A HIGH TEMPERATURE FLUIDIZED BED AND AN IMMERSED TUBE.

Sponsor: NSF
Personnel: R. L. Adams
Objective: The objective of the work proposed herein is to establish the relative contributions of radiative and convective heat transfer to a horizontal tube immersed in a high-temperature, large-particle gas-fluidized bed. Oregon State University (OSU) presently has experimental capability to study distributions of total heat transfer (radiative and convective combined) at combustion temperature (~1144K) and has had considerable success at analytical modeling of heat transfer in large-particle fluidized beds. The proposed work will specifically address the radiative contribution and will include fundamental measurements to further validate the existing analytical model along with additional analytical modeling of the radiative contribution. The results obtained from this analytical and experimental program will enhance the fundamental understanding of heat transfer in high-temperature, large-particle fluidized beds.

LABORATORY EVALUATION OF NOVEL PARTICULATE CONTROL CONCEPTS FOR JET ENGINE TEST CELLS

Sponsor: AF

Personnel: R. W. Boubel

Objective: A small (15 kw output) gas turbine-generator has been adapted to simulate a jet engine being operated in a test cell. By blending fuels of different aromatic and hydrocarbon content the turbine can be made to emit as much (or as little) smoke as required. The turbine is operated at the desired smoke level and the exhaust subjected to treatment by several air pollution control systems (scrubber, filter, and afterburner) to determine the amount of smoke cleanup. The results are projected to full scale jet engines tested in test cells.

ENERGY UTILIZATION IN THE LUMBER AND WOOD PRODUCTS INDUSTRY

Sponsor: DOE
Personnel: D. J. Bushnell
Objective: This report deals with the energy utilization patterns in the lumber and wood products industry. Yearly averages of energy usage was determined from data sheets provided by the industry. The reduced data shows a usage of approximately 1 KWH/bd-ft for lumber and approximately 3 KWH/bd-ft (1.13 KWH/square foot on 3/8" basis) for plywood and associated products. The numbers agree closely with figures from other studies.

Trends in the data indicate that energy consumption in the form of electricity and fossil fuels to be decreasing while increases in the usage of hogged fuels are observed. There is an overall increase in the total energy per unit of production and a corresponding decrease in the man hours per unit product which indicates an increase in the degree mechanization in plywood and lumber mills.

Energy available for recovery from stacks was calculated to be slightly greater than .2 KWH/bd-ft for both plywood and lumber mills. A figure of roughly .5 KWH/bd-ft was calculated to be available for cogeneration from plywood mills and lumber mills if the necessary equipment were to be installed.

Possibilities for efficiency improvement were examined in the areas of waste heat recovery, boiler improvement, and new high efficiency electric motors.

An assessment of the forest residues was made and indicates that the presently generated mill residues are currently being utilized, however, there is a significant quantity of logging residues (10 million oven-dry tons/year) and hardwoods available as an energy source. No attempt made to determine the economics for reclamation of these residues.

COMBUSTION SYSTEM FOR ENERGY RECOVERY FROM AGRICULTURAL BIOMASS IN STANDARD BALES

Sponsor: DEQ
Personnel: D. J. Bushnell
Objective: The objectives of this study were to: 1) review the current literature regarding direct combustion and present a brief summary, 2) undertake a preliminary economic feasibility study, and 3) estimate potential markets where appropriate.

To accomplish these objectives, the study is divided into three sections. The first section presents a brief overview of past studies and issues in biomass burning. The second section is an economic analysis of grass straw costs and its ability to economically substitute for existing fuels. The third section briefly analyzes supply prices and their relationship to potential domestic and Japanese livestock markets. A potential bale burner market is assumed to compete with other potential uses.

Two general conclusions are reached in this study. The first is that grass straw is competitive with other fuel sources if annualized capital and operating costs do not exceed the savings margin. The second conclusion is that grass straw may also have potential markets as a livestock feed both in domestic and foreign markets. This second conclusion is based upon interpretation of previous work and current economic conditions--further research should be done before acting upon it.

INDUSTRIAL BOILERS FIRED WITH WOOD AND BULK RESIDUE FUELS

Sponsor: SERI

Personnel: D. C. Junge

Objective: This involves two separate tasks:

Task 1: Prepare a document on the Status of Development of New Source Performance Standards for Non Fossil Fuel Fired Boilers.

Task 2: Prepare a text on Industrial Boilers Fired with Wood and Bark Residue Fuels. This text is to up-date the Research Bulletin No. 17 published by the Oregon State University Forest Research Laboratory in 1975 using the information gained from the ongoing wood energy research at OSU plus information from other literature sources.

INVESTIGATION OF THE RATE OF COMBUSTION OF WOOD RESIDUE FUELS

Sponsor: USDE

Personnel: D. C. Junge

Objective: The purpose of the research project is to develop a Decision Makers Guide to the Use of Boiler Exhaust Gases for Drying Wood and Bark Fuels. The initial stages of this work were carried out under previous funding by the DOE. This final stage is to gather full scale field data on existing dryers which use boiler exhaust gases as their energy source. The full scale data will be used to upgrade the mathematical model of a dryer system which is contained in the present report. The model will then be used in conjunction with presently available data to prepare the Decision Makers Guide.

COMPUTER AIDED DESIGN CURRICULUM DEVELOPMENT

Sponsor: Tektronix

Personnel: T. C. Kennedy

Objective: Computer Aided Design (CAD) is a rapidly developing area, and one whose use is growing both as a response to the requirement of increased productivity of design engineers and as a means of reducing development lead time. Keeping pace in this field is producing a tremendous strain on the

university's financial resources. In addition to the acquisition of hardware and software, release time is also necessary to provide faculty members with the opportunity to become acquainted with new computer systems and programs and to integrate them into the curriculum. These activities must be accomplished rapidly to be effective. Because of the rapidity required, it is not possible to use standard class development processes--hence, the release time requirement.

To provide its engineering students with an up-to-date educational experience within the restrictions of its financial capabilities, the university needs the assistance of industry. The program of industrial assistance can be best carried out through a university-industry cooperative relationship.

The objectives of the proposed work are to: 1) Provide an immediate upgrading of the CAD curriculum in the Mechanical Engineering Department at OSU; and 2) Develop a plan for a university-industry cooperative relationship.

EFFECT OF LOW-PROOF FUEL ALCOHOL ON CRANKCASE OIL DILUTION IN AN OTTO CYCLE ENGINE

Sponsor: USDE

Personnel: J. G. Mingle

Objective: The objectives were to determine the effect of the following on crankcase oil dilution with water and alcohol using an Otto Cycle Engine:

1) Proof of the alcohol - 180, 160 and 130 proofs were investigated. 2) Intake manifold temperature - 130°F and 180°F were investigated. 3) Oil temperature - 130°F and 180°F were investigated. 4) Engine load - 35% and 75% of rated load at maximum torque were investigated. A factorial design experiment consisting of twenty-four engine tests was completed. The dilution of the crankcase oil was determined quantitatively by five different ASTM tests and two nonstandard tests.

GEOHERMAL DISTRICT HEATING MODELS: A REVIEW OF COMPATIBILITY AND VALIDITY

Sponsor: Rockwell

Personnel: G. M. Reistad

Objective: This research project has the objective of developing a consistency in the various computerized district heating models that are used for evaluating the economics and feasibility of geothermal district heating. There are a number of these models across the country, and this project is to review these with regard to their engineering approach and their basic assumptions.

DESIGN OF HEAT PUMPS FOR HEATING IN THE PACIFIC NORTHWEST

Sponsor: USDE

Personnel: G. M. Reistad

Objective: This project has the objective of designing and evaluating an air source heat pump for application west of the Cascades in the Pacific Northwest. This region of the U.S. has specific characteristics that should permit the design of a heat pump unit that has improved performance, both from the consumer and utility viewpoints, relative to the presently marketed units that have

been designed for climates where the cooling requirement dictates many design aspects. The research project consists of three primary activities: (i) literature search (with special emphasis directed toward European experience, since climate and energy prices have required them to advance such designs), (ii) system design, and (iii) analytical evaluation.

The project compliments other studies within the department that have dealt with water source heat pump design for geothermal and annual energy storage systems.

HEAT PUMP PERFORMANCE ANALYSIS

Sponsor: USDE
Personnel: G. M. Reistad, Principal Investigator
Objective: This project consists of a study to evaluate the operation and design of heat pumps for seasonal thermal energy storage in underground aquifers. The project consists of two main parts: 1) a survey of the operation and performance of commercial-scale groundwater heat pump installations in the Portland, OR area and 2) an evaluation of the design needs for residential size units that are to be coupled to aquifers.

INVESTIGATION OF THE RATE OF COMBUSTION OF WOOD RESIDUE FUELS

Sponsor: USDE
Personnel: G. H. Thornburgh; D. C. Junge
Objective: The present project is a study which introduces overfire air in a spreader-stoker furnace fired with wood residue through air jets uniformly distributed across the furnace cross-section.

The study includes two configurations of air jets, two fuel feed rates, and various ratios of underfire to overfire air for various heights of air jets above the fuel bed.

Testing is now complete with final report scheduled to be completed in January 1981.

WIND RESPONSE CHARACTERISTICS OF HORIZONTAL AXIS TURBINES

Sponsor: USDE
Personnel: R. W. Thresher, Principal Investigator
Objective: To provide estimates for the gust response of wind turbines and to directly address issues associated with a statistical wind input, the resulting aerodynamic loading, and the various turbine structural responses.

The early work will involve the use of two fundamentally different wind turbine aerodynamic wake models which, it is felt, model two extreme possibilities of wind turbine wake response. The wind input to both of these will be a general gust disturbance, which is characterized in terms of the component gust power spectral densities and coherencies for a given mean wind speed. With the structural representation for the turbine, the resulting aeromechanical equations of motion will be linearized and transfer functions determined. From this the vibrational response and dynamic loading can be determined in terms of the output power spectral densities. A second phase of this line of research will compare these theoretical models

with experimental data from Rocky Flats. From this it is expected that the range of parameters over which the models are valid can be determined. It is hoped that the simple models and approximate results can satisfy some immediate needs and provide the necessary confidence in this approach as a reliable design tool.

WIND TURBINE STRUCTURAL DESIGN AND ANALYSIS

Sponsor: NASA
Personnel: R. W. Thresher, Principal Investigator
Objective: The objective of this proposed work is to provide the NASA Lewis Research Center, Wind Power Program with technical work resulting in a design handbook for wind turbines. The work will involve a careful planning effort to determine what topics should be covered, the format to be used and the priority of the various topics. Following this planning effort, work will begin on a volume of the handbook covering the structural design of wind turbines. The handbook will establish design criteria, set allowable design limits, develop and explain design procedures in detail. A major portion of the work will be directed toward developing simplified procedures which are applicable for solution using hand held calculators.

HEAT TRANSFER IN HIGH TEMPERATURE FLUIDIZED BEDS WITH IMMERSED TUBES FOR COAL COMBUSTION SERVICE

Sponsor: USDE
Personnel: J. R. Welty, Principal Investigator
Objective: This research has two objectives, both dealing with heat transfer between a high-temperature (approximately 1100 K) gas fluidized bed and immersed tubes. The first objective is to develop an analytical model which will predict the local heat transfer rates and tube-surface temperatures as functions of bed operating parameters. The second objective is to perform experiments with an operational high-temperature bed to support the analytical model and to provide data on high-temperature operation.

DARRIEUS ROTOR AERODYNAMICS

Sponsor: Sandia Labs
Personnel: R. E. Wilson
Objective: The objective of this project to decrease Darrieus Rotor Cost-of-Electricity using passive aerodynamics. The Darrieus Rotor has no active aerodynamic control elements and therefore peak output is governed by the configuration. Blade pitch and airfoil section characteristics are to be used to tailor the performance envelope of Darrieus Rotors.

HAND-HELD CALCULATOR PERFORMANCE PREDICTION PROGRAM FOR HAWT

Sponsor: Rockwell
Personnel: R. E. Wilson, Principal Investigator
Objective: Horizontal-axis wind turbine performance is to be predicted using the Hewlett Packard performance program and compared to test data from full-scale controlled velocity tests.

NUCLEAR ENGINEERING

C. H. Wang, Department Head

SPECIALIZED ENGINEERING RESEARCH EQUIPMENT

Sponsor: NSF
Personnel: S. E. Binney
Objective: At the Oregon State University Radiation Center, a large amount of research is done using neutron activation analysis. This research is conducted by professors in both the Departments of Nuclear Engineering and Chemistry. Although the Radiation Center is quite well equipped in general for this type of research, a major type of equipment that has not been previously available is a Compton suppression system. The Compton suppression system will allow research done by the Radiation Center staff to be expanded to some new elements which were not formerly capable of being analyzed at sufficiently low levels under interference conditions, as well as improving the sensitivity for detection of other elements. The Compton suppression system is being integrated directly into one of the present analyzer systems to exploit these new capabilities.

LOW LEVEL RADIOACTIVE WASTE PACKAGING STRATEGY

Sponsor: EG&G
Personnel: Brian Dodd
Objective: Research the impacts and effects of various alternatives proposed for low-level radioactive waste packaging in the strategy planning document entitled "Managing Low-level Radioactive Wastes." The three alternatives are 1) continue present practices, 2) issue one-set of regulations for both transportation and disposal, 3) issue regulations for disposal, retain transportation regulations. These were studied as they effected: generator operations and consumer services, transportation, commercial waste disposal sites, availability of technology, policy and political impacts, costs, hazards to workers and the general public, regulators and agencies.

DEVELOPMENT AND VERIFICATION OF LIGHT WATER REACTOR SYSTEMS MODELS

Sponsor: GRS
Personnel: K. Hornyik
Objective: Develop methods and numerical techniques as required for time dependent description of once-through steam generators as used in certain pressurized light water reactor-power plants; and to integrate the resulting model with a dynamic model for the primary side of the reactor. (Reactor Coolant System).

RETRAN ANALYSIS OF THE PB-2 STABILITY TESTS

Sponsor: EPRI
Personnel: K. Hornyik

Objective: The systems-transient code RETRAN is applied to simulate the stability tests performed at the Peach Bottom Nuclear Power plant in 1977. In these tests perturbations were introduced by way of the pressure regulator of the plant. The response of important process variables was recorded.

The RETRAN code contains all relevant elements required to model a nuclear power plant, including core, heat transfer loops and control systems.

The objective is to establish the qualifications of the code for this type of analysis, to gain insight into potential mechanisms leading to instability and to make predictions of stability characteristics for a wide range of operating conditions.

CHARACTERIZATION OF UO_2 SPHERE-PAC FUEL

Sponsor: EXXON
Personnel: K. L. Peddicord
Objective: UO_2 sphere-pac fuel is being investigated as a means of extending the potential burn up of light water reactor fuel pins. In this project several aspects of packed particle fuel are being investigated. These include fuel clad mechanical interaction, axial shear of the packed bed on the clad, the free thermal expansion of a packed bed, gas release modeling and sintering rates and mechanisms.

TRANSIENT THERMAL HYDRAULIC ANALYSIS OF A PRESSURIZED WATER REACTOR

Sponsor: PGE
Personnel: K. L. Peddicord
Objective: In this project, the transient thermal hydraulic response of a pressurized water reactor is calculated. The RETRAN computer code is used to model the entire primary coolant loop. RETRAN provides boundary conditions for the core analysis. The COBRA-IIIC/MIT subchannel code is used to determine the thermal hydraulic distributions within the core. Various postulated plant transients are studied.

MODELING AND CHARACTERIZATION OF SPHERE PAC MIXED CARBIDE FUEL

Sponsor: EIR
Personnel: K. L. Peddicord
Objective: Both computational and experimental studies are being performed to characterize the behavior of a sphere pac fuel pin. Computer models are under development to predict the mechanical response of a fuel pin during reactor operation. An experimental apparatus has been constructed to determine the nature of the load transmitted by the packed particle bed to the clad tube wall.

ASSESSMENT AND APPLICATION OF TRANSIENT FUEL BEHAVIOR COMPUTER CODES

Sponsor: EPRI
Personnel: K. L. Peddicord
Objective: The FREY computer code has been developed for the Electric Power Research Institute to model the mechanical behavior of LWR fuel pins

under transient conditions. In this project results from the code will be compared to other calculations and to data to assess and verify FREY.

HEAT CONDUCTION IN ECCENTRIC ANNULI

Sponsor: NSF

Personnel: K. L. Peddicord, Principal Investigator; Y. P. Ting; B. D. Reid

Objective: Rod bundles are a basic component of energy removed systems ranging from heat exchangers to fission reactor cores. For the symmetric case, the heat conduction through annular regions in the rod bundles is well defined. However, as an annular region shifts, the heat conduction through the system becomes more involved. It might be possible to vary the degree of eccentricity to optimize the performance of a particular system.

The purpose of this study is to characterize heat conduction through eccentric annuli by a theoretical, numerical, and experimental investigation.

NEUTRON RADIOGRAPHY STUDIES OF LIQUID PROPELLANTS

Sponsor: Army

Personnel: A. H. Robinson, Principal Investigator

Objective: The purpose of this project is to develop methods of applying high speed motion neutron radiography to the study of liquid propellants. These propellants may be either injected into the burning chamber or they may burn in place. In either case neutron radiography may be used to determine the distribution of the burning propellant and its movement in the chamber. Events as short as 1 millisecond can be radiographed with the system developed here at OSU.

CONCEPTUAL DESIGN ANALYSIS OF LIGHT-WATER REACTORS

Sponsor: Battelle

Personnel: B. I. Spinrad, Principal Investigator; D. Tollefson

Objective: This project has as its aim the evaluation of new design approaches to improve the performance and uranium utilization of light water reactors. Only those approaches which are non-backfillable to existing plants are considered. The analysis is done by industrial contractors and we assist Battelle in correlating, normalizing and costing the results. We also provide background analysis that can be applied to all process variations.

SPHERE-PAC CERAMIC FUEL IN A SAFEGUARDED FUEL CYCLE

Sponsors: EPRI, EIR

Personnel: B. I. Spinrad, K. L. Peddicord, Principal Investigators; M. Azarfar, A. M. Vincent, S. Polkinghorne, R. Henke

Objective: Reactor fuel today is made out of ceramic pellets. An alternative approach is to make it by packing a cladding tube with tiny spheres of mixed diameters. It is believed that this sphere-pac process improves the capability of safeguarding the fuel, i.e., providing greater assurance against its loss or theft. This project analyzes the important factors in fuel cycle safeguards,

justifies quantitative measures of safeguardability, and applies them to a comparison of pelletized and sphere-pac fuel fabrication.

TWO INPO FELLOWSHIPS

Sponsor: INPO

Personnel: C. H. Wang

Objective: This award supports two fellowships for 1980-81 for graduate students pursuing a Masters degree in Nuclear Engineering. Each student receives a \$5500 stipend and OSU receives \$2500 per student as an educational allowance to help defray costs of tuition, fees, etc. The purpose is to provide more qualified manpower for the nuclear industry and to interest students in career opportunities in the nuclear power industry.

NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT, INC.

A. L. Caron
Regional Manager

The National Council of the Paper Industry for Air and Stream Improvement (NCASI) is a non-profit industry-supported environmental research association. One of its regional research centers is located in the Engineering Experiment Station of Oregon State University. Its offices and laboratories are located in the Chemical Engineering Department. The NCASI is charged with providing the industry a technical base that can be used to reach technically feasible decisions and embark on sound environmental management programs. Personnel hold a Courtesy Academic Rank. NCASI research expenditures administered through the Engineering Experiment Station total approximately \$75,000. Graduate Assistantships for students are available.

NCASI PERSONNEL

Andre L. Caron, Regional Manager
(Assistant Professor)

Dr. Victor J. Elia, Research Chemist
(Associate Professor)

Dr. George G. Ice, Research Forester
(Assistant Professor)

Lawrence LaFleur, Research Chemist
(Instructor)

Victor Dallons, Research Engineer
(Instructor)

Kenneth Ramage, Research Associate
(Instructor)

Theresa Eschele, Technician
Diana Reece, Technician
Dean Hoy, Technician
Ronald Messmer, Technician

NCASI ACTIVE PROJECTS

The Measurement, Characterization, and Control of Volatile Organics, NO_x, and Carbon Monoxide from Pulp and Paper Industry Combustion Sources and other Processes.

Organization of Existing Information on the Performance of High Efficiency Particulate Control Devices and the Performance of Monitoring Systems.

The Analysis and Control of Halogenated Hydrocarbons in Forest Products, Pulp and Paper, and Printing Industry.

Studies on the Impact of Forestry Management Practices on Water Quality.

NCASI PUBLICATIONS

SI 332 Chlorinated Organics in Bleach Plant Effluents of Pulp and Paper Mills.

SI 334 Annual Survey of Ongoing Research on the Impact of Forest Management Practices on Water Quality and Utility.

SI 335 Guidelines for Contracting Sampling and Analysis for Priority Pollutants in Pulp and Paper Industry Effluents.

SI 337 Research and Field Investigation on the Impact of Southern Forestry Management Practices on Receiving Water Quality and Utility.

SI 343 Experience with the Analysis of EPA's Organic Priority Pollutants and Compounds Characteristic of Pulp Mill Effluents.

SI 344 Research on the Effects of Mass Wasting of Forest Lands on Water Quality and the Impact of Sediment on Aquatic Organisms.

SI 345 1980 Review of Literature on Forest Management Practices, Hydrology and Water Quality Production and Management.

SI 347 Experience with the Analysis of Pulp Mill Effluents for Chlorinated Phenolics Using an Acetic Anhydride Derivatization Procedure.

AQ 109 A Study of Wood-Residue Fired Power Boiler Total Gaseous Non-Methane Organic Emissions in the Pacific Northwest.

AQ 111 A Study of Nitrogen Oxide Emission from Large Kraft Recovery Furnaces.

AQ 112 A Study of Kraft Recovery Furnace Total Gaseous Non-Methane Organic Emissions.

TB 349 Forestry Management Related Water Quality Protection Regulatory and Investigative Programs in the South.

TB 353 Measuring and Assessing the Effectiveness of Alternative Forest Management Practices on Water Quality.

TB 354 Factors Affecting Changes in the Percent of Fine Sediment in Gravel Bedded Channels.

TB 357 Annual Survey of Ongoing Research on the Impact of Forest Management Practices on Water Quality and Utility - 1981.

TB 358 A Study of Kraft Lime Kiln Total Gaseous Non-Methane Organic Emissions.

GRANTS & CONTRACTS RECEIVED

1980-1981

<u>Principal Investigator</u>	<u>Department</u>	<u>Agency</u>	<u>Duration</u>	<u>Amount</u>
Brooks, R. H. Corey, A. T. Hydraulic Properties of Earth Materials as Affected by Clay-Water Interaction.	Agricultural Engr.	NSF	1080-982	\$ 84,299
Cuenca, R. H. Combined Energy and Economic Analysis of Optimized Irrigation Systems.	Agricultural Engr.	USDA-SEA	481-682	14,300
English, M. J. The Effect of Irrigation Frequency on Crop Yield.	Agricultural Engr.	USDA-SEA	381-382	15,600
Miner, J. R. Research on Seed Harvesting and Processing at Corvallis.	Agricultural Engr.	USDA	1080-981	31,300
Fitzgerald, T. J. Scaled Bed Modeling for Fluidized Bed Combustors.	Chemical Engr.	USDE	1080-981	99,842
Levenspiel, O. Problems in Gas/Solid Contacting	Chemical Engr.	NSF	581-482	75,295
Bell, J. R. Effects of Weathering on Geotechnical Properties of Mt. St. Helens Ash.	Civil Engr.	NSF	880-781	10,519
Bella, D. A. Hancock, D. R. Biological/Physical Interactions.	Civil Engr.	Sci. Appl.	1080-681	13,223
Klingeman, P. C. Water Assessment of Energy Technologies (Supplement)	Civil Engr./WRRI	PNRBC	679-381	5,900
Klingeman, P. C. Willamette River Sediment Transport Investigation (Supplement).	Civil Engr./WRRI	Army	779-381	700

<u>Principal Investigator</u>	<u>Department</u>	<u>Agency</u>	<u>Duration</u>	<u>Amount</u>
Klingeman, P. C. Water-related Aftereffects of the Mt. St. Helens Eruption.	Civil Engr./WRRRI	WSU	980-1082	\$ 25,000
Klingeman, P. C. Sturgeon Lake Restoration: Phase I Diagnostic/Feasibility Study.	Civil Engr./WRRRI	Multnomah	980-782	57,406
Layton, R. D. Traffic Engineering and Highway Safety Fundamentals Short Course.	Civil Engr.	OTSC	680-581	43,834
Layton, R. D. Student Assistance While Attending OSU.	Civil Engr.	USDT-FHA	980-681	10,540
Layton, R. D. Forest Service Short Course.	Civil Engr.	UCB	1080-981	48,095
Leonard, J. W. Assignment to the Navy (IPA)	Civil Engr.	Navy	781-981	11,690
Leonard, J. W. Computer Modeling of Flexible Membrane Interaction with Ocean Waves.	Civil Engr.	Sea Grant		34,250
Nath, J. H. Large Scale Model Testing of Coast Guard Buoys (Supplement).	Civil Engr.	Coast Guard	580-Indef.	4,000
Nath, J. H. Tests for Surfing Facility.	Civil Engr.	Offshore Tech.	1080-981	6,696
Nath, J. H. Hydrodynamic Roughness of Marine Growths on Cylinders.	Civil Engr.	NSF	1280-1181	90,158
Nath, J. H. Drifting Buoy Numerical Model Improvement	Civil Engr.	USDC-NOAA	781-1282	88,714
Nath, J. H. Engineering Roughness of Marine Growth on Structures.	Civil Engr.	Sea Grant		60,147

<u>Principal Investigator</u>	<u>Department</u>	<u>Agency</u>	<u>Duration</u>	<u>Amount</u>
Schaumburg, F. D. Graduate Training in Water Pollution Control.	Civil Engr.	EPA	1080-981	\$ 6,523
Schaumburg, F. D. Graduate Training in Water Supply and Pollution Control.	Civil Engr.	EPA	1080-981	6,523
Schroeder, W. L. Engineering Behavior of Forest Soils in Southeast Alaska (Supplement).	Civil Engr.	USDA-USFS	680-881	9,500
Slotta, L. S. Klingeman, P. C. Information Program to Facilitate Small Scale Hydroelectric Development.	Civil Engr./WRRRI	USDE	1080-1281	43,500
Sollitt, C. H. Hancock, D. R., Nelson, P. O., Williamson, K. J. Coos Bay Offshore Disposal Site Investigation (Supplement).	Civil Engr./Oc.	Army	1180-681	272,100
Sollitt, C. K., Bell, J. R., Vinson, T. S. Geotextile Applications in Ocean and Coastal Engineering.	Civil Engr.	Sea Grant		90,362
Vinson, T. S. Dynamic Properties of Naturally Frozen Soils.	Civil Engr.	NSF	381-282	43,259
Bhattacharya, P. K. Owen, S. J. T. Electrical Properties of Annealed and Implanted Gallium Arsenide.	Electrical Engr.	NSF	1080-981	48,233
Bhattacharya, P. K. Electrical and Optical Properties of Organometallic Vapor Phase.	Electrical Engr.	USDE	681-682	73,851
Engle, J. F. Fuel Ignition of Fuel-Air Mixtures.	Electrical Engr.	USDE-BPA	1080-981	37,000
Jensen, L. C. Investigation of Laboratory Characteristics that Affect Accurate Measurement of Corona Generated Audible Noise.	Electrical Engr.	DOE-BPA	1279-1280	22,918

<u>Principal Investigator</u>	<u>Department</u>	<u>Agency</u>	<u>Duration</u>	<u>Amount</u>
Lauw, H. K. Modeling and Analysis of Wind Energy Conversion.	Electrical Engr.	USDE-BPA	680-681	\$ 31,979
Riggs, J. L. Oregon Productivity Center.	Industrial Engr.	USDC-EDA	980-981	100,000
Adams, R. L. The Radiative Contribution to Heat Transfer Between a High Temperature Fluidized Bed and an Immersed Tube.	Mechanical Engr.	NSF	681-582	53,874
Boubel, R. W. Laboratory Evaluation of Novel Particulate Control Concepts for Jet Engine Test Cells.	Mechanical Engr.	AF	181-981	90,846
Bushnell, D. J. Energy Utilization in the Lumber and Wood Products Industry.	Mechanical Engr.	DOE	680-981	13,004
Bushnell, D. J. Combustion System for Energy Recovery from Agricultural Biomass in Standard Bales.	Mechanical Engr.	DEQ	581-781	4,347
Junge, D. C. Industrial Boilers Fired with Wood and Bulk Residue Fuels.	Mechanical Engr.	SERI	980-481	27,694
Junge, D. C. Investigation of the Rate of Combustion of Wood Residue Fuels.	Mechanical Engr.	USDE	581-982	44,500
Kennedy, T. C. Computer Aided Design Curriculum Development.	Mechanical Engr.	Tektronix	680-681	\$ 11,012
Mingle, J. G. Effect of Low-proof Fuel Alcohol on Crankcase Oil Dilution in an Otto Cycle Engine.	Mechanical Engr.	USDE	880-1080	26,530
Reistad, G. M. Geothermal District Heating Models: A Review of Compatibility and Validity.	Mechanical Engr.	Rockwell	181-282	50,000

<u>Principal Investigator</u>	<u>Department</u>	<u>Agency</u>	<u>Duration</u>	<u>Amount</u>
Reistad, G. M. Design of Heat Pumps for Heating in the Pacific Northwest.	Mechanical Engr.	USDE	481-782	\$ 47,986
Thornburgh, G. H. Junge, D. C. Investigation of the Rate of Combustion of Wood Residue Fuels.	Mechanical Engr.	USDE	280-181	\$ 139,090
Wilson, R. E. Darrieus Rotor Aerodynamics.	Mechanical Engr.	Sandia Labs	780-981	34,624
Binney, S. E. Specialized Engineering Research Equipment.	Nuclear Engr.	NSF	880-781	32,900
Dodd, B. Low Level Radioactive Waste Packaging Strategy.	Nuclear Engr.	EG&G	1280-281	28,274
Hornyik, K. Development and Verification of Light Water Reactor Systems Models.	Nuclear Engr.	GRS	980-681	21,500
Hornyik, K. RETRAN Analysis of the PB-2 Stability Tests.	Nuclear Engr.	EPRI	181-1281	19,690
Peddicord, K. L. Characterization of UO ₂ Sphere-Pac Fuel (Supplement).	Nuclear Engr.	Exxon	380-881	10,000
Peddicord, K. L. Transient Thermal Hydraulic Analysis of a Pressurized Water Reactor.	Nuclear Engr.	PGE	980-981	26,803
Peddicord, K. L. Modeling and Characterization of Sphere Pac Mixed Carbide Fuel.	Nuclear Engr.	EIR	980-981	35,472
Peddicord, K. L. Assessment and Application of Transient Fuel Behavior Computer Codes.	Nuclear Engr.	EPRI	181-1281	22,042
Wang, C. H. Two INPO Fellowships.	Nuclear Engr.	INPO	980-981	16,000

PROPOSALS SUBMITTED

1980-1981

<u>Investigator</u>	<u>Department</u>	<u>Agency</u>	<u>Duration</u>	<u>Amount</u>
Brooks, R. H. Corey, A. T.	Agricultural Engr.	NSF	2 yrs	\$ 86,554
Pressure Fluctuations During Desaturation of Earth Materials.				
Hellickson, M. L.	Agricultural Engr.	PP&L & PGE	1 yr	22,410
Medium Temperature Concentrating Solar Collectors for Milking Parlors.				
Hellickson, M. L.	Agricultural Engr.	PP&L & PGE	1 yr	23,863
A Water to Water Heat Pump for Milking Parlors.				
Cuenca, R. H.	Agricultural Engr.	NSF	Indef.	27,950
Specialized Research Equipment				
English, M. J.	Agricultural Engr.	USDA-SEA	1 yr	18,229
The Effect of Irrigation Frequency on Crop Yields.				
Hellickson, M. L.	Agricultural Engr.	PP&L	1 yr	12,000
A Water to Water Heat Pump for Milking Parlors (revision)				
Hansen, H. J.	Agricultural Engr.	USDE	1 yr	10,000
Energy Analysis for Production Agriculture.				
Hansen, H. J.	Agricultural Engr.	USDE	2 yrs	50,000
Energy Conservation in Poultry Brooding Houses				
Hellickson, M. L.	Agricultural Engr.	USDE	1 yr	17,895
Heat Exchangers for Shellfish Larvae Production.				
Kirk, D. E.	Agricultural Engr	USDE	18 mos	23,225
Domestic Heater Using Baled Straw.				
Miller, R. F.	Agric. Exper. Sta.	USDA-SEA	3½ yrs	134,085
<u>Kochia prostrata</u> : A Tool for Range Rehabilitation.				

<u>Investigator</u>	<u>Department</u>	<u>Agency</u>	<u>Duration</u>	<u>Amount</u>
Knudsen, J. G. Scaling and Biofouling and Enhanced Heat Transfer Surface Exposed to Sea Water.	Chemical Engr.	ONR	3 yrs	\$308,300
Knudsen, J. G. Seidler, R. J. Simultaneous Scaling and Biofouling of Heat Transfer Surfaces.	Chemical Engr. Microbiology	EPRI	3 yrs	294,300
Levenspiel, O. Problems in Gas/Solid Contacting.	Chemical Engr.	NSF	3 yrs	\$286,395
Levenspiel, O. The Separation of Larger or Denser Particles from a Fluidized Size Mixture.	Chemical Engr.	NSF	3 yrs	90,198
Levenspiel, O. Models for Flow and Contacting of Gas and Solids in Fluidized Beds.	Chemical Engr.	NSF	2 yrs	36,940
Levenspiel, O. Problems in Gas/Solid Contacting (revision)	Chemical Engr.	NSF	1 yr	75,295
Bell, J. R. Effects of Weathering on Geotechnical Properties of Mt. St. Helens Ash.	Civil Engr.	NSF	1 yr	11,295
Nelson, P. O. Impact of Mt. St. Helens Volcanic Ash on Aquatic Chemistry of Dilute Lake Systems.	Civil Engr.	NSF	1 yr	10,400
Hudspeth, R. T. Komar, P. D. Numerical Model to Simulate Sediment Transport (revision).	Civil Engr. Oceanography	Army	19 mos	125,727
Schroeder, W. L. Behavior of Forest Soils in Southeast Alaska.	Civil Engr.	USDA-USFS	1 yr	9,539
Nath, J. H. Tests for Surfing Facility.	Civil Engr.	Offshore Tech.	1 yr	Indef.

<u>Investigator</u>	<u>Department</u>	<u>Agency</u>	<u>Duration</u>	<u>Amount</u>
Nath, J. H. Hydrodynamic Roughness of Marine Growths on Cylinders.	Civil Engr.	NSF	1 yr	\$ 90,158
Nath, J. H. Hydrodynamic Coefficients for Cylinders with Pronounced Marine Growths.	Civil Engr.	API	1 yr	10,500
Bella, D. A. Ethics, Technology and Social Context	Civil Engr.	NSF	3 yrs	107,163
Vinson, T. S. Dynamic Properties of Naturally Frozen Soils.	Civil Engr.	NSF	1 yr	43,259
Leonard, J. W. Floating Breakwater Dynamics.	Civil Engr.	NSF	2 yrs	222,835
Nath, J. H. Time Domain Numerical Model.	Civil Engr.	USDC-NOAA	3 mos.	4,033
Nath, J. H. Drifting Buoy Numerical Model Improvement.	Civil Engr.	EPA	2 yrs	115,046
Leonard, J. W. Scholarship Grant (Pierce)	Civil Engr.	SSC	1 yr	7,974
Leonard, J. W. Dynamic Response of Fluid-Filled Membranes to Ocean Waves.	Civil Engr.	NSF	3 yrs	493,932
Nath, J. H. NRL Spar Buoy Investigation.	Civil Engr.	Navy	4½ mos	37,580
Vinson, T. S. Centrifugal Modeling to Determine Ice Forces and Failure Mechanisms.	Civil Engr.	NSF	2 yrs	177,688
Slotta, L. S. Shoaling of Lower Columbia River Ports by Sediment from Mt. St. Helens Eruption.	Civil Engr.	USDI-OWRT	19 mos	100,000

<u>Investigator</u>	<u>Department</u>	<u>Agency</u>	<u>Duration</u>	<u>Amount</u>
Nath, J. H. Drifting Buoy Numerical Model Improvement.	Civil Engineering	USDC-NOAA	18 mos	\$ 7,999
Slotta, L. S. Information Program to Facilitate Small-Scale Hydropower Development.	Civil Engineering	USDE	10 mos	40,978
Mohler, R. R. Stochastic Nonlinear Modeling and Control for Large Scale Organizational Systems.	Electrical Engr.	USDE	3 yrs	449,171
Bhattacharya, P. K. Electrical and Optical Properties of Annealed Epitaxial Semiconductors (revision).	Electrical Engr.	NSF	3 yrs	145,530
Bhattacharya, P. K. Investigation of the Electrical and Optical Properties of Organometallic Vapor.	Electrical Engr.	USDE	3 yrs	186,664
Engle, J. F. The Apark Ignition of Fuel-Air Mixtures.	Electrical Engr.	USDE-BPA	1 yr	37,000
Mohler, R. R. Nonlinear Control in Circulatory Immunology and Demography.	Electrical Engr.	NSF	2 yrs	168,565
Herzog, J. H. Instructional Scientific Equipment.	Electrical Engr.	NSF	1 yr	20,000
Lauw, H. K. Capability Extensions to the Universal Machine Code.	Electrical Engr.	USDE-BPA	14 mos	46,414
Mohler, R. R. Nonlinear Filtering and Tracking.	Electrical Engr.	ONR	3 yrs	434,838
Bhattacharya, P. K. Investigation of Electrical and Optical Properties of Organometallic Vapor (revision).	Electrical Engr.	USDE	3 yrs	192,863
Lauw, H. K. Investigation of Doubly Fed Machine in Variable Speed Applications.	Electrical Engr.	USDE	3 yrs	370,172

<u>Investigator</u>	<u>Department</u>	<u>Agency</u>	<u>Duration</u>	<u>Amount</u>
Fichter, E. F. McDowell, E. D. Investigation of a Novel Robot Arm.	Industrial Engr.	NSF	2 yrs	\$ 99,932
Funk, K. H. A Formal Structure for the Design and Analysis of Human-Computer Control Systems.	Industrial Engr.	NSF	2 yrs	47,935
Fichter, E. F. Instructional Scientific Equipment for New Courses in Computer-Aided Design.	Industrial Engr.	NSF	2 yrs	19,778
Mingle, J. G. Boubel, R. W. Effect of Low-Proof Fuel Alcohol and Crankcase Oil Dilution in an Otto Cycle Engine.	Mechanical Engr.	USDE	2 mos.	26,530
Reistad, G. M. Design of Heat Pumps for Heating in the Pacific Northwest.	Mechanical Engr.	USDE	1 yr	39,441
Thornburgh, G. E. Junge, D. C. Investigation of the Rate of Combustion of Wood Residue Fuels.	Mechanical Engr.	USDE	1 yr	182,000
Thornburgh, G. E. Junge, D. C. Investigation of the Rate of Combustion of Wood Residue Fuels (State-of-the-Art).	Mechanical Engr.	USDE	1 yr	67,000
Thornburgh, G. E. Junge, D. C. Investigation of the Rate of Combustion of Wood Residue Fuels (Drying of Wood and Bark).	Mechanical Engr.	USDE	1 yr	44,500
Thornburgh, G. E. Junge, D. C. Investigation of the Rate of Combustion of Wood Residue Fuels (Pelletized Biomass Fuels).	Mechanical Engr.	USDE	1 yr	107,000

<u>Investigator</u>	<u>Department</u>	<u>Agency</u>	<u>Duration</u>	<u>Amount</u>
Thornburgh, G. E. Junge, D. C.	Mechanical Engr.	USDE	1 yr	\$199,000
Investigation of the Rate of Combustion of Wood Residue Fuels (Carbon Char).				
Thornburgh, G. E. Junge, D. C. Boubel, R. W.	Mechanical Engr.	USDE	8 mos	65,000
Investigation of the Rate of Combustion of Wood Residue Fuels (Pollution Control).				
Bushnell, D. J.	Mechanical Engr.	USDE	5 mos	11,011
Energy Utilization in the Pulp and Paper Industry.				
Reistad, G. M.	Mechanical Engr.	USDE	1 yr	47,971
Design of Heat Pumps for Heating in the Pacific Northwest.				
Bushnell, D. J.	Mechanical Engr.	DEQ	1 yr	41,214
Combustion System for Energy Recovery from Agricultural Biomass in Standard Bales.				
Kennedy, T. C.	Mechanical Engr.	NSF	15 mos	47,796
An Investigation of Cold Bed Modeling in the Determination of Forces on Immersed Tubes.				
Bushnell, D. J.	Mechanical Engr.	USDE	7 mos	14,414
Energy Utilization in the Pulp and Paper Industry (revision)				
Mingle, J. G.	Mechanical Engr.	BKM, Inc.	5 mos	40,418
Exhaust Emissions from Small Outdoor Power Equipment Engines.				
Bushnell, D. J. Junge, D. C.	Mechanical Engr.	USDE	8 mos	65,000
Investigation of the Rate of Combustion of Wood Residue Fuels.				
Thresher, R. W.	Mechanical Engr.	USDE	6 mos	45,000
Wind Response Characteristics of Horizontal Axis Turbines.				

<u>Investigator</u>	<u>Department</u>	<u>Agency</u>	<u>Duration</u>	<u>Amount</u>
Adams, R. L. A Study of the Radiative Contribution to Heat Transfer (revision).	Mechanical Engr.	NSF	2 yrs	\$108,833
Bushnell, D. J. Design Parameters for Improved Carbon Burnup in Coal Burning Fluidized Beds.	Mechanical Engr.	USDE	2 yrs	249,879
Davis, L. E. Drilling Mud and Produced Water Disposal Using Physical Models.	Mechanical Engr.	Exxon	1 yr	49,401
Thresher, R. W. Wind Turbine Structural Design and Analysis.	Mechanical Engr.	NASA	1 yr	43,000
Bushnell, D. J. Combustion System for Energy Recovery from Agricultural Biomass.	Mechanical Engr.	DEQ	1 mo	4,347
Mingle, J. G. Bushnell, D. J. Effect of Low-Proof Alcohol Fumigation-Fueling on Crankcase Oil Dilution.	Mechanical Engr.	USDE	5 mos	38,443
Spinrad, B. I. A Finite-Element, Approximate Source Method for Solving the Neutron Transport Equation.	Nuclear Engr.	NSF	2 yrs	42,620
Wang, C. H. Advanced Fellowships.	Nuclear Engr.	INPO	1 yr	24,000
Peddicord, K. L. Assessment and Application of Transient Fuel Behavior Computer Codes.	Nuclear Engr.	EPRI	1 yr	22,042
Peddicord, K. L. Electron Microscopy Analysis of Packed Particle Fuel Tests.	Nuclear Engr.	Hanford	1 yr	39,663
Peddicord, K. L. Thermal Hydraulic Analysis of a Pressurized Water Reactor Core.	Nuclear Engr.	PGE	1 yr	26,803
Peddicord, K. L. Evaluation Models for the Prediction of the Performance of Sphere Pac Fuel Pins.	Nuclear Engr.	EIR	1 yr	48,336

<u>Investigator</u>	<u>Department</u>	<u>Agency</u>	<u>Duration</u>	<u>Amount</u>
Hornyik, K. Development and Verification of Light Water Reactor Systems Models.	Nuclear Engr.	GRS	10 mos	\$ 21,500
Dodd, B. Low Level Radioactive Waste Packaging Strategy.	Nuclear Engr.	EG&G	3½ mos	35,567
Johnson, A. G. Dodd, B. Pocket Ionization Chambers for Personnel Neutron Dosimetry.	Nuclear Engr.	NRC	1 yr	36,918
Ringle, J. C. Computer-Based Courses in the Nuclear Engineering Areas.	Nuclear Engr.	CDC	2 yrs	635,640
Hornyik, K. RETRAN Analysis of the PB2 Stability Tests	Nuclear Engr.	EPRI	6 mos	19,742
Spinrad, B. I. Sphere-Pac Fuel in a Safeguarded Fuel Cycle.	Nuclear Engr.	EPRI	9 mos	12,370
Spinrad, B. I. Sphere-Pac Fuel in a Safeguarded Fuel Cycle.	Nuclear Engr.	EIR	9 mos.	12,370
Wang, C. H. Advanced Fellowships.	Nuclear Engr.	INPO	1 yr	16,000
Peddicord, K. L. Characterization and Modeling of UO ₂ Sphere-Pac Fuel.	Nuclear Engr.	Exxon	1 yr	58,650
Peddicord, K. L. Thermal Hydraulic Analysis of a Pressurized Water Reactor Core.	Nuclear Engr.	PGE	1 yr	29,242

<u>Investigator</u>	<u>Department</u>	<u>Agency</u>	<u>Duration</u>	<u>Amount</u>
Boubel, R. W. Increase in Total Suspended Particulate Due to the Mt. St. Helens Eruptions.	Air Resources	NSF	4 mos	\$ 37,420
Boubel, R. W. Novel Particulate Control Concepts for Jet Engine Test Cells (revision).	Air Resources Center	AF	2 yrs	200,000
Boubel, R. W. Assessment for Fugure Environmental Problems - Agricultural Residues.	Air Resources Center	EPA	6 mos	112,978
Junge, D. C. Publication of a Technical Document.	Energy Institute	USDE-SERI	9 mos	17,700
Junge, D. C. Survey of the Status of Development of Proposed New Source Performance Standards.	Energy Institute	USDE-SERI	3 mos	10,000
Klingman, P. C. Information Program to Facilitate Small-Scale Hydropower Development.	Water Resources	USDE	15 mos	43,500
Klingeman, P. C. Sturgeon Lake Restoration: Phase I Diagnostic/Feasibility Study.	Water Resources	Multnomah	2 yrs	57,406
Klingeman, P. C. Slotta, L. S. Information Program to Facilitate Small-Scale Hydropower Development.	Water Resources	USDE	15 mos	43,500
Klingeman, P. C. Water-Related Aftereffects of the Mt. St. Helens Eruption.	Water Resources	WSU	25 mos	25,000
Klingeman, P. C. Willamette River Sediment Transport Investigation (Supplement)	Water Resources	Army	1 mo	400

PH.D. THESES

JUNE 1981

Ghawamedin Bayan
Chemical Engineering
"Mass Transfer in Multiple Stage
Crosscurrent Packed Column"

Dalkeun Park
Chemical Engineering
"The Plume Model for Large Utility
Scale Atmospheric Fluidized Bed
Combustors"

Donald Anthony Kane
Civil Engineering
"Bacterial Toxicity and Metabolism
of Three Hydrazine Fuels"

Cheng-Wen Lin
Civil Engineering
"Fluid Forces on Smooth and Rough
Circular Cylinders"

Stew M. Oakley
Civil Engineering
"The Partitioning and Bioavailability
of Trace Metals in Marine Sediments"

Frederick Glen Thrall
Civil Engineering
"Geotechnical Significance of Poorly
Crystalline Soils Derived from
Volcanic Ash"

Jafar Ali Assiri
Electrical & Computer Engineering
"Development of Dependent Failures
Reliability Model in Distributed
Communication Networks"

Wojciech Jan Kolodziej
Electrical & Computer Engineering
"Conditionally Gaussian Processes
in the Stochastic Control Theory"

George D. Stavrakis
Industrial Engineering
"A General Linear Optimization
Algorithm Based Upon Labeling and
Factorizing of Basic Paths on
RPM Network"

Sang Hyouk Choi
Mechanical Engineering
"Heat Transfer in Magnetic Fluids
at Low Reynolds Number"

Norkun Sitthiphong
Mechanical Engineering
"Experimental Studies of a Partially
Defluidized Bed with Immersed
Heat Exchange Tubes"

Shou Yuan Wei
Mechanical Engineering
"Application of Linear Quadratic
Control Design in Reduction of
Aerodynamic Forces in Aircraft"

Yine-Ping Ting
Nuclear Engineering
"Heat Conduction in Eccentric
Annuli"

PHOTO THESIS

JUNE 1981

M.S. THESES

JUNE 1981

Martin Theodore Nicholso
Agriculture Engineering
"A Slatted Floor Portable Shelter for
Lambing in Winter Rainfall Pastures"

Carlos Guadalupe Anaya-Sanchez
Chemical Engineering
Non-Thesis

Sadiq Safakat Bengali
Chemical Engineering
"Kinetics of Cellulose Pyrolysis Under
High Heating Rates"

Victor Manuel Blasquez-Garcia
Chemical Engineering
Non-Thesis

Brice Dardel
Chemical Engineering
"Corrosion and Corrosion Control
of Trawl Wire Ropes"

Gregory Philip Golike
Chemical Engineering
"Development and Dynamic Analysis of
an Experimental Heat Integrated
Distillation Column"

Jambulingam Palaniappan
Chemical Engineering
Non-Thesis

Sadanand Rachappa Patil
Chemical Engineering
"Dynamics and Control of a Heat
Integrated Distillation Column
With Side Heat Exchangers"

Robert Michael Schwarze
Chemical Engineering
Non-Thesis

Adonis Constantine Stephanakis
Chemical Engineering
"Fluid Dynamics in a Two Dimen-
sional Fluidized Bed of Large
Particles"

Steven Kazuo Aisaka
Civil Engineering
"A Comparison of Three Methods of
Earthquake Analysis"*

Fouad M. Al-Sinan
Civil Engineering
"Construction Management Services in
Developing Countries"*

Phillippe Bleriot
Civil Engineering
"Determination of Conditional Adsorption
Constants for Cadmium in Estuarine
Sediments"*

Peter Warren Bolander
Civil Engineering
"Test Equipment & Procedures to Evaluate
Dynamic Properties of Naturally Frozen
Soils"*

Jeffrey Thomas Chaffee
Civil Engineering
"A Continuous Flow Bioassay for Toxicity
Assessment"*

Chen Chang
Civil Engineering
"Evaluation of Selected Marginal Aggre-
gates Stabilized with Cement"

Fang-Dong Chang
Civil Engineering
"Simulation of a Ready-Mixed Concrete
Truck Fleet"*

James Howard Cross
Civil Engineering
"Owner Considerations in Construction
Contract Type Selection"*

* Project Report for Non-thesis Option.

Terence Layton Dibble
Civil Engineering
"Frequency Response Characterization
of Current Meters"*

Theodore Alan Downen
Civil Engineering
"Construction Worker Motivation
& Productivity: A Literature
Review"*

Gary Lynn Evans
Civil Engineering
"Properties of Marginal Aggregates
Treated with Asphalt Emulsion"

Mark Edward Grismer
Civil Engineering
"Evaluating Dairy Waste Manage-
ment Systems"

David Lawrence Hutson
Civil Engineering
"Parking Study, Analysis, and
Recommendations"

David Russell Keasey
Civil Engineering
"The Effect of pH & Ligand Com-
plexing Strength on Leachate
Quality: Metal Concentrations
and Toxicity"*

Nawal Hibrawi Koja
Civil Engineering
"Some Basic Aspects of Contract
Law for Construction Participants"*

Bruce Edwin Marsh
Civil Engineering
"Energy Traps Beyond Development"*

James Robert Nicoli
Civil Engineering
"Minicomputers in Construction"*

Nicole Michele Nivault
Civil Engineering
(Thesis in process)

David Paul Pierce
Civil Engineering
"Partitioning of Trace Organics
in Marine Sediments"*

Shio-Jin Pong
Civil Engineering
"Comparison of Resilient Character-
istics of Asphalt Concrete Using
Diametral and Triaxial Test Metho

Farhad Rezai
Civil Engineering
"Analysis of Construction Operatio
Through Time-Lapse Photography"*

Dominique Pascal Rousseau
Civil Engineering
"Wave Damping Over Poro-elastic Oc
Beds"*

Mary Beth Schmoyer
Civil Engineering
"The Application of Density Separat
Techniques to Determine the Parti
ing of Cadmium in a Model Sedimen

Mojtaba Bakhtiari Takallou
Civil Engineering
"Vanpooling for Oregon State
University"*

Richard Alan Walker
Civil Engineering
"Effect of Blasting Vibrations on
Green Mass Concrete"*

William George Whitcomb
Civil Engineering
"Evaluation of a Unified Design fo
Asphalt Recycling by Means of Dyn
and Fatigue Testing"

MASTER OF OCEAN ENGINEERING

Min Chih Huang
Civil Engineering
"Stability of Pipelines Under
Shoaling Finite Amplitude Waves"

Tae In Kim
Civil Engineering
"Wave Forces on Submerged Artificial
Reefs Fabricated from Scrap Tires

Hang Tuah
Civil Engineering
"Simulation of Random, Nonlinear
Wave Forces on a Circular
Cylindrical Pile"

Samia Abe El-Fattah Ali
Electrical & Computer Engineering
Non-Thesis Option

Yu-Tai Chia
Electrical & Computer Engineering
Non-Thesis Option

John Charles Dalrymple
Electrical & Computer Engineering
Non-Thesis Option

Faheem Ahmad Dani
Electrical & Computer Engineering
Non-Thesis Option

Johan Agus Darmawan
Electrical & Computer Engineering
Non-Thesis Option

David Harvey Eby
Electrical & Computer Engineering
Non-Thesis Option

Gregg Murray Fildes
Electrical & Computer Engineering
Non-Thesis Option

Dennis E. Fuoss
Electrical & Computer Engineering
Non-Thesis Option

YungHa Han
Electrical & Computer Engineering
Non-Thesis Option

Chang-Chia Hsiao
Electrical & Computer Engineering
Non-Thesis Option

Mohammad Shakaib Iqbal
Electrical & Computer Engineering
Non-Thesis Option

Patrick Terrell Jacobs
Electrical & Computer Engineering
Non-Thesis Option

Francis Saron Joseph
Electrical & Computer Engineering
Non-Thesis Option

Larry Herman Mukai
Electrical & Computer Engineering
Non-Thesis Option

Akifumi Nakatani
Electrical & Computer Engineering
Non-Thesis Option

Steve Gerard Oxborrow
Electrical & Computer Engineering
Non-Thesis Option

Asif Qayyum
Electrical & Computer Engineering
Non-Thesis Option

Muthukrishna Ramanujam
Electrical & Computer Engineering
Non-Thesis Option

Mohammad Saleem Siddique
Electrical & Computer Engineering
Non-Thesis Option

Siripong Sritanyaratana
Electrical & Computer Engineering
Non-Thesis Option

Kenneth A. True
Electrical & Computer Engineering
Non-Thesis Option

Philip Yen-Pin Tseng
Electrical & Computer Engineering
Non-Thesis Option

Niann-Luu Yang
Electrical & Computer Engineering
Non-Thesis Option

Tzay-Shen Chang
Industrial Engineering
"A Productivity Evaluation Method for
the School of Engineering at Oregon
State University"

Kim N. Mac
Industrial Engineering
(Not completed)

Kwok Wing Ng
Industrial Engineering
"Minimum Cost Scheduling of Resource
Constrained Jobs on Parallel Machines
Under Control of Interchangeable
Microprocessors"

Eduardo Marroquin Prado
Industrial Engineering
"Evaluation of Human Life"

Sabahuddin Randhawa
Industrial Engineering
"A Methodology for the Economic Evaluation
of Centralized Versus Decentralized
Automated Component Insertion"

John Warren Turnblom
Industrial Engineering
"An Approximation Procedure for the
Allocation of Inspection Effort"

Ramachandran Vanchinathan
Industrial Engineering
"Conceptual Framework for Including
Escalation and Productivity Factors
in Traditional Economic Models"

Seyed Naser Alavizadeh
Mechanical Engineering

Kuo-Kung Chang
Mechanical Engineering
Project

Yai-Song Charles Chen
Mechanical Engineering
Project

Gary Lee Clark
Mechanical Engineering
Project

Thomas Joseph Croy
Mechanical Engineering
Project

Jeffrey Nathan Hockman
Mechanical Engineering
"A Study of Bubble Size in a Large
Particle Fluidized Bed at Elevated
Temperatures"

Shuh-Ren Lin
Mechanical Engineering
In progress

William Robert McMahon
Mechanical Engineering
"Analysis of Heat Pump Coupled
Aquifer Seasonal Thermal Energy
Storage Systems"

Paul Morency Means
Mechanical Engineering
"Experimental Evaluation and Numerical
Modeling of a Water Source
Heat Pump Evaporator"

Arun Nisargand
Mechanical Engineering
"Thermal and Seismic Analysis of
Piping Systems Using Classical
Methods"

Said Shakerin
Mechanical Engineering
Project

Craig Lewin Timmerman
Mechanical Engineering
Project

Vahan Torabramians
Mechanical Engineering
Project

Nick Lungcheng Yen
Mechanical Engineering
Project

MASTER OF MATERIALS SCIENCE

James Michael York
Mechanical Engineering
"The Effect of Alpha Phase
Morphology on the Impact Energy
of Commercial Purity Titanium"

Edmund Page Coomes
Nuclear Engineering
"Thermal Hydraulic Analysis of a
Pressurized Water Reactor During
Transient Conditions"

Larry Howard Nielsen
Nuclear Engineering
"An Assessment of Describing Function
Methods Applied to Reactor Fuel
Performance Analysis"

Paul Edwin Schofield
Nuclear Engineering
"A Study of the Behavior of Actinides
Continuously Recycled in a Hard
Spectrum Reactor"

Shou-kong Lancelot Wang
Nuclear Engineering
"High Speed Motion Neutron Radiography
of Two-Phase Flow"

Mohammad Hossein Youssefnia
Nuclear Engineering
"Pressurized Water Reactor (PWR)
Accident Analysis Using the
EMERALD Code"

