UPDATE
MECHANICAL ENGINEERING
A PUBLICATION OF THE
DEPARTMENT OF MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY • AMES, IOWA
November 1987

Leading the Way to the 21st Century

Engel Laboratory

One of the goals of the Mechanical Engineering curriculum is to integrate design and manufacturing. Thanks to the gift of Ray and Kathryn Engel, the Engel Laboratory has been established to help attain this goal.

The concept of the Engel Laboratory, illustrated in the accompanying figure, is to provide computer based design work stations with appropriate software for design tasks. The purpose of this hardware and software is to facilitate design optimization.

Once the design is complete, the data can be downloaded from the design stations to computer numerically controlled machining and turning centers so that the parts can be machined or turned as required. Coupled to the machining and turning centers will be a transfer line supporting controlled tasks required during a manufacturing and assembly process. A network will interface the computer aided design work stations to the numerically controlled hardware which performs the manufacturing tasks. The conveyor line and tasks will be controlled such that all the parts can be assembled and checked.

The Engel gift will initially be used to purchase a machining center, software, and computer work stations so that the design process can be implemented and integrated with the manufacturing tasks that can be performed at the machining center.

To date the computer work stations have been ordered along with the software. The software that is being implemented is AutoCad and Cadkey. AutoCad is generally used for accomplishing two dimensional designs including layouts for heating, ventilation, and air conditioning

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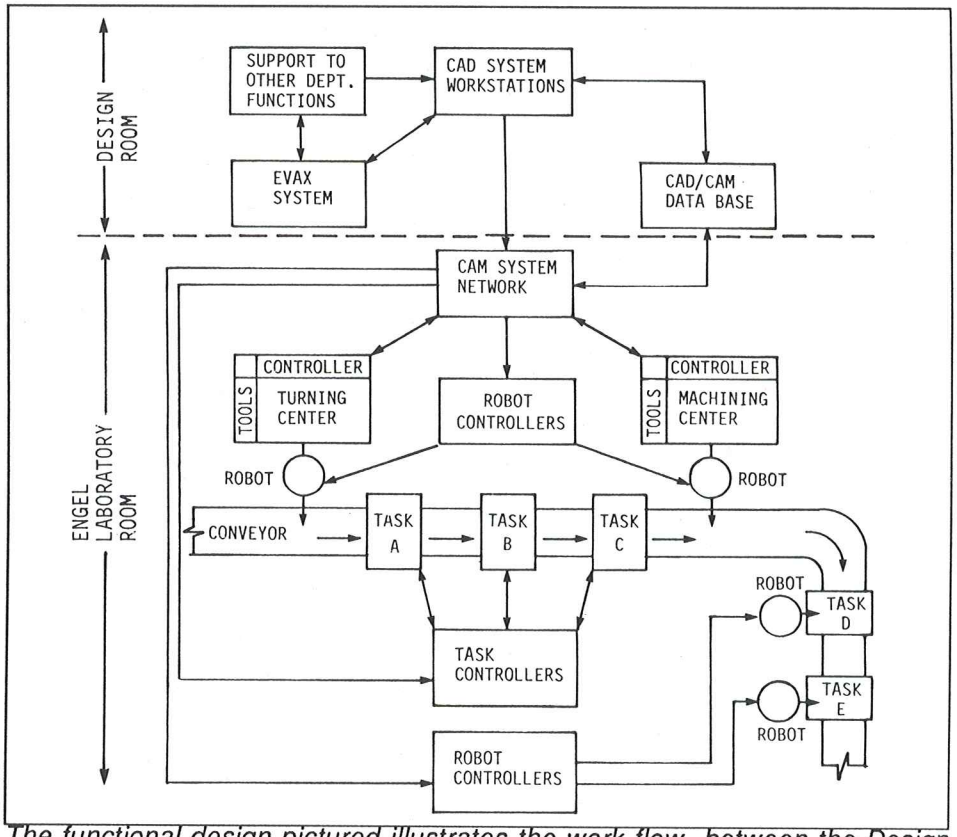

The functional design pictured illustrates the work flow between the Design Room and the Raymond A. Engel Laboratory with its state-of-the-art techniques for integrating design and manufacturing tasks.

From The Chairman's Desk

It has been about three years since I corresponded with you in this space, so it seemed appropriate to give you an overview of current developments.

We continue to be an enrollment limited department, accepting 150 new pre-ME students each year from Freshman Engineering. By the time students get to us, they are already well educated in the basics; they are computer literate and they have completed chemistry, physics and math through calculus. Students begin their professional program with our Introduction to Mechanical Engineering course, then go on to take thermo-fluids, design elements, instrumentation, and manufacturing basics. Depth of knowledge in one or more areas is increased in their senior year with a wide choice of electives, one of which must be a "capstone" design course that calls upon the experience they gained in their required courses and focuses on various design projects.

Many mechanical engineering students participate in activities in addition to their course work. Professional societies are thriving; 165 students are currently active in ASME, 35 in ASHRAE, and 40 in SAE. We also have good participation in the engineering honoraries including Pi Tau Sigma and Tau Beta Pi.

My view is that we have a first rate undergraduate program that we should continue to nurture as a key to all we are trying to do. We are committed to keeping our classes as small as we can, particularly design and laboratory-based classes where professor-to-student contacts are very important. We also continue to devote a good deal of our flexible resources, at least $20,000 each year, to supplies, maintenance, and updating of undergraduate laboratories.

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Department Chairman Jim Bernard and the ME Department faculty are working to nurture the fine undergraduate program while increasing their research contributions.

Engel Lab - Building for the Future

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systems. Cadkey supports design in three dimensions so that component parts can be specified and optimized, and the resulting configuration examined from all views of interest using the graphic terminals. As additional funds become available, the turning center, robotic components, controls, and networking will be provided to implement other features of the laboratory.

We envision the project to encompass additional areas in the Department such as instrumentation and controls, economics, dynamics, and robotics. The intent is not to limit the usefulness of the computer aided design work stations to the classical areas of machine design. Rather, we hope to implement the interactive computer-based design process in other areas including heat transfer, thermodynamics, and fluid mechanics. In fact, the heating, ventilation, and air conditioning classes are planning to use the design stations during spring semester.

The Engel Laboratory has been planned by several faculty members. These faculty, under the leadership of Jerry Hall, are currently in the process of examining and investigating equipment to fit Laboratory needs. They have made several plant visits; and have examined various machining and turning centers to prepare to select these devices. The group has sought the advice and support of the Department's newly formed Industrial Advisory Board, which met in Ames on November 13 to consider the development of the Laboratory.

In future months, as resources allow, items will be added to the Engel Laboratory. As the laboratory grows, the faculty will work on curricular changes that will incorporate new development into ME courses.

Engines ***Energy *** Robotics

Bernard - Continued from Page 2

Upon graduation most of our students choose from a wide variety of interesting careers in industry. Placement people here at ISU tell us the average starting salary for our graduates with Bachelor of Science degrees is about $28,500, and recruiters tell us they consider our students to be an excellent investment.

More than 15 percent of our graduates went directly to graduate school this past year, some at Iowa State, others elsewhere. Our graduate program is growing, with 75 graduate students enrolled on campus and several more at off-campus locations. Our most visible off-campus program has been at the John Deere Product Engineering Center in Waterloo, which has several employees pursuing Master of Science degrees through the Department.

Our faculty, along with their graduate students, are increasingly active in research. In the last academic year, we published two books, thirty scholarly papers, sixteen Masters theses, and five Doctoral theses. Our research was supported by approximately $750,000 from governmental and private sources. The government money was principally from the National Science Foundation, the Air Force, the Department of Energy, and the State of Iowa. The Department's private support came from many sources including General Motors, General Electric, Winnebago, Navistar, ASHRAE, Iowa Electric Light and Power, and Exxon. Almost all of this support was used for equipment, travel, and stipends for graduate students.

I believe that we should aim, in the near term, for a program with about one hundred graduate students and about $1.5 million in outside support. Meeting this goal will be of benefit to our undergraduates by increasing their exposure to faculty who are well known for their research as well as their teaching, and to graduate students whose presence raises the vitality as well as the technical level of our program.

The main event in recent times was our move to new quarters. The move has helped boost faculty and student morale, and providing a setting for the modern equipment we need to do a good job in teaching and research. We now have outstanding turbomachinery and heat transfer laboratories. Our internal combustion engine laboratory is gaining prominence and will soon become recognized nationally. Our Building Energy Utilization Laboratory is already carrying on several research projects under the direction of four faculty members with eleven graduate students. We are active with lasers, from powerful two kw devices for metal cutting and material treatment to the very small devices used for combustion measurements. We have research projects involving a variety of robots. We also have a fine computing system, with a VAX cluster that supports 50 terminals for the use of students and faculty from within the building and outside access from dorms and other campus locations.

We are not, of course, without challenges to meet, a fact of life that makes the Department an interesting and lively place to be. An exciting challenge is the development of the Engel laboratory, which you will read about in this issue. The continuing need to attain the resources needed to underpin all our laboratories and keep our program vital is also important. We have been greatly assisted in this effort by the income from the Black-Hilstrom fund, as you can read on pages 9 through 11, and we continue to rely on our graduates and friends in industry to help us get the funds we need to thrive in a difficult economy.

I hope this snap shot of our current activities gives you a sense of excitement about learning and research which is shared by our faculty and students, and that you find evidence here that the Department continues to merit your pride and your support.

Jim Bernard, Chairman

Department of Mechanical Engineering

Current Balance

Endowment for Mechanical Engineering

Black-Hilstrom Fund Endowment (Interest goes to Black-Hilstrom Fund)	$506,692
Black-Hilstrom Fund (Available as needed for equipment, travel, etc.)	64,339
Raymond and Kathryn Engel Endowment	823,350
Raymond and Kathryn Engel Fund (Available for capital item and support of the Laboratory)	$305,278

Mechanical Engineering Faculty Report

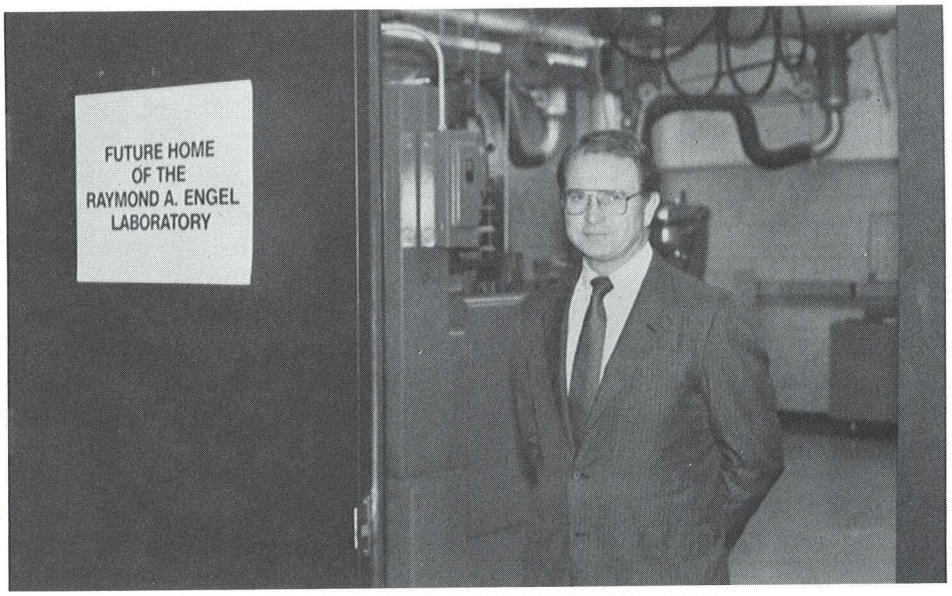
Teaching and Applied Research

With over twenty-six years of teaching experience at Iowa State, Professor Jerry Hall can be considered a pioneer of today's Iowa State ME Department. After receiving his B.S. and M.S. degrees from Iowa State in 1959 and 1963 respectively, Hall worked for Boeing Company in Seattle, Washington. From there he joined the ISU faculty to pursue a career in teaching and research. He completed his Ph.D. at Iowa State in 1967. "I've always found teaching in the classroom to be enjoyable. It's fun to see the refreshing minds that students bring to the classroom."

Hall laid the foundation for many new ideas in the Mechanical Engineering curriculum. Teaming up with Professor Charles R. Mischke, he helped to bring statistical analysis of data and design of experiments into the curriculum. He was responsible for developing the measurement and instrumentation courses for the curriculum at both the undergraduate and graduate levels. He also developed a gas dynamics course at the graduate level.

Today, Hall is the leader of the Design and Manufacturing Group. "I think it is very important to integrate manufacturing and design in the classroom because there is so much automation in industry today. We must enhance classroom learning by making the classroom experience closer to the situation and needs in industry."

According to Hall, the University needs to keep close ties to industry. The John Deere graduate program, which Hall and other faculty members helped develop, has been valuable in this regard. The program allows full-time employees at John Deere in Waterloo to further their education from an off-campus setting.



Professor Jerry Hall pictured outside the Engel Laboratory. Hall directs the Engel Lab development and is leader of the Design and Manufacturing Group.

"I am a firm believer in applied research - anything that has direct usefulness to people or industry." One project of this type on which Hall is currently working involves evaluating a gasoline vapor generator for use in appliances in motor home and recreational vehicles. The project, funded by Winnebago Industries, is aimed at finding alternatives to LP fuel.

Since joining the faculty in 1960, Hall has helped formulate long term goals for the Department. "The faculty have diverse backgrounds enabling them to see the end product differently. Setting goals helps keep people oriented in a given direction. The diverse backgrounds provide for different ways in which the goals can be achieved. One example of such goal setting by the Department faculty led to the new building and facilities we now enjoy. We are glad to have the new facilities. Among other things, it seems to have made a great deal of difference in people's morale and attitudes throughout the Department."

Outside the classroom, Hall is active as a consulting engineer. As President of J.L. Hall Engineering Services, he has worked on a variety of topics including combustion, fires, explosions, shock and detonation waves, fluid flow, heat transfer, thermodynamics, instrumentation, measurements, and testing for compliance standards. He says that he hires students to help with consulting work whenever possible. "It gives them experience they will use on the job and exposes them to interesting engineering applications. The consulting projects also provide wealth of examples for use in the classroom."

Hall has been recognized for his dedication to excellence. In 1984, he was honored as "Professor of the Year" by Iowa State ME students. He has also received the Outstanding Mechanical Engineering Professor Award, the Outstanding Teacher Award, and the ASME medallion

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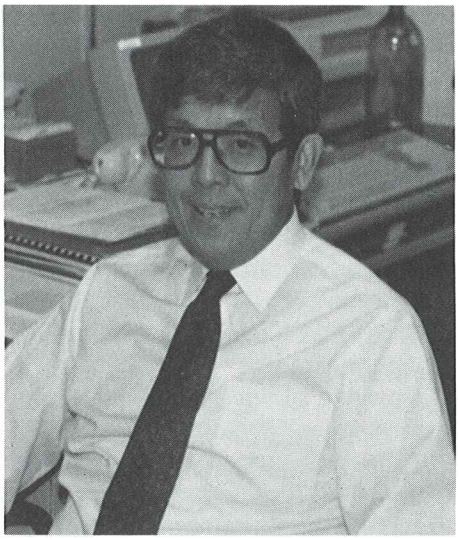
Okiishi - Superior ME Teacher



Ted Okiishi returned to Iowa State to accept a faculty appointment in 1967 after completing two years as a U.S. Army officer. His Army assignments included rocket nozzle heat transfer research at the NASA Lewis Research Center in Cleveland, Ohio, and duty with the Combined Intelligence Center in Vietnam (CCIV) in Saigon. "From Saigon in the mid-60s, Ames seemed like heaven on earth and I looked forward to filling the position at ISU more than you can imagine."

Prior to fulfilling his ROTC commitment, Okiishi received his B.S., M.S., and Ph.D. degrees at Iowa State in 1960, 1963, and 1965. He opted for academics as a career because he was "interested in education - in the classroom and in the research laboratory."

As a student, Okiishi remembers having excellent and generous teachers. These role models prompted him to "pay back the system," by striving for quality in the classroom. The ME seniors have elected Okiishi "Professor of the Year" twice in the last decade. This fall, Okiishi received the Engineering College Superior Teaching Award. In addition, he is presently co-authoring a fluid mechanics book with two other engineering professors.

With his graduate students, Okiishi has presented papers based on research at meetings throughout the world. In the past eighteen months, he and his students have participated in technical conferences in Dusseldorf, Germany,Tokyo, Japan and San Diego and Anaheim, California. "These opportunities to face the technical community and share research results are tremendous experiences for graduate students. We come away feeling gratified and ready to go for more."

With the help graduate students and enthusiastic on- and off-campus friends, Okiishi has developed a

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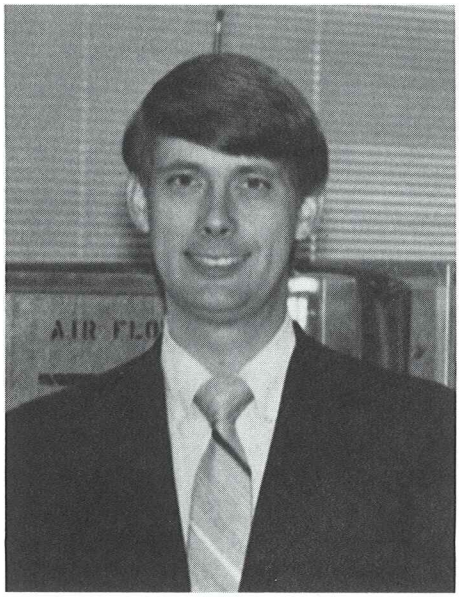
ISU an HVAC Design Leader



Gregory Maxwell cites his move to Iowa State as an opportunity to take part in educational development on a grass roots level. Originally from Indiana, Maxwell worked for Carrier Air Conditioning in Syracuse, New York prior to joining the Iowa State faculty in 1985. His primary teaching and research interests are in the area of thermo-fluid sciences, with special interest in the field of heating, ventilating, and air conditioning (HVAC).

"The facilities at Iowa State for HVAC design are among the best in the country," he says. With the arrival of the new equipment in the Department's Building Energy Utilization Laboratories came many new opportunities for teaching and research in HVAC. Maxwell has been restructuring the HVAC design courses to integrate computer aided design (CAD) into his classes. "Many design firms use CAD. By introducing our students to it, we're better preparing them to enter the profession."

The new Henry M. Black Engineering Building houses the Charles L. Schwab HVAC Air Flow Test Loop. The loop contains heating and cooling coils (heat exchangers), steam spray humidifiers, a variable speed fan, and a variety of air flow controlling devices. A pneumatic control system governs the operation of the loop. "This is a fantastic facility," Maxwell said. "We can use the loop to illustrate virtually all aspects of a building air-conditioning and air-distribution system." According to Maxwell research with the air flow test loop could result in improved system efficiencies that could reduce the amount of energy required for heating and cooling.

The Energy Research House

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Mechanical Engineering Student Report

ISU Student at Old Guard Competition

The Iowa State University Department of Mechanical Engineering will be represented at this year's national American Society of Mechanical Engineers (ASME) Old Guard Competition by Shannon Breon.

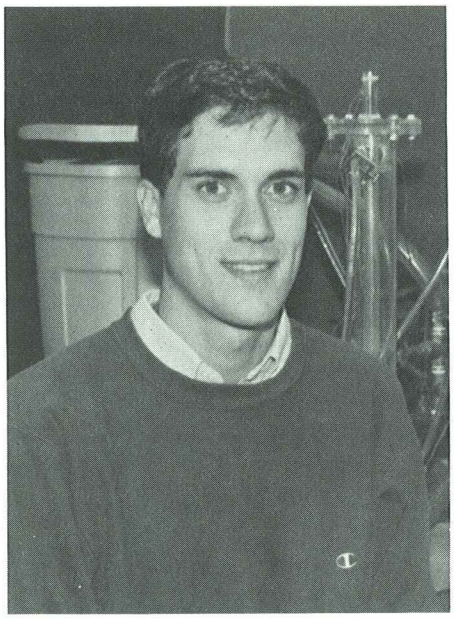
Breon, a senior in Mechanical Engineering, will present "Redesign of Flow Rates for an Improved Cornmilling Process" at the meeting in Boston, on December 15. She will be competing against 14 other regional winners for national recognition and a $1,000 first prize.

The paper, which is evolving as Breon's work on the cornmilling project progresses, won the local and regional ASME competitions as well as the Society of Automotive Engineers Dave Stover Competition this year. The paper stems from her engineering work at a Cargill Cornmilling facility in Eddyville, Iowa and an independent study project.

As a part-time project engineer at Cargill, her objective was to improve production yield by making changes in the flow through one of the process operations. After a successful prototype test, her design is now in use in cornmilling production.

Breon, who is from Agency, Iowa, has advanced her education through engineering and academic scholarships, including Departmental scholarships and the ISU Scholarship of Excellence. She is a member of ASME and SAE as well as the Society of Women Engineers. In recognition of her academic achievements she has been admitted to several honor societies, including Tau Beta Pi Engineering and Golden Key National Honoraries.

Funding Is Key To Research



When Lawrence Burken received his Bachelor's degree in May 1987, he knew he would return to ISU for an advanced degree.

"I knew for sure I wanted an advanced degree, but I wouldn't have pursued it if funding had not been available," Burken said."

Burken's research is funded through an Iowa Power Affiliates grant. The half-time research assistantship gives him freedom to concentrate on his research and nine credit hours of course work.

While he finds graduate work more demanding than his undergraduate studies, he anticipates completing all requirements for his degree in time to graduate in the summer of 1988. He was able to get a head start on his research in summer, 1987, when he devoted full time to the project, setting up his flow system.

His research in heat transfer aspects of fluidized beds has many applications. "Fluidized beds as heat exchangers are a method of getting heat from the source to the gas flow and vice versa," Burken said. "There are a lot of applications for fluidized beds in industry; for use in generating hot water and steam as well as cooling down fluids."

Burken, 22, a native of DeWitt, Iowa, came to Iowa State with no clear idea of what engineers do but he quickly adapted to the discipline. As an undergraduate he maintained a 3.8 grade point average, while working ten to fifteen hours a week in the Ames Laboratory. He was twice a recipient of the Henry M. Black Scholarship and was inducted into a number of honoraries including Tau Beta Pi. Burken is a member of ASME.

In his spare time, something he has little of as a graduate student, Burken participates in intramural sports and tutors other engineering students.

Laser Leaders At Iowa State

Lasers have come into their own as an indispensable tool at universities across the nation.

An exciting use of lasers in the Mechanical Engineering Department is in the cladding of zirconia to metals. Evan Vande Haar, an ME graduate student, has been experimenting for a year with a 1.5 kilowatt, CO_2 gas laser. The laser is used to clad zirconia oxide (a refractory ceramic material) to metals. This cladding insulates them to withstand high temperatures and coats them to reduce wear.

This project was funded in cooperation with Iowa Laser Technology of Cedar Falls. Vande Haar will conduct a few more experiments before preparing his thesis on the results.

His paper on the initial findings, "Effects of Process Variables on the Laser Cladding of Zirconia," was presented at the International Congress on Applications of Lasers and Electro-Optics in San Diego on November 11.

Vande Haar, who compares the zirconia coating of metals to wearing an oven mit, said the process has applications for components of turbine and internal combustion engines. He would like to continue to work with CO_2 gas lasers when he graduates.

Vande Haar, 23, who is from Pella, Iowa, came to ISU after receiving his undergraduate degree in Mechanical Engineering in 1986 from Dordt College, Sioux Center, Iowa. "I came to ISU because I wanted to stay in Iowa. I was also offered an assistantship, which made the decision easier," Vande Haar said.

Besides working as a Research Assistant on the laser project, Vande Haar has worked as a Teaching Assistant.

Interests Bring Obermaier Back

Lisa Obermaier went through the motions of a graduating senior in the Spring of 1987. She bought a suit. She had twenty-five interviews. She took her finals. She went to graduation. Then she opted for graduate school.

"I have too many interests," Obermaier said. "The more I looked the less I knew what I wanted to do. Going to school one more year will give me an opportunity to find my area of interest."

She began her graduate studies at ISU in the Summer of 1987. Her half-time research assistantship is funded through the Air Force Office of Scientific Research. Two other graduate students are involved in various aspects of the same project.

"I'll develop a mathematical model to determine which factors contribute to instability of our model of the Star 84 communication satellite," Obermaier said.

The model of the satellite was originally built by Doug Cowles '87 and redesigned by Michael Anderson. The results from Obermaier's computer simulations will be compared with the experimental results from the test rig.

"My computer program will numerically solve differential equations of motion for the movements of the model satellite. It's a lot easier to change a number in the program than to change the structure," Obermaier said.

As an undergraduate, Obermaier received the Alice Redding Black Scholarship twice as well as the Brunswick Foundation and ISU Inter-Residence Scholarships. She was also inducted into Tau Beta Pi Engineering Honorary and she is a member of ASME.

Obermaier, who is from Chicago, said she chose Iowa State for its campus and location, and for what it is not - the University of Illinois.

But she's not the only member of her family to attend ISU, her father George Obermaier was a graduate student in physics.

Maxwell

Continued From Page 5

(ERH) is another facility Maxwell considers to be valuable for research and education. This is Maxwell's second year as professor-in-charge of the ERH, a 2,400 square foot three-story house used for building energy research studies. The house, built in 1978, contains instrumentation and a variety of mechanical systems used for heating and cooling.

"The house provides an excellent opportunity to study the thermal interactions of a residential structure with HVAC systems," Maxwell said. Working with Associate Professor Robert Brown, Maxwell is planning a demonstration project in which a coal-limestone-water mixture in a small scale fluidized-bed combustor will be used to heat the house.

Maxwell said he is happy to be a part of an institution that provides its faculty members with the opportunity to pursue research. "The department offers a lot of good support for faculty development."

Presently, Maxwell is collaborating with other faculty on a number of projects. One of these research projects currently underway is sponsored by the American Society of Heating, Refrigerating and Air Conditioning Engineers and involves analysis and modeling thermal energy storage systems which use contained phase change materials.

"These systems can save building owners thousands of dollars in electrical utility cost," explains Maxwell. "By using less expensive off-peak electricity, a building air-conditioning system equipped with thermal storage can store reserve cooling capacity for use during the next day when the utility rates are high."

After two years at Iowa State, Maxwell is happy with his decision to come here. "I like it here. I really enjoy the diversity of the job -- teaching, working with graduate students on projects, developing labs and instructional material. I also like the campus, especially in the fall when the leaves are changing colors."

Hall

Continued From Page 5

Award for contributions to ASME. He has also been the recipient of the Ralph R. Teetor Award through the Society of Automotive Engineers.

In 1986, he contributed two chapters on measurements and inference to The Standard Handbook of Machine Design, edited by C. Mischke and J. Shigley. In 1987, he contributed a chapter on instrument statics to The Handbook of Instrumentation and Control edited by C. Natchtigal.

In his free time, Hall is an avid handball player and is the current State of Iowa open and masters class handball champion in both singles and doubles. In recent years, he also placed second, third and fourth in the U.S. Handball Association National masters Handball Tournament, and second in the national YMCA Masters handball Tournament.

Okiishi

Continued from Page 5

strong research program involving studies of the three-dimensional and unsteady fluid mechanics of turbomachines. Currently, most of their projects are cooperative with outside sources and involve support from some of the finest laboratories in the world, including the Aerodynamics Research Laboratory of the General Electric Aircraft Engine Business Group, the Lewis Research Center of NASA, and the Aeropropulsion Laboratory of the U.S. Air Force. "I cannot adequately state how important the help we receive from research sponsors is - without their cooperation, the scope of our work would be severely limited."

Okiishi has advised Pi Tau Sigma, the ME honorary, since 1982. He said this opportunity has made him more sensitive to individual student needs. Okiishi is an incoming member to the ASME International Gas Turbine Institute Board of Directors. In 1986, he chaired the ASME International Gas Turbine Conference. From 1982 to 1985, he chaired the Turbomachinery Committee of the ASME Gas Turbine Division. He says ASME activities have helped him to keep in touch with the broad aspects of the Mechanical Engineering profession.

"I've seen many improvements in ME at ISU since first arriving on campus as a student in 1957. The Henry M. Black Engineering Building is a tremendous boost for all of us. I am very grateful to all who contributed to making this great resource available."

The entire Okiishi family are ISU enthusiasts. Ted's wife, Rae, holds two degrees from Iowa State. Chris, the oldest of four boys, is currently in Freshman Engineering at ISU. The younger boys are all Cyclone fans.

Although born and raised in Honolulu, Hawaii, Okiishi considers himself an Iowan. "I am very fond of Iowa and have never regretted settling in Ames."

Mechanical Engineering

Alumni Make The Program Strong

Our ability to correspond with you is the direct result of your giving to support mechanical engineering at Iowa State University. But, that we can tell you about ourselves is really only an indication of what we're actually able to do because you give. Your support makes it possible for us to woo faculty and students whose abilities and work keep us at the top.

Money that you send allows us, in turn, to do things such as send these faculty and graduate students to conferences where they can tell about their work and benefit from learning about work going on elsewhere. You are making it possible for us to remain a highly respected institution and you are genuinely impacting engineering education in the United States.

I thought you might enjoy hearing about one person who did something special for Iowa State this year. Fund raisers are always saying that the reason successful people give to their college is that they want to give something back for the education they got at the beginning of their careers.

Lowell Greenfield '62 did just that. When Lowell was studying mathematics at Iowa State, he found he desperately needed financial help in order to complete his studies. As it turned out, engineer Les Huncke '29 had just established a loan fund in his mother's name. Lowell was able to continue his education because of the Mary Huncke Loan Fund.

This year, Lowell was thinking back on his career and he happened to write to Les to tell him that he had had a successful engineering career at TRW and that he felt indebted to Les for helping get him through Iowa State years before. Les responded by suggesting that Lowell consider giving to replenish the Mary Huncke Loan Fund and in so doing to possibly help a young person get an education in 1987.

Lowell responded immediately by joining the University's donor recognition club, The Order of the Knoll, by pledging $10,000 to repay the Mary Huncke Loan Fund. I can assure you that Lowell's contribution meant a great deal to Les Huncke, not to mention the young people a fund like this or like the Black-Hilstrom Fund is helping today.

The past year 1986 was a particularly important one for us because of the generous support given to us by Kathryn Engel and because many of you participated in year end giving. Like last year, 1987 provides tax deduction opportunities that will not exist in the future. We urge you to take advantage of the 1987 benefits and to feel for yourself the satisfaction and significance that giving something back can have.

Betsy Mayfield

ISU Achievement Foundation

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