Up and running  The Iowa Driving Simulator is now in operation, with a car mounted on a fixed base and computer-generated images displayed on a 180-degree screen. Doug Evans, graduate research assistant at the Center for Computer-Aided Design, monitors the visual display, which changes instantly in response to the driver's steering, speed, braking, and other reactions. Soon the car will be mounted on a hydraulic base, providing a more complete range of variables for study. See story on page 4.
The Science and Technology Pipeline: Faculty and Undergraduates as Partners

The network of human resources that make up the science and technology pipeline is closely tied to the competitive position of the United States in international trade and, in turn, to the future quality of life for all citizens. Because of this, the pipeline is of considerable concern to the federal government. But it also raises issues of significance for pre-college, college, and post-college education and training.

At a recent national meeting of engineering deans, Dr. John A. White, acting deputy director of the National Science Foundation, talked about pipeline issues and undergraduate engineering education. White made some provocative remarks about changes we need to make, and I would like to share them with you.

Unless the present trend is reversed, White says, fewer engineers will be produced each year for the remainder of this century. This decline will be caused by several factors: a reduced college-age population; a declining interest in engineering among today's students; and demographic shifts to an increasing number of underrepresented minorities, who find engineering less attractive as a career goal than do members of the current population majority.

To reverse this trend, he says, engineering educators must get a better understanding of why engineering is failing to attract and retain students.

White contends that the attrition rate of students who enroll in engineering is unacceptable, the time students need to earn an engineering degree is too long, and the engineering educational experience is unsatisfying—even for many of the students who complete a degree. To address these problems, he says, engineering educators should adopt the philosophy that students are their most important customers and that it's their job to transform students into knowledgeable graduates.

For instance, a qualified student's failure in a course should be seen as a joint failure in the teaching/learning process, for which both student and professor share responsibility. This view contrasts with the current practice of emphasizing the student's failure rather than blaming the breakdown of the partnership.

Also, White says, engineering educators often are more concerned about the mistake of not passing students who should pass a course than they are about passing students who should not pass. Both problems are important and should be addressed more evenly.

White believes that we should develop a “mentoring mentality” to develop the scarce human resources that may exist in the future. Thus, we would replace the largely prevalent “weeding out” philosophy with a “bringing in” or “cultivating” philosophy.

Finally, he suggests that the failure of engineering schools to attract citizens into engineering graduate programs is closely related to the faculty's attitude toward teaching undergraduate students.

I look forward to hearing your thoughts on White's remarks. It is critical to our future quality of life to make engineering careers more attractive to a diverse population and to develop an effective and efficient process to transform qualified students into high-quality, socially concerned engineers.

Continued on next page
Subsidies, Congressional Mandates May Mean Increased Ethanol Production in the ’90s

Ethanol production may increase fourfold during the nineties, according to David Lindahl, director of the U.S. Department of Energy’s office of alcohol fuels. Lindahl’s prediction is based on recent congressional mandates for cleaner burning fuels and the extension of ethanol subsidies to the year 2000.

Lindahl was one of several government, industry, and University experts who met late last fall on the University’s Oakdale campus to discuss the potential of ethanol, an alcohol product made from renewable agricultural crops such as corn, for increased use as an alternative transportation fuel.

Topics at the one-day seminar included political and consumer-related factors that affect ethanol production, and the role of fermentation, biocatalysis, and genetic engineering in producing ethanol from biomass such as corn cobs and other nonedible agricultural by-products.

Ravindra Datta, associate professor of chemical and biochemical engineering who helped plan the seminar, says the topics held national and international import and were of special interest to Iowans.

“It was valuable for all of us,” Datta says. “We were able to take a careful look at issues that are important to the state and the Midwest—particularly whether ethanol will gradually replace increasing amounts of the gasoline used in American cars and whether technological advances will produce a breakthrough for ethanol by making it cheaper to produce than gasoline.

Large quantities of ethanol could be produced cheaply, Datta says, with the development of more efficient techniques for turning biomass into fuel.

“It would be an important breakthrough, a windfall not just for Iowa but for the rest of the world.”
Research Moves into the Fast Lane
As Iowa Driving Simulator Gears Up

“This is an exciting place to work,” says Jim Stoner, looking past an array of humming computers, through a glass window, and into a room dominated by a driver’s console, multi-scan projectors, and a 180-degree projection screen.

But Stoner’s inspiration is not equipment. Instead, he’s describing activity at the Engineering Research Facility during the past months, as he and his colleagues have worked to give shape to the University’s new Iowa Driving Simulator. The operator-in-the-loop facility will be the most advanced ground vehicle driving simulator in the United States.

“We’ve put in a lot of long days,” says Stoner, associate professor of civil and environmental engineering and director of the Iowa Driving Simulator. “Everything is happening very quickly.”

Last summer Stoner visited driving simulators in France and Germany with Ed Haug, Carver Distinguished Professor of Mechanical Engineering and director of the Center for Computer-Aided Design. Haug has been one of the chief developers of driving simulation at Iowa.

Since then, the two have supervised installation of millions of dollars worth of equipment that has been purchased or donated for the simulator.

“We are up and doing research,” Stoner says, citing a study of driving skills in aging populations, being conducted by the Rural Injury Prevention Center, part of the University’s Department of Preventive Medicine and Environmental Health and an affiliate of the U.S. Center for Disease Control. The study, which will include a focus on Alzheimer’s patients, will measure judgment, perception, and reaction time of subjects in nearly real driving situations, without placing other drivers at risk.

“This is a perfect example of our facility’s value,” he says. “When do diagnosed patients become a danger to themselves and others behind the wheel? When do you restrict their licenses? Many of these people need to drive to medical appointments. We can come up with scientific answers so that lawmakers can address this painful and difficult issue fairly.”

Stoner thinks that making the center a reality has focused interest on its potential.

“Our original optimism does not seem unwarranted at all,” he says. “There is no doubt that it has enhanced our computer-aided design potential. And the social scientists and medical people—psychologists, physicians, pharmacologists—are increasingly enthusiastic. They keep coming up with new suggestions for how the facility will enhance their research.”

In February and March, Stoner and the rest of the Iowa Driving Simulator staff spent their time getting ready for a visit by a National Science Foundation panel, which will recommend a site for the U.S. Department of Transportation’s proposed $32-million National Advanced Driving Simulator. The visit came in late March, and Stoner is one of a host of Iowa researchers and administrators who are keeping their fingers crossed that Iowa will be chosen.

“The visit went very well,” Stoner says. “We are definitely one of the leading candidates, probably one of the top two. We’re waiting to hear.”
IOWA ENGINEER  ■  5

Looking good  Scott Risk (top left), a sophomore in computer science from Independence, Iowa, works on the Integraph Interact 360 at the Center for Computer-Aided Design, while Tim VanFosson (top right), systems analyst at the center, performs routine system maintenance in the computer room. The center has moved from the basement of the Engineering Building to the new Engineering Research Facility (left), which also houses the Iowa Driving Simulator and the Hazardous Substances Research Center. The Engineering Research Facility’s appearance has won recognition from the Iowa Chapter of the American Institute of Architects, which has given the building’s designers, Brooks Borg and Skiles, of Des Moines, a 1990 Certificate of Merit Award of Excellence for their work on the building.

Equipment Grant Will Aid Research on Environment

The University of Iowa Center for Global and Regional Environmental Research has received a $275,000 grant from Hewlett-Packard, Inc., for purchase of geographic analysis and environmental systems modeling equipment.

The equipment will be used for research by faculty and students. One item being purchased is a mini-supercomputer.

George Malanson, chair of the center’s geographic information systems committee, said the grant will help the center fulfill one of its principal functions—education.

“The grant means that we’ll be able to have more students involved in research activities,” he said.

College of Engineering faculty members serving on the center’s geographic information systems committee are Jim Cramer, data systems coordinator for the Iowa Institute of Hydraulic Research, and Witold Krajewski, assistant professor of civil and environmental engineering.

Malanson, associate professor of geography, Marc Armstrong, assistant professor of geography, and Frank Weirich, associate professor of geography with a joint appointment at the Iowa Institute of Hydraulic Research, round out the committee.

The Center for Global and Regional Environmental Research is an interdisciplinary group established in 1990 (see article in Fall 1990 Iowa Engineer). It brings together 34 faculty members from 15 University departments and 4 colleges.

Student Activities

■ Theresa Carpenter, a senior from Des Moines, presented a paper entitled "A study of interarrival periods between successive U.S. flood disasters" at the Eighth Conference on Hydrometeorology, held at Kananaskis, Alberta, Canada. The paper was co-authored by Professor Georgakakos. Carpenter also has been named Outstanding Senior by the Iowa section of the American Society of Civil Engineers (ASCE).

■ Scott Hagen, a junior from Homestead, Iowa, has received the Iowa Section Scholarship, an award of $500, from the Iowa section of ASCE. The award recognizes Hagen’s outstanding academic record and his activities in the student chapter of ASCE.

■ Scott Stearns, a junior from Washington, Iowa, has received the James L. Shive Memorial Scholarship in Hydraulic Engineering. The $500 award recognizes academic achievement.

Continued on next page

Electrical and Computer Engineering

Faculty Activities

■ Robert R. Cuykendall, associate professor, is the co-inventor of a "saturated optical interaction gate." A patent for the technology was issued to the University of Iowa Research Foundation, which has described the invention as significant in the development of nonlinear interfaces in optical signal processing and neural networks.

■ Adrian Korpei, professor, has received a grant from the Army Research Office to study the feasibility of optical microscopes with a resolution much smaller than the wavelength of light.

■ John P. Robinson, professor, received the Faculty Recognition Award at the University men’s annual track and cross country banquet last November. The award is presented annually to a person who exemplifies the faculty’s special relationship with undergraduate students.

■ Mark S. Andersland, assistant professor, and Thomas L. Casavant, assistant professor, have received a grant from the Defense Advanced Research Projects Agency (DARPA). Andersland and Casavant will use perturbation analysis to study methods for recovering trace data in intrusively monitored multicomputer systems. They hope to achieve lower hardware cost and higher accuracy than are available in existing methods for debugging multicomputer programs.

■ Salim Chowdhury, assistant professor, has received a grant from the National Science Foundation to study the design of power, ground, and clock networks in high-speed digital integrated circuits.

Continued on next page
**Student Activities**

- Palacharla Paparao, a doctoral student, has won a scholarship from the International Society for Optical Engineering for the second year in a row.
- Kevin H. Le, a senior from Iowa City, was awarded a 1990-91 NASA Space Grant Undergraduate Scholarship. The awards are made by the Iowa Space Grant College Consortium.
- Adam Cain, a senior from Iowa City, has been named the 1990-91 Most Promising Engineering Student by the National Cash Register Company.
- Robert Ridenour, a senior from West Des Moines, is serving as an assistant to professor Casavant under the Shell Assistants Program, funded by the Shell Oil Company.

**Industrial Engineering**

**Faculty Activities**

- Dennis L. Bricker, associate professor, has returned from developmental leave in Korea, where he wrote several chapters for a textbook. Bricker is using some of the computer material he prepared in Korea for courses he is teaching.
- James R. Buck, professor, has been part of the faculty team working on the National Advanced Driving Simulator and the Iowa Driving Simulator. Buck, J. Richard Simon, professor, and James Hinrichs, professor of psychology, are working to form a campuswide group of faculty interested in teaching and research on human-factors ergonomics.
- Gary W. Fischer, associate professor, has established a relationship among fundamental process variables for high-performance gas metal arc welding (GMAW). Fischer is attempting to develop a "quality" sensor and control system that can be used to maintain quality specification in real-time situations when welding gun travel speed is changing. His aim is to facilitate welding robot programming that improves productivity and reduces costs.
- Fischer also is developing control strategies for CNC machining operations, researching process planning methods for the concurrent engineering environment, and using the CAM laboratory to give students "hands-on" experience with a number of CAD/CAM/CIM technologies.

**Hubbard Marks 50 Years at Iowa From Student to Inventor to Vice President**

Philip G. Hubbard, one of the most distinguished and admired administrators in the history of The University of Iowa, retired on December 31. Hubbard was vice president for student services, director of Opportunity at Iowa, and professor of mechanical engineering when he retired. His relationship with the University began a half century earlier, when he enrolled as an engineering student in 1940.

"I started out in chemical engineering," Hubbard recalls. "When I first arrived, Dean Dawson called me into his office, and I had a very pleasant interview with him. Of course the college was quite small then. I got to know him and all of the deans since. They have all become close friends."

The University had no special programs for minority students and faculty when Hubbard first came to Iowa City. The young student arrived on campus with $252 and great determination to get a college education. Because he was black, he could not live in the University residence halls or eat in student cafeterias.

He worked to support himself and eventually signed up with the Army, which sent him to Penn State to study electrical engineering. When the war began to wind down, Hubbard left the service and returned to The University of Iowa, where he earned his bachelor's degree in electrical engineering, with honors, in 1946. He then went on to graduate school and a new engineering specialty—fluid mechanics.

"I had expected to resume study in chemical engineering," he says, "but I got a job working at the Institute of Hydraulic Research and wound up getting my M.S. and Ph.D. in mechanics and hydraulics."

Hubbard became a specialist in the field. He earned his master's degree in 1949 and his doctorate in 1954 and worked closely with Hunter Rouse, former institute director who became his friend and mentor. He headed the institute's instrumentation section and developed the hot wire anemometer, a device to measure the velocity of moving fluids. That led to the founding of the Hubbard Instrument Company in 1951. He also taught a wide range of courses in mechanics during the 1950s and early '60s, rising to the rank of full professor in 1959.

"I enjoyed it a great deal and was very happy," Hubbard says of his years at the institute. "I had no thought of leaving, certainly no thought of becoming an administrator."

But he had served on a University-wide human rights committee, where he caught the eye of University president Howard Bowen, who appointed him dean of academic affairs in 1966. His problem-solving skills were recognized by successive University administrations, which met his attempts to return to teaching with urgent pleas to remain and take on even more challenging administrative tasks.

"I kept teaching for awhile," he says, "but eventually I had to give it up. It was too hard to stay current, given the speed at which new ideas and techniques were coming along in my field. It wouldn't have been fair to my students."

In 1971, Hubbard was named vice president for student services, becoming the first black vice president at a Big Ten university. His many accomplishments since then have included development of the Opportunity at Iowa program, the University's initiative to recruit and retain minority students and faculty. Now, as professor emeritus of engineering, he..."
remains involved in the College of Engineering and Opportunity at Iowa.

Hubbard sees a logical bond between his experiences as student and teacher and his accomplishments as an administrator.

"People often ask me if my engineering background had any value in the things I did as an administrator," he says.

"I think it did. Engineers aren't like philosophers, who can just voice an opinion and go away and let someone else worry about it. We have to produce something, and then we are judged on how well it works. I think that background, that approach, has kept my feet on the ground over the years."

Changes, Challenges, and a Better World

Before he retired, Philip Hubbard talked with Greg Johnson, associate editor of the University's faculty-staff newsletter. Here are excerpts from that conversation.

You have been associated with the University for a half century. What has remained constant here and what has changed the most?

What remains the same is the continual spirit of renewal. New generations of students keep the entire community fresh and alive with a sense of youthfulness and critical attitude, and this has been a constant through the years.

One aspect that has changed substantially, I believe, is the extent of the University's involvement with the rest of the world. We are much more of a world contact university now than we were when I was a student. Until 18 or 20 years ago, we didn't even enroll foreign undergraduate students, only graduate and professional students. Now, there are many, many undergraduates here from throughout the world.

Another big change is how the University views the sexes. It's an incredible difference. When I was a student, men and women were separated by the river in choosing where they could live. There were very few women on the faculty compared to now, and the academic choices women were encouraged to make were far more limited.

The University's mission in regard to minority recruitment has also changed considerably.

The University has always had minorities on campus, but the ones who came in my generation did so because they were kind of unusual. Not unusually talented, necessarily, but because they had an attitude, a hope, a faith, that led them to go against the tide. Now we're reaching out to those who don't have that attitude, don't have that faith. And we're trying to convince them that they ought to take a chance, because their options otherwise are so miserable.

During your term as vice president for student services and dean of academic affairs, what was your most memorable challenge?

Certainly, the students presented me with a very significant challenge when they tried to close down the University in the early 1970s.

For the most part, I had a very good rapport with students because I felt we were operating from the same assumptions concerning basic human rights, democratic government, and listening to the voice of the people. But when they tried to close down the University as a symbolic gesture in order to influence the Department of Defense, I simply found that impossible to accept. A closed university is a defeat of all that a university must stand for. It must be open and it must not cease to operate, no matter what. So that was a very great conflict.

What will you leave the University as your legacy?

The major contribution that most of us can make to the future is our work with other people. Very few of us are like Moses or Christopher Columbus, whose deeds in themselves changed the world. At least we can influence a few people, who can continue to make it a better world to live in.

The spirit I would like to see continue and be evident for the next 50 years is the University's commitment to the basic qualities of people—their intelligence, their ability to learn, and their value systems—none of which are based on gender, race, or economic status.
Computer Program Helps Students Leap Hurdles of Electromagnetics

For someone who claims no heavy involvement with computers, Karl Lonngren has made a landmark contribution to instructional computer software. Together with graduate students Wee Beng Lim and Jamie L. Cooney, Lonngren has created MacEM, a program that helps students understand electromagnetic theory.

Lonngren, professor of electrical and computer engineering, says that in the past, he has used computers mainly for word processing. But with the help of Lim and Cooney, he took advantage of his students' familiarity with computers to make the difficult subject more accessible.

"The principles of electromagnetic theory tend to be nonintuitive and can be frustrating," Lonngren says. "We knew that most of our students were comfortable with their personal computers, and we used that as a way to get them over the first hurdle."

Lonngren says MacEM was not conceived to be an elaborate program. "The whole project started out as pretty much of a lark," he says. "The programs we wrote are really simple. In fact, we did them in Microsoft Quick Basic, which is regarded as a primitive programming language by the computer people in the department."

Lark or not, MacEM is taking off. Last fall it was added to the menu of software available on-line at workstations in the Iowa Computer-Aided Engineering Network, where student reaction to MacEM's 18 subprograms has been favorable.

"It's a big help," said one user, who had logged in and was entering changes in the value of the dielectric constants in MacEM's graphic representation of Snell's Law. "It's like having an electrical engineering lab at your disposal without having to do all of the setups or calculate all of the data. You can see what's going on pretty quickly."

The National Science Foundation and the Institute of Electrical and Electronics Engineers (IEEE) have recognized Lonngren's work with a grant for MacEM's continued development. The grant also will fund a nationwide distribution effort for the software, under the auspices of the University of Utah center for electromagnetic education.

Eventually, MacEM could be available at more than 300 sites, including IEEE societies and electrical engineering departments in academic institutions.

Lonngren, who has a joint appointment in the Department of Physics and Astronomy and researches nonlinear effects in basic plasma physics, has not let his software success go to his head. Indeed, he and his colleagues have not even attempted to copyright their program.

"We approached it from the beginning as an entertaining activity," he says, "and we are pleased that it seems to help people with the subject."

Continued on next page
George Lance, Expert On Control and Systems Dynamics, Retires

George Lance, professor of mechanical engineering, retired from the University at the end of the fall semester. He came to Iowa in 1961, after having taught at Case Institute of Technology and Washington University. He also had worked at TRW, Inc., and Moog Servocontrols.

In addition to teaching a wide range of mechanical engineering courses and working on numerous college and University committees, Lance served as acting chair of mechanical engineering from 1972 to 1974, as associate dean of the college from 1974 to 1979, and as chair of the engineering program from 1974 to 1985. He was awarded the University’s Hancher-Finkbine medallion in 1979, in recognition of his teaching accomplishments, and was named an ASME Student Section Outstanding Professor in 1986.

An expert in automatic control and system dynamics, Lance has worked as an outside consultant with several corporations. In recent years his research interests have focused on simulation of controlled mechanical systems and the modeling of hydraulic systems.

Lance received his B.S. degree in mechanical engineering and his M.S. in instrumentation engineering from Case Institute of Technology.

Student Activities

David L. Bonnet, a senior from Bussey, Iowa, was awarded a NASA Space Grant Undergraduate Scholarship for 1990-91. Teresa Grounds, a senior from Iowa City, and Buss Price, a junior from Burlington, won the same award for spring semester 1991.

Robert G. Schmitt and Jeffrey L. Haferman, both graduate students, received NASA Space Grant Graduate Fellowships for 1990-91. The awards are made by the Iowa Space Grant College Consortium.

Josh Jaeger, a junior from Iowa City, has received a one-semester undergraduate research fellowship from the U.S. Department of Energy’s Office of Energy Research. Jaeger has been conducting research at the Los Alamos National Laboratory this spring under the Science and Engineering Research Semester (SERS) program.

The MacEM menu (opposite page) lists subprograms that the user can select. Above, top to bottom, MacEM subprogram illustrations for Coulomb’s law; diffraction of a plane wave; arbitrarily placed charges on an electric field; and Lenz’s law.
**Alumni Awards**

- **Caroline Van Ingen-Dunn** (B.S. in BME, '83) has been elected to the board of directors of the Society of Women Engineers for 1990-92. She represents SWE members from a five-state region in the American southwest.
- **Joseph J. Musil** (M.S. in ME, '63) has won a Raytheon Corporation Excellence in Technology Award for designing a new line of Grayhound pavers. Musil is director of research and development for Cedarpads, Inc., a division of Raytheon that manufactures equipment for asphalt and roller-compacted concrete automated paving.
- **Joseph E. Musil** (B.S. in EE, '63) has been appointed to the editorial board of the Journal of Quality Technology. He is currently by the Education Society of the Institute of Electrical and Electronics Engineers (IEEE), which selected his paper "Noise figures as Best Transactions Paper for 1989."
- **Lt. Col. David E. Meer** (B.S. in EE, '72), assistant professor at the Air Force Institute of Technology, Wright Patterson Air Force Base, Dayton, Ohio, was honored recently by the Education Society of the Institute of Electrical and Electronics Engineers (IEEE), which selected his paper "Noise figures as Best Transactions Paper for 1989."
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**Faculty Awards**

- **Ching Jen Chen**, professor and chair of mechanical engineering, has been appointed to the editorial board of a newly formed organization, the Visualization Society of Japan. The society will examine flow visualization and related fields. Chen will contribute to the society's Atlas of Visualization, which will be published annually by the Pergamon Press of Oxford.
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Theodore F. Smith, professor of mechanical engineering, has received an honorable mention award from the American Society of Mechanical Engineers' Curriculum Innovation Program for his required senior-level course, "Thermal Fluid System Design."

Hsu-Pin (Ben) Wang, associate professor of industrial engineering, was named a 1990 Outstanding Young Engineer by the Society of Manufacturing Engineers (SME) at its annual meeting in Detroit last December. Wang was one of twelve who received the award, which recognizes research and educational achievement in manufacturing engineering.

Student Awards

Kelly L. Poort, a senior from Ottumwa, Iowa, with a double major in biomedical and electrical and computer engineering, recently participated in the annual Rhodes Scholar competition. Poort was one of six University of Iowa students chosen to compete at the state level and one of two Iowans to compete in the six-state regional competition. She follows in the footsteps of Laura Frey, who was a regional finalist last year, and Jeff McKinney, who won a Rhodes Scholarship in 1985. Both Frey and McKinney were biomedical engineering majors.

Palacharla Paparao, a doctoral student in electrical and computer engineering, was a finalist for the Optical Society of America's 1989 Newport Research Award.

What's New with You?

Help us keep up-to-date on what's new with you. Use this form to tell us about your current career status and professional activities.

☐ Please provide information on how I can help Iowa engineering students through the UI Alumni Association Career Information Network.

☐ Please send information about the Engineering Development Fund.

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Recent career information about yourself, or comments you'd like us to see: ____________________________
Winter sports  Todd Frisbie, a junior in mechanical engineering from Springville, Iowa, checks the ice layer laid for a research project at the Coralville Reservoir spillway. Frisbie worked at the spillway this winter with Wilfrid Nixon, assistant professor of civil and environmental engineering, to determine angles at which snowplow blades remove ice with the least amount of force. Nixon's project, funded by a grant from the Iowa Department of Transportation, could result in reduced use of road salt, which damages cars, bridges, highways, and groundwater. It also could result in savings on fuel needed for Iowa's snow removal equipment. "If less force is required, then less fuel is needed," Frisbie says.