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Scanning the Wafer  Graduate students Janet Lumpp (front) and Jerry Lee use a scanning Auger microprobe to analyze the metal line on a silicon wafer. The wafer rests in the microprobe's ultra-high vacuum chamber, where it is scanned. The metal line shows as a black vertical stripe against the gold background of the monitor and is represented by the peaked line on Lee's computer terminal. By observing the placement and height of the line's peaks, Lumpp and Lee determined that the metal on the wafer was tungsten; subsequent tests would determine the tungsten's purity. The analysis is instrumental in developing effective metal interconnects in integrated circuits. Lumpp is working toward a Ph.D. degree in chemical and biochemical engineering, and Lee is a Ph.D. student in chemistry (College of Liberal Arts). They work with Susan Allen, professor of electrical and computer engineering and of chemistry.
College Enjoys Consultants’ Praise, Takes Opportunity for Self-Appraisal

In spring 1988 the State Board of Regents initiated an organizational audit and hired the accounting firm of Peat Marwick Main and Company to conduct it. The audit encompassed many diverse topics, including the operation of the Board of Regents and board office, systemwide concerns, and institutional operations. Of greatest interest and concern to our college was the subject of “unnecessary duplication” of academic programs among the Regents institutions.

Engineering programs at Iowa and Iowa State underwent intense scrutiny. Each college prepared and submitted a report to Peat Marwick Main according to a prescribed format. Using these reports for background information, a distinguished team of external higher education consultants in engineering visited both colleges, prepared a report, and submitted its findings to Peat Marwick Main.

The team’s report on our college commented very favorably on the productivity of the faculty, the continuing efforts to focus college resources, the strong links between our college and other University units, and the importance of the college’s programs to the future of Iowa’s economy. The team found no unnecessary duplication of engineering programs at Iowa and Iowa State. As supportive as the engineering consultants’ report to Peat Marwick Main was for programs at both engineering colleges, it was known that Peat Marwick Main, in making their recommendations, would include “several additional factors” beyond those considered by the external consultant team.

Peat Marwick Main did submit to the Regents recommendations for changes in engineering programs at both colleges. The recommendations were revised by the board office and approved at the Regents’ October 1989 meeting. The action approved for our college was reduction of emphasis on materials engineering. This change was implemented by changing the title of a department and its graduate degree offerings and by eliminating a research center.

Although the audit produced a traumatic period of uncertainty for faculty, staff, and students, its final result is that there is no unnecessary duplication of academic programs at the two engineering colleges.

Through this opportunity for self-appraisal and review by external agencies, our college reaffirmed some of its principal objectives. That is, the college operates as an effective, efficient, and economical unit that offers high-quality educational opportunities, conducts research at the frontiers of knowledge, and serves the University and other constituencies in many diverse and important ways.

Clearly, our college has emerged from this examination with great strength. Moreover, we are confident that it is poised to advance toward our long-term aspiration of being included among the top ten public engineering colleges in the nation.

I invite you to visit the college at your earliest convenience. The faculty, staff, and I welcome the opportunity to renew acquaintances, to learn of your career experiences, and to personally demonstrate to you our commitment to achieving excellence in all of the college’s programs and activities.

Robert G. Hering, Dean

Continued on next page
Engineers Find Earthquakes, Ball Games Don’t Mix

Jerald L. Schnoor, professor and chair of civil and environmental engineering, and Gene F. Parkin, professor of civil and environmental engineering, found themselves in San Francisco last fall with a little time on their hands before the start of a Water Pollution Control Federation meeting. Luckily enough, there was a World Series game at Candlestick Park and the two baseball fans managed to find a pair of tickets. But the game they paid scalper’s prices to see turned into more—and less—than they bargained for.

Just as the two excited Iowans were riding an escalator to the stadium’s upper deck, they heard a rumble and felt the ground shake.

“I felt like I was on a water bed and somebody jumped on it,” Parkin says, adding that he remembers feeling dizzy and having his vision blur.

Parkin thought a subway was passing under the stadium. But when Schnoor looked up and saw a patch of sky suddenly appear in a yawning expansion joint, he made the appropriate deduction: The earth—not a subway—was shaking the stadium. Still, the pair thought the event might be only a minor quake. They went back to sleep.

“We had taken a cab to the park,” Schnoor says. “But we were very lucky, because right outside the park we found a number 9 bus that was heading back toward our hotels. The driver was wonderful. All the traffic lights were out and there were traffic jams everywhere, but he wound his way back in about 45 minutes.”

As the two approached the downtown area, they saw clouds of smoke from fierce fires raging in the Marina District.

“We remembered stories about the 1906 quake and how most of the casualties resulted from fires,” Schnoor says. “We kept wondering if we were doing something stupid by heading toward the city instead of away from it.”

Both spent the night in their hotel.

“I thought I was as safe on the 26th floor as I was in the lobby or out in the street,” Schnoor says. “At about four in the morning, there was a powerful aftershock and the building started making cracking and popping sounds. I thought to myself, ‘This was a dumb decision.’ But the building finally stopped cracking, and I went back to sleep.”

Parkin returned to Iowa the next day and Schnoor the day after that.

Neither has yet seen a World Series game, but both can claim to have been at the most famous World Series game that never was. They have the tickets—and the memories—to prove it.
Areas of Strength Shape College Goals

In 1988, President Hunter Rawlings appointed a Strategic Planning Committee to chart the future of The University of Iowa. This plan was completed early in 1990, and its overall goals for the University's next decades are suggested by its title, Achieving Distinction. An important part of the planning process was the simultaneous and coordinated development of strategic plans at each level of the University.

The strategic plan for the College of Engineering was developed by the Engineering Faculty Council, which worked closely with planning committees at the college's departments, institutes, and centers. A year and a half of discussions and dialogue produced a 14-page document that defined the college's mission and long-term aspirations and detailed a number of strategies and goals designed to realize them.

A. Jacob Odgaard, professor of civil and environmental engineering and chair of the Engineering Faculty Council, was involved in the planning process from its inception. Iowa Engineer talked with Odgaard about the development of the college's strategic plan and the future of engineering at Iowa.

IE: Would you say that in the future, the College of Engineering—as envisioned in the strategic plan’s statements of goals and aspirations—will be the product of major changes in direction or emphasis that were presented in the plan?

AJO: I would say no. In developing this plan, we followed the process used for the University’s plan and tried to identify and define current and emerging areas of strength on which to focus our teaching and research efforts. This kind of focus is essential today to produce an efficient return on investment. It is a simple fact of life that the areas in which you excel and gain prominence tend to attract higher levels of external support than areas in which you are back with the pack.

Through the planning process, we were able to define the college's strengths more clearly, both for ourselves and for those on the outside. The result is a better expression of our existing mission and of how we can meet the objectives of that mission. You have to build on your strengths, and we are doing that.

The long-term aspiration defined in the plan is quite easily stated: We want to position ourselves very solidly among the nation’s top ten public engineering colleges, in a range of categories that measure a school’s contributions to education, research, and public service. Our report provides a table showing that, except in external research expenditures, we are already doing well in most of the statistical categories. If you project recent trends in external funding into the future, we are improving rapidly in that area as well. So no major changes are called for.

IE: In the table you mention, Iowa stands out as being at or near the top in areas such as scholarly publications and graduate degrees per full-time equivalent faculty member. The most striking statistic, however, is Iowa’s relative size among its peer group, which includes some of the largest high-quality engineering schools in the nation. The next smallest public engineering college on the list of comparable state schools is Arizona, with a faculty of 171—almost two-and-a-half times the size of Iowa’s. Is there any plan to change this?

AJO: No. The consensus was that our physical and human resources simply cannot accommodate more than our current level of 1,200 undergraduates. That figure allows us to continue offering a complete engineering curriculum. It means that required courses can be offered at a complete engineering curriculum. It means that required courses can be offered at a
Excerpts from the Strategic Plan

Long-Term Aspiration

The long-term aspiration of the college is to achieve a quality and level of performance in education, research, and service programs that are characteristic of the top ten public engineering colleges in the nation.

Mission Statement

The mission of the College of Engineering is to serve the citizens of Iowa, the nation, and the world by disseminating, developing, transferring, and preserving technical knowledge that may be used to improve people's lives. College faculty, students, staff, and administration join to:

• provide a well-rounded and superior engineering education that attracts outstanding students at both the undergraduate and graduate levels in selected engineering fields by drawing upon the broad resources of a comprehensive research university;
• conduct high-quality research in selected areas so that faculty and students will keep pace with new developments and that the newest concepts will be taught in courses;
• serve the needs of the University, industry, government, and the people of the state, nation, and world by making the college's facilities and faculty expertise accessible to these constituencies.

Strategies and Goals

Goal 1: Provide a well-rounded, superior, and contemporary engineering education at both the undergraduate and graduate levels.
Goal 2: Conduct high-quality research in selected focus areas.
Goal 3: Achieve distinction for departments and research units of the college.
Goal 4: Achieve a diverse faculty, staff, and student body.
Goal 5: Increase public awareness of college achievements and strengths.

faculty/student ratios in line with the top-tier schools. That, of course, will take money—which is scarce—but the kind of improvements we are talking about will be made easier with this addition.

IE: What about the argument that economies of scale favor a larger institution in order to save taxpayers' money?

AJO: Those arguments come up every few years. They can be a problem, but they aren't supported by the facts. For instance, at our current level, with 20 percent of the engineering faculty at the two state-supported engineering schools, we award 20 percent of the state's undergraduate engineering degrees and 50 percent of its graduate degrees. In addition, we are responsible for 50 percent of both nonstate research funding and scholarly publications.

These impressive figures result from a variety of factors, but they certainly signify an efficient use of funds, a dedicated faculty, and a fine return on the state's investment.

IE: How important is the college's location in Iowa City to the goals outlined in the plan?

AJO: It is central. The plan calls for concentration of effort in focus areas that already have gained national and international prominence for Iowa. Many of these areas became strong as a direct result of collaborations and associations with other University of Iowa departments and disciplines. Being at a major research university and medical center like Iowa

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College Plan, continued

offers intangibles that enrich an engineer's education and research opportunities.

In the same way, having a top-flight, well-rounded engineering college on campus makes an invaluable contribution to the rest of the University community. We have engineers at all levels who are working with artists, musicians, lawyers, economists, dentists, and physicians. This sort of community, this day-to-day intellectual cross-pollination, has become very rare in the world today, just at a time when formal barriers between disciplines are becoming less distinct by the minute.

The environment here has helped to create a university that is greater than the sum of its parts. People are drawn here from all over the world because of it, and the diversity that results is a real component of the education we offer. Extending and developing that diversity in the college is one of the goals we talk about in the plan.

IE: What about weaknesses? Does the plan mention specific areas that need to be upgraded in order to achieve the distinction you are seeking?

AJO: Yes. As I said earlier, we have not reached our potential in externally funded research, and we need to work harder to define and publicize those areas that deserve greater support. Also, it's no secret that the state has been through some hard times in recent years. As a result, our resources are stretched pretty thin; this shows up in a number of ways. Our last accreditation review noted that we had a "total workload at the outer limits of faculty and staff capability."

And then there is the question of physical space. Our need for offices, larger classrooms, and labs is at a critical level, and this is hurting us in many ways. Again the solution is money, and again money is scarce, but we need to make our case to the University and the state that achieving the diversity that results is a real component of the education we offer. Extending and developing that diversity in the college is one of the goals we talk about in the plan.

IE: One goal listed in the plan involves increasing public awareness of the college's achievements and strengths. How crucial is this goal?

AJO: Very crucial. We need to do a much better job of making our case if we want to survive. Money is too scarce for taxpayers to support something they don't know much about. It takes time, but we—and I mean faculty, students, alumni, and friends—need to foster an awareness around the state and nation of two things: how badly this country needs engineers, and how good a job we are doing here at Iowa to meet that need.

We hope that down the road, when the people of Iowa hear the college mentioned, they will nod their heads with pride, because over in Iowa City their taxes have built something they can really be proud of—a moderate-sized engineering college that is one of the strongest in the country, a place where their sons and daughters are working every day with world-class minds on some of our toughest technical problems.

IE: It sounds like an exciting place.

AJO: It is an exciting place.
Senior Enjoys Research Fellowship, International Laboratory as First Japan Study-Abroad Scholar

Ross Wakai took an all-expense paid trip to Japan last summer without winning a lottery or a television game show.

Wakai, a biomedical engineering senior from Honolulu, spent three months in Japan as the first recipient of the College of Engineering's Summer Study-Abroad Experience in Japan Scholarship. The program is sponsored by The University of Iowa, Tokyo Denki University, and a group of American and Japanese corporations.

"It was quite fine," Wakai says, "because I could work in research, socialize with the students, go sight-seeing, and learn more about the culture."

During the first two months in Japan, Wakai read the available scientific literature on nonlinear dynamics and chaos, did computer programming based on mathematical models of biological systems, and observed other research projects.

"It was very similar to undergraduate research here in the States," he says. "It was very comparable in quality, but certainly the atmosphere was different."

"There was a large group of students working on related projects, and they all know each other very well. It was a much tighter group, a closer family feeling in the lab," he says.

Wakai had studied Japanese in high school and quickly adjusted to hearing and speaking Japanese.

"A lot comes back," he says. "It was just a matter of remembering all the vocabulary and picking up on the more colloquial expressions that they use."

Wakai is happy to have had an experience that most people don't get until they are graduate students.

"It certainly opened my eyes to how important it is to be international, especially in science. There's a lot going on in biomedical engineering, so it really is becoming an international laboratory."

This year five freshmen—all women—were selected to participate in the Japan summer program.


The new Japan scholarship winners are Tracy L. Curtis, Inver Grove Heights, Minnesota; Jennifer J. Lentz, Minooka, Illinois; Julene M. McCoy, Forest City, Iowa; Amy L. Miller, Topeka, Kansas; and Lynn McAleece, Sioux Falls, South Dakota.

Professor Emeritus Donald Lee Spencer Dies

Donald Lee Spencer, associate professor emeritus of mechanical engineering, died last October at age 69. Spencer was a distinguished teacher and scholar at Iowa. He also taught at Duke University, the Air Force Institute of Technology, the University of Minnesota, the Universidad Federalico Santa Maria, Chile, and in Argentina on a senior Fulbright-Hays Lecture Award.

Spencer earned his bachelor's and master's degrees from the University of Iowa and his Ph.D. from the University of Minnesota. He was a major in the U.S. Air Force, serving in World War II and Korea.

Most recently Spencer did research in solar energy and invented a flat plate solar collector. He was a member of Pi Tau Sigma, Tau Beta Pi, Sigma Xi, ASHRAE, the American Solar Energy Society, and the International Solar Energy Society. He retired from the University in 1986.

Spencer is survived by his wife, two daughters, three sons, two brothers, two sisters, and ten grandchildren.

He will be missed by his former colleagues, his students, and his many friends. Memorial donations may be sent to the American Friends Service Committee, 4211 Grandview Avenue, Des Moines.
Student Activities

- Tamara Kruepnel, a senior from Ames, received the 1989-90 award from the National Cash Register Company as the most promising student in electrical and computer engineering.
- Ryan J. Meinert, a junior from Ankeny, received the first Hamilton Medical Scholarship. The award is given to a UI student with mobile impairment.

Industrial and Management Engineering

- Scholars Edward Szczeklicki, from the Technical University of Gdansk, Poland, and Chung Young Kim, from National Defense College, Korea, are visiting the department this year.

Faculty Activities

- Andrew Kusiak, professor and chair, was elected general chair of the Conference on Applications of Artificial Intelligence in Manufacturing held in London this March. Kusiak's book Intelligent Manufacturing Systems was published by Prentice-Hall in January. He also was named to the international editorial board of International Journal of Computer Integrated Manufacturing.
- Edward Mielnik, associate professor emeritus, has sent his book on manufacturing processes to McGraw Hill Co. for publication.
- Dennis Bricker, associate professor, was on leave from teaching duties during the spring semester in order to develop hyperertext materials and computer algorithms for his courses. He will travel to China and Korea in late spring and summer before returning for the fall semester.
- James Buck, professor, continues his research on development of an engineering model of lower-order cognitive tasks, which will make possible predictions of performance accuracies and time averages as well as variations in and between individuals. He also is studying the performance of managers and designers and the possibility of applying computer-aiding techniques to issues of managerial problem solving.

- Joseph J. Pignatiello, associate professor, is working on several research projects in the manufacturing area of quality engineering. His work includes on-line monitoring techniques intended to improve manufacturing processes involving multiple quality characteristics.

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Seeing Spots Is The Heart of This New Computer Diagnostic Technique

Spots on the heart, in most cases, are something you don't want to see on a medical X-ray. But for University of Iowa researchers, spots may indicate a bright future for a new diagnostic technique.

David Fisher, doctoral candidate in electrical and computer engineering, and Steve Collins, professor of electrical and computer engineering and of radiology, are using magnetically generated spots for noninvasive study of the human heart. Funded by a $27,000 Iowa Heart Association grant and a Whitaker Foundation grant, their work endeavors to show how computer technology can be used in cardiac analysis.

"The basic idea is that the computer can help gather visual information about the heart and, in some cases, can extract information from images that could not be obtained visually," Collins says. "This particular project is related to the need to assess the motion of the walls of the heart."

The technique uses magnetic resonance imaging (MRI), a new technology that has revolutionized radiology. MRI uses a powerful magnet to align protons in the body. Then a radio transmitter is used to flip the angle of proton orientation. When the transmitter is turned off, the protons wobble back toward their original positions, emitting a signal that is used to generate an image.

Fisher has modified an MRI machine to magnetize the heart in a grid-like pattern, marking the points where perpendicular lines intersect with spots for use as reference points.

The UI researchers obtained their first heart images last fall and already have revised notions of how the healthy human heart works. Previously it was assumed that the walls of the heart expand and contract symmetrically, much the way ink spots on a balloon's surface move during the balloon's inflation. But the images generated by Collins and Fisher show that the magnetic spots on the heart's walls also twist.

"You can see the twisting motion of the ventricle," Fisher says, pointing to a computer screen where pictures appear in rapid succession. "If we just had a conventional image here without the markers, you would see the structure, but you wouldn't have any landmark to track its motion, so you couldn't tell if it is twisting or what it is doing."

Collins says that even surgery fails to provide a true picture of heart motion.

"You can imagine that if you were to open up a person's chest, the heart motion might not be completely representative of the heart motion of a person whose chest has not been opened," he says.

Collins says his first impression of the MRI images obtained by his student was one of surprise: "I was impressed that Dave managed to get such good results as quickly as he did. My second thought was, 'I knew we were really on to something.'"

Fisher and Collins say that the next step in the research project is to improve their computer algorithms in order to detect spot locations and track their motion during the heartbeat. Such work would make the system clinically useful. Now it takes several minutes to process the images, but Collins and Fisher say they can reduce the time to seconds.

Cross-sectional magnetic resonance image of the human heart with a magnetically induced grid of dark stripes superimposed; the white spots, which mark the computer-detected stripe intersections, are used to track the motion of the cardiac wall as the heart contracts.
Fisher says the technique is so new—it was introduced about a year and a half ago by researchers at Johns Hopkins University and the University of Pennsylvania—that there are no standards for comparing it to similar work. He expects UI researchers to help set those standards.

University of Iowa researchers collaborating with Collins and Fisher on the project are James Ehrhardt and William Stanford, professors of radiology, and James Martins, professor of internal medicine, all in the College of Medicine.

by Gary W. Galluzzo

Collins (left) and Fisher look at films of images tracking the movement of the heart, generated by their new magnetic resonance imaging diagnostic technique.

College Gifted with High-Speed Computing Power

A gift from Hewlett-Packard Company will give Iowa engineering students and faculty access to computer equipment with high speed computational power and one of the fastest graphics systems available.

Through the UI Foundation, Hewlett-Packard has donated two personal “super” workstations worth more than $500,000—one each to the Iowa Computer Aided Engineering Network (ICAEN) and the Center for Computer Aided Design (CCAD).

Edward Haug, professor of mechanical engineering and CCAD director, says Hewlett-Packard’s Apollo DN 10,000 VX represents “a whole new technology in workstations. With this equipment, we will be able to design and study three-dimensional mechanical equipment faster, more realistically, and more accurately than ever before. It can function as a self-contained unit or be used to drive several million dollars worth of existing equipment.”

The system’s graphics package will allow Iowa engineers to interact with the animated simulation of a system—for example, a car swerving to avoid an object in the road, study effects of changing the design, and detect design flaws.

Undergraduate students will use the new equipment primarily for mathematical computations, while graduate students and faculty will use the graphics package for design and simulation projects.

The workstations will arrive at the college early this summer.
Advisory Board Lauds Dean for Promoting Faculty Excellence, Students’ Academic Prominence

University President Hunter Rawlings made a surprise appearance at the October meeting of the College of Engineering Advisory Board to present an unsuspecting Robert G. Hering, dean of the college, with a plaque acknowledging the board’s appreciation for Hering’s outstanding service as dean.

The plaque expressed appreciation for Hering’s contributions “during a time that has seen significant strides in the quality of the college.” It went on to cite Hering’s instrumental role in raising the level of excellence of the faculty to lead the Big Ten in scholarship on a per capita basis, and in raising academic standing of the college’s undergraduates to prominence at the University and across the nation.

The plaque also expressed anticipation of future excellence resulting from Hering’s continuing service to the college.

Dean Hering came to Iowa in 1971 and served as chair of mechanical engineering before becoming dean in 1973.

The advisory board was established in 1966. Its 16 members represent a broad spectrum of engineering experience and expertise and serve as a link between engineering education at the University and professional practice.
Two from College Are Rhodes Finalists

Laura A. Frey, a senior biomedical engineering major from Iowa City, was one of two Iowa finalists chosen this year to compete for a Rhodes Scholarship against ten other candidates from the middle west region. Frey was one of two engineering graduates among twelve Iowa Rhodes finalists. Joel K. Hanson, a senior industrial engineering major from Altoona, was also among contestants interviewed in Des Moines by the Rhodes committee.

Frey was not one of the four winners at regional finals in Minneapolis, but the strong showing she and Hanson made continues a trend of Iowa engineering graduates doing well in the competition.

"It's always a disappointment not to win," Frey said, "but it was exciting to go that far."

Rhodes Scholarships recognize intellectual and academic excellence, integrity, leadership, and character. The honor was one of many Frey earned during her career at The University of Iowa. She previously won the 3M scholarship for merit in the College of Engineering, a UI Dean's Scholarship, and a four-year Gannett Foundation Scholarship. Last year she was one of 36 students nationwide invited to attend the NASA Space Life Sciences Training Program.

For the past two years she has worked fifteen hours a week in a cell membrane physiology lab at the College of Medicine. She is president of the Society of Women Engineers and has been active in developing outreach programs for high school students. She plans to pursue graduate study in bioengineering at the University of Washington.

Hanson received a Dwight D. Gardner scholarship for 1989-90 from the Institute of Industrial Engineers and last summer was an intern for Hewlett-Packard. He has been awarded a Tau Beta Pi fellowship for 1990-91 and will pursue graduate study in industrial engineering at Iowa.

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 send information on how I can help Iowa engineering students through the UI Alumni Associations Career Information Network.

☐ Please send information about the Engineering Development Fund.

Name ________________________________

UI Degree(s) and Years ____________________

Home Address ________________________________

Place of Employment ________________________________

Position Title ________________________________

Work Address ________________________________

Recent career information about yourself, or comments you'd like us to see: ________________________________
Rippes—Believe It or Not!

Doug, Mark, and Kurt Rippe, from Cedar Falls, have more in common than being brothers: They've all attended the UI College of Engineering.

While Doug was studying electrical and computer engineering, Mark enrolled in mechanical engineering because of Iowa's specialized programs and low student/teacher ratio.

"We'd study together, and he'd tell me about the courses I'd be taking," says Mark, a sophomore.

Doug now works at AT&T in Chicago, but the tradition of two Rippes at The University of Iowa continues, with Kurt enrolled as a freshman in electrical and computer engineering.

"Now I do for Kurt what Doug did for me," Mark says.

"Turning to a brother for moral support is a luxury," Kurt says. "And we can still get advice from Doug via electronic mail through the College of Engineering and AT&T."

by Dan Zinkand