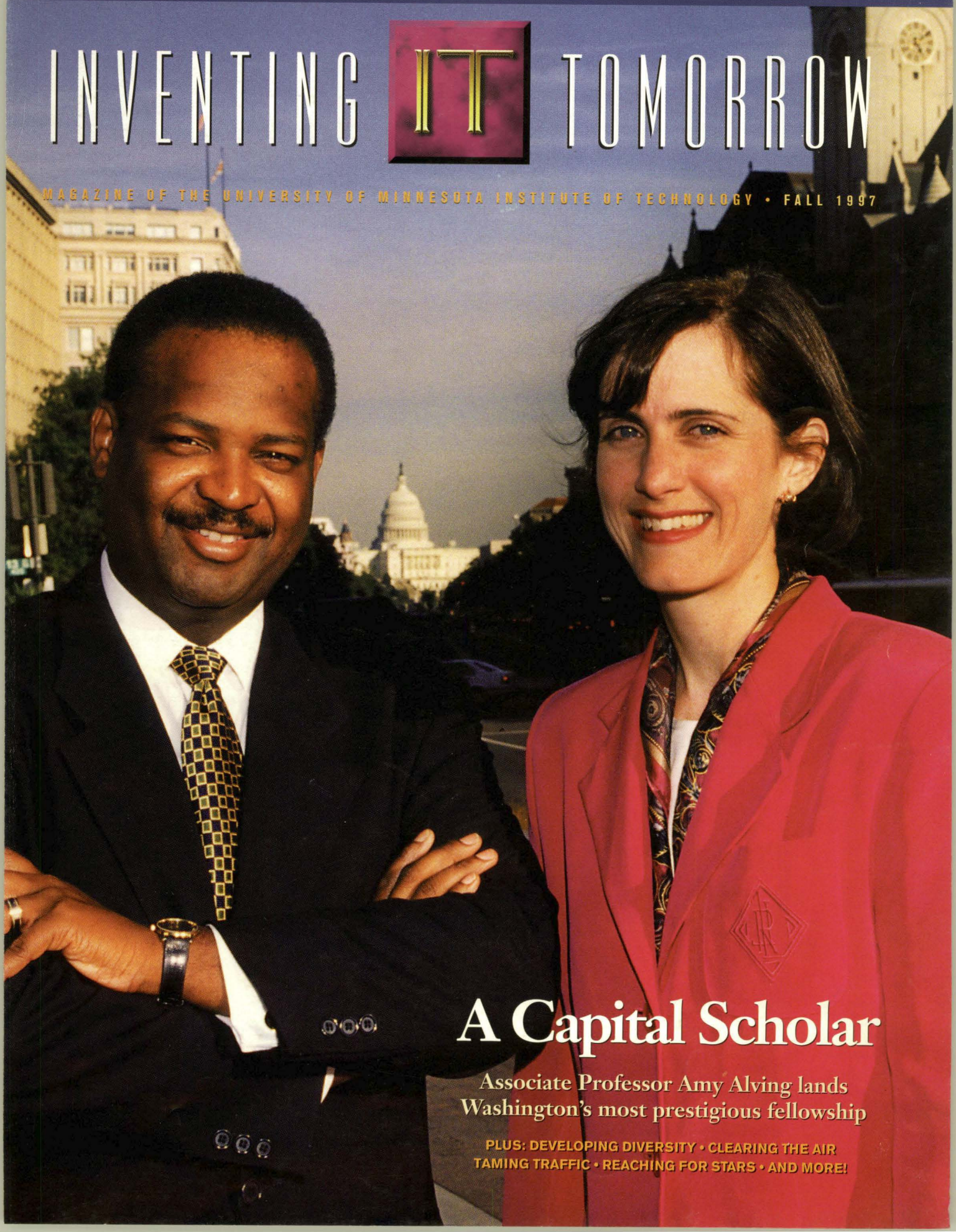
UNIVERSITY OF MINNESOTA INSTITUTE OF TECHNOLOGY

INVENTING IT TOMORROW

MAGAZINE OF THE UNIVERSITY OF MINNESOTA INSTITUTE OF TECHNOLOGY • FALL 1997



A Capital Scholar

Associate Professor Amy Alving lands Washington's most prestigious fellowship

PLUS: DEVELOPING DIVERSITY • CLEARING THE AIR
TAMING TRAFFIC • REACHING FOR STARS • AND MORE!

INVENTING TOMORROW

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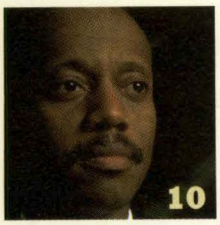
FEATURES

A Capital Scholar

On the Cover: President Clinton has named Associate Professor Amy Alving to a White House Fellowship, one of the nation's most prestigious honors. She will spend her year in Washington working with Deputy Commerce Secretary Robert Mallet (pictured with Alving, right).

Story on page 28



DEPARTMENTS

GIVING

ALUMNI

COVER PHOTO BY RONALD BELL

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The mission of IT is to provide programs of instruction, research, and service that are appropriate to a research university and that are responsible to the needs of the state, its citizens, and the nation.

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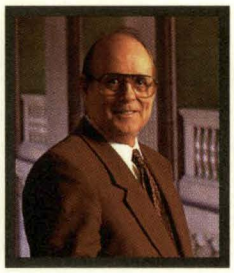
Digital Technology

IT will play a key role in reestablishing Minnesota's preeminence

DIGITAL TECHNOLOGY PERVADES EVERY aspect of modern life. From home entertainment systems, Internet commerce, and cellular phones to the high speed computers and powerful software used to design machinery, vehicles, buildings, and clothing, digital technology has revolutionized industry, entertainment, education, and commerce.



H. TED DAVIS

During the 1960s and 1970s, companies based in Minnesota — namely Control Data, Univac, Honeywell, Cray, Burroughs, and IBM — dominated the digital technology industry. Although Minnesota lost much of its advantage to Silicon Valley during the personal computer revolution, the state has an ambitious plan to reclaim its leadership in digital technology, and IT and the University will play a key role in making it happen.

A major step in that plan was the Digital Technology Summit, a conference organized by the University, the Minnesota High Technology Council, and the Minnesota Office of Technology. The summit, a brainchild of University President Mark Yudof, drew more than 700 representatives of industry, government, and education from around the nation to examine the current state of digital technology, assess the trends and challenges of the future, and determine how we can work together to reclaim Minnesota's preeminence in computer and digital technology in the world of "new media" and the networked, global information economy. Through the summit, we identified Minnesota's strengths (and potential strengths) and laid the groundwork for exciting new partnerships and collaborations between the University and the community.

The next step in the plan is the creation of a Digital Technology Center to provide a stronger focus for the University's digital technology initiatives. We at the University are working with industry and government to develop a proposal for the creation of this exciting new center, which will integrate teaching, research, and outreach in digital publishing, computer graphics and visualization, telecommunications, data storage and retrieval systems, digital commerce, multimedia and media integration, digital design and advanced manufacturing, scientific computation, and other digital technology fields.

The Digital Technology Center will be located in Walter Library as a part of President Yudof's bold plan for renovation and historical preservation of the Northrop Mall. The center will house several of our existing programs, including the Minnesota Supercomputer Institute, the NSF Geometry Center, the Laboratory for Scientific and Engineering Computations, the Science and Engineering Library, and work space for faculty from several schools and colleges. Moreover, it will bring together digital technology experts from around the University to foster cooperative, interdisciplinary collaborations between IT and other colleges and between the University and the greater community.

This center will also embrace the University's land grant mission and its commitment to improving the quality of life for all Minnesotans. Under the auspices of University College, facilities within the center will be used to extend opportunities for continuing education, teleconferencing, and workshops and short courses. Space will be available for industrial fellows to carry out collaborative research programs with University researchers in the center, and summer programs will enable teachers and students from Minnesota's other educational institutions to carry out research in digital technology.

In addition to the Digital Technology Center, President Yudof has proposed 11 new faculty positions to further enhance IT's programs in digital technology. We will fill these positions with top-notch experts in computer science, computer engineering, and the computational sciences — researchers and teachers who will complement IT's existing strengths.

Like the major waterways that brought prosperity and development to the region in the 19th century, converging information highways in Minnesota have the potential to bring prosperity and development to the state in the 21st century. We at the University and IT stand ready and committed to see that it happens.

H. Ted Davis

H. Ted Davis
Regents' Professor and Dean

DAVIS PHOTO BY PATRICK O'LEARY

Readers respond to 'A History of Women in IT'

EDITOR'S NOTE: Our Spring 1997 feature on "The History of Women in the Institute of Technology" from the *Technolog* drew a tremendous response from our readers. Here is a sampling of the letters we received.

I was pleased to read your article about women in IT — especially the part about the two who went to the civil engineering summer camp. When I registered for summer surveying camp in 1955, I was told they would have to make special arrangements for me. It gave me the impression that I was the first to do so. Can you find out how many women did go between 1924 and 1955? Was the camp always held at Grand Rapids?

– JEAN MCCALLUM
(Civil '59) Ortonville, Minnesota

Alas, we couldn't find complete records from that era. However, if any of our readers have information or stories about the camp, we'd be happy to pass them along. – *Ed.*

It was with great interest and pleasure that I read your article on "A History of Women in the Institute of Technology" in the Spring issue of *Inventing Tomorrow*. Just noticing the reference to the *Technolog* brought chills and a sense of joy which lasted for almost an hour. I hope the '*Log* is alive and well — and shall remain so for many years.

Since you used the *Technolog* as a reference source, I thought your research might have uncovered some other facts about women — or at least one woman of note.

It turns out that I was the editor of the *Technolog* during 1944-45, the silver anniversary year of the magazine. We made an appeal for staff, and luckily a terrific gal by the name of Doree Most answered. She was in fact majoring in engineering. She served in several important positions, working her way up. I was happy to recommend and endorse her for editor of the *Technolog*. She was elected and became the first woman editor in 1946. How about that! And we didn't even know about the "women's movement" yet.

Looking back 50 years, I really can't think that all men were sexist. I don't believe I was. Admittedly, the overwhelming majority of students in the engineering colleges were men. But seeing a person like Doree was an important event. I personally tried to help her as much as I could, and I think the rest of the staff had the same feeling.

– HARRY BRENNER
(Aeronautical '45) Los Angeles, California

When Doree (Most) Gamble didn't turn up in our alumni database, we feared that she was among the thousands of alumni with whom we'd lost touch with over the past several decades. As it turns out, Gamble transferred from IT into University College in 1947 to design her own degree program in technical journalism. That move, inspired in part by her groundbreaking term as the *Technolog*'s first female editor, allowed her to pursue a degree that incorporated both engineering and journalism.

Doree (Most) Gamble in 1946

We found Gamble living in Roseville, Minnesota, with her husband, Elbert, a 1952 graduate of the Medical School. She has fond memories of her days in IT, which also included terms as editor of the *Gopher* yearbook and chair of both the *Technolog* board and the student government "Tech" party.

As the *Technolog*'s first female editor, Gamble endured good-natured pranks from the men on her staff. "From time to time the fellows would insert a typographical error that had a double meaning," she recalls. "They had a lot of fun with that, but I have vague recollections of having to appear before the dean to explain. Needless to say, he was not amused."

Gamble graduated in 1948, and her unique degree in technical journalism quickly earned her positions with Sylvania Electric and later with Honeywell. She left the field in 1952 to raise her family and has since occupied her time with volunteer work. "Between my family and my volunteer work, I've had all I needed to do," she says. – *Ed.*

About the early ladies in engineering: Your story omits Viola Sommermeyer, who was denied her engineering degree only because she was a girl. The following account is from page six of my book, *Vi and Mam* (1979):

"To attend the University of Minnesota, Viola walked six miles round-trip each day to the campus, and worked at part-time jobs, first in a city branch library and later in a laboratory of the University Medical School. She enrolled in a five-year chemical engineering program, and as electives took biology and other pre-med subjects.

"In her third year, Dr. Hunter, in charge of enrollments in chemistry, refused Viola permission to take elective courses in the Medical School. That would complicate his schedules; he wanted 'regular' students. But Dean Lyon of the Medical School proved sympathetic. He admitted her for one year as a 'special' and let her fill out her 'medical' program with her chemical engineering subjects..., but in the end she was offered only a degree in chemistry. Engineering degrees were not for girls.

"Two weeks before graduation, Viola landed an engineering job. Busy with her new job and irate at being cheated out of her engineering degree, she skipped the graduation ceremonies. That was 1918. By 1928 she mellowed and attended a graduation to receive her degree."

– KARL SOMMERMEYER
(Electrical '30) San Diego, California

Inventing Tomorrow welcomes your letters! See page two for contact information.

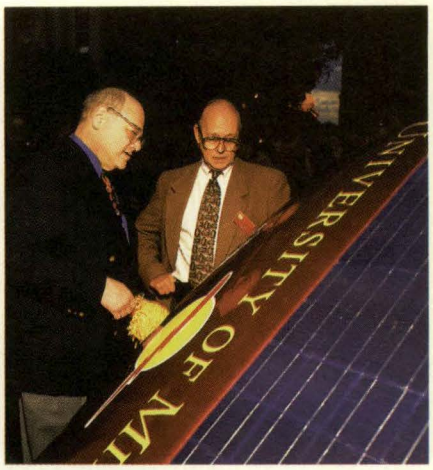
PHOTO FROM THE 1946 *MINNESOTA GOPHER*

Inauguration puts Yudof in the driver's seat

As the University formally welcomed Mark Yudof as its 14th president, IT played a prominent role in the inaugural pomp and pageantry.

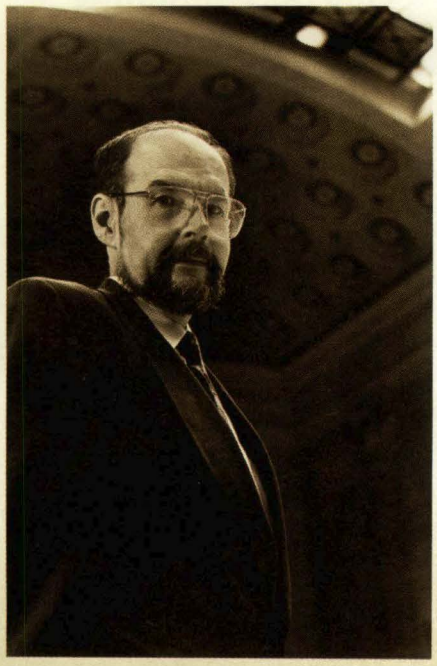
During the weeklong festivities October 13-17, students from the University's solar vehicle, concrete canoe, and formula car projects gave Yudof a firsthand look at their work. Later the president was treated to a full-contact presentation by Professor Dan Dahlberg and the Physics Force (see page 12).

At the end of the week, Dean H. Ted Davis and IT's other Regents' Professors donned academic regalia and joined representatives from 450 academic institutions for the October 17 installation ceremony.



University President Mark Yudof takes the driver's seat in the IT formula car (left) and examines the solar car, Aurora³, with Dean H. Ted Davis (above) and during the inauguration week activities.

Miller returns to mathematics; Crouch named associate dean



Professor Willard Miller was recently named director of the Institute for Mathematics and Its Applications.

One of IT's top administrators has left the dean's office to resume a more active role in his academic discipline.

Professor Willard Miller, IT's associate dean for finance and planning since 1994, returned to the School of Mathematics in September to direct the Institute for Mathematics and Its Applications (IMA).

Miller, who also served as IT's acting dean for much of 1995, has had a long association with the IMA. He headed the School of Mathematics when the institute was proposed to the National Science Foundation in 1979 and became its associate director in 1987. He served in that position for seven years before joining the dean's office staff.

A mathematical physicist, Miller studies the use of symmetry methods — particularly Lie groups and Lie algebras — in the analysis of the structure of physical theories. He has written extensively on topics in special function theory, separation of variables, and quantum algebras. He replaces Regents' Professor Avner Friedman as director of the IMA.

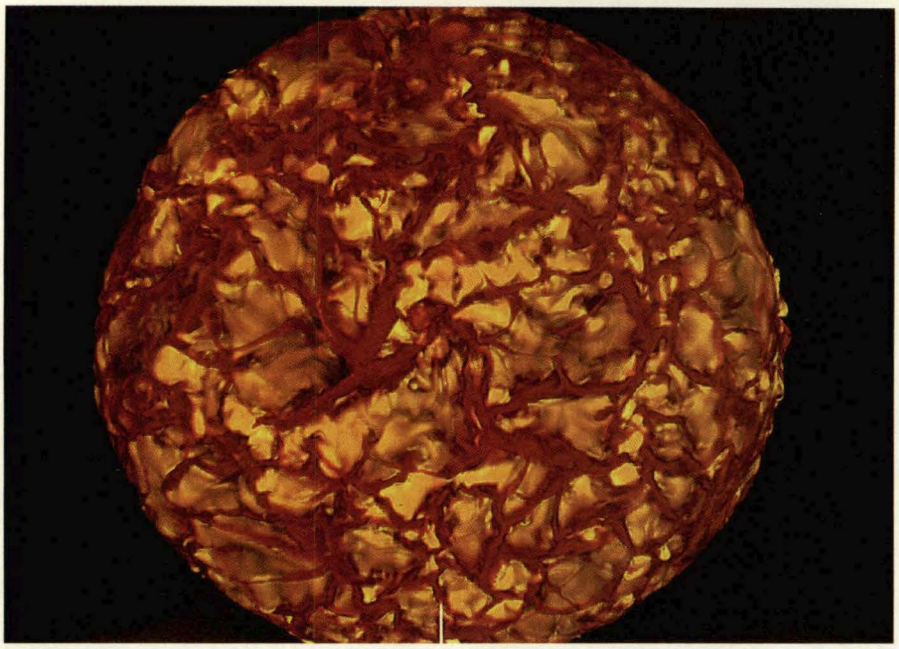
Steven Crouch

Dean H. Ted Davis praises Miller for his leadership role in the college. "Willard came to IT at a crucial time and served the college well," says Davis. "We are sorry to lose him, but he is answering a calling that is important to him."

Professor Steven Crouch, who previously served as head of the civil engineering department, replaced Miller as associate dean for finance and planning. The search for Crouch's successor in civil engineering is underway.

— Paul Sorenson

YUDOF PHOTOS BY DANIEL KIEFFER; MILLER PHOTO BY BURTON HAUN; CROUCH PHOTO BY PATRICK O'LEARY



This image is part of a three-dimensional simulation of convection in a rotating model star developed at the Laboratory for Computational Science and Engineering.

LCSE team generates groundbreaking high-resolution 3-D computer simulation

Recently, researchers at IT's Laboratory for Computational Science and Engineering (LCSE) achieved a major advance for both large-scale computing and stellar physics. Using the latest generation of parallel supercomputer, an SGI Cray Origin 2000, the laboratory's researchers have generated a high-resolution, three-dimensional simulation of a convection in an entire rotating model star.

This event marks two special achievements for LCSE. First, the simulation opens the way for calculations that may illuminate detailed dynamical processes leading to the development of differential rotation in stars. Moreover, it also demonstrates that computers built from clusters of multiprocessor parallel machines can operate as efficiently as single supercomputing systems.

In large multiprocessor systems such as the Origin 2000, each group of processors sharing a common memory is simultaneously advancing a different portion of a given task. This method of attacking a problem in parallel is how the computer attains speed and efficiency.

David Porter, a member of the LCSE team says that until now the laboratory had only been able to model small patches near the surface of a star. "Here we're modeling the whole star, and a rotating star no less."

The laboratory has ambitious plans for the simulation system, including utilizing a new NSF network to cooperate on larger applications like the stellar convection problem. For example, the Sun is known to rotate more slowly near its poles than at its equator. A large-scale effort involving the laboratory's simulation would allow researchers to understand how such a differential rotation develops in a star.

Porter admits he's excited about the project. "This is the beginning of a whole new class of simulation that we'll be able to do." IT

— Joel Meyer

U to pioneer Internet 2

The University of Minnesota will be one of the first travelers on the next generation of high-speed information highways. Launched last year by a consortium of 34 universities, Internet 2 now boasts more than 100 schools dedicated to creating a faster, more dependable network of educational and research institutions. As a founding member of this group, the University received a $350,000 NSF grant and a $1.5 million matching grant from the Minnesota Legislature to help stake a claim on the new, congestion-free system. University officials say that initial use of Internet 2 will be reserved for tasks such as high-performance computing and sophisticated image analysis. The project is part of President Clinton's Next Generation Internet Initiative, a push towards connecting national labs and universities through networks that are up to 1,000 times faster than today's Internet.

Study: women make shorter commutes

Research from the Center for Trans-portation Studies suggests that the time people spend commuting to and from work each day depends on their gender. Research assistant Elvin Wyly examined employment and travel patterns and found that married women who have children travel significantly shorter distances to work than married men. Wyly also determined that single, childless women are more likely to travel farther each day than married women. He suggests that married women who have children tend to look for employment closer to home. In turn, this narrow geographic area decreases the earning potential and variety of positions available to these women, particularly those in outer-ring suburbs.

SIMULATION PHOTO COURTESY LCSE; PHOTO ILLUSTRATIONS FROM FILE

IT lab aids in search for scratch-free surfaces

BUYERS OF MONSANTO'S DIAMONEX DIAMOND-COATED eyeglasses can thank IT's Micromechanics Laboratory for performing the tests that demonstrated the new product's value. Although the coating is only 40 millionths of an inch thick, it greatly improves the lens' scratch resistance.

The lab's instruments are designed to scratch and dent surfaces for both industry and science in order to help researchers produce more durable and scratch-resistant materials.

One instrument, called an atomic force microscope with triboscope, was designed by University researchers and Hysitron Inc., a Minneapolis company.

The triboscope, which has been sold to about a dozen labs worldwide, has a diamond tip 4 millionths of an inch wide and is used to indent surfaces.

The tip is controlled by a piezoceramic actuator. Piezoceramic is a material that expands when electricity is passed through it, thus allowing researchers to control precisely the indentation depth.

Because the triboscope is mounted on an atomic force microscope, images now can be made before and after the indentation without moving the material.

The triboscope was recently hooked up with three other instruments to create a nanomechanical test bed.

"What this nanomechanical test bed is designed to do is evaluate surface mechanical properties of polymer films or substrates," says William Gerberich, a professor of chemical engineering and director of the lab.

Polymer films are used in photographic film and computer chip manufacturing. A substrate is the base material of a computer chip.

To prevent the polymer surfaces of a film from sticking together when it is rolled up, silicon particles are applied to the film's surface.

"They provide a slight air gap between the two layers of film," Gerberich says. "But if you have those particles in there, then you have to worry about the film scratching."

Measuring the scratch resistance of film is an issue currently being investigated using the nanomechanical test bed.

Professor William Gerberich and graduate student Xinyun Xia review data gathered using a microscope that produces images of surfaces that have been indented with a diamond tip. Tests such as these are being done to help researchers produce more durable and scratch-resistant materials.

Researchers use complex computational algorithms on a supercomputer to analyze the results.

"You'd like to be able to compare the local deformation and stress distribution in a material both before and after the indentation," Gerberich says. "The algorithms follow the deformation field around an indent or a scratch."

The lab instruments also measure creep, the sagging of a material over time, and detect metal fatigue. Based on these measurements, designers can choose alloys that are resistant to metal fatigue and creep. Such measurements have practical applications, especially in the design of high performance jet engines. "At high temperatures the blades of a jet engine will creep outward, and they have been known to cut the sides of the engine," says Gerberich.

The Micromechanics Lab has a budget of $400,000 per year, about one-third of which is paid for by a grant from the National Science Foundation. IT

— Peter Kauffner

IT departments welcome 21 new faculty members

Twenty-one new faculty members join IT this year including Richard B. McClurg in chemical engineering and materials science; Marc Hillmyer, Richard Hsung, and Xiaoyang Zhu in chemistry; Robert Dexter, Bojan Guzina, Raymond Hozalski, and Paige Novak in civil engineering; Richard Voyles and Zhi-Li Zhang in computer science and engineering; Sachin Sapatnekar, Guillermo Sapiro, and Joseph Talghader in electrical and computer engineering; Marc Hirschmann and Donna Whitney in geology and geophysics; Rachel Kuske and Fernando Reitich in mathematics; Merve Erdal, Sean Garrick, Caroline Hayes, and Perri Li in mechanical engineering; and Paul Crowell in physics.

Hessburg looks back on a 51-year career with IT

When Mary Hessburg was hired as a clerk and stenographer for IT in 1946, the seventeen-year-old took her new job very seriously.

"I was very career-minded," says Hessburg, who was encouraged to apply for the position by a friend who worked at the University. "I thought of it as a career and planned on working here for a long time."

Fifty-one years later, Hessburg is still working at IT. As the administrative director of mechanical engineering, Hessburg coordinates the Civil Service staff, manages the department's budget, and juggles a number of other duties. "If there are problems, I try to solve them," she says modestly.

Hessburg will retire this November, ending a career that has witnessed some very memorable years at IT. From the invention of the black box flight recorder to recent groundbreaking research in robotics, Hessburg has seen it all, but admits she has a soft spot for student projects. "The Solar Car, the Baja Buggy — it's been great to watch them come to life," Hessburg says. "I've really appreciated seeing them happen."

Mary Hessburg

Mechanical engineering hasn't been without its share of memorable faculty either, says Hessburg. Professor James Ryan, inventor of the black box recorder and namesake of the Ryan Professorship, remains in Hessburg's mind as one of the friendliest academics to pass through the department. Ryan, who retired in 1963, was responsible for some rather unusual research in the parking lot outside the ME building.

"He used to test-crash an old beat-up car out in lot C-25," Hessburg laughs. "He'd put dummies in the front seat and run it into a wall of two-by-fours." 'Crash Ryan' often conducted his impact research during the school day, a practice that attracted crowds as well as complaints.

When asked what she'll miss most about her job, Hessburg doesn't hesitate for a moment. "The good people around the University," she says. "Students, faculty, staff—you really develop a kind of camaraderie. You deal with so many names here, but it's really wonderful to be able to match some of them with faces and get to know them."

Hessburg's retirement plans include many of the same activities she enjoyed as a young career professional with an active social life. She will continue bowling in a University league and use some of her newfound free time to travel to lush golf courses in Florida and Arizona. Though bowling has remained her lifelong passion, golf has recently become an outlet for Hessburg's surplus energy. A good 18 holes, she says, "can really get your frustrations out."

During her retirement Hessburg will make time for others as well. "I'd like to do some volunteer work," she says. "There are so many areas where help is needed; I'm not sure where to start."

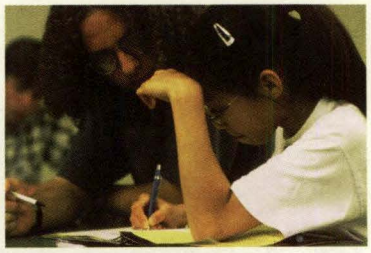
— Joel Meyer

IT's elementary, secondary math programs draw record numbers

IT's programs for mathematically promising elementary and secondary school students continue to grow at a record pace. Developed by the IT Center for Educational Programs (ITCEP), these programs provide students with a supportive environment in which to learn challenging mathematics, build friendships with peers and mentors, and begin to identify with the global community of scientists, engineers, and mathematicians. The programs are taught by IT faculty, undergraduate and graduate students, and outstanding high school teachers.

ITCEP's premier program, the University of Minnesota Talented Youth Mathematics Program (UMTYMP), has the highest enrollment in its 20-year history. This year, 580 young mathematicians are attending UMTYMP's accelerated courses, which encourage students to make meaningful mathematical insights.

In addition, more than 400 students are enrolled in ITCEP's three enrichment programs — PRIME, YES, and GAMMA — which feature periodic four-hour workshops for students in grades five through ten.



ITCEP serves elementary and secondary school students.

According to Andrea Olson, ITCEP's associate director, "These programs strive to give students a sense of participation in the culture of mathematics and how it can help them throughout their lives."

— Joel Meyer

For more information call 612-625-2861 or visit the ITCEP web site at *http://www.math.umn.edu/itcep*.

HESSBURG AND ITCEP PHOTOS BY BURTON HAUN

BRIEFS

The construction of two new 2.4m telescopes has been proposed by a consortium that includes the astronomy department, the University of Colorado at Boulder, and the National Optical Astronomy Observatories. One telescope would be built near Tucson, the other at Cerro Tololo, Chile. The astronomy department hosted an exploratory meeting with several other this summer; a second meeting will be held in Boulder this fall to determine the scientific and technical specifications of the telescopes and their instrumentation. IT astronomers and their colleagues in Boulder hope to build a series of similar telescopes to complement the Hubble Space Telescope and the soon-to-be-launched Space Infrared Telescope Facility. Funding is being sought from a combination of federal and private sources.

Graduates of IT's Management of Technology Program (MOT) gave it high marks in a recent study commissioned by the Center for Development of Technological Leadership (CDTL). MOT graduates reported success in moving up the corporate ladder after completing the program. According to the survey, 59 percent of MOT graduates currently hold management positions, an increase of nearly 25 percent. Overall, 85 percent of the MOT graduates were satisfied to highly satisfied with the program. Nearly 90 percent reported that they would recommend the program to others. For more information about the MOT program or other programs offered through CDTL, call 612-624-5747 or e-mail CDTL at general@cdtl.umn.edu.

Members of the chemistry department recently donated 12 Macintosh computers to Jefferson Elementary School in Minneapolis. The chemistry department's gift will boost the school's efforts to upgrade its media technology center. The computers will be used to teach computer-related skills to K-6 graders and supplement Jefferson's various community-education programs.

Professors Christopher Cramer, Thomas Hoye, Donald Truhlar, Louis Pignolet, and William Tolman donated the computers, along with the department's electronics shop. Department administrator Stanley Bonnema coordinated the project.

"I'm proud of the generosity of my colleagues and coworkers and of what this gift says about our desire [as a department within IT] to reach out to community to provide technical assistance and education," says Tolman.

More than 1,700 participants from around the world attended the 1997 Annual International Meeting of the ASAE, the society for engineering in agricultural, food, and biological systems. The August conference, hosted by the Department of Biosystems and Agricultural Engineering, was entitled "Tools for Transforming Tomorrow."

Hundreds of industry representatives, IT faculty members, and University students attended an open house sponsored by the Department of Computer Science and Engineering on November 5. University president Mark Yudof helped showcase new digital technology and the department's leading-edge research in the computer science and engineering field. The event was part of the computer science and engineering department's plan to foster new dialogue between the University and industry.

Yousef Saad

"More than ever before, this area of rapid change demands close ties between universities and computer companies," says Yousef Saad, head of the department. "In fact, such ties are ... vital to a healthy local industry on the one hand and to motivated and vigorous academic research and academic programs on the other."

IT PARENTS

Welcome back, IT parents! With the beginning of the new academic year, you and your student may have questions or concerns,. Please feel free to contact IT if we can be of assistance:

- IT Lower Division Office: 612-624-2890
- Student Affairs: 612-624-5091
- IT Honors Program: 612-625-2800
- IT Parents Organization: 612-624-5537

Encourage your student to participate in the IT Mentor Program, sponsored by the IT Alumni Society. The mentor program matches IT students with alumni mentors to help them explore various career options. Students and mentors meet informally at the mentor's workplace and participate in group events such as presentations and tours. The program begins in January. For more information, contact ITAS at 612-624-5537 or e-mail *itas@itdean.umn.edu*

If you would like to receive information for IT parents by e-mail, send a message to *mykidis@itdean.umn.edu* with your name and your student's name and year. We'll add your name to our online distribution list.

IT Parents polo shirts are now available! The shirts are an off-white polyester-cotton blend with the IT logo and an "IT Parent" insignia embroidered in maroon and gold. The cost is $20, plus $5 shipping and handling. All proceeds benefit the IT Parents Organization. To place an order, call 1-800-587-3884 or 612-626-9354 or e-mail *mykidis@itdean.umn.edu.*

Corrections

In our summer issue, we incorrectly identified Patrick Flynn (Agricultural '59) as a mechanical engineering graduate and omitted Avner Friedman from a list of Regents' Professors. *Inventing Tomorrow* regrets these errors.

SAAD PHOTO COURTESY COMPUTER SCIENCE AND ENGINEERING

Samuel Moore is director of IT's Academic Programs for Excellence in Science and Engineering.

developing DIVERSITY

IT's program for minorities broadens its scope

by Andrew Tellijohn and Paul Sorenson

Samuel Moore and his staff are determined to beat the odds. As the new director of IT's Academic Programs for Excellence in Engineering and Science (APEXES), Moore is leading the effort to remove barriers that discourage minority students from pursuing engineering careers.

According to the National Action Council for Minorities in Engineering, only 36 percent of minority engineering freshmen ever complete their degrees — a statistic that takes on greater importance given that African Americans, American Indians, Chicanos, and Latinos together represent only three percent of IT students and 13% of engineering students nationwide. As a result, fewer than 4,700 undergraduate engineering degrees are awarded nationwide to African Americans, American Indians, Chicanos, and Latinos each year.

To combat those statistics, APEXES — founded in 1979 as Project Technology Power — recruits minority students to

MOORE PHOTO BY BURTON HAUN

IT programs and provides tutoring and other services to help improve success rates among those already enrolled.

According to Rita Burch, the program's assistant director, APEXES' efforts begin at the middle school level, when students are preparing for college. "It's important for students at that age to have role models in science and math that they can connect with," says Burch. "Students who 'click' with a teacher tend to take interest in a subject and excel at it.... Unfortunately, there aren't a lot of teachers of color [in science and mathematics], so students [of color] tend to pursue careers in other areas."

APEXES introduces minority high school students to career opportunities in science and engineering and connects them with existing enrichment programs in IT and other University units. "The goal is to develop a pool of well-prepared students who we hope will enroll in our undergraduate programs," says Burch.

However, IT faces stiff competition from other universities who target top students. "A lot of students are drawn to our top-ranked programs in chemical engineering [and] mechanical engineering," says Burch. "But we're really at a disadvantage when it comes to scholarships," because many other schools have more full-ride scholarships to offer.

> "Those coming through IT are going to be managers in diverse groups. The ones with exposure to working with different people are going to be highly sought-after by companies."

Students who come to the University and participate in APEXES enjoy a remarkable success rate, says Burch.

Luis Ortiz (Computer Science '95), a native of Puerto Rico, participated in APEXES when he came to the University after serving an internship with IBM in Rochester, Minnesota. "[APEXES] is a great resource for people who aren't used to a system as large as the University," Ortiz says. "I wasn't used to the ... bureaucracy. They helped me look at my options as a person who was about to graduate."

The help he received included advice and counseling about choosing a graduate program compatible with his interest in computer science. Ortiz says the APEXES staff helped him select Brown University, where he is now a third-year graduate student. They also assisted him in preparing and editing his application forms.

"Definitely, for me it was a beneficial experience," he says.

Like Ortiz, most students have positive experiences at the University, but some do encounter race-related problems. "When we run into something that's insensitive or even blatantly racist ... we try to help students put it into context," says Burch. "Unfortunately, that's the kind of thing they'll probably run into again and again throughout the rest of their lives, so we try to help them deal with it, to look at it as more of a hurdle than a barrier."

To foster a better appreciation for diversity, Moore is introducing a competition involving diversity workforce teams, which will help "students from all different facets of society learn how to work together," he says.

Teams include both APEXES participants and other IT students. In the first round of the competition, students will work together to solve simple engineering problems. Over the course of the two-quarter-long competition, some teams will receive corporate sponsorship and work to solve real industry problems. More than 130 students participate in the competition.

"Those coming through IT are going to be managers in diverse groups," Moore says. "The ones with exposure to working with different people are going to be the ones highly sought-after by companies."

Among those companies is 3M, which will participate in the workforce project and provides program funding, internships, and scholarships. APEXES students frequently participate in summer internships at 3M as project engineers or lab research assistants and perform hands-on work.

"The goal we have is to provide challenging summer opportunities that will strengthen their educational process," says Gary Haugen, project engineering manager at 3M. "We've been very successful at placing those who complete the program [in permanent positions] within 3M."

Haugen adds that 3M funds programs for universities throughout the Midwest and says that IT students rank competitively with students from other schools.

Moore has also established a partnership between APEXES and IT Career Services and is building relationships with other IT departments. These relationships offer minority students additional help in seeking jobs, internships, scholarships, and counseling as well as advice on adapting to the University community.

"We continually stress the importance of building relationships with IT departments early in students' academic careers," says LaChelle Drayton, APEXES' diversity and professional development coordinator. "Those relationships will enhance and enrich their experience as future engineers and scientists."

Moore's new initiatives have been successful. According to Drayton, the program is drawing nearly twice as many participants as last year. "They're definitely coming in — old students as well as new," she says.

Over the past two decades, APEXES and similar programs at other universities have achieved remarkable results. The number of African American, American Indian, Chicano, and Latino students in IT has increased by 50 percent since 1984, and the number of undergraduate engineering degrees awarded to members of those groups has tripled since 1972.

According to Moore, that progress benefits everyone. "Our programs aren't just affecting those three [minority] groups," he says. "They're enriching all of IT."

For more information call 612-626-0219 or visit the APEXES web site at *http://www.technology.umn.edu/apexes*.

an irresistible force

BY DEANE MORRISSON

Upon meeting Professor Dan Dahlberg, you'd never suspect that the likable physicist with the Texas twang would go after a colleague with a sledgehammer. But there he stands, wielding the heavy implement with skill and obvious intent as Hank Ryan, a physics and chemistry teacher at Mounds View High School, lies motionless on a bed of nails, a concrete block on his chest. With a mighty backswing, Dahlberg brings the sledgehammer crashing down on the block, smashing it to smithereens.

"Good one," says Ryan.

So ends another demonstration by the Physics Force, a group of dedicated teachers who bring the laws of physics out of the realm of esoterica and put them squarely onto center stage.

Drawing on the 200 demonstrations in their repertoire, the Physics Force uses such everyday objects as soda straws, wine glasses, spoons, and fire extinguishers to demonstrate and explain the laws of physics. The group has wowed audiences from elementary schools to Epcot Center. The Physics Force recently added a dash of physical fun to inauguration week when University president Mark Yudof joining the group on stage at Northrop Auditorium. (Yudof did not receive the sledgehammer treatment, however.)

Dahlberg credits the group's existence to the late Phil Johnson, the demonstration coordinator for the University's physics-teaching classrooms. About 15 years ago Johnson met Ryan and Jon Barber, also a physics and chemistry instructor at Mounds View High, and the three men decided to pursue the idea of a physics demo show for high school students. They recruited Osseo High School physics teacher Jack Netland and put together a series of demonstrations; during their second year, they asked Dahlberg to join them.

"Over the next several years, we developed six shows," says Dahlberg. "Each show has a theme — electricity and magnetism, mechanics, fluids, thermodynamics, light and optics, and waves and sound."

The bed of nails/sledgehammer routine is part of the mechanics show. It illustrates how an object's mass — or, as Dahlberg defines it, "stuff" — influences its behavior. If a bed of nails has enough nails, a recumbent person's mass will be evenly distributed over the points. With no large mass bearing down on any one nail, the person's body will never impale itself. As for the sledgehammer blow, when the blow's energy is absorbed by a large mass like the concrete block, little energy is left over to hurt the person lying beneath it.

A similar demonstration involves swinging a baseball bat at a baseball and at a heavy, basketball-sized medicine ball. The baseball's small mass can absorb little of the blow's energy; the excess energy sends the ball flying. The medicine ball, however, absorbs much of the blow and so travels about as far as your average foul tip.

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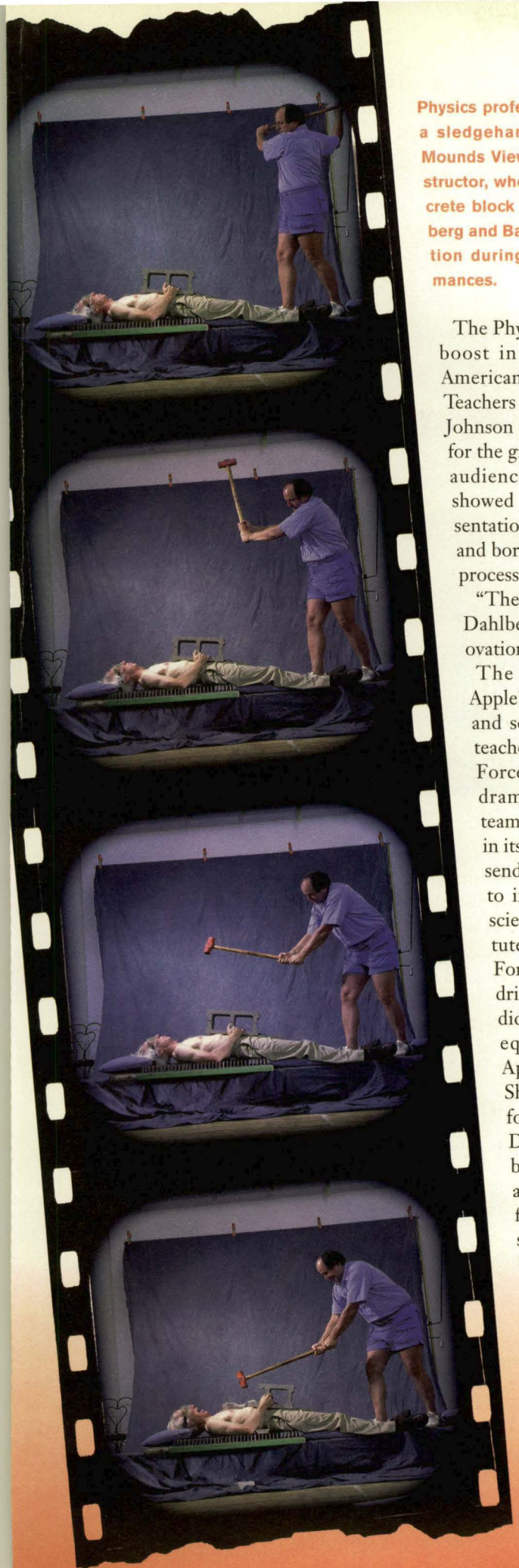


Physics professor Dan Dahlberg takes a sledgehammer to Jon Barberg, a Mounds View High School physics instructor, who reclines between a concrete block and a bed of nails. Dahlberg and Barberg use the demonstration during Physics Force performances.

The Physics Force received a big boost in May 1990, when the American Association of Physics Teachers met in Minneapolis, and Johnson arranged a performance for the group in Willey Hall. The audience watched as the team showed how well-prepared presentations can take the mystery and boredom out of the learning process.

"The crowd went wild," says Dahlberg. "We got a standing ovation."

The PBS show "Newton's Apple" filmed the performance and sold the video to physics teachers. Demand for Physics Force appearances increased dramatically. 3M asked the team to entertain participants in its Wizard Program, which sends employees into schools to interest young people in science. The American Institute of Physics booked the Force for a show in Alexandria, Minnesota. They also did a spot on the German equivalent of "Newton's Apple," the "Know-How Show," and in July they performed at Epcot Center. Dahlberg has no idea how big an audience saw them at Epcot where they performed on an outdoor stage for people walking by, but he says the "Know-How Show" regularly reaches more than 30 percent of the viewers in its prime-time slot.

All this success aside, the most amazing thing about the Physics Force may be its ability to keep going despite its members' numerous other commitments and a major setback, the sudden death of Johnson in 1994.

"When Phil died, there was an undergraduate, Fred Orsted, working with him," says Dahlberg. "He took over Phil's job in demos. Then another undergraduate, Aaron Pinski, started helping Fred." Orsted and Pinski, now science teachers in Twin Cities-area high schools, are still part of the group, whose membership now stands at six.

Undoubtedly part of the group's drive comes from the sheer enjoyment of it. When you're being dropped from a 20-foot scaffold and you have to catch a billiard ball in mid-air, there is a certain thrill that every performer can identify with. (That demo shows how an object being shot horizontally will fall to the ground just as fast as an object being dropped straight down.) Or imagine the fun of sitting on a cart and blasting a fire extinguisher to propel yourself across the stage. (For every force, there's an equal and opposite force.)

More importantly, the Physics Force thrives on the chance to help young minds realize the joys of physics.

"We did a show at Parkview Elementary School in Roseville," recalls Dahlberg. "It was the last thing in the school day on a Friday about two weeks before Christmas. The show lasted an hour and 10 minutes, but even the kindergartners stayed engrossed. We also were doing another show at the school that evening, so we told the kids to come back and bring their parents."

That night the auditorium was packed with families, and kids were explaining to their parents what was happening.

"That was really special," says Dahlberg. "I had always argued that if we wait until kids are in high school to show them that science and math are fun, interesting, and exciting, we've already lost the battle. I'd like everyone to realize that it is as much fun to exercise your mind as it is to exercise your body." ■

For more information visit the School of Physics and Astronomy web site at http://www.spa.umn.edu.

RESEARCH

precious metals

IT researchers are working with colleagues in the Medical School and the College of Biological Sciences to find out more about the roles metal ions play in essential biological processes.

by Paul Sorenson

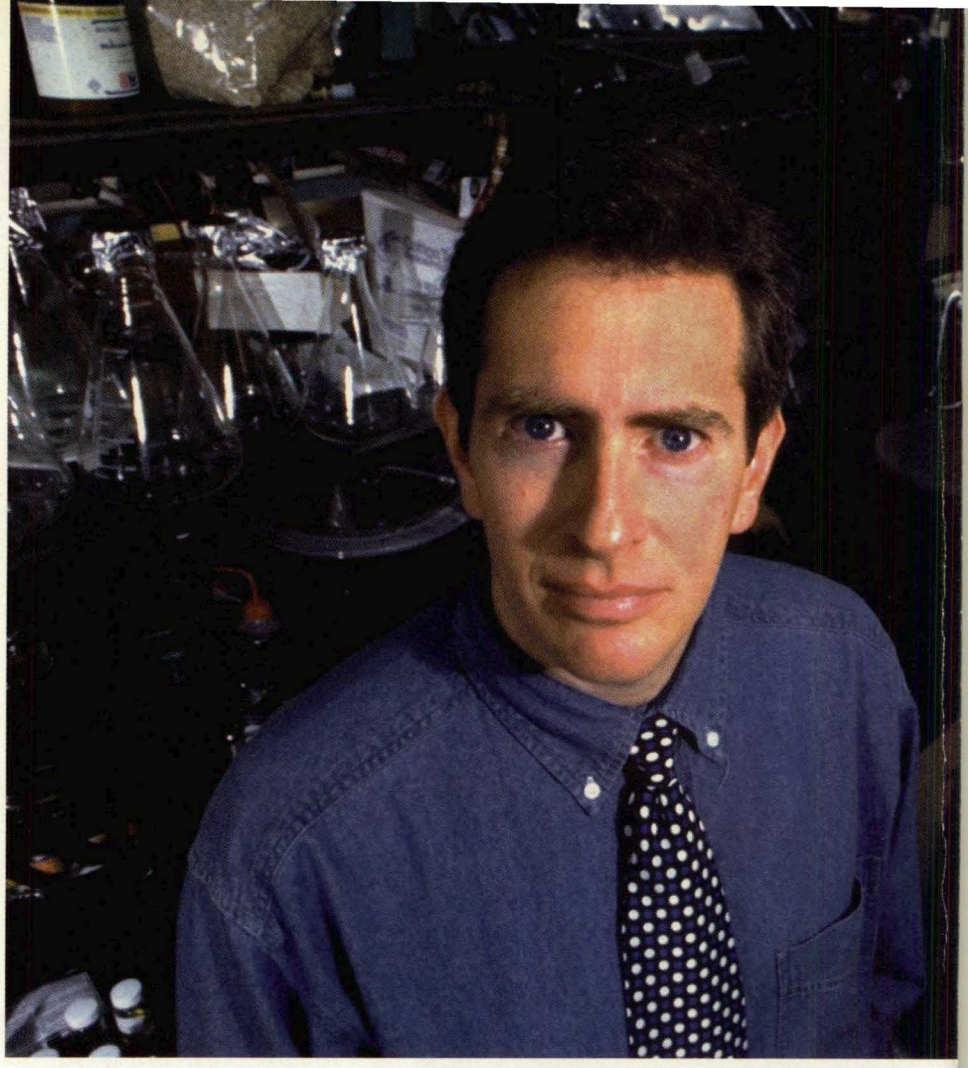


PHOTO BY BURTON HAUN

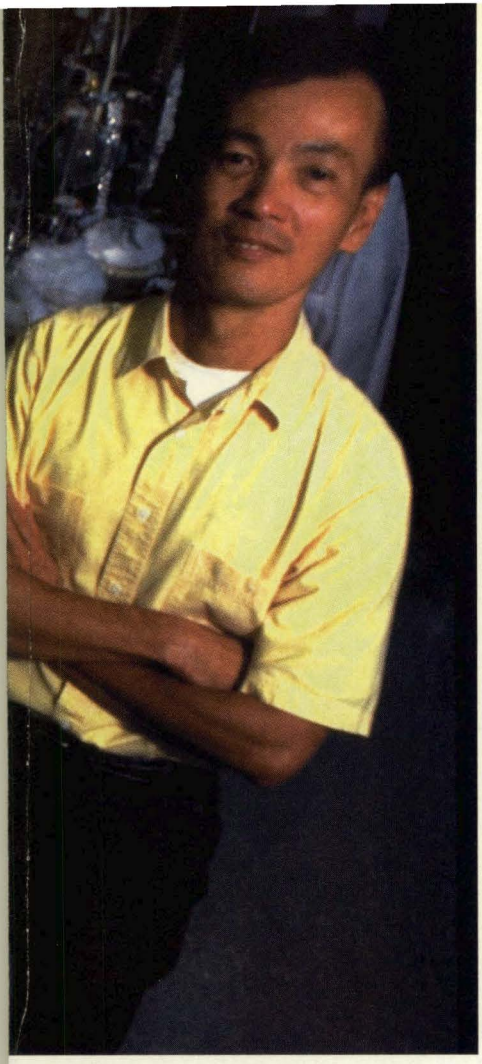
OPERATING AT THE intersection of biology and chemistry, metalloproteins and metalloenzymes hold the secret to many of the chemical processes essential to life — synthesizing the building blocks of DNA, transporting oxygen through the bloodstream, supplying energy to cells, and breaking down natural pollutants.

To help unlock these secrets, researchers in the Institute of Technology, the College of Biological Sciences, and the Medical School formed the Center for Biocatalysis in Metals — an innovative intellectual center that fosters interaction and collaboration among researchers and students from different disciplines who share an interest in how metals function in biological systems.

A 1993 grant from the Graduate School provided seed money for the center, which is an outgrowth of a long-standing metalloprotein interest group at the University. Although the center has no physical facilities (its participants have laboratories and staffs fully funded by other sources), it provides a framework through which participants can collaborate and educate.

One of the center's biggest strengths is its ability to facilitate cross-disciplinary training. Researchers and students meet monthly and host presentations by their peers and renowned biologists and chemists from around the world.

Moreover, students working with the center's researchers can pursue a wide range of approaches to the study of metal ions in biological processes. "That kind of cross-training is very exciting and tre-



Professors William Tolman and Lawrence Que collaborate with researchers from other disciplines in the Center for Metals in Biocatalysis. One of Que's discoveries, a diamond core structure essential to many biological processes, is pictured below.

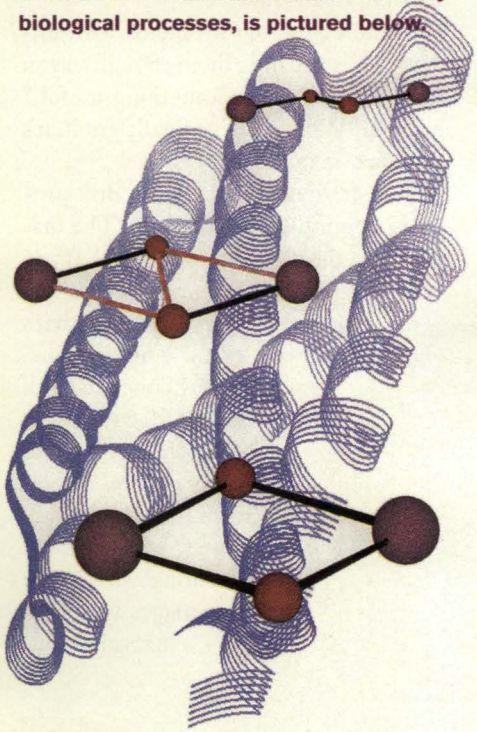


ILLUSTRATION COURTESY LAWRENCE QUE

> "Some of the most exciting things in science are happening here — at the boundaries between disciplines."

mendously valuable to students," says chemistry professor William Tolman, one of the center's founding members. The exceptional training environment has been recognized by many, including major funding agencies such as the National Institutes of Health.

The center has already gained international prominence. In 1999 it will host the Ninth Annual International Conference on Biological Inorganic Chemistry — the premier conference in the field. "We are certainly the most visible center [of this kind]," says Lawrence Que, a professor of chemistry and co-director of the center. "We are focusing attention on pushing the frontiers of our science."

Indeed, researchers in the center have recently made several groundbreaking discoveries.

For example, a team led by Tolman found the first experimental evidence that suggests how enzymes break oxygen bonds during organic oxidation and form them during the reverse process, photosynthesis.

When the chemists combined oxygen with a copper complex similar to the active site of the enzymes, they discovered that two types of products formed. One had the oxygen molecule bound to copper with the O-O bond intact, but the other was an unusual species with the O-O bond broken. Amazingly, Tolman's group found that the two species could be readily interconverted simply by changing the solvent.

This demonstration of a reversible process involving the oxygen O-O bond in synthetic compounds suggests that similar phenomena may occur in biology, including in systems containing other metals, such as the photosynthetic reaction center of plants, says Tolman.

Several months later, a team led by Que and biochemistry professor John Lipscomb identified how another enzyme breaks the strong chemical bonds in methane. The enzyme, methane monooxygenase, converts methane into methanol. "Methane is one of the most inert compounds — very difficult to break down," says Que, "so we wanted to learn what tricks nature has evolved to break its [chemical] bonds."

Because the enzyme repeats this cycle many times per second, Que and Lipscomb had to find a way to take a snapshot of the process. To do so, they combined the enzyme with oxygen and then quick-froze the mixture, trapping it in the intermediate state.

When they analyzed the intermediate structure, they discovered that the iron atoms in the enzyme bind with two oxygen atoms to form a diamond shape. The diamond core stabilizes the highly-reactive iron atoms long enough for the intermediate species to attack the methane and pull off the hydrogen, says Que.

Que and Lipscomb's findings — like Tolman's — may apply to the chemistry of many biological systems, including photosynthesis and the breakdown of fatty acids.

Identifying the diamond core structure was only the first step in the research process, says Que. "There are many areas to explore."

Explorations in biodegradation may eventually help researchers find a way to reduce environmental contaminants, Que says. "If we can find out how nature rids itself of natural and unnatural pollutants, we may be able to develop industrial processes that are more environmentally friendly by tinkering with the chemistry."

The center's participants are also exploring nitrogen oxide metabolism, DNA cleavage, metalloprotein crystallography, spectroelectrochemistry, and structural and functional models of metalloenzymes

According to Tolman, the potential benefits of research carried out by the center's participants are limitless. "Some of the most exciting things in science are happening here — at the boundaries between disciplines," he says. ■

For more information contact the Center for Metals in Biocatalysis at 612-625-2503 or visit the center's web site at *http://bioinorg.chem.umn.edu.*

CD-ROMs put a new SPIN ON TEACHING

BY JIM DAWSON

SEVERAL YEARS AGO, Fennell Evans, a professor of chemical engineering and materials science, noted the amount of time he wasted in class lectures reviewing introductory material. He questioned the efficiency of that approach and its benefit to students.

"Who has the most fun in a lecture?" Evans asks. "The lecturer does, because the lecturer has the active role, the control. The students are passive."

Furthermore, the attention span of the average college student is seven to ten minutes, Evans says. "After that, they work on something else, they sleep, or they fantasize."

Evans was convinced that there had to be a better way. Now, $1.1 million in National Science Foundation (NSF) money and nearly four years later, he believes that he's devised a better way to teach — a way that could radically change the nature of higher education.

Evans, director of the University's Center for Interfacial Engineering, designed a comprehensive, interactive CD-ROM that teaches students the basic concepts in his field, including some of the more complex areas in science — fluid dynamics, chemical engineering, and other fields that involve the behavior and interactions of substances at the molecular and atomic level.

With the help of funding from the NSF, which shares Evans' educational philosophy, the project's staff grew from a few people to the 11-person Multidisciplinary Engineering Curriculum Development group.

"This is not a mom-and-pop operation," Evans says. "To do this right you have to involve a lot of professionals."

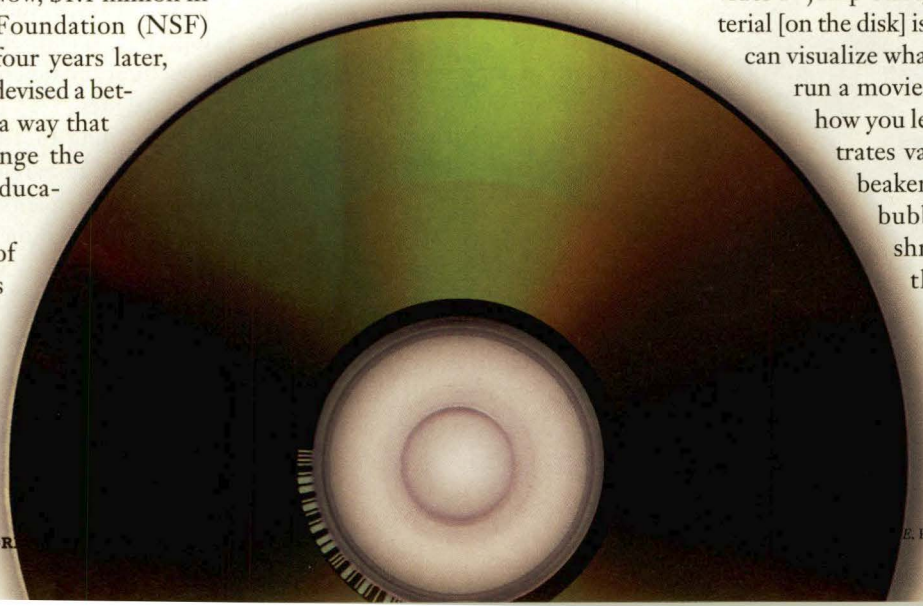
This CD-ROM contains modules, self-contained lessons on such topics as surface tension, adsorption, and chemical potential. Three modules have been completed, and three more are in development. Within each module are smaller units dealing with specific topics such as monolayers or cohesion/adhesion. Eventually the disk will contain more than a dozen core modules dealing with different aspects of the field.

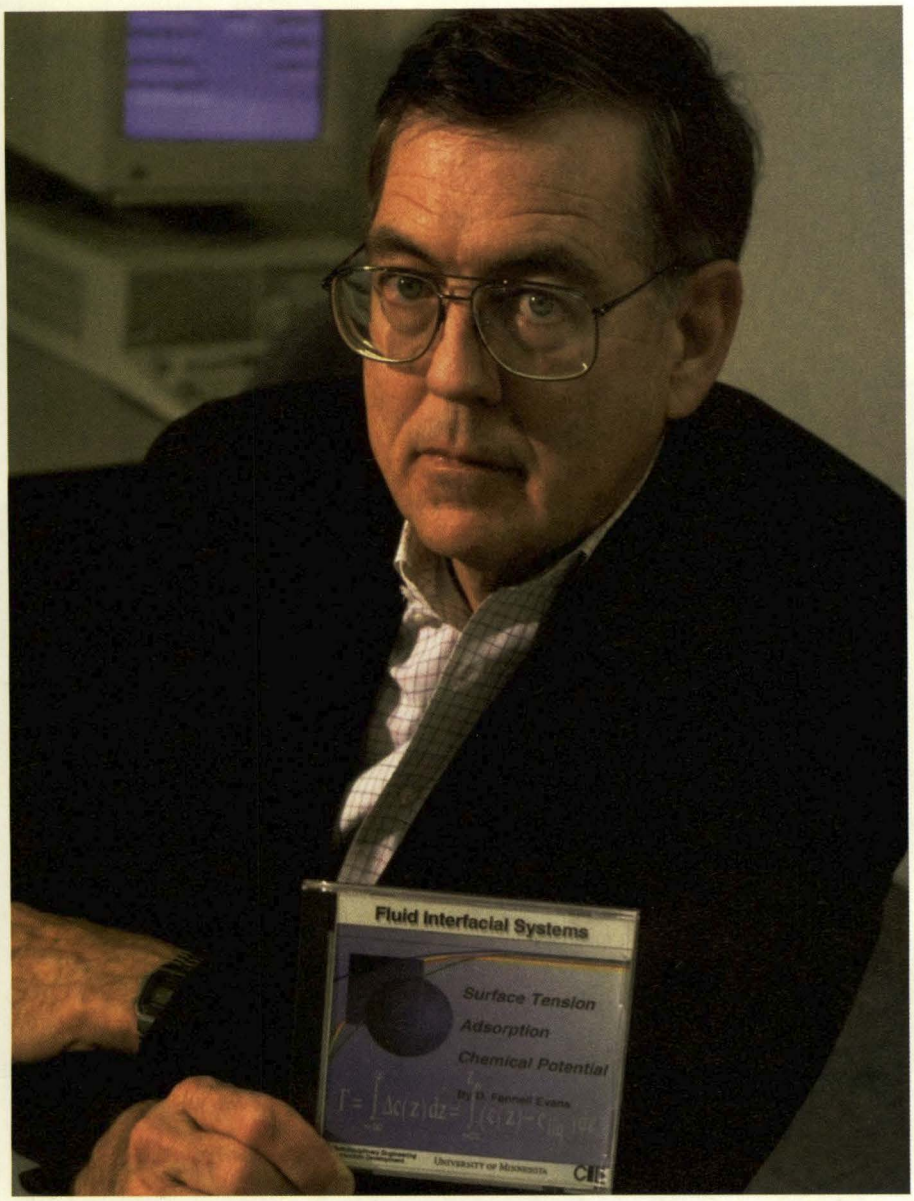
Although the existing modules are designed for graduate students, other modules for undergraduates are being written, Evans says.

"One of the big problems with undergrads is teaching them enough so you can get them to do something useful," he says. "When they've finally got it, it's time for them to go away."

For graduate students the disk provides a "jump-start," he says. "The material [on the disk] is mostly visual. If you can visualize what you're reading and run a movie in your mind, that's how you learn." The disk illustrates various concepts with beakers that fill with fluids, bubbles that grow and shrink, and molecules that dance on surfaces.

Along with those images are mathematical formu-





Professor Fennel Evans has developed a comprehensive, interactive CD-ROM that teaches students complex engineering concepts.

According to one student, the CD-ROM modules are "the most innovative improvement to the field of teaching since the invention of chalk."

las that work themselves out on the computer screen.

"On the CD-ROM, words are your enemy, images are your friend," Evans says. "Textbooks and academic lectures tend to be long, verbal tunnels, but you can intensify the material by doing it visually."

Evans and other professors, both here and at other schools, have been using the CD-ROMs in courses for a couple of years, and a pattern is developing in how students use them.

"Most like to go through the module, then read the textbook," he says. "Text is hard to read at length on a computer screen."

Christine Grant, a chemical engineer at North Carolina State University, will use the CD this year in the undergraduate courses she teaches. "My plan is to utilize a module to supplement my lectures," she says.

Eventually, Grant says, the CD-ROM could be used as Evans intends, as a replacement for many introductory lectures.

"It could be a paradigm shift in education," she says, "but people have got to use it and figure out how to put it together with what they do."

Evans isn't limiting his development to academia. Many engineering firms are interested in the project as a way to provide quick and focused education for their employees.

"Eventually you'll be able to access and read and rearrange the material any way you want," he says.

Evans predicts that educational material such as the CD-ROM will eventually be available to everyone on the Internet. "I can see chat rooms and individual tutorials and all sorts of possibilities on the World Wide Web," he says. If that happens, it could change the nature of a college education, making sophisticated material available to students everywhere. Taken to the extreme, the students wouldn't have to physically attend the schools where they are enrolled.

When Evans asked his latest group of graduate students to evaluate his CD-ROM, one student wrote, "I found Professor Evans' computer modules to be the most innovative improvement to the field of teaching since the invention of chalk." ■

For more information visit the web site of the Department of Chemical Engineering and Materials Science at *http://www.cems.umn.edu.*

EVANS PHOTO BY BURTON HAUN

clearing the air

Associate Professor Larry Jacobson is using air samples collected from hog manure to develop a rating system for odors. His research may help mitigate the growing problems caused by odors from manure.

TEXT BY ANDREW TELLIJOHN • PHOTOS BY BURTON HAUN

Pungent odors are a fact of life in rural America.

Until recently, people who lived near livestock farms could count on diffusion to abate the smell of manure. However, as smaller farms are being replaced by larger corporate operations, many rural residents are complaining that the odor from animal wastes is becoming unbearable.

Rising odor levels have caused a dramatic increase in public complaints, including claims of odor-related headaches, vomiting, diarrhea, aches, shakes, and blackouts. Moreover, environmentalists point to potential hazards associated with airborne hydrogen sulfide, which has been measured at significant levels near some livestock production sites.

These concerns have prompted commodities groups and the Minnesota Department of Agriculture to take greater interest in air quality and to fund research on ways to measure and reduce the stench from animal waste statewide.

"Up until fairly recently [the Minnesota Pollution Control Agency] has dealt with air quality on a case-by-case basis," says Associate Professor Larry Jacobson. "Now, with so many farms out there, they've just been overwhelmed. This [research] is definitely in response to a fairly urgent need."

Jacobson leads one of two research teams in the Department of Biosystems and Agricultural Engineering that are taking different approaches to solving the problem.

"It's hard to regulate or manage something like air quality or odor since there has been no way to measure it directly," says Jacobson. To solve that problem, his team is working to develop an odor rating system.

The research involves a group of eight panelists who smell air samples that are collected from livestock production sites and returned to the lab in 10-liter plastic bags. The samples are diluted with clean air by a device called an olfactometer and presented to panelists in increasing concentrations until they can detect the tainted air. Panelists generally test 10 to 12 samples per session and are paid $25 for their work, Jacobson says.

Lori Miller, a panelist since the project's beginning, says that the task may be unpleasant, but it's not as hard as it might seem.

"Its very hard for people to understand," she says. "They have no idea it's just air."

The panelists' responses will also help the team develop an odor database. "They're trying to develop a [fragrance] wheel for odor along the same line as a fragrance wheel for wines," Miller says, "effective not only for farm odors but for industrial odors as well."

Combined with the ability to measure the amount of odor in the air and a model of how smells spread across the country, that database will help the researchers develop an odor rating scale for different livestock production systems in the state.

"It's basic, but it's a very important step," Jacobson says. "If we can measure it, we can evaluate its impact."

This $390,000 study is the first part of a two-year project running through 1999. By then he hopes to establish a rating system for different types of livestock and poultry handling systems throughout the state, with curves that estimate the odor level standards a given site would produce. The rating system should provide county and city governments with a way to quantitatively handle zoning issues involving air quality, says Jacobson.

The goal of another project, under the direction of Associate Professor

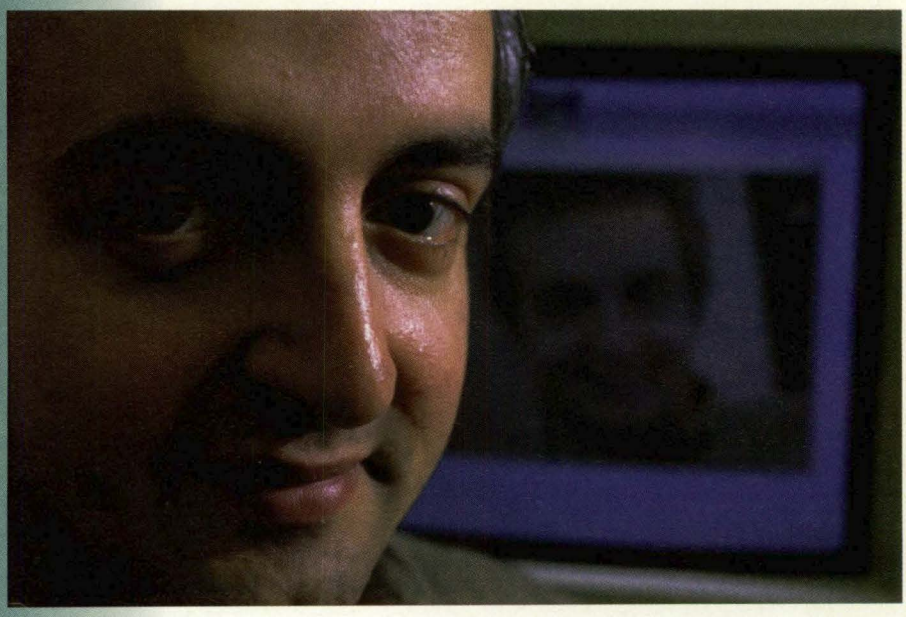
continues on page 33

Assistant Professor R. Roger Ruan has developed a non-thermal plasma reactor that converts toxic fumes from hog manure into harmless, odorless gases.

getting the green light

BY PAUL SORENSON

Traffic lights often seem to operate in a world of their own. Oblivious to traffic conditions, their timing mechanisms force drivers to wait for red lights at clear intersections and fail to allow enough time for many elderly and disabled pedestrians to cross streets safely. But relief may be just around the corner.



Professor Nikolaos Papanikolopoulos is developing new technology that could change modern transportation systems.

A team of IT researchers led by Professor Nikolaos Papanikolopoulos has developed a computer system that can detect the presence of pedestrians and adjust traffic signals accordingly.

To distinguish pedestrians from their surroundings, a computer compares live information captured by a camera to a background image stored in its memory. It subtracts this background image from the current image to identify moving patterns, including pedestrians, animals, bicyclists, and automobiles.

The background image changes over time to adapt to lighting, weather, and other conditions. "The system is sophisticated enough to create a new background so that the processor is only concerned with moving images," explains Papanikolopoulos. "The background image can be replaced every few hours or, if necessary, every few minutes."

The computer uses sophisticated software and a powerful processor to recognize different types of pedestrians and vehicles. This task, which would be trivial for a human operator, required Papanikolopoulos' team to develop complex descriptions of human movement patterns. "The movement of people is far more complex than the movement of anything else," says Osama

PAPANIKOLOPOULOS PHOTO BY BURTON HAUN

IT researchers have developed a computer system that detects pedestrians in intersections and adjusts traffic signals accordingly.

Masoud, a research assistant working on the project. "People are not rigid like vehicles, and their shapes change over time."

For the computer to recognize a moving object as a pedestrian, "the characteristics of an image have to correspond to one of the models of a pedestrian in the system's memory," says Papanikolopoulos, adding that "pedestrians have over 20 different ways of moving."

"The system focuses on special characteristics of a pedestrian," he says. "Specific points, like feet, are good to focus on and make good landmarks."

After the computer identifies a pattern as a pedestrian, it follows the image, even when an obstacle comes between the camera and the pedestrian.

"In blind spots the system assumes the pedestrian continues at the same course and speed," says Masoud. As a result, it occasionally creates a pedestrian where there isn't one, but it will recognize when an out-of-view pedestrian who has stopped or changed direction re-enters its view.

The system is also adaptable. "Sometimes two or more people will enter the field close together and be perceived as one pedestrian. If they separate, the computer can split the image into several pedestrians," says Masoud. It will also recognize and adapt to special circumstances created by small children, crowds, and people in wheelchairs.

Traffic management and safety at pedestrian crossings would improve because the systems ensures that signals allow adequate time for pedestrians to cross and would also warn those approaching the intersection when the signal is about to change. "The light will stay green only until all pedestrians have crossed or until a certain maximum time has elapsed. Oncoming traffic won't see a green light, but maybe a flashing green to warn them," says Papanikolopoulos.

Although it requires some expensive equipment, the technology can be integrated into existing traffic control infrastructure, says Papanikolopoulos. "It is relatively economical because it will work with the traffic signals that are already in place."

The system has been tested under various weather conditions in front of the Armory building and at the corner of Washington Avenue and Union Street, but legal liability issues have prevented Papanikolopoulos from conducting further tests at an off-campus intersection. "This is probably the toughest part," Papanikolopoulos said. "People tend to accuse machines [of being at fault] more often than human beings, so it's very important to make clear who is responsible in case of an accident."

For that reason, the technology may find other commercial applications before it is implemented at intersections. It could be used, for example, to track shoppers' traffic patterns in retail stores, analyze movements filmed by security cameras, count and classify the types of vehicles that use roads, or enhance safety around construction equipment in work zones.

Papanikolopoulos hopes to license his technology to a private company that will develop it commercially. "I leave the commercialization to someone else," he says. "Building ideas and making them feasible — that is my job."

Papanikolopoulos is full of good ideas. He and his team are working on nearly a half dozen other projects related to traffic safety.

One project uses a computer and a dashboard camera to monitor fatigue in drivers by analyzing how often they close their eyes or bob their heads.

"The camera first looks for the driver's eyes and then follows them, estimating the amount of time that they are open or closed," says Martin Erikkson, a research assistant working with Papanikolopoulos on the project. The computer analyzes eye movements and other characteristics and will alert a driver who shows potentially dangerous fatigue levels.

"One of the challenges in this particular project is finding the eyes," adds

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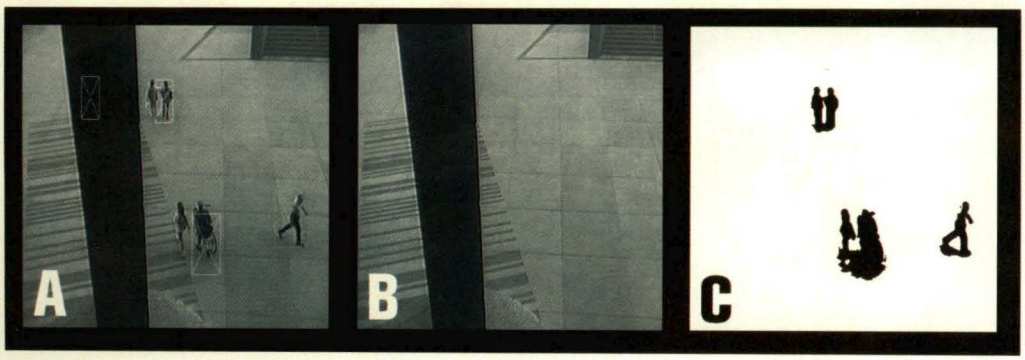


Papanikolopoulos' system compares live information (A) captured by a camera to a background image stored in its memory (B) to detect the presence of pedestrians. It subtracts this background image from the current image to identify moving patterns, including pedestrians, animals, bicyclists, and automobiles (C).

COMPUTER IMAGE COURTESY OSAMA MASOUD

reaching fo stars

THE DAY BEFORE JEANNE CLOUD LEFT Minnesota for the Kennedy Space Center was a busy one. There were clothes to wash, belongings to pack, and goodbyes to say before the University student trundled off to Cocoa Beach, Florida, for three months. Her excitement even extended to the prospect of a three-day car trip that would carry her and her young daughter thousands of miles away from home to the National Aeronautics and Space Administration's (NASA) Florida space center. "I think the whole thing is amazing," says the aerospace engineering student, whose first quarter as a NASA cooperative education student is about to end.

Cloud is one of several students to work at NASA while continuing her studies at the University. "We've definitely hired some good people from Minnesota over the years," says Mike Kincaid, director of NASA's Cooperative Education Program at Johnson Space Center, where another Minnesota student is currently involved in a co-op program. "I don't even know how many [Minnesota] people there have been over the years. But I've seen quite a few," he says.

NASA's Cooperative Education Program began in 1961, when NASA offered students a chance to gain experience and the agency expanded its recruitment pool. Although the program's purpose remains unchanged, hiring has slowed considerably since the mid-1980s, due to downsizing and the reduction in defense spending contracts.

Kincaid's records, which date from the late 1980s, include the names of former University students, some of whom still work for the agency. Although NASA no longer actively recruits, Kincaid says he does review applications from University students. "It's a top-notch school," he says.

Mechanical engineering senior Ben Holmes, who learned about the program while surfing the Internet, works at Houston's Johnson Space Center and is optimistic that he'll be one of the chosen few to stay on after graduation. "The University does a good job of teaching you, but once you get here, you're really on your own. People teach you and show you the ropes, but you've really got to take it upon yourself to go get involved, and ask people to give you jobs and go ask them to help you. That's really where you do the learning," he says. "So when I actually do graduate, I'll have a better knowledge of the whole system, and hopefully that'll carry over to my long-range goals."

Like many people who have worked for NASA at one time, Holmes wants to be an astronaut. "I can't really say that's my only goal, because that's really long-term. I have a lot of short-term goals that could supercede that just in case it doesn't happen, but being an astronaut would be a really long-term goal," he says.

Cloud, too, dreams of becoming an astronaut. "That's something I've always wanted to do," she says. And her dream was rekindled not long ago, thanks to a chance meeting with a woman at Mystic Lake Casino, where Cloud worked as a cook.

"They used to have all these seminars all the time, and one day there was a seminar about encouraging Native Americans

r the

to seek business opportunities," she recalls. Cloud, who is half Native American, happened to stop and talk with a woman sitting at one of the tables at the seminar. "She was an older lady who had finally finished school and gotten her degree," Cloud says. "She was talking, and she kept saying, 'Go for your dreams. Don't let anything hold you back.'"

"After talking to that woman at Mystic Lake, I knew that's what I wanted to do," Cloud says. "I called the school and started asking around, saying 'What do I have to do to become an astronaut?' And this is what they said I had to do.

by Kamariea Forcier

Jeanne Cloud (above) and Benjamin Holmes (with an empty space suit, below) are participating in NASA's co-op program this year. Cloud is working at Kennedy Space Center in Cocoa Beach, Florida; Holmes is at Johnson Space Center in Houston.

This was not something I thought would ever be a reality in my lifetime, but because of speaking with this woman, it is. Everything sort of fell into place after that."

Past participants agree that the NASA co-op experience shaped their future careers. Janice Voss, who eventually became an astronaut, was a co-op at Johnson Space Center from 1973 to 1975.

"Almost everyone I met at NASA had stars in their eyes to become astronauts," says former co-op student Beth (Grimaldi) Dzenitis (Aerospace '88), an aerodynamicist with Boeing. "I've always been interested in the astronaut program, and when I worked in Houston I could see that it was not an impossible dream. But I'm more realistic about it now, in terms of the chances of being selected, than I was as a 20-year-old co-op student," she says.

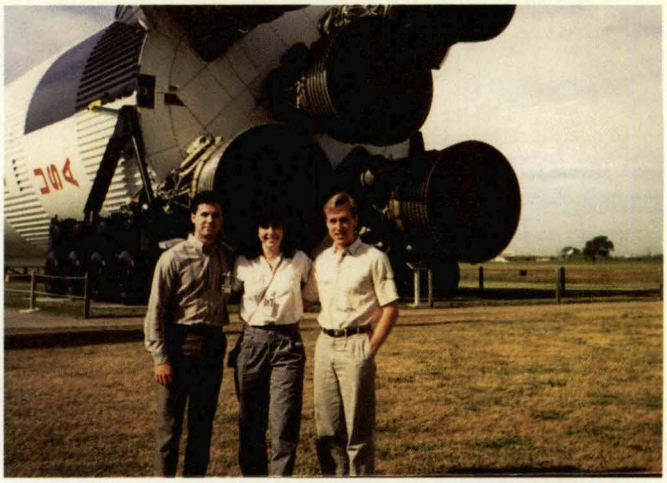
Dzenitis was a co-op from 1985 to 1988, along with two other University of Minnesota students, Nicholas Neeb (Aerospace '88) and Gerald J. Le Beau (Aerospace '89, M.S. '90). All three shared stories of how they got into the program and what it was like to be there. One trait that all former co-ops seem to share is the determination to get into the program. "Be aggressive about it," Dzenitis says. "Send down the application. Get the signatures. Find somebody to help you, or send stuff to the company you're interested in. Do what you need to, to get involved."

It's easier said than done, however. During the 1996-97 season, more than 800 people applied for fewer than 60 positions at Johnson Space Center. But there are other opportunities at the 10 NASA sites that offer the co-op program.

One drawback to the co-op program is its effect on graduation timelines. Participating in a co-op can add more than a year to a degree program. Neeb, a teacher in Eden Prairie, Minnesota, says he learned about the program late in his college career and had difficulty taking full advantage of it. "I was a senior when I got into the program," he says. "Graduation was just around the corner. I didn't want to hang around and be a co-op for two years, so I only went down twice before I graduated. The director at that time was really encouraging me to do a few more sessions. But I think he understood, too, that I wanted to graduate, get a job, and double or triple my income. You know, that's all you want to do when you're a senior."

But Dzenitis says students shouldn't let the extended school time matter. "A co-op helps define what it is you want to do, and it allows you to experience that in a real life work situation," she says. "You think you know what you like in your studies, but until you get actual projects to work on and study, it's hard to know what it is you want to do."

Nicholas Neeb (Aerospace '88) participated in the co-op program in 1988 and went on to become a teacher at Eden Prairie (Minnesota) High School.



Gerald J. Le Beau, Elizabeth (Grimaldi) Dzenitis, and Nicholas Neeb in front of a disabled Saturn 5 rocket at Johnson Space Center in 1988. All three participated in the NASA co-op program that year.

"The co-op program gets your foot in the door for possible employment when you graduate. That's a big benefit," says Le Beau, now a NASA employee. Another benefit, he says, is finding out which areas of specialization you find appealing. During one of his tours at NASA, Le Beau started working with fluid mechanics, a field in which he continues to work now. "Through the co-op tours I was able to get a feel for what some of those areas are like. And I think I did a better job of picking my area of specialization."

Both Cloud and Holmes also work on very specialized projects. Holmes is learning about flight control systems and creating computer displays and schematic drawings for the crews of the space station and mission control. "This is real stuff we're working on," he says. "It's pretty crazy, to think that something you're actually working on is going to be used for something in the space station."

"There is a lot of fun stuff going on in the aerospace field right now," says William Garrard, head of the Department of Aerospace Engineering and Mechanics. "NASA has changed its philosophy, and instead of doing a few big, expensive programs, they are doing a lot of smaller, relatively inexpensive projects like the recent Pathfinder mission to Mars, the X-33, and other vehicles for low-cost access to space. There are so many interesting new programs at NASA that it's almost like a reprise of the 1960s. I think people are getting excited about aerospace again.

"People are fascinated by aeronautics and space," adds Garrard. "These are things that stretch the mind — things that require all of your talents." IT

For more information about educational opportunities at NASA, visit the NASA web site at *http://ednet.gsfc.nasa.gov/nep/programs*.

SPACE CENTER PHOTO COURTESY NICHOLAS NEEB; NEEB PHOTO BY BURTON HAUN

A summer at the NASA Academy:

'A learning experience and a lesson in history'

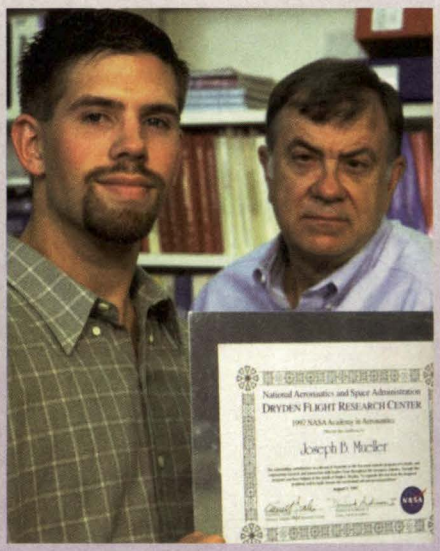
BY JOSEPH MUELLER

Years ago Hugh Dryden, aerospace science pioneer, urged his colleagues "to separate the real from the imagined" in their scientific endeavors. Today his words have a special meaning for five college students who spent last summer at the NASA Academy in Aeronautics at California's Dryden Flight Research Center. As one of those lucky students, I was proud to represent the University of Minnesota in a program that was incredibly rewarding on both the professional and the personal levels.

The NASA Academy is intended to be something more than the usual student internship at NASA. Established in 1993 at the Goddard Space Flight Center by Dr. Gerald Soffen, the academy was founded on the "principle of education through opportunity." Soffen wanted to provide promising students with an environment of unlimited opportunity so that they could unleash their creativity and "just see what happens." The academy offers students the technical rigor to expand their engineering know-how as well as a chance to develop leadership skills. The leadership development component adds a dimension to the academy experience which undoubtedly remains with the students for the rest of their lives.

The NASA Academy is now offered at three other sites–Marshall Space Flight Center, Ames Research Center, and Dryden. This summer's intensive, ten-week-long program was the first ever to be held at Dryden.

Although its program is small, Dryden is steeped in aerospace history. Chuck Yeager broke the sound barrier at Dryden in 1947, and today it is home to astronauts and test pilots Gordon Fullerton and Bill Dana, as well as Marta Bohn-Meyer, national aerobatics champion and the only woman to fly the SR-71 Blackbird. Working at Dryden was a learning experience and a lesson in history every day.



Joseph Mueller and William Garrard display Mueller's certificate from the NASA Academy. Garrard is director of the Minnesota Space Grant Consortium, which has sponsored at least one IT student in the academy each year since its inception.

During my stint as a research associate I studied dynamics and controls with Joseph W. Pahle, my principal investigator. Together we validated linear models of the F-18 High Angle Research Vehicle (HARV), a project that examined the flight control effects associated with thrust vectoring. Because HARV could alter the direction of the thrust force produced by the F-18's two powerful engines, it could sustain flight at extremely high angles of attack, making it much more maneuverable than a conventional F-18. Unfortunately, these high angles of attack added complexity to the aerodynamics, causing the system to behave with strong non-linear characteristics.

Creating a linear model from a non-linear system is like comparing a Volkswagen Bug with a Ferrari – both are cars, but they behave quite differently. My specific task was to apply linear models designed for conditions other than actual flight conditions. I tested the range over which these linear models were valid and attempted to qualitatively determine the causes of their eventual inaccuracy. About half my time was spent navigating through the Dryden Flight Data Archives and learning all that I could about the flight control features of the HARV. At the end of the summer, I prepared a written report as well as a 30-minute presentation detailing my research and conclusions.

The NASA Academy experience is not devoted only to research. For ten weeks, I found myself jumping from one opportunity of a lifetime to another. The other students and I traveled to various NASA facilities and toured the National Test Pilot School. At each site we met with prominent people from NASA and the aerospace field, including NASA Administrator Daniel Goldin, astronauts Story Musgrave and Buzz Aldrin, and industry leaders Burt Rutan and Peter Diamandis. At least once a week we dined with Dryden staff members and administrators. The contacts we made are invaluable.

As an academy alumnus, other opportunities await me. The NASA Academy Alumni Association (NAAA) serves as a central communication network for academy alumni. I hope to get involved with the NAAA through its first executive council, which will be elected before the year's end. I want to stay in contact with the academy.

NASA is a unique and valuable institution. By bringing the mysteries of the world to light, it has the power to inspire, the ability to enthrall and enliven a curious mind, and to send that mind down the path of discovery. I sincerely hope that the academy continues to provide young minds with the same gift of learning and growth that I received this summer. IT

MUELLER PHOTO BY BURTON HAUN

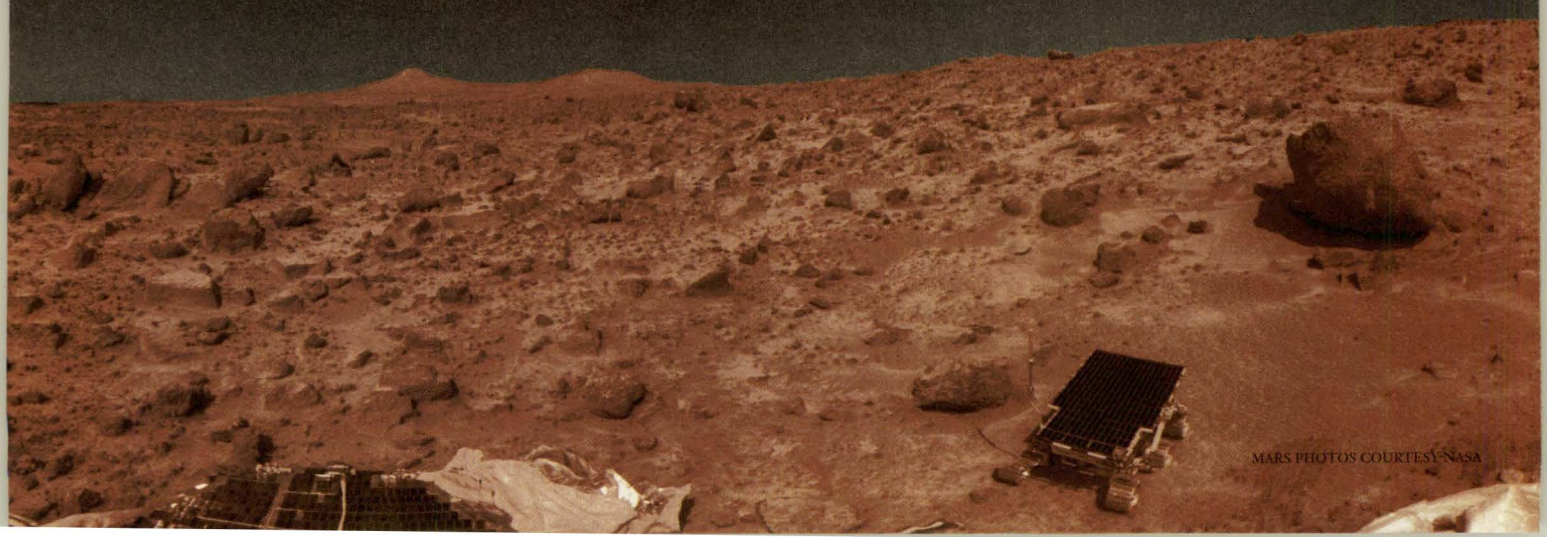
COMMENTARY

Martian Mystique

COMMENTARY BY ROBERT PEPIN

It's a bit odd to lust after a bunch of rocks, but the images of Martian terrain sent back by Pathfinder are beautiful — and tantalizing. Instruments in laboratories all over the world are waiting to analyze samples of Mars, but the rocks in these photos are so far beyond our reach that they might as well be ... well, on Mars. Still, we Mars addicts who do our science in Earth-bound labs, instead of on spacecraft or at the end of a telescope, have had an enormous stroke of luck. Every once in a while a chunk of space debris, a mini-asteroid, or small comet hits Mars with enough energy to tear loose small pieces of its surface and blast them into space. Through the laws of orbital mechanics, nature delivers some of these fragments to Earth free of charge. A dozen of these "Martian meteorites" have been found so far. Laboratory measurements of them have told us a lot about the planet they come from, including the startling report last summer that one of them may hold evidence that Mars was populated billions of years ago by a primitive kind of microbial life. This suggestion of extraterrestrial life, if confirmed (at the moment, a big "if"—there's no shortage of skeptics) would surely rank as one of the most scientifically and philosophically important discoveries of the space age, or of any age.

How would we go about proving, or disproving, the existence of life in



MARS PHOTOS COURTESY NASA

the distant past on Mars? And, if it were there, where, when, and how might it have begun, and what drove it to extinction?

In the short term, before people are there in person to explore the planet, there seems to be only one way — to bring samples of rock, soil, and the atmosphere back to Earth for detailed study. Pathfinder won't do this, nor will Global Surveyor, now on its way to orbit Mars in September, nor will any of the other missions scheduled between Global Surveyor and the first sample return scheduled for 2005. Their collective role is to scout out the territory — to gather the information needed to select the most favorable landing site and the most promising kinds of materials to bring back in 2005. This is the exploration strategy, and it's a good one, although it means throttling impatience for almost another decade (when I'll probably be doddering into my laboratory on a cane).

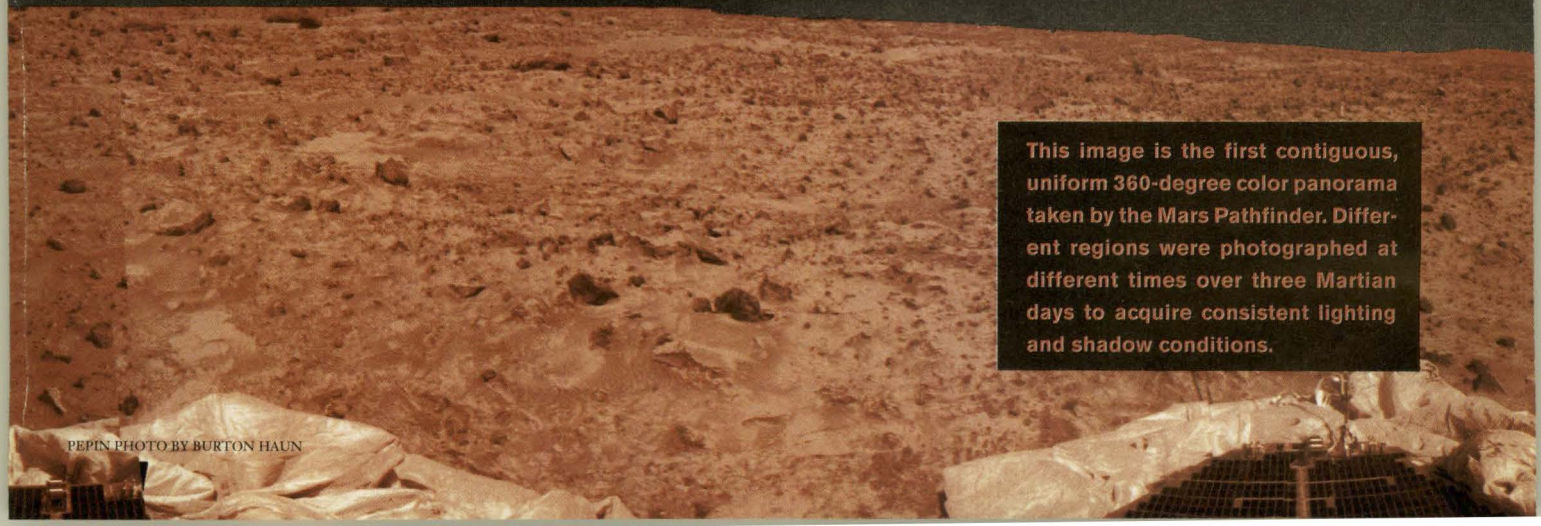
In the meantime, we have the "Martian meteorites," and with them a central question: how sure are we that they really come from Mars? The circumstantial evidence that they do is pretty convincing, but it is circumstantial — because nobody was around to see them leaving the planet. In this business there are always the surprises that make it such an exciting field. Here's where Pathfinder could help, if the chemical detector on the Sojourner rover works as well as everything else has, by allowing us to compare the chemical compositions of genuine, certified Martian rocks with the compositions of these meteorites.

In addition to the chemical measurements, Pathfinder is providing other important scientific information. Geologists are positively rhapsodic about what they are seeing up close at this landing site, at the end of an immense channel scoured into the Martian surface by an ancient catastrophic flood. Meteorological instruments are sending back reports of weather conditions in an atmosphere very different from our own.

But to me Pathfinder is turning out to be, above all, a technological tour-de-force. Who would really have believed that delicate instruments inside a super beach ball could survive a 60-mph impact, deploy themselves, and be happily clucking away to each other and to us a few hours later? The mission designers obviously thought so, and they were right. And they did it cheaply at a time when planetary exploration was becoming prohibitively costly. The little Sojourner rover, the first unmanned instrument platform on a planetary surface, is worth the price all by itself. Pathfinder could not have been more aptly named. My guess is that it will be remembered, long after its scientific measurements have been rendered obsolete by more sophisticated and more accurate data, for ushering in a new mode of planetary exploration. There are dangers, to be sure, and some future missions of this kind will fail. But the potential scientific payoffs of these fast, frequent, and relatively inexpensive visits to our planetary neighbors are worth the risks. ■

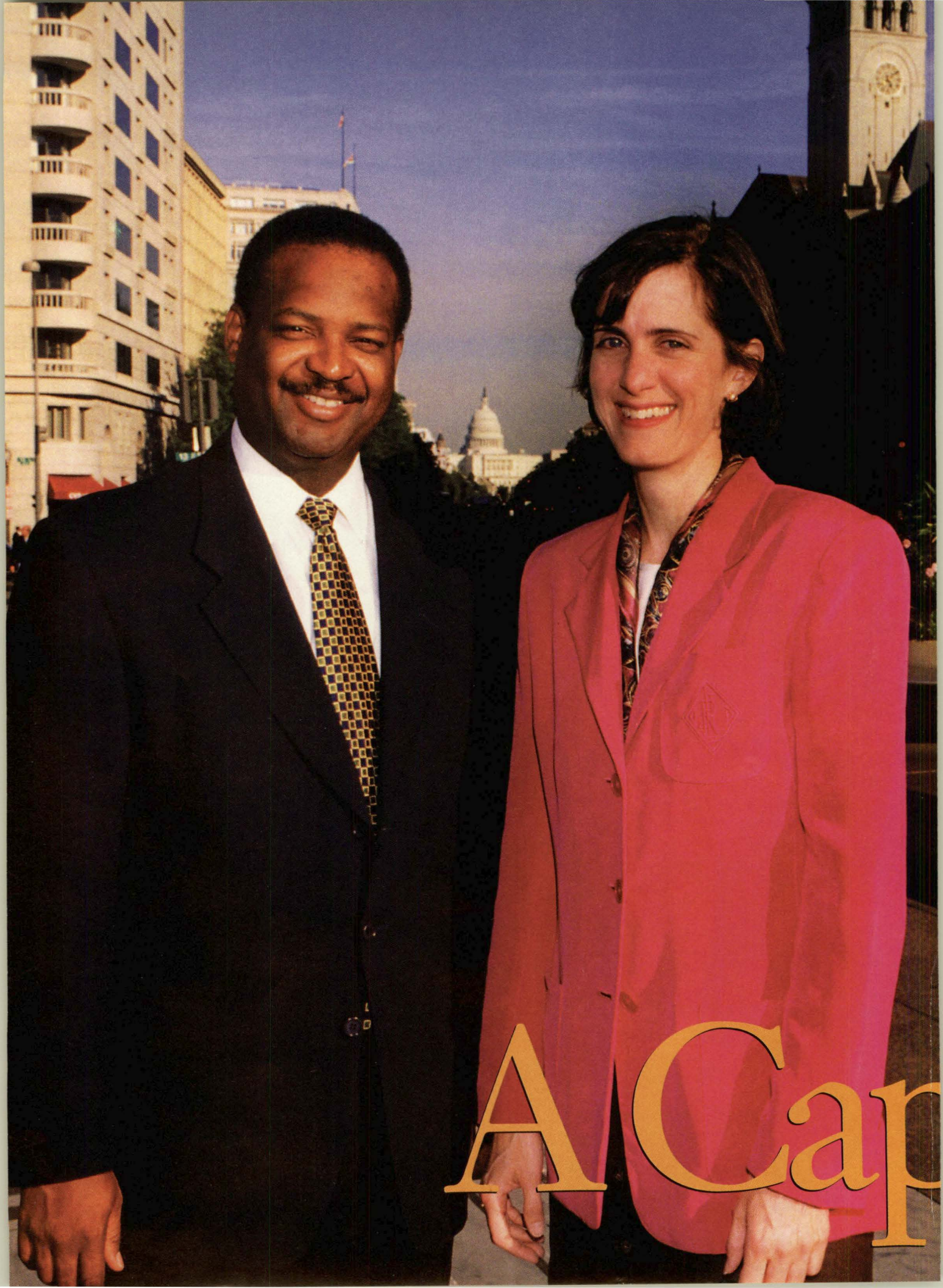
For more information about the Mars Pathfinder mission, visit the NASA web site at *http://www.nasa.gov.*

Robert Pepin is a professor of physics and director of the IT Honors Program. His research focuses on the origins of the solar system and the evolution of volatile gases in the interiors and atmospheres of Earth, Mars, and Venus.



This image is the first contiguous, uniform 360-degree color panorama taken by the Mars Pathfinder. Different regions were photographed at different times over three Martian days to acquire consistent lighting and shadow conditions.

PEPIN PHOTO BY BURTON HAUN


A Cap

One of IT's rising stars is soaring to new heights in Washington, D.C.

Amy Alving, an associate professor of aerospace engineering and mechanics, will spend the next 12 months holding one of the most prestigious White House appointments.

Alving is one of 15 White House Fellows appointed in June by President Bill Clinton and the Commission on White House Fellowships. The fellows — selected from among 600 applicants for their remarkable career achievements, commitment to public service, and demonstrated leadership potential — spend a year as full-time, paid assistants to officials in the government's executive branch.

Established by President Lyndon Johnson in 1964, the White House Fellowships provide a unique opportunity for citizens to participate in the highest levels of the federal government. "There are a lot of opportunities for people with a background like mine to contribute to policy discussion," says Alving. "Science and technology are extremely important to politics."

In addition to Alving, this year's fellows include a Michigan neurosurgeon, a Boston pediatrician, the director of Legal Aid of Cambodia, a Washington civil rights attorney, a Chicago investment banker, and the director of basketball development for the Boston Celtics. They range in age from 27 to 41.

Their ages reflect the program's purpose, which is to nurture future leaders, rather than to reward established ones. "They're looking for people who have the potential to take what they learn from the program and go on to do great things in their communities and professions," says Alving, who is 34. The 500 alumni of the program include General Colin Powell, CNN president Tom Johnson, and former Housing and Urban Development Secretary Henry Cisneros.

Alving earned her place in this distinguished group through her work as a researcher and educator. In her seven years at the Institute of Technology, she has garnered a lengthy list of grants and awards, including a five-year, $500,000 fellowship from the David and Lucile Packard Foundation, a Mondale Fellowship in the Humphrey Institute of Public Affairs and a McKnight Land Grant Professorship.

Within her field, Alving's specialty — turbulence — has a well-deserved reputation for posing tough problems. Fluid mechanics encompasses a broad range of scientific phenomena, from blood moving through tiny capillaries, air flowing over a wing to lift a bird or a 747, a torpedo spiraling its way toward an aircraft carrier, or even the flares of hot gas thrown up thousands of miles from the surface of the Sun. These are the playgrounds of chaos, where the tiniest quirk can, if undetected, lead to such an unexpected outcome that the entire system becomes unpredictable, as weather forecasters are reminded only too often.

"We know all the equations that govern the behavior of fluids, but that doesn't mean we can describe the motions of fluid in every single case," Alving says. "If we change the shape of a wing or a boat hull slightly, we may change the air or water flow pattern drastically."

Take sailing, for example. Picture a ship sailing on a calm sea, its bow slicing through the water's surface. Water behind the bow begins to churn and bubble chaotically, resulting in drag. "It's been useful to think of this kind of disorder in terms of vortices, which are tornado-like swirls of water that form along the hull," says Alving. When these spinning vortices of water interact with each other, they increase the disorder and drag.

To reduce these effects, 3M has manufactured riblets, microscopic grooves that run lengthwise in the skin of a hull. Riblets reduce drag, perhaps by trapping some of the vortices and keeping them from interfering with their neighbors.

Using her department's wind tunnel,

Associate Professor Amy Alving and her White House Fellowship principal, Deputy Commerce Secretary Robert Mallet.

tal Scholar

by Paul Sorenson

ALVING PHOTOS BY RONALD BELL

Associate Professor Amy Alving at work as a White House Fellow in the United States Department of Commerce.

Alving discovered that the proper arrangement of riblets will also increase lift — the force that makes airplanes rise and allows sailboats to tack into the wind — on curved surfaces like wings and sails. The study broke new ground in sail design and drew attention from researchers and sailing buffs around the world. It also fits Alving's idea of what makes engineering fun.

"Engineering is a spectrum from the completely theoretical to the nuts and bolts," she says. "I'm interested in the middle ground, which uses theory to solve practical problems. That's what I like to do most."

Two years ago, Alving's ability to solve practical turbulence problems earned her a seat on the Army Science Board, a group of experts that advises the military on research and development projects. "I was brought on board as a consultant because the army thought it had a turbulence problem," says Alving, "and I was eventually invited to become a full member of the board. The experience has been quite rewarding intellectually."

Retired Lt. Gen. Jack Woodmansee, a member of the Army Science Board and former White House Fellow, praised Alving's work with the panel. "She is extremely bright and works well as a part of a team," Woodmansee says, adding that he especially values Alving's broad range of expertise.

Alving has also earned praise for her work in finding creative ways to help children, including several appearances on the popular PBS television program "Newton's Apple." On the program, Alving explained fluid dynamics by describing how planes fly and how waterskiers stay above the water. "That show is important because it reaches a huge audience of kids and explains science in a way that grabs their interest and piques their curiosity," says Alving, who has also served as a consultant to the show. "It says to kids that science isn't really hard; science is around you every day."

Alving is also a regular participant in

Alving is one of 15 White House Fellows selecte career achievements, commitment to publ

"There are a lot of opportunities for faculty members who understand these issues to reshape universities. I don't expect to come back from Washington with the magic solution for the problems universities face, but I know I'll come back better-equipped to help make a difference."

Breakfast with Scientists, a successful program that brings scientists and Minnesota secondary school students face-to-face across the breakfast table. "The students have a chance to connect with real people who work in science and do interesting things every day," says Alving. "It helps them find out what science has to offer."

Mealtime discussions influenced Alving's decision to become an engineer in a different way. "My family on my father's side is all doctors," she says. "My dad, uncle, grandfather, great-grandfather, and sister are M.D.s. My mother got a physician's assistant degree. The dinner-table conversation was always about medicine, and I thought they were the most boring conversations ever. I wanted to do something different."

When it came time to choose an assignment in Washington as a White House Fellow, Alving again chose something different — the Department of Commerce. "We all hear about global economy and how the world is shrinking," she says. "So I will spend the year learning more about that."

In today's world, commerce is unquestionably linked to technology, she adds. "Technology is what is going to keep the economy going. For someone like me in a technological field, it's very interesting to see how the economic side of it works."

The Department of Commerce also oversees several high-tech agencies that appeal to Alving, including the National Weather Service, the National Oceanic and Atmospheric Administration, National Telecommunication and Information Administration, the Patent and Trademark Office, and the National Institute of Standards and Technology.

Alving's duties with the Commerce Department will vary. "There isn't a typical set of assigned tasks for a White House Fellow," she says. "You step in and fill the gaps.... The job is what you and your principal make of it."

Alving's principal is Deputy Commerce Secretary Robert Mallett, the agency's second-in-command. "He's as excited about this opportunity as I am," she says.

Alving and the other White House Fellows also participate in an education program that augments their work experience. "The overarching theme of the program is developing leaders," says Alving, "and the educational programs have the potential to have the most impact" in that regard.

The program includes informal meetings with leaders from both the public and private sectors. "We have the opportunity to engage in dialogue with people like Supreme Court justices and foreign leaders," says Alving. "That's exciting."

Fellows also travel to other major U.S. cities, domestic military bases, and foreign countries to learn about other cultures and to see policy in action. Like the work assignment, these activities focus on learning by doing. Fellows have tutored New York City school children, fired weaponry at Ft. Bragg, and risen before dawn with workers in the sugar cane fields of southern Florida. Previous classes have also traveled through Latin America, the former Soviet Union, and Asia to examine development challenges in the world's poorest countries and modern-day urban problems in its busiest cities.

This year the fellows themselves will plan where they wish to travel. "We get to decide where to go, what to do, and what we hope to get out of it," she says,

When she returns from Washington next fall, Alving hopes to take a greater leadership role at the University.

"Universities, including this one, are in trouble in many ways," she says. "They are trying to complete a lot of missions for many different constituencies. Expectations are rising at the same time funding is decreasing. The pattern is dangerous."

"There are a lot of opportunities for faculty members who understand these issues to reshape universities," she adds. "I don't expect to come back from Washington with the magic solution for the problems universities face, but I know I'll come back better-equipped to help make a difference."

For more information about the White House Fellowship program, call 202-395-4522 or visit the program's web site at *http://www.whitehouse.gov/WH_Fellows/*.

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rvice, and demonstrated leadership potential.

FACULTY

Eye on the Sky

IT professor to head prestigious astronomical society

BY JUDY WOODWARD

Ask astronomy professor Robert Gehrz about his work, and the president-elect of the American Astronomical Society (AAS) will discourse soberly about the ways in which the discoveries of astronomy can advance the technological interests of modern society. Push Gehrz a little harder, and a complementary truth emerges.

"Astronomy is a lot of fun. The whole thing is great!" he admits, sounding more like the teenage boy who once built his own telescope than the senior professor of astronomy that he is now.

Gehrz will lead the 6,500-member AAS for the next four years. His term of office will include the organization's centenary in 1999. As he prepares to take the organization, the largest group of professional astronomers in North America, into the 21st century, Gehrz reflects on the attraction that astronomy has for the general public.

"Part of it is the lure of the sky. People are interested in the lure of star-watching." Gehrz adds that astronomy is one of the few scientific fields which depends on amateurs.

"The amateurs discover things like comets," he notes. "The pros don't look at the same place in the sky night after night. That's something that amateurs can do without technical training. They take pictures day after day and look for things that move."

Gehrz explains that amateurs' astronomical observations are posted via the "daily telegram" (which nowadays arrives by e-mail) to professional astronomers. "And we scan those every day before we go out to observe."

But there's another reason for astronomy's appeal, according to Gehrz. "Astronomy deals with things like how the universe began, how life began. Origins, whether of life or of the planets, are the key to the whole thing. When I teach astronomy classes, I include physics, geology, chemistry, biology — astronomy covers all sciences."

Gehrz points out one area that astronomy definitely doesn't include. "It bothers me a lot," he said, "when people confuse astronomy and astrology. People call the astronomy department all the time asking us to do calculations showing where the planets will be at a certain time. I try to tell them that astrology is more like religion than a science, and that there's no scientific basis for it." Gehrz pauses, "I don't usually convince them, though."

As Gehrz tells it, the genuine discoveries of astronomy should be dazzling enough to convert any astrologer. Not long ago, for example, Gehrz and his fellow researchers discovered "stardust." "We were looking at the Hale-Bopp comet," he explains, "and we found ultra-fine dust grains in the tail of the comet. We've never seen such small dust granules. The effect was to make the sparkling tail extra bright."

Gehrz also points to the exciting discoveries being made by the Mars Pathfinder mission. He explains that the pictures of boulders on Mars transmitted back to Earth in recent weeks are only the first step in a planned exploration of the Red Planet which will last into the next century. Bringing back Martian rocks is an upcoming step, and interplanetary travel is not an impossible goal, Gehrz says.

Professor Robert Gehrz

When will humans land on Mars?

"If we had the national will, we could do it by 2020," he responds, although he concedes that a more realistic timetable would place manned exploration of Mars "well into the next century."

Gehrz set his sights on the stars at an early age. He said he "was turned on to astronomy" while a student at St. Paul's Central High. A teacher there introduced him to a Macalester College professor who built telescopes. Before long, young Gehrz was building his own. He even entered his homemade telescope in the 1960 Minnesota State Fair.

Gehrz has been building bigger and better telescopes ever since. After getting his B.A. and Ph.D. from the University of Minnesota, he became an assistant professor at the University of Wyoming. There, Gehrz led the construction in 1979 of what was then the world's largest infrared telescope. Now he's involved in NASA's Space Infrared Telescope Facility (SIRTF), which he describes as a "follow-up to the Hubble Space Telescope. It will make an all-new picture of the sky by the year 2001."

Gehrz does most of his stargazing through infrared telescopes, which make use of extra-long light waves that allow observers to see inside dust clouds in outer space.

When asked about astronomy's practical value, Gehrz quickly lists some of the technological benefits of research in

astronomy, from a basic understanding of nuclear fusion to the gravitational implications of satellite orbits to the discovery of the element helium. "The whole point of astronomy is to understand the ways in which physics works on the universe," he explains.

Astronomy is only one of Gehrz's passions. Tall and lanky, with the look of a man who could still fit into his high school football uniform, the 53-year-old Gehrz describes himself as "normally the oldest guy on the ice." He plays ice hockey in three or four different leagues — none of them in the senior division, Gehrz points out proudly.

Gehrz took up ice hockey in his mid-30s when he began coaching his son's team. The son has long since graduated to college football, but Gehrz remains faithful to hockey, playing as many as three games a week.

When Gehrz is on the ice, his fans include his wife, Sue, who is the mayor of Falcon Heights, and his son and daughter, both students at the University.

Gehrz sounds nearly as enthusiastic about ice hockey as he is about the future of astronomy. Although he has no plans at the moment to promote himself to the senior leagues, Gehrz likes to point out that he's seen "articles in the American Association for Retired Persons newsletter about guys in their 60s and 70s who are still playing hockey."

And if the future doesn't include hockey, there's always astronomy. "Astronomy is in a golden age," says Gehrz happily, "still fun, still great."

For more information visit the American Astronomical Society web site at *http://www.aas.org/.*

Clearing the air

Continued from page 19

Philip Goodrich and Assistant Professor R. Roger Ruan, is to eliminate livestock odors altogether. Their team has developed a non-thermal plasma reactor that converts gases from swine manure (hydrogen sulfide, ammonia, and other volatile organic compounds) into an odorless liquid mix of nitrogen, water vapor, and other gases.

Two years into the project, Ruan is pleased with the progress of the research. "We have pretty decent results," he says. "We don't have any odors coming out of the plasma reactors." His team hopes to have a low-cost commercial reactor on the market within a year.

Ruan and Goodrich have also used electromagnetic fields to kill some of the odor-causing microorganisms in manure. According to Goodrich, the process "shows considerable promise as an economical alternative to [other] techniques."

Jacobson, Ruan, Goodrich, and other researchers meet weekly to discuss the progress of their research projects. They share common goals and find their colleagues' feedback to be useful.

"All the projects are separate, but we try to share our information," Jacobson says. "It is still hard to sort out what will emerge as acceptable solutions. What works well for one [type of manure] might not work for another," he says. "We've just got to learn more about it."

The research is important because the public sees a problem in need of a solution, says Jacobson. "Even people who have lived [near farms] for a long time are seeing the need. We're not supporting anyone in particular; we're trying to serve everyone in the state."

For more information visit the Biosystems and Agricultural Engineering web site at *http://www.bae.umn.edu.*

Getting the green light

Continued from page 21

Papanikolopoulos. "The computer has to be able to 'see' them behind eyeglasses and sunglasses, and in the dark."

Another project uses a car-mounted camera to warn drivers when they get too close to the vehicle in front of them. "The system locks on the license plate [of the car in front of you] and can tell you, based on the relative size of the plate, whether or not you're too close," says Alejandro Ozerkovsky, a graduate student who works with Papanikolopoulos on the project.

Papanikolopoulos and Ozerkovsky are using the same technology to detect lane markers and traffic moving in and out of them. The team hopes to integrate the two projects, providing the first step toward developing an automated car, says Papanikolopoulos.

But this technology is still in its infancy, he warns. "We have to be careful not to get ahead of ourselves. Too often we create expectations that are far higher than the state-of-the-art," and the public becomes disillusioned when those expectations aren't met, he says.

Still, Papanikolopoulos is excited about the potential benefits of his work. "Research should be useful. It should have an impact — make people happier, safer, healthier," he says.

"These projects have the potential to do all of those things."

For more information visit Papanikolopoulos' web site at *http://www.cs.umn.edu/~npapas/.*

items

AEROSPACE ENGINEERING AND MECHANICS

Professor William Garrard has been nominated as an alternate delegate to the Aerospace States Association. Garrard was singled out by the principal delegate, Lt. Governor Joanne Benson, for his dedication to the industry and efforts to attract youth to consider aerospace careers through the Minnesota Partners in Aerospace Project.

Wendy Crone Grebner, a Ph.D. candidate, has been awarded an Engineering Dissertation Fellowship for 1997-98 from the American Association of University Women. Grebner's research involves the experimental investigation of deformation near a notch tip in metallic single crystals. Her work will advance the understanding of the effects of orientation and hardening on plastic deformation.

ASTRONOMY

Professor Robert Gehrz has been appointed chair of the International Gemini Project, a multinational corporation building two 8m telescopes at Mauna Kea, Hawaii, and Cerro Pachon, Chile. Gehrz is also a member of the SIRTF Science Working Group supervising the design, construction, and operation of the NASA Space Infrared Telescope Facility.

Professor Terry Jones and **Associate Professor Evan Skillman** will represent the University in a consortium of universities which hopes to construct a 2.4m telescope with the National Optical Astronomy Observatories.

Professor Paul Woodward will be the moderator of the Scientific Visualization Panel at the Supercomputing '97 event, held in San Jose, California. During October, Woodward was chair of the Visualization Subcommittee at the Digital Technology Summit, held in Minneapolis.

BIOSYSTEMS AND AGRICULTURAL ENGINEERING

Professor Frederick Bergsrud retired from the department in October after almost 30 years of service. Bergsrud served as department head from 1983-1987, and again during the 1991-92 academic year.

CHEMICAL ENGINEERING AND MATERIALS SCIENCE

Regents' Professor Rutherford Aris will be the institute lecturer at the national meeting of the AIChE in November.

Professor Frank Bates received the High Polymer Physics Prize from the American Physical Society in March. Bates returned from a sabbatical at the University of California-Santa Barbara in July.

Professor Robert Carr traveled to China in October to give a plenary lecture at the seventh International Beijing Conference and Exhibition on Instrumental Analysis.

Professor Barry Carter is currently at the Los Alamos National Laboratory for the first half of his sabbatical leave. In September he presented an invited talk at the Boundaries and Interfaces in Materials Symposium at the ASM/TMS meeting. During the same month he traveled to Ecuador for the Intra-America Congress on Electron Microscopy.

Professor James Chelikowsky was an invited lecturer at the Theory and Computer Simulation of Materials-Electronic Structure and Mechanical Behavior Symposium, held in Cancun, Mexico, during September. Chelikowsky also organized a focused session for the American Physical Society on "Materials Theory: Atomic and Electronic Structure" in March.

Professor Edward Cussler was named a fellow of the AIChE, as well as the American Association for the Advancement of Science. Cussler also attended the Engineering Foundation Conference on Structured Fluids and Interfaces in Italy.

Associate Professor Jeffrey Derby has been elected to the executive committee of the American Association for Crystal Growth. Derby is currently preparing for the International Conference on Crystal Growth to be held in Jerusalem, Israel, in May 1998.

Professor D. Fennell Evans was recently the focus of a *St. Paul Pioneer Press* article about his leadership of the NSF-sponsored Center for Interfacial Engineering.

Associate Professor Lorraine Francis gave an invited talk at the second European Meeting on Integrated Ferroelectrics in Jouy-en-Josas, France, in September.

Assistant Professor Daniel Frisbie has been selected as one of 20 recipients of the David and Lucile Packard Fellowships for 1997. The award consists of a $500,000 research grant disbursed over five years.

Professor William Gerberich gave invited talks at the fourth International Conference on the Fundamentals of Fracture (ICFF) and the second Euroconference on Material Instabilities in Deformation and Fracture. Gerberich has also been selected as the U.S. representative of the Scientific Advisory Board for ICFF V to be held at Oxford University in 2001.

Professor Weng-Shou Hu and Frank Cerra (of the Academic Health Center) completed an agreement with Algenix, Inc. to take the bio-artificial liver they developed into clinical trials after receiving an "investigator's new drug" status from the Food and Drug Administration.

Professor Timothy Lodge presented invited papers this fall at the Gordon Conference on Polymers, the third International Discussion Meeting on Relaxation in Complex Systems, and the fifth Pacific Polymer Conference.

Professor Chris Macosko was elected a Fellow of the Society of Plastics Engineers.

Associate Professor Alon McCormick will give two invited talks at the November meeting of the AIChE on "Control of Reaction Kinetics, Precipitation, and Self-Assembly in Sol/Gel Catalyst Preparation" and "Reaction Engineering Principles in Sol/Gel Synthesis." McCormick will also give an invited talk on sorbate placement in zeolites at New Mexico State University during the same month.

Regents' Professor Skip Scriven gave a plenary lecture at the Coating Symposium in Fukuoka City, Japan, in September. Scriven also took part in the International Union on Theoretical and Applied Mechanics Invitational Symposium on Rheology and Computation held in Sydney, Australia, during July.

Associate Professor Jack Sivertson will retire in January 1998 after 40 years of service to the department.

Professor William Smyrl presented a paper on "Modeling of Reaction Distributions over Inclusions on Aluminum Alloy Surfaces" at the Electrochemical Society meeting held in Paris, France, during September. During that same month, Smyrl presented an invited lecture at the first International Workshop on Scanning Electrochemical Microscopy in Freiburg, Germany.

Yeshayahu Talmon joined the department as this year's George T. Piercy Professor. Talmon received his Ph.D. from the department in 1979 and has since worked at the Technion-Israel Institute of Technology in Haifa. At Minnesota, Talmon will continue his collaboration with Regents' Professors H. Ted Davis and Skip Scriven, studying the microstructure of coatings using both cryo-TEM and cryo-SEM.

Professor Matthew Tirrell received the Stine Award and delivered the J. M. Smith Lecture at the University of California-Davis.

Associate Professor Robert Tranquillo served on the International Scientific Committee at the International Cellular Engineering Meeting and was an invited speaker at the fourth Abercrombie Symposium on Cell Behavior in Oxford, England.

Professor Michael Ward published a cover story in *Science* entitled "Nano-porous Molecular Sandwiches: Pillared Two-Dimensional Hydrogen-Bonded Networks with Adjustable Porosity." Ward was also awarded a creativity extension by the NSF for his research grant and gave an invited lecture at the Université Louis Pasteur.

Assistant Professor Renata Wentzcovitch will chair a symposium on "High-Pressure Materials Research" at the Materials Research Society Meeting held in Boston during December.

CHEMISTRY

Professor Paul Barbara gave a plenary lecture at the International Conference on Unconventional Photoactive Systems in Nara, Japan, in August and was an invited lecturer at the third Femochemistry Conference in Lund, Sweden, later that month. The May issue of *Science* published an article detailing Barbara's single-molecule research, as well as his own article, "Discrete Intensity Jumps and Intramolecular Electronic Energy Transfer in the Spectroscopy of Single Conjugated Polymer Molecules."

Graduate student Penny Beuning received the Louis T. Dosdall Fellowship.

Graduate student Michelle Douskey was the recipient of the Council of Graduate Students Student Leadership Award.

Assistant Professor Craig Forsyth has received one of two 1997 Zeneca Pharmaceuticals Excellence in Chemistry awards. Established in 1985, this award provides $30,000 in unrestricted research support. This is the second time a department member has been honored with this award.

Anne Hodges, an undergraduate student, received the Undergraduate Student Award for Excellence in Chemistry from Iota Sigma Pi, a national honor society for women in chemistry. The award consists of a cash prize and a year's paid membership in the society.

Richard Hsung joined the faculty as an assistant professor in September. Hsung obtained his B.S. in chemistry and mathematics from Calvin College in 1988. After receiving his M.S. and Ph.D. in organic chemistry in 1990 and 1994, respectively, from the University of Chicago, he completed two postdoctoral duties at the University of Chicago and Columbia University with an NIH fellowship. His research interests include areas involving development of new organic relations, drug design for Alzheimer's disease, and development of novel catalytic surfaces for stereoselective organic reactions.

Marcus Martin and **Rebecca Urbankek**, graduate students, both received the Stanwood Johnston Fellowship.

Wendy Naughton, a graduate student, is the recipient of the 1997 Chemistry Teaching Assistant of the Year Award.

Dale Randall received a Natlge-Nunc Professional Training Award enabling her to attend the 24th annual meeting of the National Association of Scientific Materials Managers, held in Tacoma, Washington, this past July.

Xiaoyang Zhu joined the faculty in July as an associate professor with tenure. Zhu received a Ph.D. from the University of Texas. Before coming to Minnesota, he was an assistant professor of chemistry at Southern Illinois University for four years. His research focuses on surfaces and thin films, including surface reaction dynamics, surface photochemistry, self-assembled monolayers, resistless and monolayer lithography, chemical beam epitaxy (CBE), and atomic-layer epitaxy (ALE). His recent honors include a Cottrell Scholar Award, a Camille and Henry Dreyfus New Faculty Award, and an Alexander von Humbolt Fellowship.

CIVIL ENGINEERING

Professor John Gulliver has been named acting head of the department, filling the position vacated when Professor Steven Crouch became IT's associate dean for finance and planning. The search for a permanent replacement is underway.

Professor Heinz Stefan received the Founder's Award from the International Association on Water Quality for his joint paper "Long-Term Lake Water Quality Predictors." The award is presented to American authors appearing in *Water Research*. Stefan was recently appointed to the James L. Record Professorship in Civil Engineering.

COMPUTER SCIENCE AND ENGINEERING

Associate Professors John Carlis and **John Riedl**, **Assistant Professor Joseph Konstan**, and **Professor R. Elde** of Biological Sciences were awarded a $520,000 grant from the National Science Foundation for a collaborative, distributed database for brain viewing.

Associate Professor Maria Gini will serve as the local chair for the second International Conference on Autonomous Agents held in Minneapolis during May 1998. Gini was also recently appointed to the Editorial Advisory Board of the journal *Integrated Computer-Aided Engineering*.

Associate Professor Ravi Janardan received a $190,000 grant from the National Science Foundation for a geometric investigation of layered manufacturing (algorithms, software, and fabrication). Janardan served as guest editor of a special issue of

Computer-Aided Design, and gave invited lectures on layered manufacturing at NIST and the University of Washington.

Assistant Professor Joseph Konstan was the program chair for the USENIX TCL/TK Workshop held in Boston on July 12-15. Konstan will be an ACM lecturer for 1997-98 and has been named a co-chair of the CHI 98 Basic Research Symposium held in Los Angeles, California.

Assistant Professor Zhiyuan Li and **Professor Pen-Chung Yew** co-chaired the 10th Workshop on Languages and Compilers for Parallel Computing, which was co-sponsored by MSI and Cray Research in August.

Associate Professor Nikolaos Papanikolopoulos received a $190,000 grant from the Minnesota Department of Transportation for a bicycle-counter project. He is also the guest editor of a special issue of *Robotics and Automation*.

Associate Professor John Riedl received an $18,000 grant from ICEM Systems for collaborative software inspection technology transfer.

Associate Professor Shashi Shekhar was awarded a $100,000 grant from the Center for Transportation Studies for his study "Archival of Traffic Data, Phase 2."

Elizabeth Shoop was awarded a $70,000 grant from the National Science Foundation for her study "POWRE: Combining Data Mining and Information Visualization Techniques with a Molecular Biology Sequence Similarity Database System."

Associate Professor Jaideep Srivastava and **Assistant Professor Bamshad Mobasher** have been named organizers of a panel on "Web Mining" during the IEEE International Conference on Tools with Artificial Intelligence.

Professor Pen-Chung Yew, **Associate Professor David Lilja**, and **Assistant Professor Joseph Konstan** won a $40,000 IBM Partnership Award for their collaborative work with IBM Rochester. They will develop tools to measure the performance of Java applications in a client/server environment.

ELECTRICAL AND COMPUTER ENGINEERING

Associate Professor Stephen Campbell presented an invited talk, "TiO2 as a High-Permittivity Gate Dielectric," at the SRC-sponsored Topical Research Conference held in Austin, Texas, during October.

Professor Vladimir Cherkassky published a joint paper entitled *Learning From Data: Concepts, Theory, and Methods*. Cherkassky also recently received an IBM Partnership Award for his research in learning methods for data processing.

Associate Professor Douglas Ernie and **Assistant Professor Lori Lucke** led a NSF-sponsored undergraduate research project this summer. The project, which allows undergraduates to work closely with department faculty, will be funded by the NSF for the next four years.

Associate Professor David Lilja has been appointed as an IEEE Computer Society Distinguished Visitor from September 1997 to August 2000.

Professor Ned Mohan chaired an NSF-sponsored faculty workshop on "Teaching of First Course on Electric Drives: Integration of Lectures, Simulations, and Hardware Laboratory." The workshop was attended by more than 100 participants, most of whom were faculty members from universities in the U.S.

Associate Professor Jay Moon served as program chair for the Magnetic Recording Conference held in Minneapolis during September.

Professor Keshab Parhi has been appointed to the E. F. Johnson Professorship in Electronic Communications. Parhi shares the professorship with Ahmed Tewfik.

Professor Dennis Polla was a member of the U.S. Department of Defense Science Board study on "Transnational Threats." The study recommend a policy position for the Department of Defense on terrorism and its consequences. A final briefing was made to the Secretary of Defense and Chairman of the Joint Chiefs of Staff. Polla also was part of an economic development delegation to Israel and Jordan led by Minnesota Attorney General Hubert Humphrey III. The group met with Israeli Prime Minister Benjamin Netanyahu and President Ezer Weizmann, and later was hosted by King Hussein of Jordan.

Sachin Sapatnekar joined the department as an associate professor this fall. Sapatnekar received a Best Paper Award at the 1997 ACM/IEEE Design Automation Conference with his student Naresh Maheshwari. The paper was entitled "An Improved Algorithm for Minimum Area Retiming."

Guillermo Sapiro joined the department as an assistant professor.

Adjunct Assistant Professor Bethanie Stadler is participating on the Organizing Committee of the 1998 Materials Research Society meeting on Integrated Magneto-Optics: Materials and Devices.

Professor Alan Tannenbaum and two Japanese collaborators received the 1996 Best Paper Award from the Japanese Controls and Signal Processing Society for their paper entitled "Two Block H-Infinity Problem for Infinite Dimensional Plants."

Professor Ahmed Tewfik gave invited talks at the 31st Asilomar Conference on "Affine-Invariant Content-Based Image Retrieval" and "Media Compression via Data Hiding." Tewfik will speak on "Signal Processing in Multimedia" at Purdue University and at the IEEE Signal Processing Society Chapter in Rochester, New York, during November.

Associate Professor Bapi Vinnakota received an IBM Partnership Award. Vinnakota was also promoted from the rank of assistant professor this fall.

GEOLOGY AND GEOPHYSICS

Professor Subir Banerjee will be one of two conveners at the American Geophysical Union's All-Union session on Climate History and Climate Dynamics held in San Francisco during December. Speakers will address the ability of numerical models to account for the major climatic events of the last 130,000 years in sediments and rocks.

Stephanie Brachfield, a Ph.D. student, presented two invited talks at the Antarctic Ice Margin Evolution (ANTIME) Workshop in Hobart, Tasmania, and at the Paleo-History of the Palmer Long-Term Ecological

Research Workshop in Santa Barbara, California.

Assistant Professor Marc Hirschmann joined the department in September. Hirschmann's research areas of interest include the application of experimental and theoretical models to problems in igneous petrology, geochemistry, and mineralogy. His experimental approaches emphasize the use of a newly installed piston cylinder laboratory for simulating processes in the shallow mantle. Hirschmann's theoretical activities include the calibration of an application for thermodynamic models of mantle minerals and silicate liquids using the MELTS thermodynamic algorithm. His other interests include order/disorder and crystal chemistry of rock-forming silicates, as well as petrogenesis of layered intrusions.

Associate Professor Emi Ito organized a Geochemical Society symposium entitled, "Geochemical Records of Hydrologic Response to Climate Change" for the Annual Geological Society Meeting held in October in Salt Lake City. Ito is also organizing a special session for the fall American Geophysical Union meeting entitled "Isotopic Records of Hydrologic Response to Climate Change."

Professor David Kohlstedt has been selected as a Distinguished Lecturer of the Mineralogical Society of the United Kingdom and will speak at Cambridge, Manchester, Edinburgh, Bristol, and Oxford Universities, as well as University College London, this October. Kohlstedt also published a study (along with Greg Hirth) detailing research on the compositional base of oceanic plates and evolution of the oceanic upper mantle. Kohlstedt is currently organizing a session on "Water in the Mantle" for the fall AGU meeting this December.

Associate Professor Bruce Moskowitz gave invited talks this October at the annual GSA meeting and the 1997 Mineralogical Society of America Short Course on Geomicrobiology. A special symposium at the spring meeting of the American Geophysical Union will be organized by Moskowitz in the coming year.

Professor V. Rama Murthy has been named a member of the IT Consultative Committee which is responsible for reviewing nominations and making recommendations for the awarding of various University honors, including outstanding achievement awards and honorary degrees. Murthy also published two joint papers in a recent issue of *Physics of the Earth and Planetary Interiors* outlining a new model of core segregation and chemical equilibrium in the Earth during its formation.

Professor Christian Teyssier served as an invited professor at the Université Montpellier II in France last winter, as well as at the ETH in Zürich, Switzerland, last spring. Teyssier will publish a joint paper in *Tectonophysics* detailing the importance of thermal relaxation and partial melting of the crust in the process of mountain building and subsequent collapse.

Pieter Vlag has joined the Institute for Rock Magnetism as a research fellow studying the effects of past climate changes on the magnetic properties of sediments. In his research at the University of Aix-Marseille (France) on climatic variation in Europe during the last 130,000 years, Vlag has found evidence that very rapid climatic shifts can be detected and quantified by magnetic measurements on lake sediments. At the University of Minnesota he will study wind-deposited sediments from Alaska to determine whether similar shifts are recorded there.

Assistant Professor Donna Whitney is working on several projects focusing on a complete metamorphic sequence in the Taconic Range in the Appalachian Mountains. This work includes documenting P-T paths, determining rates of metamorphic mineral growth, and interpreting the physical conditions and chemical effects of fluid flow at different crustal levels in the sequences. Whitney joined the department in September.

David Williamson, research fellow, has received approval from the French Centre Nationale de la Recherché Scientifique to extend for a second year his sabbatical at the Institute for Rock Magnetism. Williamson's research on the magnetic properties of Quaternary-age lake sediments from Europe and Africa is continuing to produce a more detailed picture of the climate history and of past geomagnetic field behavior on regional and global scales.

Regents' Professor Emeritus Herbert E. Wright celebrated his 80th birthday with a special symposium in Switzerland, organized by the University of Bern. More than 60 researchers, many of them former students of Wright, attended the celebration in Wengen. The second day of festivities included a hike over the glacial features at 2300m to Kleine Scheidegg, then a cog rail visit to the European Solar and Atmospheric Observatory at the Jungfraujoch at 3490m. A second celebration in Minnesota involved a field trip and an informal gathering at Wright's home. This year Wright celebrated his 50th year with the department.

MATHEMATICS

Professors Maury Bramson and **Mikhail Safonov** each have been invited to give a 45-minute address at the next International Congress of Mathematicians to be held in Berlin on August 18-27, 1998. Though department faculty have been selected for this honor before, next year marks the first time that two professors have been invited to speak at the same congress.

Regents' Professor Avner Friedman has been named the recipient of the Distinguished Service to the Profession Award by the Society for Industrial and Applied Mathematics (SIAM). In the 45-year history of SIAM, only two such awards were given in the past; the recipients were Edward Bolch and Gene Golub.

Professor Ettore Infante has been selected to head Vanderbilt University's College of Arts and Sciences. Infante, former dean of IT and senior vice president for academic affairs, had been on sabbatical at Brown University in Providence, Rhode Island. Before coming to the University 13 years ago, he taught mathematics at Brown and at the University of Texas.

MECHANICAL ENGINEERING

Associate Professor Saifallah Benjaafar has been named the associate editor of the *Journal of Manufacturing Systems*. Benjaafar is also serving as cluster chair for the 1997 INFORMS meeting in Montreal, Canada.

Assistant Professor John Bischof received the NSF Career Award to establish the efficacy of Cryosurgery of Uterine Fibroids. Bischof will receive $50,000 per

year for the project as well as additional funds from CANDELA Corporation that will be matched by NSF.

Merve Erdal will join the department as an assistant professor in December after receiving her Ph.D. from the University of Illinois. Erdal earned her bachelor's and master's degrees from the Middle East Technical University in Ankara, Turkey.

Matt Hansen, Erik Nafstad, and **Troy Nickel**, graduate students, were awarded first place for their mechanism design entered in a contest held by the Eaton Corporation. The $15,000 prize was awarded at a special dinner held at the company headquarters in Pittsburgh. The students were also invited to demonstrate their design for Eaton employees and given a tour of the company's Cutler Hammer Technology Center. The winning mechanism design began as a team project for Professor Arthur Erdman's ME 5203 Advanced Mechanism Design course this past spring quarter.

Caroline Hayes will join the department as an associate professor in March 1998. Hayes obtained her Ph.D. in robotics, an M.S. in knowledge-based systems, and a B.S. in math/computer science from Carnegie Mellon University.

Professor Joachim Heberlein presented a plenary lecture at the Brazilian Vacuum Society's Annual Congress on Applications of Vacuum in Industry and Science held in Petropolis, Brazil, during July.

Professor Thomas Kuehn has been named a Fellow of the American Society of Mechanical Engineers.

Professor Frank Kulacki is organizing a national conference on technology-based engineering education to be held in Nashville, Tennessee, on November 20-21.

Professor Emil Pfender presented a keynote lecture entitled "Thermal Plasma Technology: Where Do We Stand and Where Are We Going?" at the International Symposium on Plasma Chemistry held in Beijing, China, during August.

Professor David Pui has been named a Fellow in the American Society of Mechanical Engineers.

Professors Kim Stelson, **Joachim Heberlein**, and **Emil Pfender**, along with graduate student Jason Sheard, were awarded a certificate of merit by the ASM Thermal Spray Society for their paper, "Diagnostic Development for Control of Wire-Arc Spraying." Heberlein accepted the award at the Society's 1997 United Thermal Spray Conference held in Indianapolis during September .

PHYSICS

Paul Crowell will join the department as a tenure-track assistant professor beginning winter quarter 1998.

Professor Allen Goldman is finishing his year as chair of the American Physical Society Publications Oversight Committee.

Professor Kenneth Heller has been named associate department head.

Professor Benjamin Bayman is the department's new director of undergraduate studies.

Professor Marvin Marshak returned to the department following a one-year appointment as the University's senior vice president for academic affairs. Marshak has also resumed his position as director of Residential College and will serve as the Faculty Consultative Committee's legislative liaison.

AROUND IT

Stephen Johnson, associate director of the Charles Babbage Institute, has been appointed an assistant professor in the Department of Space Studies at the University of North Dakota in Grand Forks. His successor is **Anne Fitzpatrick**, who comes to IT from the Technology and Safety Analysis Division at Los Alamos National Laboratory.

Professor Sally Gregory Kohlstedt, history of science and technology, and Professor Helen Longino of the Department of Women's Studies have published a book entitled *Women, Gender, and Science.* Kohlstedt is offering the course "Science in Twentieth Century America" this fall to incoming IT honors students, assisted by Mark Largent and Eric Boyles. Historically constructed, the class includes a substantial discussion of ethics and will involve students in a number of computer-based projects on the Internet and online research. For detailed information, see *http://www.umn.edu/scitech.*

Professor Arthur Norberg, history of science and technology, and Judy O'Neill have written a book entitled *Transforming Computer Technology*, a history of the development of network, timesharing, and computer graphics technologies by the Advanced Research Projects Agency. The book has been published by The Johns Hopkins University Press.

Robert Seidel, director of the Charles Babbage Institute, will deliver an invited talk on the history of scientific computing in December at the University of Michigan-Ann Arbor.

Giving gifts of property

BY RICHARD HATFIELD, DIRECTOR OF DEVELOPMENT AND EXTERNAL RELATIONS

Contributions to the Institute of Technology need not be limited to gifts of cash or securities. Real estate and personal property are two often-overlooked ways to fulfill your philanthropic goals.

Real estate can include homes, cabins, commercial buildings, land, and other property. Gifts of this nature can be very helpful to IT while providing you with substantial tax benefits, too. Your income tax deduction is for the fair market value of the real estate, which is determined by a qualified real estate appraiser. Gifts of real estate are deductible up to 30 percent of your adjusted gross income.

If the value of your property is more than you wish to give (or deduct) in any given year, you may make a gift of only part of your interest in it. As an example, if you own farm land but do not wish to contribute all of it, you may donate a partial interest.

Artwork, antiques, rare books, patents, and similar property are subject to estate taxes at their current market value if they are left in your estate. If you donate these gifts during your lifetime, the tax savings can be substantial. You receive an income tax deduction for the value of the item and reduce estate taxes.

Occasionally donors will have items that are of great value to them but of limited value to the University. You should know that gifts must be related to the mission of the University in order to be deductible at their full market value.

Gifts of personal property are often hard to value. Although we cannot appraise the gifts, we can help arrange for their transfer.

Getting the maximum tax benefits from charitable giving is not always easy. Tax laws are complex, and you should consult your accountant, attorney, or financial advisor when you consider a gift.

For more information or to make a gift to IT, please contact Richard Hatfield, director of development and external relations, at 1-800-587-3884 or 612-624-5537 or e-mail *development@itdean.umn.edu.*

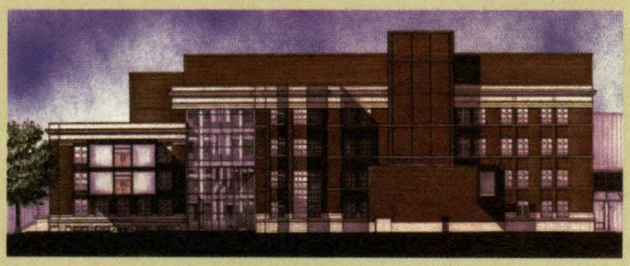
MECHANICAL ENGINEERING CAMPAIGN

ME campaign approaches $6 million

The Campaign for Mechanical Engineering approached $6 million in October, nearing two-thirds of its $9-million goal. That total includes contributions from the Bayport Foundation, Caterpillar Paving, and the Minnesota chapter of the American Society of Heating, Refrigeration, and Air Conditioning Engineers.

Three recent campaigns raised more than $310,000 from employees and retirees at 3M, MTS Systems, and UFE Inc.

3M's six-month campaign raised $270,000, which will be matched and supplemented by the company for a total contribution of more than $1 million. Seventy-one 3M employees and 15 retirees contributed, including 62 mechanical engineering graduates, 14 graduates from other IT programs, and 10 individuals with no IT connection. The success of this campaign is due largely to the leadership of 3M's Frank Vikingstad (Chemical '64), Warren Schneider (Mechanical '72), and Joe Pribyl (Mechanical '83) and 3M retirees Russ McNaughton (Electrical '57), Les Krogh (Chemistry Ph.D. '52) and Carl Kuhrmeyer (Mechanical '49). In recognition of their million-dollar contribution, one floor of the new mechanical engineering facility will be named in honor of 3M, its employees, and retirees.



At MTS, employees and retirees raised more than $88,000. That amount, coupled with the company's original gift and special matching funds generated through the employee campaign, brings MTS' total contribution to $525,577. A similar campaign at UFE Inc. generated $14,000, which will be matched by UFE for a total gift of $28,000.

Groundbreaking for the new facility (pictured above) will take place when the campaign reaches $7.2 million – 80 percent of its $9-million goal.

ILLUSTRATION COURTESY MECHANICAL ENGINEERING CAMPAIGN

Ethel Swanson

Through generous gifts to IT, Ethel Swanson has created a lasting memorial to her late husband and his love of learning.

PROFILE BY PAUL SORENSON

CARL SWANSON LOVED LEARNING. From tinkering with radios and erector sets as a young boy in North Dakota to teaching mathematics to Minnesota college students in semi-retirement, his passion for discovering and sharing knowledge shaped every facet of his life.

"He was interested in everything," recalls his wife, Ethel. "If he didn't understand something, he would work hours and hours to figure it out."

That fascination with learning led him to earn three University of Minnesota degrees in electrical engineering (a bachelor's degree in 1927 and master's and professional degrees in 1937) and a distinguished career as an engineer and educator.

Swanson's colorful career began as an engineer at Westinghouse Electric in 1927. In 1929 he returned to the University to teach courses in engineering, radio communications, and mathematics. He also developed a friendship with his colleague and former classmate, Professor Alfred Nier (Electrical '31, M.S. '33, Ph.D. '36).

Although he enjoyed teaching, Swanson left the University to work for Northwest Airlines in 1939. During World War II he worked with the military to design radio communications systems between the U.S. and Asia. One project — a precursor to radar — helped pilots land on the Aleutian Islands in zero-ceiling weather or darkness. "The pilots couldn't see where to land, so he focused narrow radio beams on either side of the runway to guide them in," explains his daughter, Esther (Swanson) Kellogg. "It was a very advanced technology. He was really ahead of the times." Later, his inventive work with high altitude ignition systems resulted in a wartime meeting with Charles Lindbergh.

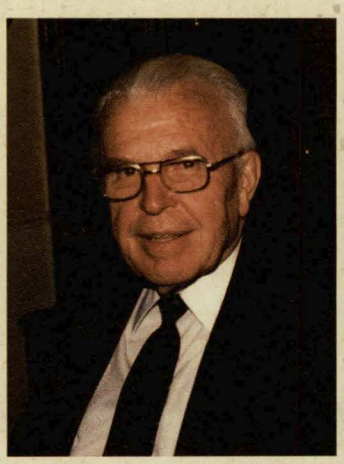
After the war, Swanson's work at Northwest focused on commercial applications for the technology he had developed for the military.

In a 1943 article for the Minneapolis *Daily Times*, he described how "so-called secret war radio inventions" would revolutionize commercial air traffic control in peacetime. "We are coming to the age of automatic piloting, of being able to fly the shortest possible routes, of being able to ignore such restraining factors as bad weather, and of obtaining control of planes and air traffic through radio devices which will put the complete picture before us on a screen," he wrote.

Later in the decade he led the Northwest team that acquired the far-reaching, 75-passenger Boeing Stratocruiser, a $1.6 million plane that could travel at more than 300 miles per hour.

Swanson left the airline in 1951 to work in senior engineering positions for Honeywell, Engineering Research Associates, Remington Rand, and Univac. In 1964 he returned to teaching mathematics in the Minnesota community college system.

"He loved to teach, and was excited to return to it," says Ethel. "Teaching at the community college was very different from [teaching at] the University, but he en-



Ethel Swanson established the Carl E. and Ethel A. Swanson Scholarship Fund to honor her late husband, an IT alumnus.

PHOTOS COURTESY ETHEL SWANSON

joyed it, and though it was demanding, he was highly respected." He retired from teaching in 1974.

A devoted husband and father, Swanson shared his passion for exploring new subjects with his family. Together they studied American Indian history, Egyptian art, Japanese sculpture, and classical music. "The minute he took an interest in something, he went all out," says Ethel. "We would be all wrapped up in that for a while, and then move on to something new. He was never bored, never boring."

"He loved to experiment with high-fidelity sound," adds Kellogg. "Of course, you can't get high-fidelity sound unless it's very, very loud. So when we listened to Beethoven, the whole neighborhood listened with us.".

Swanson was also fascinated with the challenge of using his mathematical and mechanical skills to figure out how to open combination locks. By 1973 his abilities were so well-developed that he was called on by the military to crack a safe that contained classified documents. "He opened it, but he wasn't allowed to look inside," recalls Ethel. "Of course, they had a man standing right beside him to make sure that he didn't."

> "I wanted to do something in his memory that would benefit young people. A scholarship seemed a particularly appropriate tribute."

Inspired by their father, both Esther and her brother, Roger, earned University of Minnesota degrees. Esther (Education '55) married Martin Kellogg (Industrial '53), president of UFE Inc., a Minnesota-based plastics company. Roger (Electrical '53) founded Glasstite Manufacturing, a leading manufacturer of fiberglass truck toppers. He later sold the company and began sailing the oceans around the world.

After her husband's death, Ethel created a lasting memorial to him by establishing the Carl E. and Ethel A. Swanson Scholarship Fund, which provides scholarships to outstanding juniors and seniors in IT's electrical engineering program. Her generosity ensures that his love of learning will continue to touch the lives of others.

"I wanted to do something in his memory that would benefit young people," says Ethel. "Teaching and learning were always very important to him, and he and Roger both had close ties to electrical engineering. A scholarship seemed a particularly appropriate tribute."

For more information about opportunities to support IT and the University of Minnesota call 1-800-587-3884 or 612-624-5537 or e-mail *development@itdean.umn.edu.*

PHILANTHROPY

Institute of Technology 1997-98 funding priorities

Each year the Institute of Technology benefits from the generous support of its alumni and friends. Your support helps us maintain the level of excellence that people have come to expect from IT.

As we move forward into a new year of exciting challenges, with great expectations for increased research, student enrollment, corporate partnerships, and major capital projects, we have established a list of priorities to ensure that the basic needs of IT are met and that the greatest possible benefit is derived from the available resources.

These priorities, based on recommendations from the dean and associate deans, the department heads, and the director of development and external relations, are:

1. Mechanical engineering capital campaign
2. Amundson Hall addition/renovation
3. Undergraduate scholarships
4. Department professorships/chairs
5. Graduate fellowships
6. Inventing Tomorrow Fund (Dean's Initiatives)
7. Special projects (research, summer computer camp for girls, APEXES, women's programs, math and science initiatives, lectureships, faculty initiatives)
8. IT endowment
9. Special equipment
10. Capital improvements

IT's Office of Development and External Relations promotes and coordinates institutional advancement through private contributions. Priorities change as specific goals are met and as new priorities arise.

We have initiated specific fundraising programs for the priorities listed here. We would be happy to visit with you about any of them or about potential new areas of funding.

For more information contact Richard Hatfield, director of development and external relations, at 1-800-587-3884 or e-mail *development@itdean.umn.edu.*

Cargill Incorporated

America's largest private corporation — a longtime IT supporter — has launched a generous higher education initiative

Founded as a single grain elevator alongside a set of railroad tracks in 1865, Cargill Incorporated rode the railroad boom of the late 1880s to expand its network of grain elevators, and today is the world's largest grain trader and the country's largest privately held corporation.

Cargill now encompasses food processing, financial services, steel milling, salt mining, and other industries at more than 1,000 locations in 72 nations around the world. Still, it remains largely owned by descendants of its founder, William Wallace Cargill.

Cargill has stayed on the cutting-edge of its industries by developing and adopting innovative technologies. That leadership includes everything from pioneering the use of 100-car grain trains and temperature-controlled orange juice tankers to recent breakthroughs in food processing and biodegradable plastics.

The company draws many of the bright minds that fuel its innovations from the University of Minnesota and IT. More than 440 current Cargill employees are University alumni, a quarter of whom are IT graduates.

According to Ronald Christenson (Mechanical '72), Cargill corporate vice president and chief technology officer, the caliber of IT's educational programs is one of many reasons the company has forged close ties with the University. "Cargill has been very successful in recruiting a number of outstanding University graduates, and the University provides a number of opportunities for folks to benefit from [continuing education] classes, seminars, and advanced degree programs."

Cargill has a long history of generous support for those programs. Since 1983 the combined giving of Cargill and its subsidiaries to the University represents approximately 47 percent of the company's total grants to universities and colleges throughout the U.S. Its total contributions to the University have topped $5 million, including a recent gift of $200,000 to the mechanical engineering building campaign.

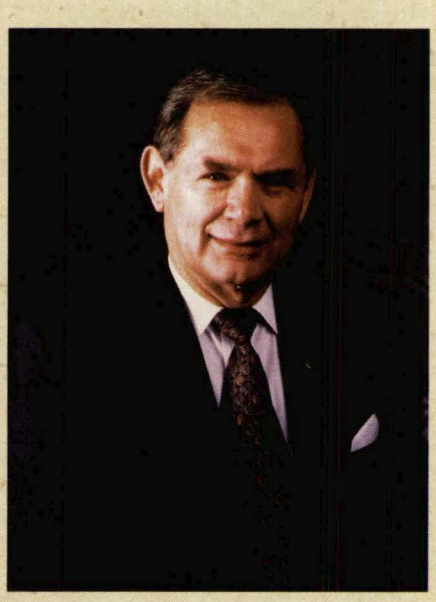
But Cargill hasn't stopped there. The company recently launched a new higher education initiative aimed at building new partnerships with the University and strengthening those that already exist. "Cargill and the University are a natural fit. Our close proximity gives us a good opportunity to work together," says Christenson. "The new [higher education] initiative will strengthen those ties."

Cargill also helps the University stay in touch with the needs of industry. Toward that end, Christenson participates on the IT Dean's Advisory Council, which helped IT develop two new professional master's programs in response to industry need.

According to Christenson, Cargill's contributions to the University lead to benefits for the entire state. "Cargill wants to be a good citizen, and ... our involvements [with the University] help us achieve that goal," he says.

— Paul Sorenson and Joel Meyer

For more information about opportunities to support IT and the University of Minnesota call 1-800-587-3884 or 612-624-5537 or e-mail *development@itdean.umn.edu*.



Ernest S. Micek, chairman and CEO

CARGILL

Primary products: Agricultural, food, financial, and industrial products

Headquarters: Minnetonka, Minnesota

CEO: Ernest S. Micek

Annual sales: $56 billion

Net income: $814 million

Employees: 79,000

For more information: *http://www.cargill.com*

MICEK PHOTO COURTESY CARGILL

Intel Corporation

The world's number one computer chip manufacturer has a long history of support for IT and the University of Minnesota

When Intel Corporation introduced the world's first commercial microchip in 1971, the chip contained 2,300 transistors and could process 60,000 instructions per second. Today, Intel's state-of-the-art Pentium Pro microprocessor dwarfs its predecessors with 5.5 million microprocessors that can execute more than 300,000 instructions per second.

Intel has expanded along with the computing power of its microchips to become the world's largest microprocessor manufacturer. In 1996, Intel's market value more than doubled — to $111 billion — and the overwhelming majority of the 70 million personal computers sold contained Intel chips.

The company also produces networking, communications, and computer- enhancement products. In 1996 it introduced the world's first low-cost PC-based video phone, which delivers video communications over ordinary telephone lines.

The company's newest products, the Pentium II and Pentium MMX, feature new graphics capabilities and have reaffirmed its leadership in the microchip market.

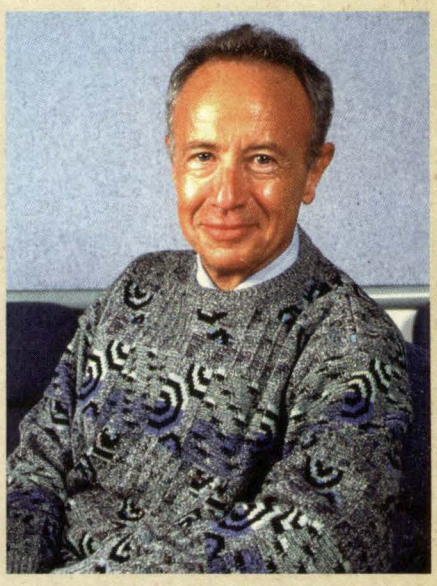
Intel's commitment to higher education has also increased. Intel has supported IT and the University of Minnesota on several fronts, donating equipment and funds for research and academic programs — including several computer-related projects in mechanical engineering, computer science and engineering, electrical and computer engineering, and the Supercomputer Institute.

The company is also a leading employer of IT students and a perennial participant in IT's co-op programs. According to Mostafa Kaveh, head of the Department of Electrical and Computer Engineering, Intel has hired more than 40 IT graduates in the past several years alone.

Intel employees also serve the University on a number of advisory committees and councils, including the electrical and computer engineering department's Industrial Advisory Council.

"Intel contributes [to IT] in many capacities," says Kaveh. "We are certainly grateful for its support." IT

— Joel Meyer



Andrew S. Grove, chairman and CEO

intel

Primary products:
Computer microchips and communications equipment

Headquarters:
Santa Clara, California

CEO: Andrew S. Grove

Annual sales: $20.8 billion

Net income: $5.2 billion

Employees: 48,500

For more information:
http://www.intel.com

For more information about opportunities to support IT and the University of Minnesota call 1-800-587-3884 or 612-624-5537 or e-mail *development@itdean.umn.edu.*

GROVE PHOTO COURTESY INTEL

alumni

Class of 1947 reunites

Twenty-one members of the IT Class of 1947 returned to campus September 11-13 to celebrate the 50th anniversary of their graduation. Events included a welcome reception hosted by the IT Alumni Society, tours of IT labs and departments, a bus tour of campus, and a class reception and dinner with IT Dean H. Ted Davis. Some members of the class also attended the Gophers vs. Iowa State football game and took a guided tour of the Twin Cities. Members of the class who returned include:

- John Adler, St. Paul, Minnesota
- Eugene Barradas, Tomahawk, Wisconsin
- Richard Bartsch, Tigard, Oregon
- Robert Batey, Rye Brook, New York
- Roberta (Huston) Cronquist, San Jose, California
- Donald G. Estebo, Menominee, Michigan
- Charles Eumurian, Mahtomedi, Minnesota
- Ed Glass, Golden Valley, Minnesota
- Roy Grieder, Roseville, Minnesota
- Albert Holler, Minneapolis, Minnesota
- Alice (Jarvis) Klein, Brookfield, Illinois
- Albert Mayer, Edina, Minnesota
- Robert McKee, Richland, Washington
- Andrew McNicoll, Reseda, California
- Ralph Miller, Jr., Normandy Park, Washington
- Robert Ouimette, Bloomington, Minnesota
- Benjamin Richards, Salt Lake City, Utah
- William Taylor, Manchester, Connecticut
- Eugene Vanhala, Duluth, Minnesota
- Elmont "Al" Ward, Edina, Minnesota
- C. M. Williams, Minneapolis, Minnesota

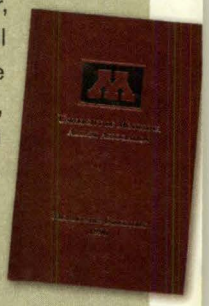
The class of 1947 and spouses gather on the steps of Lind Hall.

ITAS BRIEFS

The Class of 1948 will hold its 50th reunion in September 1998. Class members (including those who graduated with master's and doctoral degrees in 1948) who are interested in planning the reunion should call ITAS at 612-624-5537 or 1-800-587-3884, or e-mail *itas@itdean.umn.edu.*

ITAS needs volunteer mentors for the IT Mentor Program, which provides alumni mentors to currently enrolled IT students. The program, now entering its seventh year, is sponsored by ITAS. More than 160 alumni and students participated in the program last year. For more information or to become a local or long-distance (via e-mail) mentor, contact ITAS at 612-624-5537, 1-800-587-3884, or e-mail *itas@itdean.umn.edu.*

A comprehensive directory of more than 30,000 IT alumni will be published in December. In addition to cross-referenced listings by name, graduation year, career, and geographic area, the directory will include a history of the college as well as the first complete listing of IT's Nobel Laureates, faculty and alumni members of the National Academy of Sciences and the National Academy of Engineering, and Outstanding Achievement Award recipients. If you have not yet reserved your copy, please contact the publisher, Bernard C. Harris Publishing Company, directly at 1-800-877-6554. The directory is also being offered on CD-ROM, and will include all IT alumni for whom current information exists.



Membership makes a difference! The IT Alumni Society is the oldest collegiate alumni society in the University of Minnesota Alumni Association. ITAS members receive all of the benefits of UMAA membership, including a subscription to the bimonthly *Minnesota* magazine, low-cost Internet access, Twin Cities campus library privileges, hotel and rental car discounts, alumni tours of international and domestic locations, access to University meeting rooms and reception facilities, and discounts in other special programs. The annual membership fee is $30 for individual memberships or $40 for a dual or family membership. For more information contact ITAS at 1-800-587-3884 or 612-624-5537, or e-mail *itas@itdean.umn.edu.*

REUNION PHOTO BY PAUL SORENSON

IT Career Services launches Internet job service for alumni

Thanks to IT Career Services and the IT Alumni Society, you may start your next career move on the World Wide Web.

Career Services recently unveiled an ITAS-sponsored online job center for IT students and alumni. Job-seekers can search an online database of employment opportunities by key word, field, geographic area, or job level. Nearly 400 positions with large and small employers throughout the country are already posted on the site.

According to Sharon Kurtt, director of Career Services, the site gives IT students and alumni better access to top job opportunities.

"This is one of the special services we provide to help give IT students and alumni a competitive advantage [in the job market]," says Kurtt. "Through the Internet, we can make these job postings available to alumni worldwide."

To ensure that IT alumni and students have exclusive access to the site's online resources, job-seekers must contact Career Services or ITAS for a password to the system.

The Career Services web site also includes information about other services available to students, alumni, and employers.

For example, Career Services maintains information about many national and regional employers that can help IT students and alumni locate employers and industries that match their individual interests. Alumni may also participate in the center's resume referral service and free monthly workshops designed to build job-seeking and interviewing skills.

Sharon Kurtt and her staff help both IT alumni and students meet their career goals.

In addition, the center's career counselors can work with alumni individually to explore career options, prepare resumes and reference letters, or practice interviewing.

"It's all part of our commitment to providing lifelong career services," says Kurtt. "We really are a comprehensive career center." IT

— Paul Sorenson

For more information call 612-624-4090, visit the Career Services web site at *http://www.technology.umn.edu/career*, or e-mail *itcs@gold.tc.umn.edu*.

PHOTO FILE

Looking back...

Famous faces dot this 1936 photograph of the chemistry faculty in front of Smith Hall. Pictured are (front row) Professors Sneed, Maynard, Sandell, Heisig, Montonna, Lauer, (second row) Koelsch, Livingston, MacDougall, Sarver, Pervier, Stephens, Stoppel, (third row) Mann, Montillon, Clockler, Geiger, Reyerson, Thompson, Grove, (back row) Copeland, Barber, Leland, Cohen, Lind, Kolthoff, Smith, and Buth.

KURTT PHOTO BY BURTON HAUN, CHEMISTRY PHOTO FROM THE UNIVERSITY ARCHIVES

Engineering change for women

BY PAUL SORENSON

Roberta "Bobbie" (Huston) Cronquist and Alice (Jarvis) Klein

When the IT class of 1947 gathered for its 50th reunion in September, two members of the class stood out from the rest. Alice (Jarvis) Klein and Roberta "Bobbie" (Huston) Cronquist were the only women among the alumni who returned for the reunion— and two of only five women among hundreds of IT graduates that year.

Although they weren't the first women to pursue degrees in IT, Klein and Cronquist were among the pioneering women whose presence in the field of engineering helped pave the way for those who followed.

"Women [in IT during the 1940s] were treated pretty well," says Klein, but they weren't welcomed with open arms. Engineering was a male-dominated field, and "men weren't necessarily prepared to deal with women as colleagues," she adds.

According to Cronquist, many faculty members and male students didn't understand why a woman would want to pursue a career in engineering. "Although the fellows accepted us, it just didn't make sense to them," she says. "Women [who worked outside the home] were expected to be bookkeepers, teachers, or nurses — not engineers"

> "Although the fellows accepted us, it just didn't make sense to them. Women [who worked outside the home] were expected to be bookkeepers, teachers, or nurses — not engineers."

For that reason, faculty members in IT weren't as well-prepared as their colleagues in other areas of the University when it came to dealing with women in the classroom.

Some instructors resented their presence. According to Klein, one group of professors routinely peppered their lectures with off-color jokes and stories. "But when women were in their classes, they had to change their language completely and cut out all of the off-color stuff," she says. "It ruined their fun."

Other instructors attempted to set separate guidelines for the women in the class — a move that was meant to protect women from direct competition with men. "I was against division [of students by gender]," says Klein. "I didn't want to compete against women alone. I wanted to compete against everyone."

Both Cronquist and Klein proved themselves by excelling in class. "Eventually, they discovered that we [women] knew what we were doing and could do it as good or better than the men," says Klein.

Although women weren't allowed to join Plumb Bob or other honorary engineering organizations, Cronquist and Klein did participate in the hijinks of a long-standing rivalry between IT and the College of Agriculture. "Each year the ag students and the engineering students would play pranks on each other," says Cronquist. "During our senior year they painted 'agriculture' in tar across the steps of [Lind Hall] on E-Day, so we retaliated by painting a big 'E' on the field in front of the

PHOTO BY PATRICK O'LEARY

agriculture building. We thought we were so clever — until we got caught."

Cronquist and Klein also found other, less mischievous ways to get involved in the University community. Klein became president of the civil engineering student group, and Cronquist joined the student union board and the staff of the *Minnesota Technolog*.

The two women also forged a lifelong friendship that has kept them close to each other even though their lives have taken them in different directions.

After earning her chemical engineering degree, Cronquist worked for the Minnesota Department of Health until 1950, when she became a "home engineer," raising three sons and participating in a variety of volunteer organizations. She returned to chemical engineering in 1978, working for several private companies before becoming an independent consultant in San Jose, California, in 1992.

Klein went on to earn a master's degree in civil engineering from IT in 1951 and worked as a civil engineer for several consulting firms. She left engineering to raise two sons and later worked as a substitute teacher in the public schools. She eventually returned to civil engineering and was recently coaxed out of retirement in Chicago to work on several special projects.

A lot has changed in the 50 years since Cronquist and Klein left IT. "In the early days there were a lot of restrictions on what women could and couldn't do," says Klein. "Women couldn't work swing shifts, and if there weren't separate changing rooms, they didn't have to provide them." Those kinds of restrictions ultimately limited the types of positions women could hold, she says.

Eventually those limitations disappeared, and women became more welcome among engineers, thanks in part to the perseverance of women like Cronquist and Klein.

"Young women who [enter engineering] today are much more accepted than we were," says Cronquist. "I suppose that, in many ways, we opened some doors for them." IT

CLASS NOTES

Eston M. Gross (Chemistry '51) of Evanston, Illinois, recently returned to the United States following 11 years working in the Netherlands for Akzo Nobel and as an independent consultant in mergers, acquisitions, and business strategy.

Bernard E. "Bud" Horwath (Mechanical '68) of Vadnais Heights, Minnesota, has been named president and general manager of the Perfusion Technologies Division of CELLEX Biosciences, headquartered in Minneapolis.

Franklin F. Hartranft (Mechanical '78) of Plymouth, Minnesota, has been elected to the executive committee of Michaud Cooley Erickson, one of the largest mechanical engineering and electrical firms in the United States. He will continue to serve as a vice president of the firm.

Dave Konshok (Mechanical '88) of Dixon, California, is currently serving as a captain in the United States Air Force. He was recently assigned as executive officer and civil engineering liaison to the commander, 15th Air Force, Travis AFB, California. He and his wife, Clarice, have a son, Matthew.

Jonathan Leslie (Mechanical '85) received the Courage Center's Phillips Award, an honor that recognizes the outstanding accomplishments of people with disabilities. Leslie, the first quadriplegic to graduate from IT, is an engineer at Slicer Controls in Minneapolis.

Scott Stangeland (Civil '83) of Eden Prairie, Minnesota, has joined the engineering consulting firm of Van Sickle, Allen & Associates Inc. as a vice president and officer of the company. He was formerly with Betker/Stangeland, a structural engineering firm he co-founded in 1991.

Jane Lundberg (Civil M.S. '93) and **Stacy Watters** (Civil '96) of St. Paul, Minnesota, have joined Clark Engineering Corporation as structural engineers.

We'd like to hear from you! Use the envelope in the center of this issue to submit your news to Class Notes, call 612-624-5537, or e-mail *itas@itdean.umn.edu*).

IN MEMORIAM

Max Scherberg
(Mathematics Ph.D. '32)
December 1996 • Chicago, Illinois

Roger G. Bossen
(Chemical '34)
February 6, 1997 • Cuyahoga Falls, Ohio

Fredrick C. Kruger
(Geology '35, M.A. '36)
February 9, 1997 • Woodside, California

G. Richard Sass
(Mechanical '42)
January 1997 • San Francisco, California

Alton Levorson
(Agricultural '43)
September 13, 1997 • Edina, Minnesota

Lloyd G. Cherne
(Electrical '50)
October 5, 1997 • Edina, Minnesota

Sheldon J. Dicks
(Mining '51)
July 11, 1997 • Pittsburgh, Pennsylvania

Martin John Timmons, Jr.
(Aeronautical '58, M.S. '59)
May 26, 1997 • Minneapolis, Minnesota

T. S. Zimniewicz
(Mechanical '59)
August 1997 • St. Paul, Minnesota

Edward Schumacher
(Electrical '67)
July 7, 1997 • Chicago, Illinois

Brian J. Ryan
(Electrical '72)
July 1, 1997 • Munich, Germany

Thomas B. Hunter
(Chemical '87)
May 10, 1997 • St. Paul, Minnesota

events

November 20

IT Alumni Society Board Meeting. Time and location to be announced. Call 612-624-5537 or 1-800-587-3884.

January 6

IT Mentor Program Kickoff. A reception for mentors and students participating in the ITAS-sponsored program. 5:00 p.m., Radisson Hotel Metrodome.

January 22

IT Alumni Society Board Meeting. Time and location to be announced. Call 612-624-5537 or 1-800-587-3884.

January 14-23

Emerging Applications of Dynamical Systems: Computational Neuroscience IMA Workshop. The Institute for Mathematics and Its Applications presents an extensive workshop that brings together experimentalists and theoreticians for focusing on specific systems for cell-based neuronal models. The workshop's first two to three days will consist of tutorials to help introduce for nonspecialists the mathematics and basic physiology of single-neuron dynamics, neuronal interactions, network modeling, and possibly issues of neuronal coding. Call 612-624-6066.

February 9-13

Emerging Applications of Dynamical Systems: Calcium Dynamics in Cells. The Institute for Mathematics and Its Applications explores important current biological questions such as how the stochastic properties of individual molecular entities lead to organized dynamical behavior and how calcium signals are transduced into physiological function. Participants will include a mix of experimental cell biologists, theorists currently developing mathematical models, and mathematicians from the dynamical systems community. Call 612-624-6066.

March 9

Computational Steering and Interactive Visualization. Computer Science and Engineering presents Chris Johnson of the University of Utah in the third of four lectures in the 1997-98 Cray Lecture Series. 2:30 p.m., 108 Mechanical Engineering. Call 612-625-4002.

March 9-14

Emerging Applications of Dynamical Systems: Cardiac Rhythms. The Institute for Mathematics and Its Applications presents this workshop, a discussion of heart contraction models and the challenges in designing them, including differing nonlinear properties in different regions, anisotropy in the conjunction pathways, and branching in the Purkinje system which triggers electrical activity in the muscle. Call 612-624-6066.

March 26

IT Alumni Society Board Meeting. Time and location to be announced. Call 612-624-5537 or 1-800-587-3884.

For updates and additional events, visit the IT web site at *http://www.technology.umn.edu.*

PHOTO BY TOM FOLEY

ONGOING SEMINARS

The following departmental seminars and colloquia meet weekly throughout the academic year. Call or check the web for details.

Aerospace Engineering. Fridays, 2:30 p.m., 209 Akerman Hall. 612-625-8000 or *http://www.aem.umn.edu.*

Astronomy. Fridays, 3:00 p.m., 131 Tate Laboratory of Physics. 612-624-0211 or *http://ast1.spa.umn.edu.*

Biosystems and Agricultural Engineering. Fridays, 1:30 p.m., 106 Biosystems and Agricultural Engineering. 612-625-7733 or *http://www.bae.umn.edu.*

Chemical Engineering and Materials Science. Tuesdays, 1:25 p.m., B75 Amundson Hall. 612-625-1313 or *http://www.cems.umn.edu.*

Chemistry. Mondays and Fridays, 4:15 p.m., 331 Smith Hall. 612-624-6304 or *http://www.chem.umn.edu.*

Civil Engineering. Fridays, 1:10 p.m., 210 Civil Engineering. 612-625-5522 or *http://www.cme.umn.edu.*

Computer Science and Engineering. Mondays, 2:30 p.m., 108 Mechanical Engineering. 612-625-4002 or *http://www.cs.umn.edu.*

Electrical and Computer Engineering. Thursdays, 3:35 p.m., 108 Mechanical Engineering. 612-625-2855 or *http://www.ee.umn.edu.*

Geology and Geophysics. Thursdays, 3:30 p.m., 110 Pillsbury Hall. 612-624-1333 or *http://www.geo.umn.edu.*

Mathematics. Daily, various times and locations. 612-626-0230 or *http://www.math.umn.edu.*

Mechanical Engineering. Wednesdays, 3:25 p.m., 108 Mechanical Engineering. 612-625-8000 or *http://www.me.umn.edu.*

Physics. Wednesdays, 4 p.m., 131 Tate Laboratory of Physics. 612-624-7886 or *http://www.spa.umn.edu.*

Solid and Continuum Mechanics. Tuesdays, 1:30 p.m., 227 Akerman Hall. 612-625-3072 or *http://www.aem.umn.edu.*

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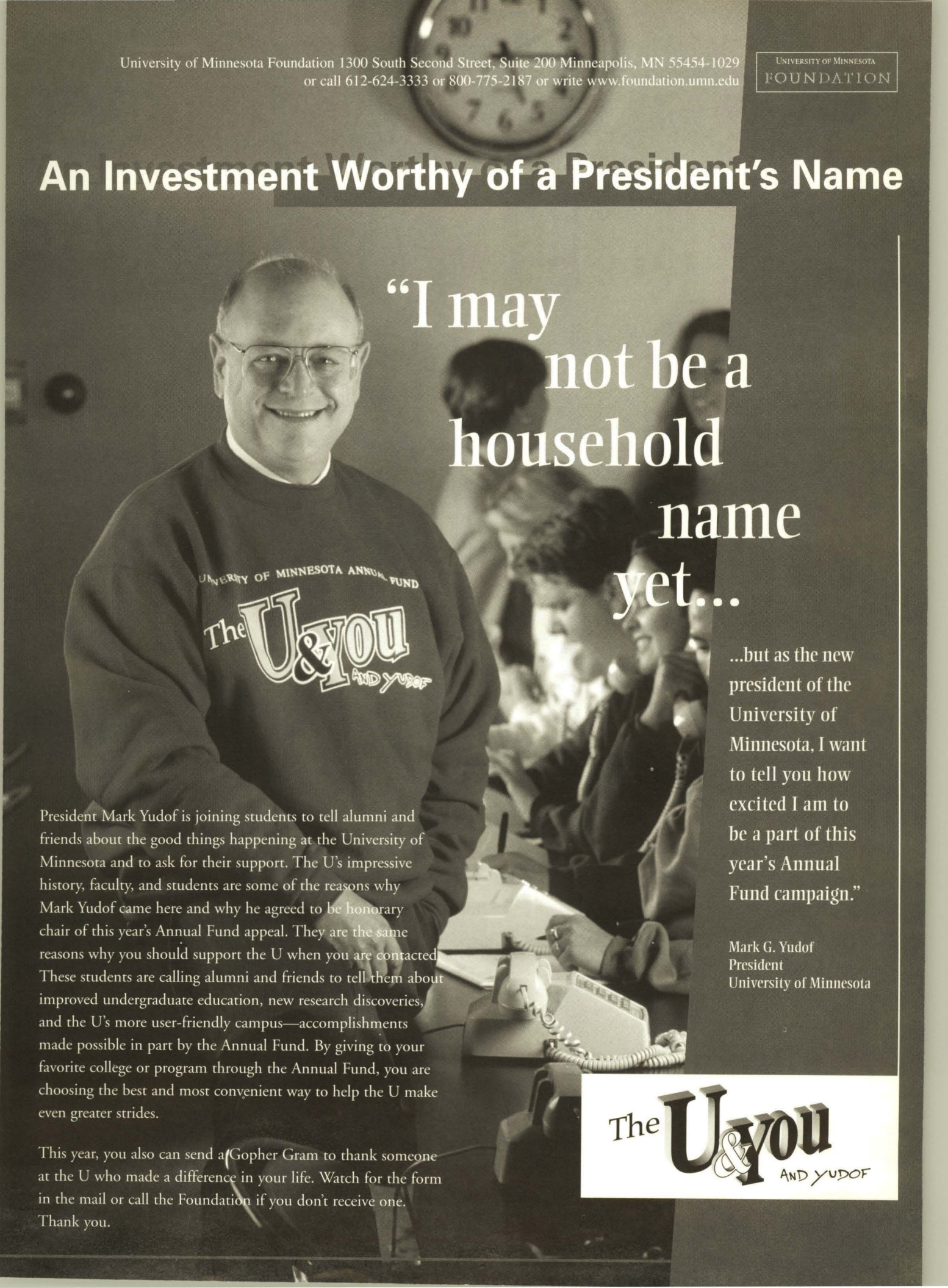

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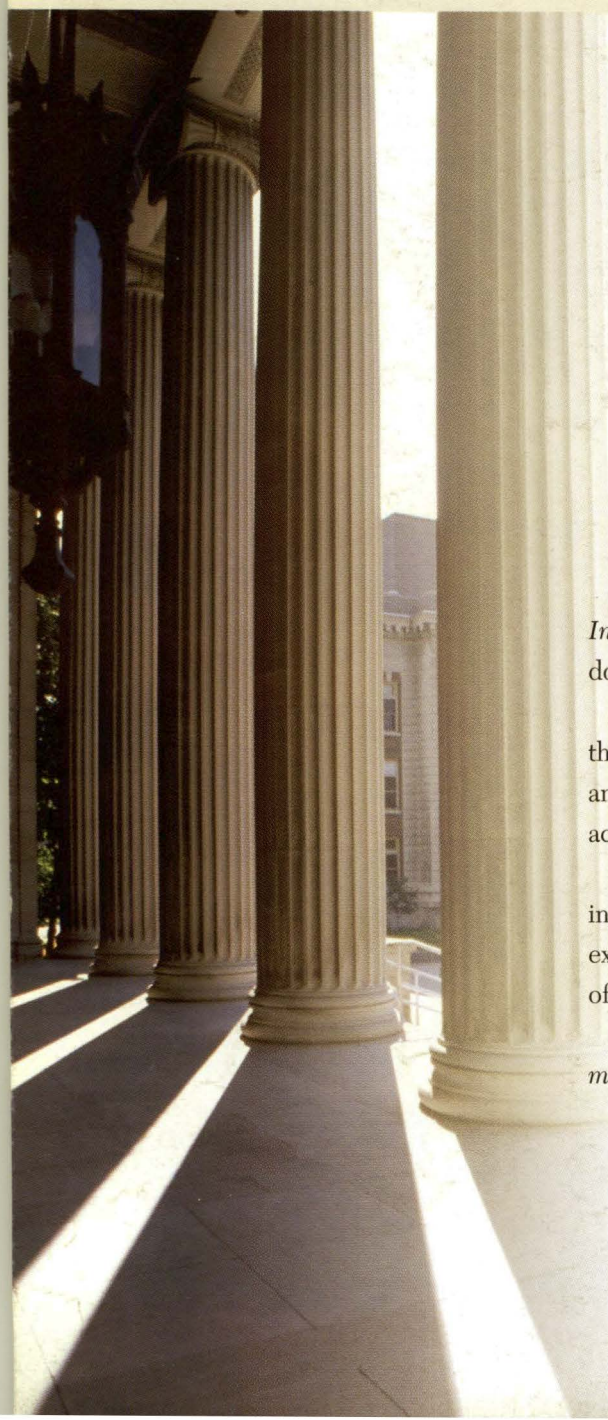

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