VISIONARY VENTURES

NSF funds bold new collaborations in earthquake engineering and surface process science

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FROM THE DEAN

Weathering the fiscal forecast

MINNESOTANS TAKE daunting weather forecasts in stride. Armed with shovels, jumper cables, insulated boots, and heavy parkas, we stand toe-to-toe with winter and never even blink—and we’re proud of it.

We may be accustomed to daunting weather forecasts, but chilling news of the projected state budget shortfalls shocked us all. Governor Tim Pawlenty canceled more than $2.81 billion in state spending—including $2.3 billion in recurring funds to the University—to cope with a $3.56 billion deficit this fiscal year. Those cuts were only the stinging prologue to an expected $4.23 billion deficit through 2005.

In his proposed budget for 2004-05, the governor recommended cutting $2.09 million in state support to the University—approximately 15 percent of the state’s biennium appropriation, the highest percentage reduction in University history. To put the amount into context, $2.09 million represents the total amount of state support for IT, the College of Biological Sciences, and the College of Liberal Arts for two years. The governor also requested that the University limit tuition increases to no more than 15 percent and impose a two-year salary freeze on its employees. Higher education bills that call for somewhat smaller reductions in state support to the University have been approved in both the House and Senate.

Meeting a fiscal challenge of this magnitude entails difficult, painful decisions. In keeping with our priorities, we’ll work hard to protect IT’s core mission. To guard our investment in undergraduate education, we intend to maintain the nation’s top three public research universities, according to a new University of Florida study. The report, The Top American Research Universities, 2002, ranks public and private universities that score within the top 25 on nine quantitative measures of quality. Top measures include the strength of the faculty, the research program, and private support. The University, which ranked within the top 25 on eight of the nine measures, is one of only three public research universities to rank within the top 10.

Although IT faces some difficult choices in the months ahead, the college’s long-term future remains bright.

Minnesota, for example. As of April 1, 2003, IT has raised $50.1 million—nearly 94 percent—of its $56 million campaign goal. Gifts made through the campaign are long-term investments in the college that help us go beyond the limits of state funding, not replace it. Nearly all of these gifts are designated by their donors for a specific purpose, such as scholarships and fellowships. Your generosity is a strong vote of confidence in IT.

Best of all, I’m pleased to report that the University continues to attract record-setting levels of research funding. For the first time, University researchers secured over half a billion dollars in research funding in a single year—$526.6 million in sponsored research funding for fiscal year 2002. Among University colleges, IT attracted $84.7 million in grants, second only to the Medical School. The federal government estimates that 3.91 jobs are created in Minnesota for every $1 million in research funding that comes to the state.

Throughout this difficult process, we’ll look for opportunities to cut costs without sacrificing quality. You can help by offering us your suggestions and by adding your voice to the chorus of University advocates at the Capitol.

Together we’ll weather this storm until the forecast improves, keeping our eyes on the horizon for the sun’s inevitable rise.

JONATHAN CHAPMAN (DAVIS); GETTY IMAGES (ILLUSTRATION)

Three recent reports underscore the strength and effectiveness of the University’s research

THE NAMES AND FACES of University researchers don’t garner instant recognition among most Minnesotans, yet they are among the chief reasons why the institution ranks so highly among its peers.

Most researchers work quietly behind the scenes in relative obscurity, but their influence extends far beyond campus borders. They attract highly coveted funding for research that advances basic knowledge and improves quality of life. They develop new technologies that industry and business use to create or improve products. Their innovations fuel the high-powered economic engine that powers the state’s economic growth.

That’s why three recent reports give cause for optimism about the state’s long-term economic future.

For the second consecutive year, the University ranks among the nation’s top three public research universities, according to a new University of Florida study. The report, The Top American Research Universities, 2002, ranks public and private universities that score within the top 25 on nine quantitative measures of quality. Top measures include the strength of the faculty, the research program, and private support. The University, which ranked within the top 25 on eight of the nine measures, is one of only three public research universities to rank within the top 10.

A new survey by the Association of University Technology Managers ranks the University fourth among 142 colleges and universities in spinning off start-up companies. University research led to the creation of 11 companies in 2002, the last year for which statistics are available. These companies do business in everything from biotechnology to production of skateboards.

In October 2002 the University announced that it had attracted record-setting levels of research funding for the fifth consecutive year. For the first time, University researchers secured over half a billion dollars in research funding in a single year—a record $526.6 million.

This is great news for Minneso-"ta,” says David Hamilton, the University’s interim vice president for research. "It is funding that likely would not come into our state but for the competitiveness of our faculty and researchers.”

RESEARCHERS FROM the University’s Intelligent Vehicles Lab in the Center for Transportation Studies are trying to make driving a snowplow, a state patrol car, or even a bus a little easier during Minnesota snowstorms. Researchers are using the global positioning system (GPS), a digital map database, obstacle detection radar, and a head-up display to give drivers a “virtual reality” representation of the road when driving conditions reduce visibility to near zero. The GPS identifies a snowplow’s exact location and offers real-time mapping accuracy when combined with digital maps showing the location of road landscape markers such as lane boundaries, guard rails, and signs. The head-up display uses this information to make it possible for drivers to “see” the road even when their eyes can’t perceive it.

At the same time, the display depicts vehicles traveling in front of the plow as white or red boxes (depending on their proximity). These cues alert the driver and greatly reduce the chance of collisions.

To date, the Minnesota Department of Transportation and the University have equipped four snowplows, one state patrol car, and one metro bus with this equipment.

U researchers earn high marks
Illuminating the infant universe

LAST WINTER a telescope designed by a University physicist gave an international team of scientists a spectacular glimpse of the infant universe. Associate Professor Shaul Hanany designed and experiment, which measured the sky’s cosmic microwave background (CMB)—radiation left over from the big bang. The balloon-borne telescope, suspended 20 miles high over the Arctic, spun twice per minute and scanned 30 percent of the sky during its 19-hour flight. The experiment yielded a remarkable snapshot of the universe when it was only 300,000 years old, before any stars or galaxies had formed. Back then the universe resembled a “soup” of electrons, protons, and radiation nearly as hot as the sun’s surface today. This mix emitted radiation with a wavelength about one micron in size, but as the universe expanded the radiation cooled and its wavelength stretched to today’s millimeter range. ARCHEOPS’ data is essential to measuring the form and volume of matter in the universe as well as the speed of the universe’s expansion. “Scientists now have a tally of the total amount of matter and energy in the entire observable universe,” says Hanany. “Also, together with other data, ARCHEOPS indicates that 95 percent of all matter is in a form that has not been identified. That is, it is not the ordinary protons, electrons, and neutrons that make up stars, planets, and everything we see around us.”

After the telescope’s data are analyzed, the results will be compared to computer models to test theoretical predictions. The findings will help astronomers understand the conditions in the early universe and how they influence the formation of the first stars and galaxies.

‘Slinky’ effect may power auroras

THE SPECTACULAR AURORA borealis displays that light up northern night skies could be powered by a gigantic “Slinky” effect in Earth’s magnetic field lines, according to University researchers. Auroras are powered by solar winds that carry along with them the rest of the universe. The solar wind is the flow of charged particles that are ejected from the sun’s corona. When the solar wind collides with Earth’s magnetic field, it can generate powerful electrical currents and magnetic fields.

In the past, scientists have speculated that auroras are powered by the interaction between the solar wind and Earth’s magnetic field. However, the mechanism by which this interaction takes place is still not fully understood. The “Slinky” effect is a phenomenon that occurs when the magnetic field lines of Earth’s magnetic field are stretched by the solar wind. This stretching can create a current in the magnetic field, which can then be harnessed to generate power.

“The Slinky effect is a fascinating phenomenon that has been studied for many years,” said lead researcher John W. Cass, a professor of physics at the University of Minnesota. “It is a powerful example of how the solar wind can interact with Earth’s magnetic field to generate energy.”

A new study led by researchers at the University of Minnesota and the University of Colorado at Boulder has shown that the Slinky effect can indeed power auroras. The researchers used computer simulations to model the interaction between the solar wind and Earth’s magnetic field, and they found that the Slinky effect can generate significant amounts of power. The results of the study have important implications for renewable energy research, as they suggest that the Slinky effect could be harnessed to generate power from the solar wind.

“By harnessing the Slinky effect, we could generate power from the solar wind, which is a renewable and abundant source of energy,” said Cass. “This could have significant implications for the future of renewable energy research.”

Cooling down the infant universe

IMAGINE INFORMATION STORED on something only a hundredth the size of the next-generation computer chip—and made from nature’s own storage molecule, DNA. A team led by electrical and computer engineer Professor Richard Kiel has used the self-assembling “stickiness” of DNA to construct a scalable and easily scalable nanoparticle-based memory device.

The researchers used a technique called DNA nanotechnology to construct a memory device that is scalable and can be expanded to store an unlimited amount of information. The device is made up of tiny DNA molecules that are self-assembled into a pattern that can be read and written many times. The memory device is also highly resistant to errors and can be used to store a large amount of information.

“By using DNA as a memory device, we can store and retrieve information at a much higher density than current computer chips,” said Kiel. “This could have significant implications for the future of computing.”

The research was funded by the National Science Foundation and the Department of Energy. The team’s results were published in a recent issue of the journal Nature.

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Gray to lead mathematics

PROFESSOR LARRY GRAY is accustomed to seeing the big picture—a skill that will serve him well in his new post as chair of the School of Mathematics. Gray will succeed Professor Naren Jain as department head July 1.

The department’s director of undergraduate studies since 1999, Gray oversees the math in thousands of undergraduate courses each year. “Math has a big impact on lots of fields, and University-wide our department teaches 6,000 to 7,000 students each semester,” he says. Gray served on the Bio-member Minnesota Academic Standards Committee that produced a framework for revising state K-12 standards in mathematics, reading, and English. Appointed in March by Minnesota education commissioner Chuck Pecoy, the committee—parents, teachers, business leaders, and representatives from higher education—wrote and revised a draft of standards that incorporated suggestions from the public. Besides serving on subcommittees that wrote the initial drafts of standards for grades K-8 and for high school, Gray was also on committee responsible for the formal version of the entire math standards document.

Gray received a Ph.D. in mathematics from Cornell University in 1997 and joined the Minnesota faculty later that year. His areas of expertise include probability theory, Markov processes, and interacting particle systems. He's currently studying the mathematics of traffic jams, an area that also related to problems in condensed matter physics and internet traffic. He is co-author of the graduate-level text “A Modern Approach to Probability Theory,” written with his mathematics colleague, Professor Bert Frisch.

Budget issues promise to be among the most difficult challenges awaiting Gray when he assumes his new responsibilities. “It’s a tough time to be in a leadership position, but I know that it values our department and what it does,” he says. “We’ll need to take a fresh look at how we do things to find solutions.”

Nanospheres: A gem of a discovery

SILICON NANOSPHERES are among the hardest known materials, ranking between the conventional hardness of sapphire and diamond, according to a recent study led by chemical engineering and materials science professor William Gerberich.

Gerberich's research team made the first-ever computer simulations conducted at Los Alamos National Laboratory of five million to 600 million atoms. Preliminary calculations have approximately 40 million atoms. The researchers then measured hardness—the sphere, the harder it was.

“This is the first time that a measurement of mechanical, rather than electromagnetic, properties can be selectively etched away. It’s a tough time to be in a leadership position, but I know that it values our department and what it does,” he says. “We’ll need to take a fresh look at how we do things to find solutions.”

Foufoula-Georgiou elected to European Academy of Sciences

DISTINGUISHED MONTKIGHT Professor Eli Foufoula-Georgiou has been elected to the European Academy of Sciences, one of the highest honors accorded to a scientist. The academy was founded in 1994 to promote international scientific cooperation and to foster the development of the sciences in Europe. Foufoula-Georgiou is recognized for her research in the stochastic modeling of surface and subsurface hydrologic processes and systems. For more on her research, see page 28.

Three more IT students awarded prestigious Goldwater Scholarships

FOR THE THIRD YEAR in a row, three University students have won Barry M. Goldwater Scholarships. The three—honors students Derek Lee (physics and mathematics), Emily Dye (chemistry), and Matt Ras (mathematics and computer science) were selected on the basis of academic merit from among sophomores and juniors in mathematics, science, and engineering. Candidates for the scholarship—the premier undergraduate award in its discipline—are nominated by the faculties of colleges nationwide.

HIGH AT HAWAII’S Mauna Kea, the Frederick C. Gillett Gemini Telescope probes the heavens, exposing fiery tempests in depicted skylines. The observatory’s infrared sensors reveal a panorama of emerging stars and distant galaxies, external landmarks otherwise shrouded in a murky veil of dust and gas.

While the Gillett telescope scans the northern skies, its twin—known simply as Gemini South—looks skyward from atop Cerro Pachón in Chile. Each telescope has a main mirror more than 2.6 feet in diameter; together they can scrutinize the entire celestial sphere.

University alumnus Fred Gillett (Physics ’50, Ph.D. ’56) helped open this breathtaking window to the skies. An infrared astronomy pioneer whose career spanned four decades, Gillett championed the Gemini project and helped design its instrumentation.

He died in April 2001, shortly after work on the first telescope—then known as Gemini North—was completed. The facility was renamed in his honor that year.

At the University, Gillett studied under renowned physicist Ed Ney. In the 1950s, Gillett and eight other scientists proposed and developed NASA’s groundbreaking Infrared Astronomy Satellite (IRAS), a 2.4-inch telescope fitted with four different types of infrared detectors.

While analyzing data sent back by IRAS after its launch in 1983, Gillett and colleague George Aumann detected a ring of particles around the star Vega. This discovery, known as the Vega Phenomenon, was the first observational confirmation that planets could exist around stars other than our sun.

For his work with IRAS, Gillett won NASA’s Exceptional Scientific Achievement Medal. Later in the 1980s he worked to develop the space agency’s infrared astronomy program and led a National Academy of Sciences committee charged with setting scientific priorities for the field. That effort led to the development of Gemini Observatory.

In November 2000, Gillett’s family, friends, and colleagues gathered in Hawaii for the ceremony to rename the facility.

“Our family is honored to have Fred recognized this way,” said Gillett’s widow, Marian. “The naming of the telescope, which always looks up at the stars, just as Fred did all his life, is very appropriate way to remember him.”

GEAR up FOR THE THIRD YEAR in a row, three University students have won Barry M. Goldwater Scholarships. The three—honors students Derek Lee (physics and mathematics), Emily Dye (chemistry), and Matt Ras (mathematics and computer science) were selected on the basis of academic merit from among sophomores and juniors in mathematics, science, and engineering. Candidates for the scholarship—the premier undergraduate award in its discipline—are nominated by the faculties of colleges nationwide.

Nasa, Gehrz focus on infrared astronomy

A $70 million investment was at stake when astronomy professor Robert Gehrz and colleagues tested the optical performance of mirrors on NASA’s Space Infrared Telescope Facility (SIRTF) before its launch. When SIRTF reaches orbit around the sun later this spring, they’ll start snapping pictures to determine if the optics are in focus. If not, the team must make the adjustments “blind.” Gehrz and other University astronomers will get 100 hours of viewing time on the telescope during its first year of operation—“SIRTF is 1,000 times more powerful than any [other infrared] telescope,” says Gehrz. “It’s going to see phenomena that we haven’t even conceived of.”
WHEN ROBERTA HUMPHREYS ARRIVED at the University in 1972, the newly hired 28-year-old assistant professor of astronomy was, as she recalls, “the fifth and youngest woman faculty member in IT.”

Over the next 30 years, Humphreys rose to the rank of full professor, received recognition for her research in astrophysics, and set a college milestone by becoming the first woman to be named an IT Distinguished Professor. Active in faculty governance, she served on the Faculty Consultative Committee for four years and as vice-chair of the University Senate for two years. In August 2002 she assumed a half-time appointment as IT’s associate dean for academic affairs.

During that same period, the number of female faculty in IT increased to 33 out of nearly 400 tenured and tenure-track positions—a substantial jump, to be sure, but still not a ratio that would cause students, faculty, and staff to take the presence of women scientists and engineers for granted.

Although women in IT still run the risk of feeling somewhat isolated in mostly-male departments, Humphreys believes that overall much has improved for women in science during those three decades.

One change is very clear. Humphreys herself is now in a position to remedy the situation even further.

Among her responsibilities as associate dean is managing the college’s Program for Women. “I want to create an environment [in which] women faculty, postdocs, and students get to know each other and to encourage interactions,” she says, adding that networking is crucial for academic women.

Shortly after assuming her new position, she began meeting with IT women in small groups. “I just wanted to get acquainted with them [and] find out [their] issues and concerns,” she explains.

In the months ahead, she will continue the meetings—but with a twist. “I’d like to mix women from different departments through her example and advocacy. Associate Dean Roberta Humphreys inspires a new generation of women in IT

BY JUDY WOODWARD

REACHING FOR THE STARS

As a teenager, Humphreys told her high school advisor that she wanted to get a Ph.D.

“He laughed and said maybe I could become a high school teacher.”

As Humphreys can testify, it wasn’t and from all levels of faculty,” she says. She also plans to sponsor a retreat for IT women faculty at the end of spring semester. By then, she hopes, group members will know each other’s concerns fairly well and “we’ll be able to formulate where we go from here.”

She also hopes to establish special funds to augment hiring possibilities within IT. “The University needs to make hiring and retention of female faculty in IT of sufficient priority that it will create opportunities within individual departments, as it does for minorities,” she says.

Another new program is already in place. “I’ve established a lecture series for distinguished women scientists and engineers,” says Humphreys. “They’re invited to speak at a regular departmental colloquium [in their academic specialty], but then we arrange for them to stay for an extra day or two to interact with students.”

She hopes the eminent visitors will be role models for students who may be at a critical juncture in their choice of careers. Informal discussions will give students a chance to hear women scientists describe their full, well-balanced lives in a natural setting. As Humphreys puts it, “They’ll show the students that ‘Yes, I’ve had a life in science, but I’ve also had a life!’ I want to get that image in front of undergrads and graduate students.”

It’s a reality that Humphreys lives every day. Married to astronomy professor Kris Davidson, she is the mother of a college-age son, who is one of the reasons she feels hopeful about the future of women in science.

“Yes, young men are much more tolerant now of girls who excel in math and science,” she says. “My own son doesn’t see anything strange in smart girls.”

As Humphreys can testify, it wasn’t
EVER WILD into her career she didn’t find herself in an atmosphere of perfect equal- ity. During her early days at the University of Arkansas, a former department chair (long since de- parted from Minnesota) warned her, “Well, Roberta, you can’t expect to get the same salary raises as men.”

She’s ignored such negative messages most of her life, ever since a memorable family trip to Chicago awakened two lifelong passions: archaeology and astronomy. “I was five or six,” she recounts, “and we got up very early to drive from Indianapolis to Chica- go. I remember looking out the window, seeing this really bright thing!”

Her father explained that she was looking at the planet Venus and then followed her to a library where she could see up close in big telescopes. “I was hooked,” she says.

American students are passing up careers in science and engineering in favor of other professions, laments Humphreys. “It’s a serious long-term problem for our country because our [position of] leadership has come from advanced science and technology,” she says.

As a former department chair (long since de- parted from Minnesota), Humphreys says, “I owe her honor.”

Humphreys believes it’s vital for the entire com- munity—but especially for young women—to meet notable women scientists and engineers who are advancing their respective fields. Humphreys’ program brings high-achieving women to campus where they participate in various events held over the course of several days. In addition to the program lecture, departmen- tal colloquia, and other presentations, the visits include social events and activities that give stu- dents a chance to talk informally with the guest speaker. These casual conversations can help fe- male students understand that a distinguished career in science or engineering is fully compat- ible with a rich, full life.

IT Distinguished Women Scientists and En- gineers Speakers Program: Spring 2003

Richard McNutt, president and CEO, Mon- terey Bay Aquarium Research Institute, past president, American Geophysical Union

McNutt heads the Monterey Bay Aquarium Research Institute (MBARI), a research laboratory funded by the Monterey Bay Aquarium Foundation to develop and exploit new technol- ogy for ocean exploration. Located in Moss Landing, California, MBARI designs and builds new tethered and autonomous under- water vehicles and in situ sensor packages for sampling the ocean and its inhabitants.

Born and raised in Minneapolis, McNutt received a B.A. in phys- ics, summa cum laude, Phi Beta Kappa, from Colorado College. He studied geophysics at Scripps Insti- tution of Oceanography, where he earned a Ph.D. in earth sci- ences. He spent three years with the U.S. Geological Survey working on the problem of earthquake pre- diction and then joined the faculty at Massachusetts Institute of Tech- nology (MIT).

During her 15 years at MIT, where she was appointed associate dean for graduate studies and department head of Geophysics, she also served as director of the Joint Program in Oceanography, and Applied Ocean Science and Engineering, a coop- erative graduate program between MIT and Woods Hole Oceanographic Institution.

McNutt’s principal research interest includes the use of marine geophysical data to study the physical prop- erties of the earth between the oceans. Her research is both theo- retical and field-based, using data she has collected on nearly two dozen oceanographic expeditions. McNutt will speak on May 8 at 3:30 p.m. in 110 Pillsbury Hall. For more information: 612-624-4333 or kressoc@m.umn.edu.
THIRTY-NINE YEARS AFTER CONGRESS PASSED TITLE VII of the Civil Rights Act of 1964, one field remains almost as solidly male as it was in the days of slide rules and pocket protectors.

Long after women carved out substantial territory for themselves in historically male-dominated fields like medicine, law, and architecture, engineering remains largely a guy thing. According to U.S. Census data, women now account for slightly more than 10 percent of all working engineers.

Dismal as that statistic may be, it represents progress. In 1966, the first year such records were kept, women earned so few engineering degrees that from a statistical perspective they didn’t even exist.

Even today, female engineering undergraduates represent only about 20 percent of the total. Among electrical engineering students, women are especially rare; many classes in that discipline include no more than a handful of female students. Regardless of the friendliness of her male classmates and the academic excellence of the classes themselves, being “the only girl” is an experience that can leave a woman feeling isolated and unsure that engineering is the right choice after all.

That’s where the Society of Women Engineers (SWE) steps in. Founded in 1950, SWE offers support, guidance, and recognition to female engineers and engineering students. Members of the educational nonprofit service organization—17,000
nationally—include professionals, graduate students, undergraduates, and men.

The University’s SWE chapter was founded during the early 1970s. Many of its 138 members, most of whom are undergraduates, simply use the organization as a way to find study partners and relax in the group’s Lind Hall lounge. But SWE also offers opportunities like mentoring programs and service projects.

For 27 years the student section has cosponsored the annual IT Career Fair. The event—the largest career fair held on campus—attracts more than 100 companies and 2,000 students each fall.

Another important activity is Technically Speaking, a daylong event targeted at girls in junior and senior high school. “Each year about 15 to 25 girls participate,” says SWE copresident Laura Marsden, a computer science senior. “We take them to campus and show them what a day in IT is like.”

Technically Speaking and other SWE outreach activities combat the notion that engineering is somehow geeky. Says Marsden, “It’s cool to be a doctor—look at [TV’s] ‘ER.’ But [female engineers] still deal with the traditional stereotype of the Big Geek. Things have changed, but gender roles still play a part. It’s really attractive for men to be smart, but girls are still encouraged to play down the smart.”

As a group, preteen girls are especially susceptible to peer influence and the pressure to conform. That vulnerability can limit their future career options if girls avoid the challenging math and science classes that prepare them for college-level engineering and technical programs.

Astronomy professor Roberta Humphreys, IT’s associate dean for academic affairs, notes that some of the difficulty in recruiting female engineering students is beyond the University’s control.

“There’s the issue of the K-12 pipeline [of having students ready for science and engineering classes],” she says. “Girls do respond to peer pressure. The University can provide opportunity, encouragement, and support, but we can’t solve all of society’s gender issues.”

Recruitment isn’t the only issue that concerns Humphreys. “When I talk to women graduate students,” she says, “they often complain that they don’t know anybody. There’s a strong culture of isolation in [technical fields].” Until the numbers of women rise to a certain percentage, we’ll always have a problem retaining them.”

Lachan Nelson (Mechanical ’94) says that membership in SWE helped her combat that sense of isolation. Nelson—in her late twenties, employed, and married with small children—was a remarkably atypical student when she entered the University in the 1980s. Over the next 14 years, she squeezed her education into the remnants of time left over from her family and work responsibilities. When Nelson began her studies, her children were preschoolers; by the time she graduated, they were ready to enroll in college themselves.

Now employed as a manager with a local Fortune 500 company, Nelson says SWE helped her feel comfortable at the University. While serving as the organization’s student publicity director, she acquired valuable experience in the “practical side of the business” when she met invited speakers from local companies.

She recalls being surprised by the lack of female students in her University classes. “I looked around and [asked] myself, ‘Why aren’t more women doing this?’” she says. “Now, as a working professional and mentor, she actively encourages young women to pursue technical studies.

One young woman who heard Nelson’s message is her niece, Candace Pederson (Electrical ’04), whose childhood role model was her Aunt LuAnn. Now an engineer with IBM, Pederson was president of the University’s SWE chapter during her senior year. She credits the organization with giving her a head start in learning the non-technical aspects of the workplace.

“She taught me how to network,” says Pederson. “It gave me an opportunity to meet people [and to acquire] leadership experience. In the beginning it was such a drama to speak in public and lead a [SWE] meeting. I didn’t know then how much public speaking I would have to do [on the job].”

IT Career Services director Sharon Kurtt loves to hear testimonials among younger women about the advantages of an engineering career. Entry-level engineering salaries, which can reach the mid-$30s, are higher than in any other undergraduate major, she says.

More importantly, she adds, “engineering allows you to do something significant. It’s a way to use your intellect and make a difference.”

A member for nearly 10 years, Kurtt considers SWE to be the ultimate women’s organization. “Gloria Steinem should have been an engineer—she’s smart enough,” she says. “At SWE we’ve been fighting the long fight before they even called it feminism.”

FOR MORE INFORMATION VISIT WWW.TC.UMN.EDU/SWE
Imagine the Marx Brothers as Physicists.

Picture the antic physical timing of four veteran circus performers who know each other’s stuff so well that they ad-lib just to keep from getting bored. Their wise-guy patter never falters, even as their slapstick double takes and well-rehearsed pratfalls attract most of the attention. Eggs whiz across the stage, one guy unexpectedly drops from a height of 20 feet, another guy careens backwards in a whoosh of escaping smoke as the fire extinguisher he grips between his knees suddenly erupts. There aren’t any rubber chickens falling from the rafters, but there are odd, semi-indiscreet tooting noises and a couple of wooden-faced young stagehands to keep things from getting completely out of control. Meanwhile, on a small table

By Judy Woodward  Photos by Jonathan Chapman
mid-stage, a large white metal barrel hovers ominously over a gas flame, suggesting that the bursts of laughter from the multigenerational audience aren’t going to be the only explosive aspect of this performance.

What’s going on here, anyway? A convention of retired vaudeville performers? A reunion of Clown College, Class of ’55?

It’s only when the mostly white-haired performers gather center stage for a rare moment of relative calm that the alert observer notices the logo on their trademark t-shirts.

The Physics Force is at it again.

A group of high school science teachers and members of the University’s physics faculty, the Force is dedicated to the proposition that it’s time to put the physical back into physics. Offering a zany but scientifically impeccable overview of the fundamental principles of hard science, the Force has been wowing school and family audiences for nearly two decades. These educators make science as fun as it is informative, and it’s probably safe to say that they do physics demonstrations like nobody else anywhere.

Audiences may arrive knowing little about the laws of gravity, but it’s likely they’ll never forget the sight of a distinguished bearded man of science dropping like a dead weight from a 20-foot gantry just as a cannon fires a ball at him—which he miraculously catches in a baseball mitt—just to demonstrate the principle that falling bodies have the same acceleration regardless of how they started.

And they’ll recall with glee the sight of a presumably dignified physics professor laughing maniacally as he’s hurled backwards across the stage in a memorable display of Newton’s third law of motion.

Who could forget the spectacle of four “mad” scientists frolicking around an overheated barrel full of water vapor, sprinting away with bottles of cold water to produce the dramatic consequences of air pressure, as the vapor condenses within the barrel to create a vacuum?

The resulting bang of implosion may be one reason that the group’s web site carries a disclaimer warning that “small children, pregnant women, and people with heart conditions (sorry, Dick Cheney) are strongly cautioned!”

For Physics Force members, the hijinks are all in the service of science.

Over the years, viewers have sometimes wondered if the Force takes its name from the movie Star Wars. Not so, says Jon Barber (Soil Science Ph.D. ’78), a founding member.

“The name has the ring of the police or air force, but of course in physics, ‘force’ has a different meaning as well,” he says.

The Physics Force got its start in summer 1984, when Barber and Hank Ryan (Science Education M.Ed. ’93), teachers at Mounds View [Minnesota] High School, attended a convention for physics teachers held at the University of Maryland. There they encountered the late Phil Johnson, who coordinated laboratory demonstrations for the University of Minnesota’s physics department.

Johnson had been searching for partners who would share his vision of adapting college physics demonstrations for high school audiences.

“It had been Phil’s dream to have demo shows at the University so that secondary school science teachers and physics professors could get to know each other,” says Barber.

Johnson’s own role was destined to be behind the scenes, but he couldn’t have found two better onstage showmen than Barber and Ryan. Friends and colleagues since the 1960s, the two popular teachers create pedagogical magic that transforms ordinary education into high-octane collaborative learning. Perennial student choices for commencement speakers, Barber and Ryan had transformed the oft-dreaded high school physics curriculum into such a draw that around three-fourths of the Mounds View High student body enrolled in their classes.

A third high school science teacher, Jack Netland, joined the team, and the men put together their first show. Not so coincidentally, Netland just happens to have been Ryan’s college roommate back at St. Cloud State University in the early sixties.) The trio’s easygoing camaraderie carried over to their stage appearances.

“Hank is a natural athlete. He does the dangerous stuff, like the 20-foot onstage drop,” says Barber. “I’m the funny one, and Jack is a crescendo singer—he fits all situations. Plus he’s the only one who can sing.”

Netland’s addition left only one hole in the cast. At the Force’s third or fourth performance (memories vary), Professor Dan Dahlberg of the physics department came aboard as what he calls “the token professor.” Initially, Dahlberg was invited to make only one appearance, but as a performer he was clearly a natural, and the onstage chemistry between the four men was close to perfection.
Barber remembers, “At first Dahlberg was shy onstage. Then he told us he really liked [performing], and he asked if he could do more.”

A star act had just been born.

Dahlberg doesn’t exactly fit the academic stereotype. After all, not many physics professors will stand onstage and pull toilet plungers from their heads with an audible pop, as Dahlberg does to demonstrate the adhesive qualities of air pressure differentials.

“This is not a suction cup because... physics doesn’t suck,” he proclaims to the audience in a Texas twang that’s barely softened after 25 years in Minnesota.

“For me, there’s nothing sacred,” says Dahlberg. “I’m no comedian, but I have a good balance between when to be serious and when to take things in fun.”

Everyone agrees that the Physics Force would never have made it without Johnson. “He was so excellent in his role,” says Dahlberg. “He developed those demos on his own time. At that time we did not have University support, but we found ways to do the shows.”

Although the others could never persuade him to appear onstage, Johnson set the group’s overall direction. Says Barber, “It was Phil’s idea to use such large apparatuses so that thousands could see [the large-scale demos].” Phil used to compare our shows to going to a concert. He said, “You don’t go to a concert to learn anything. You go to a concert to get entertained.”

Johnson died of a heart attack in 1995 at age 43, but the ensemble members are confident that the only time they’ll drop the ball is when they want to demonstrate the principle of gravity. Their only script is an ordered list of the demos, and in lieu of explanations that would disrupt the show’s pacing.

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“Newton’s Apple,” and even German television. (Force members speak no German, but fortunately the physics demos have an internationally recognizable language all their own.)

Support for the Physics Force now comes from IT, the University provost, the School of Physics and Astronomy, and the Materials Research Science and Engineering Center. Given recent cuts in state aid to the University, however, the Force’s continued existence depends on its own time. At that time we did not have University support, but we found ways to do the shows.

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The Physics Force performances annually.

“We like each other,” says Dahlberg. “We fit together like a pair of comfortable old shoes.”

In fact, their only cause for stage fright arises from the irresistible temptation to make a lighthearted wisecrack at the expense of the audience.

“Not all the kids in the audience are going to become scientists,” says Dahlberg. “It’s like going to a concert. You go to be entertained.”

“Who says pure science has no practical applications?”

Onstage, Netland grins wolfishly and declares, “This is what we call ‘relevant education.’”

Who says pure science has no practical applications?

In the audience, a young boy declares to his parents, “If school was more like this, I might learn more. You’d learn a lot more because people would be paying attention.”

As the Physics Force might say, “Q.E.D.”

For more information see www.physics.umn.edu/outreach/force/.
An IMA workshop explores the role of mathematical modeling in biodefense

BY BARRY CIPRA

CALCULATING RISKS

ONE OF THE MOST EFFECTIVE WEAPONS IN TODAY’S BIODEFENSE ARSENAL is likely to be a mathematician armed with a computer. Mathematical modelers can help the U.S. prepare for a bioterrorist attack, according to presenters at a “hot topics” workshop held last September at the Institute for Mathematics and Its Applications (IMA). The conference—entitled Operational Modeling and Biodefense—was the first such event to explore the use of mathematical techniques in analyzing the operational and logistical aspects of biodefense planning and response.

The workshop highlighted the interface between traditional epidemiological models of infectious diseases and operations research analyses of biodefense logistics. Models based on various scenarios predict the likely course of events in a bioattack, while the analyses identify the best allocation of resources for a given situation. Together they can point toward strategies for dealing with bioterrorism.
Workshop organizers included Douglas Arnold, professor of mathematics and IMA director; Dr. Mac Hyman of the Mathematical Modeling and Analysis Group, Los Alamos National Laboratory; and Edward Kaplan, William and Marie Beach Professor of Management Sciences and Professor of Public Health, Yale University. The event was cosponsored by IMA and the Society for Industrial and Applied Mathematics.

“It’s a fascinating area,” says Kaplan. “When you’re talking about logistics and bioterrorism, very interesting things start to happen.”

**EPI-QUESTERS**

Traditional epidemiological models use differential equations to study the spread of disease in various populations. They help policymakers judge the likely costs and benefits of various public health measures, such as needle exchanges for hepatitis and HIV, mosquito control for West Nile virus, or priority ordering for recipients of flu vaccines.

The models usually assume that public health measures included in the model as parameters are applied instantaneously. Normally this assumption isn’t a problem, either because the epidemic’s timescale is much longer than the policy’s ramp-up time or because preventive measures (theoretically) are in place before the outbreak of disease. In the case of flu, for example, the idea is to inoculate a sufficient percentage of the right people before the season starts in order to prevent that year’s anticipated strain from decimating the population. But a bioterrorist attack occurs on a swifter timescale. Consequently, efforts to cope with the malicious release of a pathogen will compete with the underlying dynamics of the disease it produces. Moreover, uncertainties about when, where, what kind, and even whether an attack will occur complicate the preparation problem.

According to Kaplan, models that compare the spread of disease through unvaccinated and vaccinated populations are inadequate. “You instead have to say, ‘How does the disease spread if you are simultaneously trying to vaccinate the population while it’s spreading?’” he explains.

Any emergency response puts appropriate people and supplies in place to deal with a disease in a timely manner. In the case of a bioterrorism attack, the response includes identifying sick people who need treatment (and possibly isolation) and giving prophylactic measures to those at risk. The trick is to do this as quickly as humanly possible.

“With the kinds of worries we face here, we’re talking about very fast-moving events, where a difference of a day or even hours can lead to very different results,” Kaplan says.

Queueing theory—picture long lines at a makeshift vaccination clinic—has a lot to say about what’s humanly possible, as does supply-chain analysis. Among the questions policymakers must ponder: How many and what kind of responders do you need to mobilize, and what should you have them do?

**SMALLPOX VACCINATION STRATEGIES**

Take smallpox, for example. The federal government has ordered the stockpiling of enough smallpox vaccine to inoculate the entire country. If the threat of a smallpox attack were clear, the strategy would be simple and effective. Inoculate everyone preemptively, which essentially is how the disease was eradicated in the U.S. more than 50 years ago. But mass inoculation comes at a cost. It’s estimated that for every million recipients of the vaccine, roughly 10 will make you sick. Handling a piece of mail even 10,000 anthrax spores is unlikely to make you sick. But with thousands of contaminated letters, someone is bound to be unlucky.

According to Kaplan, models that compare the spread of disease through unvaccinated and vaccinated populations are inadequate. Take, for example, the model for anthrax now being developed, the key bottleneck is queueing theory—picture long lines at a makeshift vaccination clinic—is to inoculate a sufficient percentage of the right people before the threat of a smallpox attack were clear. The strategy would be simple and effective. Inoculate everyone preemptively, which essentially is how the disease was eradicated in the U.S. more than 50 years ago. But mass inoculation comes at a cost. It’s estimated that for every million recipients of the vaccine, roughly 10 will make you sick.

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**ANTICIPATING AN ANTHRAX ATTACK**

Anthrax presents similar problems but has some important differences. Unlike smallpox, anthrax is not contagious in humans, and it’s curable if caught in time (but even deadlier if not). But a massive attack could infect millions of people simultaneously, and anthrax is known to exist in weaponized form.

Detecting an anthrax attack and judging its extent are nontrivial problems, but the logistics of response make them look easy. According to Wein, who also worked with Kaplan on a biodefense model for anthrax now being developed, the key bottleneck is likely to be hospital capacity and the number of emergency doctors—unless steps are taken to expand the number of trained...
Webb and Blaser’s simulation of the 2001 attack indicates that the Blaser of New York University School of Medicine had devised to the model. The important conclusion is that cross-contamination of anthrax spores is carefully sealed. The six letters of 2001 were taped shut, from letter to letter. Workshop presenter Glenn Webb, a mathematician at Vanderbilt University, described a model he and Martin Blaser of New York University’s School of Medicine had devised to analyze mail-borne transmission of anthrax. Their model, published last May in PNAS, simulates the cross-contamination of mail as bug-laced letters pass through the postal system. The model distills mail handling down to five stages, from pickup at point of origin (the corner mailbox) to the final destination (home or office). Each transition offers every piece of contaminated mail a chance to shed some of its anthrax spores. The model distinguishes four rough categories of contamination: the original letters (of which there were six in the 2001 attack) and three classes of cross-contaminated letters. The model incorporates estimates of the number of people exposed to contaminated mail at each stage (divided into age brackets) and the odds that exposure will lead to illness as a function of age and exposure level. Handling a piece of mail with ten or even a thousand anthrax spores is unlikely to make you sick, but with thousands of such letters, someone is bound to be unlucky. Webb and Blaser’s simulation of the 2001 attack indicates that the initial six anthrax letters led to 36, 432, and 5,000 cross-contaminated letters in the respective categories. However, these seemingly precise numbers are an artifact of the model. The important conclusion is that cross-contamination appears to present a significant risk, even when the original letters are carefully sealed. The six letters of 2001 were taped shut, presumably in an attempt to protect the perpetrator. Next time the attackers could deliberately amplify the effect of leakage. A “large-scale” attack with 100 loosely sealed letters sent to and from nonexistent people at phony addresses (ensuring that each letter would pass through the system twice) could cross-contaminate tens of millions of other letters and lead to thousands of infections if allowed to proceed unchecked.

LESSONS FROM INFLUENZA

Martin Meltzer, a senior health economist at CDC, stresses the need for models to keep things simple. “I believe very firmly in keeping models simple enough so that you can readily identify, of all the variables going into the model, which ones are really driving the model,” he says. “The more complex models you have, the less likely you’re going to readily identify what’s driving the whole shebang.” Meltzer’s specialty is influenza, which routinely kills hundreds of thousands of people worldwide each year. He characterizes pandemic influenza, which occurs when the virus mutates radically, as “nature’s own bioterrorist event.” The 20th century witnessed three influenza pandemics: in 1918, 1957, and 1968. The 1918 pandemic was the worst, killing more than 20 million people worldwide, including half a million in the U.S., where a quarter of the population got sick. “In many ways, pandemic influenza is the challenge,” Meltzer says. He’s developed a software package, FluAid, to help public health officials analyze their needs for basic resources to handle the next pandemic. FluAid is based on a model that Meltzer and colleagues Nancy Cox and Kenji Fukuda created to study the economic impact of an influenza pandemic. Their model distinguishes three age categories and assigns two risk categories to each one. Using Monte Carlo methods to address the uncertainties in key variables, the model produces a range of estimates for death toll, hospitalizations, doctor visits, and missed workdays, depending on the assumed “gross attack rate” (the overall percentage of the population that get sick enough to stay home—but not individuals who soldier on, spreading the flu bug to their coworkers). The CDC researchers’ model indicates that at a gross attack rate of 15 percent, approximately 20 million people will feel sick enough to stay home but not sick enough to see a doctor; another 18 million will see a doctor and about 34,000 of them will be hospitalized, and about 89,000 will die. If the gross attack rate is 25 percent (the highest rate studied), these numbers increase to 47 million, 42 million, 734,000 and 207,000, respectively. When the economic impact is measured, the cost of a pandemic ranges from $717.3 billion at the 15 percent gross attack rate to $136.5 billion at 35 percent. However, the models write, “the intent is not to provide the estimate of impact but rather to examine the effect of altering a number of variables.” Is there a net gain, for example, either in deaths prevented or dollars saved, if vaccination resources shift from one age group to another? How sensitive are the gains to the uncertainties in the parameters? One of the model’s key conclusions is that death is far and away the costliest aspect of a flu pandemic, regardless of the gross attack rate. Can flu preparations help in the effort against bioterrorism? Meltzer thinks they can and says a proper biodefense strategy must prepare for a variety of attacks. Flu models and the implementation of public health measures based on them could provide a testbed, he points out. “That’s the real challenge right there. How can you use the current situation as training and practice?” he says. “Perhaps the operations research people can sink their teeth into that.”

IMA’s successful formula

ESTABLISHED IN 1982, the Institute for Mathematics and Its Applications (IMA) traces its roots back to 1968, when Professor Willard Miller—then head of the School of Mathematics—learned that the National Science Foundation (NSF) was soliciting ideas for a new math institute whose programs would be both innovative and flexible. Miller and his colleagues submitted a successful proposal to the NSF that reflected IMA’s strong tradition of interdisciplinary collaboration: an institute dedicated to mathematics that would also look for ways to advance other disciplines and industry. Since offering its first program in fall 1982, the IMA has built an unparalleled reputation as a hot spot for collaborative research that closes the gap between theory and applications of mathematics. Through its various programs to date, the IMA has addressed problems in areas that include the life sciences and medicine, multimedia, materials science, geosciences, management and control of uncertainty, coding theory, optical devices, and mathematics in industry. Last fall’s workshop on operational modeling and biodefense is a prime example of the IMA’s programmatic timeliness and relevance. The IMA attracts scientists, engineers, scholars, postdoctoral students, graduate students, and industry experts from around the world. Each year the institute offers a 10-month program dedicated to a single broad topic or theme, which involves about 1,000 participants from academia, government, and industry. Thousands more attend IMA summer programs, seminars, conferences, workshops, and outreach efforts throughout the year. The institute also works closely with a group of affiliated universities and corporations. Participating corporations gain access to the IMA community and its resources; in turn, corporations offer students the chance to learn about opportunities in industry. Faculty and students from participating institutions help set the direction of IMA programs and interact with a broad section of the scientific community. Continuing collaborations and consulting relationships have evolved from contacts made at the IMA.
Two major NSF grants fund bold collaborations in earthquake engineering and surface process science

THE EARTH SHUDDERS, AND A STACKED FREeway OVERPASS COLLAPSES

onto the deck below, snapped in two like a broken chocolate bar. A docile river morphs into a roiling torrent that surges over its banks and engulfs everything in its path. Encrusted with frail shacks that house a teeming city's poorest residents, an entire hillside melts away in a giant mudslide, burying the occupants and their dreams of a better life. ■ The aftermath of a natural disaster evokes sympathy, relief money, volunteer assistance, and a sincere hope that something can be done to prevent or abate such catastrophes. Other crises—nascent, silent, unobtrusive—rarely disturb the consciousness of most people, for the problems and challenges of everyday life frequently trump long-term perspective. ■ Fortunately, a cadre of researchers around the world remains
At the University of Minnesota, multidisciplinary research and a commitment to outreach and knowledge transfer are nothing new. Here, the ivory tower comes equipped with an unlocked door and a bridge to the community.

In September 2002, St. Anthony Falls Laboratory (SAFL) and five partner institutions received a five-year, $19.3 million NSF grant to create a National Center for Earth-surface Dynamics (NCED), one of six new NSF Science and Technology Centers announced last year. NCED, which opened in September, will bring together researchers with a great deal of enthusiasm and commitment. They knew what they wanted to achieve, and they thought through every detail of their proposals.

NSF officials agree with that assessment. "The teams at the University of Minnesota developed their ... proposals with excellent vision and strength in disciplinary expertise, interdisciplinary commitment, and management capabilities. These were all very strong areas highly valued in the peer review process," says Priscilla Nelson, NSF division director for civil and mechanical systems.

Another deciding factor was the University's dedication to the projects. In both cases, the University pledged to provide resources and dollars that would complement the NSF awards, a trend that Gulliver predicts will become the norm for research in this country. "This is a very exciting time for the University," says civil engineering professor Steven Crouch, IT’s associate dean for finance and planning. "These grants will raise the awareness of what the University has to offer while also providing our researchers and administrators with the basis to help shape the future world of scientific research."

MAST MAKES IT BIG

More than a third of the world’s most destructive earthquakes on record—those that resulted in 50,000 deaths or more—occurred during the last century, a period when millions of people worldwide moved to densely populated areas in search of a better life. High-density living spells disaster when buildings, roads, bridges, and other structures can’t withstand seismic forces. In the developing world, shoddy building construction in unstable, high-risk areas compounds the effects of natural disasters. Death tolls

SHAKING THINGS UP: Civil engineering professor Catherine French heads the new Multi-Axial Subassemblage Testing (MAST) laboratory, which will test the ability of structures and their components to withstand earthquakes and other extreme events. The new facility is funded in part by a four-year, $6.47 million National Science Foundation grant.

In September 2002, St. Anthony Falls Laboratory (SAFL) and five partner institutions received a five-year, $19.3 million NSF grant to create a National Center for Earth-surface Dynamics (NCED), one of six new NSF Science and Technology Centers announced last year. NCED, which opened in September, will bring together researchers in civil engineering, geology, ecology, and biology in a remarkable assemblage of research in this country. Such collaboration to study the processes that shape the earth’s surface. SAFL, the center’s lead institution, received $14.5 million, among the largest awards in its history.

“The grants are the result of hard work for many months by a number of people dedicated to bringing these projects to the University,” says Professor John Gulliver, head of the civil engineering department. “Both of these projects were led by researchers with a great deal of enthusiasm and commitment. They knew what they wanted to achieve, and they thought through every detail of their proposals.”

At the University, multidisciplinary research and a commitment to outreach and knowledge transfer are nothing new. Here, the ivory tower comes equipped with an unlocked door and a bridge to the community.
and economic losses can reach staggering proportions. Architects and developers are more aware of the need to build earthquake-resistant large-scale structures, but there isn’t enough research available to guide them, according to Gulliver. Traditionally, earthquake engineering research has had to use small models and computer simulations that are helpful but far from perfect.

“It’s difficult to scale down things like forces on buildings. You do the best you can, but scaling up doesn’t work well,” he says.

Through the NEES collaboration, NSF intends to fill that information gap and to restructure the way earthquake engineering research is conducted in this country. The program will shift research from its current reliance on isolated physical experiments to investigations built on integrated physical models, databases, and model-based simulations—an approach that provides a comprehensive assessment of structural performance.

By 2004 NSF plans to invest a total of $48 million through NEES to develop the network of 16 sites that will share infrastructure.

No other facility in the world comes close to its capacity to simulate earthquake forces.

MAST’s equipment can deliver 880,000 pounds of force horizontally and 1.3 million pounds of force vertically.

“Consulting firms in Minnesota are increasingly involved in the University’s Digital Technology Center,” says Carol Shield, associate professor of civil engineering. “No other facility in the world can come close in terms of capacity to simulate earthquake forces.”

Research applications will focus on performance-based design, says civil engineering professor Catherine French, principal investigator for the University’s share of the project.

“Typically we like to test large-scale pieces of buildings to understand how those structures will behave in earthquakes,” she says. “If they fail, we can then develop ways to retrofit existing buildings to prepare them for earthquakes. Also, we want to test new materials and construction methods to codify how structural engineers might make use of our findings in new buildings.”

Rather than relying exclusively on tests of full-scale models, however, researchers will work to create the best computer simulations possible for earthquake modeling. In many cases they will develop a computer model first and then refine it using the MAST system.

“No NSF’s major emphasis is that we use [simulation] as the primary tool and use the models to validate the simulation,” says French. Among the MAST researchers who bring expertise in modeling and simulation are civil engineering associate professors Carol Shield and Robert Drexler.

The MAST system’s data-gathering and data-sharing capacities will be able to capture more information than similar projects have yielded. Eight video cameras, eight still cameras on robotic arms, and various sensors will create a visual, audio, and sensory record of experiments. Interfaced with a Web-based graphical visualization and control system, time-coded data will be transferred almost simultaneously to remote locations via Internet. Researchers will be able to videocall and receive data in real-time, and they’ll likely be able to control cameras and other equipment remotely. Faculty from electrical engineering, computer engineering, and computer science helped develop this aspect of the project.

“Now we have a state-of-the-art use of the Internet,” says Doug Ernie, associate professor of electrical and computer engineering.

“The idea is to get a reasonable facsimile of being here when you are really across the country. Researchers could sit at a computer and access the data, control the apparatus, and communicate via videoconferences and computer chat. A remote principal investigator could communicate with graduate students and staff while setting up, running, and analyzing an experiment.”

DATA SHARING IS KEY

NSF based the NEES initiative on a cooperative model that believes it will speed the development of earthquake-resistant structures.

“This is part of [an effort] by NSF to create an infrastructure of research facilities we don’t have in the United States,” explains Schultz. “It will open the door to people who don’t have access to sophisticated labs like these. They can simply observe. They can download the test data, video, and photos, and they can use the simulation tools to consider different scenarios when they test.”

The systems’ combined capabilities are generating excitement among civil engineering researchers who study earthquake phenomena. “It offers experimental capabilities that we don’t presently have,” says Gregory Deierlein, professor of structural engineering at Stanford University. “A lot of the simulations we use are 20 to 30 years old. Now we will be able to test large structures in more realistic, controlled settings.”

Data will be archived for future studies, a fact that appeals to Sharon Wood, professor of civil engineering at the Univer-
Consulting firms in Minnesota increase like St. Anthony Falls foula-Georgiou, facilities controlled conditions. “Therefore, if I’m developing analytical models, I can get this information, so I don’t have to call 14 researchers and then find out that I can’t read their computer files.”

“These are expensive experiments with a lot of data,” adds Deierlein. “The network allows us to archive and access data, so people around the world could benefit from one experiment. It’s like archaeology—we want to be able to look at today’s data in 20 years.”

The MAST facility and its research data also will be available to investigators from disciplines other than engineering and geology. For example, it could be used in paleo-archaeology—we want to be able to look at the sediment mechanics and erosion of braided rivers, rainfall, and climate change. Jerry Hajjar, associate professor of civil engineering, believes the University is the ideal spot for an earthquake laboratory. “Consulting firms in Minnesota increasingly are seeking national and international projects, which means they need engineers who know earthquake-resistant design,” he says. “Also, we have a strong information technology component in the University’s Digital Technology Center.”

The facility’s influence will extend far beyond Minnesota, attracting researchers from around the world—a prospect that Gulliver relishes. “Future research will be based on this model, so the MAST laboratory is a prime opportunity for the University to demonstrate leadership,” he says.

NCED: WELSPRING OF SURFACE PROCESS SCIENCE

For 65 years, researchers at the world-renowned SAFL have dedicated their efforts to solving major problems in hydraulic engineering and water resources. Tucked away on a small island in the Mississippi River, just downstream from Minneapolis’ historic St. Anthony Falls, the premier facility is the only laboratory in the world that can tap into a natural waterfall to provide virtually unlimited water flow for experiments in everything from river engineering to sediment formation.

Over the past two decades, SAFL has expanded its focus to include interdisciplinary research on water and its interaction with the environment. A modern computational network, field projects, and new labs in water quality and biological engineering complement SAFL’s existing experimental facilities.

During this period, the number of large-scale facilities for experimental water-related research declined dramatically. Full-scale water flow research gave way to computerized models and equipment that requires minimal space. SAFL is now one of about a half-dozen U.S. laboratories that offer large-scale experimental facilities for engineering and geophysical fluid dynamics.

Valuable as they are, however, computers and models won’t make large-scale facilities obsolete. “You can’t understand everything with models and equations, so you need to test hypotheses under controlled conditions,” says Jerry Hajjar, associate professor of civil engineering.

“One-time renewable NSF grant, combined with the University’s contributions, will fund research in four major areas: landscapes and seascapes; basins; the effects of living things on the development of landscapes and stream channels; and integration of processes that change the shape of the earth’s surface across environments and scales.”

NCED researchers will study everything from sediment mechanics and erosion to braided rivers, rainfall, and climate dynamics.
Inventing Tomorrow 2003

Developing and most populous nations are among the most pressing challenges. Population growth in the western and southwestern U.S. has created more developments in areas like Death Valley and the San Fernando Valley, former riverbeds that are prone to flash floods, mudslides, and landslides. Many of the world's developing and most populous nations are located in regions of high seismic activity.

"These are issues in terms of disaster, in terms of planning," says Parker. Aaron Packman, assistant professor in Northwestern University's civil and environmental engineering department, was one of the first researchers to use the NSF grant money. Packman, who studies the analysis and modeling of environmental transport processes, says the laboratory's research capabilities were a big draw.

NCED will collaborate with the Science Museum of Minnesota to create an interactive Science Park on the river flats adjacent to the museum. Content will be based on NCED research and will illustrate how water, air, and other forces sculpt the earth's surface.

POPULAR SCIENCE: A portion of the NCED grant is reserved for research topics of special interest to the general public. "Certain topics...produce results the public can relate to," says Professor Gary Parker. "For example, we might look at social issues involved when there is massive flooding of the Mississippi Delta or at the effect global warming has on society."

BRINGING INFORMATION TO THE PUBLIC:
A portion of the NSF grant—$300,000—is reserved for a relatively small but noteworthy expenditure. NCED will seek recommendations from social scientists on research topics of special interest to the general public.

"The bulk of what we'll do is basic research, but there are certain topics that produce results the public can relate to," says Parker. "For example, we might look at social issues involved when there is massive flooding of the Mississippi Delta or at the effect global warming has on society."

"We have a small lab here [at North- western]... so I came to the University of Minnesota to use the large facilities," he says. "There are only six to eight labs of this size in the country!

NCED also will generate research opportunities for institutions that might not otherwise be able to fund studies, such as Fond du Lac Tribal and Community College.

"We always opened the lab to others, but now [they can submit] proposals. Now we can give them money and have an engineer available to help them," explains Karen Campbell, knowledge transfer director with SAFI and NCED.

The center encourages researchers to design their projects within a broad framework. One such study will attempt to determine if growing alfalfa on a riverbank affects erosion, sedimentation, vegetation, and other factors.

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BRINGING INFORMATION TO THE PUBLIC:
A funding requirement, 10 percent of NCED's work will be dedicated to outreach and knowledge transfer. Fond du Lac Tribal and Community College and the Science Museum of Minnesota are the center's partners in these efforts.

NCED is working with the tribal college to identify ways in which they can collaborate. Several programs already in place at the college would mesh very easily with the center's overall mission.

One strong candidate is the St. Louis River–River Watch program, a youth-based water-quality monitoring effort in northeastern Minnesota that's coordinated by the college's Environmental Institute.

Twice each year an estimated 800 secondary school students and teachers from 25 schools collect chemical, physical, and biological data in the St. Louis River watershed and surrounding watersheds. The lower segment of the St. Louis River—the largest U.S. tributary to Lake Superior—is among 43 sites identified by the U.S. and Canadian governments as Great Lakes Areas of Concern.

In most participating schools these activities are integrated into the science curriculum. As students strengthen their scientific skills, they're also helping communities identify and solve environmental problems. The data collected by the students are compiled, evaluated, and shared among all schools and with state and local communities in a variety of ways.

The Environmental Institute's wild-rice restoration project and a summer camp program offer other partnership opportunities.

NSF also wants NCED to reach out to minority groups. "At issue to what we do is to manage landscapes, and that's important to Native American tribes," says Parker. "As a result we are developing an outreach program for junior colleges and high schools to show Native American students how their out-of-doors can relate to careers in science and technology."

NCED researchers also plan to offer short courses for engineers on such topics as submarine sedimentation and stratigraphy, erosion control, stream rehabilitation, and dam removal. Engineers from industry and government are also eligible for NCED research grants.

The largest and most visible NCED outreach project, however, is its collaboration with the Science Museum of Minnesota, located in downtown St. Paul. Situated on a bluff with a spectacular view of the Mississippi River—"noted for its lively educational programs—is a natural fit for NCED."

The museum will create a series of interactive exhibits for a Science Park, to be built on a 1.2-acre section of the river flats adjacent to the museum. No specific exhibits for outdoors park have been planned yet, but the content will be based on NCED research and will illustrate how water, air, and other forces sculpt the earth's surface. The park is scheduled to open in 2004.

"I think a partnership between the lab and the science museum will create a very exciting outdoor experience for our visitors," says Carleen Pieper, the museum's communications director. "The science museum has always had a focus on environmental education. There are basic levels that most people understand—erosion, for example—but then there are more complicated things, like the effect of storm sewers on the environment. Forces that sculpt the landscape go beyond ordinary things, like a stream that overruns its banks now and then. Our exhibits will show that landscapes are also affected by the decisions we make and how we plan for these occurrences."

The museum will expand its existing youth science center into the Science Park, where young people will serve as guides. Other plans include a summer institute for middle school teachers and the development of outreach programs for schools across the Upper Midwest.

WELCOMING THE UNEXPECTED
Both in concept and practice, the MAST and NCED initiatives will foment creativity. The ingredients are all there: a host of challenging problems, inventive minds, technical expertise, partnerships across disciplines and institutions, state-of-the-art technology, financial support, and an investment in education.

Unique in size and scope, the Universi- ty's MAST system will expand large-scale testing capabilities nationally and internation- ally, and through NEES it will aid a sweeping effort to restructure earthquake engineering research in the U.S. At NCED, an extraordinary scientific collaboration will oversee the genesis of a new superfield—surface process science—while the center's education and outreach partners serve the public through creative programs.

It's an exhilarating time for everyone involved, from program administrators and researchers to the wider scientific community and beyond. Perhaps most exciting of all is the prospect that MAST and NCED will generate significant advances that are virtually unimaginable today.

Parker summarizes their shared hopes for the future. "I'd like to see in 10 years some really important scientific developments, educational developments, and applications that we could not in any way have predicted."

Given the resources and talent comm- itted to both ventures, it's going to be a dynamic decade. ■

FOR MORE INFORMATION SEE W W W.C E.U M N.EDU

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The midwinter sun peers timidly over the horizon when dawn breaks in northwestern Minnesota. Its fainthearted light brings no warmth as it creeps over the frigid landscape, bathing acres of snow-covered soil in a pallid glow. In this corner of the state, residents sometimes awaken to an early-morning temperature of 20 degrees below zero. Darrell Rinerson still remembers that bitter cold. From the age of six he rose daily before sunrise to help his parents and three siblings run the family farm, located near Ada, Minnesota. For 12 years he milked cows and helped plant corn and soybeans. To city dwellers, farming may seem a romantic, even idyllic, way of life. But Rinerson experienced the reality behind the myth: hard
with a $30 million bequest. The gift, the largest single gift ever made to the University, will provide unrestricted funds to the University's total revenues is shrinking, and competition for top faculty and students is intense.

"We are in tough competition for students and faculty with our private counterparts who have major endowments," says Kaveh. "Darrell's commitment is a major boost."

Although Rinerson's gift is a planned contribution—the departments won't receive money for perhaps 30 years in the future—both Kaveh and Professor Allen Goldman, head of the physics department, have identified some of the ways in which the gift may be used.

Faculty support is a top priority for both departments. "If we don't have the funds to recruit and retain the best faculty, they are going to be snapped up by other institutions," says Kaveh, who would like to increase endowments to support faculty chairs and professorships in electrical engineering.

The physics department also needs funds for faculty support, says Goldman. When a new faculty member joins the staff in an experimental science, he explains, it's necessary to set up laboratory facilities for that person's research—sometimes at a steep cost.

Both professors want to increase support for graduate students (departmental fellowships and grants) and for undergraduate research programs. Upgrades to facilities and technology will be a recurring need, and both administrators emphasize that the future will bring new opportunities and challenges.

"What's going on in the world right now is continuously changing with time," says Goldman, who was one of Rinerson's undergraduates in the 1960s. "At the time Darrell was here, the main research areas were nuclear and space physics. Now, he says, the main research focus is on condensed matter and elementary particle physics, while astronomy, a subset of physics during the 1960s, enjoys more autonomy.

"Demands by industry have changed, and storage has expanded in emphasis in our department," he adds. "One lone faculty member [used to work on that, and now three faculty members focus on that aspect of the field]."

For Rinerson, his choice is not obvious. For me, college was really a change in perspective. It was the place where I learned how to do more."

INVENTING TOMORROW Spring 2003

When you're on a farm, unless someone has gone before you, the possibilities for tomorrow's students and helping the departments who serve them.

"I don't want to downgrade it," he says, "but [high school] was almost too easy. It didn't really prepare one for college, although that's probably the way it has to be, so everyone can get through it."

Although no one in his family had ever gone to college, Rinerson was determined to get an education. In 1965, at age 18, he left Ada for the University, intent on becoming a scientist. "I wanted a career that kept me out of the weather, warm and dry," he says.

The University gave Rinerson the tools he needed to transform his life into a modern rags-to-riches tale: the meteoric rise of a farm boy whose pioneering work in computer chip technology made him a major player in Silicon Valley.

"I've been lucky," he says. "The field was exploding when I first graduated from college. I saw my first computer at Univac—it was the size of a room. Today they're tiny and so much more powerful. They've evolved so much in 30 years, and I've lived through the whole thing."
"M" Club Hall of Fame inductee Paul Mitchell beat the odds to achieve extraordinary success on the gridiron and in the corporate world

BY TRACEY WILSON

WHEN PAUL MITCHELL BEGAN PLAYING SANDLOT FOOTBALL AT age 10, he had no idea how far his passion for the game would take him.

As a kid growing up in Northeast Minneapolis, the legendary Golden Gopher tackle loved the rough-and-tumble neighborhood scrimmages with an intensity that sometimes dismayed his mother.

"I would play almost all day and on the weekends, too," he says. "I'd come home all bloody and dirty. My mother didn't like it, but I loved to play so much."

A few years later, his feats on the college gridiron had reporters scrambling to find enough superlatives to describe his talent. Mitchell (ME '43) laughs when asked if he knew then just how good he was. "I never realized that," he says. "My wife tells me I was okay, so I guess I did pretty well."

That modest self-assessment doesn't accurately portray one of the finest tackles in Gopher football history. In 1943 alone, Mitchell walked ten blocks to the hospital, where doctors told him his leg was broken. "I had no idea it was broken," he laughs. "I thought it was just strained real bad."

Sometimes the practice and away-game schedule forced Mitchell to miss a week of classes at a time, and occasionally he felt overwhelmed by the difficulty of keeping up with his studies. Fortunately, several professors recognized his dilemma and offered their assistance. "They would always help me catch up when I missed classes or labs," he says. "They were wonderful. I wouldn't have made it without their support."

Mitchell also received constant support from his future wife, University student Ingrid Vallo. She became a Gopher football cheerleader in 1943, the first year women were admitted to the University. Mitchell and Ingrid met at Edison High School.

"Paul is one of the greatest tackles to ever participate in the game and one of the humblest men I've ever met," says ITM alumnus Ken Olson, who nominated Mitchell for the award. "He just doesn't like to make a fuss."

Mark Davy, National "M" Club president, agrees that Mitchell was a great choice. "We're proud to induct a man of his stature for all of the honors I've received."

Mitchell proved to be extraordinarily resilient, both as a student and as an athlete. On the football field, Mitchell kept going long after most players would quit. During a Gopher victory over Northwestern University in 1941, he injured his leg but continued to play despite intense pain. After the game, he went to the hospital, where doctors told him his leg was broken. "I had no idea it was broken," he laughs. "I thought it was just strained real bad."

Mitchell still seems a bit awe-struck by his Hall of Fame peers and surprised to find himself among that elite group. "It's an amazing honor to be alongside so many of my friends and heroes," he says. "I just can't believe it."

Others take a more objective view of Mitchell's accomplishments on the football field. "Paul is one of the greatest tackling machines I've ever seen," says former University president Regis P. Mahoney, who knew Mitchell from his days at the University and hired him on the spot. Given the opportunity to use his mechanical engineering degree, self-discipline, and sturdy work ethic at Garrett, the former Gopher standout achieved considerable success on a new playing field. By the time Mitchell retired in 1980, he was vice-president of the corporation.

Immediately after leaving AlliedSignal, funded Palos Verdes Enterprises Corporation, which constructs homes and apartment complexes. The company also manages apartment complexes, mobile home parks, and mini-warehouses.

Over the years the Mitchells have been involved in many civic and community activities. They've been active in the Pet Protectors League, an organization that Ingrid Mitchell founded to rescue stray animals. They've supported the Los Angeles Music Center, worked with the local school board to establish the best school system for their district, and established a scholarship fund at Edison High School.

In 1992 the couple sponsored two bronze busts of the late King Olav V of Norway created for Concordia College in Moorhead, Minnesota, and for Versterheim Norwegian-American Museum in Decorah, Iowa. They have fond memories of meeting the king several times, including a private audience with him in Norway.

"We just like to stay as active and involved as we can," says Ingrid Mitchell. "With three children and four grandchildren we always stay pretty busy, but there is always more to do."

Mitchell, who remains unfailingly modest, still seems a bit awestruck by his Hall of Fame peers and surprised to find himself among that elite group. "It's an amazing honor to be alongside so many of my friends and heroes," he says. "I just can't believe it."

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Daring well and doing good

T he taste for adventure begins early, as any parent can tell you. Some pretty rousing tales spring from the mind of a youngster left alone with a few simple props and a vivid imagination.

For most of us, real adventure begins only when we leave the security of home and school behind to launch our professional careers. Many IT alumni spend those first years after graduation as employees, gaining knowledge and experience, and then forge a new path by starting their own companies.

Entrepreneurship is an exhilarating, often risky adventure, but it has great appeal for IT alumni. Twelve years ago the college’s Founders Project identified more than 1,000 alumni who had established their own companies. Over the past decade we’ve added many more names to that list, which continues to grow every year.

During this same period the University launched Campaign Minnesota, the most ambitious fundraising effort in its history. As the campaign nears its end, we’ve noticed an interesting phenomenon: IT’s founders’ list and the roster of campaign donors include many of the same names: individuals who took the less-traveled road and returned to share their blessings.

Alumni Darrell Rinerston’s story, recounted in this issue, offers a powerful example. His incredible career, which began here in Minnesota with Univar, flourished in Silicon Valley during the semiconductor revolution. His planned bequest of $30 million—the largest in University history—expresses great affection for his alma mater and for the physics department and electrical and computer engineering department, where his journey began.

His story is not unique. Lee Johnson, Bob Wahlshted, and Dale Merrick started Reld Precision Manufacturing, and all three created charitable remainder trusts with IT as a remainder beneficiary. Lee and his wife, Betty, donated additional funds to the new Mechanical Engineering Building, and he served as a member of IT’s campaign steering committee.

The late Lee Whitson founded WR Medical Electronics after working at 3M and as an industrial engineering teacher. Lee’s legacy will create our largest scholarship fund, allowing the mechanical engineering department to offer competitive fellowships to the top students applying to its graduate program.

Civil engineering alumni Otto Bonestroo and Bob Rosene, founders of the well-known engineering consulting firm Bones troo, Rosene, Anderlik & Associates, are extraordinary friends of IT who have volunteered their time, talent, and treasure. Bob has served as IT Alumni Society president, and both men have created and contributed to endowed scholarships, fellowships, professorships, faculty recognition, and equipment funds.

Art Schwall worked with Medtronic until he started Cardiac Pacemakers and American Medical Electronics. He and his wife, Nancy, have pledged a generous gift to support scholarships. I could fill this entire magazine with similar examples.

The common thread in all these stories involves a journey to personal success that begins in IT and comes full circle back to its origins. The creative philanthropy of our founder/donors ensures that future generations of our alumni will venture forth to establish new companies, advance science and technology, and serve the greater community.

It’s a timeless story that never loses its magic, and we are all the better for it.

Phil Oswald

A SHARED COMMITMENT to service and the love of flying forever bound the lives of twins John and Robert McCollom. The brothers graduated from the University in 1942 with degrees in aeronautical engineering and ROTC commissions in the U.S. Army Air Corps. In May 1943, a plane carrying the brothers crashed in New Guinea, killing Robert. John, stranded in the remote jungle along with other crash survivors, was rescued a month later.

Following John’s death in 2002, his widow, Betty, estab lished the John and Robert McCollom Memorial Scholarship to provide financial assistance to undergraduate students majoring in aerospace engineering. It’s a fitting tribute to the brothers, whose lives exemplified leadership and service. Gifts like McCollom’s create an enduring legacy, says IT Dean H. Ted Davis. “Memorial gifts accomplish two significant goals at once: They honor and commemorate a loved one, and they help us achieve our collegiate goals. It’s a great way to help build a better, brighter future.”

Memorial gifts can be made to a specific program or fund, or their use may be left to the college’s discretion. Donors can also establish a new fund to commemorate a family member, classmate, faculty member, or friend. For more information about the McCollom scholarship or about making a memorial gift to honor someone in your life, contact IT’s development office at development@it.umn.edu or 1-800-587-3884.

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MY PATH IN AND OUT OF THE UNIVERSITY wasn’t exactly a straight line. I entered the University through the East Bank, planning to become an electrical engineer, and emerged seven years later from the West Bank as a fledgling attorney specializing in intellectual property law.

While I was a student at the University, not only was there a lack of information about employment opportunities, but I was also afraid of blowing it. I had the sense that if I made a mistake, I’d never get another chance. The lack of information coupled with my fear of failure was a recipe for a haphazard decision-making process. Today I think they call that “interdisciplinary studies.” Back then, however, people just thought I’d gone mad. But the high-tech age was dawning, and I suspected what keeps me involved and motivated are the members and the tie that binds the happy union has always been IT. Today I think they call that “interdisciplinary studies.”

IT helps build Minnesota’s economy. In the long term, we can serve you better. In this issue you’ll find a brief alumni survey form that asks for demographic data and professional interests—that documents the ways in which IT serves a wide range over a variety of technologies. ITAS leaders are highly skilled professionals who know how to manage people and to transform your ideas into reality. You can help us decide which alumni programs offer the greatest benefit and how we can serve you better. In this issue you’ll find a brief alumni survey form that asks for demographic data (degrees, graduation date, schools attended, employment status, companies founded) and for feedback on our programs. All individual responses will be kept strictly confidential. We’ll also email you instructions for completing the survey online.

ITAS president, I urge you to take a few minutes to complete the form. Survey results will give us an updated collective snapshot of our alumni—your careers, entrepreneurship, professional interests—that documents the ways in which IT serves individuals, its alumni, and the broader community.

Currently much attention is focused on the legislature and the painful process of slicing up the budget pie. In the long term, though, we must find ways to make the pie bigger and increase our state’s collective wealth. IT is an essential ingredient in creating relationships between IT alumni and the community, he says.

“There are few endeavors in life that will provide as rich and protracted a return as a good education,” says Torniainen, who heads an ITAS program that connects alumni with K-12 programs seeking volunteers with expertise in math and science.

“We’re looking for volunteers interested in small commitments—like making a classroom presentation or leading a discussion—as well as those willing to make a longer commitment,” he says.

Given the state’s current budget crisis, the program is even more important. “Difficult times define the character of a community,” he says. “Policies are clarified. We have a golden opportunity to make a difference.”

To volunteer or get more information, call 612-626-8272 or email itas@it.umn.edu.

S&T Banquet raises $20K for scholarships

A CROWD OF roughly 550 executives, alumni, faculty, and friends packed the ballroom at the Minneapolis Hyatt Regency Hotel for IT’s 2003 Science & Technology Banquet on April 23. The banquet, IT’s premier alumni event, raised $20,000 for the ITAS Scholarship Fund. Richard Gross, Dow Chemical’s vice president for search and development and new business development, headlined the event, which also featured remarks by University president Robert Birnminks and IT dean H. Ted Davis.

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ARCUS MATTISON didn’t set out to create a landmark, but his “temporary” contribution to the University landscape became a campus icon nonetheless.

The University hired Mattison (Civil ’33) to build the two wood-planked bridges that carried pedestrian traffic over Washington Avenue between Coffman Union and Northrop Mall for 61 years. Completed in 1940 to coincide with the opening of the new student union, the bridges were supposed to stay in place for less than a decade, says Mattison.

“The original plan was to depress Washington Avenue [below grade] from Oak Street to the Mississippi River,” he recalls. “But then the war came along and put everything on hold.”

That plan, which would have extended Northrop Mall to Coffman plaza, later was abandoned, and the pedestrian bridges remained in place. In January 2002 they were finally demolished to make way for safer, more accessible replacements.

Building the bridges was Mattison’s first major contract, and construction was a challenge. Workers installed the steel bridge frames at night to avoid disrupting streetcar traffic. “We had six hours to complete the steel construction and get the trolley wires back in place,” he says.

Mattison also remembers raising concerns about the bridge design. “I was worried about corrosion where the steel columns were embedded in the concrete,” he says. He expressed his concerns to civil engineering professor Joseph Wise, who designed the structures.

“He said, ‘Don’t worry about it. They’ll only be here for 10 years; they won’t have time to corrode,’” recalls Mattison. “We were both wrong.”

After the bridges were completed (at a cost of just $5,000), Mattison turned to other projects. “I didn’t really think of [the bridges] as anything special,” he says. But generations of University students did. Academic processions and protest marches alike traversed the arched walkways, and homecoming pennants shared space with antiwar banners along its railings. According to University estimates, campus denizens crossed the bridges more than 100 million times.

Professor Thomas Fisher, dean of the University’s College of Architecture and Landscape Architecture, says it’s no surprise that people were fond of the bridges. Located in the heart of the Minneapolis campus, they summon up all kinds of associations that have little to do with the bridges themselves but everything to do with memories, he says.

Marcus Mattison, the alumnus who built the original “temporary” Washington Avenue pedestrian bridges in 1940, returned to campus last fall to dedicate their replacements. The new bridges (above) are clad in stainless steel to complement the nearby Weisman Art Museum. Mattison (left) was escorted by University vice president Kathleen O’Brien.

“It’s not the bridges people are attached to; they may not have walked over them for 25 years,” Fisher said. “Physical things wear out, and memories don’t. The new bridges [are] in roughly the same place and will have new associations for people.”

Covered in stainless steel that matches the exterior of nearby Weisman Art Museum, the new bridges slope gently, curving to the side to preserve a clear view from Northrop Mall to Coffman Union.

At 12 feet wide, the new bridges are four feet wider than their predecessors. A heating system embedded in the concrete will keep them free of ice and snow. The $4.5 million project also included transit stations, landscaping, and lighting along Washington Avenue.

Mattison was the first to cross the new bridges at a dedication ceremony in October. At the event, he confessed a fondness for the originals. “In old age, I guess nostalgia sets in,” he says. “I started to realize that they were something special.”

As for the new bridges, he says, “They’re nice—real fine structures. I hope they last as long as the old ones did.”

FOR MORE INFORMATION SEE WWW.IT.UMN.EDU/INVENTING.