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Forefront

COLLEGE OF ENGINEERING UNIVERSITY OF CALIFORNIA, BERKELEY *fall 2006*

BIG GAME TICKET DRAWING!
See inside back cover.

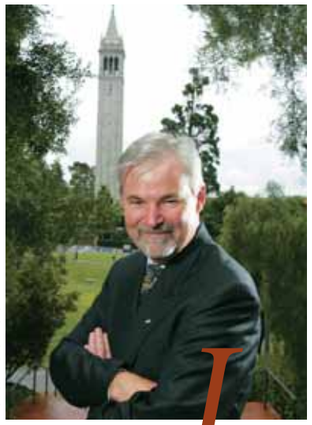
Broken Levees: New Orleans to Sacramento

UC Berkeley engineers lead search for solutions

- New center puts Berkeley on the synthetic biology map
- Simulated quake rocks the house
- Can biofuels break our oil addiction?

dean's message

THE MANY DIMENSIONS OF DIVERSITY



NICK LAMMERS PHOTO

In a recent conversation I had with Charles Simonyi (B.S.'72 Eng. Math), one of our 2006 distinguished alumni, he warmly described Berkeley Engineering's part in his incredible success story. Charles arrived in the United States in 1968 as a young student, having fled an oppressive Hungarian regime and leaving his family behind in Budapest. Ultimately he navigated a soft landing at our College, where he launched his extraordinary American career as a pioneer in software engineering.

I hear stories every day from our graduates—many from low-income families—who tell me how the opportunity to attend Berkeley Engineering changed their lives. Low socioeconomic status can mean decreased access to college, but at Berkeley the opposite is true. In fact, this tradition of economic diversity and accessibility gives us some of our most high-achieving engineers. They come here not just because they're smart but also because they're passionate and because they want to change the world.

Forty-one percent of our engineering undergraduates receive need-based financial aid, and 25 percent receive Pell Grants, a federal grant for students from low-income families, typically a family of four earning less than $35,000 annually. Berkeley's College of Engineering alone has more of these students than all the Pell Grant students at MIT, at Yale or at Princeton. Early data on our 2006 entering class show that 22 percent are first-generation college students, meaning neither parent has a four-year college degree, and nearly 26 percent speak a first language other than English. Also enriching our classrooms are the more than one third of our graduate students who are foreign or foreign born, and our junior transfers who bring with them a higher level of life experience than—and, by the way, GPAs at the same level as—entering freshmen.

What makes these students so special? Besides their own remarkable accomplishments against a backdrop of adversity, I believe they also open the eyes of their often more privileged classmates and inspire them to even greater levels of achievement. Few things can shake you out of a sense of entitlement like rubbing shoulders with a fellow student who did better on the midterm, even though he or she has to work 15 hours a week and study English at night as well.

Cultural and economic diversity is one of the pillars of strength of Berkeley and our other great public universities: Giving all our talented young people an opportunity to thrive, whether native born or foreign born, privileged or disadvantaged, street-smart or book-smart. The secret is in the mix, the melting pot, where diverse individuals can bring their myriad talents and varied experiences together and inspire one another to transcend their limitations and reach their greatest potential.

I welcome your thoughts at **dean.forefront@coe.berkeley.edu.**

— A. RICHARD NEWTON
Dean, College of Engineering
Roy W. Carlson Professor of Engineering

Forefront takes you into the labs, classrooms and lives of professors, students and alumni for an intimate look at the innovative research, teaching and campus life that define Berkeley Engineering.

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On the cover
Read the story on page 12.
Broken levees led to massive flooding in New Orleans in the wake of Hurricane Katrina, a disaster experts fear could repeat itself in the California Delta, where a fragile labyrinth of levees could be seriously damaged or fail should an earthquake occur even as far as 100 miles away.

COVER PHOTO COURTESY OF FEMA

BACK COVER PHOTO BY PEG SKORPINSKI

Forefront

COLLEGE OF ENGINEERING UNIVERSITY OF CALIFORNIA, BERKELEY *fall 2006*

CONTENTS

The flat world fuss

In response to Dean Newton's message [spring 2006], the world is indeed "flat." But Friedman is wrong about our technological and economic preeminence being in jeopardy because more degrees are coming out of Asia. Every engineer with a degree tries to develop a product that makes life better or makes millions of dollars. I was able to do this even without a degree, so we shouldn't feel threatened.

—TREVOR J. BUCKINGHAM
Senior Software Engineer and Owner, QL2 Software Company Chicago (EECS 1998–2002)

Defining engineering excellence

The brave new world of engineering excellence Dean Newton envisions [spring 2006] looks rather different to me. I agree that the quality of life of any society depends greatly on what the society chooses to do locally. But I suspect I am attending to different criteria and constraints.

You refer to goals of caring for one another, educating our children, creating new industries and well-paid jobs and investing in infrastructure. However, it is not clear to me that the kind of engineering projects and prototypes I see in the pages of *Forefront* are at all optimal in terms of our long-term quality of life, that is to say, sustainability.

What we should be doing is importing and expanding the output/input definition engineers are accustomed to by explicitly describing the desired output: necessities—that is, food, shelter and clothing—for all before luxuries for the few. Failure to explicitly describe the desired ends of the economic process allows people to delude themselves that the means they happen to be using at the time are actually the ends they really want.

By using money and transaction volume as indicators for economic health, we have ended up with a system that is much better at maximizing monetary profit than actual well-being. And as long as engineers and engineering students—not to mention lawyers, accountants, physicians and businessmen—keep thinking that money is what is important, we will continue to perpetuate the unhealthy materialism that is denounced by both left and right.

A notable example of the kind of wild-goose chase induced by this mistaken emphasis on means rather than ends is the widely proposed revival of nuclear power in the face of rising oil prices. As it happens, Per Peterson and I have disagreed on this point since we were colleagues in grad school.

I am not aware of any comprehensive analysis demonstrating that nuclear power is the way to obtain the maximum amount of necessities for the least cost in energy and resources. We are far from solving the waste disposal problem, and there are a litany of other thorny health and environmental problems still plaguing the field of nuclear technology.

—MURIEL STRAND
Sacramento (B.A.'76 French, M.S.'88 ME)

Clear choice for suicide barrier

The spring 2006 issue of *Forefront* shows three options for a suicide barrier for the Golden Gate Bridge. The modified pedestrian rail option has a number of distinct advantages over the other options. It has an attractive,

clean look and utilizes cable construction, which is compatible with the main bridge vertical support cables. It is the easiest to install at the lowest cost and is similar to cable restraint barriers now being installed in structures like stadiums and, as such, it is very difficult to climb. Finally, it creates only minimum blockage to a photographer's camera lens.

—BILL SCHICK
Los Altos (B.S.'57, M.S.'58 ME)

Engineering ties to industry

The article in the spring 2005 issue of *Forefront* about faculty–industry ties is very appropriate and interesting.

I have worked 20 years as a professional engineer in industry and academics, including 15 years in the Bay Area and as a professor and department chair at North Dakota State University. I am also on the Body of Knowledge committee of the American Society of Civil Engineers, working to develop the required knowledge and skills a civil engineer will need in the future to function as a professional.

When I was in the Bay Area, it was common knowledge that much of the local industry was developed or nurtured by faculty from Berkeley and Stanford. I have good memories of Berkeley from my years as a graduate student. Most of the faculty I had contact with had a good balance of research and practical engineering experience.

The National Academy of Engineering 2020 report on education recommends that engineering faculty have practical experience. It is unfortunate that many are lacking in this regard. In my opinion, it is a serious handicap for those trying to educate engineers for a profession of practice when they themselves have so little.

—MERLIN KIRSCHENMAN
Professor Emeritus, NDSU Moorhead, Minnesota (M.S.'76 CE)

Write to us at **forefront@coe.berkeley.edu** or send your letters to *Forefront* letters, 1925 Walnut St., #1704, University of California, Berkeley, CA 94720-1704. Please include the writer's name. Note that we cannot include all letters received, and those published may be edited for length and clarity.

News from the Northside

What's New at Berkeley Engineering

BART NAGEL PHOTO

Berkeley ChemE and BioE professor Jay Keasling is director of the new NSF-funded Synthetic Biology Engineering Research Center (SynBERC), which will unite researchers, industry and policy experts to drive advances in the emerging field of synthetic biology.

SynBERC puts Berkeley on the synthetic biology map

A new UC Berkeley center for synthetic biology research could transform the biotechnology, high-tech, pharmaceutical and chemical industries, researchers say, by providing cheaper drugs, cleaner fuels, biological sensors, replacement organs from stem cells and other novel materials.

Funded by a five-year, $16 million grant from the National Science Foundation (NSF), the Synthetic Biology Engineering Research Center (SynBERC) was announced in August. It unites researchers in synthetic biology from five universities—Berkeley, MIT, Harvard, UCSF and Prairie View A&M University in Texas—for a unique "engineering" center. Prairie View is a small, historically black university included expressly to provide its faculty and students access to research in the fledgling field.

"The focus of SynBERC is to make biology easier to engineer," says Berkeley ChemE and BioE professor Jay Keasling, director of the new center. Synthetic biology involves designing and constructing new biological entities such as enzymes, genetic circuits and cells, or redesigning existing biological systems specifically to treat disease and address pressing environmental problems.

SynBERC researchers hope to engineer microbes to produce the anticancer drugs vincristine and vinblastine—currently used to treat lymphoma, leukemia, and some types of breast and lung cancer—which today are extracted from plants and, because of their chemical complexity, are difficult to synthesize in the laboratory. Projects under way in Keasling's Berkeley lab include designing a microbe that changes the hard-to-digest cellulose of plants directly into fuel, and improving the bacteria and yeast he has already engineered to produce the antimalarial drug artemisinin. (See cover story in *Forefront*, spring 2005 issue, on the Web at **www.coe.berkeley.edu/forefront/spring2005/malaria.html.**)

The NSF grant includes several unique components, including an open source registry that will allow SynBERC engineers to share the designs for their biological parts and devices. Through industrial agreements, 12 firms have already committed to partnership with the center as investors and research advisors; in return, they will have access to student researchers and graduates. Members of the team will create synthetic biology curricula for K-12 and community college students, encouraging participation of minority and underrepresented students.

The center will also address the ethical implications of synthetic biology. "We are going to make biology easier to engineer, which means it will be easier for someone to misuse the technology," Keasling says. SynBERC will bring social scientists and public policy experts into the synthetic biology discussion to consider the societal, ethical, biosecurity and biosafety implications.

The center was spearheaded by the California Institute for Quantitative Biomedical Research (QB3), a public-private partnership founded in 2000 that facilitates multidisciplinary research. At Berkeley, QB3 has made synthetic biology one of its key initiatives, so securing the NSF funding is a major milestone.

For more, go to **www.synberc.org.**

BY ROBERT SANDERS, UC BERKELEY MEDIA RELATIONS

PHOTOS COURTESY KHALID MOSALAM

An 8.0 earthquake simulated on the shake table at Berkeley's Earthquake Simulator Lab was featured on NBC-TV's "Dateline" in May. Following the tests, the replica of a pre-code "soft-story" San Francisco home sustained structural damage, and unsecured furnishings on the second story came crashing to the floor.

NBC's "Dateline" rocks the house with simulated 8.0 quake

CEE professor Khalid Mosalam designed and conducted a dramatic visual experiment commissioned by NBC-TV and broadcast on the network's "Dateline" news program to demonstrate how a pre-code San Francisco home would fare in an 8.0 earthquake.

The program, which aired last May 21, showed footage of the earthquake simulator at Berkeley's Earthquake Engineering Research Center in Richmond shaking a replica of a Sunset district home. The family that occupies the actual dwelling was shown viewing live video of the test as chandeliers were sent spinning and room furnishings came crashing to the floor. Mosalam appeared to explain the experiment and what it revealed about "soft-story" structures, the term used to describe the first story of two-story houses built over a garage.

In covering the anniversary of the 1906 quake, NBC wanted a story that would further earthquake research and education. Working with Mosalam and his graduate students, with input from several practicing engineers in the Bay Area, they devised the tests to demonstrate how a pre-code structure would behave in a strong quake. The soft-story structure—typical of homes built in 1930s and '40s San Francisco—is particularly vulnerable to earthquake damage because of the garage on the first floor. The tests were conducted on the 20' x 20' shake table at Berkeley's Earthquake Simulator Lab, which can simulate seismic activity and its effect on structures up to 40 feet tall and weighing up to 60 tons.

"My goal was mainly to understand how houses built over a garage behave up to their point of collapse," Mosalam said. "Ultimately, I would like to come up with affordable retrofit systems for these residential structures." The garage door retrofit system, although still only in its infancy, would provide homeowners with an inexpensive system that they could install themselves to strengthen a weak first story.

Mosalam ran two tests to demonstrate how furnishings would behave when secured, then unsecured, during a 52-second quake measuring approximately 8.0 on the Richter scale. During these two tests, the house was strengthened to ensure that it remained standing. A third test eliminated the strengthening scheme to demonstrate the effects of the quake on the structure itself.

More than 70 sensors affixed to the house collected data during the tests that Mosalam and his students are now busy analyzing.

"The bidirectional response that combined shaking in two horizontal directions compared with one-directional shaking was very informative and provided us with a better understanding of how such structural systems may twist under strong shaking," Mosalam said.

Go to the MSNBC website at **www.msnbc.msn.com/id/12911952** to see portions of the broadcast.

Berkeley participates in "spintronics" research

PEG SKORPINSKI PHOTO

Jeffrey Bokor

Berkeley engineering faculty will be among 30 researchers taking part in the four-campus Western Institute of Nanoelectronics (WIN), one of the largest joint research programs to focus on the pioneering technology called "spintronics" and its potential applications in semiconductor engineering.

"The semiconductor industry is facing a huge challenge, which is to come up with a technology successor for CMOS (complementary metal oxide semiconductor) standards," said EECS professor Jeffrey Bokor, who is heading the Berkeley effort. "What's exciting about the WIN program is that the semiconductor companies are placing a large bet on our university team to come up with the needed innovation."

Information-processing technology has up to now relied on charge-based devices like vacuum tubes and million-transistor microchips. Spintronics exploits the natural spinning motion of electrons, which could be harnessed to carry additional information without consuming more power. The technology holds promise for improving the efficiency and performance of conventional electronics devices.

Centered at UCLA and directed by electrical engineering professor Kang Wang, the institute will be funded with $18.2 million in starting grants, largely from semiconductor companies Intel, IBM, Texas Instruments, Advanced Micro Devices, Freescale Semiconductor and MICRON Technology. Other participating universities include UC Santa Barbara and Stanford.

Duke study challenges statistics on engineering graduates

There are three types of lies, 19th-century British Prime Minister Benjamin Disraeli once said: lies, damned lies and statistics.

It now turns out that some startling statistics—reported last year by the National Academy of Sciences and repeated in media nationwide—have been "corrected" by a recent Duke University study. The original report, widely interpreted in the mainstream media to mean that the United States is losing its technological edge, said that China each year graduates 600,000 engineers and India 350,000, compared with 70,000 in the United States.

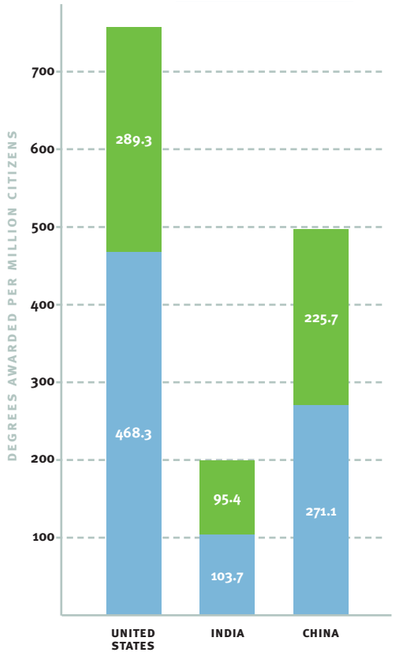
The Duke study found that China and India actually graduate many fewer engineers than that, 350,000 and 100,000 respectively, and U.S. colleges graduate nearly twice as many as originally reported, with 137,000 engineers each year. When factored by population, U.S. colleges produce roughly 750 engineers per million citizens per year, compared with 500 in China and 200 in India, the study says, demonstrating that the United States remains competitive in global markets. (See graph.) Even more important, Duke engineering professor Vivek Wadhwa told National Public Radio, U.S.-trained engineers are better educated.

"Our graduates have a much better chance of competing and doing innovation and rising within the corporate world than average engineers graduated from India and China," Wadhwa said. The danger, he warns, is over-reporting of U.S. engineering jobs being outsourced overseas, which discourages young people from pursuing engineering careers.

Wadhwa thought the numbers originally reported looked suspect and, with several student researchers, tried to verify them. The researchers could not find sources for the original numbers or get accurate statistics from educational agencies overseas.

Because India has so many new schools, officials can't even keep track of the number of students and programs. China had defined engineer broadly, including not just graduates of four-year programs, but also three-year and diploma programs. Wadhwa tried to establish common terms, defining an engineer as someone who graduated from an accredited four-year baccalaureate program in engineering, computer science or information technology.

Go to **http://memp.pratt.duke.edu/downloads/duke_outsourcing_2005.pdf** for a copy of the report.



Bachelor's and sub-baccalaureate degrees in engineering, computer science and information technology awarded annually

REPRODUCED COURTESY PRATT SCHOOL OF ENGINEERING

Cyber security expert snags 2006 teaching award

PEG SKORPINSKI PHOTO

David Wagner

When students in David Wagner's class give him a hard time about something he just said or leave class debating a point in his lecture, he knows he's succeeded as a teacher.

"My ideal classroom scenario is one where students are active learners forming their own conclusions," Wagner says. "I try to get them engaged in debating the material or puzzling through it themselves."

Wagner (M.S.'99, Ph.D.'00 CS), assistant professor of computer science in the College's EECS department, was one of three faculty to receive the 2006 Distinguished Teaching Award, Berkeley's highest honor for instruction. Granted by the Berkeley Division of the Academic Senate's Committee on Teaching, the award has been bestowed on only 219 teachers since its inception in 1959.

During his years working toward his undergraduate degree in math from Princeton University, then as a graduate student at Berkeley, he had very little experience as a teacher and a lot of trepidation about going into the field. But, after joining the Berkeley faculty in 2000, he knew he'd made the right decision.

"Not only did I like the teaching, I loved it," he says. Wagner is recognized as one of the world's leading cryptographers and experts in computer security. In a letter recommending him for the award, University Professor Richard Karp of EECS said that Wagner's stature as a researcher informs his teaching.

"He has invented most of the main techniques for analysis of cryptographic protocols, won early fame for his exploits in breaking cryptographic systems, and has contributed greatly to providing a rigorous foundation for the field of software security," Karp wrote.

STEVE MCCONNELL PHOTO

UC Berkeley Chancellor Robert Birgeneau held a news conference August 23 to outline his efforts to enhance diversity on campus, a key goal of his administration.

New top administrators sought to oversee diversity, compensation

As the 2006 fall semester kicked off, UC Berkeley Chancellor Robert Birgeneau announced three new diversity research projects as well as a new cabinet-level position to "enhance significantly" campus efforts to include underrepresented minorities, people with disabilities and members of the lesbian, gay, bisexual and transgender community at UC Berkeley. A national search for the new vice chancellor for equity and inclusion was initiated in early September. Go to **www.berkeley.edu/news/media/releases/2006/08/23_press_rjb.shtml.**

Enrollment of underrepresented minorities is actually up among Berkeley's nearly 9,000 new students, from 14.5 percent in fall 2005 to 16 percent this year. But steady declines in the last decade have been blamed largely on Proposition 209, the 1996 measure passed by California voters banning affirmative action programs.

On the system-wide level, the UC Board of Regents last July appointed search committees for three new vice president–level positions in a reorganization designed to address the compensation controversy that has roiled the University at its topmost administrative levels for nearly a year. The new administrators, in conjunction with a new Regents Committee on Compensation, will provide increased oversight and accountability on administrative compensation practices throughout the UC system. Go to **www.universityofcalifornia.edu/news/compensation** for more.

Berkeley and College again tops in rankings

UC Berkeley was again ranked the top U.S. public university and tied for 21st place overall in *U.S. News and World Report*'s annual undergraduate college rankings, published in August. Berkeley Engineering's undergraduate program was number two, tied with Stanford's and following MIT's. In graduate rankings published separately last April, *U.S. News* again placed Berkeley Engineering third, following MIT and Stanford.

The *Washington Monthly*, a D.C.-based progressive magazine, started its own national university rankings in 2005 and this year placed UC Berkeley second in the nation. Its unique criteria emphasize research, community service and social mobility. "By our yardstick," the *Monthly* says, "UC Berkeley is about the best thing for America we can find."

U.S. News rankings by undergraduate program placed Berkeley second in chemical, civil, materials science and mechanical; third in electrical; fourth in computer and nuclear; and fifth in industrial. Berkeley's graduate programs are all ranked in the top 10—with civil and computer science ranking first in the nation—except for biomedical, which was ranked 14th.

Go to **www.berkeley.edu/news/media/releases/2006/08/18_rankings.shtml** for more.

PEG SKORPINSKI PHOTOS

Agogino *Der Kiureghian* *Feldman* *Mitchell* *Nelson* *Pister* *Varaiya* *Weber*

For her work in engineering and on issues of gender and minority equity, ME professor **ALICE AGOGINO** received the UC Berkeley Chancellor's Award for Advancing Institutional Excellence, which brings a $30,000 check to support her continued efforts in these areas.

The ASCE Engineering Mechanics Division awarded CEE professor **ARMEN DER KIUREGHIAN** the 2006 Alfred M. Freudenthal Medal for his research in structural and system reliability, risk analysis, random vibrations and earthquake engineering.

A new book by EECS and cognitive science professor **JEROME FELDMAN** was published this summer by MIT Press. *From Molecule to Metaphor* summarizes two decades of work by the Neural Theory of Language group, housed at the International Computer Science Institute, on the neural basis of human language and thought.

Bioengineering senior **ARAM KIM** won a 2006 Genentech Scholars Award based on her concept for an education program on diabetes, including disease prevention literature in multiple languages and financial assistance to free clinics. She is also a fellow of the SAGE Scholars Program, UC Berkeley's program that helps students from low-income backgrounds develop professional and leadership skills.

For his more than 50 years of teaching and research in geotechnical engineering on soil properties and behavior, CEE professor emeritus **JAMES MITCHELL** received the 2006 Outstanding Projects and Leaders (OPAL) Lifetime Achievement Award in Education from the American Society of Civil Engineers.

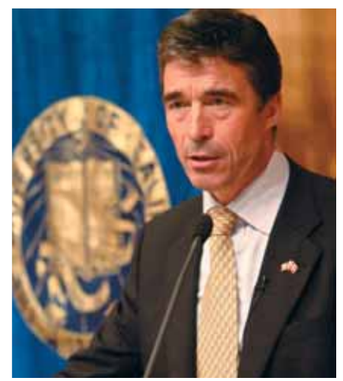
SARAH NELSON, Berkeley professor of BioE and UCSF professor of radiology, has been appointed scientific director of the UCSF component of QB3, the California Institute for Quantitative Biomedical Research. QB3 is a cooperative effort among Berkeley, UCSF, UC Santa Cruz and private industry for the study of biological systems. Nelson joined the Berkeley faculty in 2002.

Among the 2006 fellows of the American Academy of Arts and Sciences are **DEAN A. RICHARD NEWTON** and EECS professors **DAVID PATTERSON** and **PRAVIN VARAIYA.** Newton was tapped by the Ewing Marion Kauffman Foundation to chair its Panel on Entrepreneurship Curriculum in Higher Education. Patterson was also named to the National Academy of Sciences.

EECS professor **KRIS PISTER** received the second annual Alexander Schwarzkopf Prize for Technology Innovation of the National Science Foundation's Industry/University Cooperative Research Center, recognizing his development and commercialization of Smart Dust miniature wireless sensors.

EICKE WEBER, MSE professor since 1983, left the Berkeley faculty in July to return to his native Germany as director of the Fraunhofer Institute for Solar Energy Systems, Europe's largest solar energy research institute. He is also chair of applied physics, solar energy, at the University of Freiburg.

Embracing globalization: *Prime Minister Anders Fogh Rasmussen of Denmark visited UC Berkeley last June and gave a talk entitled "Partnership in a Globalized World: A Declaration of Interdependence." Describing global competition as an opportunity to forge new international partnerships, he outlined his concept for a 21st century trans-Atlantic alliance that would enable Europe and the United States to confront the opportunities and challenges of globalization together while helping to ensure security and prosperity worldwide. "Globalization is a fact, and we have to embrace it," Rasmussen said. He was accompanied by 30 colleagues from the Danish government and industry in his visit to Berkeley, one of seven U.S. university partners of the University of Copenhagen. See video of the event, which was sponsored by CITRIS, the Center for Information Technology Research in the Interest of Society, at* ***mms://media.citris.berkeley.edu/Anders_Fogh_Rasmussen.***



AARON WALBURG PHOTO

SCOTT OLSON/GETTY IMAGES PHOTO

Adkins Energy plant in Lena, Illinois, is one of 101 processing plants now enjoying the ethanol boom, which analysts predict will contribute to an increase in U.S. ethanol output from 4.8 billion gallons this year to about 8 billion in 2008. Congress last year mandated that gasoline contain 7.5 billion gallons of "renewable fuel" by 2012.

PEG SKORPINSKI PHOTO

Dan Kammen has appointments in nuclear engineering, the Goldman School of Public Policy and the Energy and Resources Group. Founding director of Berkeley's Renewable and Appropriate Energy Laboratory, he joined the faculty in 1999.

PEG SKORPINSKI PHOTO

Tad Patzek, professor of civil and environmental engineering, joined the Berkeley Engineering faculty in 1990. A native of Poland, he was formerly a petroleum engineer for Shell Development in Houston.

Can biofuels help break our addiction to oil?

Henry Ford called ethanol the "fuel of the future" and planned to run his Model T on it until oil, which was plentiful and cheap at the time, emerged as the dominant fuel. Ethanol resurfaced during the 1973 oil crisis, when gasoline prices edged upward and price controls, gas rationing and oil embargoes became the order of the day. More recently, ethanol in a 10 percent concentration has been rapidly replacing methyl tertiary-butyl ether (MTBE) as a gasoline additive, and it is now increasingly available in an 85 percent mix called E85.

Also called grain alcohol, ethanol is one of several *biofuels*, fuels made from agricultural crops like corn or soybeans and waste products like used lumber and manure. The biofuel business is booming, fueled this time by more than rising prices at the pump. Proponents say biofuels could help end our dependence on oil imports, boost a sagging agriculture industry and reduce environmental damage caused by burning fossil fuels. President Bush is advocating biofuels, Bill Gates is investing in them and Willie Nelson is even marketing his own brand.

But not everyone agrees that biofuels are the answer to America's 20-million-barrel-a-day oil habit. Critics claim that producing biofuels consumes more energy than they generate, and some warn that converting farmland from food to fuel crops could result in higher food prices and deplete natural resources worldwide.

A new center established this year, the Joint Center for Transportation Sustainability Research, will help focus UC Berkeley's research in the areas of transportation, environment and sustainability, including biofuels (see sidebar). But for the last three years, Berkeley has been a microcosm of the ongoing debate, as two of its most widely quoted authorities, Dan Kammen and Tad Patzek, are crunching data on opposite sides of campus in an effort to determine the truth about biofuels.

"We know that ethanol is a net energy winner," says Kammen. "With investment and innovation, it could be a huge resource." The Class of 1935 Distinguished Professor of Energy, Kammen has appointments in nuclear engineering, the Goldman School of Public Policy and the Energy and Resources Group. His latest research shows that corn-derived ethanol—produced from the U.S. corn crop through an expensive and resource-intensive process that uses just the corn kernel—saves significantly on gas but reduces greenhouse gas emissions only by about 15 percent.

Even so, what Kammen likes about corn ethanol is that it is available now and can begin making a dent in our petroleum consumption while research continues on better alternatives. Most promising, he says, is cellulosic ethanol, made from paper pulp, specially designed fuel crops like switchgrass and many wastes that can be diverted from landfill and turned into fuel.

The big success story in cellulosic ethanol comes from Brazil, which will achieve energy self-sufficiency some time this year thanks to a 30-year investment in ethanol derived from its native sugarcane. Cellulosic ethanol has the potential to yield many times more energy than corn ethanol and will greatly reduce greenhouse gas emissions, Kammen says. With a few new experimental refineries under construction, he adds, cellulosic ethanol could be powering some U.S. cars in a few years.

Tad Patzek, professor of civil and environmental engineering, disagrees. His studies of the amount of fossil fuel consumed in manufacturing ethanol—including everything from producing crop fertilizers and repairing farm machinery to transporting crops and building refineries—show that it takes three to six gallons of ethanol to replace one gallon of gasoline. Cellulosic ethanol performs "marginally" better than corn ethanol, he says, but will require an entirely new technology and infrastructure and is no more environmentally benign.

"Biofuels will not solve existing problems with automotive fuels," Patzek says, "but they will increase the rate we burn natural gas and coal while adding to CO_2 emissions." Growing fuel crops of any kind strains the water supply, he adds, and is accelerating the collapse of the Midwestern prairie soil, tropical forest and savannah ecosystems through soil erosion, overuse and land reclamation.

Biofuels would not be viable, Patzek says, without the generous federal subsidies that have cost U.S. taxpayers $144 billion in the last 10 years and end up lining the pockets of investors in agribusiness giants like Archer Daniels Midland, the leading U.S. ethanol producer. In fact, taxpayers pay twice for ethanol: first through crop subsidies to corn farmers and again in a 51-cent subsidy on every gallon of corn-derived ethanol sold as fuel. Even worse, Patzek says, policymakers and drivers are being lulled into a sense of false comfort by what they think is the magic bullet of biofuels.

"We need optimism, but technology cannot 'save' us," he says. "Our lives have to be redesigned." Kammen and Patzek both advocate making aggressive investments in viable mass transit and highly efficient "plug-in" hybrid cars as well as implementing steep carbon emissions taxes. But, while Kammen sees biofuels as an important part of this future scenario, Patzek says that simple gas-saving measures—like properly inflating car tires or increasing vehicle fuel efficiency by three to five miles—would reduce gas consumption more than converting to ethanol. We could do all three, Kammen counters, and reduce petroleum consumption even more.

Biofuels require specialized engines and refitted gasoline pumps, neither of which are yet in widespread use. Detroit's big three automakers sell several models of "flex-fuel" vehicles, capable of using either E85 or gas, and about five million of these can be found among the 200 million cars and trucks on U.S. roads. Of 180,000 gas stations, only about 600 can pump E85, and the oil industry estimates that it will cost owners an estimated $200,000 per station to refit their pumps. Kammen thinks that estimate is high and that the transition to ethanol will be relatively painless. But, he says, a "green fuels standard" is needed to monitor the emerging industry.

"Corn-based ethanol made at a distillery running on coal is nowhere near as good as a cellulosic ethanol plant using wind power," Kammen says, emphasizing the many options available to manufacturers. Some ethanol plants, for example, are burning coal—high in carcinogenic and greenhouse gas emissions and considered one of the world's dirtiest fuels—to save on production costs. Standards would require that plants consider sustainability as well as profit.

The United States consumes 140 billion gallons of petroleum annually, more than half of which is used for transport. If the country's entire corn crop were processed into ethanol today, it would provide enough fuel to meet only about 15 percent of those transportation needs. One thing is certain: Reducing our petroleum appetite will require a combination of aggressive research and innovation, rapid implementation of new technologies and a dramatic change in the behavior of the American driver.

BY PATTI MEAGHER

New center unites transportation researchers

UC Berkeley's new Joint Center for Transportation Sustainability Research, launched last May, unites six campus groups working in the areas of transportation and the environment. The center is housed in the Institute of Transportation Studies (ITS) and directed by Alex Farrell, assistant professor in the Energy and Resources Group.

"As the name implies, this center will be the home for our research activities at the intersection of transportation and sustainability," said ITS director and CEE professor Samer Madanat. One of its initial undertakings was a week-long research trip this past summer to study methods for growing sustainable fuel crops in Minnesota and Nebraska.

Participants in the center include the ITS, UC Transportation Center, UC Energy Institute, Energy and Resources Group, Center for Global Metropolitan Studies and the Berkeley Institute of the Environment. Researchers from the Center for Metropolitan Studies and the UC Energy Institute will also be involved.

For more details, go to **www.its.berkeley.edu/sustainabilitycenter.**

CEE graduate named University Medal finalist

CEE major Siu-Ting Mak—a tall, modest, Chinese-born pianist who was the first in his family to attend college—was one of five finalists for this year's University Medal, UC Berkeley's highest honor given to one graduating senior each year.

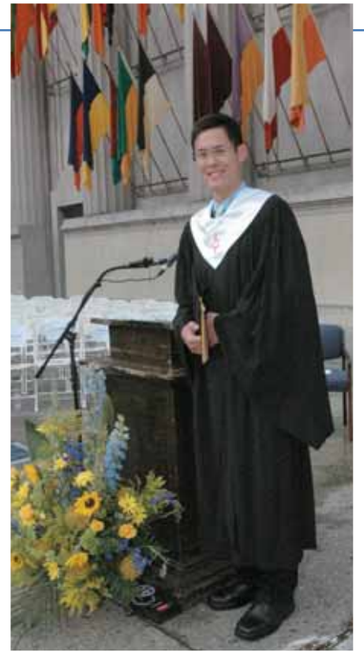
This fall Mak will continue his studies, pursuing his master's and possibly Ph.D. in CEE's Structural Engineering, Mechanics and Materials Program. Inspired by a junior year research assignment on self-anchored suspension bridges, he has a particular passion for public works like bridges, roads, water treatment plants and air pollution control systems that unobtrusively keep the world's infrastructure humming smoothly.

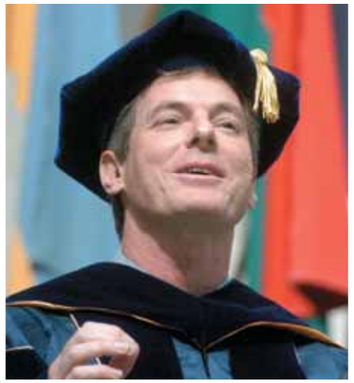
"I want to affect people's lives, not in fancy ways," Mak says, "but in implicit ways, something that people might not even notice. But if they do, they would appreciate its benefits."

During his four years at Berkeley, Mak also performed with Cal Community Music, entertaining seniors at East Bay convalescent homes and retirement centers. An accomplished pianist, he started studying music at age five and now has a penchant for chamber music and contemporary compositions.

He credits his parents, who live in Hong Kong, with giving him a desire to learn and his mother with suggesting that her high-achieving son apply to U.S. colleges. Now, he says, he considers his choice of Berkeley the best decision he ever made. And he appears to have started a family trend of coming to California; his sister is now studying business at San Francisco State University.

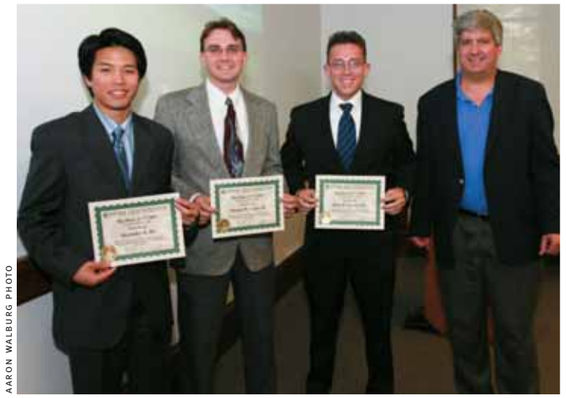
Mak was one of 1,144 undergraduate and graduate engineering students, a record high, to receive their degrees at commencement ceremonies last May 20 in the Greek Theater. Paul Jacobs (B.S.'84, M.S.'86, Ph.D.'89 EECS), CEO of San Diego–based wireless telecommunications company QUALCOMM, gave the commencement address.





PEG SKORPINSKI PHOTOS

CEE major Siu-Ting Mak (top), one of five finalists for Berkeley's University Medal, was among the record 1,144 engineering students graduating last May. QUALCOMM CEO Paul Jacobs (right) delivered the commencement address.



AARON WALBURG PHOTO

Vineyard sensor takes top prize: *ME graduate students (from left) Alexander Do, Thomas Cauley III and Brian Sosnowchik, pictured here with Special Assistant to the Chancellor for Science and Technology Tom Kalil, won the top prize in the first annual white paper competition sponsored by the Center for Information Technology Research in the Interest of Society (CITRIS) and Big Ideas@Berkeley. The paper, "Mitigation of Water Scarcity in California," described their VinePod, a wireless network of sensors designed to help control frost in California's vineyards. Mounted on 12-foot poles in order to monitor air temperature, humidity, and soil and leaf moisture, the sensor transmits data to a central computer and signals which areas are most at risk for developing frost when temperatures dip below freezing. The Berkeley team shared first place with a UC Santa Cruz team, and both teams won $7,500. Kalil organized the competition to showcase the creativity of UC student research.*

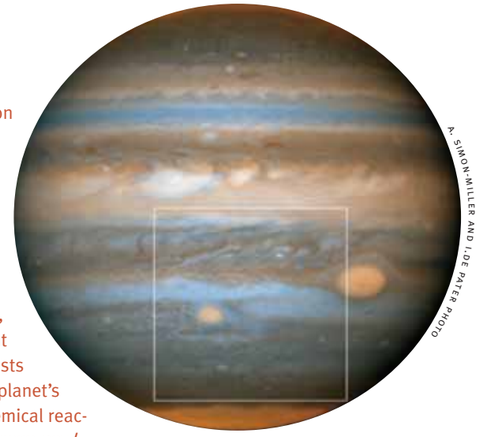
A new video-conferencing system is in development by EECS professor Ruzena Bajcsy and colleague Klara Nahrstedt at the University of Illinois. Tele-immersive Environments for EVErybody, or TEEVE, is an inexpensive but sophisticated distributed multi-tier application that uses off-the-shelf equipment to deliver high-quality full-body images from all angles. The researchers say it is best suited for training in activities such as physical therapy, sports and the performing arts. **www.citris-uc.org/TEEVE-April2006**

Using electric fields to make nanofibers, Berkeley researchers are able to deposit them in a direct, continuous and controllable manner. The technique, known as *near-field electrospinning*, imposes order on the chaotic process of spinning polymers into tiny fibers, which characteristically tangle randomly almost as soon as they are created. The work, by ME professor Liwei Lin and colleagues, offers the possibility of producing specialized materials like wound dressings and bio-scaffolds out of nanofibers. **www.berkeley.edu/news/media/releases/2006/04/12_nanofibers.shtml**

RON WILSON PHOTO

Common household air fresheners and cleaners emit chemicals that could pose health risks when used regularly or in small indoor spaces, according to a study led by CEE professor William Nazaroff. "We've focused a lot of effort in recent decades on controlling the big sources of air pollution," Nazaroff says. "However, now we've learned that we also need to pay attention to pollution sources that are right under our nose." **www.arb.ca.gov/research/abstracts/01-336.htm**

Eyeing Jupiter's new red spot



A. SIMON-MILLER AND I. DE PATER PHOTO

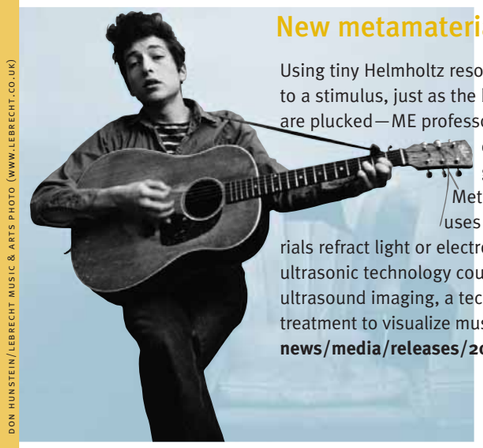
Scientists are now analyzing images of a new storm on Jupiter they photographed through NASA's Hubble Space Telescope. ME professor Philip Marcus and astronomy colleague Imke de Pater snapped Red Jr., which first appeared in 2000 as a white spot but recently took on the brick-red hue of Jupiter's 300-year-old Great Red Spot, the most powerful storm in the solar system. Red Jr. was first white, then brown; its new red color could mean it is intensifying, signaling a global warming trend on Jupiter that might have applications for Earth and other planets. Scientists theorize that the storms stir material high above the planet's cloud cover, where solar ultraviolet rays initiate a chemical reaction that causes the red appearance. **http://science.nasa.gov/headlines/y2006/02mar_redjr.htm.**

Cheap mass production for RFID tags

An inexpensive mass production process for radio-frequency identification (RFID) tags could make the technology widely affordable. Similar to a barcode, RFID tags are tiny silicon chips placed on an object and encoded to track it electronically. EECS professor and Alien Technology founder J. Stephen Smith developed a process that could cut the per-unit price from 50 cents today to about five cents in just three years. The Department of Defense, Wal-Mart and the Food and Drug Administration plan to use RFIDs to track everything from army boots to counterfeit drugs. **www.citris-uc.org/publications/newsletter/february2005#feature2.**

More meaningful maps

Software that renders helpful route maps has been created by EECS professor Maneesh Agrawala, who studies human perception and cognition to make computer software capable of delivering data in truly human-friendly formats. *LineDrive* creates route maps that, instead of focusing on details like exact scale and irrelevant streets, emphasize turning points along the route. He also developed a system for manufacturers to create assembly instructions for products like furniture and toys that reduce assembly time by 35 percent and cut assembly errors in half. **www.coe.berkeley.edu/labnotes/1005/agrawala.html.**



DON HUNSTEIN/LEBRECHT MUSIC & ARTS PHOTO (WWW.LEBRECHT.CO.UK)

New metamaterial could improve ultrasound

Using tiny Helmholtz resonators—chambers that vibrate in response to a stimulus, just as the body of a guitar resonates when its strings are plucked—ME professor Xiang Zhang and colleagues have developed an ultrasonic metamaterial to get greater insight into sound waves. Metamaterial research is an emerging field that uses manmade substances to alter the way materials refract light or electromagnetic radiation. The researchers say the ultrasonic technology could be applied to enhance the resolution of ultrasound imaging, a technique widely used in medical diagnosis and treatment to visualize muscles and internal organs. **www.berkeley.edu/news/media/releases/2006/05/31_metamaterial.shtml.**

Broken Levees: New Orleans to Sacramento

CAN KATRINA'S LESSONS FORESTALL DISASTER IN THE DELTA?

By the time Hurricane Katrina made landfall in Plaquemines Parish, 70 miles southeast of New Orleans, at 6 a.m. Monday, August 29, last year, it had weakened from a Category 5 hurricane to Category 3, its swirling winds dropping from 160 to 114 miles per hour. The city's flood protection system—more than 400 miles of levees and floodwalls—was ostensibly built to withstand this level of storm.

BY ROBERT SANDERS

Barreling due north, Katrina churned the waters of the Gulf of Mexico like the blade of a washing machine, whipping counterclockwise as it spun along a 150-mile-wide path. Wave heights reached 25 feet as winds piled water into the bay known as Lake Borgne east of the city, spilling over into Lake Pontchartrain north of downtown. The fact that the eye passed east of the city was, in retrospect, just as bad as if it had borne down on the city center. The cyclone winds at the advancing edge of the storm blew hard, driving water into a blind pocket of bay and lake, creating high waters—so-called storm surge—16 to 18 feet higher than normal in Lake Borgne. Add to that the storm-tossed waves, and the levees were simply overwhelmed.

The first sign of trouble came even before landfall, at 4:30 a.m., when water piling into Lake Borgne funneled into the Industrial Harbor Navigation Canal, a shortcut for ocean-bound ships exiting the Mississippi River, breaching a levee meant to protect homes in the heart of New Orleans. This was followed within hours by eight other major breaches, which together flooded 80 percent of the city to depths of up to 20 feet, inundating 200,000 homes, killing upwards of 1,300 people and displacing 450,000 more, and running up costs, according to some estimates as high as $300 billion. Katrina was the most costly peacetime disaster to hit an urban area in U.S. history.

It was a disaster that needn't have happened, according to Berkeley civil and environmental engineers Raymond Seed and Robert Bea, and a disaster that could repeat itself in California, they say.

"A stunningly similar situation exists in California with the potentially catastrophic seismic risk associated with the fragile labyrinth of levees

PHOTO COURTESY FEMA

that safely passes two-thirds of California's vital fresh water through the key node in the state's extensive water distribution system," Seed wrote about the levees in the Sacramento and San Joaquin River Delta.

While Sacramento is protected from flooding by riverbank levees, many built in the 1990s by the U.S. Army Corps of Engineers, none of these levees is designed to withstand earthquakes. Even a distant temblor could cause a levee break, inundating heavily populated low-lying residential areas—and more homes are being built in flood-prone areas each year. Even worse is the hodgepodge of privately owned, 140-year-old levees protecting the islands and farms of the Delta. Haphazardly maintained, they are all that stand between salty San Francisco Bay and the freshwater intake pumps supplying drinking water for much of Southern California and irrigation for the fertile Central Valley.

Aware of the disaster Katrina could cause in the southeast, Seed and Bea followed the storm's trajectory for days. The morning it hit New Orleans, Seed told his 9 a.m. class to go home, turn on the TV, and watch "the engineering disaster of your lifetime."

Bea followed Katrina with an intimate appreciation of the devastation he feared could befall New Orleans, where he lived for 10 years while working for Shell Oil. In 1965, Hurricane Betsy destroyed Bea's home. After Betsy, a 40-year federal project was initiated to strengthen levees around still vulnerable areas of New Orleans and top the levees with flood walls. The goal: to knit existing levees into a reliable system to protect the city. Yet, in the ensuing years, says Bea, critical corners and budgets were cut. Geotechnical oversight by the Corps of Engineers—the principal agency tasked with the massive project—was weakened, and worse, deadlines slipped by unnoticed. When Katrina hit, portions of the levee system were woefully incomplete. Many had not yet been built to their specified height; others had subsided several feet since construction.

Aware that Katrina could flood the city like Betsy had, Seed and Bea approached the National Science Foundation, asking it to fund forensic studies of the levee system failures and Katrina's effects on offshore oil platforms and pipelines.

NSF agreed, providing $230,000, which was augmented by $50,000 from Berkeley's Center for Information Technology Research in the Interest of Society (CITRIS). Bea and Seed quickly assembled a team of national experts, arriving in New Orleans September 27, a month after Katrina.

"Since Loma Prieta, we have become the world's best earthquake and geotechnical forensics group," Seed says, referring to a small group of civil engineers around the country, in particular at Berkeley. "We have people adept at landing in the midst of chaos and confusion, who literally get in, without much notice, to retrieve crucial data before it disappears or is buried by emergency repair operations."

During their nine-month New Orleans analysis, the team repeatedly consulted with the Corps and was quick to call them on the carpet. After issuing its preliminary report last November, Seed traveled to Washington, D.C., to testify before the Senate Committee on Homeland Security and Governmental Affairs and meet with Lieutenant General Carl Strock, commander of the Corps, to brief him on the team's findings.

The full force of the critique was left for the final report, an exhaustive document compiled by 37 engineers and scientists from around the world, issued in May. The authors paint a dispiriting picture of a protection system in name only, faulting levee designs throughout the system that led to some 50 failures and breaches in the greater New Orleans region. At the heart of the problem, Bea says, was dysfunctional Corps of Engineers "streamlined" by decades of congressional mandates dating back to the 1970s. To save money, local levee districts had been allowed to build some of their own portions of the system without adequate oversight, resulting in a mishmash of designs that failed at the weakest links, says Bea, who began his career in 1954 with the Corps, working on levees and canals around Lake Okeechobee in South Florida.

The Corps in its final report conceded that, even though the storm surge and storm waves together exceeded what the levees were designed to withstand on the eastern flank of the levee system, many levees failed even before they were overtopped.

"Since Katrina, the Corps has rebuilt most of the levees to fix the overtopping problem, but they aren't yet addressing underseepage, including at levees that didn't fail during Katrina," Seed says.

Adda Athanasopoulos, an engineering graduate student who helped oversee field studies of the levees, noted problems with the sheetpiles, the interlocking steel palisades pounded into the ground beneath the levees and topped with a concrete wall designed to keep out water that rises higher than the earthen levee. "At sites like New Orleans's London Avenue Canal, the sheetpiles were too short to cut off the underseepage forces through the sandy material, which created pressures that reduced the strength of the foundation soil and led to failure."

"Katrina was a disaster that needn't have happened."

Tromping the New Orleans levees over a four-month period, Berkeley student teams took borings with three-inch diameter "Shelby" tubes, or thin-walled core samplers, and conducted core penetration tests to determine the strength of the soils. These were the levees protecting the city from three canals piercing the heart of lower New Orleans and the sites of the most catastrophic breaches. With the experienced eye of Berkeley alumnus and University of Missouri-Rolla geology professor David Rogers, the student team discerned that the cause of the 17th Street Canal levee failure was a jelly-like layer of flocculated clay that allowed the rising waters to push the levee 50 feet sideways, "as if it slipped on a banana peel," Bea says. This layer, which was probably thrown down by another hurricane 1,200 years ago, was evident in about half of the 20 borings.

Corps engineers could easily have missed this layer, but two other weaknesses—a layer of peat and a deep layer of soft clay—should have been caught before the levee was built.

Rune Storesund, a working geotechnical engineer and Berkeley graduate student, focused on the performance of New Orleans's earthen levees to assess whether existing design standards were complete and accurate. "The design standards didn't take into account all loads you should look at when designing levees; they didn't take into consideration degradation over time or address impacts from ships, barges or even the effect of rodent burrows, a pervasive problem," he says.

To prevent a repeat of Katrina, Bea notes, "The Corps needs to bolster the barrier islands, plant trees and other vegetation, eliminate drainage canals, build underground culverts, and turn some backyards into fields."

The lessons embodied in their New Orleans report apply, Seed and Bea say, to levee systems around the country, including those protecting the city of Sacramento, where recent studies suggest that those sheetpiles also may be too short to prevent seepage through porous soils underneath.

In the Sacramento–San Joaquin Delta, however, seepage through peat and sandy foundation soils beneath the levees is the main source of irrigation for crops cultivated on some Delta islands that have sunk as much as 20 feet below river level over the past 150 years. Privately built levees protecting these islands, some dating from the late 1800s, suffer breaches every few years when Sierra Nevada storm and snowmelt runoff is heavy.

"The parallels with New Orleans are exact," Bea says. "Only it won't be a hurricane that's the tester. Our hazard comes from annual flooding down the Sacramento River and from earthquakes."

RUNE STORESUND PHOTO

MARTIN SUNDBERG PHOTO

LEFT: *Damaged levee floodwall adjacent to a major breach along the Industrial Harbor Navigation Channel in New Orleans's devastated Lower 9th Ward.*

BELOW: *Professors Seed (right, wearing Cal cap) and Bea survey the water-side face at a recently improved levee near the Antioch Bridge in the California Delta, where an earthquake, considered long overdue, could wreak havoc with the existing web of levees.*

Few of the 1,100 miles of California levees in the Delta or the levees protecting Sacramento are built to withstand an earthquake, says Seed, who has studied these levees for 26 years. A quake on the San Andreas Fault more than 100 miles away could liquefy the sandy foundations, he says. Closer to the Bay Area near Antioch, a blind thrust fault runs right under Sherman Island's levees. Seed describes a scenario where seismically induced levee failures could turn the Delta islands into a marshy sea, allowing winds to accelerate across the more open water and dash waves against the faces of other levees, generating a cascade of failures. The failures would draw salt water from the San Francisco Bay into the Delta until

MARTIN SUNDBERG PHOTO

Adda Athanasopoulos (left), Rune Storesund (center) and Kofi Inkabi use tape and hand level methods to document the levee's geometry. Like New Orleans, the Delta levees are slowly subsiding, requiring constant maintenance to keep them at their specified level of protection.

the intake pumps diverting water to farm fields and Southern California homes were flooded with brine.

"There's a great Armageddon risk in the Sacramento Delta," says Seed. "We may find it will take years, if it is even ever possible, to fix these failures." Meanwhile, what about the 23 million people throughout the state who get drinking water from the Delta and the farmers who rely on the water to turn the Central Valley into the most productive farmland in the world?

Lynn O'Leary, Delta project manager for the Army Corps' Sacramento District, acknowledges the catastrophe a quake could unleash in the Delta, where three-quarters of the levees are privately owned and not overseen by the Corps. "But the other big risk in the Delta is high tides and high winds," a combination common in the Delta, accentuated by spring runoff, she says. Such conditions nearly caused a New Year's Day failure on Andrus Island near Antioch, where a combination of snowmelt, high tides and wind sent waves crashing over the top of the levee.

Seed is on the steering committee for a new joint state/federal study by the California Department of Water Resources and the Corps of Engineers of the risks posed by the levees protecting the Delta's 60 to 70 islands, source of roughly two-thirds of California's precious freshwater supply. "The good news is our local agencies are coordinated, and we are looking at the system as a whole, unlike New Orleans," O'Leary says.

talized Corps given power by Congress and the president to build and maintain levees as a unified and uniform bastion against flooding, not as a patchwork quilt replete with weak links that threaten lives and property. California Governor Arnold Schwarzenegger has joined with Louisiana Governor Kathleen Blanco to lobby Congress and the President for funds to cover the billions of dollars needed to fix the Corps' levees. Next month, voters will decide on two state propositions that, if passed, would dedicate nearly $5 billion to flood control improvements throughout the state of California. After Schwarzenegger declared a state of emergency in the Delta last February, the federal government expedited the permit process to speed repair of some 50 problematic erosion sites along the levees lining the upper Sacramento, American and San Joaquin Rivers. The State Department of Water Resources and the Corps began repairs on 29 of these sites in July. By September, that number had grown to 110.

Governor Schwarzenegger saw the urgency, Seed says, perhaps because a series of levee failures from a single catastrophic earthquake or high runoff flow could bankrupt the state just from liability claims.

"Sacramento is currently the least safe major city in North America in terms of flood protection. It's even worse than New Orleans."

Seed is also concerned that an earthquake could cause liquefaction of Sacramento's riverbank levees, flooding Sacramento's low-lying suburbs without warning. In part because these levees are built to a lower standard than those of New Orleans, "the city of Sacramento is currently the least safe major city in North America in terms of flood protection. It's even worse than New Orleans," Seed says, "but efforts are now under way to address this."

The solutions for Sacramento, like the solutions for New Orleans and other flood-prone areas, according to Bea and Seed, are a revi-

"One of the things I've wanted to accomplish in my professional career is to make California's levees safer," Seed says. A report Seed coauthored in 1999 set the stage for changes in California. But New Orleans's tragedy may have unwittingly provided that much needed kick in the pants.

"This is likely to open the dam of public awareness for levee safety," says Seed. "If there's a silver lining to New Orleans, it's the chance to prevent a similar calamity in California."

For more, go to **www.ce.berkeley.edu/~new_orleans.**

Robert Sanders has covered science, engineering and medicine for more than 25 years, the last 15 in the news office at UC Berkeley. His stories have appeared in *Berkeley Magazine*, *UCSF Magazine* and *Forefront*.

The Ghost Bird and the Robot

BY DAVID PESCOVITZ | PHOTOS BY DEZHEN SONG

Somewhere in the swamps of eastern Arkansas, where mosquitoes reign supreme and thousand-year-old trees shroud the bayou below, the largest woodpecker in North America is hiding. Or not.

The ivory-billed woodpecker is thought to have been extinct for the last 60 years. However last year, researchers from Cornell University made headlines with their announcement that the elusive ivory-bill, also known as the "ghost bird" or "grail bird," had been not only spotted but also caught on a few seconds of video. If the species has indeed survived, it would justify decades of nature conservation efforts. To this day controversy rages about whether Cornell's blurry image flying off in the video is in fact the ivory-bill or a common look-alike, and whether the sighting reports are fact or figment.

So, even as this very human quest continues for the legendary ivory-bill, the first glamour shot—if the bird is indeed still flying over Arkansas—may actually be taken by a robot co-developed at Berkeley.

College of Engineering professor Ken Goldberg and collaborators from Texas A&M University and the Cornell Laboratory of Ornithology are developing an autonomous robotic camera that will maintain a constant vigil on the Arkansas skies above Bayou de View Wildlife Refuge. The aim is to get definitive video documentation of the "rediscovered" ivory-bill.

"Biologists spend a great deal of time observing and recording nature," says Goldberg, who holds a joint appointment in the Departments of Industrial Engineering and Operations Research and Electrical Engineering and Computer Sciences. "We're trying to help them bring the latest technology into the field."

The system, developed by Berkeley and Texas researchers, consists of two commercially available ultra-high-resolution video cameras and a computer processor mounted in a custom waterproof box. It will be mounted on a power line that cuts across the swamp. Pointed at opposite angles, the cameras will continuously capture video of the sky above. Most of that footage will be thrown out seconds after it's recorded. But if a bird flies through the frame, algorithms developed by Goldberg and former Berkeley Engineering student Dezhen Song (Ph.D.'04 IEOR), now an assistant professor at Texas A&M, will detect the motion and store the video for later analysis by Cornell's ornithologists.

"There's a long, romanticized history of field biologists trekking around in treacherous swamps," says Ron Rohrbaugh, project director for the Cornell search. "A camera might sound a little sterile, but it could cover the area of 10 people and probably do a better job. From a scientific perspective, that's terribly exciting to us."

Rohrbaugh's excitement has grown exponentially since Goldberg and Song first contacted him with their idea. His first reaction? "Skepticism," he says. Last year, the Cornell search cost nearly $1 million and involved nearly two dozen paid staff, many more volunteers and five field stations in the swamp. Most of the searching was conducted on foot or by canoe, with researchers looking for the bird, listening for its distinctly nasal "kent" calls and double raps and conducting transect surveys from tree to tree for possible nests and roosts in the half-million-acre Big Woods. The researchers had already deployed time-lapse cameras mounted to trees and remote microphones to listen for the telltale calls. In fact, Rohrbaugh had already investigated mounting a surveillance system along the same power line that Goldberg and Song identified as a strategic location for their system. The problem, Rohrbaugh says, was that the field of view he wanted to observe was so large and the camera resolution so low that even if the ivory-bill showed up for a screen test, it likely would be too small in the image to be positively identifiable.

"The system Ken and Dez are installing is much more sophisticated," Rohrbaugh says. "This robotic camera's ability to zoom in so you can identify what you're seeing from far away is just spectacular."

When it comes to the uncharted terrain of robotics in the wild, Goldberg and Song are trailblazers. For a dozen years, Goldberg has experimented with telerobotic cameras on the Internet. In 1994, he and his colleagues unveiled the Mercury Project, the first robot on the Internet that enabled anyone to interact remotely with the real world. Participants operated a telerobotic arm from their Web browsers to excavate artifacts in a terrarium in Goldberg's laboratory. Over the next 10 years, Goldberg experimented with myriad telerobotic systems, including the Telegarden, a physical garden that an online community tended using a robotic arm, and the Tele-Actor, a system he developed with Song and others where online users democratically "controlled" a human "robot" to explore remote spaces.

"After 9/11, there was a huge rise in the development of surveillance and security devices," Goldberg says. "In 2003, Panasonic came out with a low-cost, super-high-resolution controllable camera that greatly magnified the potential for invading personal privacy."

The result was Demonstrate, an art installation Goldberg and his students developed for the Whitney Museum of Art. In September 2004, they mounted a high-resolution robotic camera over Berkeley's Sproul Plaza, birthplace of the Free Speech Movement. Via the Internet, 4,000 people online participated in controlling the camera and recording activity on the Plaza. Demonstrate's state-of-the-art system raised compelling questions about personal liberty and personal privacy in public places.

"Afterward, we started thinking about how such cameras could be constructively installed in remote natural environments to help biologists observe endangered species," Goldberg says.

Bears, birds and other animals don't seem to mind a quiet camera nosing in on their business. Based on that assumption, Goldberg and Song obtained funding from the National Science Foundation last year and designed their first CONE (Collaborative Observatories for Natural Environment). The ultimate CONE is self-contained in a small, wheeled trunk that scientists leave behind at their research sites. Just open the lid, and the system automatically kicks into operation, seeking out a satellite connection for Internet access and charging its batteries via solar panels. Once the scientists return to the lab, they log onto the Internet to see what the camera sees and collaboratively steer it to keep an eye on their animal subjects from afar.

"To our knowledge, there is no serious robotics research to develop tools for the scientific study of natural environments," Song says. "That's unbelievable to me, but for a researcher, it's a gold mine of opportunity."

The researchers tested their first CONE at the Marin County, California, home of Berkeley professor Eric Brewer, whose balcony overlooks a bird preserve. They kept the camera running for three months. Coincidentally, that's when Goldberg first read about the quest for the ivory-bill.

"That story struck me because it had all the ingredients we were talking about," he says. "The ivory-bill search is a really hard problem requiring a lot of remote fieldwork. Bird watching is all about vigilance. But a lot of that sitting and waiting is drudgery. Fortunately, robots are great at drudgery."

After speaking by telephone with Cornell Laboratory of Ornithology head John Fitzpatrick, Song and Goldberg took a February field trip to Brinkley, Arkansas, hometown of the ivory-bill search. "We were riding in the back of these pickup trucks, where it's extremely cold and damp," Goldberg says. "Then we get into canoes and paddle through this serene swampland. They took us to the place where the sightings had occurred in the bayou."

A power line that cuts right across the bayou provides a swath of sky 50 feet wide by 900 feet long. It's the perfect spot for a CONE for several reasons, Goldberg explains. First, there aren't any trees in the line of sight. That's essential because the camera is triggered by movement. The sway of a tree would yield a false positive. And if the bird is out foraging in the area, it would likely pass over this region at some point. Finally, the power line can provide endless juice to keep the camera running day and night. The one thing lacking in the middle of the swamp, though, is a wireless network.

"We're doing the ultimate in old-fashioned networking," Goldberg says. "A student will row a boat out there every two weeks, pull out the hard drive and put in a new one. The student will then go to a local lab to upload the images for remote analysis."

Those brave souls are students of David Luneau, the avid birdwatcher who shot the highly scrutinized 2004 video that's still the best evidence that at least one ivory-bill was alive and well in Arkansas. Luneau, who is a professor of electronics and computers at the University of Arkansas at Little Rock, recently joined the CONE team to create a database of the gigabytes of video that the camera will capture each week.

Meanwhile, Song and his students are collecting clips from several cameras on the roof of his lab to ensure that the system captures the resolution necessary to satisfy Cornell's critical eye. This easy-access deployment also serves as a testbed to hone the computer-vision algorithms that recognize when a bird flies across the background. Just defining that background isn't easy, Goldberg explains. For example, the system must be smart enough to know that clouds or rain or even changes in lighting shouldn't be treated as objects of interest.

Next fall, the team will row back into the swamp to install its CONE system. That's just before mosquito season starts and things get really ugly out there, Goldberg says.

For Rohrbaugh, the robotic camera isn't the only method his team will use in their continued search. It's in his best interest, he says, not to put all his eggs in one basket. "There are techniques we're onto now that offer real optimism." And cautious optimism, Goldberg agrees, is the name of this game.

"I'm hopeful but not overconfident," Goldberg says. "We're willing to run this camera for years, and we're prepared to accept it if we never see the bird. We always assume the null hypothesis. But if this persistent robot out on the bayou manages to capture verifiable high-resolution images of the legendary ivory-bill, it would be a major discovery for scientists, for conservationists and for more than 45 million American birdwatchers."

For more on the project, go to **www.c-o-n-e.org/acone.**

DAVID PESCOVITZ (david@pesco.net) writes *Lab Notes,* the College of Engineering's online research digest. He is also co-editor of *BoingBoing.net* and editor-at-large of *MAKE: Magazine*.

RIGHT: *This prototype camera will be replaced next month with a pair of ultra-high-resolution robotic video cameras developed by UC Berkeley and Texas A&M researchers.*

CENTER: *Berkeley professor Ken Goldberg (front of canoe) and Cornell ornithologist Ron Rohrbaugh in the Bayou de View Wildlife Refuge, Arkansas.*

FAR RIGHT: *One of America's most majestic birds, the ivory-billed woodpecker was believed to be extinct, but several sightings have been recently reported, prompting a massive search by experts and "ghost chasers."*

COURTESY OF THE AUDUBON SOCIETY

TELE-MEDICINE'S SIGHT FOR SORE EYES

RURAL CLINICS IN SOUTH INDIA BENEFIT FROM TECHNOLOGY THAT COULD REVOLUTIONIZE HEALTH CARE IN THE DEVELOPING WORLD

BY RACHELE KANIGEL

PEG SKORPINSKI PHOTO

SONESH SURANA PHOTO

LEFT: *In his Berkeley Intel Research Lab, Eric Brewer (left) and graduate student Sonesh Surana make adjustments on a prototype for models they have deployed in India. This low-cost wireless technology, part of a collaborative project between UC Berkeley, Intel and the Aravind Eye Hospital in South India, creates high-speed network links directly connecting patients in rural clinics to ophthalmologists in distant hospitals.*

RIGHT: *Each of Aravind's vision centers, or clinics, is a rented room in a family's home. Simply equipped, each has a slit lamp, a computer and a set of refractive lenses for eye testing. Currently, about 1,700 patients a month are seen in all five rural vision centers.*

In a spare, one-room eye clinic in the rural South Indian village of Bodinayakannur, a 64-year-diabetes patient named V. Ramaswamy and a medical technician sit facing a computer monitor. On the screen is a live video of an ophthalmologist at the Aravind Eye Hospital in Theni, nine miles away. Speaking into a microphone, the technician describes the patient's condition to the remote physician, then hands the man the microphone. "For the last week, my eyes have been red and itching," the patient, Ramaswamy, tells the physician in Tamil, the local language. "There has been swelling and watering." The physician prescribes five days of eye drops, explaining that Ramaswamy has an infection, and asks him to come to the hospital for a follow-up exam.

Later Ramaswamy, who had heard from a friend in town that he could go to a local eye clinic for a teleconference with a hospital doctor, said he might not have sought prompt treatment if he'd had to find a way to the hospital nine miles away. "They said I could talk straight to a doctor through the TV," he says. "If I had to go to Theni, I would have put it off or maybe not gone at all. Because the clinic was here, I came right away."

This virtual consultation and hundreds more conducted every week at the clinic are made possible through videoconferencing technology developed by a team of UC Berkeley computer scientists. The group has helped set up five clinics, or vision centers, with video conference links to the Aravind Eye Hospital in Theni, in the South Indian state of Tamil Nadu. The pilot project, less than two years old, has been so successful that hospital administrators plan to expand the program over the next few years to 50 clinics linked to Aravind's five hospitals in South India. Together these centers will serve a population of roughly 2.5 million people.

"The information technology revolution holds tremendous potential for addressing problems in developing countries," says Eric Brewer, Berkeley professor of computer science and director of the Berkeley Intel Research Lab. "Historically though, most projects have been either too expensive or too technologically complex to use in poor, rural areas. What we've done here is develop a simple, inexpensive software and hardware system that can provide villages with a high-bandwidth connection to computer networks in cities as far as 50 miles away."

Brewer has been a visionary in the field of computer science since 1996, when he cofounded Inktomi Corporation, a pioneering search engine venture, with a Berkeley grad student and helped lead it onto the NASDAQ 100. The company was bought by Yahoo! in 2003. But the modest, unassuming computer scientist isn't looking for fame; his aim now is to apply his technological know-how to solving some of the developing world's most intractable problems.

The Aravind Eye Hospital project is part of a larger initiative Brewer leads called Technology and Infrastructure for Emerging Regions (TIER), a collaborative project between UC Berkeley and Intel underwritten by the National Science Foundation and sponsored by CITRIS, the Center for Information Technology Research in the Interest of Society. Brewer has deployed student teams around the world, working on a variety of IT projects in Ghana, Rwanda, Mexico, Sri Lanka and Cambodia, as well as India. The emphasis is on tailoring technology to meet pressing community needs in practical ways.

"The only way to close the divide—not just the digital divide, but the general divide between the industrialized world and the developing world—is through technology," Brewer says. "But technology can only make a difference if it's useful. We're trying to create new technology options that are less complicated, less expensive, require less power and that meet local needs."

In 2004 Sonesh Surana, a native of India and a Berkeley computer science doctoral student working with Brewer, heard about the Aravind Eye Care System—a network of five eye hospitals, the first of which opened in 1976. Its founding mission: to eradicate preventable blindness in Tamil Nadu, a state of 62 million people. Employing a unique fee system, Aravind provides free eye care to two-thirds of its poorest patients with revenue generated by the other third of patients who can afford to pay.

Still, poverty, inadequate transportation and poor publicity have kept many locals from getting to eye hospitals to obtain the free care. In response, Aravind administrators came up with the idea of establishing village eye centers that could offer basic eye care and access to specialists through videoconferencing.

In August 2004, Surana visited the Aravind Hospital in Theni to see if a collaborative venture with Berkeley was possible. He surveyed the existing setup and did a preliminary topographical survey to determine if TIER's technology was feasible, given the requirement for line-of-sight between communicating endpoints. "I realized that Theni's current situation could be greatly improved by adding much higher bandwidth wireless links to dramatically improve the quality of videoconferencing, eventually allowing for services such as retinal image transfer and live remote examination of the eye itself," says Surana. "They had a need and we had a solution."

Telemedicine—using telecommunications technology for distant medical diagnosis and patient care—has been around for years. In many parts of the world, patients "meet" with doctors via teleconferencing technology. But such virtual consultations depend on a community having some basic technology, such as reliable

SONESH SURANA PHOTOS

TOP: *Towers like this one set atop the Chinnamanur vision center's roof ensure clearance over surrounding groves of tall coconut trees, some 60 feet in height, allowing clear line-of-sight transmission between distant antennae.*

CENTER: *R. Varadharajan, far right, who lost his vision in one eye, was the first patient seen at the Bodinayakannur Vision Center.*

BOTTOM: *Patient being examined on opening day of Chinnamanur vision center last March.*

Internet access and high bandwidth. These amenities are often not readily available in much of rural India, where some homes don't have electricity and many people live on about $2 a day. Satellite technology, which is commonly used in telemedicine, is prohibitively expensive.

Brewer considered nearly 100 other prospective projects before deciding on Aravind. Their extensive network of facilities, efficient administration and commitment to serving the poor, he thought, would make them ideal collaborators.

Brewer's team uses inexpensive, off-the-shelf equipment—802.11 wireless cards and high-gain directional antennas—to create WiFi-based (wireless fidelity) long-distance networks. The wireless cards, also off the shelf, are used for short-distance communication, usually up to about 200 feet. But the team, including graduate students Sergiu Nedevschi and Rabin Patra, modified the software, specifically the WiFi Media Access Control. Now, combined with the antennas and routers that send, receive and relay signals, the network can handle high-speed communications over distances as great as 50 miles.

The solution is not only innovative, says Brewer, it is truly cheap. The equipment costs a mere $600 to $800. "The monthly cost of satellite technology is typically higher than the one-time cost of our equipment," Brewer says. "And no cellular or satellite network company is required, so the hospital can expand according to its own schedule."

The Berkeley team has traveled to South India many times over the past two years to install the equipment and work out the bugs for the first two vision centers, located in the villages of Bodinayakannur and Ambasamudram. The team replaced low-bandwidth links with high-speed links, dramatically improving the videoconferencing technology previously in place. They then trained local technicians to install the links themselves. For the third link, in Chinnamanur, local staff installed the equipment with only minimal assistance from the Berkeley team and created a high-speed link where none existed before. Last May, local crews installed two more links on their own, in Periakulum and Andipatti.

R.D. Thulasiraj, director of information technology and systems for the Aravind Eye Care System, says the collaboration has raised the technological competency of the Aravind IT group. "Working with the team sent by Professor Brewer is really easy and extremely pleasant," he wrote in an e-mail interview. "It is a group of young professionals who are driven by the excitement of new technology and even more by the opportunity of employing the technologies to directly benefit humankind."

Until the clinics opened, local people would walk as far as 12 miles to the Aravind Hospital in Theni to get eye care, forcing them to lose a day of work, Brewer says. Now many can walk to the local eye center and get their eye care needs met in an hour or two.

The clinics are run by ophthalmic technicians, usually local women without extensive education, trained in eye care by Aravind. Patients generally get a rudimentary exam from the technician and then have a brief consultation on a Web camera with a doctor at the distant hospital. Patients can buy glasses and medications at the vision centers. And if the doctor believes that an in-person exam or a medical procedure is warranted—most often cataract surgery—the patient is given an appointment at the hospital.

"The major impact is that we are now able to offer higher quality diagnostic care by using local people with less training," Thulasiraj says. "It also gives confidence to the ophthalmic technicians in the rural setting who are independently handling the patients, knowing that there is a backup if they get into a decision-making problem or uncertainty about the mode of treatment. For the patients themselves, this has significant benefit in terms of eliminating unnecessary visits to the hospitals, or in some critical conditions, reinforcing the urgency of coming to the hospital for treatment in the hospital."

The first three clinics opened in 2004 and 2005; two more opened last spring, and all WiFi links became operational over the past two years. Together the five clinics examine about 1,700 patients a month and the numbers keep growing. "The goal," says Brewer, "is to eventually expand to 50 clinics or vision centers, each serving a population of roughly 50,000 people." The centers have had a tremendous influence on the health of the communities they serve, hospital officials say. In a recent study on the impact of the clinics, Aravind Eye Care System researchers found that 85 percent of the men and 58 percent of the women who had lost their jobs due to vision impairment were able to return to work after getting treatment.

"This is an exciting venture, and we believe it has the potential to effectively address the problem of eye care access in rural India," says Dr. S. Aravind, administrator of the Aravind Eye Hospitals. "TIER's partnership has been invaluable in enabling this approach to get off the ground with such speed and success."

Surana, who has not only led the project's fieldwork, but is also extensively involved in the design of and experimentation with new laboratory protocols, says it's been an extremely fulfilling effort. "Helping Aravind restore vision to poor people's eyes and giving them the ability to work again is very gratifying," says Surana. "Professor Brewer's TIER group gives us the opportunity to transform people's lives during the course of our education. Today, patients are already being examined on our network. It's not every day that a computer science student can claim such benefits."

Brewer hopes to apply the same teleconferencing technology used in India to other communities in the developing world and to rural settings in the United States, including remote Native American reservations, where access to health care is inadequate.

"Wherever there is a demand for eye care or other medical services, you can easily and inexpensively use one of our networks," Brewer says. "This could revolutionize the delivery of health care services and greatly improve the quality of life in the rural developing world."

RACHELE KANIGEL is a freelance writer who lives in Oakland. She teaches journalism at San Francisco State University.

Go to **www.coe.berkeley.edu/alumni** for the latest news and events of interest to Berkeley Engineering Alumni.

CLASS NOTES

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2000s

ANTHONY AZEVEDO *(B.S.'05 Eng. Physics)* spent nine weeks this summer in the 2006 WISE program, Washington Internships for Students of Engineering. One of eight students selected nationwide, Azevedo was sponsored by the Institute of Electrical and Electronics Engineers. The program sends engineers to Washington, D.C., to learn how they can get involved in legislative and regulatory public policy decisions on complex technological issues.

PICASSO BHOWMIK *(M.S.'04 CEE)* of Fullerton, California, is currently working as a project engineer at Oltmans Construction Co. in Whittier.

LISBETH BLAISDELL *(M.S.'04 CEE)* of Wall Township, New Jersey, received the American Institute of Steel Construction, Structural Steel and Education Council Fellowship in 2005. She is also a graduate of the Marine Academy of Science and Technology, Sandy Hook, where she was valedictorian, and of Princeton University, where she received the David W. Carmichael Prize for Civil and Environmental Engineering.

XINYAN DENG *(Ph.D.'04 ME)* of Newark, Delaware, received the National Science Foundation's prestigious Faculty Early Career Development Award, one of its highest honors for young faculty members. Deng, assistant professor of mechanical engineering at the University of Delaware, is working to develop microaerial vehicles inspired by real flying insects and other creatures capable of stable and maneuverable flight. The award will provide $455,000 over five years in support of her work.

KATHY ATKINSON/UD PHOTO

NICHOLAS HANSEN *(B.S.'03 ME)* of Orange, California, completed his master's in mechanical engineering at Cal State University Long Beach.

CHUNGHAU LEE *(B.S.'03 EECS)* of Camarillo, California, attended UC Santa Barbara after Cal and earned a master's in computer science. He is now working at Amgen providing technical support.

MISHA LEYBOVICH *(B.S.'05 Eng. Physics)* began working on his Ph.D. in aerospace engineering and technology policy at MIT this fall. Before settling into graduate school, he spent five months traveling through four continents and 20 countries in a tour that featured, among other highlights, a trek to Mount Everest Base Camp and running with the bulls in Pamplona. He also spent five months working at The Aerospace Corporation in El Segundo and worked as hiking director at Camp Oski at the Lair of the Golden Bear, Berkeley's family camp in the Stanislaus National Forest. He writes, "Getting to live and hike in the wilderness on a regular basis as well as meet hundreds of cool alums and befriend the dozens of amazing fellow staffers made for the best summer job I've ever had."

PEG SKORPINSKI PHOTO

YEONJOON PARK *(Ph.D.'03 MSE)* of Yorktown, Virginia, writes, "Let the miracles of the class of 2003 begin! UC Berkeley was my academic hometown and remains in my mind forever."

SHUYI "CHRIS" SHI *(B.S.'01 EECS)* of Orange County writes, "I graduated in a tough year. It was just after the dot-com bust and very tough to find decent work. But no losers come out of EECS! After taking a low-paying job in Texas, I have climbed my way up within four years of graduating to become a lead software engineer commanding a six-figure income. Give me a holler if you are looking for programming work. Go Bears!" **cshi@rothstaffing.com**

DIANE FLORESCA SMITH *(B.S.'01 CEE)* of Foster City, California, is working as a project manager at Project Management Advisors, Inc., in San Francisco, managing 600,000 square feet of biotech development space in the Bay Area.

SETH TAYLOR *(M.S.'98, Ph.D.'02 MSE)* of Schenectady, New York, works as a materials scientist at General Electric's Global Research Center in Upstate New York. He does materials research and development as part of several advanced technology programs focused on developing new technologies and new products for various GE businesses.

CELIA (LIN) TSAO *(B.S.'00 EECS)* writes, "My husband Perry and I went on a four-week vacation in May with our tandem bicycle. We flew up to Seattle and bicycled down the Pacific Coast back to our house in Sunnyvale, for a total of

1,150 miles! Traveling by bicycle is a terrific way to experience the beauty of the coast. We had an amazing time and I highly recommend bicycle travel."

MIKE TAO ZHANG *(M.S.'00, Ph.D.'01 IEOR)* of Phoenix won the Outstanding Young Industrial Engineer Award from the Institute of Industrial Engineers in 2006. He has been elected co-chair of the Institute of Electrical and Electronics Engineers Robotics and Automation Society Technical Committee on Semiconductor Factory Automation. He writes, "Anyone interested in joining the committee is welcome!" **zhang@intel.com**

1990s

MARJAN ABADIAN *(B.S.'92 EECS)* of Greenbrae, California, writes, "After working with Cisco Systems as a software engineer, I am now a full-time mom. I have two daughters, two and a half and four years old. The family is preparing to go on a two-week bike tour with all four of us riding on one tandem bike and trailer."

TOM BOARDMAN *(B.S.'90 CEE)* of Oakland just joined the Water Distribution Division at East Bay Municipal Utility District as an associate civil engineer.

TENNILLE CHRISTENSEN *(B.S.'99 BioE)* of Mountain View, California, is now in her third year of law studies at UC Hastings College of the Law.

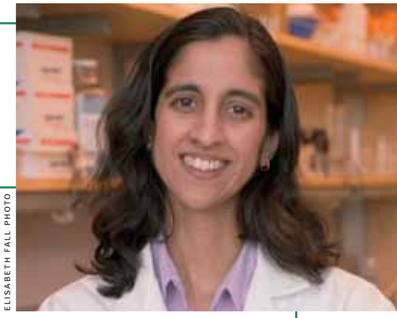
MICHAEL PRINCE PHOTO

Andy Grove (Ph.D.'63 ChemE)

BRIAN SMALE PHOTO

Charles Simonyi (B.S.'72 Eng. Math)

ELISABETH FALL PHOTO



Tejal Desai (Ph.D.'98 BioE)

2006 ALUMNI AWARDS GO TO PIONEERS IN COMPUTING, TISSUE ENGINEERING

They were born a decade apart in the same city 6,063 miles away from Berkeley and fled a communist regime to make their careers in the United States. Two of the most influential forces in the computing industry, Andy Grove (Ph.D.'63 ChemE) and Charles Simonyi (B.S.'72 Eng. Math), both natives of Budapest, Hungary, are recipients of the College's 2006 Distinguished Engineering Alumni Award (DEAA) for Lifetime Achievement. Also honored as Outstanding Young Leader is Tejal Desai (Ph.D.'98 BioE), a pioneer in the field of tissue engineering.

As a young man, Andy Grove dreamed of becoming an opera singer, not the world-renowned engineer, business leader, inventor, philanthropist, author and educator he would become. Grove, best known as cofounder of Intel Corporation (with Gordon Moore and Robert Noyce) in 1968, will receive his award on November 18 at the DEAA celebration on the Berkeley campus.

After arriving in the United States, Grove received his bachelor's degree at City College of New York before coming to Berkeley. With Intel, he served as CEO and chairman of the board, leading the company to the top of the semiconductor industry to become one of the world's most successful businesses. Named *Time* magazine's Man of the Year in 1997, Grove has written six books, including *Only the Paranoid Survive* (1996) and *Swimming Across* (2001), his autobiography. In 2004 Grove was named the "most influential business person in the last 25 years" by Wharton School of Business and the Nightly Business Report. He is also actively involved in the Grove Foundation, a private philanthropic organization.

Software visionary Charles Simonyi led the development of two of the most widely used computer applications, Word and Excel, in his 20-year career with Microsoft. He began his career at the Berkeley Computer Corporation in the 1970s, then moved to Xerox PARC, when a personal computer cost $50,000. There he built Bravo, the world's first WYSIWYG ("what you see is what you get") word processor, an interface that paved the way for the era of personal computing. In 1981 he moved to Microsoft. He cofounded Intentional Software Corporation in 2002, where he now develops "self-writing" software. A philanthropist in the United States and Europe, he established the Charles Simonyi Fund for the Arts and Sciences in 2000.

In September 2006 Simonyi was accepted as the world's fifth paying passenger on a 10-day science mission to the International Space Station in March 2007. He began a six-month training regime in Moscow in October. Thus unable to attend the November 2006 festivities, Simonyi will be honored at the 2007 DEAA event.

Bioengineer Tejal Desai's work developing micro- and nanofabricated platforms has revolutionized drug delivery and replacement of damaged blood vessels. She is developing an artificial pancreas that could free America's 18.2 million individuals with diabetes from daily insulin injections. The device—a microfabricated chip that, when implanted in the pancreas, responds to changes in glucose level and stimulates insulin secretion—has been successful in rats and could be ready for human use by about 2010. Desai is professor of physiology at UCSF and director of its Laboratory of Therapeutic Micro and Nanotechnology.

For more information about the DEAA, its history and past honorees, go to **www.coe.berkeley.edu/deaa.**

GEORGIA TECH PHOTO

REGINALD DESROCHES *(B.S.'90 ME, M.S.'92, Ph.D.'97 CEE)* of Roswell, Georgia, is co-researcher on a major project studying the risk earthquakes pose to U.S. ports and possible consequences for the economy. DesRoches, associate professor of civil and environmental engineering at Georgia Tech, first became interested in quake research as a graduate student at Berkeley, when the Loma Prieta quake struck the Bay Area in 1989. Researchers will investigate ports in Savannah, Charleston and West Coast cities in an effort to identify better construction and retrofitting techniques for use in ports as well as preparation and recovery plans for public officials.

ELIZABETH (GREEN) FRANCOIS *(B.S.'96 ChemE, NE)* of Jemez Springs, New Mexico, is working in high explosives research at Los Alamos National Lab.

JAMEY JACOB *(M.S.'92, Ph.D.'95 ME)* of Stillwater, Oklahoma, started as associate professor in the Department of Mechanical and Aerospace Engineering at Oklahoma State University last July after spending 10 years at the University of Kentucky in mechanical engineering. **jdjacob@okstate.edu**

ALLISON (FARIS) REILMAN *(B.S.'98, M.S.'99, Ph.D.'04 CEE)* is married and working in Los Angeles.

LOKESH SIKARIA *(B.S.'94 EECS)* of Folsom, California, is currently chief operating officer of Rapidigm, Inc., the second largest privately held information technology services firm in the United States, with revenues of more than $250 million.

1980s

CHANNING BROWN *(M.S.'82 EECS)* has recently relocated from central New Jersey to Champaign, Illinois. After a career spanning almost 23 years, he left Telcordia Technologies as a senior software engineer and is now running his own company, Greencourt Software.

LEROY CHIAO *(B.S.'83 ChemE)* joined the Louisiana State University (LSU) College of Engineering as a visiting professor of mechanical engineering and the first Smiley and Bernice Romero

PHOTO COURTESY NASA

Raborn Chair in Mechanical Engineering. The positions were established to recognize Max Faget, 1943 LSU engineering alumnus who designed the Mercury spacecraft and contributed to the designs of every U.S. human spacecraft from Mercury to the Space Shuttle. Chiao, a veteran of four space missions in his 15-year NASA career, is an expert in U.S. and Russian extra-vehicular activity and has logged more than 229 days in space.

SANDRA CORBACIOGLU

(M.S.'83 EE) is teaching mathematics at Robert College in Istanbul, Turkey. **sandra.corbacioglu@usa.net**

BRUCE DEMCZYK *(M.S.'85 Eng. Sci., MSE)* of West Newton, Pennsylvania, recently left Maxtor Corporation in San Jose and is now working as a consultant.

BRIAN DOWD *(B.S.'86 CEE)* of Aptos, California, was appointed vice president and director of human resources at Granite Construction Incorporated of Watsonville, where he has worked for 20 years in positions including project engineer, estimator and director of employee development.

DEBORAH ESTRIN *(B.S.'80 EECS)* of Pacific Palisades was selected the inaugural Athena Lecturer for 2006–2007, a new honor of the Committee on Women in Computing of the Association of Computing Machinery (ACM-W). Estrin, the Jon Postel Chair in Computer Networks at UCLA and director of the National Science Foundation Center in Embedded Networked Sensing, delivered her lecture at the MobiCom conference in Marina del Rey in September. Her research is in the area of networking and focuses on the use of sensors in environmental monitoring.

PHOTO COURTESY UCLA

MARK JEROLIMOV *(B.S.'86 ME)* of San Jose owns a machine shop (parts manufacturing) in the South Bay. He writes, "Cal gave me the confidence and will to test and challenge myself. I appreciate that."

KATHERINE (HANKE) JOHNESCU *(B.S.'82 ME)* of Alameda writes, "I'm thinking of my old friends as I drive past Etcheverry Hall every day after work. I'm very pleased to be working for the Department of Energy at Lawrence Berkeley National Laboratory as the federal director for projects including the Molecular Foundry, a nanoscale science research facility that just started initial operations. I live in Alameda with my husband Paul Johnescu *(M.S.'88 IEOR)* and our children, Laurel and Joey." **johnescu@alamedanet.net**

RHONDA PECK *(M.S.'88 IEOR)* of Hoboken, New Jersey, writes, "Hello, classmates. I have started a statistics and software consulting firm. Please check out our website at **www.pecksconsulting.com."**

WILLIAM CHARLES TAO *(B.S.'80 ChemE, NE)*, an expert in the energy and technology field, has been named to the board of directors of Worldbid Corporation to assist in the proposed acquisition of Royalite Petroleum Corp., a Nevada corporation exploring oil and gas properties in Utah. Tao previously served as director of International Program Development at Lawrence Livermore National Laboratory, chief technology officer at Clean Fuels Technology, Inc., and has served as a consultant to the Department of Energy, the Department of Defense and the Environmental Protection Agency.

1970s

ILESANMI ADESIDA *(M.S.'75, Ph.D.'79 EECS)*, the Donald Biggar Willett Professor of Engineering, was named dean of the College of Engineering at the University of Illinois at Urbana-Champaign. He joined the Illinois faculty in 1987 and holds appointments in the departments of electrical and computer engineering and materials science and engineering. A native of Nigeria, Adesida has been recognized worldwide for his extensive and innovative work in semiconductor processing and microelectronic devices. At Illinois he is also director of the Micro and Nanotechnology Laboratory and the Center for Nanoscale Science and Technology.

PHOTO COURTESY UIUC

LEONARD ADLEMAN *(Ph.D.'76 EECS)* of Los Angeles, professor of computer science at the University of Southern California's Viterbi School of Engineering and professor of molecular biology at USC College, was elected to the National Academy of Sciences and the American Academy of Arts and Sciences. In 1977 Adleman co-developed an algorithm that became the foundation for an entire generation of technology security products and earned him and his collaborators the A.M. Turing Prize. Adleman was the recipient of Berkeley Engineering's 1995 Distinguished Alumni Award in Computer Science.

PHOTO COURTESY USC

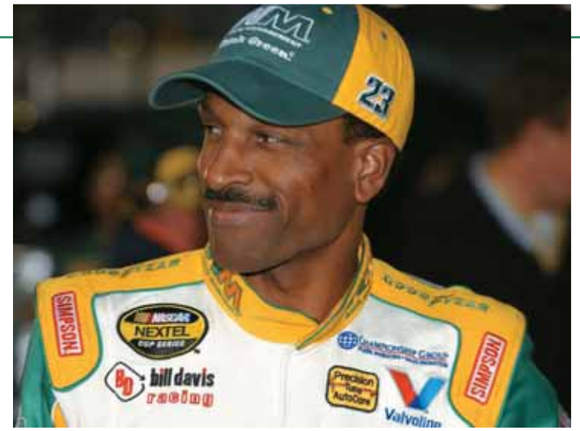
IMAD BITAR *(B.S.'74 EECS)* of Santa Monica was named vice president of Northrop Grumman's Electromagnetic Systems Laboratory, which provides defense and intelligence services. Bitar, who joined the company in 1982 as a member of the technical staff, has focused his recent work on the engineering, development and fielding of critical tactical command and control systems for the U.S. Army.

PATRICK FARRELL *(M.Eng.'78 ME)* was appointed provost and vice chancellor for academic affairs at the University of Wisconsin-Madison, where he joined the mechanical engineering faculty in 1982. He previously served as director of the Engine Research Center and then as associate dean for academic affairs and executive associate dean of the College of Engineering.

PHOTO COURTESY UW-MADISON

EDWARD KAVAZANJIAN *(D.Eng.'78 CEE)* of Tempe, Arizona, was named interim chair of the Department of Civil and Environmental Engineering in the Ira A. Fulton School of Engineering at Arizona State University. He joined the ASU faculty in 2004 after 20 years in industry, including working on the English Channel Tunnel Crossings and a $600 million bridge across the Gulf of Corinth in Greece. He is co-author of the U.S. Environmental Protection Agency guide on seismic design for landfills and the Federal Highway Administration guide on geotechnical earthquake engineering for highways.

PHOTO COURTESY ASU



Bill Lester (B.S.'84 EECS) left Hewlett-Packard in 1998 to pursue his lifelong dream of professional auto racing. After five full seasons with NASCAR's Craftsman Truck Series, he qualified for the Nextel Cup earlier this year, driving the No. 23 Bill Davis Racing Team Dodge in three starts. Now working to secure $15 million in sponsorships, he hopes to drive full time in next year's NASCAR Nextel Cup circuit. "My story is one of perseverance and persistence," he says, "overcoming obstacles and not letting anything derail me from my path."

Bill Lester takes EECS career down the horsepower path

His father took him to his first auto race at Laguna Seca Raceway when he was eight years old. Something told Bill Lester (B.S.'84 EECS) even then that he was destined to become a speed demon.

"It was intoxicating. The sound and the speed left an overwhelming impression on me, and I never got over it," he says. "I had a passion for racing and I wasn't happy doing anything else."

In 1998 Lester left a 15-year career and six-figure salary as a software engineer and project manager at Hewlett-Packard to pursue that eight-year-old boy's vision of himself in the driver's seat. Until then he had spent years being a weekend road warrior, racing part-time in amateur events and picking up rides wherever he could find them. His wife Cheryl finally insisted that he quit the day job and go after his lifelong dream.

"At Hewlett-Packard I was on the career fast track, managing 24 engineers and making a good paycheck," Lester says. "But I wasn't successful by my own definition." He finally earned a full-time slot in the Craftsman Truck Series in 2002 and, last March, qualified for the Nextel Cup, becoming the first African American in 20 years to race in NASCAR's most prestigious event.

At 45, an age when most drivers are retiring, Lester is just entering the top echelon of auto racing. It is a demanding sport, a high-risk ride at speeds nearing 200 miles per hour. On top of racing 36 weekends a year—every race in a different city—these athletes drive hard even off the racetrack, hustling for the $15 million in sponsorships needed to support them for one season.

"It's insane," Lester says. "You really have to love what you're doing because the travel alone would flat wear you out." The day-to-day reality of auto racing is like a roller-coaster ride, he says, with endless pressure and a constant awareness that outcomes are determined by much more than the driver's skill.

"Racing is the epitome of the highest of highs and the lowest of lows. You are graded every weekend, and you can have the best weekend of your life one week and the worst weekend the next. You're relying on your pit crew and controlling only one car out of a whole field." Currently ranked 56th of 65 teams in the Nextel Cup circuit, Lester has yet to win a NASCAR race. He says that is his next goal.

Now one of the fastest-growing sports in the United States, NASCAR (the National Association for Stock Car Auto Racing) boasts a huge fan base and growing numbers of supporters across a wide demographic spectrum, including women, white-collar professionals, blacks and Hispanics. Organizers are actively cultivating more diversity, not just among fans, but also among drivers and crew. But that's not why Lester got involved.

"It is an opportunity for me to expand minority involvement in the sport," he says, "but I didn't get into it to be a torchbearer. I want to be respected for my achievement." Just as at Hewlett-Packard, where he was often the only African American in boardrooms, and at Berkeley, where he doesn't remember any other black engineering students graduating with him, he is NASCAR's only black driver. He is also NASCAR's only driver who has a Berkeley Engineering degree.

"Most of the guys I'm racing with barely finished high school," he says. "My engineering foundation gives me a leg up on the competition, especially as racing becomes more theoretical and computers have a bigger role. I can work directly with my engineers and view the data with a problem-solving mindset."

First exposed to computers by his father, William Lester Jr., a theoretical chemist at UC Berkeley and Lawrence Berkeley Lab, Lester says engineering was a good fit for him. But he always regarded it as a way to subsidize his love of driving and, if the driving career didn't come through, something to fall back on. In fact, when he got his first paycheck from Hewlett-Packard in 1984, he spent it on the down payment for his first race car.

"I had a great experience with engineering and working for Hewlett-Packard," Lester says. "They gave me the freedom to pursue my other interests. But my calling was a different one."

PHOTOS COURTESY OF CHAMPIONSHIP GROUP

Oski: The evolution of a beloved mascot

MIKKI FERRILL PHOTO

William Rockwell (B.S.'48 ME) returned to campus in 1998 to celebrate his 50th class reunion and the ursine mascot he brought to life.

Oski. He cavorts along Memorial Stadium sidelines. He hugs kids on Cal Day. He drinks through a straw in his eyehole, a startling but mesmerizing trick. Berkeley's lovable bear mascot turns 65 this fall but he's far from retirement. How did the goofy grin, high-stepping gait and clasped hands become a Cal institution? The story begins with an engineer, of course.

As a student at Long Beach Junior College in 1938, William Rockwell (B.S.'48 ME) was invited to fill the "Ole Olson the Viking" mascot suit for a school parade. Rockwell was shy and quiet, but disguised as a Viking he became an outgoing rabble-rouser of school spirit. Then he transferred to Berkeley.

In the 1930s, the California Golden Bears used live ursine mascots with predictably unpredictable results, and officials welcomed the idea of a human interpretation. In the autumn of 1941, Rockwell donned a homemade bear head, baggy pants, a large letter sweater, oversized shoes and white gloves. In front of thousands of Cal fans, he led cheers, waved to children and flirted with girls. Later, he would walk on the crossbar between goalposts and try to grab the football from referees. So began the signature look, personality and—since Rockwell kept his identity concealed—the secrecy that still surrounds Oski today.

Oski (named after lines from an old Berkeley cheer) became so popular that Rockwell's studies suffered. After flunking a midterm, he left school and served as a distinguished fighter pilot in World War II. He returned after the war and, as graduation neared, anticipated the need for a mascot management system. Like so many public institutions, Oski required a committee.

The Oski Committee lives on. Its members are undergraduates who choose the person in the bear suit, Oski's successors and successor committee members. The group is pledged to lifelong secrecy, so its workings are difficult to plumb. But staff member Diane Milano, Cal Spirit adviser and "bear handler," does share a few details.

"I coordinate all Oski's appearances and travel," she explains, referring to the major games and 40 to 50 campus events Oski does each year. "I also oversee the costume. It's a hot outfit, and I'm always after the student to air it out and spray some Febreze in it."

After graduating, Rockwell went on to become a design engineer for the U.S. Department of Agriculture. He died in 2000. Like all great engineering projects, his lives on.

BY RACHEL SHAFER

HSING-HSIEN KUNG *(Ph.D.'75 Eng. Physics)* is a partner at Acorn Campus of Cupertino. A native of China, he moved with his family to Taiwan before the 1949 Communist takeover of the mainland and then to Texas in 1967 to earn his master's degree. He has been involved in three successful startups and now works with organizations like Monte Jade, Cupertino Rotary, the United Way and the Asian Pacific American Leadership Institute at De Anza College to integrate Asian Americans into every aspect of Silicon Valley life.

SANJAY MEHROTRA *(B.S.'78, M.S.'80 EECS)* of Los Altos Hills, executive vice president and chief operations officer (COO) of SanDisk Corporation, has been named president of the Sunnyvale-based storage technology manufacturer and will continue as COO. Cofounder of SanDisk in 1988, Mehrotra's 26-year career in the semiconductor industry includes engineering and engineering management positions at Intel, Seeq Technology, Integrated Device Technology and Atmel.

MARK MELTZER *(B.S.'72 EECS)* of Palo Alto writes, "I studied law after Berkeley and am working as vice president, general counsel for a medical device company in Silicon Valley. I started skydiving while a freshman at Cal and just can't quit the adrenaline rush. Exited with 80 fellow skydivers from a DC 9-21 airliner at 14,000 feet last July at the World Free Fall Convention. I still love electronics, like to tinker and have several U.S. patents, including use of correlators to distinguish radio-frequency interference from bio-signals in medical devices." **mmeltzer@foxhollowtech.com**

STEVEN NAUMANN *(M.S.'77 CEE)* writes, "I went to law school and became a trial attorney in Houston. Thanks to that move, I could attain the American dream!"

JAMES RILEY *(M.S.'77 EECS)* of Kirkland, Washington, is working at Calypso Medical Technologies as a senior staff engineer. He writes, "My colleagues and I are developing a guidance system for radiation therapy based on magnetic tracking of implanted devices."

BRUCE SABACKY *(Ph.D.'78 MSE)* was appointed chief technology officer of Altair Nanotechnologies, a supplier of advanced ceramic nanomaterials. Sabacky will continue as vice president of research and development and, as chief technology officer, will direct overall science strategy and technical development for the Reno-based company.

WILLIAM SEAGER *(B.S.'70 Eng. Physics)* of Coronado, California, is retired after many years of teaching, mostly high school physics, mathematics, computer programming and chemistry. He was elected to the Coronado School Board in 2004. **wseager@hotmail.com**

GERALD SERVENTI *(B.S.'75, M.Eng.'78 CEE)* of Alameda has worked for the Port of Oakland since 1978 and is now director of engineering. He oversees design, construction and environmental work at the airport and seaport.

JONATHAN STANLEY *(M.Eng.'74 ME)* of Oakland was named chief executive officer of the U.S.S. Hornet Museum, a nonprofit museum aboard the historic landmark aircraft carrier, which is permanently docked at the former Naval Air Station in Alameda. Stanley, a retired engineer and U.S. Naval Academy graduate, has worked for the past 30 years in engineering consulting and software applications.

ERIC STRID *(M.S.'76 EECS)* of Portland, Oregon, has been honored with the Southwest Test Workshop Lifetime Achievement Award of the Institute of Electrical and Electronics Engineers. The award recognizes his more than 25 years of outstanding technical contributions to the field of radio-frequency wafer level measurements, including development of the Pyramid probe for testing semiconductor devices. Strid cofounded Cascade Microtech in 1983 and has served as its chairman and chief executive officer since then. Previously he was principal engineer with Tektronix, Inc., and TriQuint Semiconductor.

1960s

BETTE (HARRIS) BLANK *(Ph.D.'65 MSE)* and **STUART BLANK** *(M.S.'64, Ph.D.'67 MSE)* are living in New Jersey, where Stuart works for Bell Laboratories.

Bette is an artist and has a painting on permanent exhibit at the Jewish Museum in New York. Entitled "Kaddish," it was inspired by the traditional Jewish prayer of mourning.

CHARLES CORDERO *(B.S.'62 EECS)* of Tarzana, California, writes, "After graduating in 1962, I spent 25 rocky years in the aerospace/defense industry as a design engineer. Since leaving the field in 1987, I have been involved with investments."

ROGER HARKER *(B.S.'66 EECS)* of Minden, Nevada, writes, "After nearly 40 years with Bently Nevada Corp., I have retired and am enjoying traveling and spending time with family and friends."

CAMDEN MCCONNELL *(M.S.'67 CE)* of Pittsburg, California, writes, "I am running for Congress as a Libertarian in California's District 7. The district covers northern Contra Costa County from Richmond to Pittsburg and Solano County along the I-80 corridor from Benicia and Vallejo to Vacaville. I am the sole candidate opposing the incumbent, George Miller."

PARVIZ NOURAFCHAN *(B.S.'65, M.S.'68 CEE)* of Beverly Hills is president of Beverly Wilshire Investment Company, a real estate investments company.

FRED RHYNE *(B.S.'66 EECS)* of Lutz, Florida, and his wife **NANCY (SPARKS) RHYNE** *(B.S.'66 Food & Nutrition Science)* are in their 27th year living in Florida. He completed his MBA at Florida Tech in 1984 while working for Harris Corporation. After graduating from Cal, he began working in the aerospace and defense industry as chief technology officer at Sypris Electronics, LLC, in Tampa. Their two children both pursued environmental engineering careers. John graduated from the University of Central Florida and is corporate director of environmental health and safety for Sypris Solutions. Melissa graduated summa cum laude from Georgia Tech and has her Georgia State professional engineer's license. Fred plans to retire in four years. **fred.rhyne@earthlink.net**

SCOTT RHYNER *(B.S.'63 EECS)* writes, "I've retired to Prescott, Arizona, where I'm working part time at the local community college. Loving life!"

DAVID SELWAY *(B.S.'61, M.S.'63 ME)* of Danville, California, is now retired from Lawrence Livermore National Lab and doing volunteer work for the Blackhawk Museum.

BERKELEY INTERCOLLEGIATE ATHLETICS PHOTO

One of his engineering professors advised Patrick Briaud (B.S.'05 IEOR) to change majors if he wanted to continue playing tennis at such a high level. But Briaud kept competing, ending his Cal tennis career ranked 15 in doubles, all while completing his bachelor's degree in IEOR with a 3.58 GPA.

IEOR alum puts his faith in tennis

With a fresh engineering degree under his belt and a successful collegiate tennis career behind him, Patrick Briaud (B.S.'05 IEOR) still hasn't quite decided what he wants to do when he grows up.

"I have no idea what's next," he says with relaxed confidence, adding that he is now considering a medical career. "Right now I'm enjoying the break from tennis, since I've been going at it pretty hard from the time I was eight or nine."

That break didn't last long. The 23-year-old from College Station, Texas, was all set to do an engineering internship in London this fall but decided instead to train full time and dedicate 2007 to playing tennis. He already earned his first three ATP (Association of Tennis Professionals) points—the points used to put professional players on the world map—playing tournaments in Venezuela and China in 2005.

"As an engineering student, Patrick was unique," says Cal Men's Tennis Head Coach Peter Wright, who hired Briaud as full-time assistant coach just after he graduated. "Both the academics and the athletics demand your 100 percent attention, but Patrick was able to do both at an incredibly high level."

Briaud ascribes his success to not only doing the sports and the studies and keeping mindful of priorities, but also to finding people to support him in both pursuits. "My relationships are the most important thing. That's what got me through the tough times."

Coached by his father, Texas A&M civil engineering professor Jean-Louis Briaud, Patrick started hitting tennis balls at age five. In high school, he won the state 5A singles championship, took the Junior Davis Cup for Team Texas and was named two-time team MVP. At Cal, he made All-American in 2004 and was ranked as high as sixth nationwide in doubles.

Last June Briaud spent three weeks in Kazakhstan with Athletes in Action, a Christian ministry organization for college athletes. Active in ministry groups since high school, he continues to look for ways to integrate his faith into his life, no matter what activity he pursues. So, if he does go after that medical career, it won't be in sports medicine or surgery.

"I would do something broad, like general practice or family or emergency medicine, maybe on the international scale," he says. "I'd like to be able to help people anywhere, and help the most people I can."

His wife Sara is a retired office manager now volunteering for the Discovery Center Counseling Facility.

JAMES WEEKS *(B.S.'65 IEOR)* of Silver Spring, Maryland, was recently appointed to the National Academy of Sciences panel to evaluate the mining program of the National Institute for Occupational Safety and Health. He is also senior editor of *Preventing Occupational Disease and Injury*, second edition, published in 2004 by the American Public Health Association. After completing his Cal degree, he received his Sc.D. in 1981 from Harvard School of Public Health.

PAUL WU *(B.S.'62, M.S.'64 ME)* of Encinitas is a hardware design engineer with Hewlett-Packard Company in San Diego.

1950s

THEODORE ARTHUR JR. *(B.S.'51 ME)* of Baton Rouge, Louisiana, is now widowed and active in several Masonic and Methodist Church groups. He has three children and four grandchildren and is expecting his first great-grandchild this year.

BRUCE BAIRD *(B.S.'50 ME)* of Garden Grove, California, was responsible for design and manufacture of N_2O_4 and hydrazine tanks, which were made from the largest titanium forgings ever produced. The tanks were used to fuel the descent and ascent stage rocket engines of the lunar module that landed astronauts on the moon and returned them to orbit. Baird (at left in photo with Richmond High School athlete Turner Brashear at Sequoia Field, California, in 1943) writes, "My wife Suzanne now has Alzheimer's. I visit the nursing home twice daily when not

in central California working on historical preservation of the airfield where I soloed as a pilot at age 18 during World War II."

JESSE BEQUETTE *(B.S.'59 EECS)* of Costa Mesa, California, is retired and keeping busy with the Boy Scouts, the Lion's Club and his grandchildren.

NATHANIEL BERCOVITZ *(B.S.'41, M.S.'52 EECS)* of Beaverton, Oregon, writes, "I'm urging the U.S. government to be honest and compassionate."

ROBERT DEAN *(B.S.'54 CEE)* of Gainesville was part of a three-consultant panel that submitted a report to the South Florida Water Management District describing the Herbert Hoover Dike as a grave and imminent danger to the people and the environment of South Florida. Dean has held academic positions at the University of Florida, the University of Delaware and MIT and has consulted for about 100 companies and government agencies.

PHOTO COURTESY J.W. LONDON

Six V-12 engineers returned to campus for a nostalgic tour. Shown with Alumni Relations Director Karin Mack (center), they are (from left) John Van Bronkhorst (B.S.'46 ME), J.W. "Jack" London (B.S.'46 ME), Boyd Thompson (B.S.'48 EE), Dino Williams (B.S.'46 ME), Daniel Shiells (B.S.'46 ME), and Bill Kenton (then William Kleinberg). London's memorabilia include the photo at left, showing him (center) at Sather Gate with Kenton (left) and the late Carl Seibly (B.S.'46 ME).

Navy V-12 engineering alumni reunite

J.W. "Jack" London (B.S.'46 ME) earned a four-year ME degree from Berkeley in two years and eight months. The rush was deliberate. With World War II roaring in two theaters, the Navy urgently needed engineering officers to keep its ships operating. As an enrollee in the V-12 program, the Navy's accelerated degree training program for officers, London was one of 16,000 boys chosen to go to college.

"It was tough," London recalls. "I studied hard. But I was given an opportunity I never would have had otherwise. My folks couldn't afford a college education. I had to go for the big apple. This was my chance and I wasn't going to mess around with it."

At UC Berkeley, V-12s went to school all year long. Their day began at 5:30 a.m. and ended promptly at 10 p.m. They took part in regular PT, physical training, and bunked in International House (temporarily renamed Callaghan House at the time). Of the 40 engineers who started with London, he recalls, only about 15 graduated. But there was an upside to the grueling regime.

"Seven to one," says fellow V-12 alum Boyd Thompson (B.S.'48 EE), chuckling. "That was the ratio of women to men on campus." Indeed, during slivers of free time, London dated a fellow Berkeley student, a woman he'd met on campus and would later marry.

By the time the group received their commissions, the war was over. But six of them have remained friends, and last spring they reunited for the first time since 1946 for a campus tour with Berkeley Engineering Alumni Relations Director Karin Mack. They noticed changes big and small, but one thing remained the same.

"We were totally together for our entire time at Cal," London says. "The six of us have kept in touch all these years. We've always felt like brothers."

BY RACHEL SHAFER

THOMAS MCKAY *(B.S.'55 CEE)* of Atherton, California, writes, "I'm retired and enjoying every minute of it."

ROBERT MOLINE *(B.S.'58 CEE)* of Santa Monica retired in 1997 from a 38-year career as a soil mechanics and foundation engineer, the last 15 years of which he spent freelancing as a geotechnical engineering consultant. He writes, "My wife Jo Ellen and I married during my first year (as a junior) at Cal and have enjoyed 50 years together and counting. We have lived at the same address in Santa Monica for more than 36 years."

ZUHAIR MUNIR *(B.S.'56 ChemE, M.S.'58, Ph.D.'63 MSE)*, distinguished professor of chemical engineering and materials science and former dean of engineering at UC Davis, was selected to deliver the annual Distinguished Research Lecture of the Davis Division of the Academic Senate. The award, the highest honor presented by the senate for scholarly research, has been given annually since 1942 and was last awarded to an engineer in 1970. Munir, a native of Iraq, does research in the area of electric fields and their effect on materials processing.

CLEMENTS PAUSA *(B.S.'53, M.S.'54 MSE)* of Atherton, California, is a retired semiconductor industry executive working part time as a director at the PricewaterhouseCoopers Global Technology Centre.

1940s

DONALD ALDEN *(B.S.'47 CE)* of Carmichael, California, is retired as a supervising bridge engineer from Caltrans and Imbsen and Associates Engineering Consultants. He writes, "I learned to row at Cal in 1941 under Ky Ebright and returned to rowing competitively in 1986 along with some other ex-Cal rowers, including Tim Scofield. I recommend rowing as the best exercise for older men and women. You do it sitting down."

JOHN ALRICH *(B.S.'48 EECS)* of Santa Barbara is retired from Xerox. He writes, "After World War II I returned to college at UCLA and UC Berkeley. It was a wonderful experience. My most memorable (and difficult) class was the senior class given by John Whinnery. John, I still don't know what 'curl' is!"

THEODORE COHN, UC Berkeley professor of optometry and bioengineering, died in May of lymphoma at age 64. He joined the faculty in 1970 as assistant professor of physiological optics and was given a joint appointment in bioengineering after helping establish that department in 1998. For the last 15 years of his career, he applied his knowledge of vision science to solving practical problems in transportation engineering. Before he died, he was investigating methods for improving railroad crossing safety.

LYLE DELOE *(B.S.'58 IEOR)* of Sacramento died in February at age 76. He trained the U.S. Air Force and the Royal Air Force on guidance of the Thor missile, the first U.S. operational ballistic missile. Working for Aerojet, he served as a consultant on the vulnerabilities of the U.S. nuclear missile fleet to electromagnetic pulse. His two sons also graduated from Berkeley Engineering: **DEREK DELOE** *(B.S.'82, M.S.'85 ME)* of Auburn, Washington, and **DEAN DELOE** *(B.S.'86 ME)* of Stamford, Connecticut.

WARREN DRYDEN *(B.S.'51 ME)* of Camarillo, California, died in April of Parkinson's. Upon his retirement, he was a program manager at Lockheed Martin Test Facility in Palmdale.

ERIC MOHR *(B.S.'49 ME, M.S.'70, Ph.D.'77 CEE)*, a member of Berkeley's first graduate class in highway and traffic engineering, died in January. A native of Germany, he came to California in 1939 and served in the U.S. Army Counterintelligence in Europe during and after World War II. He worked for Deleuw, Cather & Co. in Chicago and the California Public Utilities Commission in San Francisco before returning to Berkeley to do graduate study. He taught transportation and logistics at San Francisco State, San Jose State and Golden Gate University, serving as dean of the latter's School of Transportation and Logistics Management from 1984 to 1989.

JOHN PALMERTON *(M.S.'71 CEE)* of Vicksburg, Mississippi, died of lung cancer in February at age 64. He had a 30-year career with the U.S. Army Corps of Engineers and owned Geosynthetic Applications Simulations. He played violin with the St. Joseph Symphony Orchestra of Louisiana and was an active member of First Baptist Church of Vicksburg, where he sang in the choir and played handbells.

RICHARD PLUM *(B.S.'49 Eng. Physics)* of Seatac, Washington, died in March.

DAVID KEITH TODD *(Ph.D.'53 CEE)*, UC Berkeley CEE professor emeritus and a pioneer in groundwater engineering, died of acute leukemia in April at age 82. During the 1950s, he did some of the earliest research on seawater intrusion into aquifers and chemical contamination of groundwater. His book *Groundwater Hydrology*, a standard in the field for two decades, was translated into Turkish, Persian and Malaysian, among other languages. As an educator, Todd was most proud of his many students who went on to leadership positions in groundwater engineering.

PEG SKORPINSKI PHOTO

Theodore Cohn

Lyle Deloe

Eric Mohr

David Keith Todd

CHARLES FAULDERS *(B.S.'48 ME)* of Camarillo, California, is enjoying retirement with his wife of 52 years, Rita. After graduating from Cal, he received his doctorate in mechanical engineering from MIT. He spent most of his professional career at Rockwell International, first in the Space Division in Fullerton, then moving to the Atomics International Division in the San Fernando Valley in 1975.

RICHARD FOY *(B.S.'42 EECS)* of Redondo Beach writes, "We were recently on a cruise of the Mediterranean from Genoa to Egypt with many shore excursions. The most interesting was a drive into the Libyan Desert south of Tobruk to see a total solar eclipse. This is the fourth total eclipse we have seen and they are awesome. Now that I am home, I have renewed my activities translating the work of scientists from NASA and the National Oceanic and Atmospheric Administration on global climate change into meaningful language for my government representatives. I hope this will help them become aware of the urgency of these findings."
rhfoy@earthlink.net

SABURO HORI *(B.S.'40, M.S.'42 ME)* of Glendora, California, is enjoying retirement in Southern California after 45 years in Kalamazoo, Michigan, with Checker Motors Corporation.

ALAN SAMUEL *(B.S.'43 ME)* of San Jose writes, "Lorraine and I each turned 85 on May 6 and celebrated our 61st wedding anniversary last October. We are enjoying gardening and visits with our three children and seven grandchildren. I retired from FMC Corporation Defense Systems as assistant chief engineer, propulsion systems, in 1986 and am keeping busy with American Society of Mechanical Engineers and Society of Automotive Engineers activities and my photography."

ROBERT SMITS *(B.S.'48 EECS)* of Lafayette, California, is retired from Lawrence Berkeley Lab and has taken up astronomy. He joined the Mount Diablo Observatory Association, which recently established an observatory on Mount Diablo.

LINN SPAULDING *(B.S.'48 CEE)* is retired and living with his wife Ida in Eugene, Oregon.

C. NORMAN WINNINGSTAD *(B.S.'48 EECS)* of Newport, Oregon, writes, "As an electrical engineer, I have had many a good opportunity to apply engineering principles to the world around me in more than the techweenie sense. Time and again I have found well-meaning liberal arts grads pushing on something good without realizing that it can be too much of a good thing. So I finally wrote a book, *The Area of Enlightenment*, recently published by Dancing Moon Press (**www.aofe.org**). My wife Dolores and I have been together 58 years, and my hobbies are fast cars, fast airplanes and fast helicopters."