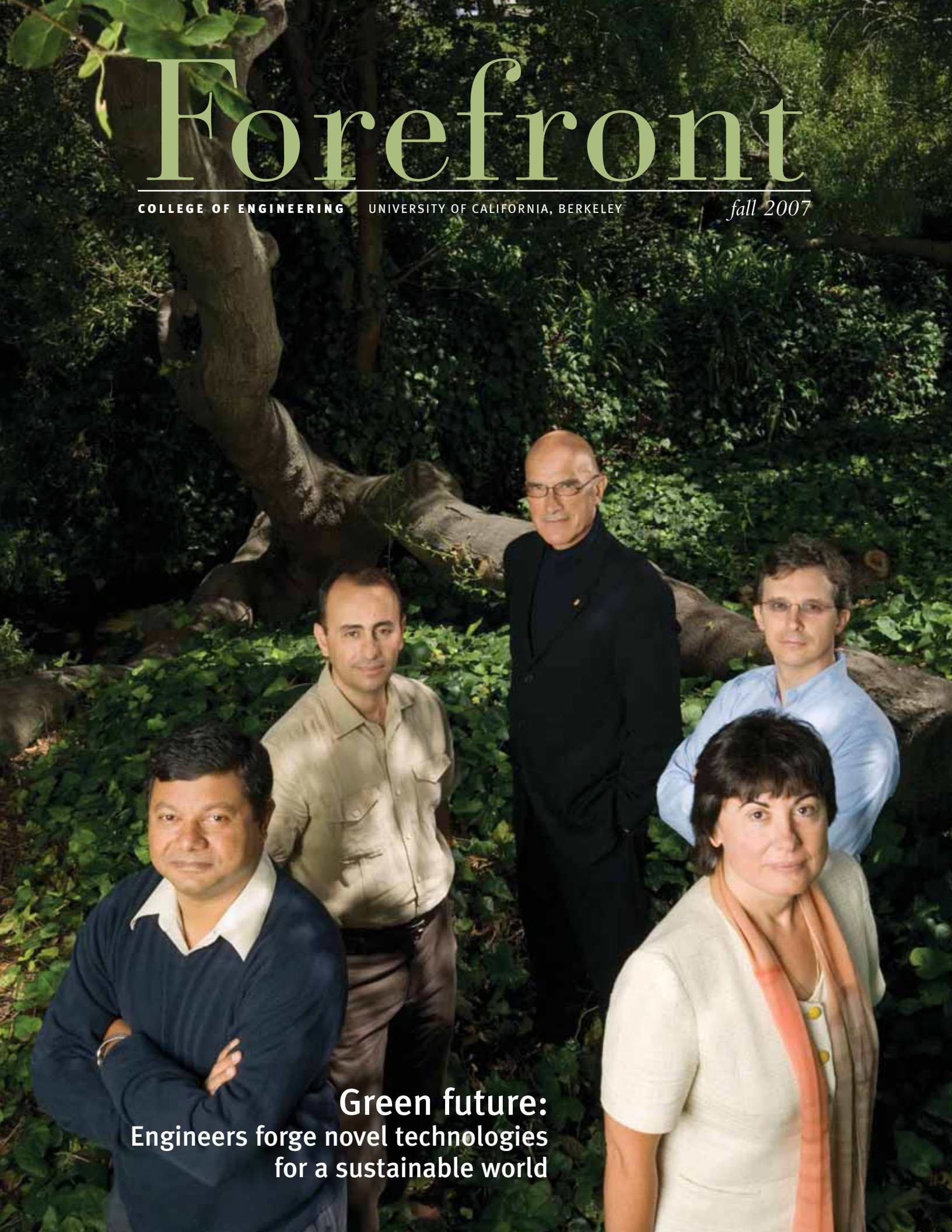


Forefront

COLLEGE OF ENGINEERING

UNIVERSITY OF CALIFORNIA, BERKELEY

fall 2007

A group of five people, four men and one woman, are standing in a lush, green forest. They are dressed in professional attire. The man on the far left is wearing a dark blue sweater over a white collared shirt and has his arms crossed. The man next to him is wearing a light-colored, short-sleeved button-down shirt. The man in the center is wearing a dark suit and glasses. The man on the far right is wearing a light blue button-down shirt and glasses. The woman in the foreground is wearing a light-colored blazer and a scarf. They are all looking towards the camera.

**Green future:
Engineers forge novel technologies
for a sustainable world**

TECHNOLOGY WITH IMPACT



BART NAGEL

I am thrilled to be the new dean of engineering at Berkeley. In my 30 years here, I've been privileged to witness the College of Engineering evolve into an institution of impact. While deeply rooted in academic tradition, perhaps Berkeley's greatest hallmark is that it defies the confines of academia to fully engage in every corner of the world to create novel technologies and new industries, drive economic growth and stimulate social change. The College's role as a major sparkplug in Silicon Valley and the information technology revolution is just one example of this tradition.

Berkeley's approach, what I like to call its West Coast style of engineering, is not only to train engineers as superb technologists but also to instill in them an urgent sense of the implications of their work. They understand which technologies can make a real difference in the real world.

From my vantage point as past director of CITRIS, the Center for Information Technology Research in the Interest of Society, I saw no better exemplar of engineering with an impact than CITRIS. My predecessor as dean, Rich Newton, championed this institute as a multi-disciplinary and collaborative framework to engage Berkeley faculty and students with the three other CITRIS campuses at Davis, Merced and Santa Cruz and engineering partners worldwide to develop information technology innovations around the globe.

Even when its new headquarters is complete in 2009, CITRIS will continue to operate this way: not focused on the four corners of its own college quadrangle, but reaching outward. My vision for the College will follow this template but push even farther, beyond science and technology, beyond engineering industries, to include our colleagues in the disciplines of medicine, law, business, public policy, economics, social sciences, public and global health and the service industry.

The problems we seek to address are social in nature and global in scope. Creating the solutions—new power sources like sustainable energies and biofuels to preserve our environment, new methods for improving health care delivery like low-cost cures for emerging infectious diseases—will not be enough. We must push beyond the technology to forge new collaborations that will help us open eyes, change behaviors and make a difference in the critical areas that affect us all.

Please send us your thoughts at dean.forefront@coe.berkeley.edu.

— S. SHANKAR SASTRY
*Dean, College of Engineering
 NEC Distinguished Professor of Electrical Engineering & Computer Sciences*

Forefront is published twice yearly to showcase the excellence of Berkeley Engineering faculty, alumni and students and bring their work to life for a broad engineering audience through news and research, profiles and current issues and events.

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Teresa Moore
EXECUTIVE EDITOR

Patti Meagher
MANAGING EDITOR

Rachel Shafer
ASSOCIATE EDITOR

Megan Mansell Williams
ASSISTANT EDITOR

David Pescovitz, Writer-in-residence
 Jeff Van Bueren, proofreader
 Sarah Yang, UC Berkeley Media Relations
CONTRIBUTORS

Alissar Rayes
DESIGN

S. Shankar Sastry
DEAN

Melissa Nidever
**ASSISTANT DEAN,
 COLLEGE RELATIONS**

Karin Mack
DIRECTOR, ALUMNI RELATIONS

Dawn Kramer
**ASSISTANT DIRECTOR,
 ALUMNI RELATIONS**

SEND COMMENTS AND LETTERS TO:
forefront@coe.berkeley.edu

SUBMIT YOUR CLASS NOTE AT:
www.coe.berkeley.edu/classnotes

SEND CHANGE OF ADDRESS TO:
ffaddresschange@coe.berkeley.edu

SUBMIT ENGINEERING GIFTS ONLINE AT:
www.coe.berkeley.edu/giving

OR MAIL TO:
 Berkeley Engineering Fund
 208 McLaughlin Hall #1722
 Berkeley, CA 94720-1722
 Phone: 510.642.2487

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fall 2007

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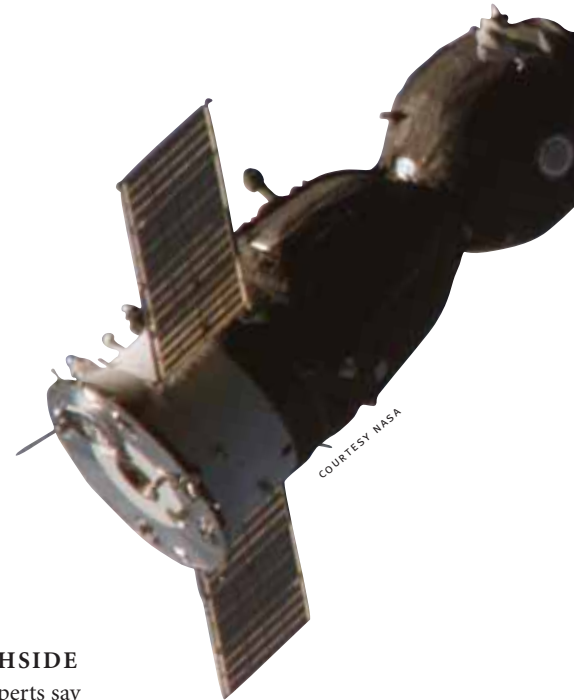
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Engineering faculty members (clockwise, from left) Arun Majumdar, Samer Madanat, Paul Wright, Arpad Horvath and Jasmina Vujic on the banks of Strawberry Creek on campus. They are just five of the many UC Berkeley researchers working on new technologies, infrastructures and other novel approaches to curb carbon emissions and reverse centuries of global climate change.

COVER PHOTO BY BART NAGEL



STEVE MCCONNELL/UC BERKELEY



News from the Northside

What's New at Berkeley Engineering

Athletic center sound, quake experts say



PEG SKORPINSKI

Professors Greg Fenves (top) and Jack Moehle (bottom) say construction of UC Berkeley's proposed Student-Athlete High Performance Center should move forward.

To build or not to build?

As of press time, the fate of UC Berkeley's planned student-athlete training center rests in the hands of Alameda Superior Court Judge Barbara Miller, who has 90 days from October 11 to decide whether the University can proceed with construction of the facility.

During the fall trial, lawyers argued over several issues, including the center's seismic safety.

Two Berkeley Engineering professors proffered their own opinion on the matter earlier this year. After reviewing an independent study that found no active faults under the building site, civil and environmental engineering professors Greg Fenves, past department chair, and Jack Moehle, director of the Pacific Earthquake Engineering Research Center, argued in a *San Francisco Chronicle* op-ed that the project must go forward.

"Cal athletes and athletic staff deserve the same level of protection as occupants of other seismically upgraded campus buildings," the researchers wrote. "Let them move out of Memorial Stadium and into a state-of-the-art building that meets meticulous earthquake safety standards."

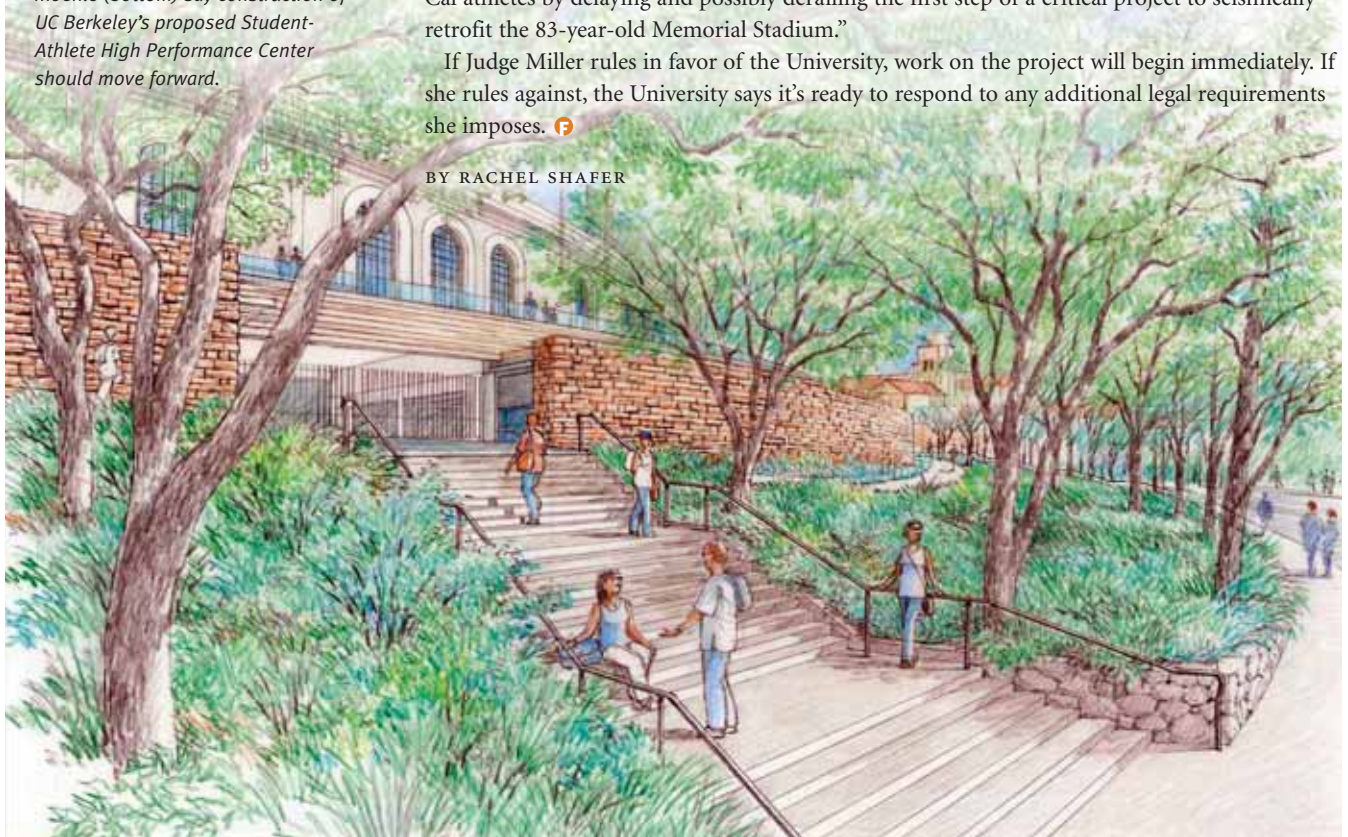
Construction on the center has been stalled since last January when Judge Miller issued an injunction in response to three lawsuits brought against the University.

Fenves and Moehle cited the independent study as evidence that the project is compliant with seismic law. Although the center would be close to the Hayward fault, it would experience no greater shaking than any other building within a two-mile radius, they argued, and its superb, peer-reviewed design assures seismic soundness.

"The city's allegation is unfounded from our perspective as earthquake engineers," Fenves and Moehle concluded. "In fact, the city's lawsuit has the potential to jeopardize the safety of Cal athletes by delaying and possibly derailing the first step of a critical project to seismically retrofit the 83-year-old Memorial Stadium."

If Judge Miller rules in favor of the University, work on the project will begin immediately. If she rules against, the University says it's ready to respond to any additional legal requirements she imposes. [f](#)

BY RACHEL SHAFER





BERKELEY ENGINEERING UNDERGRAD PROGRAM RANKS NO. 2

U.S. News & World Report again ranked UC Berkeley College of Engineering’s overall undergraduate program in second place, tied with Stanford and following number one–ranked MIT. Released in August, this year’s report ranks 10 of Berkeley Engineering’s undergraduate programs number five or above. Civil engineering moved up from second to first place, and electrical engineering moved up from third to second. For more, go to www.coe.berkeley.edu/newsroom/rankings.html.

Berkeley’s Department of Mechanical Engineering was ranked number one for faculty productivity in a new annual index evaluating graduate programs in 104 fields nationwide. Produced by Academic Analytics, the Faculty Scholarly Productivity Index examines 7,300 doctoral programs and has been praised for objectively measuring productivity by faculty publications, citations and number of awards and grants received rather than by reputation. For more, go to www.academicanalytics.com/overview.html.

E-voting machines crack under scrutiny

Swiss cheese: That’s what the source code for California’s electronic voting machines looks like when it comes to protecting voter security and privacy. The flaws were uncovered by David Wagner, associate professor of electrical engineering and computer sciences, and a UC-led team that conducted a review ordered last summer by Secretary of State Debra Bowen.

“We looked for anything that could corrupt the software, shut down a polling place or do harm to an election,” says Wagner, a renowned cryptologist and computer security expert who co-led the study with UC Davis professor Matt Bishop. “The flaws we found were pervasive, blatant and mundane.”

That was bad news for manufacturers Diebold Elections Systems, Hart InterCivic and Sequoia Voting Systems, and even worse news for the 43 counties that have sunk millions into the latest polling place technology, hoping to have it ready for use in California’s February 5, 2008, primary. Now counties will limit their use of the machines (polling places must have at least one electronic booth to accommodate disabled voters) and may return to paper ballots in the near term. Manufacturers must make technical improvements as recommended by the study.

In the midst of the shakeout, Wagner, who calls himself an electronic voting proponent, stands firm by his conclusions. Charged with reviewing the source code security of the


different systems as well as their documentation, he pulled together a team of 25 experts from around the country. The group was given two months to execute various attack scenarios. “The procedures we used are standard in the industry for evaluating security,” Wagner says.

All three machines had similar problems. The biggest was a vulnerability to viruses. “In the worst-case scenario, these malicious codes could be used to compromise the votes recorded on the machines’ memory cards or render the machines nonfunctional on election day,” he says. That’s a fundamental design flaw, Wagner argues, and not correctable with a simple patch.

The team also found scenarios where the secrecy of a ballot could be compromised but concluded that those problems are fixable.

What does this mean for voters? Go with paper ballots if possible over the next couple years, Wagner says, but don’t let an electronic voting machine deter you. The main thing is to vote, period.

After achieving notoriety by hacking into corporate security systems as a student, Wagner now focuses on national security issues and governmental safeguards. He calls the review one of his most rewarding projects.

“This is a landmark study with implications not just for California but other states as well. It’s exciting to do work that can help vendors and officials improve elections and benefit democracy.” 

BY RACHEL SHAFER



COURTESY SEQUOIA VOTING SYSTEMS

UC Berkeley’s David Wagner and team found the Sequoia AVC Edge e-voting machine susceptible to software attacks.

MICROSOFT ESTABLISHES \$1 MILLION AWARD HONORING RICHARD NEWTON

Software giant Microsoft Corporation has established a \$1 million research award to honor the memory of A. Richard Newton, dean of the College of Engineering from 2000 until his death earlier this year. The award was announced in July by Microsoft External Research & Programs (ER&P), Microsoft Research's outreach arm to colleges and universities.

"Richard Newton's advice, experience and participation in our activities over the years was respected and valued," said Tom Healy,

lead program manager of Microsoft ER&P. "Newton was an advocate of multidisciplinary research, and this research award reflects that point of view," Healy added. Newton had been a longtime member of the Microsoft Research Technical Advisory Board and actively participated in its events.

Submissions are due in early December, and winners will be announced in March 2008. For details about appropriate types of projects and how to apply, go to <http://research.microsoft.com/ur/us/fundingopps/default.aspx>.


"Perfect storm" caused Minneapolis bridge collapse

When the steel truss of the I-35W bridge in Minneapolis broke into three pieces and tumbled into the Mississippi River on August 1, Berkeley professor of civil and environmental engineering Abolhassan Astaneh-Asl began investigating. He booked a hotel room overlooking the wreckage and boarded a plane headed east. For nine days he took photos, interviewed survivors, consulted other engineers and studied the bridge's designs and reports to reconstruct the event and prevent similar catastrophes in the future, whether benign or intentional.

"I'm trying to figure out how this bridge lasted so long," Astaneh-Asl told the audience at the Society of American Military Engineers' Brown Bag Technical Seminar in San Francisco in late August. "The bridge was fracture critical. By fracturing one member, the entire system collapsed like a house of cards. The public may not know it, but we have a lot of bridges like this." According to California's highway agency Caltrans, more than 800 raised spans in the Bay Area alone have been deemed "structurally deficient," the same rating as the I-35W.

A leading expert in failed steel, Astaneh-Asl has assessed—among others—the destruction of the World Trade Center in 2001 (he recently released a study pinpointing what he says were money-saving design flaws that weakened the towers) and the April 29 collapse of an overpass in the East Bay's MacArthur Maze, which fell onto the 880 roadway when a gasoline tanker carrying 8,600 gallons of fuel hit a guardrail and caught fire.

The I-35W bridge collapsed due to a "perfect storm" of accumulated problems, Astaneh-Asl concludes. There was a history of corrosion, poor maintenance, crude pre-1970s welding technology and fatigue cracks exacerbated by brutal winters and administration of de-icing agents. Inspection of key areas was blocked because openings had been covered up to prevent pigeons from nesting inside. But the final straw, he says, may have been construction on the span at the time of the collapse, resulting in cuts in the roadway and added weight from heavy trucks and materials.

The National Transportation Safety Board won't release a final report on the accident for many months, but Astaneh-Asl says it is critical to identify the nation's weakest bridges now and pursue appropriate retrofitting measures, especially for urban interstate bridges traveled by large numbers of commuters. 

BY MEGAN MANSELL WILLIAMS



PEG SKORPINSKI

HOMECOMING 2007 last month featured a weekend full of presentations, open houses and campus tours for alumni and parents. Engineering highlights included a panel discussion by Professors Dan Kammen (left) of nuclear engineering and Jay Keasling (right) of chemical and bio-engineering entitled "In Service to Society: Energy and Health." Kammen gave a history of fossil fuels and explained how renewable power sources like solar, wind and hydrogen can encourage job growth and provide a cleaner and more secure energy supply. Keasling described how the new field of synthetic biology can synthesize malaria therapies and transportation fuels from bacteria in the laboratory. Go to www.coe.berkeley.edu/multimedia. Nuclear engineering professor and chair Jasmina Vujic also gave a talk on "The State of Nuclear Energy," detailing safety and waste disposal improvements in the nuclear power industry (see page 17).



PEG SKORPINSKI

Berkeley professor Abolhassan Astaneh-Asl, an expert on structural steel failures, studied the collapsed I-35W bridge that fell 115 feet and killed 13 people.

Carpool lanes: A tale of two studies

The state's first carpool lane was installed on the San Francisco–Oakland Bay Bridge in 1971 to encourage carpooling and move more people more quickly. But Bay Area traffic congestion, up by 6 percent last year according to transit officials, still gets worse every year; and carpoolers complain that life in the fast lane is not fast enough, due to pokey hybrids and scofflaws.

Two Berkeley Engineering professors are delving deep into freeway physics to find out how carpool lanes—also known as HOV (high-occupancy vehicle) or diamond lanes—affect traffic flow. Both researchers studied six of the Bay Area's most notorious stretches along Interstates 80, 237, 880 and 101 and came down squarely on opposite sides.

“As currently operated,” says electrical engineering and computer sciences professor Pravin Varaiya, “the HOV system does not meet its goals.” There are exceptions, he admits, such as the heavily metered chokepoints on the Bay Bridge, where private cars carrying three-plus passengers and transit vehicles can zip by toll free. Otherwise, his study concludes, carpool lanes so insignificantly reduce congestion and travel time that they do not motivate solo drivers to carpool.

Mike Cassidy, civil and environmental engineering professor and acting director of the Institute for Transportation Studies, disagrees. While he did identify some HOV lanes that are underutilized or poorly located, Cassidy concluded that carpool lanes are effective overall in reducing travel time in carpool lanes while not significantly increasing travel time in regular lanes. Where the two researchers differed, Cassidy says, is the type of data they captured.

“Traffic is a spatial and temporal phenomenon,” he explains. “If you're going to analyze problems, you have to look at it spatiotemporally, over several-mile-long stretches.”

Both researchers used the California Freeway Performance Measurement System—a public database of input from 26,000 loop detectors, or sensor points, throughout the state's freeways—to analyze traffic flow, speed and other factors. Focusing on specific points, Varaiya found that carpool lanes are choked by slow-moving “snails” and violators darting in and out to dodge backups. He advocates converting HOV to “HOT” lanes, high-occupancy toll lanes for transit vehicles that private drivers can access by paying a toll.

Cassidy examined consecutive points along stretches of up to 15 freeway miles to pinpoint

where and how congestion first manifests and used video to analyze bottlenecked traffic. He found that backups in carpool lanes were a natural consequence of increased traffic volume at peak hours or were caused by accidents or construction up ahead. Cassidy's remedy is to more carefully study proposed HOV installation sites based on specific traffic patterns in each area.

At stake is a \$21 billion Caltrans plan to double the number of HOV-lane miles statewide by 2020. Caltrans claims that HOV lanes do work, that carpooling is up, and that the state's ever-growing population inevitably causes increased congestion. Despite these claims, the Federal Highway Administration cited California for not complying with federal guidelines requiring a minimum average speed in carpool lanes of 45 mph during 90 percent of peak hours. In response, Caltrans is taking measures like limiting HOV access in severely congested stretches and beefing up enforcement of HOV violators.

Both Berkeley researchers agree that HOV lanes merit further study. “The persistence of debate,” Cassidy says, “suggests that the impacts of HOV lanes are not fully understood.”

BY PATTI MEAGHER



By the Numbers

- 12.2% Drivers carpooling in 2000
- 10.7% Drivers carpooling in 2005
- 4.7% Public transit users in 2000
- 4.7% Public transit users in 2005
- \$1.523 Cost of gas per gallon in 2000
- \$3.011 Cost of gas per gallon in 2005

SOURCE: U.S. Census Bureau and Energy Information Administration

Q & A Societal-scale mind

The new engineering dean talks about his vision for the College, the biggest challenges in the field, and why he may still have your business card.

What are you most excited about in your new role as dean of UC Berkeley College of Engineering?

Berkeley has one of the premier colleges, if not the top engineering college, in the world. I feel the College is poised to become an even more powerful fountain of innovation in the years to come, through pushing forward the limits of technology and science and creating new companies. More than 300 startups have come out of Berkeley Engineering in the last 30 years, and some of these companies, like Intel and Marvell Semiconductor, are household names today.

What has best equipped you to become dean of the College of Engineering?

I've been here 30 years and care deeply about the College. I come into the deanship with a lot of humility about continuing a wonderful tradition at a great institution. I guess that may not be a qualification, but that's what I bring to the table.

How will your transition to dean from director of CITRIS, the Center for Information Technology Research in the Interest of Society, affect the scope of your research?

CITRIS focuses on helping people by applying better information technologies (IT) to societal scale systems. But beyond IT, there are a lot of other technologies—biotechnologies like neuronal technologies, synthetic biology, systems

biology and nanotechnologies—that are coming of age. To bring all of these into the service of societal problems represents a massively expanded version of my job at CITRIS.

You frequently use the term “societal scale systems.” What do you mean by that?

Societal scale means a large-scale system that is subject to economic forces and legal constraints, like our telecommunications infrastructure or our water delivery systems. By and large, most engineering systems we are putting together nowadays are of this nature.

How do these systems figure in our day-to-day lives, and how can engineering help?

The biggest challenges, in my opinion, are developing more innovative technologies for health care delivery, for clean energy and environmental sustainability, and for stronger complex societal systems, that is, technological systems with a social and economic piece to them. For a few examples, we are increasingly confronted with blackouts, air traffic failures with people stranded on runways for six hours, gridlock on freeways. That's because our transportation systems and electric grids and other infrastructures have grown organically by adding and reengineering pieces.

Even our computer systems and the Internet don't behave predictably because they are not well planned out. Engineers use the phrase *composable system*, which means you construct

the pieces to play nicely with each other; even if one piece of the road degrades, it does not cause catastrophic failure. So we've got to teach ourselves and our students how to build these systems to be more pliable and more fault tolerant when they suffer breakdowns or even when they're under attack by terrorists.

What about health care delivery and environmental preservation? How will you prepare the next generation of engineers to make contributions in these areas?

Fifty years ago engineers learned to digest physics and inorganic chemistry as the sciences that drove technology. This led to quantum mechanics and the semiconductor industry, which then begot transistors, computers, the World Wide Web, cell phones and so on. The challenge is to integrate organic chemistry and biology as the sciences that are driving technology now. We've got all kinds of biological sciences on campus, but they are more discovery oriented. In engineering, you actually take this discovery and convert it to solutions for health care, for the environment and perhaps for other kinds of systems.

How specifically will engineering be involved in energy and health care delivery? Can you give us some examples?

A key area in energy research will be the use of synthetic biology to develop biofuels. In health care, we're working on telemedicine

SASTRY'S PATH TO ENGINEERING DEAN

5.15.1956 Born in Bombay, India

1977 Received Bachelor of Technology, Indian Institute of Technology, Bombay

Berkeley degrees:
1979 M.S. EECS
1980 M.A. Math
1981 Ph.D. EECS

1994 Gordon McKay Professor of EECS, Harvard University

Fellow, Institute of Electronics and Electrical Engineers

1996–1999 Director, Electronics Research Laboratory, UC Berkeley

1998–1999 Member, Chancellor's Advisory Council on Biology

1999–present Professor of Bioengineering, UC Berkeley

2000 Director, Information Technology Office, DARPA

2004 Member, American Academy of Arts & Sciences

2005–2007 Director, Center for Information Technology Research in the Interest of Society (CITRIS) and the Banatao Institute @ CITRIS Berkeley

2005–present Director and principal investigator, NSF Science and Technology Center Team for Research in Ubiquitous Security Technologies (TRUST)

and electronic medical records, as well as elder care and nonproprietary treatments for emerging and neglected diseases like malaria and tuberculosis. The big drug companies may not even develop drugs for such diseases because they can't actually charge enough for the doses to support their costs.

You've been at Berkeley for 30 years except for brief periods at MIT, Harvard and DARPA. How did you end up leaving academics for the government?

When I had my interview for a green card in 1982, the judge in Boston asked me if I had registered for the draft. I said I didn't realize I had to because I wasn't a permanent resident. Then he said, "Why do you want to be a permanent resident in a country you don't want to defend?" So many years later, when DARPA asked me to run the information technology office, that question about responsibility and duty was still in my head, and I went off to DARPA. I was supposed to be there three years, but when Rich Newton became dean, he twisted my arm to come back and take his job as department chair, so I came back to Berkeley after 13 months.

How did you first know you wanted to be an engineer?

Actually, I wanted to study math after high school, but my father suggested it wouldn't be quite the right choice. My father was a mechanical engineer, and my grandfather and uncle were chemical engineers. I realized engineering was a good way of combining my interest in mathematics and physics with problem solving in the real world.

What do you think is the coolest technology out there right now?

Wireless. But I think we should call it *untethered communications*. I like this term

better because it explains that it's a way of communicating.

How would your closest friends describe you as a person?

As gregarious and epicurious. I think that's a pretty accurate description. I'm fond of good wine and good food.

What do you like to do in your spare time?

I'm a history buff. I like to read histories, every year in a different area. Right now I'm reading a history of Mongolian culture. There have been a whole ton of them recently, and there was one in particular which got me started, which traced the beginnings of the Mongol Empire, the Ottoman Empire and the Mughal Empire in India.

We hear you're a big Cal Bears fan. What got you interested in college football?

When I came to Berkeley I stayed in I-House and drew a room looking right on to Memorial Stadium. So I was introduced to Cal football by these program vendors early Saturday morning, going "Programs, programs," outside my window.

Why, as a communications technologist, do you keep seven low-tech Rolodexes full of names?

I have them all electronically, but I like to keep the business cards themselves, even after they've been scanned in.



BART NAGEL

1980–1982 Assistant Professor, Massachusetts Institute of Technology

1983 Joined Berkeley's EECS faculty

1985 Awarded NSF Presidential Young Investigator Award

2001 Member, National Academy of Engineering

2001–2004 Chair, UC Berkeley Department of EECS

2002–present Nippon Electronics Corporation (NEC) Distinguished Professor in the College of Engineering and the Walter A. Haas School of Business

2007–present Professor of Mechanical Engineering Director, Blum Center for Emerging Economies

5.1.2007 Appointed Dean, UC Berkeley College of Engineering

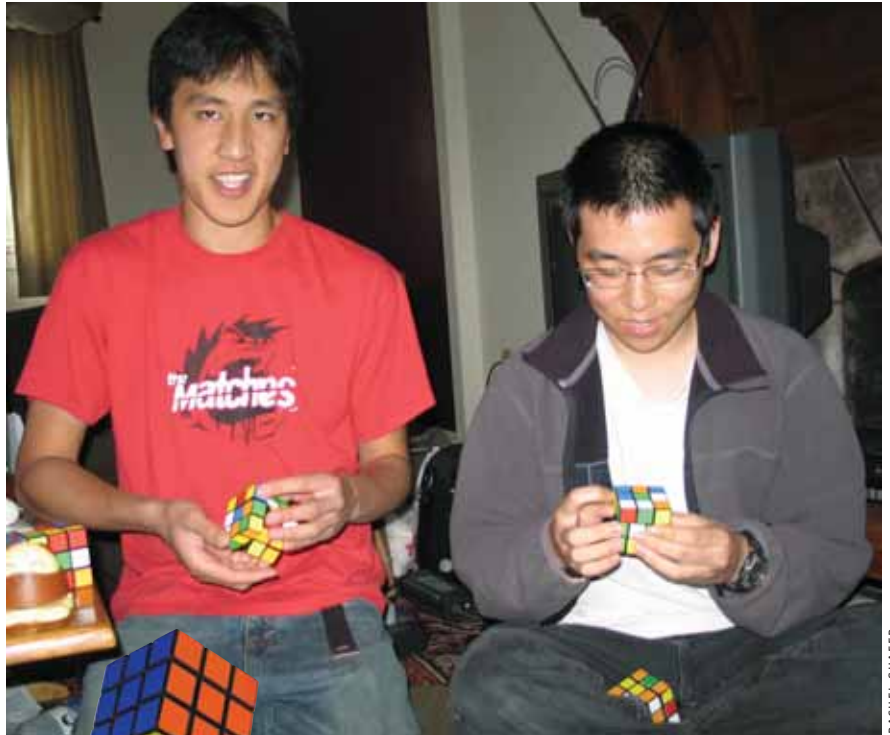
EARTHQUAKE RESEARCH CENTER “CRITICAL” TO STATE

As UC Berkeley’s Pacific Earthquake Engineering Research (PEER) Center celebrated its first 10 years in business, the California Seismic Safety Commission (CSSC) issued a report citing the center as the “primary earthquake engineering arm” of California. The report recommended that the State ramp up funding as 10 years of financial support by the National Science Foundation comes to an end this fall.

The center is “emerging as a critical tool” statewide for design and evaluation of major buildings, utilities and lifelines, the report said. Specific successes have included a cost-effective seismic retrofit program for BART and guidelines for strengthening existing buildings, including seismically deficient buildings on the UC Berkeley campus. PEER has made significant contributions in the areas of earthquake ground motion estimation, computer simulation and performance assessment of facilities subjected to earthquakes, as well as student and practitioner training.

“The earthquake hazard will always be here,” says civil and environmental engineering professor and PEER director Jack Moehle, “but by building intelligently we can manage the risks posed by earthquakes.” Although NSF funding will end this year, PEER’s programs will continue with a range of federal, state and private contracts.

The CSSC is required by law to periodically monitor the work of PEER and has issued three previous reports. For more details, go to <http://peer.berkeley.edu/events/summative>.



ME senior Dan Dzoan (left), who recently set a record for one-handed speedcubing, caught the cubing bug from floormate, EECS junior and “cubing guru” Ryan Zheng (right).

The fine art of cubing

ME senior Dan Dzoan cubes while walking to class, talking with friends or after meals in the dining commons. He does it with one hand and is working on doing it blindfolded. He holds the cube familiarly, fingers flying as he turns the tiles with a soft crunching sound. First a green side emerges, then a yellow, then, in a flash, it’s done.

Dzoan solved a 3x3x3 cube one handed in 17.9 seconds last January at the CalTech Winter Rubik’s Cube Tournament, setting a then–world record time for speedcubing. Not bad for someone who learned to solve the puzzle only two years ago.

“I find it kind of fun,” he says, casually scrambling the cube again.

When Rubik’s Cube mania hit in the early 1980s, Dzoan hadn’t been born yet. He had a cube growing up, but it didn’t become what he calls his “strange obsession” until, as a junior, he transferred to Berkeley and met floormate and EECS major Ryan Zheng. Zheng had taught himself to solve the cube in less than 40 seconds, and his cubing was infectious. Soon, nearly the entire residence hall floor was cubing, racing each other to faster times.

Dzoan began practicing up to three hours a day and adopted the Fridrich method, a popular speedcubing solution credited with the recent resurgence in competitive cubing. Using the Fridrich, a puzzler must memorize 50 algorithms for solving the cube in four efficient steps. His secret, says Dzoan, is not blind memorization, but understanding why and how each step works until it becomes a matter of pattern recognition. Within three months he was producing solutions in less than 30 seconds. He entered his first tournament shortly afterward.

“What I like about the Rubik’s Cube is that, for being a puzzle with one solution, there are so many ways to solve it,” he says. A normal 3x3x3 cube has more than 42 quintillion possible positions.

See Dzoan conquer the cube at www.youtube.com/watch?v=MnFP1vA2m1k. 

BY RACHEL SHAFER



Alvarez-Cohen



Brayton



Ritchie



Shenker



Szeri



Wright

LISA ALVAREZ-COHEN has been appointed department chair of civil and environmental engineering. Holder of the Fred and Claire Sauer Chair in Environmental Engineering, she is also a faculty scientist at Lawrence Berkeley National Laboratory. Alvarez-Cohen's research involves environmental microbiology methods for cleaning up hazardous waste and groundwater contaminants using microbes.

ROBERT K. BRAYTON is the 2007 recipient of the Phil Kaufman Award in recognition of his seminal contributions to the fundamental design automation algorithms used in making integrated circuits. The award, presented by the EDA Consortium and the Institute of Electronics and Electrical Engineers, is considered the Nobel Prize of the electronic design automation (EDA) industry. Brayton, Cadence Distinguished Professor of Electrical Engineering and Computer Sciences, also received the Paris Kanellakis Theory and Practice Award from the Association for Computing

Machinery (ACM) for his innovations in logic synthesis and electronic system simulation, which the ACM called "key enabling technologies for the EDA industry."

ROBERT O. RITCHIE received the 2007 A.A. Griffith Medal and Prize from the Institute of Materials, Minerals and Mining (London) for his work on the fracture of bone, ceramics, intermetallics and advanced metals. Ritchie, the H.T. & Jessie Chua Distinguished Professor and chair of Materials Science and Engineering, has been on the faculty since 1981.

The University of Chicago granted electrical engineering and computer sciences professor **SCOTT SHENKER** an honorary doctorate for his significant contributions to the architecture of the Internet. Shenker, who received a Ph.D. in physics from the Chicago school, is also head of Berkeley's International Computer Science Institute's networking group.

The University appointed mechanical engineering professor **ANDREW J. SZERI** graduate division dean. The specialist in fluid dynamics served as associate dean for two years and will work with the Academic Senate in his new role to advocate on behalf of graduate education, teaching and research campuswide.

PAUL K. WRIGHT has been named acting director of CITRIS, the four-campus Center for Information Technology Research in the Interest of Society, and the Dado and Maria Banatao Institute @ CITRIS Berkeley. The A. Martin Berlin Professor of Mechanical Engineering, Wright also received the North American Manufacturing Research Institution/Society of Manufacturing Engineers S.M. Wu Research Implementation Award for the first "open architecture control" of CAD/CAM designs, a project known as CyberCut when it ran in the College in the 1990s.

DELTA IN DISTRESS: Ongoing development is jeopardizing the well-being of the Sacramento–San Joaquin Delta, says a March 2007 report by the UC Berkeley–based Delta Initiative. The report presents the first-ever comprehensive map of development risk and urges the state to create a land trust to acquire parcels of land and flood easements to protect vulnerable areas. The hub of California's water supply, the Delta is



ROBERT TWISS

also the center of a large agricultural industry, a delicate wildlife habitat and home to 500,000 people. With much of its land below sea level, vulnerability to flooding or earthquake damage is extremely high. "The levees are the weak link," says Robert Bea, Berkeley professor of civil and environmental engineering, who investigated New Orleans's levees post-Katrina and is studying the Delta in hopes of preventing a similar disaster there. "If developers build 1,000 homes 15 feet below flood level, they have a 30 percent chance of losing all those homes in 30 years. We're dealing with something dangerous, and the defenses we've got are tissue-paper thin." For a copy of the report, *Re-envisioning the Delta*, go to <http://landscape.ced.berkeley.edu/~delta>.

nerd (nûrd) *noun*: an unstylish, unattractive, or socially inept person, especially one slavishly devoted to intellectual or academic pursuits, as in *computer nerd*

MERRIAM-WEBSTER'S COLLEGIATE DICTIONARY, 11TH EDITION



ME senior Josh Bishop-Moser is proud to be a nerd. Or is he a geek? The Oakland resident and president of UC Berkeley's Rubber Band Club was a contestant on CW Network's reality TV show "Beauty and the Geek" this season.

PHOTO: JOSEPH VILES/
THE CW NETWORK

Nerd or not?

The word first appeared in 1950 with Dr. Seuss's goofy imaginary creature, the "nerd," in *If I Ran the Zoo*. Many subsequent variants include the alternate spelling *nurd*, said to have originated at Rensselaer Polytechnic Institute when *knurd* (*drunk* spelled backwards) was used to describe teetotaling students who spent their night lives in the library. Perhaps most visually evocative is the theory that the word originated at Northern Electric Research and Development in Ottawa, Ontario, Canada, where the acronym was emblazoned on pocket protectors of the engineers who worked there.

With such a rich and lore-laden history, it's no surprise that the word evokes a wide range of reactions. Despite the pejorative connotations, nerd pride runs high in certain circles. MIT sells a 14-karat gold "Nerd Pride" pendant, Spain celebrates "Nerd Pride Day" on May 25, and a new popular music genre called *nerdcore* hip hop or *geeksta* rap are just a few examples.

Berkeley engineers also have strong feelings about the word, as evidenced by a recent exchange of letters in the *San Francisco Chronicle*.

It started with a March 17 story about a robotics tournament for high school engineering students, one of whom was quoted as saying, "People call us nerds . . . I guess I take it as a compliment." Thus, the story received the headline, "Robotics tourney gives high school 'nerds' chance to compete."


Chancellor Emeritus Karl Pister (B.S.'45, M.S.'48 CE) took issue with the choice of terms and wrote a letter to the editor. "At a time when California needs more . . . technically educated people in the workforce to sustain its economy, the pejorative word 'nerd,' coupled with youthful peer pressure, sends exactly the wrong message."

Alumni Amelia Marshall (B.S.'80 EECS) and William Imler (Ph.D.'86 MSE) fired back. "We are proud of our nerdish heritage," they

responded in a subsequent letter. "From the days of yore when we balanced slide rules on our pyramids of books, to our own college days when we tried in vain to break our Hewlett-Packard scientific calculators, . . . nerds have made an invaluable contribution to the engineering profession."

Pister says that, in the many conversations he's had with his faculty colleagues about the exchange of letters, everyone is in complete agreement with him.

"I have absolutely no concern about anyone who wants to self-identify as a nerd, and some people like to celebrate eccentricity," Pister says. "But the word just throws cold water on our efforts to encourage young people to go into scientific and engineering careers."

What do you think? Are you a nerd or not? E-mail us at forefront@coe.berkeley.edu. 

BY PATTI MEAGHER



JIM BLOCK

SERENDIPITOUS STANLEY: September 28 festivities, including a rousing performance by the Cal Marching Band, sounded the official opening for the new Stanley Hall, home to UC Berkeley's California Institute for Quantitative Biosciences (QB3) and the Department of Bioengineering. In addition to classrooms, the 11-story building houses state-of-the-art wet laboratories and eight computational suites for 650 researchers and staff. Under construction since 2003, the facility is engineered to encourage "serendipitous collisions" among faculty, students and postdocs from multiple disciplines and facilitate a new era of interdisciplinary bioscience research. For more, go to www.berkeley.edu/news/media/releases/2007/09/26_stanley.shtml.

Berkeley researchers at the engineering forefront

INTERNET REBORN: If the Internet didn't exist yet, how would you build it? Electrical engineering and computer sciences professor Scott Shenker, with researchers from the Stanford Clean Slate Design for the Internet project, is working on Ethane, a radically new architecture for enterprise networks that takes a bottom-up approach to security. Rather than allow open communication by default, Ethane prohibits all exchanges from the start, then allows authorized operators to clear secure channels as appropriate. <http://cleanslate.stanford.edu/index.php>

BETTER DVD PLAYERS: Electrical engineering and computer sciences professor Connie J. Chang-Hasnain and students built a super-thin high-performance mirror that may usher in the next generation of laser optics devices like high-definition DVD players and laser printers. Mirrors are used in these objects to create powerful laser beams. The new mirror, which works by passing light over a series of grooves in the device's layered structure, captures just as much definition as larger mirrors but is 20 times thinner and functions under a broader light spectrum. www.berkeley.edu/news/media/releases/2007/02/13_laser.shtml

HEALTH CONNECTIONS: Online support for a range of health issues from cancer to diabetes and parenting is now available from OurHealthCircle.org, co-founded by electrical engineering and computer sciences graduates Jeremy Schiff, Frank Wang, Tracy Wang and Haas School of Business student Heston Liebowitz, with Professor Jon Burgstone of Berkeley's Center for Entrepreneurship and Technology. The site allows users with similar concerns to swap advice and encouragement on more than 750 topics in a secure and anonymous environment. www.ourhealthcircle.org



Canned heat

The ubiquitous aluminum can, convenient as it is, takes an awful lot of energy to produce. But materials science and engineering professor James Evans may have a solution. Currently, to isolate the metal, smelting plants run hundreds of massive electrolytic cells that require regular attention from operators to curtail their inherent release of greenhouse gases.

Evans and team are fighting fumes by installing temperature-tracking wireless sensors on the cells that transmit to operators' laptops so they can tell when something is amiss and correct the problem. www.coe.berkeley.edu/labnotes/0307/aluminum.html

Double-dipping cranes



Two birds, one stone. That should be the motto for gigantic freight-carrying cranes used to haul cargo on and off ships at port, according to studies by civil and environmental engineering professor Carlos Daganzo and University of Washington's Anne Goodchild (M.S.'02, Ph.D.'05 CEE). Cranes now hoist goods from barge to dock until the decks are clear and then load the ship back up again. But Daganzo is working on a technique known as "double cycling," in which cranes never swing back empty-handed. Instead, they deliver a load on each return trip to save money, fuel and carbon emissions. www.earthtimes.org/articles/show/69902.html

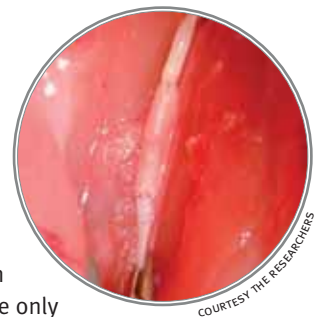
Get plugged in

A new and improved Toyota hybrid that charges via wall socket joins Berkeley's Institute of Transportation Studies (ITS) fleet as part of a study funded by the California Air Resources Board. The prototype vehicle is similar to the popular Prius in that it shifts from electric to gas power on the go, but it has a powerful battery pack that allows it to run longer (and at higher speeds) on pure electricity, saving fuel. The researchers will assess the usability of the vehicle over a two-year period in which ITS staff participants will routinely test-drive and test-charge the car. www.berkeley.edu/news/media/releases/2007/07/25_plugin.shtml



Nanografts to the rescue

Coronary bypass surgery—a treatment performed on some half million heart disease sufferers each year—could get a whole lot easier, thanks to the efforts of bioengineering Ph.D. student Craig Hashi and team. To sidestep a blockage, the researchers coax all-new vessel growth using a nanofiber scaffolding studded with the patient's own adult stem cells. This graft is then implanted into the patient, where the foreign fibers break down to leave only healthy tissue. The device won the national Biomedical Engineering Innovation, Design and Entrepreneurship Award and the National Inventors Hall of Fame Collegiate Inventors Competition and will soon enter clinical trials. www.coe.berkeley.edu/engnews/Fallo6/EN03F/nanografts.html



COURTESY THE RESEARCHERS

green future:

Engineers forge novel technologies for a sustainable world

BY DAVID PESCOVITZ | PORTRAITS BY PEG SKORPINSKI



Strawberry Creek, here surging with water following a rainstorm, was one of the features that led to selection of the campus site for UC Berkeley in 1860. After two centuries of pollution and disruption of its natural flow, the creek today serves as a living laboratory for environmental education.

JONATHAN KING/UC BERKELEY

UC Berkeley engineers are known for thinking far into the future, contemplating what tomorrow may bring so they can keep us technologically prepared. The fruits of their forecasting have transformed entire industries, from construction to semiconductors to software. Right now, many UC Berkeley researchers are asking a question that will have consequences not only for us but for our children and grandchildren: What can we do to reverse our centuries-old habit of conspicuous energy consumption and preserve the health of our planet?

Call it global warming, anthropogenic climate change or extreme weather, the Intergovernmental Panel on Climate Change (IPCC) this month is scheduled to publish a report summarizing the findings of more than 1,250 scientists from 130 countries who agree that the phenomenon is real. While a few experts still argue to the contrary, the IPCC reports that, by the end of the century, global temperatures may increase by as much as 4.0 degrees Celsius, causing longer droughts and hotter heat waves. Rising sea levels from melting glaciers will result in flooding and more intense tropical storms. Many animal and plant species will be driven to extinction.

The IPCC, which shared the Nobel Peace Prize last month with former Vice President Al Gore for its work on global warming, says that human activities—everything from manufacturing widgets to driving cars—have produced excessive greenhouse gases like carbon dioxide, which trap heat in the Earth's surface and lower atmosphere, warming the entire planet.

Perhaps the biggest challenge is that global warming is, well, a global problem, and it is getting worse. Already, China and India have the biggest coal stockpiles after the United States. The International Energy Agency estimates that, in 2009, China will surpass the United States as the world's biggest emitter of carbon dioxide.

"The energy crisis of 1973 was about the availability of energy and its cost," says Arun Majumdar (Ph.D.'89 ME), professor of mechanical engineering and a researcher at Lawrence Berkeley National Laboratory (Berkeley Lab). "Now we have the additional concern of CO₂ emissions from burning fossil fuels and their impact on climate change. What can we do to keep CO₂ from being emitted?"

The name of the game is sustainable development, famously defined by the Brundtland Commission—created by the United Nations in 1983—as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs." Berkeley researchers are working on a range of novel approaches in disciplines as diverse as nanoscience, transportation research, information technology, mechanical engineering, synthetic and systems biology and, yes, nuclear engineering.

"These problems need to be solved for the entire world," says College of Engineering Dean S. Shankar Sastry (M.S.'79, Ph.D.'81 EECS). "To chip away at carbon emissions, you have to find many solutions across the board, from conservation and efficiency, to renewables and nuclear energy, to carbon capture and gas substitution. And there must be a massive amount of intellectual power coming together to solve a problem of such global magnitude."

Sustainability research is hot at the moment, but Berkeley engineers have been exploring renewable energy and green engineering for years through such groups as the Consortium on Green Design and Manufacturing, the Renewable and Appropriate Energy Laboratory and the Network for Energy and Environmentally Efficient Internet Economy, formed in 2000 as a collaboration among UC Berkeley, Carnegie Mellon University and Berkeley Lab. The entire University of California has a critical role in addressing the problem from every conceivable angle, with new technologies, fledgling industries and creative collaborations with government and policymakers. In August, two of UC's top transportation energy experts, Berkeley's Alex Farrell and Davis's

Daniel Sperling (M.S.'79, Ph.D.'82 CE), released a new low-carbon fuel standard for automotive emissions, commissioned by Gov. Arnold Schwarzenegger. Designed to stimulate innovations in transportation fuels, the standard is expected to become a model for similar initiatives worldwide.

Berkeley has also become a major focus for funding. In June, the Department of Energy awarded a \$125 million, five-year grant to Berkeley Lab, UC Berkeley and four other partners to form the Joint BioEnergy Institute (JBEI). The goal is to develop better biofuels to reduce our dependence on coal and oil. That grant followed February's announcement of the Energy Biosciences Institute (EBI), a \$500 million research effort funded by energy firm BP at UC Berkeley, Berkeley Lab and the University of Illinois at Urbana-Champaign that will initially focus on producing sustainable transportation fuels through biotechnology.

Biofuels are key to curbing greenhouse gases. In California

Your carbon footprint

Each U.S. citizen emits about 24 metric tons of CO₂ equivalent of greenhouse gases per year, as calculated on a per capita basis, according to the Environmental Protection Agency. This includes emissions from transportation, electricity and heating, and emissions from industry, agriculture and landfills where garbage is sent. Small changes can make a difference: driving a mid-size car 1,900 miles emits one ton of CO₂, for example, while a hybrid will get 6,000 miles for the same carbon "cost." To calculate your carbon footprint and find suggestions for reducing it, go to www.epa.gov/climatechange/emissions/ind_calculator.html.

alone, burning gasoline and other transportation fuels accounts for about 40 percent of all greenhouse gas emissions. Still, as crucial as alternative fuels are to solving our environmental problem, they're just one part of a huge puzzle.

"There isn't one silver bullet," says Berkeley Lab director and Nobelist Steven Chu (Ph.D.'76 Physics). "Not even a six-shooter would do it. We need lots of BBs, a palette of solutions."

In the following pages, you will meet five Berkeley Engineering faculty working to find energy in new places and reduce our collective carbon footprint. These are only a few of the Berkeley researchers dedicated to creating the technologies, the machines both large and small and the infrastructures that will make our future green.

DAVID PESCOVITZ (david@pesco.net) is coeditor of *BoingBoing.net*, a research affiliate with the Institute for the Future, and editor-at-large of *MAKE: Magazine*.

W

hen given a choice—paper or plastic, cloth diapers or disposables, garbage can or recycling bin—most of us do what we think is greenest. The problem is, we’re often wrong.

“We make emotional decisions, but often there’s no scientific proof to back things up,” says Arpad Horvath, professor of civil and environmental engineering. For several years Horvath has focused on developing systematic methods to assess the environmental impact of our industrial processes, consumer goods and services and beyond.

“When people want to do the right thing for the environment, we should be able to give them the correct information to make informed choices,” he says.

With his team in the Consortium on Green Design and Manufacturing, Horvath analyzes every environmentally signifi-

cant process surrounding a product or service. They measure each drop of energy consumed, every raw material processed and any terrestrial or marine ecosystem impacted by the manufacture and use of that product, even unto death (when, ideally, it is reborn through reuse or recycling).

“And nearly every sector of our economy—mining, manufacturing and services—supplies to the building industry.” To tease out these myriad factors, Horvath is using techniques like economic input–output analysis, a model traditionally used to forecast changes in the economy. This approach maps quite well to the supply chain, Horvath explains, helping identify the number of suppliers, their contributions to a particular product or service and the environmental impact of each link in the chain.

The energy that goes into a building’s construction and use is only part of the story. Builders must consider health hazards such as fine dust blowing from the construction site or operational issues like maintenance, cleaning and renovations, to name just a few.

“We’re also looking at the end of a building’s life,” he adds. “Demolishing it and hauling the debris to the landfill seems



ENVIRONMENTAL FOOTPRINTS: SUSTAINABILITY BY THE NUMBERS

Arpad Horvath • *civil and environmental engineering*

The CITRIS headquarters construction project is using concrete with a high volume of coal fly ash, reducing the need for portland



cement, which releases huge amounts of CO₂ when manufactured. Civil and environmental engineer Arpad Horvath is devising systems builders can use to reduce energy consumption and emissions in all stages of new construction.

cant process surrounding a product or service. They measure each drop of energy consumed, every raw material processed and any terrestrial or marine ecosystem impacted by the manufacture and use of that product, even unto death (when, ideally, it is reborn through reuse or recycling).

In a 2004 study, for example, Horvath’s assessment revealed that reading the *New York Times* wirelessly on a PDA instead of having the paper delivered to your door requires consumption of about 140 times less carbon dioxide and 26 to 67 times less water. Now he is bringing his research to bear on the building industry, examining a building’s sustainability in the context of the entire supply chain behind its construction, operation, maintenance and end of life.

“Besides transportation and electricity generation, buildings are the single greatest consumers of energy and other resources,” he

wasteful. Can we do better?”

But Horvath is a researcher, not a builder. His mission is to collect the data and spread awareness that the environmental footprint of the things we make and the services we use goes far beyond our immediate field of view. Horvath also spearheaded and is directing a new training program, the Engineering and Business for Sustainability Certificate Program, launching this year, to educate young engineers about the importance of environmental impacts and other sustainable engineering practices.

“All we can hope is that, once we can provide the data, people will make their own informed decisions,” Horvath says. “You can’t argue with the numbers.”

Almost all the world's power, roughly 10 trillion watts, is produced by burning fossil fuels and running engines based on heat. For every watt of power generated, one and a half watts are dumped as waste heat. It's a law of thermodynamics.

"Can we extract some of the juice from that waste heat?" asks mechanical engineering professor Arun Majumdar. He and his colleagues are working at the nanoscale to build super-efficient devices that directly convert heat into electricity. Their research could some day lead to hybrid automobiles that generate electricity from the radiator to charge their batteries, or homes powered by extracting energy from their walls or the ground they stand on.

"When you generate 10 trillion watts of power, you're wasting a staggering 15 trillion watts," Majumdar says. "Extracting even a fraction of that would amount to huge fuel savings and reductions

meter or 100,000 times smaller than the diameter of a human hair.

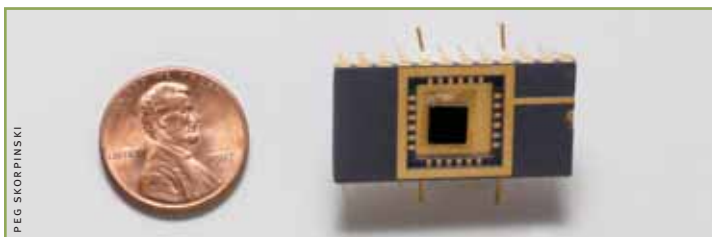
The researchers used a custom scanning-tunneling microscope whose tip, consisting of a single gold atom, was positioned above an electrically heated gold surface. The two materials were kept apart with an organic molecule trapped between them. A thermoelectric voltage was then detected and measured across the junctions between the gold and the organic molecule.

The experiment represented the first time scientists had ever measured the Seebeck effect in inexpensive organic materials. Besides cost, Majumdar explains, they also benefit by being able to use time-tested organic chemistry methods to process the materials and fine-tune their thermoelectric properties.

Majumdar also runs a thermoelectrics program at Berkeley Lab, where he and colleagues Peidong Yang (chemistry), Ramesh

TINY GENERATORS: RECAPTURING WASTE HEAT

Arun Majumdar • *mechanical engineering*



PEG SKORPINSKI

The dark semiconductor film at the center of this tiny generator is made of a conducting oxide that has the remarkable property of being able to convert heat to electricity with high efficiency. Mechanical engineer Arun Majumdar and colleagues at Berkeley Engineering and Lawrence Berkeley Lab are developing such devices in order to conserve even a small amount of the heat wasted when generating electricity.



in carbon dioxide emissions."

The idea of converting waste heat into electricity isn't new. Thermoelectricity, the branch of thermodynamics that governs the conversion of heat to electric power, exploits a physics phenomenon called the Seebeck effect, which occurs when two dissimilar materials juxtaposed at different temperatures generate a voltage. The problem is that the process isn't very efficient, and thermoelectric generators require costly semiconducting materials that are impractical for large-scale use.

Majumdar and chemical engineer Rachel Segalman, both researchers at Berkeley Lab, recently demonstrated the Seebeck effect using cheaper and more abundant organic molecules like benzenedithiol. The trick was to think small, at the nanoscale, where objects are measured in nanometers, that is, one-billionth of a

Ramamoorthy (materials science and physics) and Joel Moore (physics) are exploring other common materials, such as silicon and ceramics, for thermoelectric applications. The goal is to create a scalable technology that is either low-cost or highly efficient, preferably both. Besides many urban applications, such devices could bring electricity to rural villages in developing countries. A thermoelectric sheet wrapped around a cooking stove, for example, could generate 10 watts of power, enough to keep a reading lamp burning all evening.

"It's easy to burn something, but it's not always easy to generate electricity from that burning," Majumdar says. "You can't have a gas turbine in every home, but this could be a way for individual families to efficiently produce electricity for their own household."

9

he next time you're stuck in rush-hour gridlock, try to imagine traffic in China, where automobile ownership is growing at the astounding rate of 80 percent annually. In just three years, China will have more cars on its roads than the United States. To help keep that growth sustainable, researchers at UC Berkeley's Institute of Transportation Studies (ITS) are designing an urban transportation system that could curb the need for cars in Chengdu, China, and similar developing cities without sophisticated mass transit systems.

"The Chinese government is concerned with two issues: air quality as impacted by vehicle emissions and energy consumption," says Samer Madanat, Xenel Professor of Civil and Environmental Engineering and ITS director. "China wants to depend as little as possible on foreign energy sources."

The central government has mandated that public transit

"We are using a new paradigm developed at Berkeley's Volvo Center of Excellence," Madanat says. "We view the city as a system of reservoirs and simply try to understand aggregated inflows and outflows from the reservoirs."

When ITS researcher and Volvo Center assistant director Yuwei Li visited Chengdu last year, the city was already planning to modernize its public transportation system. Their design included seven subway lines radiating like spokes from the downtown hub and one additional line circling around the core. The problem is that most commuters live in neighborhoods far away from the core and, the farther from the core, the longer the walk between lines.

The Berkeley researchers proposed augmenting the subway with radial bus rapid transit (BRT) lines. Meanwhile, local buses traversing each neighborhood will shuttle people to the BRT and



CURB YOUR CAR: TRANSFORMING PUBLIC TRANSIT

Samer Madanat • *civil and environmental engineering*

Civil engineer Samer Madanat is working on a transit system that will seamlessly integrate several modes of public transportation in Chengdu, China, to reduce the number of motor scooters and taxis, now the primary modes of powered transportation. The researchers are already considering how to bring similar transit planning methods to other developing cities like Xian, China; Santiago, Chile; and Nairobi, Kenya.



account for 30 percent of travel in larger cities within the next 10 years. Chengdu, the capital of Sichuan province with a population of 5 million, is now at about half that. Its primary modes of powered transportation are taxis and electric- or gasoline-powered motorbikes, which are heavy polluters during their production as well as their operation.

In developing regions like China, the information generally used for urban transit design—data on commuter origins and destinations, routes and mode of transport, which are loaded into mathematical representations of the transportation system to make predictions and simulate changes—simply doesn't exist. Instead, Madanat and his colleague, professor of civil and environmental engineering Michael Cassidy, are taking a high-altitude view.

subway lines. Those feeder buses will be time-synchronized with the rest of the system so that passengers arriving at the station need only wait a minute or two for a BRT or a subway train.

As part of Berkeley's Urban Sustainability Initiative, supported by a \$1.1 million grant from the Gordon and Betty Moore Foundation, Madanat, Cassidy and Li spearheaded a partnership with Chengdu and Southwest Jiaotong University (SWJTU). The collaboration includes a research exchange program with a SWJTU professor visiting Berkeley for one semester.

"Our approach is to develop solutions that combine technology and policy to improve the sustainability of transportation in cities around the world," Madanat says.

A coal-fired power plant capable of producing 1,000 megawatts of electricity burns at least 7.3 million kilograms of coal and releases upwards of 24 million kilograms of carbon dioxide into the atmosphere per day. The equivalent nuclear fission plant consumes just 3.2 kilograms of uranium per day and emits no carbon dioxide.

While nuclear power is alive and well in Europe (France derives 77 percent of its electricity from nuclear plants, and Belgium 58 percent), only 20 percent of U.S. electricity is nuclear. Most of our 104 plants went online in the 1970s, before the 1979 nuclear accident at Three Mile Island stopped the U.S. nuclear power industry cold.

“This country has neglected nuclear energy for the last 30 years,” says Jasmina Vujic, professor and chair of Berkeley’s Nuclear Engineering Department. “But if the United States wants to have

in remote locations and crank out 100 to 300 megawatts for 15 to 20 years without refueling. Some serve as their own shipping crates for return to the factory, where the fuel is reprocessed for another battery.

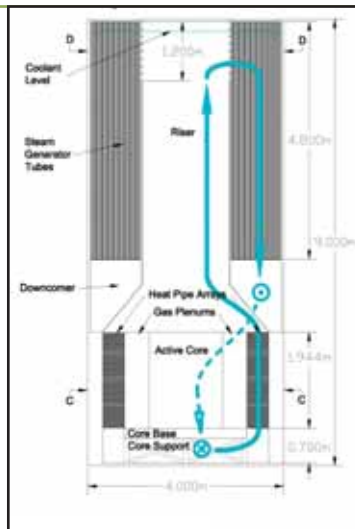
“These would be especially useful in developing regions without a central electricity grid or advanced infrastructure, where we could provide cheap nuclear energy but also limit access to the fissile fuel,” Vujic says.

The heat pipe encapsulated nuclear heat source, for example, is a new innovation developed with graduate students Max Fratoni, Lance Kim, Sara Mattafirri and Robert Petroski. The students sourced new materials and modified a cooling system design borrowed from spacecraft reactors to keep the device small and lightweight.

NUCLEAR RENAISSANCE: REVIVING GREENHOUSE-GAS-NEUTRAL POWER

Jasmina Vujic • *nuclear engineering*

This design for a new nuclear reactor or “nuclear battery” won an award last year for four graduate students working with Jasmina Vujic and her colleague Ehud Greenspan of nuclear engineering. Known as the heat pipe encapsulated nuclear heat source, the fuel module acts as its own shipping crate to be returned to the factory for recycling after 15 to 20 years, addressing both the problems of nuclear waste and security.



energy independence and reduce global climate change, it’s time for a nuclear renaissance.”

While nuclear plants do not emit carbon dioxide, they do produce radioactive waste. At today’s U.S. plants, waste is stored in spent fuel pools or casks nearby; but Vujic and colleagues, including Professors Ehud Greenspan and Per Peterson, are designing reactors that are far safer and more efficient at handling waste.

“Sustainable nuclear energy means you have to recycle the spent fuel, destroy most of what can’t be reprocessed and store very small amounts of short-lived fission products underground. With this new approach, the U.S. will need only one repository for high-level nuclear waste for the next 100 or so years,” Vujic says.

The newest designs, called “nuclear batteries” or small-footprint nuclear reactors, are self-contained power plants that can be installed

Spent fuel is not the only waste product of nuclear reactors; the other is heat, which can be harnessed for other uses. “With some of the new reactor designs, waste heat could be distributed for district heating of homes or used for efficient production of hydrogen,” Vujic says.

Optimistic that a nuclear revival is at hand, Vujic cites support from the current U.S. administration and a 2001 Field Poll in which 59 percent of Californians supported construction of new nuclear power plants. Last time the question was asked, in 1984, only 33 percent supported new plants.

“The moment you try to turn on your light and there is no power, you have a different perspective,” Vujic says.

W

e were lucky this past summer. There were some scorchers, but nothing like the heat wave of 2006, in which 110-plus-degree temperatures in some Bay Area cities lasted four consecutive days, leaving 57,000 residents without power. As summer temperatures rise and more air conditioners power on, the risk of outages and brownouts increases. Utility bills spike. Even worse, we push the limits of existing power plants and build new ones, all the while spewing greenhouse gases into the atmosphere.

“Wouldn’t it be great if your meter could receive information about when the price is lowest to run your appliances and air conditioning?” asks mechanical engineering professor Paul Wright, acting director of the Center for Information Technology Research in the Interest of Society (CITRIS). To increase home energy efficiency and cut the cost of keeping cool, Wright and colleagues are

prices shift, they are transmitted wirelessly from the utility company to the home’s smart meter.

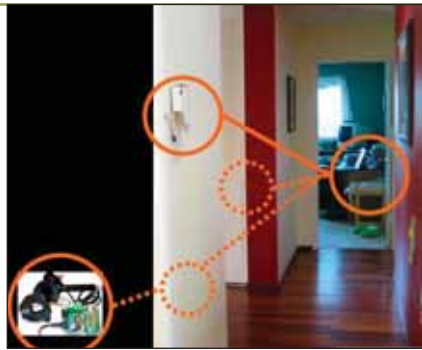
The resident will simply program temperature preferences on a user-friendly thermostat. Employing control algorithms, the system then sets the air conditioner to match the desired profile as temperatures shift throughout the day.

During the summers of 2006 and 2007, engineering students led by Professor David Auslander and postdoc researcher Nathan Ota teamed with Professor Ed Arens and students in the Department of Architecture to test the technology in a handful of Bay Area homes. Collaborating with the California Energy Commission (CEC), the Public Utilities Commission and the state’s largest utility companies, the students demonstrated that you can save energy without making people uncomfortable.

GET SMART: NEW THERMOSTAT FOR COMFORT AND SAVINGS

Paul Wright • *mechanical engineering*

Mechanical engineer Paul Wright is working on a “disaggregated” thermostat, which is exploded into its various parts and scattered about to keep the home cool without having to power on the air conditioner at peak times. The device was tested in several Bay Area homes this year by engineering and architecture students, who demonstrated that it can keep temperatures comfortable and save energy at the same time.



COURTESY NATHAN OTA




bringing electronic brains into our home’s electrical systems, the next generation of “smart” meters and thermostats.

The approach, known as demand–response technology, uses the smart dust sensors originally developed at Berkeley by Kris Pister and colleagues Dick White, David Culler and Jan Rabaey, all from the Department of Electrical Engineering and Computer Sciences. Today, these devices are about the size of three 25-cent coins and contain a small computer, radio and sensors.

In this application, the sensors are used to monitor temperatures in various rooms of your home or apartment and relay data to a networked thermostat. Sensors coupled to electrical circuits in breaker boxes monitor power consumed by other appliances and indicate the cost of running, say, the washing machine at 2 p.m. on a sweltering day, when energy is most expensive. As energy

Now the Berkeley researchers are collaborating with industry to reduce the size and cost of the sensors, which currently run on replaceable batteries. Graduate student Lindsay Miller is working on an “energy scavenging” approach that would convert ambient vibration of structural components like air-conditioning ducts into electricity.

Policy and pricing will play as critical a role as technology. The CEC’s goal is to equip every California home with new meters within 10 years, and the researchers hope their technology will be inside those devices. According to an Electric Power Research Institute report, the technology could eliminate the state’s need for five to ten new power plants over the next decade.

“We won’t need to produce as much electricity, because we’ll be using it more sensibly,” Wright says. 



An Intentional Life

Software engineer Charles Simonyi (B.S.'72 Eng Math) scores success with space sojourn

● BY PATTI MEAGHER

He is no stranger to bold ventures. At age 17, he left his family behind in communist Hungary, with no intention of returning, to pursue his dream of becoming a computer programmer. When government authorities discovered the defection, it was his father who took the punishment by having his electrical engineering professorship stripped from him. The boy would not see his family again until 1989, when the Iron Curtain fell.

The Russian Soyuz spacecraft carrying space tourist Charles Simonyi approaches the International Space Station on April 9, 2007.

“I am convinced,” Simonyi says, “that space will be accessible to anyone, without much more preparation than what we do today for an airline flight.”

That boy was software engineer Charles Simonyi (B.S.’72 Eng Math), now age 59 and a U.S. citizen since 1980. Best known as the “father of Microsoft Word” and less well known as the companion of Martha Stewart, his latest claim to fame is his most recent bold venture, the 14-day, 5.5-million-mile voyage he took last April with Expedition 15 to the International Space Station (ISS). He became only the fifth civilian space tourist in history and, in the process, added zero-gravity existence and the Russian language to his eclectic list of achievements.

An entrepreneur and philanthropist, Simonyi is also an aviator, yachtsman, collector of modern art and music lover. Ranked 891 on *Forbes.com*’s list of world billionaires, he made his fortune at Microsoft, which he joined in its startup phase and left in 2002 to found Intentional Software. His 20,000-square-foot lakeside home in Medina, Washington—which features an art gallery, a glass-enclosed swimming pool and a heliport—cost him \$10 million to build. His space adventure cost him twice that amount, \$20 million, and he says it was worth every penny.

Simonyi has been fascinated with aviation and space for as long as he has been tinkering with computers. He was selected Hungary’s Junior Astronaut at age 13, winning a trip to Moscow and the chance to meet one of Russia’s first cosmonauts, Pavel Popovich. Currently licensed to fly multi-engine aircraft, he has logged more than 2,000 hours of flying time.

To share his experience in space, Simonyi created an elaborate website that includes images, video, a section for kids and a blog chronicling his training and space expedition. Through www.charlesinspace.com, Simonyi has unabashedly invited the world into his life on a first-name basis and probably done more than anyone since Gene Roddenberry (creator of NBC-TV’s *Star Trek*) or Philip Kaufman (screenwriter/director of *The Right Stuff*) to advance the popularity of space. The difference is that Simonyi has advanced our understanding of the *real* stuff, the details of what actually goes into training for and executing manned space travel.

His goal for the site, he says, is “to provide a civilian’s perspective on current space travel, making it as tangible as possible to as many people as possible.” Through an interactive feature called “Ask Charles,” anyone can submit questions about everything from black holes, to what space sounds like, to how he brushed his teeth and went to the toilet aboard the ISS. The site has received millions of queries, and Simonyi has personally answered many of them. He believes that humans will one day live and travel comfortably in space.



COURTESY NASA

Crew members with Berkeley Engineering alumnus Charles Simonyi (front center) on the International Space Station last April included (clockwise, from left) Oleg Kotov, Michael Lopez-Alegria, Mikhail Tyurin, Sunita Williams and Fyodor Yurchikhin.

“I am convinced that, in the long run, space will be accessible to practically anyone without much more preparation than what we do today for an airline flight,” Simonyi says. “However, we are still very far from that point. The spacecraft and space station are built for trained personnel.”

As a civilian, Simonyi trained intensively for six months, primarily in Star City, Russia, outside Moscow, to prepare for the rigors of space and his assigned tasks. He was a willing pupil, training in operations, survival skills and life-support systems, to name just a few. He was fitted for and trained in his custom-made spacesuit (which he got to keep) and learned how to navigate in three environments: the Russian Soyuz craft that transports crews to and from the ISS, and both the Russian-built and U.S.-built wings of the ISS. He spent about 25 percent of his training time learning Russian, “one of the great benefits” of his preparations.

Of course, he also had to learn how to live and function in weightlessness, which he describes with evident delight as “lots of fun,” similar to flying, floating or scuba diving. “Eating is surprisingly easy,” he writes. “If I drop a little piece, it will just float in the



COURTESY CHARLES SIMONYI

FOUND IN SPACE: *Software engineer Charles Simonyi, a native of Hungary, trained for six months to become the world's fifth civilian space tourist.*

air and I can catch it with my mouth. . . . Another fun thing is to observe what happens to water in weightlessness. It turns into wonderful silvery balls that float about.”

The space-tour package, organized by Virginia-based Space Adventures, Ltd., coordinates civilian space travel with the twice-yearly Soyuz trips to the ISS. Simonyi took off April 7 from the same concrete pad in Kazakhstan used to launch Sputnik 1 in 1957 and the first man in space, Yuri Gagarin, in 1961. For the two-day trip to the space station, he joined two professional astronauts who were on their way up and returned April 20 with two who were coming home. During his 14 days in space he saw 213 sunsets and countless spectacular views, all while traveling at an average speed of 17,236 mph. With their clocks set to Greenwich Mean Time (GMT), the crew’s daily routine began in the evening and ended in the morning, a ritual that Simonyi, with his software programmer’s problem-solving mind, found both amusing and frustrating.

“Every day during my stay here,” he posted to his blog on April 9, “we will be going to bed at 10:30 a.m. and waking up at 18:30 p.m. (GMT). Why can’t we just admit that we are in a time zone different from Greenwich, for example, in a time zone where it is 9 or 10 in the evening right now when we go to bed? I was told the software could not handle it and that it does not make sense for the space station to be in a time zone anyway. . . .!” Nevertheless, he slept well and felt remarkably calm and comfortable throughout the entire journey, even saying he felt “at home” in space.

Simonyi approached his adventure with the confidence, pragmatism and intention that have defined his life and career choices ever since he first resolved to leave Hungary. He had by then already learned the basics of computing on an obsolete vacuum-tube-powered Soviet mainframe and secured himself an invitation to

work at Regnecentralen in Copenhagen. Then he landed at Berkeley Engineering, where, he says, he was “skimming the bottom of the expulsion curve” due to immigration and financial troubles. He hooked up with Butler Lampson and joined Berkeley Computer Corporation (see *Project Genie*, p. 22), then Xerox Palo Alto Research Center (PARC), where he built Bravo, the world’s first WYSIWYG (“what you see is what you get”) word processor. When he started working for Xerox PARC in 1972, he hadn’t completed his Berkeley education; but by the time he left in 1980, he had his bachelor’s degree and a Stanford Ph.D. in computer science. As he describes his transition to Microsoft, it sounds like he was the one doing the hiring.

“When I decided that I wanted to leave Xerox and seek employment in the fledgling personal computer industry,” Simonyi says, “Bob Metcalfe [the inventor of Ethernet] helped me draw up a list of the key players. Microsoft was first on my list, and I was so impressed by Bill Gates’s vision that I did not interview with any of the others.”

Gates calls Simonyi “one of the great programmers of all time.” At Microsoft, he developed Word and Excel, two of the world’s most widely used software applications. He left in 2002 to found his own company, Intentional Software, based in Bellevue, Washington. There he is developing a bold new approach to programming that creates generic tools, whether for inventory tracking or missile guidance, that the end user can modify to guide the software’s future evolution.

After investing so much time in his space sojourn, Simonyi was anxious to get back to his company, where he says he is working harder than ever. His musings in space, however, leave no doubt that he will be quick to seize the next bold venture that comes his way. **f**



Project Genie researchers (left to right) Professor Paul Morton, Mel Pirtle and Wayne Lichtenberger at UC Berkeley with the SDS 930, the computer they and others on their research team modified to be the first commercially successful timesharing system. The project was one of the seminal pioneering efforts that would transform the computer from elite technology—exclusively serving U.S. industry and the military—to personal computer. With the SDS in the background, Pirtle sits in front of the machine's operator console.

PROJECT GENIE:

Berkeley's piece of the computer revolution

BY PAUL SPINRAD AND PATTI MEAGHER

Mid-1960s computers were enormous, room-filling machines that only major corporations, government agencies and universities could afford. Prohibitively expensive, they functioned like today's programmable-memory calculators: no words, no images, no sounds or music, no networking, just number crunching. IBM manufactured most of these mainframes to run the accounting systems and print the paychecks of the world's corporations.

By today's standards, these machines weren't capable of much, but few of us appreciate how difficult they were to operate. Not only did they lack graphical user interfaces but, more fundamentally, computers were far too valuable to allow just anyone to sit at and work on. Computing was done by "batch processing," which is like corresponding with the machine remotely via postal mail. The programmer submitted a "job" of coded punch cards into a queue, the jobs were fed through the computer by a lab-coated technician and the programmer received the resulting printout the next day.

Even in research circles at the relatively freewheeling labs and universities, computer time was a limited resource, like telescope time for astronomers or beam time for high-energy physicists. This meant that politics and position could trump scientific merit when it came to allotting researchers computer access for their experiments.

But a growing underground of computer scientists envisioned a different type of computing experience, a creative human-machine dialogue in which the computer acted as a true extension of the brain. Innovations were under way at Berkeley, MIT, Dartmouth, Stanford and Manchester University that helped move computing into a golden age of progress and democratization that helped liberate its bottled-up magic, first by re-engineering mainframe computers to make them more accessible, then by inventing the personal computer, a tool that anyone could use. Among these was Project Genie, a research effort at UC Berkeley.

"Projects like Genie have both a technical piece and a people piece," says David Patterson, Berkeley professor of electrical engineering and computer sciences, whose textbook *Computer Organization and Design* provides historical perspectives on milestones in the evolution of computing. "If you look over the years at the projects Berkeley is famous for, they share this component of a group of talented grad students and a set of faculty working together to build things—as opposed to making theoretical con-

tributions—to create an exciting new prototype that has an effect on industry."

The timesharing alternative

In 1963, under the visionary direction of J.C.R. Licklider, the U.S. Department of Defense Advanced Research Projects Administration (ARPA, now known as DARPA) began funding Project Genie at Berkeley's Department of Electrical Engineering, under principal investigators David Evans and Harry Huskey. The project had a fairly open-ended objective of improving computer technology for the military.

"Back then, the DARPA people were just sprinkling money around to schools where they thought they'd get a return," says Wayne Lichtenberger, a new visiting assistant professor at the time, to whom Evans passed direction of Project Genie just months after it began. Genie's primary researcher, graduate student Mel Pirtle, was focusing on building a timesharing system, an interactive alternative to painfully slow batch mode that dramatically reduced the per-user cost of computing. Multiple users could connect to one computer simultaneously, and the operating system would alternate processes so quickly that users felt they had their own machines.

Project Genie continued to attract talent, like grad student Butler Lampson and sophomore Peter Deutsch, who complemented Pirtle's hardware orientation with system design and programming skills. Later, grad students Ken Thompson and Chuck Thacker came on board. The team built its system on the SDS 930, at \$73,000 a relatively low-cost minicomputer manufactured by Scientific Data Systems, whose computers were used by science and engineering labs like Jet Propulsion Laboratory and Brookhaven National Laboratory to guide satellites and run experiments, a far cry from printing paychecks and tracking accounts receivable.

The SDS 930 arrived at Berkeley in September 1964, and the team began by writing a modified version of its assembler and linker, the programs that facilitate all subsequent programming and development. The machine had no operating system of its own.

“We chose the machine partly because it did not carry the immense baggage of an established operating system,” says Lichtenberger. “We had to write the systems software from scratch, which allowed all of it to be done by people who had the same philosophy and general goal.” In the next three years they developed the bulk of the software suite, including the timesharing system, the line-oriented text editor QED, the now-standard fork operation to create new processes, command-line completion, state-restoring crash recovery and many other innovative features.

Genie goes commercial

“Project Genie was the earliest useful realization of timesharing on a minicomputer,” says Robert Spinrad, Xerox vice president for technology strategy at the time, who later became director of Xerox Palo Alto Research Center, better known as Xerox PARC. “Their computer differed from earlier systems in that those were built on large, mainframe computers. This system was attractive to SDS because they made minicomputers and had been thinking of getting into the timesharing business.”

SDS manufactured the SDS 940—basically the SDS 930 with the Genie modifications made more bulletproof and at a much higher price—which became the most successful computer in SDS history, earning \$40 million in sales and a devoted following among scientists and researchers worldwide. It ushered in the new business of commercial timesharing and was the initial hardware base for two major timesharing service companies.

“One of the great triumphs of Project Genie is that they used a smallish machine that people could afford,” says Jim Mitchell, now a VP at Sun Microsystems who worked at Xerox PARC in its early years. “There were a number of 940s around, so that created openings for other people to do other projects on them, like the Engelbart NLS, which he developed on a 940.” The NLS was the On-Line System, developed in 1968 by Douglas Engelbart (M.S.’53, Ph.D.’55 EECS), which featured the first graphical mouse- and windows-based interface.

The Project Genie team, brimming with ideas for even greater innovation, decided to leave Berkeley in 1968 to start their own company, Berkeley Computer Corporation (BCC). With Pirtle as president and \$4 million in venture funding, some of it from the UC Regents, BCC assembled the best possible technical team, drawing mostly from Berkeley, MIT, Jet Propulsion Lab and SDS. Within two years, the company had created a prototype machine featuring numerous compilers and programming languages, an SDS 940 emulator and even remote-entry batch processing. But it was 1970, the economy was in a recession and, worse yet, BCC was light on sales and marketing talent.

“Mel Pirtle was a genius when it came to computers, but he could not really run a business,” says Lotfi Zadeh, professor emeritus of electrical engineering and computer sciences and department chair from 1963 to 1968. “Tragically, BCC went bankrupt.”

Birth of the personal computer

As BCC was failing, other changes were brewing. Xerox Corporation decided to enter the business computing market, purchased SDS, renaming it Xerox Data Systems, and founded its Palo Alto Research Center (PARC). ARPA’s Bob Taylor, who had overseen Project Genie for the federal agency, was hired to head PARC’s Computer Science Laboratory; he hired 20 employees, 11 of them from BCC, including Lampson, Thacker and Deutsch. Some of PARC’s other researchers who had been fans of the SDS 940 now found themselves working alongside its creators.

“There’s a direct line from this group of Genie/BCC people to the personal computer.”

—EECS professor David Patterson




The Xerox Alto—built by Project Genie alumni Butler Lampson, Peter Deutsch, Chuck Thacker and colleagues at Xerox PARC in the early 1970s—is considered by many to be the first personal computer. The air-conditioner-sized unit under the desk contains the computer's printed circuit boards.

“When BCC folded, Xerox gave them a home at PARC, a brilliant move on Xerox’s part and an excellent move for the Berkeley guys,” Spinrad says.

Lampson, Deutsch, Thacker and company had many achievements at Xerox PARC, including the Multiple Access Xerox Computer, according to Lampson “one of the first systems with semiconductor memory.” But the Berkeley guys soon realized they could build a completely different type of machine, a single-user computer with a three-button mouse, keyboard, graphical user interface mode of operation and page-sized display. This was the Alto, a landmark in technological history that many consider the first personal computer, even though it was never sold to the public.

“Xerox was unsuccessful in making a commercial version of the Alto,” Berkeley’s David Patterson says. “But when Steve Jobs saw the Alto, he was inspired to create the Macintosh. Then, when

Jobs showed the windows and mouse interface of the Mac to Gates, that inspired Gates to create the Microsoft Windows operating system. There’s a direct line from this extraordinarily talented group of Genie/BCC people to the personal computer.”

Lampson and Thacker championed the new Alto for PARC internal use in 1972. Timesharing had been the first step in democratizing computing, and this was the next: personal computers communicating in entirely new ways, through e-mail and word processing, with graphical user interfaces, networked together via Ethernet and served by laser printers, all of which were developed at PARC during the next decade. The old Project Genie team had uncorked another magic bottle. As a result, interactive technology is now everywhere, and your wish is its command. 

PAUL SPINRAD, a San Francisco-based writer and editor, remembers visiting SDS and Xerox PARC with his dad, Robert, who worked at both.

Life after Project Genie

Following the 1968 exodus to Berkeley Computer Corporation (BCC), Project Genie alumni continued to make pioneering contributions to the science of computing. This is only a partial list of the major players and their subsequent claims to fame.



L. Peter Deutsch (Ph.D.’73 CS) went on to Xerox PARC and Sun Microsystems, founded Aladdin Enterprises and is now a composer. He is a fellow of the Association for Computing Machinery (ACM), corecipient of the ACM Software System Award and a distinguished alumnus of Berkeley’s computer science program.



Butler Lampson (Ph.D.’67 EECS) was a founding member of Xerox PARC in 1970, where he was instrumental in developing the Alto, laser printer design, the first WYSIWYG formatting program and Ethernet. Now working for Microsoft Research and as an adjunct professor at MIT, he is a recipient of both the ACM Turing Award and the Charles Stark Draper Prize.



Wayne Lichtenberger joined the faculty at the University of Hawaii from 1971 to 1981, then left academics for corporate positions at Hewlett-Packard, Ungermann-Bass, Inc. and Cisco Systems. He is now working full time at XKL, LLC, in Redmond, Washington, which he helped start.



Melvin Pirtle (B.S.’61, M.S.’62, Ph.D.’67) was the impetus behind the BCC and served as its president. He then took on the ILLIAC IV project for DARPA at NASA/Ames in Mountain View. He spent two years sailing the Pacific, then began consulting with various companies. He was living and working in Las Vegas when he died of a heart attack in 2003.



Charles Thacker (B.A.’67 Physics) moved on to Xerox PARC and worked on the Alto, Ethernet and the first laser printer, among other technologies. He was a founder of the Systems Research Center at Digital Equipment Corporation and joined Microsoft Research in 1997. He is a fellow of the ACM and recipient of the Charles Stark Draper Prize.



Ken Thompson (B.S.’65, M.S.’66 EE) worked on the MULTICS operating system and joined Bell Labs where, in 1969, he co-created the UNIX operating system. He also co-created hardware and software for the chess computer Belle and now works at Google. He is a recipient of both the Turing Award and the National Medal of Technology.

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2000s

JAMES M. ALPERT (B.S.'04 EECS)



of Alexandria, Virginia, is an associate attorney with Birch, Stewart, Kolasch & Birch, LLP, an intellectual

property law firm located in Falls Church. He previously worked for the U.S. Patent & Trademark Office.

TOBIN BASTA (M.S.'03 CEE)



recently joined Q&D Construction of Reno, Nevada, as project manager on the Ritz-Carlton Highlands

Lodge, a 173-room, \$200,000,000 project featuring a six-story ski resort and spa. At the time of his report, Basta's team had installed the 110-foot concrete core, footings and walls.

AUTUMN M. FELD (M.S.'01, Ph.D.'06 MSE) is a postdoc at the University of Leoben in Austria.

WESLEY D. FREY (B.S.'01 NE) is working on a Ph.D. in radiation health physics at Oregon State University. He creates computer algorithms that allow detectors to record and analyze signals digitally, which could ultimately facilitate screening for plutonium-based nuclear weapons.

FRANK D. GENNARI (M.S.'01, Ph.D.'04 EECS) is founder and chief technology officer of the design for manufacturability startup CommandCAD, recently purchased by Cadence Design Systems. Electrical engineering and computer

sciences professor Kurt Keutzer is technical advisor to the company.

ILAN GUR (B.S.'02, M.S.'03, Ph.D.'06 MSE) is helping launch a



startup called Seo with colleagues from UC Berkeley. The company develops novel materials for the next generation of rechargeable batteries, and Gur—in addition to contributing to the technological effort—is managing the early stages of business development. “I’m having a blast so far,” he writes. “While I’m sad to drift away from photovoltaics, I’m thrilled to have this opportunity to work with a great team and have an impact on energy storage, the proverbial yin to my yang.” igur@berkeley.edu

CAROL HU (B.S.'02 EECS) worked for the national law and consulting firm Manatt, Phelps & Phillips, LLP, as a 2007 summer associate in the Los Angeles office. Hu is in the 2008 class at UCLA's School of Law, where she is articles editor on the *Entertainment Law Review* and a member of the Asian/Pacific Islander Law Students Association. She also volunteers at El Centro Legal Clinic and spent last summer at Hogan & Hartson, LLP. Before law school, Hu worked as a senior applications engineer for Oracle.

HOLD YER HORSES

Polo has gone high tech. The game originated in ancient Persia as a way of training cavalry units on horseback. Since then spinoffs have been played in swimming pools and even on camels and yaks. Now they're playing it on Segways.

Steve Wozniak (B.S.'86 EECS), executive vice president of Acquicor Technology and co-creator of Apple Computers in 1976, is a big fan of the fledgling sport. In September, his team, the Silicon Valley Aftershocks, won the 2007 Woz Challenge Cup, the second official international tournament for Segway polo.

“I was one of the first consumers to get a Segway in 2002,” says Wozniak, familiarly known as Woz. “I loved it so much I bought another, and another. I have about 10 now.” The game originated in 2004 and is played in teams of five. Players can travel up to 12 miles per hour, so helmets are required and the mallets are padded for safety.

“Segway polo rules are like horse polo's with a few modifications, like the ones they've made up to stop me,” says Woz. “I learned to chip the ball over the defender's head; they made a rule that you can't score that way.”

The Segway personal transporter, an upright two-wheeled moving device powered by computers and sensors, went on the market in 2001 and sells for about \$5000. It was invented by Dean Kamen as an automobile substitute for short solo trips.—*Courtesy Corporate Board Member magazine*



Steve Wozniak (B.S.'86 EECS), in yellow shirt, plays Segway polo every other Sunday with his team, the Silicon Valley Aftershocks.

CALIFORNIA SANTA CLAUS

He lives in a snowy land and sports a full head of white hair and a round, ruddy nose. He has even been known to keep reindeer. No, it's not Mr. S. Claus, but Mr. J. Putnam Henck (B.S.'40 CE), 89, of Skyforest, California. And though he isn't Kris Kringle, he did reign over a Christmas-inspired theme park built on his family's forested homestead in the San Bernardino Mountains near Lake Arrowhead.

"I've been all over the world, and I can't think of a nicer place to be," Henck says of the 5,700-foot-elevation plot he's called home since 1923.

Henck's pioneering parents started the community's first school and fire department and ran water and electricity to the mountain. They thinned the forest to prevent fires. Young Putnam, the oldest of four and the only boy, helped with all the heavy lifting. He attended Cal when it came time for college, then landed a job building airbases in Central and South America. He rose from foreman to superintendent within a single year, a feat he credits to two things: his Berkeley degree and the skills he learned in Skyforest.

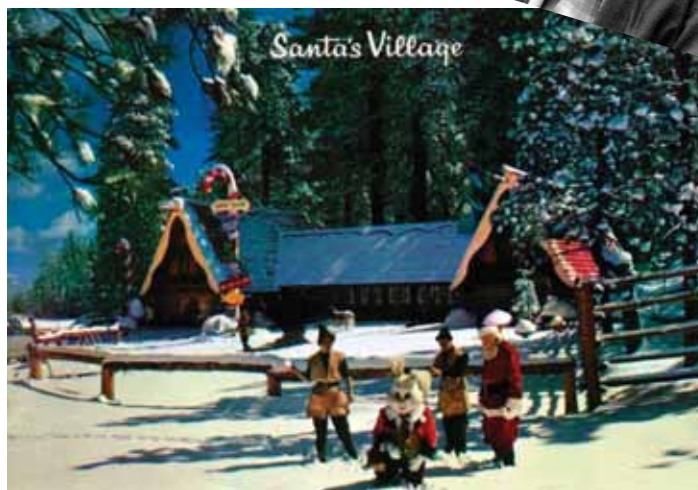
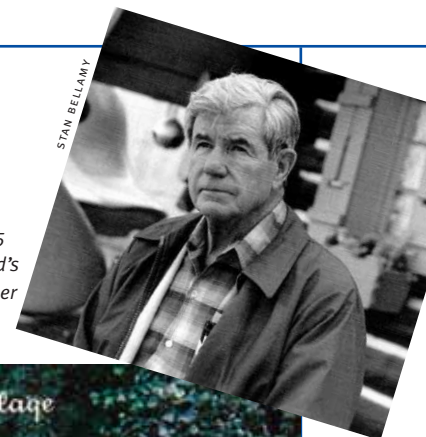
"Everybody asked why I got ahead so fast," Henck says. "It was because I had such a good work ethic from living up here in the mountains."

Henck spent most of World War II in a hospital bed with a broken leg sustained in a shipboard fall. He was probably the only Navy lieutenant promoted while lying flat on his back, he says. By the time he healed, the war was over, so he headed home to Skyforest to get his contractor's license and marry Pamela Wright, a Broadway actress and singer who had toured military bases with the USO.

When a group of investors leased a parcel of land from Henck's parents for the first in a small chain of theme parks to be called Santa's Village, they didn't have to look as far as the North Pole for a hardworking contractor. Putnam built the life-size gingerbread house, sleigh ride and snow-capped toyshop, readying the park for its opening on Memorial Day 1955, six weeks before Disneyland.

In the following decades, Henck oversaw hundreds of building projects in Southern California, and he and Pamela raised three children. But in 1980, they returned to Skyforest to resuscitate Santa's Village, which was failing under its current management. The family effort—which included 12-hour days with the Henck children taking tickets and running rides—brought

J. Putnam Henck (B.S.'40 CE) built and later managed Santa's Village, which opened in 1955 in Skyforest, California. He was Lake Arrowhead's Citizen of the Year in 2002 and the local chamber of commerce bears his name.



years of success. In 1999, they threw in the jingle bells, opting for some well-deserved rest.

Looking back, Henck says, only one job ever got the better of him. In 1996, around Christmas, all his hired Santas got sick on the same day. Henck had to don the red suit himself and belt out his best Ho Ho Ho.

"Playing Santa is hard work," he says. "The little kids have wet pants from sitting around in the snow. Three days of that was enough."

BY MEGAN MANSELL WILLIAMS

BASSAM TABBARA (M.S.'98, Ph.D.'00 EECS) of Sunnyvale, California, recently moved and changed jobs. He's now a senior research and development engineer at Synopsys in Mountain View, a leader in the electronic design automation industry.

KAREN TRUONG (B.S.'05 IEOR) works full time at IBM in Burlingame, California, and is pursuing a master's degree in industrial and system engineering at San Jose State University.

1990s

SCOTT ASHFORD (M.S.'86, Ph.D.'94 CE) was named director of Oregon State University's School of Civil and Construction Engineering

in May. The OSU alumnus and former UC San Diego Jacobs School of Engineering professor has eight years of industry experience. His research focuses on highways, seismic hazards and landslides. At OSU, he plans to expand graduate programs in civil engineering and construction engineering management and create a lab devoted to studying the relationship between buildings, foundations and soil.



CHRISTOPHER J. BLUME (M.S.'93 EE) of Chicago and fellow Berkeley alum **CESARE LOBASCIO** (M.S.'93 CE) cohosted a conference in June called Classmates Collaboration for the Advancement of Environmental Engineering Science. The pair gave a presentation at the meeting entitled "The Zero Discharge Environment: The Technological Heritage of the International Space Station and Future Challenges of Planetary Exploration." Blume is chairman of the Lake Michigan States Section of the Air & Waste Management Association. cblume@gaiatech.com

VICTOR K. CHU (Ph.D.'96 ME) of Milpitas, California, and his wife, Sheree Wu, cowrote the book *Angelic*

Force: A Modern Medium's Communication with the Spirit World, available



in English and Chinese, about their experience with an American trance medium. victor@doublelight.com

LEE E. CLEVELAND (B.S.'90 EE) of Santa Clara, California, is senior vice president of engineering at Sipex Corporation in Milpitas, where he employs numerous Cal grads. "Berkeley gave me a real

advantage in my career,” writes Cleveland, who travels the world for fun and has been to every continent except Antarctica.

ELI DARLAND (B.S.’97 ME) of Bellevue, Washington, is president of nightclub promotions company Rare Form Productions and chauffeur service company Rare Form Limousine.

JOHN F. DEWAR (M.S.’90 CE) was named a principal at the consulting firm Freese and Nichols, Inc. Dewar has two decades of design and management experience, 13 of them with Freese and Nichols. Earlier this year, he became a manager of the

transportation/infrastructure and structural groups at the company’s Fort Worth, Texas, office.

TUAN H. LE (B.S.’95, M.S.’97 EECS) is software architect for the Mountain View financial tracking startup Mint. “I love developing software that I would use myself,” he writes.

U. AYTUN OZTURK (B.S.’99 IEOR) was appointed assistant dean of business at Hawaii Pacific University and will continue



to teach in the MBA program as associate professor of quantitative methods. Ozturk’s research interests include applied stochastic optimization, combinatorial optimization, energy modeling and applications of optimization in health care.

ELLEN M. RATHJE (M.S.’94, Ph.D.’97 CE) received the 2006 Shah Innovation Prize from the Earthquake Engineering Research



Institute, a national nonprofit technical society. The award is given

to cutting-edge young professionals and academics for “creativity, innovation and entrepreneurial spirit” in the study of earthquake risk and management. Rathje is an associate professor of civil, architectural and environmental engineering at the University of Texas at Austin, where she studies seismic performance of structures, site responses, soil improvement methods and use of remote sensing to assess damage.

1980s

MARK B. CATLIN (M.S.’84 CE) of San Diego, California, got married in 1992 and helped start a medical device firm in 1999. “I had twins



COURTESY SHAHED AMANULLAH

Shahed Amanullah (B.S.’91 CEE) created a Muslim American news website following 9/11 and is now regularly consulted by the State Department and national media.

CEE ALUM BUILDS ONLINE COMMUNITY FOR MUSLIM AMERICANS

By day, Shahed Amanullah (B.S.’91 CEE) works as a project manager for a Texas development firm. By night, he logs on to altmuslim.com, an online news and discussion forum he created and launched in 2001. As editor-in-chief, Amanullah oversees six volunteer editors, a team of contributing writers and 1,750 registered users who debate important issues facing Western Muslims today.

The site’s news summaries strive for objectivity, Amanullah says, and its opinion pieces encourage discussion. “High Stakes in Texas Muslim Charity Trial” read a news headline this summer on the U.S. government’s case against the Holy Land Foundation. Farther down the page, an entry about a Canadian girl who was asked to remove her *hijab* (headscarf) elicited more than 40 responses from readers. With 8,000 unique visitors a day,

altmuslim.com is the go-to place for many Muslim Americans reading and discussing ideas that affect their community, and non-Muslims in high places are paying attention.

The Department of Homeland Security, State Department and National Security Council rely on Amanullah for briefings. So does the media. The father of two has made appearances on national television and contributed analyses to the *New York Times*, *Newsweek* and the *Washington Post*.

That’s catapulted Amanullah from regular-guy webby to Muslim American advocate—all to promote open dialogue. “We’re in the great Berkeley Free Speech tradition, where people have a safe and welcoming space to discuss ideas and ask hard questions of each other in a civil and respectful manner,” he says.

In fact, it was at Berkeley where Amanullah, an American citizen whose parents are from India, first earned his advocacy stripes. He helped found the Progressive Muslim Alliance in 1988, which morphed into today’s Muslim Student Union. *Altmuslim.com* traces back to September 11.

“Most Muslims I know didn’t want anything to do with 9/11 or the aftermath,” he recalls. “It was just too much of a nightmare scenario for them. And most responses from the Muslim community were, for my tastes, too dismissive of the real fears that Americans had. It’s not easy to talk about extremists in your midst. But I knew silence wasn’t an option. If we didn’t ‘own’ our problems, other people would.”

Amanullah envisioned an Internet-enabled community. With an engineer’s instincts to problem solve and a startup veteran’s love of technology, he coded the site himself and christened it with a nod to the alt./usenet newsgroups, the original computer discussion forums first created in 1980.

Last year, a Danish newspaper ran a cartoon of Mohammed that enraged Muslims worldwide, and *altmuslim.com* jumped in. The site advocated ignoring the cartoon. Amanullah ran commentary and sent his editors to appear in the media. “There was significant debate on our site, and I think many in the Muslim community were waiting for someone to take this position so that they could rally around it,” he says. “I think we shaped a lot of the debate.”

The civil engineer claims no personal agenda other than concerned dad. “I want my children to grow up in a country where they, as Muslims, feel valued,” he says, “and where their religion doesn’t contradict their nationality.”

BY RACHEL SHAFER

Blake and Laura in 2001, survived brain surgery in 2005, and returned to geotechnical engineering in 2006.” catlin@geoconinc.com

EDWARD A. CHANG (M.S.’87 IEOR) of Gresham, Oregon, recently had his article “Five Math Courses to Increase Career Options” published by the Association of Computing Machinery. After graduating from Berkeley, Chang briefly returned to teaching high school math but changed careers in 1988 to “create linear and mixed integer programming models for complex domestic and cross-border tax-advantaged leases.” He partially retired in 1998. www.changsite.com

DEBORAH ESTRIN (B.S.’80 EECS) received the Women of Vision Award from the Anita Borg Institute in May for her innovative research on embedded sensors and global network design and their contribution to technology. Estrin is professor of computer science at UCLA, where she holds the Jon Postel Chair in Computer Networks. She is also founding director of the Center for Embedded Networked Sensing.

ROBERT G. FONG (B.S.’87 EECS) returned to the Bay Area recently with his wife and two children, Stephanie and Ryan, and is a managing partner with Nosal Partners LLC, an executive leadership solutions firm.

SCOTT R. HUNTSMAN (B.S.’75, M.S.’76, Ph.D.’85 CE) of Walnut Creek, California, was promoted to director of engineering services/senior



principal engineer for TRC Engineering, Inc. Based in Oakland, he oversees geotechnical engineering at the Oakland, Mountain View, San Ramon, Fairfield, Fullerton and Manteca offices. shuntsman@trcsolutions.com

KELLY A. MILLER (B.S.’82 ME) of Meridian, Mississippi, spent almost



10 years on active duty in the U.S. Air Force before joining the Mississippi Air National Guard, where he has served for 12 years. A full-time instructor/evaluator pilot in the KC-135 four-engine jet tanker, Miller says, “My wife Karen and I are celebrating our 20th anniversary this year! We have two great sons: Daniel, eight, and Steven, seven.” kemiller1@comcast.net

STEVEN RUDICH (Ph.D.’88 CS), was honored with the Gödel Prize by the Association of Computing Machinery’s Special Interest Group on



Algorithms and Computing Theory. He and Alexander A. Razborov shared the prize for addressing a fundamental sticking point in network security, the P vs. NP problem, which has implications for ATM cards, computer passwords, electronic commerce and more. Rudich is an associate professor of computer science at Carnegie Mellon University in Pittsburgh. www.cs.cmu.edu/~rudich/

KENT K. SASAKI (B.S.’87, M.S.’89 CE) is consultant and branch man-



ager for the San Francisco office of structural engineering firm Wiss, Janney, Elstner Associates, Inc. Recently, Sasaki led the team that assessed damage to a freeway overpass in the East Bay’s MacArthur Maze after a tanker truck caught fire and caused the structure to collapse. His group evaluated existing concrete for fire damage and provided repair and replacement recommendations to Caltrans, the state’s highway agency.

PETER A. TOPP (M.S.’81 CE) of Colorado Springs, Colorado, earned his master’s degree in homeland security last year from the naval postgraduate school in Monterey, California.



COURTESY CHABOT SPACE AND SCIENCE CENTER

Alumna Cathleen Vasquez (far right) gives a lesson in gears and simple machines to sixth-graders (left to right) Rosibel Dubon and Estefany Garcia of Peralta Creek Middle School in Oakland.

GIRLS JUST WANNA HAVE FUN, WITH SCIENCE

If seeing is believing, then a new crop of girls now understands that smart, fun women are every kilogram the engineers that men are.

Last spring, Cathleen Vasquez (B.S.’07 IEOR) and May C. Chu (B.S.’06 ME) teamed up with Techbridge, an outreach program of the Chabot Space and Science Center aimed at encouraging girls to get involved in technology, science and engineering. Vasquez, a student at the time, and Chu, now working at Intevac in San Jose, visited Peralta Creek Middle School in Oakland and led a classroom full of sixth- to eighth-grade girls in a lesson on simple machines.

They discussed gears, helped the girls assemble mini-lawnmowers and eggbeaters from K’NEX™ building kits, then had them take the gadgets apart and put them back together again. Before saying farewell, the mentors talked about different engineering majors, their own career plans and how they themselves got excited about the field.

“The girls were really bright, inquisitive and funny,” says Vasquez, who now works for Boeing in Seattle as an industrial engineer. “I really enjoyed working with them and was thrilled to see that they were interested in being engineers and scientists.” Six other Berkeley Engineering teams also took part in the project last year, so perhaps a small army of young women recruits will be headed toward Berkeley Engineering soon.

If you’re interested in volunteering as a mentor through the Techbridge program, go to www.coe.berkeley.edu/alumni/volunteer.

BY MEGAN MANSSELL WILLIAMS

SPACE: NOT HER FINAL FRONTIER

From the time she was a little girl, Carolyn Chee's (B.S.'86, M.S.'88, Ph.D.'98 ME) dream was to become an astronaut. Poor eyesight prevented her from having that flight of fancy but not from having an exciting career ride.

Stops included NASA and Boeing. She returned to Berkeley Engineering for a Ph.D., then she was off to a startup for a spell. UC Berkeley Extension came next and, finally, she reached a soft landing back at her beloved alma mater. Last fall, Chee became director of Berkeley's Graduate Services, a new office that combines three formerly separate student stops—appointments, degrees and fellowships.

During her years at NASA Jet Propulsion Laboratory, Chee worked on space probes Magellan and Galileo, which she got to autograph before they launched. So, although she herself has never been up there, her signature is. "It's kind of cool to know that my name is circling around some planet other than Earth," she says.

With her career in the cosmos denied due to earthly limitations, Chee pursued her mechanical engineering Ph.D., modeling the fluid dynamics of blood flow through the heart. Then she switched gears again and accepted a job at a dot-com, where, she says, it was the bubble's financial incentives that "lured me to the dark side."

Within a year, she decided that another occupation shake-up was in order. A wife and mother at this point (she now has four kids under the age of nine), she landed a slot at UC Berkeley Extension, overseeing engineering and tech programs for adults, a position she says she enjoyed immensely. But when the role of Graduate Services chief materialized, she leapt.

The parallels between her current job and her days as an engineer are surprisingly close, Chee says. It's a lot like systems engineering: Students come in with problems, a set of parameters, if you will, and she's there to help find solutions.



Carolyn Chee (B.S.'86, M.S.'88, Ph.D.'98 ME) is an engineer, wife, mother of four and now director of UC Berkeley's Office of Graduate Services.

Coming back to the Berkeley campus was, in a way, coming home. Chee grew up in Sacramento, one of four children. All of them attended Cal, as did their father, an engineer for Aerojet.

"I had such a positive experience at Cal," she says. "Life is not just one area of expertise, but it is about so much more. And Berkeley had so much to offer outside of engineering. I want to give back to the community that made it so pleasant for me."

BY MEGAN MANSELL WILLIAMS

1970s

STEVE BECK (B.S.'71 EECS) and



EECS professor Carlo Séquin held an on-campus demonstration in February of their Noor Project, a colorful, animated light-emitting diode sculpture that uses complex geometry to derive an ever-changing display of ancient Middle Eastern patterns like those found on tiled mosaics at mosques. Beck, a visiting fellow and executive in residence at UC Berkeley's Center for Entrepreneurship and Technology, says he hopes that Noor, which means "light" in Arabic and Farsi, will help bridge cultural gaps between the West and Middle East. www.stevebeck.tv

RICHARD T. LANSU (M.S.'70 CE) of Chicago is now vice president of Walker Parking Consultants, the largest parking consulting firm in the nation. He joined the company as a structural engineer in 1987 and served as director of operations until his recent appointment.

PAUL LUBOCK (M.S.'79 ME) is cofounder of SenoRx Inc. in Aliso Viejo, California. In May, the Food and Drug Administration approved the company's multi-lumen radiation balloon, an innovative new tool for treating breast cancer using precisely placed radiation seeds. Among the company's other devices is a fine probe for taking minimally invasive biopsies.

JAMES L. MANNOS (Ph.D.'72 EE) of Los Altos, California, in June was appointed president of San Jose-based Silicon Optix, which manufactures programmable video processors. Mannos has more than 30 years of executive and engineering

experience, most recently as chairman, president and CEO of WISchip International, a company he cofounded.

GEORGE PALMER (B.S.'74 EECS) was appointed vice president of operations for Sunnyvale, California, semiconductor company SiBEAM.

1960s

VIVEK D. BHISE (M.S.'66 IE) of Ann Arbor, Michigan, is professor of industrial and manufacturing systems engineering at the University of Michigan-Dearborn. He retired from Ford Motor Company in 2001 after 28 years designing cars and trucks and now enjoys research and teaching courses in vehicle ergonomics, vehicle packaging, human factors engineering and safety engineering.

MICHAEL J. HALLORAN (B.S.'62 ME) of Washington, D.C., is counselor to the chairman and deputy chief of staff of the U.S. Securities and Exchange Commission. "I

received a law degree at Boalt Hall and practiced securities and corporate law in San Francisco and Silicon Valley for many years, assisting developing-stage companies with their private and public securities offerings and their mergers and acquisitions," Halloran writes. He also served as general counsel for Bank of America during its acquisition phase.

ARTHUR W. HIRSCH (B.S.'60 EECS) spent 36 years in Silicon Valley before retiring to Tucson, Arizona, where, he writes, "living is a lot less expensive."

ROBERT KAHN (B.S.'67, M.S.'68 CE) of Newport Coast, California, is president of RK Engineering Group, Inc., a full-service transportation engineering firm.

JAMES A. MCLANE (B.S.'66 EECS) retired to Reno, Nevada, with his wife after 40-plus years in the microwave communications industry. "We have four grown children, one married, "I

one engaged and two single," he writes. "We are enjoying our retirement by skiing in the winter and cruising in the spring. Summers are filled with hot days."

KENNETH VOAK (B.S.'64 EE) retired in 1999 as president of Schouberg Research and moved from Santa Cruz, California, to Vail, Arizona, in 2005, where he enjoys "fantastic scenery, weather and lots of golf courses." kenvoak@aol.com

LORING A. WYLLIE (B.S.'60, M.S.'62 CE), a senior principal of Degenkolb Engineers, in April won the American Society of Civil Engineers' 2007



OPAL (Outstanding Projects and Leaders) Lifetime Achievement Award for design. The honor recognizes Wyllie's 40-year effort to promote public safety by improving the seismic capability of structures. His experience includes a strengthening system for UC Berkeley's award-winning University Hall and design

repairs for the San Francisco Bank of California following the Loma Prieta earthquake in 1989. Wyllie is a former president of the Earthquake Engineering Research Institute and the Structural Engineers Association of California. He also directed the American Concrete Institute and served as chair of the California State Historic Building Safety Board.

1950s

KENNETH D. BAILEY (B.S.'50 EECS) retired from Bechtel Corporation Engineers and Constructors, San Francisco, in 1988, after more than 37 years with the firm. He resides in Carmel-by-the-Sea and credits much of his career success to the education he received at Berkeley Engineering and the UC Extension course in Management he completed in 1964.

WALTER BARRON SWEET (B.S.'50 CE), of Arcata, California, recently retired from Walter B. Sweet, Inc., his civil engineering, surveying and geology firm in Arcata and Ventura.

1940s

ROBERT BARBER (B.S.'48 ME) has been retired for 22 years and is still enjoying it. He grows and occasionally sells maple and juniper bonsai plants.

EDWIN D. JONES (B.S.'49 Eng Sci) lives in Pacifica, California, and is the CEO of web security company TESCO, Consulting Engineers.

RUTH DUNBAR SALIN (B.S.'42 ME) lives in Avila Beach, California, and is a retired Kaiser engineer. "Still alive!" she writes.

1930s

HERBERT CROWLE (B.S.'36 CE) of San Lorenzo, California, retired from a 13-year position on the Oro Loma Sanitary District Board of Directors and moved to San Diego to be near his daughters. Appointed assistant professor of civil engineering at age 21, Crowle says he was the youngest person to become a full-time Berkeley faculty member. He was Alameda County's first public works director and, at age 91, he just scored 100 percent on his driver's license test.

ALFRED A. LINGO (B.S.'38 EECS) is retired and lives in Stockton, California. He worked as a steam division manager for Southern California Edison. His great-granddaughter attends UC Davis.

missing

JAMES N. GRAY (B.S.'66 Eng Math, Ph.D.'69 CS) of San Francisco, age 63, disappeared with his sailboat off the San Francisco coast in



January and is a legally missing person. He was a technical fellow at Microsoft Research and winner of the Turing Award in 1998 for his seminal contributions to database and transaction processing research and technical leadership in system implementation. Gray was the first recipient of a doctorate from UC Berkeley's Computer Science Department.

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DOUGLAS W. BAINBRIDGE (*M.S.'52, Ph.D.'57 MSE*) died in May in Cortez, Colorado, at age 86. A pioneer in the use of X-ray crystallography, Bainbridge received his bachelor's at the University of Wisconsin, Madison, and worked for General Electric during World War II. He taught metallurgy at the Colorado School of Mines and was a professor of mechanical engineering at Oregon State University.

ROBERT IRVIN BROWN (*B.S.'47 ME*) of San Ramon, California, died in July at age 88. A U.S. Army Air Corps pilot who led 23 missions during World War II, he was shot down over the Baltic Sea and imprisoned in the notorious Stalag Luft III, where he helped dig one of the three trenches immortalized in the 1963 film *The Great Escape*. He later worked for Vok-McLain Communities, which developed land in what is now Dublin and San Ramon.

WILLYS O. BRUNK (*B.S.'48 ME*) died in July at age 90. Brunk was a magnet engineer at Lawrence Berkeley National Laboratory, then worked for the Stanford Linear Accelerator Center until his retirement in the 1980s.

ARTHUR H. GREEN (*B.S.'38 CE*) of Carmichael, California, died in January at age 91. He was a retired U.S. Navy lieutenant-commander and World War II veteran who served with the Seabees on Eniwetok Atoll (Marshall Islands). Green worked in the Highways Division of Caltrans for 38 years, serving as design squad chief on the first rural freeway in California near Tulare.

DONALD M. KEAGY (*M.S.'56 CE*) of Carson City, Nevada, died at the age of 83 in May. Keagy graduated from Penn State University and was a captain in the U.S. Navy, a member of the Methodist Church and a barbershop singer. He worked as an engineer for the State of California for 25 years.

FRANCIS H. MOFFITT, professor emeritus of civil engineering, died of pneumonia in April at his Berkeley home. He was 84. Moffitt was an expert in photogrammetry, a process of analyzing physical objects through photographs and images. He wrote on the subject and used its principles to reconstruct accidents and provide forensic evidence at trials.

RICHARD FOSMARK PUCK (*B.S.'40 ME*) died in March in Mount Vernon, Washington, at age 90. He was a U.S. Army captain during World War II and an Air Force major during the Korean War. He worked as a general contractor in Pasadena and served as president of the Rio Alto Water District. An avid adventurer, he met his wife, Charlotte, at the bottom of the Grand Canyon in 1972.

SAMUEL A. SCHAAF (*B.A.'39, Ph.D.'44 Mathematics*) Berkeley professor emeritus of mechanical engineering, died in May. SchAAF served on the Berkeley School Board during the 1960s and, as a member of the Academic Senate, participated in the 1968 report *Education at Berkeley*. He was also a volunteer coach for the Cal golf team.

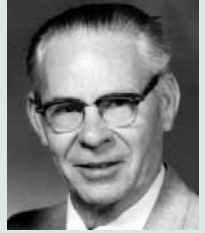
ALEXANDER C. SCORDELIS (*B.S.'48 CEE*), Berkeley professor emeritus of structural engineering, died in August at age 83. An expert on long-span bridges and prestressed concrete, his work is visible in the massive dome of St. Mary's Cathedral in San Francisco and many of the state's bridges and freeways. Scordelis interrupted his studies to serve in World War II, where he fought in the Battle of the Bulge.

ERNEST VAN LEEUWEN JR. (*B.S.'40 EECS*) died in April at his home in Encino, California, at age 94. The oldest competitor in several recent Los Angeles Marathons, he finished 12 races, the last one in 2006. He worked in the aircraft industry and started running in his 50s.

ROBERT BRADY WILLIAMSON, professor emeritus of civil and environmental engineering, died in August at age 73. A fire safety expert, his experimental assessment methods—including the "corner test" for measuring flammability—helped improve building safety codes. Among Williamson's honors were the 1988 Harry C. Bigglestone Award for Excellence in Communication of Fire Protection Concepts and the 2001 Arthur B. Guise Medal from the Society of Fire Protection Engineers.



Bainbridge



Green



Keagy



Moffitt



Puck



Scordelis



Williamson



PEG SKORPINSKI

For more than four decades, John and Kathleen Dracup have been part of the University of California, first as students and then as faculty. Today, John is a professor in the graduate school in Berkeley's Civil and Environmental Engineering Department, and Kathleen is dean of the UCSF School of Nursing. John and Kathleen recently revised their estate plan to establish an endowed fellowship at UC Berkeley in the College of Engineering and an endowed chair at UCSF in the School of Nursing.

*“Berkeley is a magical place.
We’re fortunate to be able to help future generations
of Berkeley students benefit as we did
from this outstanding University.”*

—JOHN (PH.D.’66 CEE) AND KATHLEEN DRACUP

*To learn how you can make Berkeley Engineering part of your estate planning, contact
Jeff Rhode at 510.643.0908 or go to www.coe.berkeley.edu/giving/planned_giving.html.*

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