

Forefront

COLLEGE OF ENGINEERING UNIVERSITY OF CALIFORNIA, BERKELEY

spring 2010

Lessons in the Amazon

Bioengineers teach lifesaving science to young Peruvians



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Speaking of engineering



ROY KALTSCHMIDT

Al Pisano is acting dean of engineering while S. Shankar Sastry is on leave this spring.

Teresa Trowbridge (B.S.'84 Engineering Physics) describes her job at Skyline Solar in Mountain View: "Years ago, when people asked me what I did, and I told them semiconductors, that always stopped the conversation. Now I say solar development, and people get excited. They relate to it."

You can meet Trowbridge here in *Forefront* (p. 19) and in the April issue of our online monthly *Innovations*, where you'll find reporter Rachel Shafer's full story on five Berkeley Engineering alumni working in the Silicon Valley on green tech.

But what struck me about that quote is the inherent communications challenge of being an engineer. Unless you're retrofitting Memorial Stadium or designing a laundry-folding robot, engineering is not always the best subject for party talk. Although we are increasingly indispensable in building everything from space shuttles to solar panels, few who benefit know the first thing

about engineering. As David Douglas and Greg Papadopoulos say in their new book, *Citizen Engineer*:

The increasing complexity of products leads to greater dependence upon engineering; yet most people don't understand engineering or the underlying sciences and technologies. This situation can be scary to the general public, and can lead to bad public policy and misconceptions that hold back new innovations. There is a pressing need for engineers to become more proactive with society—to engage, to communicate, and to lead.

In his latest book, *The Essential Engineer*, Henry Petroski argues that engineers will be the primary players in solving global challenges like sustainability and health care. Even so, he says, along with medicine and "high technology," engineering often gets subsumed under the general category of "science" rather than meriting an identity of its own.

How can we elevate the profile of our profession? As engineers, we need to communicate this message about what we do to the public at large: Engineers provide a vital service to society. We get some help in this effort from mass media like TV's *Crime Scene Investigation* and movies like *Iron Man*, where engineers can be nerds and heroes at the same time. But, the burden of "messaging" falls squarely upon each one of us.

Talk about engineering every chance you get, to anyone and everyone who will listen. Talk about the great things you and your fellow engineers are doing every day to make the world a better, safer, greener and healthier place.

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

—ALBERT P. "AL" PISANO
Acting Dean, College of Engineering
FANUC Professor of Mechanical Systems

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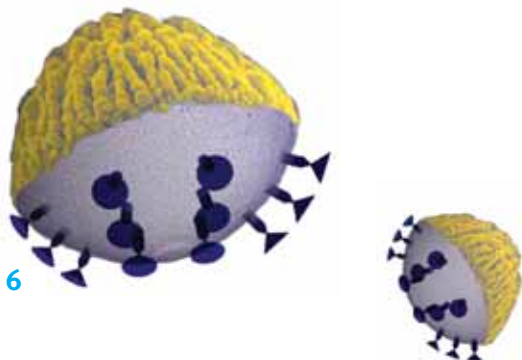
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On the cover

Read the story on page 8.

A Peruvian boy learns how to use a microscope as part of an outreach project led by Berkeley bioengineers to bring a science education to rural, developing areas of the world.

**COVER PHOTO BY JAMIE LIU
BACK COVER PHOTO BY NICK LAMMERS**

Letters

TO THE EDITOR

BioE back story

While it is nice to see space devoted to bioengineering (fall 2009, p. 9), and I am sure it is true that the department was launched in 1998, your story does a disservice to those of us who graduated in the field many years before. In the 1960s, the college had an engineering science department with five sub-disciplines, including bioengineering, from which I graduated in 1972.

My eighth grade career project had been on bioengineering, and that set the stage for my college goals. Even in the early '60s we were suggesting such things as memory assistive devices. The era was just coming to grips with the overlapping and synergistic nature of many fields, and there was at times an uneasy truce between the medical and engineering communities in terms of access, introduction of technologies and patient interaction.

I continued on for a doctorate in bioengineering at the University of Washington, where Robert Rushmer, head of cardiology in the medical school, had established the Center for Bioengineering. We have all seen tremendous changes over the years in how engineering disciplines have greatly aided diagnosis, treatment and health care delivery, all visions of folks from an earlier era.

So I found myself working for Boeing in Seattle, assuming the ideal job would be just around the corner. Well, that was 1980, and I am still with Boeing, so the lesson there is to be ready to adapt. The great education I got at Cal prepared me well and was second to none.

—DANIEL S. JOSEPH (B.S.'72 BioE)

The Boeing Company, Colorado Springs, Colorado

From the editor:

Our historians tell us there were several programs in engineering science and mechanical engineering with a bioengineering emphasis. While students who completed them technically received degrees from their admitting department, they have been considered bioengineering alumni for communications purposes since the department was officially created. We thank Dr. Joseph for providing this glimpse into the early days of the field.

Connecting the dots

I have to wonder, are the students protesting UC Berkeley fee hikes incapable of connecting the dots? If the California budget has less money, something has got to give. Cal students could protest fee increases much more effectively by creating a demand for out-of-the-box budget solutions. Not only should a bunch of Cal engineering students have plenty of ideas for making constructive suggestions on state budget issues; they would be big news because of their technology credibility.

—MARK E. CAPRON (B.S.'76, M.S.'81 CE)

Oxnard, California
www.PODenergy.org

Making smart phones safer

I am bothered by the photo that accompanies the story, "Smart phone, smart user" in your last issue (fall 2009, p. 3). The Wikipedia article on the subject (go to http://en.wikipedia.org/wiki/Mobile_phones_and_driving_safety) cites 11 studies showing that using a hands-free cell phone is no safer than a handheld one. Perhaps professor Bayen's group will come up with a cell phone that is "less dangerous" when used while driving, but I am hesitant to even use the word "safer." The nature of the problem is immediately obvious to anybody who has tried to get a person's attention while that person is talking on the telephone. (Please try this at home or in the office, not while driving.)

I recall buying my first new car (a 1957 Triumph TR3) when I was a freshman in college. It did not have a radio, and I insisted that an after-market radio be installed under the dashboard. The car salesman said that he did not think radios belonged in sports cars because they distract the driver. Times change, and I applaud Dr. Bayen for trying to keep us as safe as possible as they change.

—ROBERT G. PLANTZ (B.S.'62, Ph.D.'71 EECS)

Professor Emeritus of Computer Science
Sonoma State University, Santa Rosa, California



Professor Bayen replies:

Thank you for your valuable comments. We are working on using the GPS in phones to gather traffic data. As with other multifarious phone capabilities, the choice of when and whether to query traffic data belongs to the driver, through using the voice interface or not, or pulling off the road or not. The problem you are talking about is a broader problem. As Transportation Secretary Ray LaHood pointed out, the issue is distracted driving. The real question is whether or not to ban phone usage at the wheel (with or without a headset), a problem that some other countries like the UK have addressed. In addition, you say, "Perhaps professor Bayen's group will come up with a cell phone that is 'less dangerous' when used while driving." To clarify this point for our readers, we are developing software, not creating new phones.

Correction: The photo illustrating the above-referenced story was inadvertently cropped to exclude the dashboard mount holding the phone to the right. We apologize for any confusion.

WE LOVE YOUR LETTERS!

Write to us at forefront@coe.berkeley.edu or send letters to *Forefront* letters, 312 McLaughlin Hall #1704, University of California, Berkeley, CA 94720-1704. Please write a maximum of 250 words and include your name. We cannot include all letters and may edit for length and clarity.

Reverberations of magnitude 8.8: lessons for California and beyond

A hemisphere away, Chile's 8.8 earthquake struck closer to the U.S. West Coast than one might think.

Both regions are seismically active, with "megathrust" faults off their coastlines, where subducting and overriding tectonic plates meet and trigger the biggest quakes on Earth. Both feature modern buildings and well-designed infrastructure systems constructed to comparable seismic codes. Both have older and faulty construction susceptible to seismic failure.

The Pacific Northwest expects its own big quake one day. In California, we're overdue. What can the West Coast learn from Chile's massive temblor?

Less than two weeks after the quake, UC Berkeley earthquake engineering faculty were on the ground (and in the air), documenting the damage and analyzing what held up and what failed.

At a briefing back on campus, team members shared initial findings. Engineered buildings generally performed very well, reported structural engineer Jack Moehle, professor of civil and environmental engineering. But some newer, multistory buildings with irregularities to accommodate underground parking

sustained greater damage. Reinforcement detailing that is prevalent in California but not used in Chile could have protected these buildings.

Hospitals, in particular, performed poorly, but not because of structural damage, which was relatively minor, reported William Holmes, a structural engineer. Rather, nonstructural elements like electrical systems, piping, lay-in ceilings and elevators malfunctioned, leading to widespread evacuations. California hospitals are in the process of performing state-mandated retrofits to secure these nonstructural elements, but hospitals outside the state remain vulnerable.

Soil also played a critical role. Buildings, bridges, highways, ports and other facilities built on looser or weaker soils suffered more damage as the ground liquefied or softened and deformed during shaking, said geotechnical engineer Jonathan Bray, Berkeley professor of civil and environmental engineering.

Though not surprising to many earthquake engineers, the findings serve as valuable reminders of what needs to be done to prepare for a large quake. "We don't want a repeat performance here," Bray said.

See more at www.eqclearinghouse.org/20100227-chile and www.geerassociation.org.

BY RACHEL SHAFER



Members of the NSF-sponsored Geoengineering Extreme Events Reconnaissance Association (GEER) team, co-led by UC Berkeley professor Jonathan Bray (not pictured), inspect a sinkhole at the Port of Coronel in Chile, part of an international effort by engineers to understand effects of the 8.8 earthquake. "Most probably, the sinkhole was associated with the presence of drainage pipes where the material washed out when the sand layer liquefied," explains team member Dominic Assimaki, assistant professor of civil and environmental engineering at Georgia Tech, who photographed the damage.



PEG SKORPINSKI

Clinton packs the house at Zellerbach

Tu Tran was lucky. The flood of students requesting free tickets to Bill Clinton's campus appearance in Zellerbach Auditorium crashed the event's website, and when IT staff restored it, the Feb. 24 event sold out in minutes.

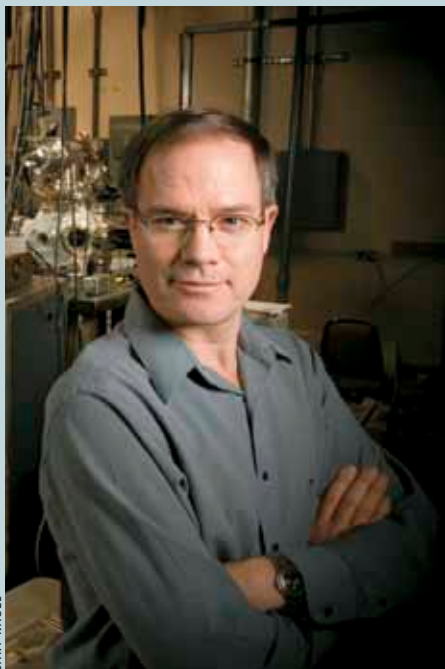
Tran, a senior bioengineering/rhetoric major, managed to snag a ticket. A native of Thailand, he was 5 years old when Clinton took office in 1993. Tran went, he says, not to bask in the glow of a former U.S. president,

but to hear Clinton's ideas on international development and philanthropy.

Clinton didn't disappoint the 2,000 students, faculty and staff in attendance. His call-to-action speech on global poverty and social responsibility urged students to "put yourselves on the line" to combat inequality. "You're living in a time in human history when the individual citizen . . . can have more influence over the outcome of affairs

than ever before," he said. Clinton was on campus at the invitation of the Blum Center for Developing Economies.

"It was very inspiring, even unreal," Tran said afterward. Also ASUC executive vice president, Tran put Clinton's message into action, spearheading a summit held last month to organize UC-wide earthquake relief efforts in Haiti.



BART NAGEL

NE's Peterson joins DOE commission

Per Peterson, Berkeley professor of nuclear engineering and current department chair, is one of 15 leading nuclear power and policy experts from across the country appointed to the U.S. Department of Energy's (DOE) new Blue Ribbon Commission on America's Nuclear Future.

Appointed by Energy Secretary Steven Chu, who is also former director of Lawrence Berkeley National Laboratory and a former UC Berkeley physics professor, the commission is charged with providing recommendations for developing a long-term approach to safely managing the nation's nuclear waste and used fuel. It will conduct a comprehensive review of policies for managing the back end of the nuclear reactor fuel cycle and recommend alternatives to storing used fuel at Yucca Mountain in Nevada.

Peterson has expertise in advanced reactor systems, nuclear waste processing and nuclear materials management. He was recently a member of a National Research Council committee reviewing DOE Office of Nuclear Energy research and development programs. He also served as member and chair on numerous advisory committees for the national laboratories, including Lawrence Livermore and Los Alamos National Laboratories.

Other members of the commission include scientists; representatives of industry, environmental and labor organizations; and former elected government officials, all with a wide range of expertise in nuclear energy and policy. The group, which is co-chaired by former Indiana Congressman Lee Hamilton and former National Security Advisor Brent Scowcroft, will produce a final report within 24 months.

AND THE WINNERS ARE...

Last year brought good news to three young Berkeley engineers—Ali Javey, Michelle Khine and Dawn Song—who joined 32 other elite researchers worldwide recognized by *Technology Review* as 2009's Top Young Innovators Under 35.



ALI JAVEY
UC Berkeley assistant professor of electrical engineering and computer sciences

INNOVATION / Javey developed a precise method of arranging nanowires on electronic circuits using a roller printer device to “paint” the wires into straight rows.

APPLICATIONS / By establishing greater manufacturing control, Javey’s innovation facilitates the development of nanowires as a next-generation material for advanced electronics like inexpensive solar cells and high-resolution displays.



MICHELLE KHINE
(B.S.’99, M.S.’01 ME; Ph.D.’05 BioE)
UC Irvine assistant professor of biomedical engineering

INNOVATION / Khine developed a fast, inexpensive method of manufacturing microfluidic devices using thermoplastic sheets of polystyrene from the children’s arts-and-crafts toy, Shrinky Dinks®.

APPLICATIONS / Khine’s concept significantly lowers the barrier to entry for anyone needing to prototype microfluidic devices, accelerating development of potential applications such as low-cost diagnostic chips for detecting diseases.



DAWN SONG
UC Berkeley associate professor of electrical engineering and computer sciences

INNOVATION / Song developed a system of automated software analysis that defends against viruses, worms and other malicious software known as malware.

APPLICATIONS / Song’s approach enables automated software analysis for security applications, which includes identifying root causes of malicious code attacks, creating filters to secure computers, and significantly reducing the time it takes computer security analysts to fight malware.

See more at www.technologyreview.com/TR35

Calling all engineering leaders

Put an engineer in charge and good things will happen. Alumnus Coleman Fung (B.S.’87 IEOR) even envisions a day when a Berkeley engineer will reside in the White House. Fung’s recent \$15-million gift to Berkeley is launching a new College of Engineering institute that will prepare engineers for executive roles in industry, government and the nonprofit sector.

“Our students must step outside of their technical comfort zone to change and improve

our world,” says Fung, founder of the New York-based software firm OpenLink and supporter of numerous Berkeley initiatives. The Coleman Fung Institute for Engineering Leadership will offer professional master’s programs for students who want to sharpen their business acumen in tandem with their technical expertise. Coursework will increase students’ global leadership and entrepreneurial capabilities in energy, health care and other fields where emerging technologies can be of use.



The institute is under the interim direction of Dean Shankar Sastry (on leave spring 2010) and ME/EECS professor Albert Pisano (acting dean, spring 2010). Ikhlaq Sidhu, founding director of the college’s Center for Entrepreneurship and Technology and an IEOR faculty member, is serving as chief scientist. An advisory board, chaired by Fung, will help facilitate collaboration with external partners.

Hot minds, hot careers: It’s good to be in computer science these days. EECS continues to be the most popular engineering major at Berkeley, with an undergraduate enrollment of 922 students, about one in three undergraduate engineers.

Maybe that’s because computer science and engineering are among the top five most lucrative majors, according to the National Association of Colleges and Employers, which surveyed the highest-paying graduate job offers last year.

In fact, software engineer and computer systems analyst were the second and third best U.S. careers to have in 2009. Says who? The jobs website *Careercast.com*, which ranked careers on income as well as employment outlook, environment, physical demands and stress level. (Actuary took number one, in case you’re wondering.)

Even America’s pop culture princess can’t resist a glowing computer screen. Going on sale this October is “Barbie® I Can Be...™ Computer Engineer,” the newest arrival in a long line of occupation-themed Barbies, which include *Star Trek* officer and NASCAR driver.

Barbie’s new career was decided by popular vote, when Mattel held its first-ever online voting campaign asking Barbie’s public to select her next occupation, and computer engineer won the most votes. The doll’s designers worked closely with the Society of Women Engineers and National Academy of Engineering to develop an authentic geek chic look, complete with smart phone, laptop and Bluetooth headset.



Breakthroughs

BERKELEY RESEARCH AT THE ENGINEERING FOREFRONT

MORE BREAKTHROUGHS www.coe.berkeley.edu/news-center

Adding biofuel to the fire

Plants aren't just for eating or admiring. Chemical engineer and bioengineer Jay Keasling, who is also CEO of the Joint Bioenergy Institute, is manipulating strains of *E.coli* bacteria to produce a usable biofuel directly from plant mass. The bacterium is genetically altered to break down biomass, specifically hemicellulose from plant cell walls, into fermentable sugars, then convert them into fuel. The process is capable of making chains of long hydrocarbons characteristic of biodiesel, jet fuel or kerosene, and Keasling's team is also working on producing the shorter chain hydrocarbons characteristic of gasoline. Because *E.coli* is well understood, hardy and fast growing, it could become a cheap and efficient microbial factory for mass producing fuels of the future.

www.scientificamerican.com/article.cfm?id=bacteria-transformed-into-biofuel-refineries



COURTESY THE RESEARCHERS

Dashingly HANDSOME

For some, the sight of a scurrying cockroach might incite a shriek, but engineers in the lab of electrical engineering and computer sciences professor Ronald Fearing are learning many things from these resilient insects. One result is graduate student Paul Birkmeyer's DASH, the dynamic autonomous sprawled hexapod, an easily manufactured 10-cm robot built from cheap but durable cardboard and two small motors to steer and power its six rotating legs. At 16 grams, DASH can reach speeds of up to 1.5 meters per second and easily withstand falls of up to 28 meters without breaking, making it a prime candidate for locating survivors following events like the recent earthquakes in Haiti and Chile and future disasters.

<http://www.youtube.com/watch?v=LsTKAtBBkFU>

Just say no to Botox

Irina Conboy of bio-engineering may have discovered a better way to fight the march of time. Her research team and collaborators in Denmark recently pinpointed important biochemical pathways linked to the aging of human muscle. They found that one such pathway, mitogen-activated protein kinase (MAPK), plays a key role in the regulation of human tissue regeneration. By manipulating this and other pathways, the researchers prompted old human muscle stem cells to restore their youthful vigor. The results offer hope that one day we can stay healthier and look younger longer by delaying the onset of muscle wasting, which is common to aging and degenerative disorders.

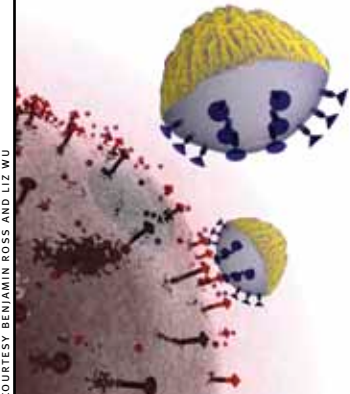
www3.interscience.wiley.com/cgi-bin/fulltext/122613619/HTMLSTART



CANCER CELLS, BEWARE

Imagine, for a moment, microscopic spaceships injected into the body to destroy cancer. Nanoprobes developed by Luke Lee of bioengineering and his team of researchers target cancer cells, inject them with therapeutic drugs and send back information on how the cells are reacting to treatment. Inspired by the biology of natural coral, these nanocorals feature a roughened gold surface on one side that achieves sensing capability through a technique called surface-enhanced Raman spectroscopy, or SERS. The nanocorals, Lee reports, could eventually become important tools for diagnosing and treating cancer.

www3.interscience.wiley.com/cgi-bin/fulltext/123264094/HTMLSTART



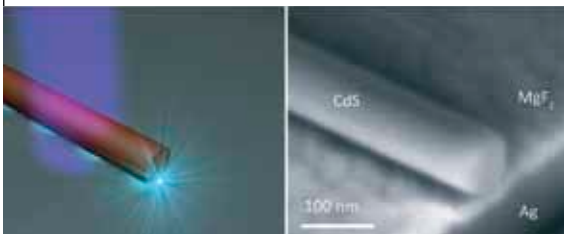
COURTESY BENJAMIN ROSS AND LIZ WU



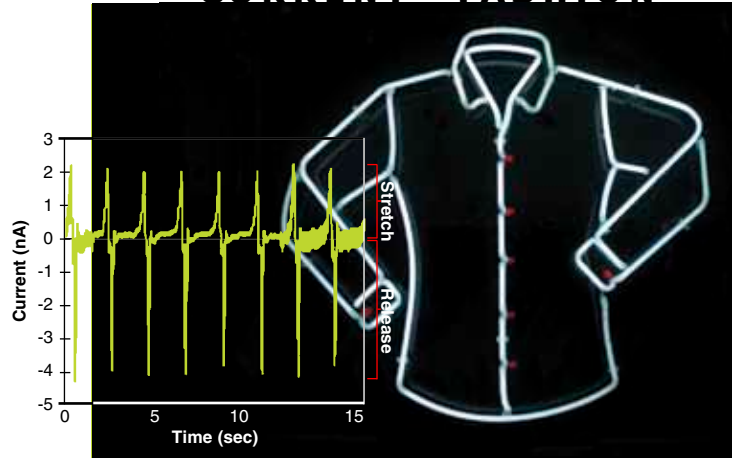
World's tiniest laser

It's no optical illusion. Xiang Zhang of mechanical engineering has created the world's smallest semiconductor laser, a new breakthrough in optics and laser physics. His research team demonstrated a novel technique that crunches visible light into a space smaller than a single protein molecule and keeps the light energy from dissipating as it moves. By coupling a cadmium sulfide nanowire—measuring 1/1,000th the width of a human hair—with a silver surface separated by a five-nanometer gap, the researchers created a non-metallic environment that significantly preserves light energy. Nanolasers of the future may be used in DNA research and optics-based telecommunications and computing.

http://berkeley.edu/news/media/releases/2009/08/31_nanolaser.shtml



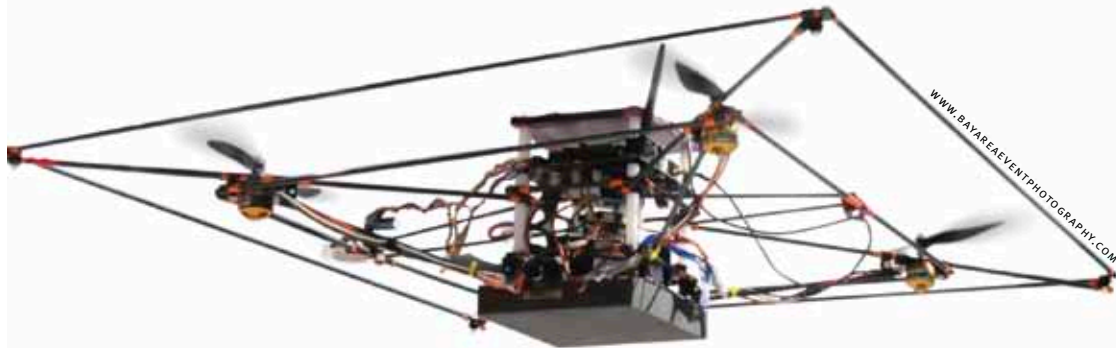
“CURRENT” FASHION



GRAPH COURTESY THE RESEARCHERS

It gives new meaning to the expression “power suit.” Humans expend thousands of calories every day in executing simple movements like extending an arm or turning a head. Mechanical engineer Liwei Lin and his research team are thinking twice about the energy generated by these natural movements. They are developing a fiber nanogenerator

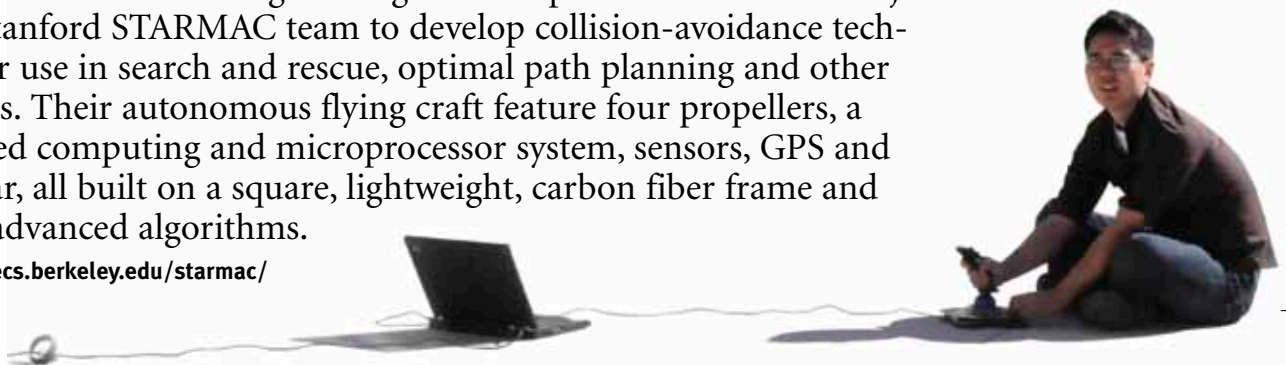
with “piezoelectric” properties capable of converting mechanical energy captured from any little stretch, stress or twist of the human body into electricity. With no discomfort to the wearer, the tiny nanofibers could be attached to or fabricated into clothing and used to power small electronics. <http://pubs.acs.org/doi/full/10.1021/nl9040719>



Robots in the sky

They spin. They hover. They even do backflips. Small, aerial robots with surprising agility avoid crashing into one another and return to their trajectory, demonstrating that one day super smart cars and airplanes may safely avoid crashes as well. The proof of concept is part of ongoing work by Claire Tomlin of electrical engineering and computer sciences and her joint Berkeley-Stanford STARMAC team to develop collision-avoidance technologies for use in search and rescue, optimal path planning and other applications. Their autonomous flying craft feature four propellers, a sophisticated computing and microprocessor system, sensors, GPS and landing gear, all built on a square, lightweight, carbon fiber frame and guided by advanced algorithms.

<http://hybrid.eecs.berkeley.edu/starmac/>



*Bioengineers teach lifesaving science
to young Peruvians*

LESSONS IN THE AMAZON

BY RACHEL SHAFER | PHOTOS BY JAMIE LIU AND RICHARD NOVAK | CAPTIONS BY RICHARD NOVAK

PERU

Lima

Iquitos

Water nurtures life in the Amazon Basin and threatens it. Abundant enough to support one of the greatest displays of biodiversity on the planet, the river is heavily polluted in areas, with industrial contaminants and human waste flowing unchecked into stream channels. People along its banks drink the water and contract water-borne illnesses. Some die. A science education, say Rick Henrikson and Richard Novak, will change that.

Last year, the two bioengineering graduate students started Future Scientist, a tiny but highly motivated aid organization made up of Berkeley and other students and alumni from multiple disciplines whose mission is to teach practical science and technical skills to young people in rural, developing regions. The hope is that, with a steady infusion of know-how, these young people will learn to use local resources safely and sustainably and, as adults, be able to address their community's needs—good health care, electricity, sanitation, jobs—with science-based solutions of their own.

By luck or serendipity, Future Scientist ended up in Peru, working in the village of Puerto Alegría, up a tributary of the Amazon River from the city of Iquitos. On their first trip last year, 11 volunteers worked with local schoolchildren, teaching them a two-week crash course on water pollution, pathogenic microorganisms, disease transmission, filtration techniques, optics and solar-powered electricity. They chronicled their efforts in thousands of photographs. *Forefront* presents a selection here, annotated by Novak.

.....
WEB EXTRAS <http://innovations.coe.berkeley.edu/vol4-issue2-mar10/futurescientist>.

OUR FUTURE SCIENTIST TEAM



THE CHICAS

From left, Bechtel engineer Frances Bell, UCSF medical student Jana Broadhurst, IBM software engineer Jamie Liu, bio-engineering grad student Sisi Chen and public health grad student Mei Gao.



THE CHICOS

From left, Tyson Kim, Gautham Venugopalan, Richard Novak, Rick Henrikson, and Frankie Myers, all Berkeley bioengineering graduate students.



MICROSCOPIC FUN The evening we arrived, we unpacked one of our microscopes. It became an immediate hit as we sat on the river bank and scooped up samples, showing the kids—most of whom had never seen a microscope before—various algae and protozoa. We used the microscopes to show how water can be filtered to remove many disease-causing germs. Of the strategies employed by global aid organizations, outreach in the form of a basic science education is one of the most underutilized.



SWIMMING POOL AND WASHING MACHINE

With no running water, women wash clothes in the river while their children swim nearby. At one point, Rick observed people collecting water next to a latrine built over the river. Water-borne illnesses are a leading source of morbidity here, so many of our projects focused on these kinds of illnesses.



SOLAR LESSON I'm showing how solar panels turn light into electricity as part of a larger demonstration on how a solar panel array, which we had brought with us and later installed, will provide power for village buildings. During our stay in Puerto Alegria, we frequently fielded questions from both the kids and the adults in the community about solar power and its applications.



UPON CLOSER INSPECTION When we weren't teaching, we got to know the kids. Here four-year-old Luis plays dentist with Rick.



FUTURE SCIENTIST One young boy uses a pipette to collect water from a swamp for viewing under the microscope. From the time we unpacked the first microscope, the boys were fascinated with what they could see. We hoped to cultivate this fascination and show that science was cool, that it would make a good career. But mostly that scientific knowledge would lead to a better life.

SUN, THEN SONG We obtained a small grant from the Clinton Global Initiative that paid for supplies such as small solar power teaching kits. Here the boys try out the panels from the kit, which they had wired to a music-playing device.



JUNGLE MUSIC Frankie (right) and Eduardo, a local caretaker, jam for us in an impromptu concert accompanied by frogs, crickets and other rainforest sounds. Light at night was a luxury. Electricity in the area is supplied by generators, but the gasoline to power them is expensive for the villagers and has to be shipped in, so there was electricity for only an hour or two, if at all.

NOURISHMENT FOR BODY AND MIND Tyson and the boys wait for dinner. Starches like rice, plantains and potatoes form the staple of most meals there. Overall, our first trip to the Amazon was a success. We left feeling more committed than ever to our mission of making scientific knowledge available to everyone. Armed with it, regardless of their circumstances, these young people can build a better future.



High on high-speed rail:

Can California make it happen?

BY PATTI MEAGHER

It's fast. It's sustainable. It's the way of the future.

It's also expensive, risky and loaded with pitfalls.

High-speed rail is in the spotlight and in the hot seat, and the \$8 billion in stimulus funds passed out to several regional projects following President Obama's State of the Union address has only intensified the debate.

California's high-profile project is gearing up to start construction on a system capable of moving trains from San Francisco to Los Angeles at a speed of 220 mph in just 2 hours, 40 minutes. Voters approved a \$9.95 billion bond measure to fund it in November 2008. The California High-Speed Rail Authority (CHSRA), the agency established in 1996 to investigate the feasibility of the project, is well under way with plans, designs and environmental studies.

Advocates claim high-speed rail provides a cleaner, greener mode of intercity transport. It will reduce highway and air traffic congestion, help break our dependence on foreign oil, create thousands of new jobs and revitalize interconnecting public transit systems. But skeptics say it's too expensive, especially in the midst of a fiscal crisis, and that cost and ridership projections are wildly optimistic. Even worse, it could hurt the airline industry and small cities in its path.

Entire books have been written about the predominance of the U.S. railroad in the mid-19th century and its demise following World War II. In his book *New Departures*, Anthony Perl writes, "Nowhere else in the industrial world was the passenger train's rise in importance so meteoric, and nowhere else in the post-industrial world was this followed by such a steep decline."

So why is going back to the rails so attractive? Can we really pull off high-speed rail now, with costs much higher, regulations much tighter and communities much more entrenched than they were six decades ago?

Transit system override

We can't afford *not* to invest in high-speed rail, proponents say. Census figures predict that California's population will grow from 37 million today to 46 million by 2030. Freeways and airports are maxed out, and oil prices will keep going up. Burning fossil fuels to power our autos and airplanes will keep fueling the global climate crisis. High-speed rail, says Carlos Daganzo, UC Berkeley's Robert Horonjeff Professor of Civil Engineering, could have a "transformational effect" on urban mobility if managed properly,



COURTESY CALIFORNIA HIGH-SPEED RAIL AUTHORITY

High-speed rail could have a transformational effect on urban mobility, motivating cities to improve feeder public transit lines and diversifying transit options.

motivating cities to improve feeder public transit lines and diversifying transit options.

“As demand increases, if we do not have high-speed rail, we will continue to rely on automobile and air travel for our long-distance needs,” Daganzo said, speaking at a UC Berkeley Institute of Transportation Studies (ITS) symposium last fall. “Now is the time to start, even though high-speed rail may run deficits for some years.” Government will need to subsidize ticket prices to motivate passengers to switch from air and auto travel, he explained, and upfront costs will be high. But the financial and environmental cost of energy to run the trains—electricity rather than fossil fuels—would be lower and more stable over time than continuing to build and use new roads and airports.

The infrastructure required is massive. High-speed rail systems use light, aerodynamic cars, steel wheels on steel tracks and dedicated lines with no sharp turns and little cross traffic. New tracks must be laid. At grade crossings they must either be elevated or tunneled to preserve the high-speed train’s right of way. Trains will slow down as they approach major cities, but on the high-speed segments secure fences are needed to keep people and animals off the tracks. New power supply stations must be built to provide electricity. In California, of course, everything must meet seismic code.

Current plans call for phase one to begin construction by fall 2012 and finish by 2020, connecting San Francisco to Los Angeles via the Central Valley. Later phases will extend north to Sacramento and south to San Diego. According to the CHSRA website, construction will be one-half the cost of expanding highways and airports to the same capacity. The system will create 160,000 construction-related jobs and, by 2035, 450,000 permanent jobs to support the 800 miles of track, multiple train lines and 24 stations.

Not so fast

The bad news is that construction will take 10 years, and many painstaking details have yet to be resolved. Even those who support high-speed rail express growing concern that early projections and promises about ticket prices and funding, which helped gain voter approval in 2008, are not holding up.

In January, the Legislative Analyst’s Office, California’s nonpartisan fiscal and policy advisory body, identified several flaws in the project’s 2009 business plan, including its projections for cost, ridership and revenues. In this latest plan, earlier CHSRA projections were adjusted upward: one-way fare between SF and LA, which was to cost \$55, will now cost \$105; and overall project cost ballooned from \$33.6 billion to \$42.6 billion, against which California’s federal stimulus funding of \$2.25 billion is pocket change.



Connectivity is essential to the success of high-speed rail, and California cities do not have enough of it.






Speaking at the Berkeley symposium last fall, Samer Madanat, Xenel Professor of Engineering and ITS director, acknowledged the challenges inherent in such a “mega project,” which compounds the engineering challenges with politics and economics. Construction and management are being tackled in a series of eight smaller regional projects, now grappling with thorny planning issues like environmental impacts and eminent domain. The cities of Menlo Park and Atherton are suing. Union Pacific Railroad won’t share its right of way.

It will be impossible to please every stakeholder. For example, the long debate about whether to connect the Bay Area through the Pacheco Pass or the Altamont Pass remains unresolved. Madanat favors the Altamont route, due to the greater ridership potential in the heavily populated and fast-growing Alameda and Contra Costa counties. But the CHSRA continues to push for Pacheco.

A recurring theme at the Berkeley symposium was the need for high-speed rail to get major components of the plan right from the outset or risk major losses on investment. Ridership projections, for example, must be accurate for forecasting revenue and determining whether long-term savings in dollars and toxic emissions will ultimately outweigh the initial outlay. Madanat cautioned that high-speed rail would struggle to compete with air travel in any case, due to poor transportation connectivity in most California cities.

“In Europe and Japan, where high-speed rail has been especially successful, train stations are very well connected to urban metro systems, so access and egress times are short relative to airports,” Madanat explained. Access to Eurostar, for example, is easy and car-less; a passenger from London arrives in downtown Paris in two-and-a-half hours and can walk or take the Métro from the same station to his or her meeting. This connectivity—or short access and egress time to and from the primary mode of transport—is essential to the success of high-speed rail, and California cities do not have enough of it.

High-speed by the numbers

-  Technologies and exact speeds vary internationally, but by general definition high-speed trains are express lines that travel at least 125 mph between major population centers. The fastest trains exceed 200 mph.
-  High-speed trains carry eight times more passengers than an airplane over a given distance, using the same amount of energy and emitting one quarter the carbon dioxide for each passenger, according to the International Union of Railways.
-  Berkeley alumus John Neerhout (B.S.’53 ME) was chief executive on the Chunnel, the part of the Eurostar linking Britain with mainland Europe under the English Channel. It opened in 1994 and took three years and \$21 billion to build, at that time the most expensive construction project ever undertaken.
-  Japan’s Shinkansen, the world’s first high-speed train, opened in 1964 and has nearly eliminated air travel between some cities. Future upgrades to the system will include the use of magnetic levitation technology to power quieter and smoother trains at speeds exceeding 300 mph.
-  The closest thing to a high-speed train in the United States is Amtrak’s Acela Express, which serves the Northeast Corridor at speeds averaging under 100 mph, although it can reach 150 mph in stretches. Amtrak is performing feasibility studies on implementing 220-mph service between Washington and Boston.

Rail's ripple effects

But what if high-speed rail did attract enough passengers to compete with airlines like Southwest that depend heavily on the California corridor? Civil and environmental engineering professor Mark Hansen said this could hurt the industry, resulting in fewer airlines, fewer flights, smaller aircraft and higher prices. Then again, it would reduce air congestion, one of high-speed rail's key promises.

Success for high-speed rail could also cause sprawl in some smaller Central Valley towns, said Robert Cervero and Elizabeth Deakin, two ITS faculty from the Department of City & Regional Planning who warn that less expensive suburbs and exurbs near rail stations would experience a new wave of growth. The state has undertaken land use planning to mitigate the problem, Deakin added, through SB375, a state law providing incentives for compact development around transit. The CHSRA is also working on downtown revitalization strategies around its proposed stations.

While it is generally assumed that high-speed rail is greener than other modes, civil and environmental engineering professor Arpad Horvath provided a bigger picture. If the system's electricity is produced by coal-fired or natural gas-fired plants, he said, it will actually produce substantial greenhouse gas emissions until cleaner, alternative fuel sources like wind power become available. The bottom line, he concluded, was that high-speed rail "only outper-

forms other modes if there is a very high passenger load or a very clean energy source, neither of which is assured at the moment."

Horvath, also director of the Consortium on Green Design and Manufacturing, published a paper in January comparing energy consumption and emissions impacts of high-speed rail with other modes, not just during operation but throughout the entire life-cycle of vehicle manufacture and maintenance, infrastructure and electricity production. His complex quantitative analysis calculated time to return on investment (ROI), using a variety of passenger load mixes. If ridership stays low compared with auto and air, high-speed rail would never achieve a return on investment; but if the trains pulled enough riders from their cars and airplanes, ROI could be achieved in less than 10 years.

There's a lot riding on California's high-speed rails. If it fails, America's dream of building networks of bullet trains like those in Europe and Japan could grind to a screeching halt. But if it succeeds, it could set a gold standard for others to follow, revolutionizing intercity travel within, even between, states and challenging the status quo on California's congested freeways and in its not-so-friendly skies.

CHRISTINE COSGROVE, UC Berkeley Institute of Transportation Studies editor, contributed to this report.



Class notes

Keep in touch by mailing your news and photos to *Forefront Class Notes*, UC Berkeley College of Engineering, 312 McLaughlin Hall #1704, Berkeley, CA 94720-1704. Or go to www.coe.berkeley.edu/alumni/class-notes and click on "Submit a new Class Note."

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2000s

MATTHEW AVERY (B.S.'01 ChemE/MSE) of Palo Alto,



California, received his J.D., *summa cum laude*, from UC Hastings in May 2009, graduating second in his class. In October, he won the American Intellectual Property Law Association's Past President's Award for his studies of intellectual property law and his contributions to academic literature. He is now working at Baker Botts L.L.P. as an associate in the firm's intellectual property group.

DEREK MASON DITTMAN (B.S.'07 CE) is a civil engineer at Oliver & Company, Inc., of Richmond, California. He writes, "Still living in Berkeley. Go Bears!"

OMER "RON" KORNITZ (B.S.'07 Eng Math & Statistics) of Sunnyvale, California, writes, "I am writing software for AOL Advertising and learning a lot about myself and the world. Berkeley was a great starting point for both endeavors."

BRUNO F. MEHECH (B.S.'09 EECS) moved from Santa Clara, California, to the Los Angeles area to work at Adconion Media Group as a software engineer.

1990s

JOHN DENG, aka **DENG ZHONGHAN** (Ph.D.'97 EECS), of Beijing was named to the Chinese Academy of Engineering, the country's highest academic title in engineering science and technology. Deng, 41, is chairman of the board and CEO of Vimicro International Corp., China's largest

multimedia semiconductor technology company, which he founded in Beijing in 1999 after returning to China from the Silicon Valley. Previously he was a research scientist for IBM at the T.J. Watson Research Center in Yorktown Heights, New York.

CLIFFORD K. "CLIFF" HO (M.S.'90, Ph.D.'93 ME) of Albuquerque, New Mexico, has received the Chinese Institute of Engineers' Asian American Engineer of the Year Award for his work at Sandia National Laboratories, which included developing thermal-hydrologic models for the Yucca Mountain Project. Ho's recent projects include water treatment and distribution security as well as development of cheaper, more efficient solar technology. He is also developing "energy forecasting systems," which tie national meteorological forecasts to weather-dependent renewable energy supplies like solar and wind for smart energy distribution.

CHRISTOPHER HOADLEY



(M.S.'98 CS) of New York City followed up his master's with a doctorate in science and math education from Berkeley's Graduate School of Education. He recently returned from a Fulbright scholarship in India and Nepal to study technology for cross-cultural environmental education in the Himalayas. He also studied user preferences among different educational technology platforms—including the One Laptop Per Child (OLPC)

initiative, netbooks, e-book readers, smartphones and electronic toys—for developing countries. He is currently associate professor at New York University in educational communications and technology.

HAROLD ZIN HTUTT (B.S.'97 MSE/ME) of San Jose, California, works at Fremont-based network storage company 3PAR.

MICHAEL JEON (B.S.'99 EECS) of Emeryville, California, joined Samsung's corporate venture group in 2007 and has been working on strategic investments in digital media and wireless companies. He writes, "We are now opening a new office in England to cover strategic venture investment opportunities in Europe, and I will be transferred to London to start that effort. A big change in life to come!"

1980s

TIMOTHY SANDS (B.S.'80 Eng Physics; M.S.'81, Ph.D.'84 MSE) of West Lafayette, Indiana, has been



appointed Purdue University's executive vice president for academic affairs and provost. Sands joined the Purdue faculty in 2002 in the departments of materials engineering and electrical and computer engineering and was appointed director of its Birk Nanotechnology Center in 2006. He invented the lift-off process used worldwide in the manufacture of high-performance green and blue LEDs. His current research focuses on developing novel nanocomposite materials for

environmentally friendly and cost-effective solid-state lighting, direct conversion of heat to electrical power and thermoelectric refrigeration. Sands was previously a UC Berkeley professor of materials science and engineering and director of research groups at New Jersey-based Bellcore, now Telecordia.

PETER STRASSMAN (B.S.'81 IEOR) of Cupertino, California, writes, "After seven years as a manufacturing engineer, I spent the next 20 as owner of a printing company and a printing manufacturers' representative. I recently signed on with Touch Plate, a print management firm based in the East Bay."

JULIA USHER (M.S.'87 ME) has written a book, *Cookie Swap*, which was published in 2009 by Gibbs Smith. It features recipes, techniques for baking and a discussion of the social aspect of baking. After working as a nuclear engineer and management consultant, Usher graduated from Cambridge School of Culinary Arts in Massachusetts, where she was valedictorian and received the school's M.F.K. Fisher Prize for outstanding scholarship. She lives with her husband, Bryan Meyers (Physics, 2006), in St. Louis, where for several years she ran a bakery, AzucArte, that gained her a reputation for culinary excellence and ornate decoration.



KAREN FORSYTHE
Julia Usher

1970s

MICHAEL BARCLAY (B.A.'73 Physics, B.S.'74 EECS) of



Palo Alto, California, is retiring from his 30-year career as a high-tech patent litigator at Wilson Sonsini Goodrich & Rosati. Known as the "keeper of all knowledge" among his colleagues, he made his mark on intellectual property law in *Lotus v. Borland*, a case that tested the limits of software copyright and made it all the way to the Supreme Court in 1996. Barclay, 57, who lost his 22-year-old son in a boating accident in 2007, says the personal tragedy changed his outlook about work. He and his wife, Susan Kayton, are avid square dancers.

BRUCE GREGORY BARNES (M.S.'79 CE) of Mequon, Wisconsin, is project manager for the state of Wisconsin Department of Transportation, where he works on airport planning and traffic engineering. He writes, "Studying at UC Berkeley's Institute of Transportation Studies formed a strong career base for me."

RALPH GRAVES (M.Eng.'78 CE) of Seattle, Washington, is managing director of Capital Development at the Port of Seattle.



STEVE ADAMS

STEVEN J. GREENFIELD (M.S.'72 EECS) of Palm Harbor, Florida, has been recognized as a fellow of Catalina Marketing Corporation of St. Petersburg, Florida. He is also vice president of research and development in Catalina's Information Technology Department.

ROBERT S. "BOB" GULETZ (B.S.'70 CE) of Albany, California, writes, "I'm in my



25th year at Harris & Associates engineering consultants in Concord. I have no plans for retirement, as my 17-year-old twins are heading off to college in fall 2010."

STEPHEN MONISMITH (B.S.'77, M.S.'79, Ph.D.'83 CE) writes, "After leaving Berkeley in 1983 for the distant shores of Australia, I ended up on the even more distant shores of Palo Alto, where, since 1987 I have been a professor in Stanford's Department of Civil and Environmental Engineering. I currently am department chair and hold the Obayashi Chair in the School of Engineering. I return to Berkeley frequently to work with colleagues and maintain my 30+-year relationship with Top Dog on Hearst Avenue."

1960s

ROBERT L. MILLS (B.S.'61 CE) of Orinda, California, works for Mills Associates, preparing environmental impact documentation.

HANS G. PAYER (M.S.'67, Ph.D.'70 Naval Architecture) of Hamburg, Germany, writes, "At Berkeley I learned not to follow the general consensus but to always look for my own conviction—and follow it. This is fun! And it has also helped me in my career."

DONALD JAMES SMITH (B.S.'65 CE) of Fairfield, California, is working as a consultant.



ENERGY ENTREPRENEURS: Christian Cermelli (left) and Dominique Roddier with a poster showing their design for WindFloat, which solves major problems facing current offshore wind farms.

A sea change for wind farms

Twenty miles out to sea, far from seabirds and boat traffic, a 300-foot wind turbine spins in the breeze. It's not alone.

Thirty turbines are generating electricity. Each turbine, integrated into a highly advanced floating platform, is tethered by thick chains to the sea floor. Electricity flows into a giant undersea cable extending toward shore. At 200 megawatts, this floating offshore wind farm powers 60,000 homes with clean energy.

It's a futuristic vision, but one Dominique Roddier (Ph.D.'00 Naval Architecture) and Christian Cermelli (M.S.'90, Ph.D.'95 Naval Architecture) are poised to realize. The ocean engineers and entrepreneurs call their concept WindFloat. Through their company, Marine Innovation and Technology, they are working with Seattle-based Principle Power to develop a WindFloat prototype for deployment in Portuguese waters in 2011.

"WindFloat was based on previous platform work for the oil and gas industry, and those results showed that, after scaling properly, it could be coupled with a wind turbine," says Pedro Valverde, project engineer for Energias de Portugal (EDP), a power company. "EDP had no doubts about choosing this technology."

With the ink dry on the contract, Roddier and Cermelli are working on fabrication drawings, which they'll send to a manufacturer later this year.

"Portugal was very interested in our project and wanted to be the first to do it," Roddier says. "The country has very good wind resources and is trying to distinguish itself from the rest of Europe with renewable energy."

Such farms already exist off the European coastline, and one is proposed for Massachusetts. Current designs, however, incorporate fixed-platform technologies using

a steel structure sunk into the seafloor. To maintain cost effectiveness, columns can't extend down very far, limiting them to relatively shallow waters. This means they're visible from shore, which invites controversy with coastal property owners and other constituents, as in the case of the Massachusetts project.

Offshore wind farms needed sea legs. But no one knew how to float the platforms way out at sea and keep 300-foot wind turbines upright in the roll of deep ocean water and winter storms until Roddier and Cermelli came along. Their WindFloat design employs 80-foot-wide horizontal plates that, when submerged at the base of the structure, counteract the ocean's forces, minimizing the vertical and angular platform motion. WindFloat also features an active ballast system and triangular design to help the structure maintain stability. The platform can easily be assembled onshore and towed out to sea, the engineers say, where it will be connected to its mooring system.

If the prototype proves successful, WindFloat has enormous potential as a green energy business. Environmental hazards can be mitigated by anchoring platforms away from fishing grounds, shipping channels and sea-bird gathering zones. Technologies for warding off birds may be implemented, the inventors say, and marine mammals won't become entangled in the anchor lines.

As the world races to find viable clean energy solutions, Roddier and Cermelli hope WindFloat flourishes with governments and utility companies, carrying our fossil fuel dependence away on the breeze.

See more at www.principlepowerinc.com/products/windfloat.html



BY RACHEL SHAFER

RACHEL SHAFER

Engineering the magic

He has worked in restaurants, analyzing food and beverage service, and in workforce planning and forecasting. He has even worked on the railroad, optimizing process design and crowd flow. Yet, he is never far from Main Street, U.S.A. Where does this man work?

Meet industrial engineer Brian Loo (B.S.'09 IEOR), who last August joined the Workforce Planning team at Disneyland. Following a childhood of family vacations to Disney's original theme park in Anaheim, California, and internships there and at Walt Disney World in Orlando, Florida, Loo is now a "Cast Member," a bona fide Disney employee.

"One of the great things about working here is that there's a ton of different roles," Loo says. "It just amazes me on how much goes on every day."

The Bay Area native did his first Disney internship in 2006 as a Berkeley sophomore. He worked on Big Thunder Mountain, operating the ride and loading and unloading passengers (known as "guests" in Magic Kingdom parlance), then analyzing the attraction for operational improvements.

"I had never worked in a theme park before, so I had to get in the mindset of what an attraction is," Loo explains. Disney Resorts worldwide juggle a dizzying number of transactions each year, like 10 million incoming calls at the Disney Call Center, and 9 million hamburgers at Walt Disney World alone. Smooth operation depends on teams of industrial engineers to analyze, model and optimize every process from transportation systems to long lines at Space Mountain. In our era of automated telephone answering systems and deteriorating retail customer service, Disney's seamless, friendly perfection in the operation of all these details can make the experience a magical one indeed.

"The goal is to deliver the best guest experience possible by constantly evaluating and improving park dynamics," Loo says. In his current assignment, he supports the myriad parades, marching bands and other

entertainments throughout the park. Fantasmic, for example—where Mickey battles evil in a nighttime extravaganza featuring special effects like fireworks and lasers—requires booking the pyrotechnics team in addition to the leading man, er . . . mouse, and his supporting cast.

"If Mickey Mouse calls in sick, you have to get Donald Duck," Loo says, matter-of-factly. He is working on a forecasting tool for managing staffing levels and efficient workloads. Unlike his prior roles, this one involves working with colleagues who have backgrounds in entertainment. Loo relishes the variety; in fact, it could carry him through a lifelong career in the most magical place on Earth.

"If I'm not doing engineering, I would love to get involved in park operations," Loo says when asked what he might be doing in 10 years. "At the end of the day, I see myself working here."

BY PATTI MEAGHER



Disneyland "Cast Member" Brian Loo (B.S.'09 IEOR)

RAYMOND M. "RAY" WILLE (B.S.'62 ME) retired from United Technologies' Pratt & Whitney Space Propulsion in 2005 and is living in Daly City, California.

1950s

LOWELL C. ALLEN (B.S.'51 CE) worked for Caltrans and retired in 1991. He is living in Eureka, California, and enjoys travel and serving on dispute resolution boards.

DONALD G. "DON" GREGORY (B.S.'51 EE) of San Rafael, California, writes, "I am trying to grow old gracefully."

HUGO JOHN HANSON (B.S.'51, M.S.'69 CE) is retired from his career in geotechnical engineering and is living in San Rafael, California.

EDWIN "ED" KRENZ (B.S.'52 Petroleum Engineering) worked until 1978 for Fluor Corporation, where he did project management on the Alaska pipeline. He then moved to Parsons Corporation, where he worked until 1984 on the Strategic Petroleum Reserve project in New Orleans. He writes, "Since then I have been active as a real estate developer with no plans to ever retire. I have too much fun, especially in these crazy times." He is now living in Mesa, Arizona.

HARRY J. KRUEPER (B.S.'51, M.S.'53 CE) of San Bernardino, California, worked



in memoriam

HENRY CLARK BOURNE JR. of Winston-Salem, North Carolina, died in March at age 88. He served on the Berkeley faculty as professor of electrical engineering from 1954 to 1963. He was a fellow of the Institute of Electrical and Electronic Engineers and a fellow of the American Association for the Advancement of Science.

WALTER LOUIS BRIANT JR. (B.S.'55 ME) died at age 79 in Poipu Beach, Kauai, following a hang gliding accident. A track star at Cal, he was an avid windsurfer and hang glider all his life. He served in the U.S. Navy as a midshipman in the Korean War,



then founded the Kauai Department of Water and started Briant Construction and Aqua Engineers, both of which are still in operation today.

GEORGE M. COLEMAN (B.S.'47 EECS) of San Diego, California, died in 2008 at age 88.

IAIN FINNIE of Berkeley, California, died last December at age 81. A UC Berkeley professor emeritus of mechanical engineering and chair of mechanical engineering, Finnie was one of the world's leading experts on the fracture of materials. His 1959 text, *Creep of Engineering Materials*, co-authored with William Heller, is a classic in the field.



EDGAR ALFRED JONES III (B.S.'50 CE) of Santa Clara, California, died last July at age 89. He served in the New York National Guard, the 27th Division of the U.S. Army and the 102nd Engineers during World War II. He worked for 34 years as a civil engineer for the California Division of Highways.

HUGH DONALD MCNIVEN of Berkeley, California, died in December at age 87. He was a UC Berkeley professor emeritus of civil and earthquake engineering from 1957 to 1991, also serving as director of Berkeley's Earthquake Engineering Research Center and president of the University Art Museum.

EDWARD F. NEWMAN (B.S.'48 IEOR, J.D.'51) of Santa Cruz, California, died last October at age 85. As an attorney in Hayward, he defended citizens in proceedings before the House Un-American

for the city of Berkeley and is now self-employed as a civil and traffic engineering consultant.

ALAN W. LARUE (B.S.'57 ME) was a Naval Reserve Officers Training Corps Scholarship student. Upon graduation, he received his commission, becoming navigator and gunnery officer on the USS Buck (DD-761). His career included working as an engineer for Singer Aerospace, as marketing director for Honeywell and BEI Syston Donner, and as international marketing director for Singer Librascope. Now retired, he is living at Sun City Shadow Hills in Indio, California, with his wife, Ouida, and works as a substitute science and math teacher in the local high schools. He writes, "I have been a member of the Berkeley Engineering Alumni Association for more than 12 years and still attend football games, events and luncheons. Go Bears!"

CLAYTON D. "DAN" MOTE JR. (B.S.'59, M.S.'60, Ph.D.'63 ME) of College Park, Maryland,



will step down as president of the University of Maryland and return to his faculty position as professor of engineering. Mote, 73, is credited with taking the university to a new level of excellence; during his tenure, its *U.S. News & World Report* ranking moved from 30th to

18th, freshman applications doubled and grade-point averages rose by half a point. He moved to Maryland after a 30-year career at UC Berkeley, where he served as a vice chancellor and received the Berkeley Citation and Distinguished Engineering Alumnus Award.

ANTHONY J. RANDO (B.S.'59 ME) is retired and living in San Francisco.

CARL WEINBERG (B.S.'52, M.S.'53 CE) of Walnut Creek, California, retired as manager of research and development



at PG&E 16 years ago. He is still active in consulting and serving on boards of non-governmental organizations.

1940s

CHARLES HODGES AVERY (B.S.'47 Metallurgy) of Sparks, Nevada, writes, "At 89, I am in excellent health. My career has evolved from materials and process engineering in the aircraft industry to business owner.

For the past 25 years, I have worked as a materials and process analyst, project engineer, court expert and problem solver."

NEAL L. DYTE (B.S.'44, M.S.'50 ME) of Arroyo Grande, California, has been retired since 1986. He was in the V-12 Navy College Training Program at Berkeley and served in the U.S. Navy in World War II. He later worked in aircraft environmental control systems at Garrett Corporation in Los Angeles.

JAMES O. "JIM" GIERLICH (B.S.'46 CE) of Hermosa Beach, California, has been retired for 25 years after selling his business to his partner. He now serves on the Berkeley Engineering Alumni Society Board of Directors and the Cal State University, Dominguez Hills, Foundation Board. He spends his spare time doing professional singing, playing golf and visiting with his three great-grandchildren.

WILLIAM L. MARRE (B.S.'47 EECS) is retired and living in Stockton, California.

WALLACE A. NORUM (B.S.'48 CE) had a 60-plus-year career in structural design, city planning and building inspection. He is now living in Los Altos, California.

1920s

ROBERT JORDAN STREICH (B.S.'29 ME) writes, "I just turned 103 and am living at my home still!" He lives in Napa, California.



COURTESY TERESA TROWBRIDGE

HER OWN SOLAR SYSTEM

"My only A+ at Berkeley was in my solar engineering class," says Teresa Trowbridge (B.S.'84 Eng. Physics). "I've always wanted to go solar." She did just that in 2007, when she installed 24 Sanyo HIT (heterojunction with intrinsic thin layer) solar cell panels on the roof of her Los Altos garage. The high-efficiency HIT cells better absorb diffuse light due to a layer of amorphous silicon, she says. The system generates 4.8 kilowatts, powering her home and, in summer, producing an excess that goes into the grid.

Trowbridge champions solar not only at home but also at work. She is director of product management at Skyline Solar, a Mountain View startup she joined in 2008. Before that, she worked for Applied Materials, helping launch its solar business group in 2005.

WEB EXTRAS <http://innovations.coe.berkeley.edu/vol4-issue3-apr10/greentech-sv>



Activities Committee, handled cases for the ACLU and was president of the Santa Cruz County Bar Association.

THOMAS H. PIGFORD of Oakland, California, died in February at age 87. He established the nuclear engineering department at MIT and later became professor and first chairman of Berkeley's department. Throughout his career, Pigford was recruited by the U.S. government

for his expertise on major nuclear accidents and nuclear waste. His notable achievements included investigating the accidents at Three Mile Island and Chernobyl, Ukraine. In the mid-1990s,

he also served on an Environmental Protection Agency panel investigating standards for the nuclear repository at Yucca Mountain, Nevada.

WILBUR BAYNHAM RICKETT (B.S.'38 CE) of Bakersfield, California, died last February at age 93. Known for his work at the Kern County Land and Tumblin Companies, he contributed to many Bakersfield structures that still stand, including Bakersfield College's Memorial Stadium, Old Church Plaza and the Chester Avenue underpass. He loved hunting big game and taking his family to Catalina on camping trips.

RENATO V. SALCEDO (B.S.'58 EECS) of Paso Robles, California, died at age 81. Born in Valparaiso, Chile, he served in the U.S. Army during the Korean War, then got his degree under



the GI Bill. His 30-year career in design of satellite communications included positions at Westinghouse, Hughes and TRW. He retired in 1989 and built a hill-top retirement home on his ranch, Villa Giselle. He also served as treasurer and director of the Berkeley Engineering Alumni Society of Southern California.

ERICH G. THOMSEN (B.S.'36, M.S.'41, Ph.D.'43 ME) of Walnut Creek, California, died last February at age 103. A native of Hamburg, Germany, he spent five years in the refrigeration and air conditioning industry, then joined the Berkeley faculty in 1951 as professor of mechanical engineering and becoming emeritus professor in 1973. He specialized in teaching and research in metal processing.

Engineering matters

HIGH-POWERED PANEL

The highlight of this year's BEARS symposium—Berkeley Engineering's annual showcase for new developments in electrical engineering and computer sciences (EECS)—was a standing room only panel on how information and communication technology can help control our “oblivious consumption” of an increasingly precious energy supply. Heavyweight panelists David Culler, Randy Katz and Eli Yablonovitch, all Berkeley EECS professors and members of the National Academy of Engineering, shared their supercharged ideas for how to harness IT innovations to address the question of the day.

WEB EXTRAS <http://www.eecs.berkeley.edu/BEARS/>



David Culler

Culler is working on LoCal, a project designed to increase energy efficiency in campus buildings via intelligent interaction with the grid. That's because buildings are responsible for three-quarters of our energy expenditure, with massive amounts wasted in empty buildings full of computers. “We all focus on high performance and getting everything done,” he said, “but the key starting point in conserving energy is: Do nothing well. This is a systems problem that can be solved by an information technology approach.” That solution, he explained, is a smart grid based on decoupling the stack, distributed innovation and training future leaders in a range of electrical, mechanical and civil engineering skills.

Randy Katz

“In order for innovation to take place, the true cost of energy has to be reflected,” Katz said, advocating a carbon tax on power users. “It's the only way to get people to invest.” He first realized the huge amount of power computers require during a 2005 internship at Google, he said, where he had a close encounter with a modular datacenter. “When you open the bank vault door on this container-sized object, you are hit with a blast of air coming from the fastest, heaviest air movers I had ever seen in my life. As a computer designer and architect, that got me thinking in general about societal scale energy consumption.”

Eli Yablonovitch

“We can be one million times more energy efficient than we are now,” said Yablonovitch, director of the new NSF-funded Center for Energy Efficient Electronic Science (E³S). The multi-institution research center is investigating ways to dramatically reduce power consumption of electronics by developing lower-voltage and more efficient alternatives to today's transistors. He had more good news: “I've been working on solar for 30 years, and I've never been more optimistic. With the amount of brain power working on this, I believe solar will rise to become our cheapest form of primary energy.” He predicted that we'll soon see highly efficient solar panels as cheap as a sheet of glass.

*I had an enjoyable and rewarding
career as an engineer.*

Larry Peirano

'51



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