

Fall 2009

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School of Engineering

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engineering news

School of Engineering

FALL 09

SANTA CLARA UNIVERSITY

DEAN'S MESSAGE

There is a lot of talk using the word "green" these days. Certainly, with our involvement in the Department of Energy's Solar Decathlons, we have used the word in a number of contexts.

We have watched our students, many of them *green* recruits—freshmen—blossom into confident and capable teammates working tirelessly toward a *green* future. A project of this magnitude obviously takes a lot of *green*, and we are ever grateful to our sponsors for helping us realize the dream of allowing our students to participate in such an important competition (twice!).

But recently, the importance of keeping our University *green* and thriving has come to the forefront. With the downturn of the economy, Santa Clara has experienced a sharp decline in annual alumni giving that affects us in surprising ways. You may not know that corporations and foundations grant funding based on annual alumni giving. And the *U.S. News and World Report* rankings (which also figure prominently in our ability to attract foundation and corporate funding) base their rating on this same criterion.

In difficult times, it is more important than ever to keep universities green and vibrant and growing. Even a small donation can have a big effect on the well-being of your alma mater and its ability to educate the next generation of leaders. In this edition of SCU's *Engineering News* (a new name for us, formerly *Horizons in Engineering*), you will read about exciting research and programs, dedicated faculty, and outstanding alumni. Your help in supporting our efforts and keeping us green is much appreciated.

Godfrey Mungal
Dean
School of Engineering



SOLARBRATION!

Two years and an estimated 67,000 student hours spent designing, engineering, and building an 800-square-foot solar-powered home culminated in October with a Third Place finish for our team in the U.S. Department of Energy's 2009 Solar Decathlon! Accepting the award, student project manager Allison Kopf '11 said, "We proved to the world today that you don't have to compromise comfort, style, and convenience to live in a green home."

For this competition between 20 teams from colleges and universities around the world, Santa Clara University partnered with California College of the Arts to create *Refract House*, which was designed to celebrate California's love for sunlight and outdoor living while maximizing energy efficiency and sustainable living. *Refract House* incorporates a number of cutting-edge technologies and building strategies. Open-web bamboo beams that allow ducting, electrical wiring, and plumbing to run through while providing structural support for the roof and a fully-integrated photovoltaic racking system, were designed to be used as the roof joists. A carbon meter measuring carbon offsets at real-time rates was developed in partnership with SolarTech, thanks to a grant from the California Energy

Commission. Student engineers also created a user-friendly control system for energy and water consumption that can be implemented from anywhere in the world via an iPhone. A greywater treatment system, reclaimed water storage pond, and smart irrigation management also contributed to the award-winning home.

Team member Preet Anand '10 said working on the undergraduate-led Solar Decathlon team was "an amazing experience and great education, from technical engineering to project management." He adds, "It is an unbelievable opportunity to be given so much responsibility and to have fans that not only believe in your project, but believe in you as people. The students who come out of this project will be future pioneers and leaders in green innovation and policy. The Department of Energy, our sponsors, and our universities, did something amazing in supporting this competition: they made an investment in the future."

For more information:
www.refracthouse.com
www.scu.edu/engineering/solardecathlon

RIPPLE HOUSE LIVES UP TO ITS PROMISE

When it was being designed and built for the U. S. Department of Energy's 2007 Solar Decathlon competition, students and faculty working on "Ripple House," SCU's 3rd place winning entry, always envisioned the solar-powered home serving as a laboratory for energy research. With the help of a grant made by the California Energy Commission to SolarTech, a PV industry consortium, that is exactly what is happening.

"The funding has allowed Santa Clara University to partner with SolarTech over the past year to develop carbon metering and to research Building Integrated Photovoltaics (BIPV) and Plug & Play technology with the aim of lowering installation costs for residential and commercial systems," said Dr. Mark Aschheim, professor of civil engineering.

Under the direction of Dr. Jorge González-Cruz, former professor of mechanical engineering at SCU,

students have made excellent progress on the carbon meter, which is now available for license. According to González, "The carbon meter will measure carbon offsets from almost any home at real-time rates. This concept will allow homeowners to be compensated for saving energy while contributing to saving the planet, enabling a potential economy of carbon cap and trade. The sophisticated instrumentation of the Ripple House is allowing the students to test this idea with surprisingly good results, matching data with the theory proposed by the professors."

The BIPV research to streamline installation and improve performance is also progressing apace. "This is an emerging area," said Aschheim. "No one knows what to make of it yet. There are a number of new technologies out there that may or may not improve performance. Current systems using identical panels strung together with an inverter are intolerant of poor performance due to shading, panel malfunctions, dirt, etc. Our students are looking into ways of making installation easier and faster, and they are researching strategies for improving the physical devices so



With the master bedroom of Ripple House re-purposed as a research space, Adam Wong, BSME '09 (left), and James Cardwell, BSEE '10, monitor sensor data from experiments designed to characterize the thermal properties of the house.

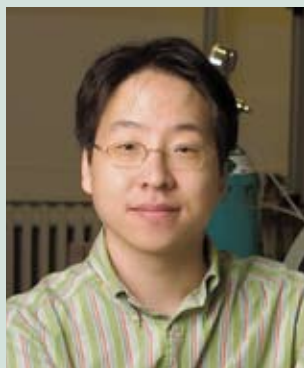
PV can be arranged in previously inefficient configurations."

This fall, students are testing power maximization devices from National Semiconductor, Enphase Energy, and Tigo Energy, using the carbon meter to analyze results. "The Ripple House is a great testbed for conducting thermal and PV experiments," said

Aschheim. "The house was always planned to be a research lab; with our partners at SolarTech, we are fulfilling that mission and we welcome other opportunities for collaborative research."

For more information: www.scu.edu/engineering/solardecathlon/reports

HOHYUN LEE JOINS MECHANICAL ENGINEERING FACULTY



A desire to bring about change through the education of the next generation of mechanical engineers is credited

with bringing new faculty member Hohyun Lee to the Department of Mechanical Engineering. Professor Lee recently received his Ph.D. from Massachusetts Institute of Technology. His research focuses on heat transfer mechanisms at the nanoscale and engineering thermal properties of nanomaterials for the purpose of energy harvest.

"I love teaching," said Lee. "If I can help students understand difficult concepts pertaining to transport phenomena at the atomic scale, I'll be satisfied," he added. Of course, continuing his research in nanoscale energy transport is also a priority. With a focus on investigating the principles of heat and electrical transport and how to control the physical properties of material to maximize efficiency in

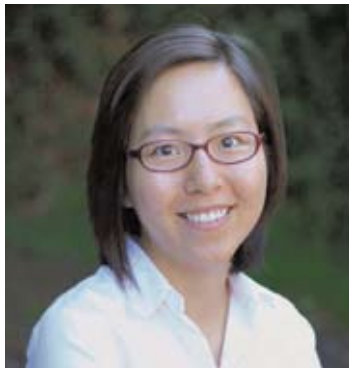
energy systems, Lee sees a myriad of uses for his work. "We can engineer properties to suit a number of applications—everything from making mobile energy power systems to assisting health monitoring. Generally, only thirty percent of the energy produced in a system is useful; the rest is lost to heat. Efficiency can be improved with the help of thermoelectric materials which can convert heat to electricity. Through research on materials and heat and electrical transport, we can engineer properties for thermal insulation, enhancing heat transfer for cooling and reducing energy waste within the system."

Tim Hight, chair of the Department of Mechanical Engineering, is delighted to welcome Dr. Lee to Santa Clara. "In addition to his work in nanoscale

transport phenomena and materials characterization and instrumentation, Professor Lee also focuses on renewable, sustainable energy and water purification system design. His dedication to teaching and commitment to research in sustainability make him a real asset for the School of Engineering."

"Not many research-oriented universities place such a high value on teaching as Santa Clara," Lee said. "Education is the most efficient method for changing the world in a better direction, and I am excited to be in an environment that emphasizes the application of education."

BIOENGINEERING PROGRAM WELCOMES NEW PROFESSOR



Dr. Kim serves as the Director of the Biological Microtechnology Laboratory.

Following a successful introductory year, the Bioengineering Program welcomes Dr. Unyoung (Ashley) Kim to the faculty as assistant professor and director of the Biological Microtechnology Laboratory. Dr. Kim recently received her Ph.D. from the University of California, Santa Barbara, where she was also awarded a Certificate in College and University Teaching (CCUT).

A mechanical engineer by training, Dr. Kim's research focuses on the investigation of integrated microfluidic systems to address challenges in biomedical applications. "What I work on is often called 'lab on a chip,'" she said. "In this field, we create miniature platforms for diagnostics that offer the

functionality of complete benchtop systems found in conventional clinical labs." Shrinking has its advantages, she notes. "Due to its small size, it consumes a smaller amount of cells and reagents, and we can provide faster analysis with better performance. Also, providing a portable device for diagnostics means that better health care can be made available to those in even the most remote areas. This is what originally led me to study microfluidics."

In her first year with the program, Prof. Kim looks forward to introducing the new major to freshmen and to working with the many biotech companies in the Bay Area to provide interesting research projects for her students. Program chair Dr. Yuling Yan is also looking forward to a great year. "Dr. Kim brings a passion for undergraduate education and a commitment to social justice that is perfectly fitting to Santa Clara's Jesuit philosophy," she said. Dr. Kim agrees, "SCU has always been about serving others. We need to think about how our work can help the world and focus not just on ourselves, but on the greater good."

To learn more about the Bioengineering Program: www.scu.edu/engineering/bioengineering

ALICE SUMMER WORKSHOPS INSPIRE HIGH SCHOOL TEACHERS AND STUDENTS



As part of the Alice workshop, students and educators enjoyed a field trip to the global headquarters of Entertainment Arts (EA) in Redwood City, CA.

For two weeks last summer, the School of Engineering hosted workshops for high school teachers and students to learn the popular Alice programming language—an easy-to-use, engaging tool that opens the world of computing to those who might otherwise be intimidated by the necessity to learn intricate code.

Read the full story on our Web site: www.scu.edu/engineering/enews/2009fall/alice.cfm

SCU ALUMS HELP EASE BACK-TO-SCHOOL EXPENDITURES

Back-to-school doesn't have to mean breaking the bank when it comes to procuring college textbooks, thanks to some innovative Santa Clara alums. In 2006, Colin Barceloux '03 founded BookRenter.com, the first online book rental service, and took it from a two-person startup team to a highly successful Internet-based business, serving more than 3,000 campuses and saving students up to 75% off the retail price of textbooks. "When we developed BookRenter.com," he said, "we dedicated ourselves to a company that makes education more affordable for students. We utilize state-of-the-art technology and superior customer service to provide students with a better value and a hassle-free process."

To bring that state-of-the-art technology to his business, Barceloux called on two fellow Broncos, Chris Williams and Philippe Huibonhoa—both of whom participated in the five-year joint degree program earning their bachelor's degrees in computer science and master's degrees in computer engineering in 2006.

"When we joined the company," said Williams, "we really had to start from scratch to build the platform." Huibonhoa added, "We looked at the underlying code from the prototype and said, let's take what we learned and start over. So, we did. We jumped in head-first." For a year they worked without pay out of Williams' apartment. The pair, who had gained valuable experience at SCU

Photo: Heidi Williams



Philippe Huibonhoa and Chris Williams show their Bronco pride at the Campbell offices of BookRenter.com.

working together on projects as undergraduates and again on their master's thesis, used open-source free technology in building their system. "The money had to go to inventory—this is a capital-intensive business," they said. But things are paying off as the two now share an office in the firm's Campbell, California, headquarters. "While I was at Santa Clara, I had an internship at a large defense company," Williams said. "There were lots of processes and red tape. At a start-up it's the complete opposite. It's stressful, there's more responsibility, fewer resources, but there's also passion, control, and the power to make decisions."

They were both drawn to the idea of helping students (and parents) save money. Huibonhoa remembers standing in line to sell his textbooks back at the end of the term: "One time, the person in front of me got forty dollars while I only got five dollars for the same book, because the quota had been met. Renting books is such a great idea, and to see the company grow and more people using our service is very exciting." Williams agrees, "We built this from the ground up and it has just taken off. The best part of being an engineer is seeing people use what you have created."

To learn more: www.BookRenter.com

SWATH BOAT COMMISSIONED IN LAKE TAHOE SCIENCE MISSION

In October, students in the SCU Robotic Systems Laboratory conducted a marine geology mission in Lake Tahoe with the Lab's new SWATH (small waterplane area twin hull) boat. The deployment was the first science mission for the Lab's autonomous SWATH boat, an event that involved four years of development work by more than a dozen undergraduate and graduate students.

The Lake Tahoe student team included graduate students Paul Mahecek, Thomas Adamek, Vincent Howard, and Steve Li, all of whom worked through the past summer to develop an autonomous navigation system for the boat and to install a multi-beam sonar system that allows shallow-water bathymetric maps to be created. The boat uses an innovative twin-hull mechanical design that improves the boat's stability in waves. In addition, a suite of high-precision sensors measures the boat's position and dynamic properties in order to properly interpret and resolve the sonar data, thereby improving map quality.

In Tahoe, the SCU students worked with a science team from the U.S. Geological Survey (USGS) and the University of Nevada at Reno (UNR) and operated the boat to create a

high-resolution map of a series of boulder ridges on the Tahoe Shelf along the northwestern shore of the lake. These ridges are proof of a tsunami wave that occurred in the lake during the McKinney Bay landslide thousands of years ago. Using the Lab's Triton underwater robot during a series of dives in 2005 and 2006, the SCU-USGS-UNR team discovered these ridges, representing a highly significant scientific finding as the first-ever proof of tsunami in the lake. Student Paul Mahecek, who has been active on the project since its inception, commented, "When you put so much time and effort into projects like these, it's great just to get them running. But it is an amazing feeling to get them operating in the field and generating valuable science data."

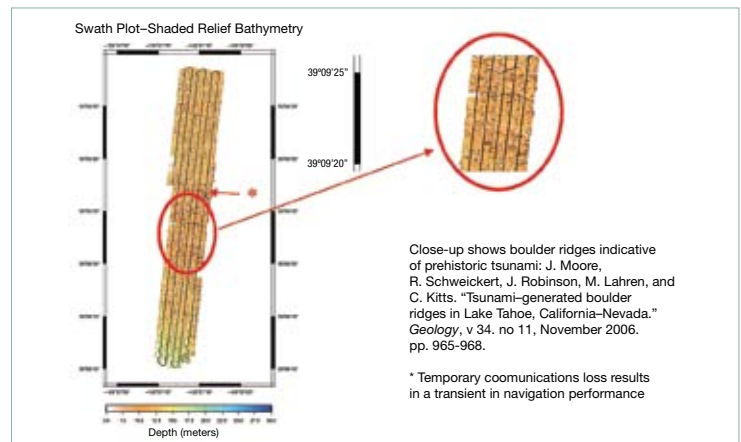
The team continues to improve the boat by adding new control systems, improved wireless communications, and several innovative autonomous functions. In 2010, NOAA (National Oceanic and Atmospheric Administration) and NASA will be sponsoring the SCU team in order to conduct a series of mapping missions along the West Coast and in Alaska.

To learn more: <http://rsl.engr.scu.edu>

Photo: Christopher Kitts



SCU's SWATH boat aids research in Lake Tahoe.



Data from bathymetric mapping indicates prehistoric tsunami.



SMART GRID AND SOLAR COURSES FEATURED IN GRADUATE OFFERINGS

Addressing the tremendous interest in smart grid and solar technology development, SCU Engineering is offering a full complement of courses and certificate programs to prepare students to enter this exciting arena. Offerings include one-day Emerging Topics certificate programs, 16-unit certificate programs, and individual courses offered through the Open University program.

"The Obama administration's strong push for smart grid and solar development and deployment is leading to a boom in 'green' jobs here in Silicon Valley and beyond," said Olivia Jenq, director of graduate programs. "The School of Engineering is here to serve a wide range of needs—whether it is simply to assist with freshening up a dated skill set, or to gain the knowledge required for an exciting new career."

SCU engineering alums qualify for a 50 percent discount on auditing all graduate engineering courses and emerging topics programs. Contact LeAnn Marchewka 408-554-4765 to register.

For a complete list of smart grid courses and programs: www.scu.edu/engineering/graduate/smartgrid.cfm

For a complete list of solar courses and programs: www.scu.edu/engineering/graduate/solar.cfm

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