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Horizons in Engineering

Dean's Message

The School of Engineering views a main part of its mission as one where we "serve the valley." However, over the years, the emphasis in the valley has changed from the development and commercialization of integrated circuits and storage technology in the 1970s, to the development of the microprocessor and personal computer in the '80s, and the Internet in the '90s. Now we are witnessing this process of change where sustainability, renewable energy, bioengineering and nanotechnology are some of the emerging areas of activity in the valley.

Santa Clara University is responding to these changes with a greater emphasis in the areas of solar power as witnessed in our Solar Decathlon House, nanotechnology through our Center for Nanostructures, and our new program in Bioengineering which is currently under development and implementation. We aim to produce engineers who will contribute significantly to these emerging areas while becoming the leaders of the future.

Our Solar Decathlon House, which has involved more than fifty students, as well as a number of faculty and staff members, competes in Washington D.C. at the contest sponsored by the U.S. Department of Energy. This event has generated considerable excitement here among all segments of the campus and significant financial support from more than 200 corporate and individual donors in the surrounding valley. We fully expect a new wave of leaders to emerge from this project, reflecting the change we are implementing as we "serve the valley." A popular proverb says "May you live in exciting times." I believe that we do.

Godfrey Mungal
Dean
School of Engineering



**Santa Clara
University**

School of Engineering

Solar Decathlon Team Ships House to D.C.

Capping 16 months of exhaustive engineering, construction, and fundraising, the SCU Solar Decathlon team performed a last series of tests of their controls system and then dismantled the deck, removed the siding, disconnected the appliances, and watched as their entry into the U.S. Department of Energy's competition was hoisted onto a 60-foot trailer for its trip to Washington, D.C.

The team had been working nearly round the clock for the past few weeks in a last-ditch push to get their house on the road in time to reach its destination on the National Mall by early October. Once the house is reassembled, the team will compete against 19 other universities from around the world in 10 events that will test the functionality of the totally solar-powered homes.

The result of the SCU team's hard work is an elegantly designed and crafted 650-square-foot house that brings cutting-edge technology home. For more on the design elements, see the accompanying article later in this issue. And be sure to check on the team's progress at www.scusolar.org and www.scu.edu/engineering.



Team members look on as the Solar Decathlon house is loaded on the trailer.

PHOTO: CHARLES BARRY

Robotics Students Go “North to Alaska”

Ever been to a kelp-cutting ceremony to celebrate the opening of a \$12.5 million marine laboratory? A group of SCU robotics students had just that experience this summer when they traveled to Kasitsna Bay, Alaska, to install a weather station and provide an outreach activity for 100 guests.

The Kasitsna Bay Laboratory, owned by the National Oceanic and Atmospheric Administration (NOAA) and operated in partnership with the University of Alaska, Fairbanks (UAF), is a marine research and teaching laboratory that welcomes approved researchers from academic and government institutions. About three years ago, NOAA and UAF began conversations with Christopher Kitts, director of SCU’s Robotics Laboratory, and Bill Kirkwood, an adjunct professor of

mechanical engineering who is also the Associate Director of Engineering at the Monterey Bay Aquarium Research Institute. After a site survey, Kitts and Kirkwood initiated the development of a technology roadmap for supporting marine research, which led to a field trip this past summer by mechanical engineering graduate students Paul Mahacek and Giovanni Minelli.

But before the weather station could be installed, it first had to be built and tested here in Santa Clara’s robotics lab. Ognjen “Ogi” Petrovic (B.S. Computer Engineering, M.S. Mechanical Engineering) integrated and configured various software tools to fit the lab’s requirements. The result is a device that includes a live webcam, anemometer, pyrometer, leaf moisture sensor, rain gauge tipping bucket, plus the requisite

PHOTO: GIOVANNI MINELLI



Mahacek (left) and Minelli with their ROVs.

barometer and thermometer. “This is the only piece of weather equipment on Kasitsna Bay,” Petrovic noted. “As the only data point on this side of the inlet, the information is of vital interest to locals and scientists alike, and will contribute to NOAA’s national database.” The weather station is supported and maintained remotely by SCU students.

After installing the station, Mahacek and Minelli contributed to the festivities by helping celebrants build their own robotic Remotely Operated Vehicles (ROV) for oceanic exploration using pre-made motors, pumps, and PVC pipe. Next summer, the team plans to bring their Autonomous Surface Vessel (ASV) to map the bathymetry of this most diverse marine ecosystem. Mechanical engineering student Todd Berk recently worked with Kitts and Kirkwood to test the ASV and the sonar system in the Moss Landing harbor; Petrovic and Mahacek are currently working on the control system for the boat’s autonomous navigation and for the multibeam sonar that will be used. “NOAA has large vessels for deep water exploration, but our smaller ASV is perfect for investigating the near-coastal waterways that are too shallow for other craft,” said Mahacek.

Minelli is enthusiastic about his work in the robotics lab: “Where else can you work on underwater robots and satellites in the same day? There are so many integrated projects; whatever opportunity you want to pursue, it’s happening right here.”

Read more about the Kasitsna Bay Laboratory and SCU’s robotics lab: www.westnuc.uaf.edu/kbay.htm
<http://rsl.engr.scu.edu>

Godfrey Mungal Appointed Dean of Engineering

M. Godfrey Mungal, a self-described “teacher who does research,” has been appointed dean of Santa Clara University’s School of Engineering. He began his new duties in September.

An associate dean at Stanford University and professor of mechanical engineering for the past 22 years, Mungal’s teaching and research has focused primarily on the area of thermosciences. He is the author or co-author of more than 150 papers and has won several teaching and advising awards, including Stanford’s Tau Beta Pi award for excellence in undergraduate teaching. Mungal also served as director of the High Temperature Gasdynamics Laboratory at Stanford and coordinated the ABET accreditation process as associate chair for student services.

Born in Trinidad, the new dean earned his Ph.D. in aeronautics from California Institute of Technology and is a fellow of both the American Physical Society and the American Society of Mechanical Engineers.

According to SCU President Paul

Locatelli, S.J., “Dr. Mungal has a strong, demonstrated commitment to diversity, recruitment and retention issues in education, and he is particularly interested in the role of engineering in advancing the cause of under-represented and first-generation students.”

As dean, Mungal will seek ways to promote the University’s goals of increasing enrollment in the undergraduate and graduate engineering programs, and forming partnerships within the Silicon Valley community to enrich the curricula. He is experienced in fundraising, budgeting and generating resources, having raised and managed more than \$7 million in government and industrial funding to support his research at Stanford.

Although the job is new, Mungal is already quite familiar with what it means to be a Bronco. One of his daughters is a 2004 alumna; the other is an SCU sophomore.



Modeling the Future of Transportation

Transportation engineering is a growing field that has the potential to improve the quality of urban life in a number of different ways. A division of civil engineering, this field focuses on reducing traffic congestion, alleviating noise and airborne pollutants from vehicle emission, and planning for safe evacuation in times of disaster, whether natural or human-caused.

But, as Professor Rachel He points out, transportation engineering differs from other disciplines of civil engineering in that “we’re dealing with people, and their driving behaviors are not easily predicted and modeled. We can model mechanical properties; we can model structural loads, but the randomness of human behavior defies total predictability.”

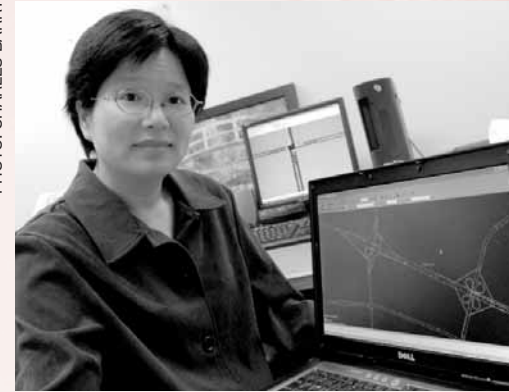
To model different scenarios, Dr. He uses traffic simulation computer

software. “On the computer, we can not only build large urban transportation networks with freeways, interchanges and major arterials, but also study a single intersection on a local street,” she said. Integrating the fixed attributes of the roadway—number of lanes, directions, and slope grades—is the easy part; accounting for the uncertainties—traffic conditions, day of the week, time of day, and weather conditions that all affect a driver’s decision-making—is what makes the work interesting.

As the computer simulation models are becoming more mature, the research is becoming more viable, and Professor He is increasingly motivated to bring undergraduates into the field. Each year she advises several students who choose transportation simulation modeling as their senior capstone proj-

ects. “I want our students to have an early exposure to traffic simulation modeling,” she said. “Alleviating congestion, reducing environmental impact, and ensuring safe evacuation in times of disaster are as much a part of our survival as structural engineering.”

PHOTO: CHARLES BARRY



Professor Rachel He models traffic scenarios in her office at SCU.

Professors Work to Improve Communication for All

Talking with professors JoAnne Holliday (computer engineering) and Sarah Kate Wilson (electrical engineering) about their research in the field of wireless network communication is an enlivening experience. Their enthusiasm for their work is contagious, which is fitting because they are working on making communication contagious on a number of different levels.

According to these two, computer and electrical engineers have not had much of a history of communicating with each other. With a well-defined interface between the two disciplines, there wasn’t always much need for talk. But when they discovered that their individual research was taking them further into the middle ground, they began working together on determining the feasibility of using small, turn-key base stations for cellular networks that would inexpensively increase the digital capacity on high-traffic networks, and also extend the reach of existing cellular networks in third-world or developing countries.

“Technology can benefit people in surprising ways,” Wilson said. “We envision agile base-stations (ABS) that will not only improve network connectivity near the 49ers’ stadium on game day, but will also help fishermen in Bangladesh determine which market will bring the best price for their catch.”

The cost of installing a wireless base-station can be prohibitive for poorer communities, leading to a digi-

tal divide. “We’re looking for an inexpensive, flexible, and efficient way of increasing cellular network productivity for everyone” said Holliday, “and we think the ABS is a step in the right direction.”

Using algorithms for frequency and code assignment and for routing decisions, their study will help determine how ABS can affect the overall throughput of the system and the throughputs of individual users. With the help of funding from SCU’s Center for Science, Technology and Society, the professors are concentrating their research on increasing the number of low-cost, low-rate service channels (such as pagers or voice), making communication contagious around the world, and allowing many to benefit from the information age.

PHOTO: CHARLES BARRY



Professors Wilson (left) and Holliday test the wireless network.

What Goes Into a “Green” House?

In fashioning its entry into the U.S. Department of Energy’s Solar Decathlon, SCU’s team scrupulously considered every detail of their design—from the beautiful bamboo beams overhead to the eco-friendly stuffing in the sofa cushions. As Yasemin Kimyacioglu, mechanical engineering student and member of the interior design team, said, “Though SCU’s entry is not judged on the green-ness of the furnishings used, it was important to the team’s outreach mission to present a cohesive product that raises awareness of some of the options available to consumers, so they can adopt eco-friendly decision-making when outfitting their homes.” Here are some of the features included:

- Patent-pending bamboo I-beams, developed by the SCU Solar

Decathlon Civil Engineering Team. Strong and uniquely sustainable, bamboo quickly replenishes itself.

- Modularized electrical system: Photovoltaic panels, electrical inverters, and batteries form a versatile system, allowing the homeowner to operate on or off the power grid.
- Absorption chilling technology: Solar-heated water drives a thermodynamic conversion generating chilled water to cool the house.
- Nana Wall: This beautiful glass wall maximizes natural light while minimizing heat loss.
- Controls system: A controls system algorithm and myriad sensors monitor and adjust temperature, lighting, humidity, etc.
- Siding: Fiber cement siding with

advanced thermal insulating properties is used on the west and south faces of the home, where sunlight predominates. On the north and east walls, a durable surface made of paper from certified managed forests is employed.

- Insulation: Recycled blue jeans!
- Interior finishes: Hickory kitchen cabinets from certified forests and reclaimed oak furniture create a warm, casual environment, while recycled glass and ceramic tiles, and recycled-Coke-bottle glass accents beautifully finish the kitchen and bathroom. Paints and upholstery materials trim indoor air pollution through reduction of volatile organic compounds.

Learn more: www.scusolar.org

Mentoring the Next Generation of Engineers

Recognizing the challenges women and traditionally underrepresented minority groups often face in choosing engineering as their academic and career path, the School of Engineering has taken a giant step in aiding their success by partnering with MentorNet, an online community that pairs students with engineering professionals for e-mail-based mentoring. Through the School’s subscription to the program, engineering students of all levels — undergraduate, graduate, and Ph.D.— can sign up, at no charge to them, to become the online protégés of professionals from business, academia, and government sectors for one-on-one encouragement and advice. Junior

faculty members are also eligible to participate.

Founded in 1997, MentorNet is an award-winning non-profit network striving to positively affect the retention and success of those in the fields of engineering, science and mathematics, particularly women and others who have been traditionally underrepresented. As founder Carol Muller, Ph.D., notes, “Until women and people of color are fully represented in the fields of science and engineering, society is losing out on the talents of a vast number of potential contributors.”

Ruth Davis, associate dean for undergraduate studies and Robert W. Peters Professor of computer engineer-

ing, was instrumental in bringing this benefit to the students. “Sometimes educating the whole person means pointing them in the right direction to learn from others outside our institution. This program perfectly fits our mission of educating a diverse community of leaders of academic excellence and social conscience. Not only does it provide a positive, non-threatening environment in which our students can grow and thrive, but it also affords an opportunity for our alumni to reach back and assist the next generation of engineers.”

For more information, or to join as a protégé or mentor, visit:

www.mentornet.net

You’re Invited!

2007 Distinguished Engineering Awards Dinner

Sunday, December 2, 2007

Adobe Lodge, Santa Clara University

For more information:

www.scu.edu/engineering/about/engach.cfm



Santa Clara University

School of Engineering

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