SANTA CLARA UNIVERSITY
1912-2012
A Century of Engineering Excellence
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School of Engineering
engineering news

DEAN'S MESSAGE

This year, the School of Engineering celebrates a very important anniversary—100 years of engineering excellence at Santa Clara University.

Since its founding in 1912, Santa Clara's School of Engineering has established a reputation of academic excellence that is exemplified by our illustrious alumni. We have educated Broncos who have gone on to become heads of state, leaders of Fortune 100 companies, entrepreneurs, researchers, professors, lawyers, venture capitalists, instruments of social change, and simply outstanding citizens.

It is a privilege to continue this century-long tradition of educating engineers of integrity within the context of a Jesuit mission that challenges us to provide the very best academic experience while also opening our students' minds to the gritty realities of the world and the needs of those less fortunate. In this edition of *Engineering News* you will find examples of how we are doing just that.

While we celebrate this historic milestone in the life of Santa Clara University and the School of Engineering here in Silicon Valley, we are ever mindful of our calling to engage with those whose lives can best be improved through our knowledge, our talents, and our compassion.

Here's to another 100 years of delivering our best!

Godfrey Mungal
Dean
School of Engineering

Photo: Charles Barry

Hundreds of alumni, faculty, and friends celebrated the School of Engineering Centennial at The Biggest Bash Ever! in October.

100 YEARS STRONG ... AND WE'VE GOT MOMENTUM

Happy Anniversary, School of Engineering! This fall the School of Engineering kicks off a yearlong celebration of a century of engineering excellence at Santa Clara University.

Founded in 1912 under the direction of George L. Sullivan, the College of Engineering later gave Santa Clara the distinction of being the first Catholic institution west of St. Louis to have an accredited engineering program. Sullivan led the College for a remarkable 43 years, shepherding the program safely through the turbulence of two World Wars, the Great Depression, the Korean War, and wave after wave of technological innovation.

Through the decades, Santa Clara engineering faculty and alumni have contributed greatly to their professions, to their communities, and to the world. In the 1940s, Santa Clara engineering was instrumental in helping the war effort by training civilians in the defense industry; in the 1960s our newly instituted "Early Bird" graduate program gave local engineers the opportunity to expand their knowledge while they were transforming the Valley of Heart's Delight into Silicon Valley, a hub of technological innovation. Pioneering research in the field of alternative fuel sources in the 1970s brought SCU international recognition, which was further enhanced by our recent advancements in sustainable engineering and our 3rd Place finishes in the 2007 and 2009 U.S. Department of Energy's Solar Decathlon competitions.

Today, we take pride in educating students who put their heads, hearts, and hands to work in areas of focus that could hardly be imagined back in 1912—bioengineering, nanotechnology, sustainability, and frugal innovation for the developing world. The best is yet to come for the School of Engineering at Santa Clara University and we invite you to join with us as we embark on our next 100 years of engineering excellence.

Read more: **www.scu.edu/engineering/100**

ASPIRING SOLAR DECATHLETES PREPARE FOR COMPETITION

Here we go again! This fall, the School of Engineering will submit a proposal to participate in the U.S. Department of Energy's 2013 Solar Decathlon, an international competition in which 20 colleges and universities vie to design and build the best solar-powered home. Santa Clara University won third place in both the 2007 and 2009 competitions (taking a break in 2011 to focus on this year's Centennial celebration).

A dedicated corps of undergraduate engineers is taking on the mantle proudly worn by their Bronco predecessors. A course in solar home design and analysis offered last spring ignited their passion for sustainable design and engineering. The crew spent the entire summer completing dozens of projects on the 2009 Refract House and, according to Teddy Tortorici '13, "playing with the code for the control systems on the 2007 Ripple House to get the best efficiency out of the entire system." Both solar homes are permanently and proudly installed on Santa Clara's campus.

"Basically, we're hooked now," said Guillermo Gallardo '13, but for several of the aspiring decathletes the chance to join the solar team was a big factor in their decision to enroll at Santa Clara University. "I'd heard about the solar house before coming here and I wanted to study sustainable design," said Dane Kornasiewicz '13. Jake Gallau '13 and Tortorici were also drawn to SCU because of a desire to get involved with the project. Kendra Lane '14, civil engineering, had initially considered studying architecture, so she is excited to be learning Revit, the design software used by architects.

To prepare for joining the competition, the team has traveled to Washington, D.C., to tour the homes in this year's Decathlon. They were accompanied by faculty project manager and professor of mechanical engineering Tim Hight, and Jim Reites, S.J., associate professor of religious studies and member of the faculty of the School of Engineering. A smaller group traveled even farther afield this fall, exploring innovations emerging from China with 2007 Decathlon student project leader James Bickford '08, now manager of business development in China for Tigo Energy.

Some undergraduates might be overwhelmed by the scope of the project, but this crew is unfazed. "I was nervous and hesitant in the beginning," said Guillermo, "but by just getting involved and learning on the job we're learning to just get it done."

With proposals due to the DOE by November 10, prospective contenders will be anxiously awaiting announcement of the selected teams by the end of the year. In the meantime, you can bet the Broncos will be hard at work in anticipation of a positive result.

GENDER AND ENGINEERING COURSE LEADS TO SELF-DISCOVERY

A graduate level class, Gender and Engineering, taught by Bonita Banducci, president of Banducci Consulting, is causing breakthroughs in self-awareness for participants who learn to understand how the different cultural lenses, paradigms, and competencies held by men and women affect the engineering workplace and personal relationships.

Framing gender competencies, communication, and leadership styles in terms engineers can readily relate to, Banducci helps students understand themselves and each other and their colleagues at work as never before. "With this knowledge, they can stop labeling themselves or another person as 'wrong,' can put into words what they and others contribute, and can understand how others who are different can be effective," she said.

"Research has shown that 'collective intelligence' and productivity is increased in groups with varying perspectives and sets of competencies," she continued. "Effective management of differences contributes to research, development, and marketing of products and processes as well as increased advancement of both men and women."

Another benefit of understanding gender is the effect it can have on the students' personal lives. "For me, this is very rewarding work," Banducci said. "Many of the most remarkable results are from international students who have strong traditions built around gender roles. They report not only improvement in situations that had been thwarting career advancement, but also peace and deepened relationship with parents and spouses brought about by their own transformation."

Banducci isn't alone in her enthusiasm for the class. One electrical engineering master's student, who works as a design engineer in the R&D group of his company, wrote: "This class was a journey of self-discovery for me. I feel [Professor Banducci] just handed me the key to my inner self so I can begin to understand myself. Yes, I feel that much more liberated."

NEW FACULTY JOIN BIOENGINEERING PROGRAM

Photo: Heidi Williams

Zhiwen (Jonathan) Zhang

Prashanth Asuri

The School of Engineering is happy to welcome two new faculty members to the Bioengineering Program this fall, Prashanth Asuri and Zhiwen (Jonathan) Zhang.

After receiving his Ph.D. from Rensselaer Polytechnic Institute (RPI), Asuri held a research position at Solidus Biosciences where he developed high-throughput predictive cell-based assays for screening small molecules and facilitating the metabolic toxicity analysis of drug candidates. He later spent two years as a postdoctoral researcher at University of California, Berkeley, applying biomolecular and material approaches to obtain a better understanding of the conditions and molecular mechanisms for self-renewal and neuronal differentiation of human pluripotent stem cells.

"This is my dream job," said Asuri of his new position at Santa Clara

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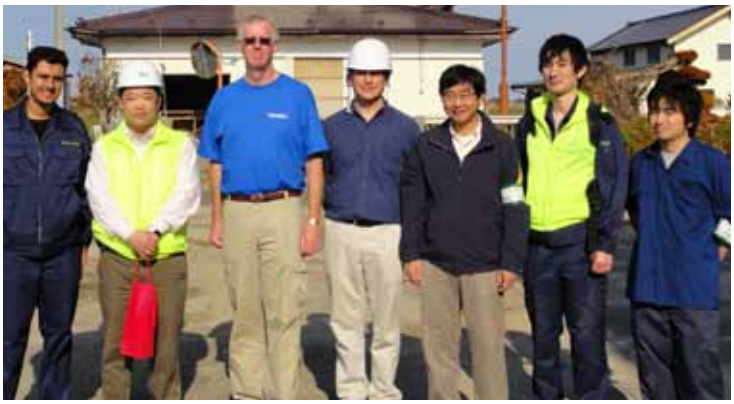
LESSONS LEARNED FROM JAPAN'S EARTHQUAKE

Photo: unknown



Mark Aschheim (center, in hard hat) joins fellow earthquake engineers in Japan.

Mark Aschheim, chair of the Department of Civil Engineering and member of the Earthquake Engineering Research Institute, traveled to Japan this summer with a team of earthquake engineers led by Prof. John Wallace of UCLA to perform earthquake reconnaissance for the Learning from Earthquakes program funded by NSF. As a member of the buildings team, he spent a week in the Fukushima and Sendai areas investigating damage to reinforced concrete buildings incurred as a result of the devastating March 2011 quake. Faculty from the University of Tokyo and Tohoku University organized the weeklong visit on behalf of the Architectural Institute of Japan (AIJ).

"We were in the field every day assessing the damage caused by ground shaking," said Aschheim, whose research focuses on developing techniques for performance-based seismic design. "We saw fairly typical failures of reinforced concrete columns, in particular. It was apparent that while some areas had higher concentrations of damage due to softer soils, elsewhere, affected buildings were relatively far apart from each other and only the most vulnerable buildings suffered serious damage."

Aschheim notes that those buildings that had used "stiff" retrofits (with diagonal braces and in-fill shear walls) had negligible damage. This was in contrast to a retrofit that had employed viscous dampers, which caused "those columns to undergo larger displacements and suffer substantial damage, although less than would have occurred without the retrofit," he said.

"It's an illustration of what is obvious from an engineering point of view; however, it's good to have field validation that control of deformation matters," Aschheim said. He continued, "There is a subtle but big paradigm shift that is happening in earthquake engineering today. In the past, the focus was on keeping buildings from collapsing, and ductile structural systems were the most prized. Now we need to address the fact that ductility [the ability of a material to stretch or deform rather than fracture] implies damage; we need to focus first on tolerable damage levels and then on the structural systems that can deliver the desired performance."

Aschheim cites as an example the response of two hospitals to the earthquake in Japan. One facility was constructed with steel moment resisting frames and several wings of the facility were heavily damaged from the deformation caused by this flexible and ductile system. "This was a relatively new hospital that needed to be operational after the earthquake, but was severely impaired by damage. Another nearby hospital, which had used a base isolation system, responded so well that surgery continued unimpeded during the earthquake."

Seeing first-hand how Japan's reinforced-concrete structures weathered the temblor is important for earthquake engineers here in the United States. "Observing the aftermath of an event such as took place in Japan last spring is extremely valuable," said Aschheim. "It helps us understand how to better mitigate damage and manage risk from such a devastating occurrence."

PROFESSOR, TEACH THYSELF

A primary focus of Santa Clara University is to promote students' global understanding and engagement. To this end, School of Engineering Dean Godfrey Mungal organized a faculty trip to Nicaragua in September. "Last year," he said, "a group of us spent two weeks in China learning about the vast changes occurring there. In contrast, this year's trip to Nicaragua, the second poorest country in the Western Hemisphere, brought us in touch with poverty, hope, appropriate engineering, and new opportunities for international collaboration."

The group of 16 faculty members, one advisory board member and two Jesuits toured parts of the country, and visited the Managua City Dump where hundreds of families live and eke out their existence amid the filth of rotting garbage, but where hope is found in programs providing schooling and meals for children and tools to learn an occupation outside the dump. The group spent time at a Matagalpa coffee cooperative where a biodigester converts unused portions of the coffee bean into methane gas for sustainable energy. A trip to Universidad Centroamericana (UCA), opened new avenues for collaboration between three of the SCU engineering faculty members and their Central American cohorts.

"I don't think one can competently speak about globalization without some firsthand experience of the needs and realities of the world as a whole," said Aleksandar Zecevic, associate dean for graduate studies and professor of electrical engineering. "This trip reminded me of why I chose engineering and teaching as my profession. As engineers, we should not only understand how to provide solutions for the developing world, but also what compels us to make this a priority," he added.

Photo: Godfrey Mungal

Ahmed Amer and Jim Reites, S.J., operate a rope pump system in Nicaragua.

Many of the professors spoke of being inspired by the trip. "It infused me with ideas on how I can bring social awareness to my civil engineering classes, " said Tonya Nilsson. "I now see ways I can incorporate assignments that require the students to gain greater awareness of the difficulties that millions of people live with each day." Ahmed Amer, associate professor of computer engineering was profoundly affected by witnessing "the good in people and their potential to overcome the harshest circumstances, which stands in sharp contrast to the poisonous, can't-do attitude that leads to excuse-making and apathy. This experience has led me to rethink targets for some of my own work on reliable distributed computing systems. How can what I do well help the most?"

"The Jesuits exercise a 'preferential option for the poor,'" said Mungal. "Bringing our faculty face-to-face with the realities of the developing world reminds us of how important our work as educators and engineers really is, and instills a renewed enthusiasm for sharing with our students the Jesuit mission to serve others."

FOSTERING A COMMUNITY SPIRIT

Serving the community has always been important to Santa Clara University, and one of the ways the School of Engineering does its part is by putting undergraduates to work on projects for our neighbors.

"We want students to get excited early on about engineering and how it can be used in every aspect of the community," said associate professor of electrical engineering Shoba Krishnan. "From the very start we want them to be keen on working in multilevel, multidisciplinary groups to solve a problem for the local community. We have enough problems in our own backyard to keep plenty of students busy."

An avid proponent of getting engineering students excited about their chosen field of study, Krishnan teaches ENGR 110, Engineering Projects for the Community. "It's a great course because students can try different types of engineering to see what they like," she said. Even students who are firmly ensconced in a particular major can tackle projects outside their area of expertise, broadening their knowledge while performing a valuable service. "Aside from the hands-on experience they gain," Krishnan added, "they also build confidence in their problem-solving abilities."

In the past year, students completed projects for a number of community partners, including the Wilson Adult Education Center, Peterson Middle School, Walden West Science School, and SCU's own Bronco Urban Garden (BUG). Stephanie Truong, a mechanical engineering major, worked on a civil engineering project with a teammate from the College of Arts and Sciences, designing and building an urbanite wall for the garden made from leftover junk. The two sought advice from civil engineering faculty on structural integrity, scrounged material from SCU labs and a neighboring indoor rock climbing facility, and made dozens of trips to the job site with wheelbarrows full of donated materials before actually completing the structure.

"They got really excited about engineering working on that project and now they can point to the wall and say 'I built that,'" said Krishnan. "Another group of mechanical engineers calculated how many solar panels it would take to heat the SCU pool, applying what they'd learned about heat transfer," she said, adding "It's really fun to witness those moments when students take the theory they've learned and are excited to apply it for the good of the community."

Photo: Charles Barry

Associate Professor Shoba Krishnan (center) advised Ayesha Ahmad '11 and Christina daSilva '11 on their wind turbine project for Walden West Science School.

The students aren't the only ones doing something good for the community in this scenario: Krishnan and other faculty members teach the course voluntarily, outside of their teaching load. "Teaching this class takes a lot of time inside and outside of the classroom, but I'm learning to manage my teaching load and time while teaching this class every quarter," she said. "I get to know the students at a completely different level, and with each project they take on, I learn something new, too."

NEW FACULTY JOIN BIOENGINEERING PROGRAM *(Continued from Page 2)*

University. "Rather than staying behind the scenes writing grants, analyzing data, and relating to people through papers or presentations, or solving other people's problems in industry, I want to help train the next generation of engineers." He added, "Situated at the interface of many disparate disciplines, the field of bioengineering applies engineering principles to provide unique insights into real-world problems in medicine and biology.

"There is a crucial need for active researchers in this rapidly advancing discipline, and there is also a growing need for educators who will nurture and train bioengineers and scientists by providing education through efforts both in the classroom and on cutting-edge research projects. With my combined experience in industry and academia, I feel uniquely qualified to help students explore and evaluate future career options in both these sectors."

Program Director Yuling Yan agrees, "Dr. Asuri brings a wide range of experience to our program. Aside from his background in industry and research, he is very encouraging to students and brings strong teambuilding and problem-solving skills to the classroom. We are delighted to have him with us."

Also joining the Program this fall is Dr. Zhiwen (Jonathan) Zhang. "The theme for my research," said Zhang, "is bioengineering toward medicine. The idea is to engineer novel materials —particularly proteins and peptides— and devices and apply them to study basic biological and medical questions that ultimately lead to drug discovery."

Zhang's long-term goal is to find a cure for the malfunctioning proteins that are the cause of so many diseases. At the present time, he is studying how "superbugs" have evolved their proteins to become immune to antiobiotics. "Living things are smart and they have developed an anti-antibiotic capacity," said Zhang. "We are running out of the arsenal to fight these superbugs, so we really need to get onto that. I'm using engineering as a tool to study the mechanism through which proteins evolve and mutate; once we know how that is done, we can use engineering to design new molecules, or drugs, to fight the bad proteins."

Zhang, who received his Ph.D. from the University of Texas at Austin, did postdoctoral research at The Scripps Research Institute and taught medicinal chemistry and protein engineering in the College of Pharmacy at UT Austin before coming to Santa Clara, is excited by the possibilities for collaboration afforded at SCU. "With the biodevices being created here by Yuling and Ashley [Kim], I can see more; and with my molecules, they can do more with their devices. There are so many other faculty doing fascinating stuff here, definitely sparks can be generated," he said.

Zhang also looks forward to encouraging students to start early doing research in his lab. "Research is not limited to a single experiment; you have to solve lots of problems. I enjoy teaching students not to be afraid, to identify, analyze, and find solutions, to speak properly and hone their presentation and writing skills, and to work with others in the lab. Those skills are necessary in finding a great position and starting a career."

"At Santa Clara," he continued, "I'm expecting great collaborations and great students—both undergraduate and graduate. The mission here is clear, the students know what they want, and I know what I can give; it's the perfect environment for getting the best out of us all."

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