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School of Engineering

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engineering news

School of Engineering

WINTER 13

SANTA CLARA UNIVERSITY

DEAN'S MESSAGE

For years, Santa Clara University has held fast to the promise of instilling in our students the Jesuit-inspired three Cs—competence, conscience, and compassion.

But as we in the School of Engineering launch our second century of educating ethical engineering leaders, we also inspire our students to open themselves to two other Cs: courage and collaboration. Our Silicon Valley location affords us stellar examples of courage—innovators and entrepreneurs who are not afraid to change the world, to imagine, to try, or even to fail and try again and again in the pursuit of a dream—and we are fortunate, indeed, to be situated among the world's foremost visionaries in every field of engineering.

It also is important that our students learn that engineering is not a solitary endeavor. More and more, the work we do is interdisciplinary and collaborative. Much of our curriculum is designed to promote interaction and provide the experience of working on diverse teams that is so necessary for success in today's world.

In this edition of *Engineering News* you will find many examples of courage and collaboration, as well as the other three Cs. Enjoy!

Godfrey Mungal
Dean
School of Engineering

Photo: Charles Berry



Michael Holligan (left) and Peyton Harrod with a prototype of the roof for Radiant House

SOLAR DECATHLETES KEEP THEIR COOL

Things are heating up as the U.S. Department of Energy's Solar Decathlon nears, but Bronco decathletes are keeping their cool developing a radiant heating and cooling system as teammates prepare to build SCU's entry. Named Radiant House, this 1,000-square-foot, solar-powered home will compete against 19 entries from other international universities in Irvine, California, this coming October.

Like the Olympic decathlon, the Solar competition is divided into 10 contests. Mechanical engineering juniors Peyton Harrod and Michael Holligan are taking on the Comfort Zone Contest in which the house will be judged on how well it keeps temperature and humidity steady, uniform, and comfortable during specified periods of time throughout the competition. The pair have spent long hours researching the best thermal system for the home, studying the efficiency of energy transfer, and considering the placement of windows and the effect of sunlight.

They are working with industry leader, Messana, to design a system that integrates the company's prefabricated radiant panels into the floors, ceilings, or walls to maximize comfort and efficiency.

"We've calculated the energy we anticipate we will need to heat and cool the house during competition, using software that takes into account the number of windows, type of insulation, and site orientation. Based on that information, we determined the size of the system we would need," said Harrod. "Radiant heating and cooling feels different from traditional forced air—it really does feel great. We're excited to bring this experience to the competition while achieving our energy goals and making sure the system meets the heating and cooling loads."

So just how are they using those radiant panels? "For now, that information is classified," said Holligan. "Come out to Irvine in October, and we'll be happy to tell you all about it."

More on SCU's team: <http://sd13.scu.edu>

A VISION FOR BIOENGINEERING

Photo: Charles Barry



Paul Davison teaching his Medical Device Product Development class.

Paul Davison, M.S. '08 has always been a visionary for the School of Engineering's bioengineering program. As a graduate student in the Engineering Management and Leadership program, Davison applied his years of experience working in the medical device industry to his master's thesis—a guide for how to develop medical devices. Later, he created a course on the subject and began teaching it through the engineering management department. As the bioengineering program was launched at Santa Clara, department chair Yuling Yan

recognized Davison's expertise, keen insight, and passion for growing Santa Clara's program; she recruited him for the Bioengineering Industry Advisory Board.

Since then, Davison, vice president, Advanced Energy, for ConMed Linvatec, and inventor on eight U.S. patents for medical devices, has been a tireless supporter of the program. As an advisory board member, he helps guide curriculum and program development; in his role as adjunct professor he teaches two courses—medical device product development and biomaterials; and he serves as a project advisor, mentoring undergraduates who are working on real challenges for local medical device companies. "It's been very rewarding advising on projects," he said; "It benefits the students, the University, and the industry. After working on these projects, many of our students have jobs immediately after graduation

and are working in the medical device industry now." His mentorship doesn't end with graduation, though; with 24 years of experience in engineering and mid-level and senior management, Davison is regularly called upon by former students who are working in industry or developing their own products.

"I truly believe we should always be learning," he said. "That's part of what I enjoy about teaching and serving on the advisory board—I learn a lot from our students and it's wonderful to meet the faculty and other board members whose accomplishments are so impressive. We all have different experience, so collectively we bring a lot of value to the University." Dr. Yan agrees: "We are fortunate in having an impressive and effective advisory board whose members are pioneers in their fields of medical devices, biotechnology, and medicine. Many are making significant contributions to the

development and advancement of the Department of Bioengineering, including the teaching and training of our students, co-advising of senior design projects, facilitating internships, and providing valuable advice on career opportunities. Paul has been extremely active in all of these endeavors, and we are grateful for his unwavering commitment, dedication, and generous contributions to our department and students."

For his part, Davison envisions great change in the medical field through bioengineering. "There are strong opportunities to develop low-cost alternatives to existing devices, and for devices that can reduce the overall cost of surgery and length of hospital stay while minimizing patients' pain and speeding recovery. The future is bright for bioengineering."

More about the Department of Bioengineering: scu.edu/engineering/bioengineering

INNOVATIVE COLLABORATION BENEFITS INTERNATIONAL ENERGY LEADERS

When Abengoa, an international leader in innovative technology solutions for sustainability, was seeking a project management program for its employees, they reached out to Santa Clara University. Following a successful previous workshop by the Leavey School of Business in February 2012, the program was expanded this year when the School of Engineering was invited to collaborate with Abengoa executives and faculty from the business school's Executive Development Center on a second workshop. The new workshop is designed to provide understanding of the technical fundamentals of project management and sharpen participants' skills in leadership, negotiations, and managing across cultures.

The current workshop began in December with a visit to the company's Arizona solar plant, where Frank Barone, chair of the Department of Engineering Management and Leadership, presented "Project Initiation." Over the next six months, eight three-day modules will be held on Santa Clara's campus—five modules to be taught by engineering faculty, two modules by professors from the Department of Management, and one module by Abengoa senior staff. Civil engineering assistant professor Hisham Said, whose research focuses on sustainable development and efficient construction operations, is coordinating the effort for the School of Engineering. "Our engineering faculty bring a wealth of

industry experience in team management, planning, estimation, and execution of construction and engineering projects. At the end of the program, participants will be well prepared to seek Project Management Professional (PMP) certification if they choose," he said.

"There are many benefits stemming from this collaboration," Said added. "Abengoa gains project management professionals who have been exposed to SCU's Jesuit tradition of educating ethical leaders; faculty take their experience working with an industry trailblazer back to the classroom, and the Schools of Business and Engineering pave the way for future fruitful collaboration. I envision a lot of

opportunities by building this unique relationship with Abengoa that would benefit our Sustainable Energy graduate program, and international senior design projects that relate to sustainable energy."



Civil engineering faculty member Gary Walz and students from Abengoa

A CIVIL SOLUTION

Photo: Heidi Williams



Michaela Nava '13 conducts research at the Annex Laboratory.

Needing a large testing facility for student and faculty research while facing space and budget constraints, civil engineering Professor Reynaud Serrette had to get creative to find a solution. He reached out to alumnus Georgi Hall '96, M.S. '98, director of engineering at California Expanded Metal Company (CEMCO), and a fruitful collaboration was launched with the addition of a Santa Clara University Civil Engineering Annex Laboratory at the company's Pittsburgh, California, facility.

"CEMCO is the largest manufacturer of cold-formed steel framing and metal lath in the Western United States," said Serrette, "and they were already involved in full-scale experimental testing. They've provided space, materials, and personnel for us and they benefit from our expertise and research."

Michaela Nava, a senior in SCU's five-year combined BS/MS civil engineering program, works in the Annex where she is leading a project to evaluate the performance of light frame shear walls with different aspect ratios and panel constructions. She and CEMCO's lab technician built 20 walls during the fall quarter and they are currently in the test phase. "We're learning about the reduction in strength for shorter walls," she said. "The trend in architecture is to have more windows and open space, so there is less room for walls; but the shorter the wall, the less strength to resist load. I'm conducting tests to mimic lateral load on the wall, documenting the damage from each test with video and still photography, and graphing the results."

Michaela, whose work in the Annex is funded by a Clare Booth Luce scholarship, has gotten a wide range of experience there. "It's been really cool—I've had to budget, price materials, schedule work to be done, procure donations of steel from CEMCO, and help to design and fabricate the test equipment. There was a lot of problem solving, adjusting equipment to fit my project. I've had lots of freedom to do what I want, and it's a good opportunity to get published, because I will write a paper at the end of the project. Everyone here is really nice; I get advice from Georgi, and Dr. Serrette helps me a lot."

For his part, Hall sees the collaboration as a win-win situation. "Based on the work SCU is doing here, we've expanded the capabilities of our facility and increased the scope of our accreditations, adding other fields of structural testing, which generates revenue for us." He also enjoys mentoring the next generation of civil engineers. "Michaela talks with us about projects we're working on. We have the latest and greatest equipment, tools, and software available to our staff, and she has free access to these resources as well. She can also interact with CEMCO personnel to learn about new, emerging technologies within the cold-formed steel framing industry, such as BIM (building information modeling), and our expertise with codes and compliance. To have research done and realize its outcome being applied to real world applications in the design of cold-formed steel structures all happening in one place is a huge benefit for the students, and it's a great opportunity for CEMCO to have a closer connection with the academic world."

More about the civil engineering facilities on campus: scu.edu/engineering/eNews/winter2013

Photo: Heidi Williams



Georgi Hall '96, M.S. '98, helps lead the next generation of civil engineers.

SCU's Department of Civil Engineering has a new testing facility at CEMCO.

ENVISIONING A FRUGAL CATARACT DETECTION SYSTEM

One of the requirements Professor Radha Basu, director of the School of Engineering's Frugal Innovation Lab, makes of students taking Engineering for the Developing World (ENGR 336) is attendance at the annual Global Social Benefit Incubator wherein social enterprises present their business plans before an audience of Silicon Valley entrepreneurs and venture capitalists. From this pairing of bright students and worthy causes comes some great collaborations, one of which could bring affordable eye care to people in remote areas of Mexico.

At the conference, graduate students Ruth Borrud, Jasmin Gonzalez, and Layne Orr learned about the work being done by Salauno, a social enterprise that is seeking improved means for diagnosing cataracts in patients living in remote areas and referring them for surgery to their urban center. Currently, Salauno has set up satellite eye camps, where expensive equipment and doctors with limited availability are brought in to identify potential patients, some of whom travel a great distance just to learn they are not candidates for surgery. Salauno

was seeking a way to broaden its impact through the use of affordable, transportable detection devices.

"Radha was very helpful," said Orr. "She was aware of a device, CATRA, developed by a team at MIT, that can be assembled for less than two dollars. Attached to a smartphone, an interactive app is used to scan the eye and map cataract locations. After familiarizing ourselves with this and other emerging technologies, we determined CATRA would work well for Salauno."

The team developed a concept for how Salauno could integrate this device, proposing a smartphone application to be developed that would merge data from the scan with patient information for transmittal from the phone to Salauno's cloud. From there it could be retrieved at Salauno's vision centers where surgeons could review the information and determine if the patient needed to come in for further examination and/or treatment.

"It was quite amazing to see how pairing MIT's device with our plan for a mobile app and cloud-based storage system could

help so many more people, while saving significant time and money for patients and Salauno," said Orr.

"The Frugal Innovation Lab develops accessible, affordable, and appropriate technologies and products for emerging markets, aimed at social impact," said Basu. "Bringing this unique perspective to Silicon Valley engineering students at a time when companies are increasingly focused on the developing world is very exciting and satisfying."

For Orr and a new team of students taking Dr. Kern Peng's course, Advanced Project Management and Leadership (EMGT 335), the work continues as they further develop the Salauno-CATRA concept and project plan this quarter.

Engineering students team with social enterprises to develop products and services for emerging markets in SCU's Frugal Innovation Lab.

FRUGAL INNOVATION CORE COMPETENCIES

	Slit-lamp & visual acuity test	Scheimpflug photography	Retro-illumination techniques	Wavefront aberrometer	NIDEK EAS-1000	CATRA	Back-scattered light device
Rugged	▲	▲	▲	▲	▲	●	N/Aat
Human Centric	×	×	▲	▲	▲	●	●
Distribution	×	×	▲	▲	▲	●	●
Simplified	×	×	▲	●	▲	●	●
Adaptable	×	×	×	×	×	●	●
Local	×	×	×	×	×	×	×
Green	×	×	×	×	×	●	▲
Affordable	×	×	×	×	×	●	▲
Mobile	×	×	×	×	×	●	×
Lightweight	▲	×	×	×	×	●	●

x = Low, ▲ = Medium, ● = High

A THIRST FOR ADVENTURE BRINGS CLEAN WATER TO HONDURAS

Photo: Tonya Nilsson



EWB students with members of the local water board

A spirit of adventure, willingness to help others, and desire to put their engineering skills to good use in the world are some of the motivations that drive engineering students to participate in the student chapter of Engineers Without Borders (EWB). But what keeps them involved ... is patience.

Elliott Martin, a senior mechanical engineering student, is president of SCU's student chapter of EWB and recently returned from his third visit to El Pital, Honduras, where Bronco engineers are working with local citizens and Un Mundo, a non-government organization, on a number of projects tied to a water distribution system for the rural community. "On our last trip, we wrapped up assessment and made a final decision on which water source to use, and laid out next steps. A comprehensive survey of the entire proposed system will be conducted, and curricula for educating the community must be created and implemented before construction can begin in 2015. Education is crucial to the success of the project," he said.

Rob Golterman, a junior, agrees. "To think we can just focus on the engineering is foolish," he said. "It takes so much more than just designing a system and installing it. Part of our job is to teach hygiene and sanitation—lessons we take for granted in the United States, but the importance of which cannot be overlooked in developing regions." Having traveled to El Pital, Rob is keenly aware of the benefit he and his fellow students derive from meeting the people and seeing the community's needs firsthand. "Getting involved in EWB has taught us so much about how the world works, how people interact and communicate, and how a project gets done. This is a unique learning opportunity for me and all the students who went," he said.

Fresh from their trip to Honduras, a group of EWB students pitched their project to top executives from an international construction giant. "They questioned us repeatedly on why we would wait until 2015 before starting construction when we could have started yesterday, theoretically," said Martin. "But we stood up for what we believe is right—long-term sustainability is reliant on education, and that will take time." In the end, the students' passion and expertise paid off; they walked away not only with

corporate funding, but also with checks from the individual execs. "It was really affirming for the students to be acknowledged as the experts, to validate that they are on the right track and to learn that their passion and work can inspire others. Knowing they can stand up and tell their stories and get the results they hoped for is a great confidence builder," said faculty advisor and civil engineering lecturer Tonya Nilsson, who added, "One of the greatest things about working with this group is seeing the change in students who travel."

Colin Boyle '14, who had extensive international travel experience before joining EWB, concurs. "It's a big eye-opener for those who are leaving the country for the first time. Seeing the cultural and educational differences inspires us to keep doing what we're doing. It makes it a lot more real and brings it closer to home."

"Working with EWB has just been a really prime opportunity," said Martin. "Not only has it changed my life because of the potential for this project, but it has changed me at a different level. I have more motivation for all my classes, because I'm learning things that I can apply right away. It makes my experience at SCU more meaningful to have a real project and the tools and techniques and a place to put them in the world."

For more information on how to support the SCU student chapter of Engineers Without Borders, visit www.facebook.com/ewbscu.



Site visits are an important part of the design process.

Photo: Tonya Nilsson

INNOVATING INSIDE THE BOX

Photo: JP Allport



From left: Kevin Boehnlein, Justin Visas, Hannah Dunrud, Maor Berstein, and Phillip Mirenda show off their aesthetically pleasing designs.

If you were given a marble and a three-sided cardboard box and told you had to design the space within to allow the marble to enter 10 inches above the base on one side and exit 10¼ inches above the base on the other, could you do it?

This was the challenge presented to 170 freshman engineering students as the final project of Introduction to Engineering (ENGR 1) in December. Working in pairs, the newbies crafted a seemingly limitless panorama of imaginative solutions by incorporating pulleys, homemade motors, ramps, buoyancy, and even a burst of air to

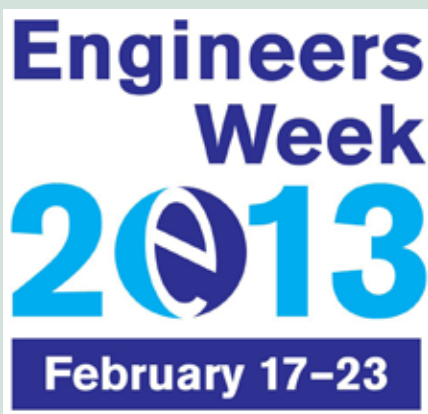
complete the task. Rubber bands, duct tape, legos, remote-controlled car parts, and recycled cardboard were common ingredients of the finished products that were judged by peers and guests for frugality, ingenuity, and aesthetic qualities. The crowd favorite depicted the marble making its way through Santa's workshop via a ramp and a motor-powered "staircase."

Students were well primed for their task, as the course includes a weekly 3-hour lab in addition to the lecture component. Lab activities focused on the problem-solving challenges found

within each discipline offered in the School of Engineering (bio-, civil, computer, electrical, and mechanical engineering) through assignments such as building a thermos, programming robots, and investigating sensors that can enable an iPad, check your pulse, or control an accelerometer. Class presentations introduced students to the design process, frugal innovation for emerging markets, ethical concerns, extreme engineering, and strategies for success both at SCU and beyond.

In addition to merely exposing students to the wide range of career opportunities and the boundless possibilities for making a difference in the world through engineering, the goals of the course are to have the freshmen recognize their chosen field of study as the noble profession that it is while also providing a forum for thinking deeply about their place within the discipline. So, coupled with their final design project, students were also required to write their own short-and long-term aspirations and goals.

CELEBRATE eWEEK @ SCU



National Engineers Week is February 17–23, 2013. Check out the events and activities we have planned and celebrate the engineers in your life.

scu.edu/engineering/eweek



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