utah ENGINEERING

BUILDING MOMENTUM

THE UNIVERSITY OF UTAH • COLLEGE OF ENGINEERING NEWSLETTER

WINTER 2012

TRAJECTORY FOR GROWTH

Efforts by the University of Utah's College of Engineering to improve and grow its programs are succeeding and being recognized nationwide.

As the leader in a statewide effort to increase engineering and computer science degrees in Utah, the College of Engineering is helping our state, regional and national economies grow. We are pleased to report that the College is making significant strides toward this goal: in 2012, we awarded a record-high 721 degrees, putting the College in the top 40 U.S. engineering programs in bachelor's, master's and Ph.D. degrees awarded.

Our teaching and research standing also continues to grow. In the latest issue of U.S. News & World Report's "America's Best Colleges" rankings of undergraduate programs, the College of Engineering continued its steady climb, moving up two spots to #64 (of 346 colleges of engineering) in the nation. Our graduate ranking is consistently higher (#54 in the nation in 2012), and the university as a whole ranked #17 in Forbes Magazine's "Top 100 Best Buy Colleges." The College had $74.7 million of external research expenditures in 2011.

"The growth in research quality and quantity, and the increases in the number of graduates are examples of what can be accomplished when the State, University, private donors, and the College work together," says Richard Brown, dean of the College of Engineering, "The result has been a stream of well-educated engineers and computer scientists who are finding excellent jobs and building the economy."

GEOFOAM TECHNOLOGY REDUCES PRESSURES ON GAS LINES

Lightweight and stiff as a board: a plastic foam is being used to protect Utah's natural gas pipelines from rupturing during earthquakes.

"If an earthquake occurs, high-pressure gas lines are one of the most important items to protect," says Steven Bartlett, associate professor of civil engineering at the University of Utah. "If they rupture and ignite, you essentially have a large blowtorch, which is catastrophic."

Bartlett has partnered with natural-gas company Questar to use large expanded polystyrene blocks called "geofoam" as a protective cover for natural gas pipelines buried underground. One-hundredth the weight of soil with similar strength, geofoam blocks don't erode or deteriorate.

"This low-impact technology has an advantage in urban environments, particularly if you need to realign gas lines or utilities without affecting adjacent buildings or other facilities," says Bartlett.

Geologists expect when a major earthquake strikes the Wasatch fault zone in the Salt Lake Valley, a fault rupture likely will make the valley drop down relative to the mountains, causing a buried pipeline to lift up. However, most buried pipelines lie under six to eight feet of compacted soil—too much for a pipe to bear without rupturing, Bartlett says.

Numerical simulations of earthquake fault ruptures performed by Bartlett and his students show a geofoam-protected pipeline on the valley side of the Salt Lake City segment of the Wasatch fault could withstand up to four times more vertical force than traditional soil cover.

Questar asked Bartlett to develop a strategy for protecting buried pipelines crossing earthquake faults in urban areas such as 3300 South in Salt Lake Valley. Rather than gut a major thoroughfare, Bartlett proposed a "slot trench" design in which a block of geofoam is placed in a narrow trench between a pipeline and the pavement above. If the pipeline begins to lift up, it will displace the geofoam block and compress it without sacrificing the material's overall integrity. As the geofoam is compressed further, it will slide upward along the trench sidewalls and could damage the pavement above, but the pipeline will remain intact.

Compared with compacted soil, geofoam is competitive when total construction costs are considered, Bartlett says. What's more, geofoam requires typical road embankment construction times of one month, compared with 12 to 15 months using traditional methods.

"When there are sensitive utilities involved, seismic stresses or time is a factor, this technology wins hands down," says Bartlett.

KENNECOTT BUILDING RENOVATION UNDERWAY

The College has begun a complete renovation of the iconic "Kennecott Building" as the new home for the Department of Mechanical Engineering at the University of Utah. This project will include seismic strengthening, modernization and renovation of the mechanical systems, offices, restrooms and laboratories, plus the addition of student study space, and design and project space to create a modern, functional and energy-efficient building. Phase I of the project will be complete by fall 2013, with the hope that sufficient funding will be in hand for Phase II.

For nearly a decade, the Department of Mechanical Engineering has accelerated its growth to meet local demand for highly qualified graduates. While doubling enrollment, the department also doubled its annual output of bachelor's and master's degrees. With more than 1,000 students, mechanical engineering at the U now ranks in the top 25 mechanical engineering departments nationally in both undergraduate and total enrollment.

The department is now at the crossroads; having outgrown its physical facilities, mechanical engineering is facing serious limits to continued growth. With demand for mechanical engineering graduates both locally and regionally at unprecedented levels, now is not the time to slow down.

Mechanical engineering is one of the largest, broadest and oldest engineering disciplines at the University of Utah. The department's integrated design approach to undergraduate education provides students who are "industry-ready." Students encounter design classes in each of their four years, culminating in a senior design project. Some of the senior projects are sophisticated enough to contain patentable innovations.

In response to industry demand, the department offers a B.S./M.S. track, a master's degree designed for working professionals and online courses tailored to specific industry needs. New courses have been developed in systems, sustainable manufacturing and product manufacturing. The department also takes pride in leading-edge research programs in: robotics/controls; solid mechanics; fluid mechanics; energy and sustainable systems; biomechanics and computational mechanics.

A fund raising campaign is underway to help support the project. Naming opportunities are available, and all donations of $500 and above will be recognized on a donor display in the building.

For more information, contact Marilyn Davies, mdavies@coe.utah.edu.

HONORS PROGRAM PROVIDES ABUNDANT OPPORTUNITIES

When Joe Illingworth was deciding which college to attend, he had a wealth of possibilities to choose from. As a motivated high school student and class salutatorian, he was courted by engineering powerhouses Rose-Hulman Institute of Technology (Indiana) and the California Institute of Technology.

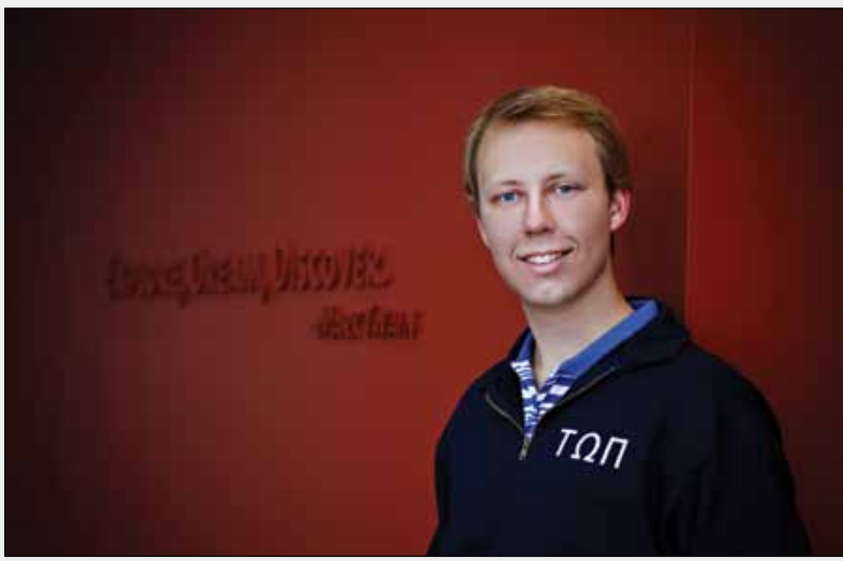
Illingworth, now a freshman majoring in bioengineering at the University of Utah, said the tipping point came when he learned about the great research opportunities available at the U from the day he set foot on campus.

"Very few engineering schools allow freshman to do research," Illingworth says. "Between the quality of education and great research opportunities, there is so much to choose from at the U and this opens doors so much faster!"

With support from a Merrill Engineering scholarship, Illingworth is conducting research with bioengineering faculty member Hamid Ghandehari on using nanoparticles to carry and deliver drug therapies for head and neck cancer.

He is also one of 309 students at the University of Utah living in the Donna Garff Marriott Honors Residential Scholars Community, dedicated in September. Named for its major benefactor, the community provides apartment-style living to honors students at the U and is located on the eastern side of campus, adjacent to the TRAX light rail station.

Designed to create a seamless living and learning environment, student apartments, classrooms, faculty offices and a library help create an engaged student experience. The



building currently meets Leadership in Energy and Environmental Design (LEED) gold certification and incorporates many green and sustainable features such as occupancy sensors, energy-efficient lighting and appliances in common areas, and separate chutes for recycling trash.

Celebrating its 50th year, the Honors College at the U uses a learning model based on small, intensive courses led by distinguished faculty across disciplines to promote an enriched academic environment for talented and highly motivated students.

"It feels like a small college, rather than being lost in a sea of people," Illingworth adds. "I knew I would be able to challenge myself in this environment with other elite students and develop multiple skill sets that will help me in my future career."

ARCS® Foundation Inc.

Congratulations to the 2012-2013 ARCS Scholars: Jennifer A. Bauer, Bioengineering; Katherine Lambert, Bioengineering; Brian E. Zaugg, M.D., Ophthalmology Department, Moran Eye Center; and Megan Campbell Prestgard, Materials Science and Engineering. The $15,000 awards are funded by the generous donors and volunteer members of the ARCS Foundation Utah. The Utah chapter is part of the national ARCS® Foundation which stands for Achievement Rewards for College Scientists. Former Salt Lake Community College Vice President for Academic Affairs Anne Erikson is the current chapter president.

IN BRIEF

Meyer, Rakamaric Win Microsoft Awards

The School of Computing's Miriah Meyer and Zvonimir Rakamaric were recognized with awards from Microsoft. Meyer, a Utah Science Technology and Research (USTAR) assistant professor, is one of seven Microsoft Research Faculty Fellows for 2012. This award recognizes innovative, promising new faculty members from research institutions around the world for their advancements in computing research. Meyer says this award is a "strong show of support from leaders that the direction I'm taking my work has the potential to really make an impact in computer science, biology, and how we think about dealing with an avalanche of data."

Rakamaric was awarded the prestigious Software Engineering Innovation Foundation (SEIF) award at the 2012 Microsoft Research Faculty Summit. The SEIF award is given for software engineering research related to mobile and cloud computing, and provides each of ten winners with $25,000 in unrestricted funds. Rakamaric, an assistant professor at the University of Utah, says his research proposal on automatically finding bugs in parallel and concurrent software is "a hot topic at Microsoft and the software industry in general."

U Alum Elected President of National University of Kaohsiung—Taiwan

Jow-Lay Huang, a University of Utah graduate (Ph.D., materials science and engineering, 1984) was elected president of the National University of Kaohsiung, Taiwan in May. Huang is an expert in functional and structural ceramics, and is a member of the World Academy of Ceramics, which was established to promote progress in the field of ceramics and foster better understanding of its impact. The academy members are internationally renowned scholars who have made significant contributions and achievements in the research field of ceramics. Huang also serves as president of the University of Utah Taiwan Alumni Club.

356 Scholarships Awarded to Engineering Students

Thanks to our loyal engineering alumni, corporate partners and friends, 356 College of Engineering students received scholarships this year, representing more than $1.5 million in support. These students and their donors were honored at the annual Scholarship Awards Banquet on October 25, 2012. Chemical engineering undergraduate Jacob I.K. Abraham, recipient of the Chevron Undergraduate Scholarship, gave the student remarks.

Tasdizen Wins NSF CAREER Award

Tolga Tasdizen, a Utah Science Technology and Research (USTAR) assistant professor in the Department of Electrical and Computer Engineering, was awarded a five-year research grant of more than $400,000 from the National Science Foundation to research pattern recognition and image processing for neuroscience applications. Tasdizen said this award will give him the freedom to investigate new high-risk, high-payoff techniques, adding that "without research and innovation, this type of analysis would likely be several decades of full-time work for a single neuroscientist using manual techniques."

Electrical Engineers Recognized for Location-Sensing Technology

A University of Utah team won two awards at EvAAL, a prestigious international competition on location-sensing technologies designed to ensure the health and well being of a person needing assistance, such as the elderly or people requiring long-term home-based care. These technologies, called ambient assisted living technologies, may enable such individuals to stay in their home longer rather than moving to assisted living facilities. Led by Department of Electrical and Computer Engineering post-doctoral fellow Maurizio Bocca and faculty member Neal Patwari, the Utah team won first place in the tracking accuracy category, which recognized the best tracking performance in each system, and second place overall.

NEW FACULTY

Andrew Merryweather
Mechanical Engineering

Ph.D., mechanical engineering, University of Utah

Biomechanical/biomedical design, ergonomics, rehabilitation engineering and human-centered movement analysis

Cem Yuksel
School of Computing

Ph.D., computer science, Texas A&M University

Computer graphics from physical-based modeling to real-time and offline rendering techniques

Jacobus van der Merwe
School of Computing

Ph.D., computer science, University of Cambridge

Networking systems research, mobile networking, network evolution and security, and cloud computing

Jamesina Simpson
Electrical and Computer Engineering

Ph.D., electrical engineering and computer science, Northwestern University

Computational electromagnetics theory and applications

Jeff Walling
Electrical and Computer Engineering

Ph.D., electrical engineering, University of Washington

High efficiency radio architectures for low power wireless sensors and software-defined radio

Shad Roundy
Mechanical Engineering

Ph.D., mechanical engineering, University of California, Berkeley

Methods to harvest and store energy for wireless and MEMS inertial sensors

Zvonimir Rakamaric
School of Computing

Ph.D., computer science, University of British Columbia

Practical techniques for improving reliability and correctness of complex systems such as software

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Season's Greetings

STUDENT LIFE

Camping Stove Turns Cooking Heat into Electricity

For outdoor enthusiasts who want a technology fix even when they're off the grid, a new portable generator lets electronic junkies have their cake and eat it too. Developed by University of Utah materials science and engineering graduates David Toledo (B.S. 2010) and Paul Slusser (B.S./M.S. 2009), the PowerPot is a portable stove that transforms excess cooking heat into electricity.

Toledo and Slusser launched PowerPot in April 2012 on Kickstarter, a crowd-funding website for creative projects. Just one month later the duo surpassed their initial funding goal of $50,000 by selling 850 PowerPots, raising more than $126,000 in advance pledges.

"This is a great geek product for campers who want to listen to music or use their smart phones," says Slusser.

The PowerPot uses a thermoelectric generator, a solid-state material that funnels excess heat from energy inefficient systems, such as car engines or power plants. In the PowerPot, "waste heat" recovered from boiling water or cooking dinner on any heat source is turned into electricity.

Since charging most modern electronic devices requires scant power—just five watts—the PowerPot can easily charge an iPod or GPS device in the same time it would take at home. Currently, the PowerPot comes in two sizes: a 1.5-quart (5 W) model and a larger 2-quart (10 W) version.

Slusser and Toledo are also developing a larger one-gallon PowerPot that they hope will help families in countries with emerging economies generate electricity in their homes. Although the electric grid network in these regions is patchy, many families have cell phones or electrical lighting that could easily be charged using a larger PowerPot, says Slusser. Such a resource could also help promote education and sustainable businesses in these underdeveloped areas.

The PowerPot team is donating PowerPots through various non-governmental organizations and Engineers without Borders, and customers who purchase a PowerPot can donate an additional cook stove at a discounted price.

"We came up with this idea in our apartment on Emerson Street just three years ago," says Toledo. "To see this response has been amazing— with half of our customer base being international, PowerPots have literally gone around the world."