utah ENGINEERING

BUILDING THE FUTURE

TRANSFORMING OUR CAMPUS TO MEET GROWING NEEDS

THE UNIVERSITY OF UTAH • COLLEGE OF ENGINEERING NEWSLETTER

FALL 2020

BUILDING THE FUTURE

Winston Churchill once said: "We shape our buildings; thereafter, they shape us." And so it is for the buildings of the University of Utah College of Engineering's campus where future engineers develop and grow.

The college's buildings, including the venerable Merrill Engineering Building and the newly refurbished Rio Tinto Kennecott Mechanical Engineering Building, are intrinsic parts of the student experience and the ever-growing engineering curriculum. Which is why the university and Engineering Dean Richard B. Brown are committed to constantly renovating the facilities to meet the needs of the students and faculty.

"Our student body has tripled in size and the faculty has doubled, so in addition to the new space the college has built, we have had to remodel existing buildings to capture every available square foot of space," Brown said. "As engineers drive advances in technology, university buildings must be updated to accommodate new research, equipment and courses."

This year, even in the face of the global pandemic, renovation is underway in several buildings and labs, both to accommodate the scientific demands of researchers and to ensure their safety.

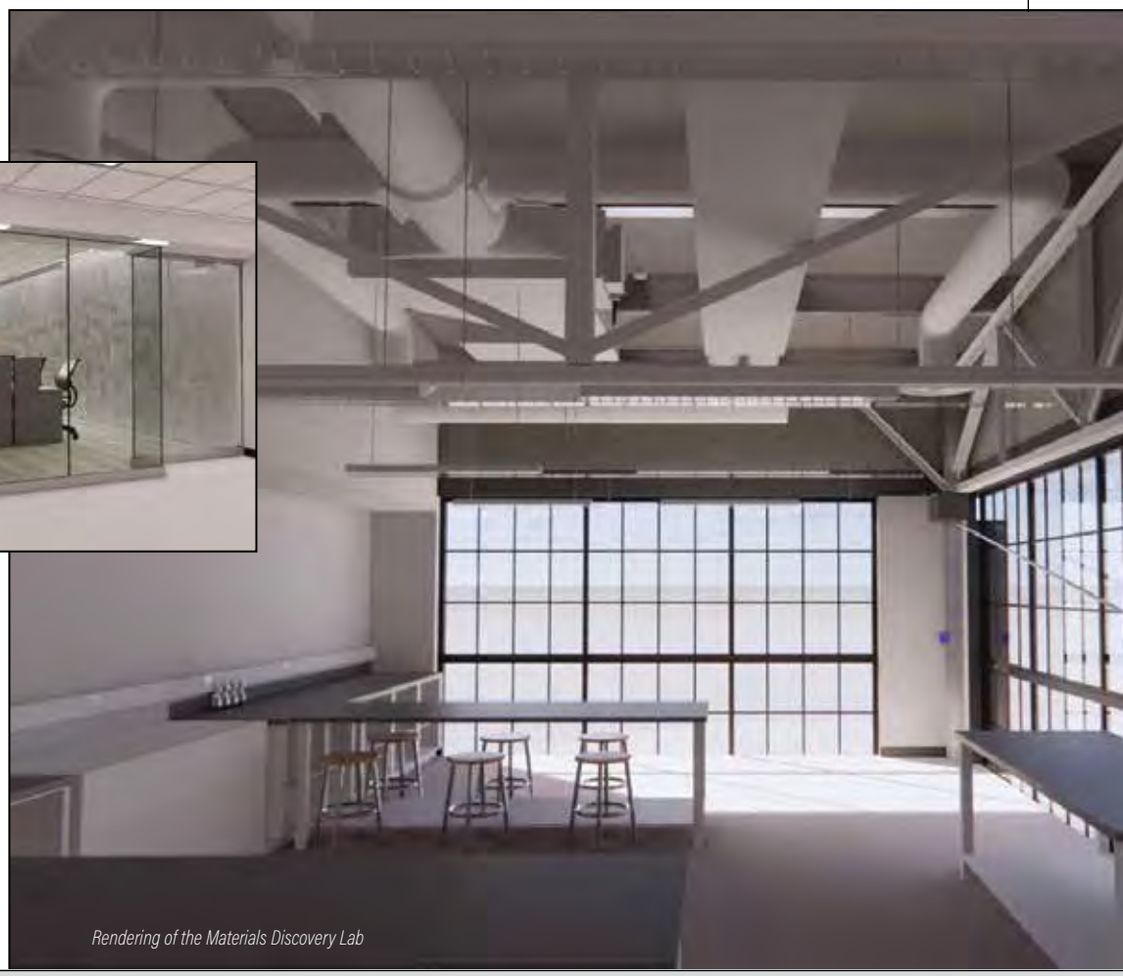
One of the largest projects, which will be completed later this year, is the construction of the new David and Annette Jorgensen Electrical and Computer Engineering Teaching Laboratory on the second floor of the Merrill Engineering Building. It will be comprised of separate sections, each focusing on a different ECE field.

Within the lab will be areas that cover MEMS, circuits, and solid-state technologies; power and control engineering; computer engineering; systems, signal processing, and communications; and electromagnetics and optics.

ECE chair Florian Solzbacher said he wanted a lab that reflects new directions in electrical engineering that focus on software-programmable hardware. "Today, almost everything is like an iPad that you program," he said. "We want to give them hardware experiences, but they need to learn programming too."

In addition to new PCs, monitors and printers, the labs will be outfitted with additional equipment including function generators, oscilloscopes, digital multimeters, laser cutters, 3D printers and more. And the labs will be designed to give students more access.

Rendering of the David and Annette Jorgensen Electrical and Computer Engineering Teaching Laboratory



Rendering of the Materials Discovery Lab

The labs were possible through the generous donations from the David G. and Annette T. Jorgensen Family Foundation, L3 Technologies, Inc., and other contributors.

At the Rio Tinto Kennecott Mechanical Engineering Building (MEK), work will begin this December on a project to fill the space in the center of the U-shaped structure. The infill will consist of four floors and more than 27,000-square-feet and will be the future home to undergraduate teaching labs, a senior design lab and mechatronics lab. It will also include mechanical engineering associate professor Bart Raeymaekers' Tribology and Precision Engineering Laboratory and assistant professor Tommaso Lenzi's Bionic Engineering Lab. And it will house research labs for future faculty hires in the ever-growing department. Construction is expected to be completed by December of 2021.

The infill project is the final phase of a multi-year renovation of MEK. Built in the 1950s, the building is now one of the most sustainable structures on the U campus and a LEED Gold-certified building that uses nearly 53 percent less energy than a standard compliant structure.

"Everyone in the department is really excited about this final phase," said associate professor Rob Stoll, who chairs a committee advising on the project. "It allows us to expand and bring in the new faculty we need, and it helps build our mechanical engineering community of students."

Meanwhile, construction is underway in the historic HEDCO Building (built in 1939), remodeling the Materials Discovery Lab of associate professor Taylor Sparks. The lab, which will be used for predicting and synthesizing new inorganic compounds, includes the 1,460-square-foot lab, a new 226-square-foot student room, and 650 square feet of improvements. Those upgrades will include student study space and a new American Disabilities Act ramp to the second floor of HEDCO.

The lab will be furnished with new equipment such as a custom-built spark plasma sintering press, Bridgman single crystal growth furnaces, quartz ampoule sealing station, tape caster, hot press lamination system, and arc melting and induction furnaces.

Conceptual rendering of Phase III addition for Rio Tinto

Finally, major improvements are being made to the Merrill Engineering Building that will be conducted in three phases. The building was constructed in 1960 and named after the college's first dean, Joseph F. Merrill. It currently houses the departments for Electrical and Computer Engineering, Chemical Engineering and the School of Computing.

Work on the building includes replacing windows throughout, installation of new structural steel for the roof, and a new roof membrane. Another improvement involves updating all of the existing emergency eyewashes and showers as well as the addition of new units in several labs and corridors. The upgrade includes hot and cold-water mixing valves for tempered water and flow meter alarms on all of the units. In the event of an emergency, the alarm will go off locally with a siren and a message will be sent to Facilities Operations and designated College of Engineering personnel. These renovations will not only result in a significant facelift but also ensures the building continues to meet OSHA standards with the latest and best safety systems.

Despite the global health crisis that has halted progress for many, it has not interrupted the college's ongoing mission to expand and meet the needs of Utah and the U.S. for more qualified engineers. The College of Engineering remains devoted to ensuring that its students and faculty can innovate and learn in safe and modern facilities.

Merrill Engineering Building

SAFE AND SOUND

One in six adults take psychotropic drugs for mental disorders such as depression and anxiety, and for many these medications have been a godsend. But for others, pharmacological therapies produce unwanted side effects or are just not effective at treating the condition.

University of Utah biomedical engineering assistant professor Jan Kubanek says treating mental disorders doesn't always have to involve taking drugs. He believes many can be treated with neuromodulation in the form of sound waves.

Kubanek began his education in electrical engineering at the Czech Technical University in Prague but he shifted to the brain sciences as he learned about the potential to treat brain disorders using bioelectronic medicine rather than drugs.

He saw his transition from electrical engineering to brain stimulation as a natural progression. "I realized while studying electrical engineering," said Kubanek, who would later earn his doctorate in biomedical engineering at Washington University in St. Louis, "that the brain is a kind of a processor that is much more capable than anything we will ever come up with."

Kubanek recently published a paper in the journal *Science Advances* in which he describes the potential for a procedure involving waves of high frequency ultrasound emitted into a patient's brain to alter his or her state. It's a noninvasive treatment that doesn't involve medications or surgery and has the possibility of treating mental disorders including depression and anxiety and neurological disorders such as chronic pain and epilepsy. The treatment can target specific brain circuits and is therefore expected to be more effective and carry fewer side effects than conventional methods.

"On average, about one third of patients with brain disorders cannot be treated with drugs," he said. "That's a lot of people we are leaving behind. Neuromodulation with ultrasound has a potential to treat the neural sources in a personalized way. For the first time, it allows us to do this in both a targeted and noninvasive way."

Kubanek's procedure involves pulses of sound at a high, inaudible frequency aimed into the brain using an ultrasonic transducer similar to wands used for ultrasound scans. The sound pulses target neural circuits in the brain and cause neuronal membranes to oscillate, thus activating neurons and influencing the behavior those neurons control. There is no pain or discomfort.

In tests, Kubanek learned ultrasound for neuromodulation can influence behavior. He was able to control whether monkeys looked left or right by targeting specific brain regions. This simple procedure and well-defined behavioral outcome proved that ultrasound treatments could have a strong effect on neurons.

This ultrasound treatment does not involve surgery, and unlike other brain stimulation technologies such as with magnetic or electrical pulses, a doctor can target much more specific pathways including those deep in the brain.

"Ultrasound, being noninvasive, allows us to target specific brain regions in a systematic way until we find the one that provides the greatest relief for a given patient. That's something that's hard to do with surgeries or with deep brain stimulation because you can't physically poke into the brain many times," Kubanek said.

He and his team have built a prototype and in about a year plan to go into clinical trials in which he and doctors will test the procedure's efficacy on human patients with depression- and anxiety-related disorders.

NSF CAREER AWARDS

University of Utah mechanical engineering assistant professor Roseanne Warren, chemical engineering assistant professor Kerry Kelly and chemical engineering assistant professor Heather Holmes each have received a National Science Foundation's Faculty Early Career Development Program (CAREER) award for 2020.

HEATHER HOLMES

Chemical Engineering Assistant Professor

Holmes has received a $400,000 grant to further develop the weather and air quality models for an online smoke forecasting tool that will provide warnings for people during the wildfire season. Her project will help improve our fundamental understanding of wildfire smoke plume dynamics and complex atmospheric flows governing smoke transport over mountainous terrain.

KERRY KELLY

Chemical Engineering Assistant Professor

Kelly has received a $400,000 grant to create and deploy in northern Utah nanofiber sensor arrays in a network to identify the source or sources of formaldehyde. The low-cost portable sensors, together with advanced analytical techniques, will provide location information to help pinpoint the sources of the pollutants. Formaldehyde is a key air pollutant and known human carcinogen.

ROSEANNE WARREN

Mechanical Engineering Assistant Professor

Warren has received a $500,000 grant for research into developing a process similar to a roll-to-roll printing process to mass produce well-controlled porous materials for lithium-ion batteries. One way of possibly doing that is using nanoscale bubbles as templates for porous electrodes. This new process could help increase the battery's cycle life, capacity, and power.

WANG RECEIVES DOE AWARD

University of Utah School of Computing assistant professor Bei Wang was awarded more than $832,000 from the U.S. Department of Energy's Early Career Research Program, one of only 75 scientists in the nation and the only faculty member from the U to earn the award this year.

Wang's project, will conduct a study of topology-preserving data sketching techniques to improve the visualization and understanding of large scientific data.

As scientific simulations generate a large amount of data while the simulation is running, it has become challenging to keep track of interesting phenomena and apply appropriate actions such as storage, analysis, and visualization.

Wang's project combines ideas from data sketching with topological techniques in visualization. The multidisciplinary project will be universally applicable in many scientific areas, including but not limited to computational fluid dynamics and materials science.

IN BRIEF

CENTER EARNS TOP HONOR

The Intermountain Industrial Assessment Center (IIAC) at the University of Utah, led by director and chemical engineering assistant professor Kody Powell and co-director Julie Sieving, has received the Center of Excellence Award from the U.S. Department of Energy's Industrial Assessment Centers (IAC). The honor is given to the highest-performing center in the country.

The national IAC is a program that helps small- and medium-sized U.S. manufacturers save energy, improve productivity, and reduce waste by providing free technical assessments by university teams of engineering students and faculty. There are 31 centers around the country.

The team of researchers and students at the IIAC typically spends one day on-site working with manufacturing companies to identify cost-effective opportunities to save electricity, gas, and water. With this consultation, the center can help companies save 10% to 20% in energy and productivity savings. They provide the company a report outlining ways the facility can save, and it includes a detailed engineering and economic calculation of potential energy-saving ideas.

LEANG NAMED ASME FELLOW

University of Utah mechanical engineering associate professor Kam Leang has been elected a Fellow of The American Society of Mechanical Engineers.

Founded in 1880, the ASME is a not-for-profit professional organization "that enables collaboration, knowledge sharing and skill development across all engineering disciplines, while promoting the vital role of the engineer in society."

Leang earned a bachelor's and a master's degree from the University of Utah and a doctorate from the University of Washington, all in mechanical engineering. He joined the U as an associate professor in 2014. His research focuses on dynamic systems, control, mechatronics, and robotics. Applications of his research include nanotechnology (nanopositioning and scanning probe microscopy), precision mechatronic systems, electroactive polymer-based actuators for soft mechatronics and robotics, and unmanned aerial vehicles for emergency response and environmental monitoring.

GAILLARDON RECEIVES AWARDS

University of Utah electrical and computer engineering associate professor Pierre-Emmanuel Gaillardon was awarded the Association for Computing Machinery's SIGDA Outstanding New Faculty Award, given annually to a junior faculty member early in his or her career who demonstrates "outstanding potential as an educator and/or researcher in the field of electronic design automation."

The award is presented annually at Design Automation Conference.

Gaillardon also recently received the IEEE CEDA Ernest S. Kuh Early Career Award, which is given to only one researcher each year who has made substantial contributions to the field of electronic design automation.

Gaillardon's research is focused on semiconductor processes, digital full custom design, digital architectures, disruptive digital architectures, and reliability in nanoelectronics. He received his doctorate degree in electrical and electronics engineering from Ecole centrale de Lyon in Écully, France. He joined the University of Utah in 2016.

ZAGAL INDUCTED AS HEVGA FELLOW

The Higher Education Video Game Alliance (HEVGA) inducted Entertainment Arts and Engineering (EAE) professor (lecturer) José Zagal into the ranks of the prestigious HEVGA Fellows. EAE is the University of Utah College of Engineering's nationally recognized video game development program.

HEVGA's Fellows Program recognizes senior scholars in the games domain who have made significant contributions to the field in design, theory, or research.

Zagal received his Ph.D. in computer science from the Georgia Institute of Technology.

ALUMNI SPOTLIGHT
TONY CURTIS

As a civil engineering student at the University of Utah, Tony Curtis "didn't want to leave any learning opportunities on the table." He was active in the ASCE student chapter (American society of Civil Engineers) and captain of the steel bridge competition. Now, as president of the Engineering Alumni Association (EAA), Tony is supporting enrichment opportunities for today's students through EAA-sponsored events like the Career Fair Bootcamp, which provides coaching for students on preparing for their job search. He also supports campaign efforts that created an EAA Scholarship Endowment, which awards two scholarships each year to engineering students at the U.

With 18 board members and 2,500+ members overall, EAA alums volunteer their time as professional mentors and seminar speakers. They host career-building events, networking activities and K-12 outreach activities. Like Tony, EAA members share a common desire "to give back" to the college that helped to prepare them for life.

Tony came to engineering in a roundabout way. After graduating from Jordan High School, he worked for a carnival company called Custom Events that provides inflatable carnival rides (like bouncy houses) and interactive attractions for organizations, parties and community organizations, eventually becoming its president. He next ventured into commercial real estate until the 2008 economic collapse shut down most new development. Tony took advantage of the downturn to complete an associates' degree at Salt Lake Community College before transferring to the U in 2010, where he initially thought about majoring in architecture. "After only one class, I felt that architecture was too subjective. I wanted a field where there was always a 'right' answer."

As Civil and Environmental Engineering student, Tony observed that "structures" was one of the most difficult areas of emphasis, and one that seemed to attract the least students. Since the pool of graduates was also smaller, his business sense told him that it would likely be an area with higher job demand. After graduating in 2012, he initially worked for Structural Design Studio, before securing a position as a Structures engineer at Horrocks Engineers in Pleasant Gove.

At Horrocks, a company founded in 1968 by U of U alum Gilbert Horrocks, Tony works on the design and detail for transportation and municipal structures, such as bridges, pump stations, water tanks, and culverts. One of his current projects includes the design for the elevated roadway that is part of the Salt Lake International Airport expansion. Horrocks is teamed on the land side contract for the project that includes "everything before you get to the airport," including roadway, drainage, utilities and structures.

Tony has also been leading and managing the company's development of web-based dashboards to improve coordination and communication on complex projects. He believes that his earlier experiences in sales and customer-based businesses have helped him to be a better communicator. That's also why he was willing to accept the role as EAA president. He said, "Giving back is something I had to do."

As EAA president, Tony is most excited about projects that promote career development for students.

"There is such a need to get our students ready for their job search. Engineering and STEM fields power the U.S., and the best way for students to learn is from other successful graduates." This year's Career Fair Bootcamp was held virtually on September 14 -16.

Tony would also like to see more engineering alumni get involved. "We welcome engineers who can help with resume writing, interviewing and other essential skills," he said. "We also invite their support for the EAA Scholarship."

To learn more about the Engineering Alumni Association, or to become a member, go to the Alumni tab on the College of Engineering homepage: www.coe.utah.edu.

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COLLEGE OF ENGINEERING
OFFICE OF THE DEAN
72 S. Central Campus Drive
Salt Lake City, UT 84112-9200
www.coe.utah.edu

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STUDENT FELLOWSHIPS 2020

Thanks to the generous contributions of private donors and organizations, more than a dozen engineering students have received fellowships to further their educational pursuits. Congratulations to these hardworking students for demonstrating a continuing excellence in their respective fields as they work toward their graduate degrees. Here is a list of this year's recipients. To read more about who they are, go to www.coe.utah.edu/fellows. The site will be updated as more students earn fellowships.

FELLOWSHIPS:

Sterling Baird
Materials Science and Engineering
Gregory B. McKenna Fellowship

Yang Chen
Biomedical Engineering
Ernst R. & Marianne M. Friedrich Fellowship

Shaila Collins
Electrical and Computer Engineering
Gerald & Barbara Stringfellow Fellowship

Taylor Greenwood
Mechanical Engineering
Campbell Endowed Graduate Fellowship

Ethan Griswold
Biomedical Engineering
ARCS (Achievement Rewards for College Scientists) Fellowship

Jacob Immonen
Chemical Engineering
ARCS (Achievement Rewards for College Scientists) Fellowship

Mary Jeppson
Chemical Engineering
E.B. Christiansen Fellowship

Seth Miller
Civil and Environmental Engineering
Utah Department of Transportation (UDOT) Fellowship

Laura Moldovan
Biomedical Engineering
Ernst R. & Marianne M. Friedrich Fellowship

Carl Peterson
Electrical and Computer Engineering
John C. Jackson Fellowship

Michael Reynolds
Chemical Engineering
Kurtley J. Nielson Fellowship

Caleb Thomson
Biomedical Engineering
Campbell Endowed Graduate Fellowship

Steven Tran
Electrical and Computer Engineering
Greg and Debra Treseder Fellowship

Rachel Walker
School of Computing
Shane & Robin Robison Fellowship