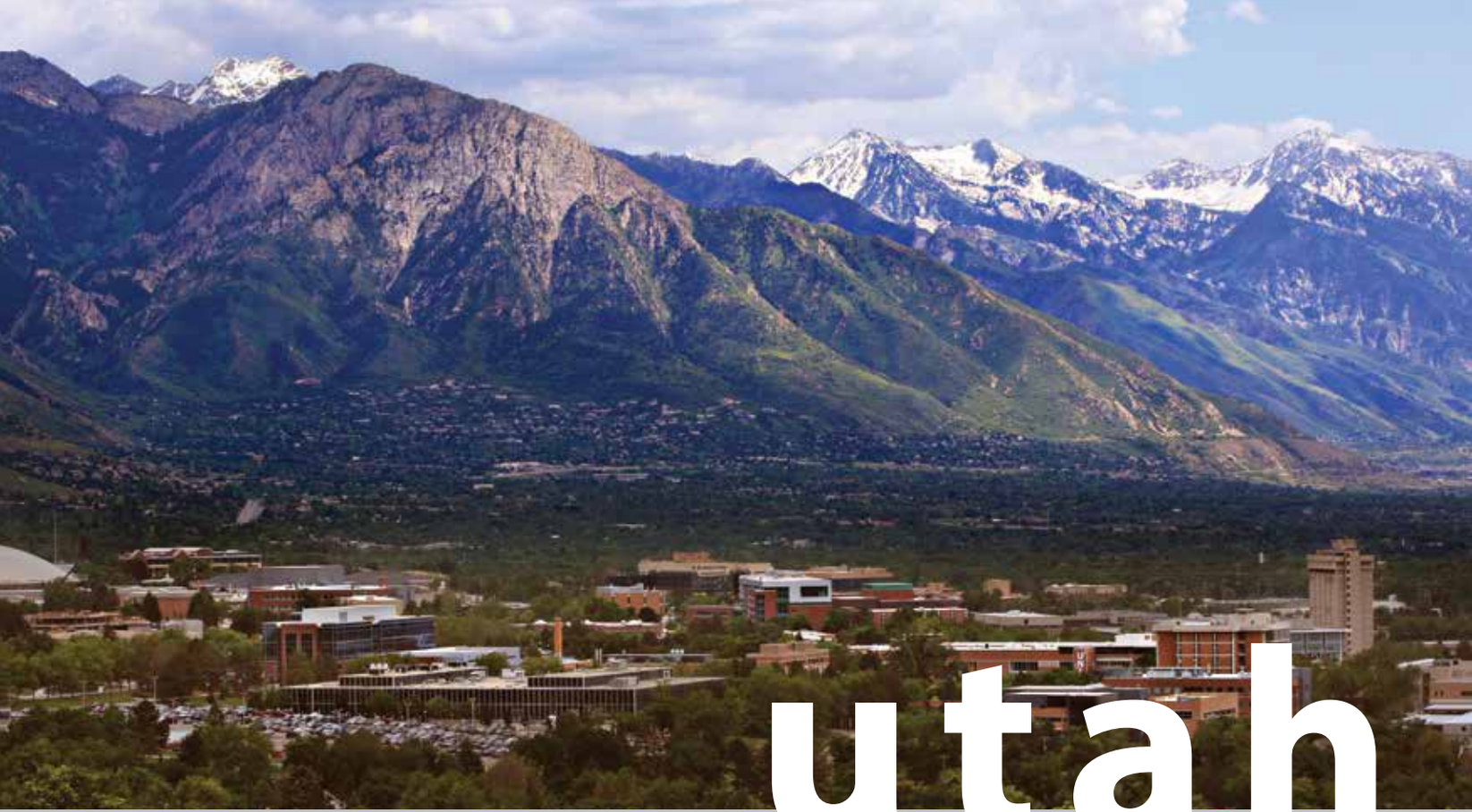


utah ENGINEERING

NATIONAL EXPERT JOINS COLLEGE

GLENN SJODEN GUIDES U NUCLEAR PROGRAM

THE UNIVERSITY OF UTAH • COLLEGE OF ENGINEERING NEWSLETTER

SPRING 2020

HARNESSING NUCLEAR ENERGY

Nuclear Engineering at the University of Utah took a major step forward this year with the announcement of Glenn Sjoden as the Energy Solutions Presidential Endowed Chair of the U's Nuclear Engineering Program. Sjoden is one of the nation's most distinguished nuclear engineering researchers with expertise in non-proliferation, radiation transport research, and nuclear systems engineering, as well as expertise in arms control and defense programs for the U.S. government.

"I was drawn to the research, the collaboration among the faculty, the facilities, and the support from the dean," he said about his choice to come to the U's College of Engineering. Sjoden is hoping to guide the program into an exciting new era while conducting his own research on radiation transport methods and computational numerical modeling.

Nuclear engineering education and research has been a facet of the University of Utah since the 1950's with the operation of an AGN 201 reactor (Atomic galactic nuclei). The program took off in the 1970's with the installation of a TRIGA reactor in the Merrill Engineering Building. (TRIGA stands for Training, Research, Isotopes, and General Atomics.)

The reactor is used for training students, various research projects and isotope production. The focus of research at the time was the danger of radioactive waste from uranium mine tailings. Today, the program offers masters and doctoral degrees as well as a minor for students who may be interested in learning more about nuclear power, nuclear medicine, and nuclear forensics.

The TRIGA reactor at the College of Engineering is one of only 12 remaining university reactors. According to Sjoden, it was part of the attraction for joining the University of Utah. "A reactor is a huge plus because you really can't put the principles into practice unless you have a reactor," he said. "That's my specialty — enabling the use of those neutrons from the reactor for research purposes."

He already is planning to use the reactor for neutron radiography to image 3D-printed manufacturing parts, a way to inspect and validate those parts without having to disassemble them. He is also collaborating with U civil and environmental engineering assistant professor Tara Mastren and researchers from the U's health sciences in areas of nuclear medicine and radiation safety.

Sjoden's resume includes a distinguished military career, academic posts and government service. After joining the U.S. Air Force in 1984, he earned his Ph.D. at Pennsylvania State University and served in a variety of positions in nuclear engineering research in the Air Force. He was a nuclear systems evaluator, nuclear systems officer, and associate professor for the Air Force's Department of Mathematical Sciences at the USAF Academy in Colorado. Later, at the Air Force Technical Applications Center (AFTAC) in Florida, he was the chief of the Molecular Sciences Division, as well as the deputy director of Materials Technology, and deputy director for Technology and Research.

In 2004, after retiring from military service, Sjoden became associate professor and Florida Power and Light Endowed Term Chair in the Department of Nuclear and Radiological Engineering at the University of Florida. Six years later, he was professor and director of the Radiological Science and Engineering Laboratory, Nuclear and Radiological Engineering and Medical Physics Program at the Georgia Institute of Technology.

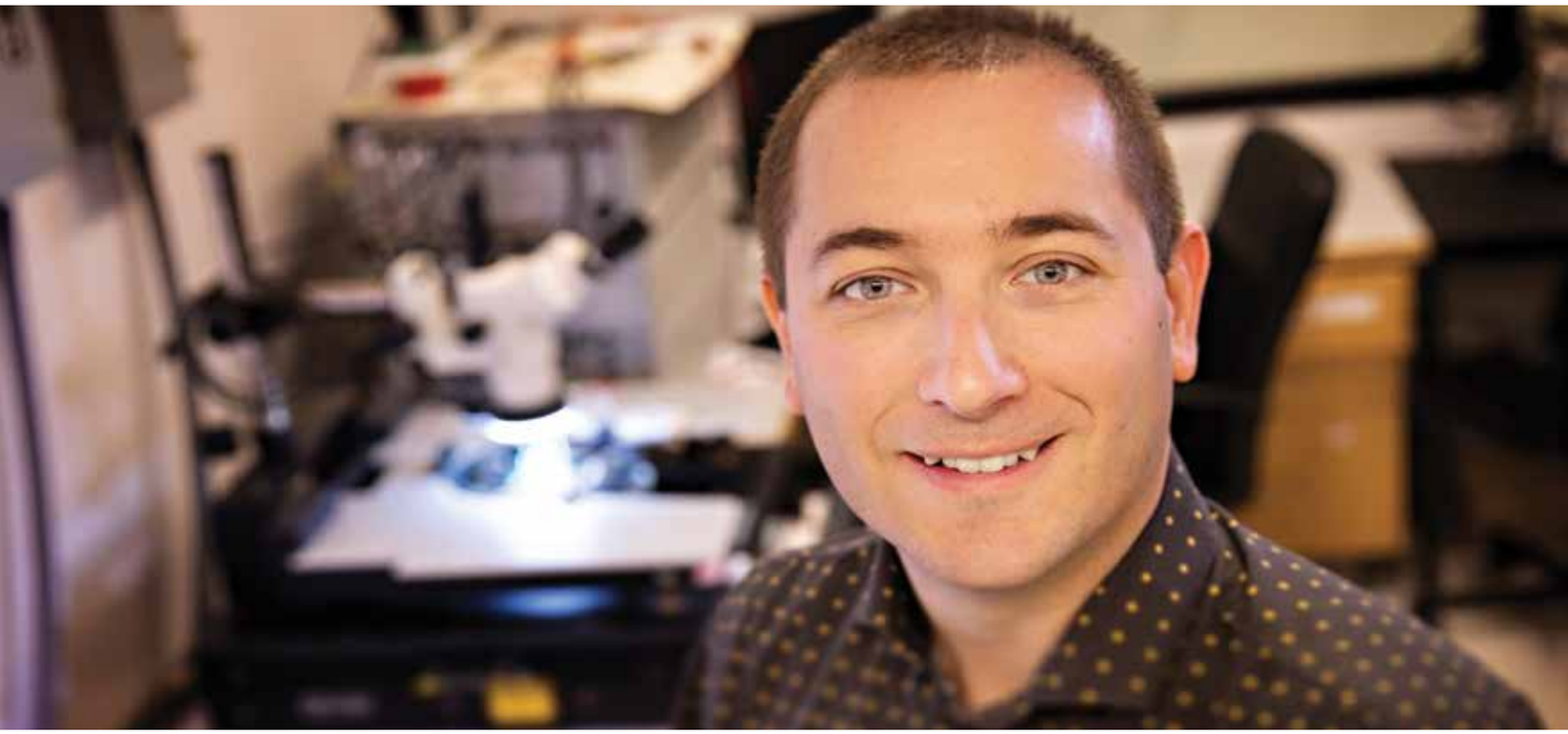
After four years at Georgia Tech, Sjoden was asked to return to AFTAC, where he became the chief scientist. In that position, he was in charge of all science and technology for the organization of the U.S. government that monitors all nuclear treaties.

"I took that job knowing that I would eventually go back to academia," he said. "I helped to solve a number of critical problems in the defense community. I crafted a research-and-development road map to address the critical research gaps in treaty verification for the Department of Defense." He was later awarded a Presidential Rank Award in 2019 for his outstanding service as AFTAC chief scientist.

Sjoden said his new position with the U's nuclear engineering program is a "dream job" that allows him to conduct hands-on research while working with students and faculty.

"When you have the kind of environment like the College of Engineering, you can get a lot done," he said. "I am hoping to have a big impact on the school, the students and the engineering output."

LIVING ON 'THE EDGE'



University of Utah electrical and computer engineering associate professor Pierre-Emmanuel Gaillardon believes one key to better computing systems is a piece of hardware with a one-size-fits-all approach — a microchip that can be programmed to become anything the user wants.

He is hoping to create an open source version of a field-programmable gate array (FPGA), an integrated chip that can be programmed or reprogrammed to perform different functions after it's been manufactured.

"FPGAs are the stem cells of digital logic," said Gaillardon, who received his doctorate in electrical and electronics engineering from École Centrale de Lyon and CEA-Leti in France. "You buy a chip and then program it to implement any piece of logic."

With the same FPGA, the chip could become a microprocessor, an accelerator for machine learning or any other type of semiconductor chip that's needed. Because it's not strictly a software solution, an FPGA provides much better performance and better energy efficiency. As a result, FPGAs are gaining popularity in the cloud such as Amazon AWS or Microsoft Azure. The Department of Defense needs the performance of FPGAs for many of its electronic systems while also keeping them secure from hackers.

Gaillardon believes FPGAs can also result in more innovation. He and his students are designing the first open source FPGA, a chip that is produced with an open design that anyone can use and is easily learned.

"With our project, the user can implement FPGAs at a lower cost. As it becomes more accessible to more people, we're hoping this will transform the ecosystem," he said. "It gives everyone more freedom and resources to focus on the really innovative stuff. That's what we want to do here."

FPGAs are just one project that Gaillardon and his students are working on at his Laboratory for NanoIntegrated Systems. The lab covers every aspect of computer engineering, from new device technology to embedded systems and electronic design automation (EDA), a category in which software is used to design integrated circuits.

"EDA helps us to design new computing systems across traditional design boundaries," he said. "For example, new electronic chips that are capable of running applications at a better performance/energy point."

Another project Gaillardon and his students are working on involves using machine learning and circuit design for what is called "edge computing." If computing for internet devices could be done at the edge of the network where the source of the data is (your smartphone or laptop, for example) rather than on central servers or "the cloud," computing could become much faster. Ask Siri a question on an iPhone, for example, and the request is sent to a central server thousands of miles away where the answer is calculated and sent back. "Edge computing would do the processing closer to the user," Gaillardon said, "so the calculations would be faster, more private and more reliable. But it also requires more computing horsepower."

"With emerging artificial intelligence at the edge and the need for greener computing," he said, "innovations are required in all fields of computer engineering to enable transformative energy efficiency improvements."

CATMULL TO RECEIVE TURING AWARD

University of Utah College of Engineering alumnus, Ed Catmull, who ushered in a revolution in movie animation as the co-founder and president of Pixar Animation and president of Walt Disney Animations Studios, will receive the Association for Computer Machinery (ACM) A.M. Turing Award, referred to as "the Nobel Prize of computing."

Catmull and Patrick M. Hanrahan will together be honored with the award for "fundamental contributions to 3-D computer graphics and the revolutionary impact of these techniques on computer-generated imagery (CGI) in filmmaking and other applications," according to ACM. Hanrahan, a founding employee at Pixar, is a professor in the Computer Graphics Laboratory at Stanford University.

Catmull received his Ph.D. in computer science from the University of Utah in 1974. While at Utah, Catmull created a new method of representing a smooth surface via the specification of a coarser polygon mesh. He would produce a short film, a computer-animated version of his left hand, that would be the first landmark in computer animation.

In 1986, Catmull established Pixar with Apple co-founder Steve Jobs. In addition to dozens of short films, Pixar so far has produced 23 feature-length computer-animated films that have garnered 12 Academy Awards. Catmull himself has received six scientific and technical Academy Awards. In 2006, Pixar merged with Disney, and Catmull remained as president of the company while also becoming president of Disney's Animation Studios. He announced his retirement from both Pixar and Disney in 2019.

The ACM A.M. Turing Award carries a $1 million prize, with financial support provided by Google, Inc. It is named for Alan M. Turing, the British mathematician who articulated the mathematical foundation and limits of computing.

UNIVERSITY OF UTAH JOINS AAU

The University of Utah is one of the newest members of the prestigious Association of American Universities, which for more than 100 years has recognized the most outstanding academic institutions in the nation.

In addition to the U, the AAU also invited the University of California, Santa Cruz and Dartmouth College for membership, which brings the total number of AAU member institutions to 65. AAU invitations are infrequent; this year's invitations are the first since 2012.

"AAU's membership is limited to institutions at the forefront of scientific inquiry and educational excellence," said AAU President Mary Sue Coleman. "These world-class institutions are a welcome addition, and we look forward to working with them as we continue to shape policy for higher education, science, and innovation."

"We are delighted to be invited to join the Association of American Universities, the most prestigious association in higher education," said U President Ruth Watkins. "AAU requires its member institutions to be engaged at the highest levels of research, scholarship and education. Our selection as one of AAU's newest members reflects the excellence the University of Utah has achieved in each of these areas."

The AAU formed in 1900 to promote and raise standards for university research and education. Today its mission is to "provide a forum for the development and implementation of institutional and national policies promoting strong programs of academic research and scholarship and undergraduate, graduate and professional education."

The membership criteria are based on a university's research funding (the U reached a milestone of $547 million in research funding in FY2019 with engineering-related research being a major contributor); the proportion of faculty elected to the National Academies of Science, Engineering and Medicine; the impact of research and scholarship; and student outcomes. The U has 21 National Academies members, with some elected to more than one academy. Current College of Engineering faculty that are members of the National Academy of Engineering include Gerald Stringfellow, Jan D. Miller and Anil Virkar.

IN BRIEF

MARC PORTER
Chemical Engineering

MARY HALL
School of Computing

BART RAEYMAEKERS
Mechanical Engineering

NEW FELLOWS NAMED

University of Utah College of Engineering faculty continue to receive international recognition for their research and dedicated work in their respective disciplines. In the last year, a number have been named fellows in prestigious engineering and science associations.

U chemical engineering professor Marc D. Porter was named both a Fellow of the Council of the American Association for the Advancement of Science (AAAS), the world's largest multidisciplinary scientific society, and of the Royal Society of Chemistry. The AAAS has members in more than 91 countries and is also the publisher of the *Science* family of research journals while the Royal Society has more than 54,000 members around the world.

Porter received his bachelor's in chemistry and a master's in physical chemistry from Wright State University in Dayton, Ohio, and a doctorate in analytical chemistry from The Ohio State University.

School of Computing professor Mary Hall was named a 2020 IEEE Fellow, recognized for her "contributions to compiler optimization and performance tuning."

Hall received her bachelor's in computer science and mathematics and a master's and doctorate in computer science, all from Rice University. She joined the University of Utah as an associate professor in 2008 and was named professor in 2012. She was also named Distinguished Scientist from the Association of Computing Machinery.

The IEEE Grade of Fellow is conferred by the IEEE Board of Directors upon someone with an outstanding record of accomplishments in any of the IEEE fields of interest. The IEEE Fellow is the highest grade of membership and is recognized by the technical community as a prestigious honor and an important career achievement.

Meanwhile, mechanical engineering associate professor Bart Raeymaekers was recently named fellow of the American Society of Mechanical Engineers (ASME). The ASME fellow grade recognizes "exceptional engineering achievements and contributions to the engineering profession." The title has been awarded to only about 3% of over 100,000 ASME members.

Raeymaekers received his bachelor's and master's degrees in mechanical engineering in his native Belgium and moved to the U.S. in 2004 where he earned another master's and a doctorate degree at the University of California San Diego, also in mechanical engineering. After finishing his Ph.D. he obtained a full-time MBA at the Massachusetts Institute of Technology and was hired as the first "entrepreneurial post-doc fellow" at the Los Alamos National Laboratory in 2009. He joined the University of Utah in 2010.

ALUMNI SPOTLIGHT
JOHN SUTHERLAND

Back in 2000, as a newly appointed member of the College of Engineering's Industrial Advisory Board, John Sutherland had no idea that he was about to embark on a 20-plus-year role as the volunteer leader and industry face of Utah's Engineering Initiative. The opportunity came in early 2001 from state Sen. Lyle Hillyard, whose SB 61 would go on to invest millions of dollars in engineering and technology education in both public and higher education. The bill was designed to increase the number of students graduating with engineering and computer science degrees, and to fill the university pipeline with academically qualified students.

Hillyard felt strongly that the Engineering Initiative should have industry oversight for transparency and accountability, and established a Technology Initiative Advisory Board (TIAB) to report to the legislature and the Utah Regents. Governor Michael O. Leavitt asked Sutherland, then a division general manager for Intel, to join the board where he was elected chair in its first meeting. Twenty years ago, Sutherland was among the industry leaders who, along with Governor Leavitt, clearly saw the future. The emergence of the internet, and its implications for the global economy meant that the world was changing, and the state's workforce had to change with it.
"It was clear that the management and exchange of information would become the underpinning technology for businesses ranging from IT to commercial banking," Sutherland said. "More than just a website, every company would need to develop an IT infrastructure with the engineers and computer scientists to design and maintain it."

Since then, Sutherland has traveled all over Utah meeting with deans and public-school superintendents, interacting with industry and state leaders and reporting annually to the legislature. As chair of the TIAB, he is responsible for generating reports, assuring that the institutions meet the stipulations of the funding requirements, and working closely with engineering deans to monitor their progress. He has led this effort as an unpaid volunteer and remains among the most trusted and credible figures on Capitol Hill.

Accountability has been a key factor in the initiative's long-running success. Since 2001, $19 million of ongoing funds and $10.45 million of one-time funding have been appropriated to Utah's public engineering programs to increase the annual output of graduates. During fiscal year 2018, 1,730 engineering degrees were awarded statewide compared to 862 in 2000, and 1,553 computer science degrees were awarded compared to 513 in 2000.

"With the emergence of 'Silicon Slopes' (the nickname for Utah's tech sector), it's been gratifying to watch our efforts to build a highly skilled workforce drive the success of the tech sector," Sutherland said. "It's become a virtuous cycle. As we increased the number of graduates, our local companies flourished and continue to increase the demand."

Sutherland earned a bachelor's degree at Brigham Young University in Provo, Utah, and a master's at the University of Utah, both in electrical engineering. He said his experience at the U was invaluable, giving him the confidence to tackle difficult technology-related problems.

"It taught me that I could master new things and be successful at them," he said. "I dove into things I had never done before."

In addition to Intel, Sutherland has been an engineer and executive at companies such as Cericor, Inc.; Hewlett Packard; LANDesk Software, Inc.; and Cemaphore Systems, Inc. He is currently IT systems architect at Brigham Young University where he is responsible for the networks for all three of its campuses. He is founder and advisor for investment firm Clarity Partners as well as an advisor for Utah-based Tula Health, which is developing a high-tech health monitoring system.

Meanwhile, Sutherland remains committed to strengthening engineering education in Utah as a critical factor in fueling the economy. "It's wonderful that the state's engineering and computer science graduates no longer have to look any farther than Utah to launch a great career."

THE UNIVERSITY OF UTAH

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

Follow us:

@UtahCoE

facebook.com/utahcoe

@UtahCoE

STUDENT LIFE
SUZI CREVELING

COMING HOME TO ENGINEERING

A love for the University of Utah's mechanical engineering department might seem like an unusual family tradition. But for Suzi Creveling, arriving at the College of Engineering felt like coming home.

"I come from a long line of engineers. My grandpa was an engineer, as were my aunt and uncle, and all three of my siblings," said Creveling, who is a mechanical engineering sophomore. "It's been pretty cool to watch them excel; I also want to excel and to be part of great research like them."

Older brothers Peter and Kiffer are completing doctoral degrees. Peter works in the Utah Composites Laboratory, and Kiffer is based in the Utah Head Trauma Lab. Older sister Polly is currently a medical student at the University of Utah.

As the youngest of four siblings, Creveling never felt pressure to follow in their footsteps; rather, her family inspired her.

"We're all different people, but it really was automatic for me. I thought engineering would be perfect," Creveling said, "I've always liked math and science, but particularly the mechanics in everyday engineering, for example, aeronautics or astronautics."

Like her siblings, Creveling is a high achiever. She has received multiple scholarships, including the Wesley H. Ford and Joseph H. Merrill Engineering Scholars Scholarship, and the Engineering Alumni Association Board Member Scholarship. She is an undergraduate research assistant in the composites lab, where she helped to reverse engineer sit skis for Paralympians. More recently, Creveling has been testing the tensile strength of NASA parachutes.

"NASA parachutes haven't evolved much, so we used strain testing to determine how far the parachute material could be stretched," she said.

When not in the lab, Creveling is involved with ASUU student government and the Women's Water Polo team. She joined the College of Engineering Ambassador team last semester, which helps support the College of Engineering's outreach efforts.

Graduate school is already in her sights, maybe a combination of engineering and business. However, she has an overarching vision.

"The end goal is helping people with real-world problems and solving them with the skills I learn from engineering," she said.