THE BRIDGE

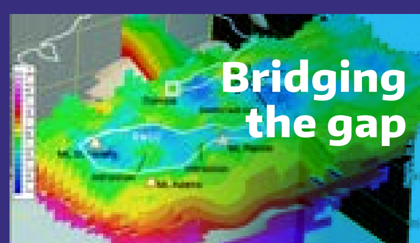
Snow sleuths

Prior to the snow season, CEE researchers traveled to Colorado's Rocky Mountains to prepare for a winter of data-gathering to investigate what happens to missing snow.

Page 6

FALL 2022

CIVIL & ENVIRONMENTAL ENGINEERING
UNIVERSITY *of* WASHINGTON



Bridging the gap

Study assesses impact of M9 earthquake on bridges

Page 4

MESSAGE FROM THE CHAIR

Welcome to the autumn edition of *The Bridge*. After a record wet spring, a very dry summer, and a smoky start to fall quarter, we are now settling into our familiar weather. Thankfully, COVID-19 has not dominated campus as it has in previous years. As a result, we are seeing students return in greater numbers than in the past two years. The College of Engineering is also celebrating its largest incoming Direct to College freshman class — and CEE is working hard to recruit the next generation of civil and environmental engineers from among that cohort.

At the end of summer, I assumed the role of department chair. To make the transition as seamless as possible, I have been working closely with my predecessor, Professor Laura Lowes, who guided the department through some major challenges, including COVID-19. In the coming year, my focus will be on rebuilding community now that we have returned to campus, undergraduate recruitment, and completing our department's strategic planning effort. The latter has been ongoing for about a year. We plan to complete the planning effort during winter quarter, and it will guide our departmental activities for the next five years, conveniently aligned with my term as chair.

In this edition of *The Bridge*, you can learn about fieldwork by Professor Jessica Lundquist and students in her Mountain Hydrology research group to measure snow sublimation in the Rocky Mountains in Colorado. Sublimation, which is the transition of snow directly into water vapor, is difficult to measure, but can be an important insight for water resources management. This issue also features a report by faculty Marc Eberhard, Jeffrey Berman and Brett Maurer, in which they use the latest simulation data and models to predict how a M9 earthquake would impact bridges in Western Washington.

I would like to take a moment to introduce new faculty and express my heartfelt gratitude to newly retired faculty. This fall, Assistant Professors Bethany Gordon and Erica Fuhrmeister and Associate Professor Amelia Regan joined the UW CEE faculty. And after many years of dedicated service to the department, Professors Tim Larson and Joe Mahoney retired. Fortunately, they will stay involved as part of our online graduate curriculum.

Bart Nijssen
Chair & Allan & Inger Osberg Professor

Faculty honors

CYNTHIA CHEN APPOINTED ISE INTERIM CHAIR

Professor Cynthia Chen has been appointed interim chair of the Department of Industrial & Systems Engineering for a two-year term. An internationally renowned scholar in transportation science, Chen directs the Transportation-Human Interaction and Network Knowledge (THINK) lab at the UW, which researches the intersection of human behavior and the systems within which individuals and businesses operate. Chen brings leadership experience to the position, having represented CEE on the College Council and also serving as a National Science Foundation Program Director within the division of Civil Infrastructure Systems.

STEVE KRAMER INDUCTED INTO THE NAE

In early October, Professor Emeritus Steve Kramer was officially inducted into the National Academy of Engineering (NAE), one of the highest professional distinctions in engineering, after being elected to the honor in 2020. The NAE welcomed the classes of 2020, 2021 and 2022 at a ceremony in Washington, D.C., during the organization's first in-person annual meeting in three years. Kramer was elected for "contributions to geotechnical earthquake engineering, including liquefaction, seismic stability and seismic site response."

Professor Emeritus Steve Kramer, center, at the NAE induction ceremony.

DEPARTMENT NEWS

Welcome new faculty

Amelia Regan

It's full speed ahead for Amelia Regan. After retiring from a 25-year career in academia, Regan is bringing her expertise and energy to a new role — as director of the Supply Chain Transportation and Logistics (SCTL) master's program and associate teaching professor in UW CEE.

"I'm super excited about this job," says Regan. "I'll be teaching what I love most — trucks and trains and buses."

For two and a half decades, Regan taught and conducted research at The University of California, Irvine, where she retired as Professor Emeritus from the Bren School of Information and Computer Sciences. Although she started her career in the civil engineering department, Regan eventually transitioned to computer science, which was her primary appointment for the past 17 years.

The field of transportation, especially freight vehicles, fascinated Regan from a young age. After completing a bachelor's degree in systems engineering at the University of Pennsylvania, Regan worked for the Association of American Railroads and also United Parcel Service. She eventually earned a master's degree in applied mathematics at The Johns Hopkins University, followed by a master's and Ph.D in civil engineering from the University of Texas.

Regan is looking forward to continuing the success of the SCTL master's program, which prepares students for leadership roles in managing global supply chains. The SCTL master's program is unique, Regan says, in both its caliber and structure. Affiliated with the SCTL Center, the master's program leverages the expertise of industry and government institutions.

Top: Associate Teaching Professor and SCTL Master's Program Director Amelia Regan. Below: Assistant Professor Bethany Gordon.

Bethany Gordon

The 2011 Christchurch earthquake not only unsettled a town in New Zealand — it also shook up Bethany Gordon's career path. Seeing the damage first-hand during a study abroad program, Gordon was intrigued by the uncommon materials used to construct temporary buildings, such as the Cardboard Cathedral, fabricated primarily out of cardboard.

"I came back to school the next semester and became a civil engineering student — I was interested in community engagement and resilience," says Gordon, who at the time was studying a different branch of engineering. "What was most important to me was that I could see an avenue for having a positive impact."

An assistant professor, Gordon's focus area is currently at the intersection of the built environment, equity and behavioral science. Building from courses she taught as a graduate student at the University of Virginia, where she completed her undergraduate degree and Ph.D. in civil engineering, Gordon will be introducing two new classes to the department's course offerings: a behavioral design class in the winter and an engineering justice class in the spring.

BRIDGING the gap

New study assesses impact of a M9 earthquake on bridges

It may be impossible to predict when a magnitude 9 (M9) earthquake may strike the region, but researchers have succeeded in predicting a crucial detail: the likelihood that bridges in Western Washington will be passable following such an event.

New research reveals that although there is predicted to be widespread damage to bridges close to the fault region, which runs along the western side of the Olympic Peninsula, as well as some bridges situated in sedimentary basins that underlie Seattle and much of the Puget Sound region, bridges outside these areas are likely to be operational.

"We found that the damage to bridges is much lower than expected — for the vast majority of bridges in the region, we think they will be just fine," explains CEE Professor Marc Eberhard, who led the research.

While most earthquakes last for 10-20 seconds, an M9 earthquake is unique, estimated to last two minutes or more. Located off the Washington and Oregon coasts, the Cascadia Subduction Zone (CSZ) is a fault that runs from Vancouver Island, B.C., to Cape Mendocino, California. Capable of reaching 9.0 magnitude, the CSZ last ruptured in the year 1700. These types of earthquakes occur roughly every 500 years.

Above: The map shows soil classifications for King County, which vary widely. Long portions of major highways in King County (I-5, I-90 and I-405) are located on softer soils. It was therefore necessary to adjust the baseline M9 ground motions to more accurately reflect local soil conditions in and around the Puget Sound region. Credit: Palmer et al. 2007

Three years in the making, the report "Impacts of Cascadia Subduction Zone M9 Earthquakes on Bridges in Washington State" draws on the expertise of Eberhard, as well as faculty Jeffrey Berman and Brett Maurer. Also assisting with the effort were graduate students Zachary Kortum and Kan-Jen Liu. The research is a continuation of a 2019 study that investigated the effects of simulated M9 ground motions on tall reinforced concrete buildings. Enabled by access to the latest simulation data and models, the researchers wanted to help prioritize earthquake retrofit efforts and inform emergency response plans. A report from the U.S. Department of Homeland Security previously estimated that 80% of bridges in Western Washington state would be inoperable following an M9 earthquake.

The research was funded by the Washington State Department of Transportation (WSDOT) and the Pacific Northwest Transportation Consortium (PacTrans). The researchers also utilized baseline ground motion simulation data produced in partnership with the U.S. Geological Survey.

Studying specific sites

With more than 500 bridges alone along major routes extending from Olympia to Everett, the researchers focused their efforts on 10 specific locations in Western Washington. The sites were selected to reflect a variety of distances from the fault as well as depths of sedimentary basins. Until now, previous damage assessments of bridges haven't taken into account the effects of sedimentary basins that underlie much of Puget Sound.

Based on proximity to the fault and basin depth, the 10 sites were grouped into four categories. The final report discussed results for one city from each group: Ocean Shores, a coastal city close to the fault and outside of a basin; Olympia, an inland city further from the fault and outside of a basin; Port Angeles, an inland city in a shallow basin; and Seattle, an inland city in a deep basin (see sidebar).

To inform the study, the researchers relied on a database compiled by WSDOT, which specified key parameters for hundreds of bridges located along major Puget Sound highways. To measure the level of estimated damage to bridges in the event of a M9 earthquake, the researchers developed models for typical bridges constructed both before and after 1976, when significant changes were made to earthquake design codes. The models were then subjected to ground motions from 30 simulated baseline M9 scenarios, incorporating geological conditions for the 10 representative locations.

"These bridges are a typical highway overpass that has a couple spans, a couple columns and is pretty standard," says Berman. "It's the typical bridge that you use as you drive on I-5 from SeaTac Airport to Tacoma."

The findings

Among the 10 locations, the results varied significantly. The estimated damage to bridges depended greatly on distance from the fault and whether the location was underlain by a sedimentary basin.

When evaluating the structural performance of the bridges, the researchers noted the "period" of the earthquake, which is the time it takes for seismic waves of energy to vibrate. Each location has a natural vibrating frequency, with hard bedrock having shorter periods than softer soils. While ground shaking usually decreases as the period elongates, it can actually increase inside basins, which amplify the seismic waves. Within basins, the damage to bridges is selective, dependent on the bridge's own unique properties and resonance.

"Seattle is sitting on softer rock, which tends to make the ground motions go back and forth really slowly, and those are amplified in the basin," Eberhard explains. "It's bad for tall buildings and it's also bad for bridges."

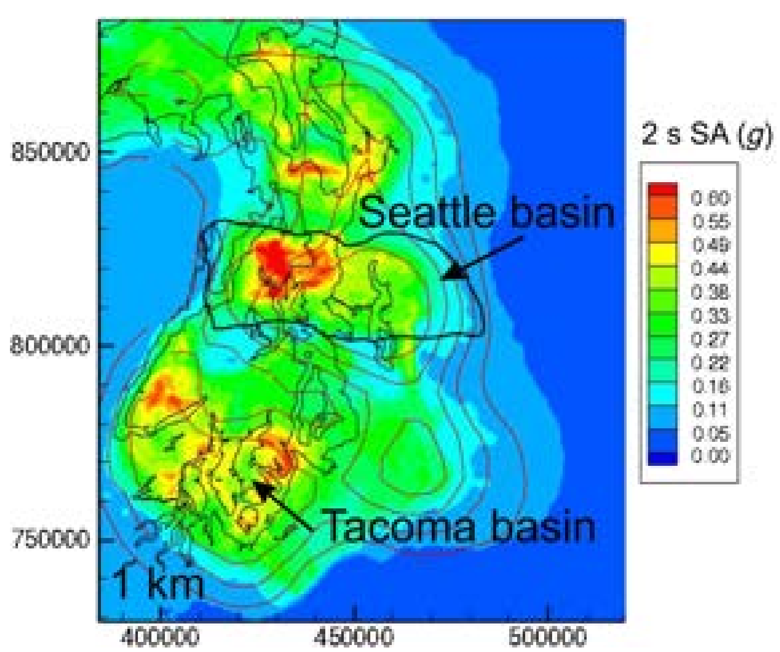
In the study, moderate bridge damage was predicted for inland cities located in deep or shallow sedimentary basins. Overall, the most damage was predicted for bridges in coastal cities, which are located close to the fault but don't have basins.

Next steps

To increase the resilience of Western Washington's transportation networks, the researchers hope the study will help inform emergency response plans and seismic retrofitting efforts.

"There are about 8,000 bridges in Washington state, so how do you decide which ones to fix? We are trying to give WSDOT a sense of the level of damage and how to prioritize them," Eberhard says.

The team is already working on a third study, which aims to develop even more detailed models of bridges to better evaluate structural performance. The researchers plan to apply what they've learned to make predictions for specific bridges and will also investigate the soil where bridges are located to better understand the role of liquefaction — when soil behaves like a liquid during an earthquake.



At left: Spectral accelerations at longer periods were significantly amplified by the presence of sedimentary basins, as can be seen in the red, orange and yellow areas. The figure shows the log-average spectral accelerations at a period of two seconds for the Puget Sound region for the 30 M9 ground motions. Credit: Frankel et al. 2018

City-specific results

When subjected to simulated M9 ground motions, the following details how bridges in the following cities performed:

Ocean Shores
Located close to the fault, but not on a basin, this city has relatively strong ground motions and bridge damage is expected to be significant.

Olympia
Located further from the fault, and outside the basin, this city is relatively undamaged by the ground motions.

Port Angeles
Located further from the fault, on a shallow basin, ground motions are amplified for longer periods and bridge damage is expected to be moderate.

Seattle
Located further from the fault, on a deep basin, ground motions are amplified for longer periods and bridge damage is expected to be moderate.

Snow SLEUTHS

Researchers around the world join forces to investigate missing snow, improve water resources modeling

A single snowflake hadn't yet fallen when a team of civil and environmental engineering snow researchers descended on a small town in Colorado's Rocky Mountains this past fall. But that was intentional — they were preparing for the coming winter's mission to answer a longstanding research question: What happens to snow after it falls?

The researchers are investigating a phenomenon known as sublimation, which is the transition of snow directly from a solid state into water vapor, skipping the liquid stage. This is similar to the behavior of dry ice, in which frozen carbon dioxide vaporizes. Currently the largest source of uncertainty in snow modeling, sublimation has the potential to be an important insight for water resources management, especially estimating future water reserves.

"Sublimation is an extremely hard thing to measure. Lots of people have tried and come to different conclusions," says Professor Jessica Lundquist, who is co-leading the Sublimation of Snow (SOS) project. "This will be the first time it's been looked at with this level of detail in a mountain region."

The UW team is collaborating with researchers around the world to leverage expertise and equipment. In early October, Lundquist and graduate students Danny Hogan and Eli Schwat arrived at the Rocky Mountain Biological Laboratory (RMBL), located north of Crested Butte, Colorado. They deployed equipment and planned for data collection, which the graduate students will conduct on-site this winter.

"It takes this kind of effort to solve something this difficult. It's a question of scale — we need both tiny and big measurements," Lundquist explains. "It's exciting when you see so many different people and agencies come together and say 'We'll work together as a team.'"

Funded by a National Science Foundation grant, the SOS project is led in collaboration with alumna Julie Vano (CEE Ph.D. '13), research director for Aspen Global Change Institute. In addition to SOS, participating field campaigns are the National Oceanic and Atmospheric Administration's SPLASH project and the U.S. Department of Energy's SAIL project. Also involved are the National Center for Atmospheric Research's Earth Observing Laboratory, the Swiss Federal Institute for Forest, Snow and Landscape Research (SLF), and the Swiss Federal Institute of Technology Lausanne (EPFL).

The mystery of the missing snow

The Colorado River watershed is an ideal site to study sublimation, as the phenomenon occurs more often in dry climates. In recent years, there have also been unexplainable decreases in the river's flow, which people in seven states depend upon for drinking water. In 2021, the Colorado River snowpack was estimated at 80% of average, but streamflows ended up being only 30% of average. The researchers speculate that the discrepancy may in part be explained by sublimation.

"Twenty million people depend on the Colorado River, and snow is the biggest input in the water resource equation," Hogan says. "We don't really know how much water is being lost from sublimation definitively."

Current models used to predict sublimation rely on a fundamental theory, developed in flat cornfields in Kansas in the 1950s, that has proven to be inaccurate in more complex terrain, such as mountainous regions. Models based on this theory vary widely in terms of how much snow is predicted to sublimate, ranging from 10-90%.

"A simple way to explain why the theory in the prairie doesn't apply in complex terrain is to imagine a river flow — it behaves well over smooth ground, but if you introduce bumps to the river bed, the flow becomes complicated," Schwat says.

To improve future models, the researchers are working to better understand the precise combination of conditions that lead to sublimation, which tends to occur during low temperatures, low humidity and when both strong sunlight and wind are present. Since sublimation impacts snow on the surface and likely the snowflakes blowing above, the researchers will be paying close attention to the top layer of snow. They'll also be investigating the characteristics of the turbulent air motions above — which can fluctuate widely depending on wind and other conditions.

"Studies show that when snowflakes are picked up by the wind and blown around, they may sublimate, so blowing snow is not necessarily just deposited elsewhere," Schwat explains.

In a mountain valley located about a mile from RMBL, the UW team deployed an array of sensors, including "snow pillows," which weigh the snow to monitor the amount of water in the snowpack. Four towers, up to 65 feet tall, were installed by collaborators for meteorological measurements, such as wind speed. Other instrumentation includes X-Band Radar, Doppler Lidar and terrestrial laser scanners to measure and track blowing snow.

"Few studies have the unique combination of instruments that we have here, both in terms of variety and sheer quantity," Hogan says. "We'll be able to see how well the theoretical equations and relationships play out when we have measurements at so many levels."

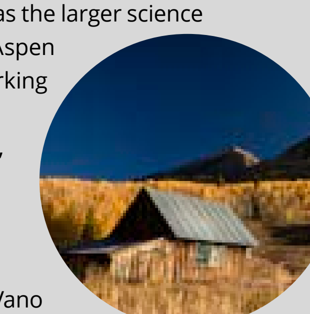
At left: The scenery the UW research team passed as they drove to Gothic, Colorado, home to the Rocky Mountain Biological Laboratory.

Winter observations

In January, the graduate students will return to Colorado to oversee field observations through mid-March. They will stay on-site in cabins, as RMBL is only accessible via cross-country skiing during winter months.

"It's a unique spot where we are staying, about four miles from the town of Crested Butte, so it's ski in and ski out, which makes for more of an adventure feel to the field work," Hogan says.

In addition to maintaining the field equipment, the graduate students will gather measurements during various weather conditions. In late January, the students will be joined by Lundquist, Vano and collaborators for two weeks of intensive observations. In addition to better understanding the process that leads to sublimation, the researchers hope to discern what types of measurements and instrumentation can best predict snow sublimation in a mountain valley.

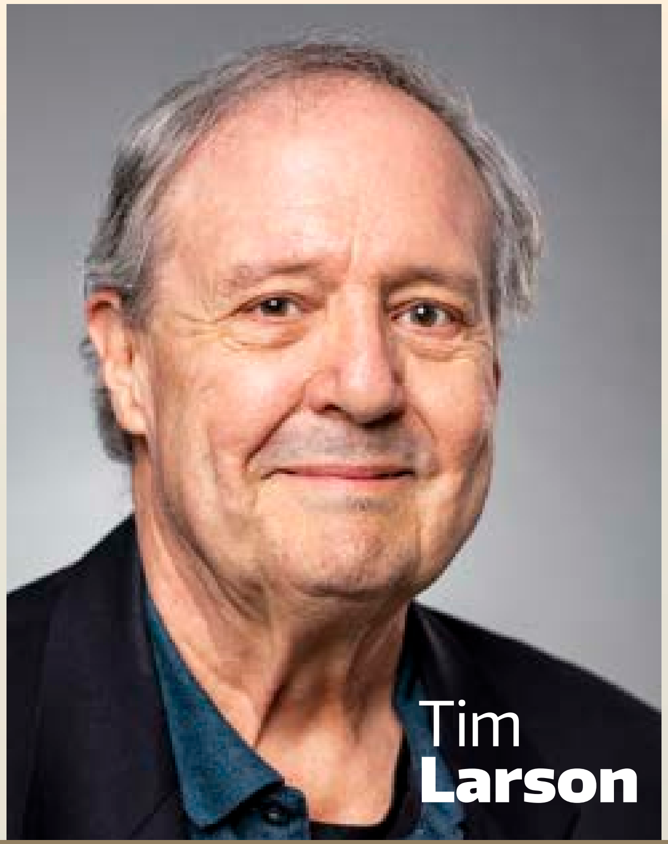


To highlight the importance of the project to people whose water comes from mountain regions, as well as the larger science community, Vano and her team at the Aspen Global Change Institute are already working on outreach. Through the creation of videos and other educational materials, they hope to bring more visibility to the often overlooked topic.

"It's in this intersecting space between hydrology and atmospheric sciences," Vano says. "Hopefully through this work there will be a greater awareness of what snow sublimation is and the value and excitement of doing this type of research."

View the data

Follow along as the researchers share preliminary data during the winter field campaign:
https://archive.eol.ucar.edu/docs/isf/projects/SOS/isfs/



Setting standards

During his 39-year career, Professor Tim Larson helped implement air quality regulations

Although much of what he researched is practically invisible to the eye — air pollution particles 30-700 times thinner than a strand of human hair — Professor Tim Larson's contributions to the field of environmental engineering can be easily seen.

From helping set federal government air pollutant standards to identifying the previously unknown footprint of air pollution near airports, Larson advanced the field of air pollution research. After 39 years as a faculty member in UW CEE, with an adjunct appointment in the Department of Environmental & Occupational Health Sciences, Larson retired in June.

"I'm grateful to have been part of the university for so long, it's a great job and department," Larson says. "My words of wisdom are to do what you find interesting and keep at it."

During his time in the department, Larson served in a number of leadership positions — he co-directed the online Master of Science in Civil Engineering: Energy Infrastructure program, was associate chair twice and interim department chair three times.

Larson first became aware of environmental issues as an undergraduate student at Lehigh University in Pennsylvania, where he could visibly see industrial pollution in the local river caused by a nearby steel mill. After graduating with a bachelor's degree in chemical engineering, Larson worked for the U.S. Public Health Service — the precursor to the Environmental Protection Agency (EPA) — before heading to UW for graduate school.

Working with the EPA

Throughout his career, Larson was part of numerous EPA committees that worked to determine the health outcomes of various air pollution exposures and pushed for more stringent standards. A notable accomplishment was establishing standards for fine particulate matter (PM2.5), which are small particles in the air that can cause adverse health effects at high levels. At about 2.5 micrometers in diameter, they are 30 times smaller than a strand of human hair.

"It took almost 10 years before we could convince the EPA to form PM2.5 standards. We slowly guided them and were lobbying for it for a decade," says Larson, who worked with colleagues on a 10-year public health study that correlated PM2.5 exposures with cardiovascular diseases such as stroke.

Research highlights

Uncovering the previously unknown and unmeasured hazards of aircraft pollution was also a career highlight. In collaboration with researchers at UW and universities in California and Massachusetts, Larson discovered a way to distinguish air pollution originating from aircraft from other sources, such as freeway traffic.

More recently, Larson's work has focused on setting the groundwork to regulate even smaller particles, called ultrafine particles. At less than 0.1 micron in diameter, ultrafine particles are 700 times thinner than the width of a human hair.

"We aren't going to find that ultrafines are good for you," says Larson, who plans to continue his research during retirement. "When the particles are that small, they can go through membranes into your brain and are not recognized by the body."

Paving the way

From remote learning to start-ups, Professor Joe Mahoney leaves a legacy

During his career, Professor Joe Mahoney paved the way for more than just advancements in transportation-related infrastructure. An early adopter of online learning, he also founded the department's first remote master's program 20 years ago.

"No one had done true online delivery at the university — it was limited," recalls Mahoney. "A lot of the faculty oversight groups were concerned because it was a very different delivery system for graduate education."

But Mahoney persevered and founded, along with the Department of Construction Management, the Master's in Construction Engineering program and a companion Construction Management online degree in 2002.

"The early distant learning efforts really lie with Boeing, Mechanical Engineering, and Aeronautics & Astronautics and some of the things they were doing at the time," says Mahoney. "Faculty were taping lectures and sending them to Boeing in Everett for engineers to view."

Embracing the internet, Mahoney's early distance-learning efforts entailed writing complete course lectures, which a computer programmer converted to html and posted online. Over the years, he has continued to expand the department's online offerings — in 2018, he helped establish the Master's in Energy Infrastructure program.

Introduction to engineering

Growing up in Texas, Mahoney's early interest in engineering can be traced back to high school, when he met the chief chemical engineer of ExxonMobile and was introduced to the work of energy companies. Also impactful was his father's work as a county commissioner, a position that entailed overseeing the maintenance of buildings and roads.

Mahoney earned all of his degrees at Texas A&M University. In between his undergraduate and graduate degrees, he joined the U.S. Air Force and worked in military base and airfield engineering for four years before transitioning to industry as a consultant specializing in airfield and industrial projects.

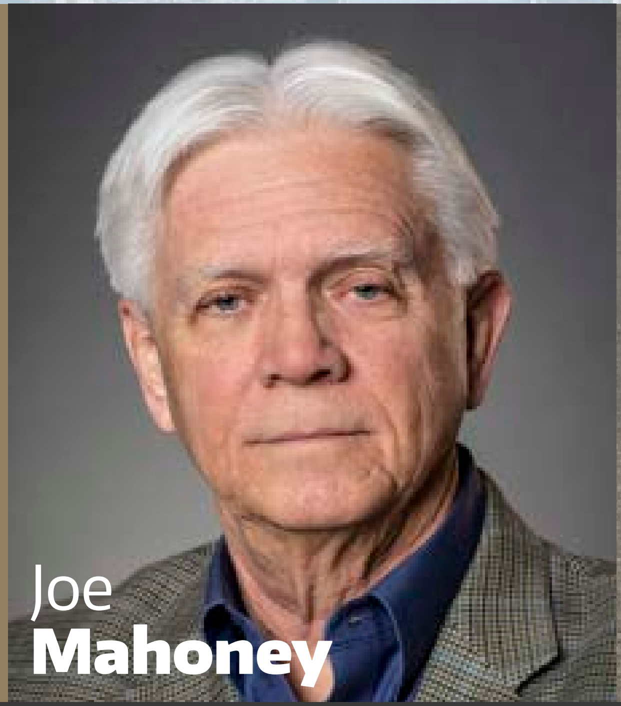
"I never intended to join a university; I was planning to go back into the private sector. My wife is from here and that played a major role," Mahoney says about what eventually brought him to Seattle.

Start-ups and research

During his career, Mahoney was involved in three different start-ups. About 15 years ago, he co-founded Pavia Systems, now known as Headlight, which develops software for the construction industry.

On the research front, Mahoney's primary focus has been transportation-related infrastructure, with a specific focus on pavement materials for highways and airfields and roadway funding. He also taught undergraduate and graduate level courses on a variety of topics including construction materials and energy infrastructure.

"You get to know the students and you begin to care deeply," says Mahoney, who will continue teaching online courses during retirement.



FUNDING FOLLOW-UP

In honor of Professor Joe Mahoney's retirement, a student scholarship fund was established last spring by Steve and Yvonne Muench. To date, nearly 80 donors have collectively contributed more than $50,000. Donations will continue to be accepted until the scholarship goal of $100,000 is reached. To contribute, please visit **ce.uw.edu/campaign/joe-mahoney**

PacTrans hosts regional transportation conference

During a panel discussion, representatives from state agencies and city governments discuss regional collaborations.

Pacific Northwest Transportation Consortium (PacTrans) hosted a conference in October in collaboration with the Center for Safety Equity in Transportation and the UW Mobility Innovation Center. The annual Region 10 Transportation Conference brought together transportation professionals from public agencies, private industry and academia to learn about critical research needs, build relationships with potential collaborators and showcase practical mobility solutions. The one-day conference featured a welcome video from Rick Larsen, U.S. representative for Washington's second congressional district; a keynote address from Dan Sperling, professor of civil and environmental engineering at the University of California, Davis; and a panel session on the Infrastructure Investment and Jobs Act. Technical sessions covered topics including connected and autonomous vehicles, artificial intelligence, rural and tribal safety, supply chain challenges, workforce development, and technology transfer. Researchers funded by PacTrans also had an opportunity to showcase their research through a poster session. Conference sponsors included Verizon, the Washington State Department of Transportation, AIWaysion and Concord Engineering.

RAPID researchers test new technology at Hurricane Ian

Even before Hurricane Ian made landfall in late September, Natural Hazards Reconnaissance Facility (known as RAPID) researchers were already busy gathering data in Florida, as part of a mission to collect before-and-after data of the natural disaster event. Based on a projection of where the hurricane was expected to land, the researchers conducted drone surveys to capture images that would enable them to map neighborhoods and coastlines. Following the hurricane, which landed further south than originally projected, RAPID Operations Specialist Jaqueline Zdebski spent a week surveying the damage using a new piece of technology: a fixed wing drone equipped with five cameras, which was loaned to RAPID for the surveying project by Frontier Precision. In comparison, drones that the center typically uses have one or two cameras. Using the new drone system, which can be used to derive centimeter-level accurate measurements, Zdebski conducted 16 drone flights, collecting a total of 208,000 images. The data will be used to develop 3D models of the damaged portions of three barrier islands near Fort Myers: Fort Myers Beach Island, Sanibel Island and San Carlos Island.

Reconnaissance teams collaborate for Hurricane Ian post-hazard data collection.

Future Rivers students attend summer program

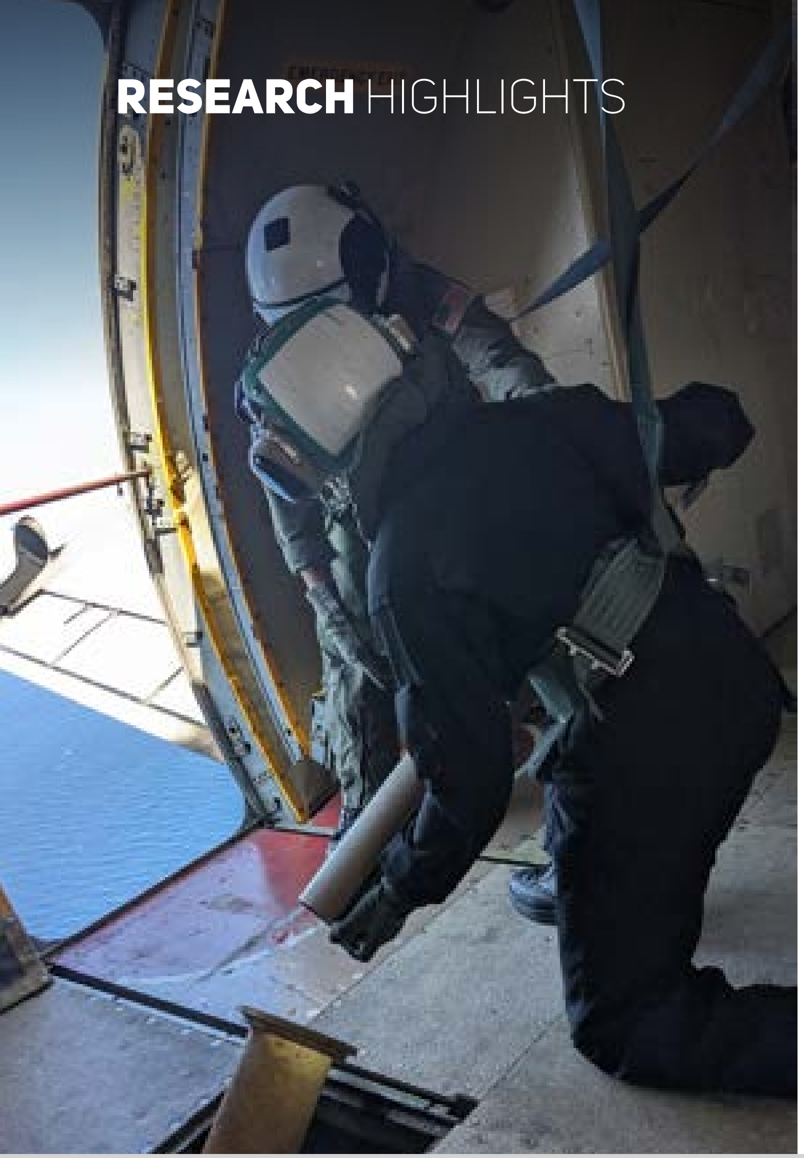
Future Rivers, the Freshwater Initiative's graduate student training program that launched in 2020, provides innovative training that prepares students to address complex freshwater issues locally and around the globe. This past August, students and faculty attended the first Summer Field Institute, which had been postponed due to COVID-19. They spent a week in the North Cascades of Washington state learning about the Federal Energy Regulatory Commission (FERC) relicensing process for the Skagit River Hydroelectric Project. Guest speakers shared their perspectives on the complexities of the hydroelectric project, discussing various aspects of what the river offers, from energy to habitat to recreation. Students also toured the tri-dam complex and broader watershed by foot and boat. Based on what they learned, the students are developing a story map, which they plan to share with community members to help communicate perspectives regarding the hydroelectric project. The Freshwater Initiative is a collaboration between the College of Engineering and College of the Environment. View more photos: **https://ce.uw.edu/center-news/fall-2022**

Students tour various sites to learn about the Skagit River Hydroelectric Project.

Urban Freight Lab hosts meeting in Silicon Valley

The Supply Chain Transportation & Logistics' Urban Freight Lab (UFL) hosted their quarterly meeting of members and partners at Playground Global in Palo Alto, California. Offering start-up support as a venture capital firm, tech incubator and engineering lab, Playground is home to UFL members Lacuna Technologies and BrightDrop. About 30 UFL members gathered to learn about the latest trends in digital transformation, new tools to improve urban freight efficiency, real-time curb space management, last-mile operations, and transforming logistics. Live demos were provided by two start-ups: Nauto, an AI-technology company advancing safer driving, and Agility Robotics, which is working to enhance robotic mobility. The group also toured the headquarters of autonomous delivery company, Nuro, and saw a demo of the zero-occupancy autonomous vehicle in development for local goods delivery. Guest speakers addressed topics such as implementing digital policy and infrastructure in the public realm; digital tools to enhance operational efficiency; the impacts of curb use allocation on curb performance; and real-time curb management strategies and technologies.

UFL members and partners stand next to a Nuro autonomous vehicle.



Wave sensors deployed in Florida to improve hurricane forecasts

In late September, researchers dropped technology developed at the UW off the coast of Florida to measure ocean waves in the path of Hurricane Ian. Led by Professor Jim Thomson and Ph.D. student Jacob Davis, the test was part of a broader effort to improve forecasts for the fast-moving and deadly weather systems. Members of the U.S. Navy's VXS-1 Squadron helped deploy the equipment in the path of Hurricane Ian before the hurricane made landfall. The researchers used a smaller version of the UW-built sensors known as the Surface Wave Instrument Float with Tracking (SWIFT), which in the past have been deployed to study waves in the changing Arctic Ocean. The smaller microSWIFT sensors drift with the waves to gather detailed measurements of waves and currents at the ocean's surface. The current research effort in the path of Hurricane Ian aims to understand how the extreme low-pressure storm system affects the ocean and, ultimately, coastal areas. Part of a collective effort to improve hurricane forecasts, the microSWIFT observations at the ocean's surface will be combined with other observations, including technologies deployed on the same flight by Scripps Institution of Oceanography and Sofar Ocean Technologies.

New approach, not in the Clean Air Act, could eliminate air pollution disparities

While air quality has improved dramatically during the past 50 years thanks in part to the Clean Air Act, people of color at every income level in the United States are still exposed to higher-than-average levels of air pollution. A team led by CEE researchers wanted to know if the Clean Air Act is capable of reducing these disparities, or if a new approach is needed. The team compared two approaches that mirror main aspects of the Clean Air Act and a less common third approach to evaluate if it could better address disparities across the contiguous U.S. The researchers used national emissions data to model each strategy. Although the first two approaches didn't resolve the disparities, the third approach — which targeted emissions in specific locations — eliminated pollution disparities and reduced pollution exposure overall. Implementing this location-specific approach would require additional work to identify which locations would be the best to target and also working with communities to identify how to reduce emissions, the researchers say. The findings were published in the Proceedings of the National Academy of Sciences by the team, which includes Professor Julian Marshall and Ph.D. student Yuzhou Wang.

Snow Spotter: Uncovering snow's effect on summer water supplies

When falling snow is intercepted by trees, it sometimes never makes its way to the ground. As a result, current models struggle to predict exactly how much water will be available from the snowpack in forested regions. To improve the models and investigate what happens to intercepted snow, CEE researchers created a citizen science project called Snow Spotter. A total of 6,700 volunteers viewed time-lapse photos from remote locations in Colorado and Washington, collectively scanning 13,600 images and identifying which photos showed trees with snow in their branches. This information provided the first glimpse of how snow-tree interactions may vary between climates and affect predictions of summer water supplies. There are three possible scenarios for snow that's been caught by trees. It could fall to the ground and add to the current snowpack; it could blow away and turn to water vapor and not contribute to the snowpack; or the snow could melt and drip to the ground, which may not add to the snowpack. The findings were published in AGU Water Resources Research by the team including Ph.D. student Cassie Lumbrazo, alumni Andrew Bennett and William "Ryan" Currier, and faculty Bart Nijssen and Jessica Lundquist.

NEW INITIATIVE:
Computing for the Environment

To accelerate research addressing climate change, pollution, biodiversity and more, Computing for the Environment (CS4Env) brings together civil and environmental engineering researchers, computer science engineers, environmental science researchers and data scientists.

The cross-disciplinary research teams from Civil & Environmental Engineering, The Paul G. Allen School of Computer Science & Engineering, the College of the Environment, and the eScience Institute are applying technologies and tools — including deep learning, data visualization, software engineering and machine learning — to address topics ranging from air quality and wildlife conservation to wildfires and landslide risk. CS4Env launched this past summer with 12 inaugural projects.

"Research to slow down the impacts of climate change requires a multidisciplinary approach involving a lot of data collection and analysis," says Professor Dorothy Reed, one of CS4Env's three directors. "For example, some of us in CEE have lots of domain expertise, but face challenges in collecting and processing huge datasets."

Also leading the initiative are Vikram Iyer, an assistant professor in The Allen School, and Alex Turner, an assistant professor of atmospheric sciences.

"One of the aims of CS4Env is to provide a platform that brings together researchers with expertise that allow us to tackle big interdisciplinary problems in the environment," Turner says.

The initiative provides seed funding for research teams to explore new projects. To facilitate the sharing of information, the researchers gathered during autumn quarter for biweekly presentations, and to discuss the broad range of topics funded by the initiative.

Rising to the challenge

CEE alumnus Richard Partington (BSCE '55) wasn't afraid of a challenge, both in his personal and professional lives.

When he learned there was a youth soccer coach shortage, never having played soccer himself, Richard (Dick) Partington learned how to coach by reading books on the game. When a developer wanted to purchase a 10-acre piece of wooded property in his community, he helped establish a city park instead. And, he used his structural engineering skills to solve problems and develop missiles during a 40-year career at Boeing.

And now, there's another item to add to the list: Helping undergraduate students overcome financial hardship. To commemorate her husband, who passed away in 2019, Patti Partington founded the Richard L. Partington Distinguished Endowed Scholarship in Civil & Environmental Engineering in 2021. The scholarship will be awarded for the first time this year, providing financial assistance for tuition and other educational expenses.

"What motivated me was that my husband graduated from civil engineering at UW and was proud of his education," Patti Partington says. "It was logical to do this to honor him, based on his education and his career."

After graduating in 1955, Richard Partington worked for several small structural engineering firms, during which time he helped design the Rainbow Bridge in La Conner, Washington, known for its graceful arch design. He eventually transitioned to Boeing, where he spent the majority of his career.

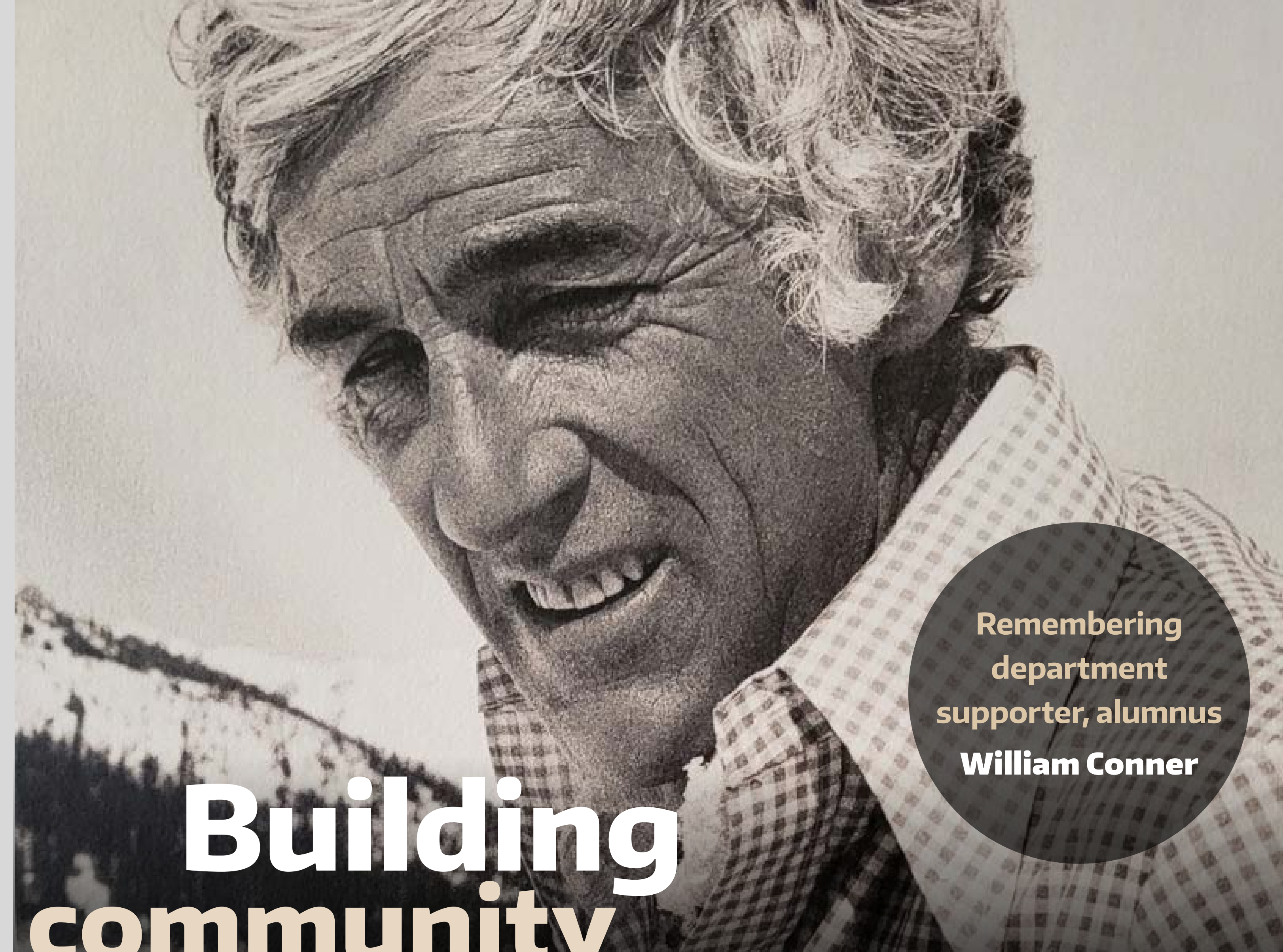
At Boeing, Richard Partington received many awards of excellence associated with his work in the defense and space programs. He was involved in several high-profile projects including the AGM-69 Short-Range Attack Missile (SRAM), Minuteman Missile Programs and the Inertial Upper Stage (IUS) booster rocket. The IUS was developed by Boeing for the U.S. Air Force for raising payloads from low Earth orbit to interplanetary trajectories, following launch aboard Titan rockets. There were several launches on space shuttles for planetary missions at the time.

"Several astronauts came back and had a reception for the engineers who worked on it, thanking them," Patti Partington recalls.

Outside of work, community service was important to Richard Partington. He spent 30 years in the military reserves and retired as a full colonel from the U.S. Army. He also served as president of the Robinswood Community Club and was a member of the City of Bellevue Park Board. Instrumental in the founding of Robinswood Park, he helped pass a bond issue that enabled the city to purchase the property.

"It was a beautiful piece of property, and a developer wanted to build a combination of houses and townhouses, but Dick managed to convince the city to float a bond issue," recalls Patti Partington. "The interesting thing is, he was pretty low-key and wasn't this big voice — he just got things done in a very nice manner."

Top: Patti and Richard Partington; Bottom: Richard Partington, center, receives a Performance Excellence award from Boeing's Research & Engineering Division in 1972.



Building community

Remembering department supporter, alumnus William Conner

During his lifetime, William Conner (BSCE '53) built many things. In addition to being known as a leader in the home building industry, he also fostered support for students and faculty through philanthropic gifts.

At the age of 90, Conner passed away in January 2022. Over the years, he and his wife, Marilyn, were strong supporters of Civil & Environmental Engineering and the College of Engineering. To provide financial assistance to graduate students, they established the William M. and Marilyn M. Conner Endowed Fellowship in 1992. Several years later, they founded the William M. and Marilyn M. Conner Endowed Professorship in 2006, with the goal of enhancing the department's ability to attract and retain distinguished faculty through increased financial support of research activities. They have also supported undergraduates through significant investment in the College's new Interdisciplinary Engineering Building, scheduled for completion in 2024.

After graduating with his bachelor's degree, Conner worked for heavy construction firms in various locations, from Utah to New Mexico to Colorado. He then returned to Seattle and joined his brother, John, in founding Conner Construction Company in 1959. The company specializes in building homes, condominiums and apartments and restores historic hotels. Conner became sole owner of Conner Development Company in 1973, and served as president for many years. The company is still family-owned today.

Throughout his career, Conner was a trailblazer in the home building industry. His company received numerous awards for innovative and environmental designs, such as the first "Earth Sense" sustainable homes, which they introduced before the concept became widely used throughout the industry. To maximize living space within urban settings, the company also introduced the "Zero Lot Line" concept in the Seattle area, when a residential structure is built close to the edge of a property line.

Conner served as president of the Seattle Master Builders and the Building Industry Association of Washington and was board chair of the Washington Policy Center and the Freedom Foundation. He was also president of The Conner Group, a brokerage firm dedicated to selling the company's homes and neighborhoods.

Outside of work, Conner and his wife enjoyed spending winters at a cabin they built near Snoqualmie Pass. A skiing enthusiast, Conner enjoyed the sport until well into his 80s, spending many ski seasons in Sun Valley, Idaho. He is survived by his wife, three children and many grandchildren.

THE BRIDGE

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ENJOY THE VIDEO: 2022 WENK LECTURE

In early December, Paulina Jaramillo presented a talk titled "An Open Energy Outlook for the United States," which highlighted the importance of achieving carbon neutrality by midcentury to mitigate the worst effects of climate change. In support of this goal, Jaramillo called attention to the Open Energy Outlook Initiative, launched by Carnegie Mellon University (CMU) to provide stakeholders with open-access models and databases to inform energy and climate policy.

Jaramillo is a professor of engineering and public policy at CMU, where she co-directs the Green Design Institute and is a fellow of the Scott Institute for Energy Innovation and Research.

Enjoy the video at **ce.washington.edu/news/video**