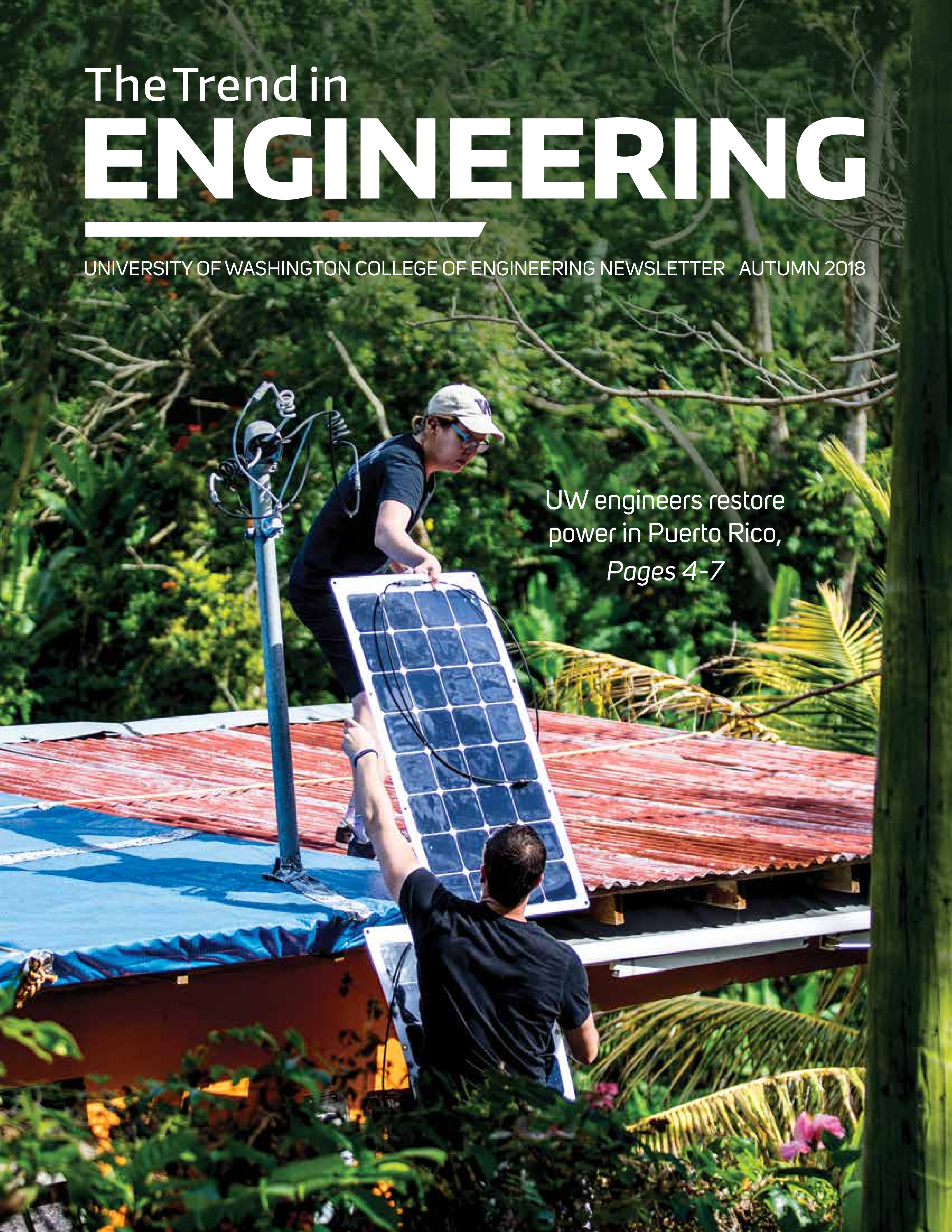
The Trend in ENGINEERING

UNIVERSITY OF WASHINGTON COLLEGE OF ENGINEERING NEWSLETTER AUTUMN 2018



UW engineers restore power in Puerto Rico,

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ENGINEERING IMPACT

The start of this school year is special as it is the beginning of a new era for the college. Nearly 950 freshmen enter the UW as our inaugural Direct to College (DTC) cohort. I'm pleased to report that 70 percent of the class are Washington residents; thanks to DTC, Washington students chose the UW to pursue their engineering education at a higher rate than previous years. The summer has been filled with orientation sessions, advising and peer mentor matchups to ensure the success of this exceptional class. We continue to develop and refine our curriculum and programs to integrate this new class into the engineering community.

While we are encouraged by the positive impact of DTC and the certainty it offers students that they can pursue their engineering degree at the UW, we still face significant challenges meeting student demand for engineering education. This year nearly 7,000 students requested engineering on their application to the UW and 950 students make up our inaugural cohort. We're continuing to partner with the state to address our capacity issues so that we may better accommodate them.

I'd also like to share an update about our STARS program, which helps more low-income students from underserved high schools become engineers at the UW: Last spring's graduating class included 11 STARS students, part of the first cohort to earn their degrees. The program is showing strong results, with 75 percent of its students either continuing their engineering studies or graduating.

On another note, we welcome 18 new faculty members to the college this year. You may meet them all at engr.uw.edu/newfac2018.

As you'll see in this issue, whether they are working right here on campus or across the globe, our students, alumni and faculty are committed to improving peoples' lives through engineering. Please enjoy these stories, and join us this fall for our Engineering Lecture series, which will focus on engineering for social good.

Mike Bragg

Frank & Julie Jungers Dean of Engineering

Above: Mike Bragg with student panelists at the 2017 Scholar Donor Luncheon.

DIAMOND AWARDS

Nominate an exceptional engineer for a 2019 Diamond Award.

The Diamond Awards honor outstanding alumni and friends who have made significant contributions to the field of engineering. If you would like to nominate an engineer for a Diamond Award, please do so by October 19 at **engr.uw.edu/da.**

AERONAUTICS & ASTRONAUTICS CENTENNIAL CELEBRATION

The William E. Boeing Department of Aeronautics & Astronautics celebrates 100 years of instruction.

Join us on Friday, October 12, for a day of speakers, panels and a special keynote address to celebrate this milestone and look ahead to the next 100 years of A&A. The event is open to the public. Learn more and RSVP: **events.uw.edu/aacentennial**

A new era begins

UW Electrical Engineering has changed its name to the Department of Electrical & Computer Engineering (ECE) to expand student opportunities and better reflect current teaching, research and service.

The department's new name — which went into effect on September 16, 2018 — has been widely endorsed by university and college leadership, faculty, students, staff, alumni, advisors and industry leaders.

"This is an exciting development for our engineering community. The UW is known for our interdisciplinary environment and the Department of Electrical Engineering and the Paul G. Allen School of Computer Science & Engineering have a long history of innovation and collaboration. Much of our strength in computer engineering comes from that expertise — at the intersection of computer science and electrical engineering," says Michael B. Bragg, the Frank & Julie Jungers Dean of Engineering.

The new name more accurately reflects the department's research focus and student interest in embedded systems and other hardware digital systems. It also better highlights the close connection between electrical and computer engineering in research and industry.

Current industry jobs and entrepreneurial opportunities in hardware-driven computing domains are vast and it is anticipated that this shift will open more opportunities for our students.

The name change will not impact the degrees granted. The ECE department will retain its degree program in Electrical Engineering, and the Allen School will retain its degree program in Computer Engineering as well as its degree program in Computer Science.

"There is an industry need for electrical engineers that also have a computing background because devices are becoming smarter," said Rico Malvar, chief scientist for Microsoft Research and ECE affiliate professor. "Computing is in everything we do today, including electrical engineering."

Much of the UW's strength in computer engineering arises from faculty — including Shwetak Patel, Joshua Smith, Michael Taylor, Georg Seelig and Linda Shapiro — who are jointly appointed in ECE and the Allen School. These faculty members lead notable research programs such as the Ubicomp Lab, the Sensor Systems Laboratory and the Molecular Information Systems Laboratory.

"There is an industry need for electrical engineers that also have a computing background because devices are becoming smarter."

- Rico Malvar, chief scientist for Microsoft Research

"These top caliber faculty attract sought-after graduate students, which feeds the cycle of excellence, and we believe our new name will only strengthen such recruitment efforts," says Radha Poovendran, professor and chair of ECE. "The field of electrical and computer engineering has produced inventions that have changed the world and the way we live. As our department begins a new era, the opportunities for impact are endless."

GRID BY GRID

By James Urton
Photos by Dennis Wise

Even six months after Hurricane Maria, thousands in rural Puerto Rico still lacked electricity. In partnership with local communities, UW researchers worked to restore their power.

The stout house built into a hillside in Jayuya, a rural municipality in the mountains of central Puerto Rico, hasn't been connected to the electrical grid for six months. Someone inside suffers from sleep apnea, and his family has relied on a noisy generator — and the gas it consumes — to power the machine he needs each night.

Outside, under the thin smile of a crescent moon, four University of Washington engineers complete their work. Soon a new solar/battery nanogrid will power the sleep-aid machine: no gas, no fumes, no cacophony.

Mareldi Ahumada Parás and Wesley Tatum, doctoral students in electrical engineering and materials science and engineering, secure four flexible solar panels to the roof using yellow rope. Aeronautics and astronautics alumna Anya Raj, '17, feeds wires from the panels through a hole in the roof, while chemical engineering sophomore Hugo Pontes illuminates Raj's efforts with his smartphone.

The team connects the panels to a battery inside the house that will be charged by tomorrow's sun. They finish just as the mosquitoes emerge.

Getting to the heart of the damage

Ahumada, Tatum, Raj and Pontes are part of a team of UW engineers and scientists who are assessing the long-term impact of Puerto Rico's power loss on the health of rural residents.

Over three trips, the researchers crisscrossed this 39-square-mile region on single-lane switchbacks, some of which have narrowed sharply since Hurricane Maria struck the U.S. territory in September 2017. Jayuya is home to the highest peaks in Puerto Rico — and 17,000 people.

The team visited homes and community centers, interviewing dozens of caregivers and residents who use electronic medical devices, as part of a long-term field study on the impact of power loss on public health. They also donated and installed 17 solar/battery nanogrid systems — prototypes of a sustainable, clean energy infrastructure that can buoy public health in rural areas when power grids fail.

"You adapt because you have to, but you never achieve the normal life you had back when you had power."

- Lilo Pozzo, associate professor of chemical engineering

Like many natural disasters, Hurricane Maria had a disproportionate effect on those with the fewest resources: low- and fixed-income families, the elderly, the sick and rural residents in places like Jayuya. Thousands have remained disconnected from the electrical grid since Maria sliced through. The UW team hopes that the storm's lessons will help engineers develop better nanogrids — like the prototypes they've installed — for an infrastructure that meets the needs of the most vulnerable communities.

As the team has learned in their trips here, the current infrastructure's shortcomings have left deeper scars than downed utility poles and darkened homes. "It is invisible suffering," says Lilo Pozzo, associate professor of chemical engineering, who has led the trips. "You don't know what the situation is until you go into homes and see exactly how people are getting by."

Opposite page: Lilo Pozzo, Chanaka Keerthisinghe and Wesley Tatum connect a solar panel.

This page: Mareldi Ahumada Parás and a local resident position solar panels for installation.

Uncovering the hidden harm

Blue FEMA tarps are still common, but many overt signs of storm damage have been repaired: People have cleared debris, replaced windows and patched roofs. But the UW researchers have documented myriad “hidden” adjustments that residents have made since losing power. These include eating canned and preserved food, despite the lower nutritional value, or making daily trips to a doctor’s office for refrigerated medicine.

“You adapt because you have to,” says Pozzo. “But you never achieve the normal life you had back when you had power.”

Pozzo chose Jayuya for this study because her spouse, Marvi Matos, a chemical engineer, grew up there. Like many with family ties to Puerto Rico, the couple sent supplies to the island after the hurricane. But a month after Maria, barely 20 percent of the electricity grid had been restored, according to FEMA.

Pozzo and Matos envisioned using their expertise to unearth the storm’s impact on health and energy infrastructure. Pozzo recruited partners from the School of Public Health and the College of Engineering. They received funding for the study from the Clean Energy Institute and the Global Innovation Fund, while private donations covered the cost of the nanogrids. Contacts in Jayuya connected them with community organizers and needy families.

Top: Due in part to steep topography, Jayuya remained largely disconnected to Puerto Rico’s power grid even six months after the storm.

Bottom: Team members assembled what they could before leaving Seattle. Some parts, like batteries, were purchased on the island.

“This storm’s lasting impact is that it uncovered the vulnerable places of Jayuya,” says Maria Pérez, a local community organizer. “It showed us the people in our midst who didn’t have help, who were living in inhumane conditions.”

Dedicated to a sustainable future

The UW team first visited Jayuya in November 2017, gathering data and donating four solar/battery systems. They expanded their goals for their March and July trips, buying and assembling three types of solar/battery systems. The smallest can power a miniature refrigerator for storing medical supplies like insulin, while the largest can power more complex devices, such as an oxygen concentrator or a full-size refrigerator.

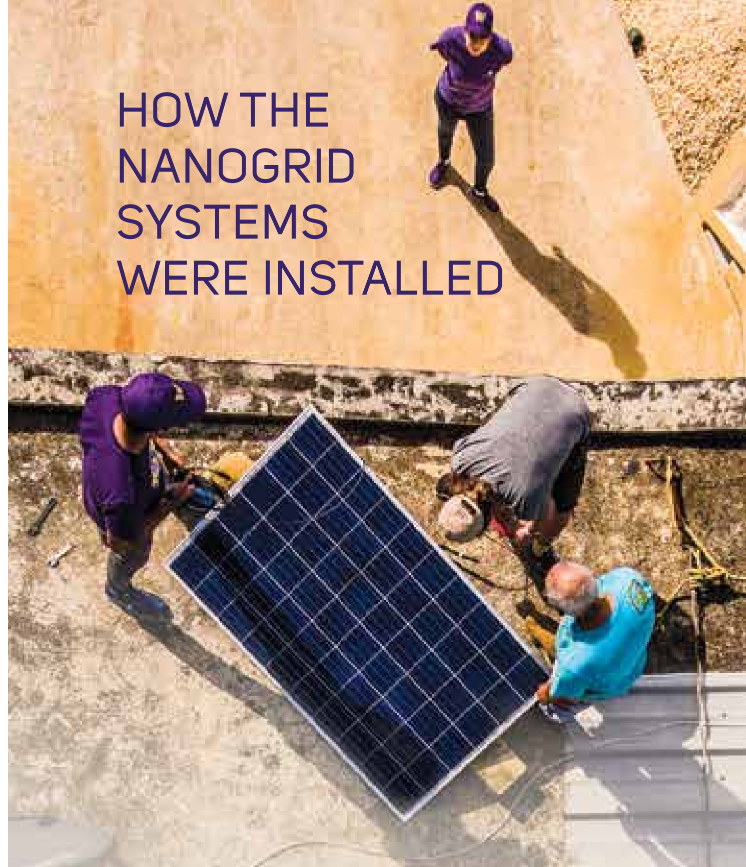
“We want these systems to be simple for the patients and their caregivers,” Ahumada says. “There’s no point in donating something that they’re unable to use easily.”

The researchers also installed 11 data loggers into some of the nanogrids to record information on energy use, which they are currently analyzing.

“We’re combining the information that the data loggers have recorded with information from the interviews to design even more effective nanogrids,” says Chanaka Keerthisinghe, a post-doctoral researcher in electrical engineering.

After installing their final nanogrid, the UW team passed a boy playing in front of his powerless house. He was wearing a Captain America costume and saluting passing cars. A nearby house sported the island’s flag with a handwritten message: *Puerto Rico se levanta.*

Puerto Rico rises.



HOW THE NANOGRID SYSTEMS WERE INSTALLED

Pozzo and her team purchased and assembled three different types of solar/battery systems — small, medium and large, based on the amount of power they can generate. All three work essentially the same way. Solar panels soak up the sun, delivering charge to a battery that can then power a medical device. Depending on the system, there may be additional equipment such as a power inverter to govern the power inflow and outflow from the battery.

They are small-scale counterparts to the types of clean-energy solar/battery grids that have become more popular in Puerto Rico since Hurricane Maria. According to Jesus Martes with Borintek, a solar-energy construction and installation firm in Jayuya, homes and businesses have hired firms like Borintek to install solar panels with battery systems that can provide an electricity lifeline when the power grid fails.

For the solar/battery systems supplied by the UW researchers, Pozzo and Matos ordered most parts before leaving Seattle, and team members brought those components with them in their luggage to Puerto Rico. Some parts, like batteries, were purchased on the island. Solar panels for the medium nanogrids were ordered from Borintek. Team members then painstakingly assembled each system, including repairing damaged parts since they didn’t have funds for backups, before loading them into rented vans for delivery. Each installation took several hours.

RESTORING WATER SYSTEMS AFTER ISIS

By Brooke Fisher

Last year Heta Kosonen, '18 Ph.D., spent six months in the Middle East helping to repair water infrastructure destroyed by ISIS in northern Iraq.

"It was exactly the kind of engineering work I always dreamed of — a high pressure environment in which things were constantly changing and every week presented new challenges," civil and environmental engineering alumna Heta Kosonen says of her recent work in the Middle East with JEN, an international aid organization that provides support to people affected by conflict and disaster.

As a program officer for JEN, the recent Ph.D. graduate oversaw an engineering team working to restore water to areas previously occupied by the Islamic State in Iraq and Syria (ISIS), which destroyed infrastructure before retreating. The team's progress enabled displaced people to return to their homes in newly liberated areas.

"The situation was very volatile when I started the job," Kosonen says.

In particular, accessing key areas and crossing borders could be especially stressful. From Amman, Jordan — which served as her home base for six months — Kosonen remotely managed a team of four engineers, two security officers, two logistics officers and two administrative staff in Kurdistan, a region in northern Iraq.

Crossing borders and cultures

Kosonen had to travel to Iraq to tour project sites and meet local leaders in the municipalities where her team was stationed. She wasn't allowed to fly into Kurdistan, however, due to security concerns after an independence referendum led to armed conflicts between the Kurdistan and Central Iraq regions. So she had to take a much longer route — she traveled through Turkey in a vehicle to cross the border into Iraq.

Amid daily power outages, Kosonen managed logistics, supervised projects and developed plans to react to specific community needs. She also helped monitor security situations to determine if it was safe for field staff to work in certain areas. Each day brought new challenges, with political conflicts often leading to road closures or safety concerns delaying projects.

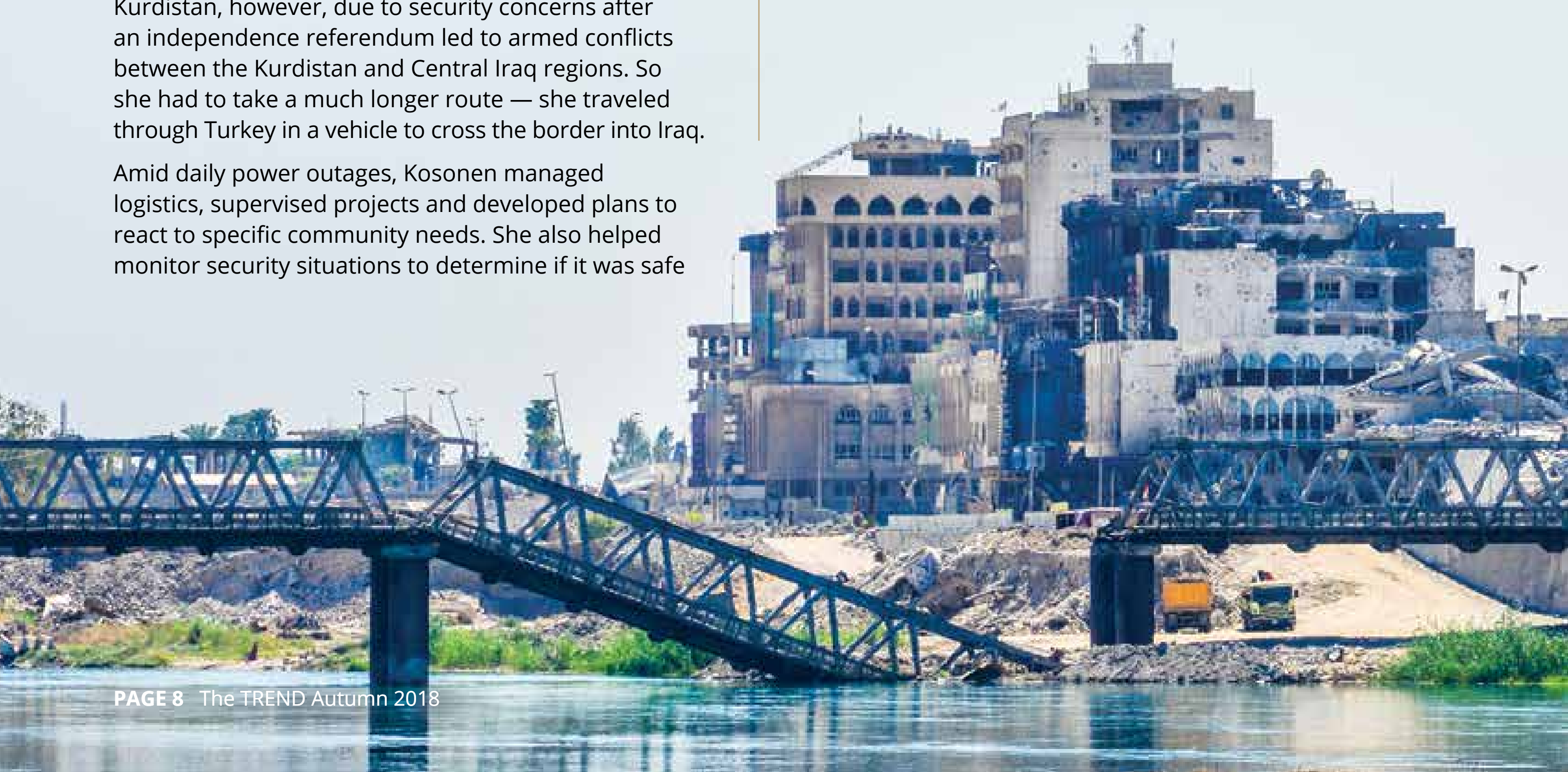
"Things were constantly changing," Kosonen explains. "I needed to have a plan F, not only a plan B."

Moreover, as a female engineer, Kosonen experienced cultural differences stemming from the traditional role of women in Iraqi culture. Being an engineer is not a common occupation for women in Iraq, where the majority of women do not work outside the home. It was therefore a surprise to some project partners and collaborators that Kosonen was knowledgeable about water systems and asked technical questions at meetings. At one meeting, a few men refused to shake her hand and were confused about her role as a decision maker.

"You can imagine how frustrating that was, but I consider it a useful growing experience both for me and for them," Kosonen says.

Restoring water systems

Kosonen's team worked on water restoration projects in northern Iraq, close to the Syrian border, in areas previously occupied by ISIS. As ISIS retreated, refugees began returning to their homes. However, many communities suffered from a lack of clean water because ISIS destroyed water networks and other infrastructure,



leaving little behind. Anything of value — pumps, generators and electrical equipment — had been stolen.

"The destruction level was quite high, and there was almost nothing when people were going back," Kosonen says. "Everything was destroyed."

The team worked on several water-related projects, the most common of which was rehabilitating boreholes — narrow wells drilled into the ground. This process entailed rebuilding a simple borehole/well room, rebuilding a water tank base and installing new equipment, such as pumps and generators.

Team members worked to restore water and sanitation systems at schools. They also helped to coordinate water delivery to several small villages as well as in West Mosul, where they delivered water to seven neighborhoods with a combined population of 114,000 people.

Short-term emergency response projects also required the team's attention. In one instance, the mayor of Zummar asked for help with a water crisis. More than 50,000 people in the town of Zummar and surrounding villages lost access to safe drinking water after the water level of Mosul Dam Lake decreased drastically in a short amount of time. Because the inlet pipes of the main pumping station were above water level, the mayor asked if the team could help extend the pipelines to get water flowing again.

"We explained this situation to our donors, calculated the budget, did a quick tender process with a few contractors and were able to start the project within one week of the mayor's initial request," Kosonen explains. "The pumping station is now working again and people can access water. It feels quite good to be able to react to something like this."

Building on her humanitarian aid experience, Kosonen will embark on a new adventure this fall. She will be working for United Nations Children's Fund (UNICEF) as a program officer in the innovation unit in Copenhagen, where she will help develop new technologies and practices that strengthen UNICEF's mission to help children in developing countries.

Top right: Engineers prepare to cast the walls for a water storage tank.
Middle right: Kosonen practices evacuating from a car. All JEN employees working in the field must take security training.
Bottom right: Kosonen with JEN team members.
Below: Mosul, after the occupation.

Turning research into IMPACT

By Jamie Swenson and Chelsea Yates

To apply their protein research to the pharmaceutical pipeline, the bioengineers behind A-Alpha Bio learned the language of business.

"The average cost of developing a new drug is $2.6 billion," says David Younger, who received his Ph.D. in bioengineering from the UW in 2017. "But it's not necessarily that it costs that much to develop one compound. It's that nine out of 10 compounds that enter clinical trials fail."

When it comes to drugs that target and disrupt specific protein interactions to fight maladies such as autoimmune diseases and cancer, screening candidates can be especially challenging. These drugs show great promise in their effectiveness — but there's a catch.

"If you design a drug to disrupt a particular protein interaction, it's likely that it's also going to disrupt others," says Younger.

These unplanned, or "off-target," interactions are difficult to predict — and potentially lethal. In addition, they can typically be tested only one at a time using established screening techniques.

With these problems in mind, Younger invited fellow BioE Ph.D. students Bob Lamm and Randolph Lopez to join him in starting a business focused on improving drug-testing efficiency.

Rooted in Younger's thesis work on agglutination (yeast reproduction), their business, A-Alpha Bio, is developing a platform that uses genetically engineered yeast to help scientists test hundreds of drug candidates against thousands of potential targets.

By programming yeast cells to adorn their surfaces with human proteins and adding different drugs into the mix, the researchers can see which proteins and drugs interact — and how strongly.

"Basically, we can screen thousands of protein interactions in a single test tube," Younger explains.

But venturing into the world of business came with very different challenges than the ones presented by engineering microorganisms roughly 1/200 of a millimeter in diameter.

"It's like learning a new language," says Younger.

Learning the language of business

"We've always believed that commercialization is the best way to get technology to people who will benefit from it, and thanks to the help and mentorship we've received at the UW over the last year and a half, we're getting closer to doing just that," says Lamm.

After trying their luck — and succeeding — in the 2017 Science and Technology Showcase, hosted by the UW Buerk Center for Entrepreneurship and the Science and Engineering Business Association, the team entered A-Alpha Bio in the UW Business Plan Competition that same year.

Through the Buerk Center, they connected with local attorneys, entrepreneurs and investors who helped coach the team as they built out their business plan, presentation and pitch for the competition.

"The support we've received from UW and the Seattle community has made it possible to start our company. I have no idea how we would have gone about it otherwise."

- David Younger, '17 Ph.D., A-Alpha Bio CEO

"Each step through the Business Plan Competition was accompanied by workshops and panels that opened our eyes to more and more we didn't know," says Lamm.

"We had no idea what we were doing," adds Younger. "You put a pitch together and show it to people, and they say, 'Nope, that's a science pitch. Start over.'"

Though they didn't place, they took home the Perkins Coie Best Innovation / Technology Idea Prize, and a lot of encouragement. That support fueled them to dive deeper into the business world.

With the help of UW CoMotion, A-Alpha Bio filed for patent protection and received a grant from the CoMotion Innovation Fund, a partnership between CoMotion and the Washington Research Foundation that helps applied research advance from the lab to the marketplace. Younger also received a fellowship through CoMotion, enabling him to complete a postdoctoral year to continue working on A-Alpha Bio.

The team applied for and was accepted to the Buerk Center's 2017-18 Jones + Foster Accelerator, a structured program that helps early-stage student companies through their initial months.

"The Accelerator program allowed us to hone our business development skills," says Lopez. "Seattle has an incredible innovation community, and I still can't believe how much access the program gave us to local experts and entrepreneurs."

Technology translation for the greater good

Younger, Lamm and Lopez say that the work they've done over the last 18 months to develop their business has been like pursuing an intensive second graduate degree.

Along with the Buerk Center and CoMotion, the team credits electrical engineering professor Eric Klavins and biochemistry professor David Baker as integral to their growth.

"Not many professors would be as generous with their time, lab space, equipment and resources as these two have been," Younger says. "Additionally, Lance Stewart, the Senior Director of Strategy for the UW Institute for Protein Design helped us considerably with planning for commercialization."

Last spring A-Alpha Bio won first place in the 2018 Hollomon Health Innovation Challenge and the Business Plan Competition and applied their winnings toward equipment for their own lab in Fluke Hall, which they moved into in July.

In the long term, they see potential for their technology to become the most cost- and time-effective method of screening drug interactions, in turn helping pharmaceutical companies make their products safer and cheaper.

"The support we've received from UW and the Seattle community has made it possible to start our company," says Younger. "I have no idea how we would have gone about it otherwise."

Opposite page: Bob Lamm and David Younger of A-Alpha Bio.

This page: Randolph Lopez explains A-Alpha Bio's technology at last spring's UW Business Plan Competition.

Support graduate student research by making a gift to the Dean's Fellowship Fund:

giving.uw.edu/engineering-fellowship

Meal Matchup

By Leah Pistorius and Chelsea Yates

A human centered design and engineering team is helping campus dining halls donate and deliver excess food to local homeless shelters.

"If you had a million dollars, what kind of tech project would you create for social good?"

When this question was posed to Madison Holbrook, '18, in a human centered design and engineering (HCDE) class taught by Irini Spyridakis, she knew exactly what she'd do: use technology to reduce hunger and food waste.

"I was raised in a food-minded community in eastern Washington — my mother runs our family ranch, and my dad and brother manage a mobile catering service that provides food to emergency responders during disaster events," the former HCDE major and STARS student explains. "Through community and family I learned the importance of not wasting food."

In the U.S., it is estimated that 30-40% of food goes uneaten. Holbrook noticed a major disconnect between food going to waste on campus and people in need. "I thought, 'There has to be a way to use engineering to help,'" she says.

For her class project she proposed a website that would pair UW dining halls with local shelters to coordinate food donations.

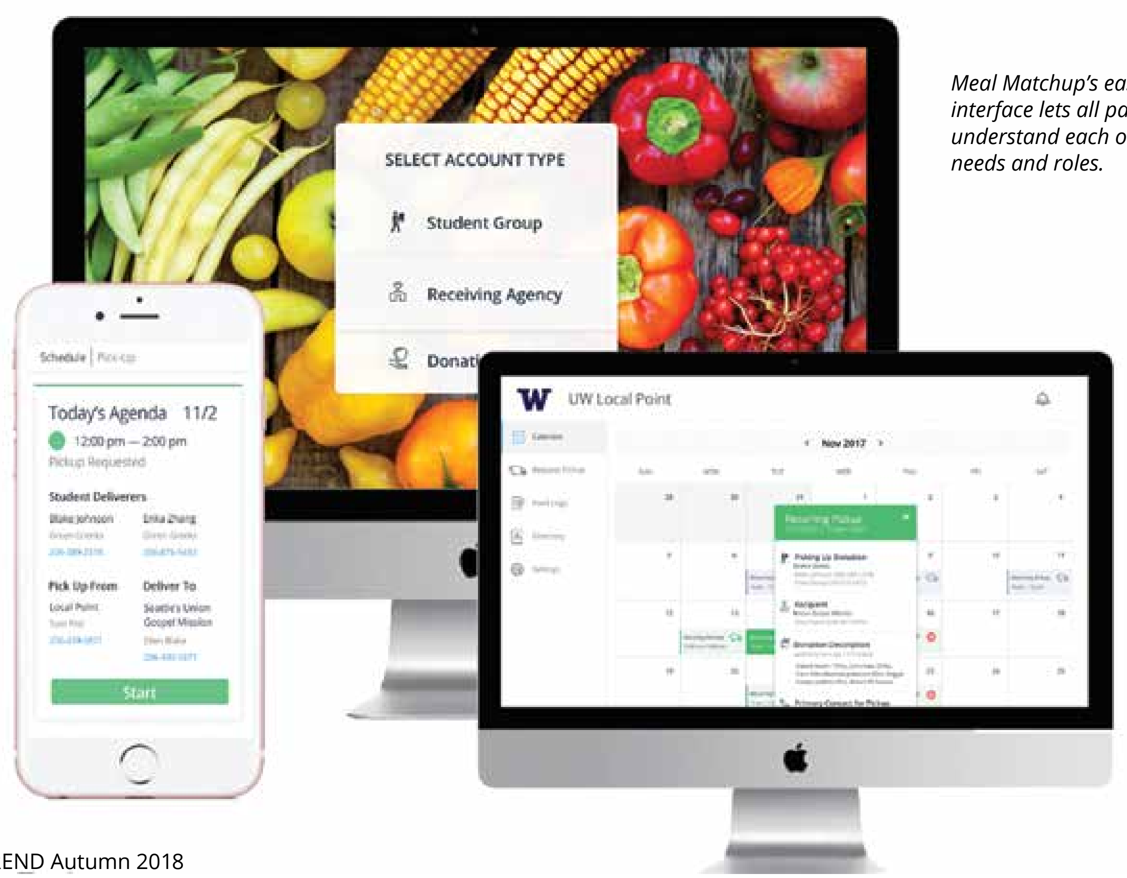
"When she presented her idea, we all agreed it made so much sense," says Spyridakis. "She'd come up with a way to make an impact starting right here on campus."

Spyridakis encouraged Holbrook to take the concept further, and together they wrote a proposal to the UW Campus Sustainability Fund. Their project was awarded $21,000 to support the creation of a website to connect excess dining hall food with local non-profit agencies that could distribute it to people in need.

From classroom to kitchens

Over the past year, Holbrook and Spyridakis have led an interdisciplinary research group to develop the concept into a fully functional web platform.

Their team — which has grown to include 33 students from from HCDE, the Information School, and the Paul G. Allen School of Computer Science and Engineering — designed the interface for and with the help of three stakeholder groups: UW dining halls, local shelters and student volunteers.



Meal Matchup's easy-to-use interface lets all parties understand each other's needs and roles.

Their web platform, mealmatchup.org, works like this: Food providers log food donations and request pickups online. Food transporters then schedule drivers for pickup and deliveries. Since it's important to ensure that food donations meets required state guidelines, transporters are trained in food handling and safety, and they use the website to document proof-of-pickup and delivery, track food temperatures and navigate pickup and drop-off locations. Receiving agencies also use the interface to understand what will be arriving, when, how much and who will be delivering it.

To launch the project, team members deepened their understanding of stakeholder needs and concerns. On campus they worked with UW Housing & Food Services administrators and dining hall managers. They also interviewed managers at more than 50 local homeless shelters, food banks and soup kitchens.

Through that assessment, key priorities emerged.

"We needed to create a logistics-focused platform that was clear and easy-to-use so all parties could understand each other's needs and roles," Holbrook explains. "Some campus dining halls already had donation systems in place, so rather than replace them we focused on enhancements."

LEARN MORE AT MEALMATCHUP.ORG

Timing, storage and transportation presented the biggest challenges for both the providers and receivers.

"Dining halls can't necessarily send their staff to deliver food, and shelters can't always rely on volunteers to regularly pick up food," Holbrook says.

For help with food transportation, Holbrook and Spyridakis reached out to UW Carlson Leadership & Public Service Center staff and Green Greeks, a student group committed to sustainability.

"Through Green Greeks and the Carlson Center's Service Learning program — in which students can earn course credit for participating in service activities — students agreed to organize and deliver food to area shelters from campus," says Spyridakis. "This arrangement has given the project a much-needed framework for managing and communicating transportation and has introduced our team to some wonderful new partners."

Piloting and next steps

The team piloted Meal Matchup in May 2018 with UW dining halls Local Point, The 8 and District Market and shelters Union Gospel Mission and Compass Housing Alliance.

Through Meal Matchup, student volunteers transport excess food from campus dining halls to local homeless shelters.

"That experience was so valuable," Holbrook says. "We accomplished all of the goals we set for the pilot and successfully problem-solved a few unexpected hurdles, such as how to adapt when a partner organization experiences management or staff turnover."

This fall the team will fine-tune their web platform, which they've designed to be open-source so other schools can use it to create their own donation systems.

"Our goal is that the program will be adaptable, self-sustaining and fully student-run," says Spyridakis, who will continue to supervise the project.

Now working as a user experience designer for Hewlett-Packard, Holbrook will stay involved with the project as a consultant. She is excited to see campus interest in Meal Matchup grow and to help new students step into leadership roles.

"The best part of this project is knowing you can dream up an idea, communicate it, find interested people, and develop something that will actually make a difference," she says. "For a long time, it was just pen and paper, meetings and designing. But now that Meal Matchup exists, we are able to connect food that would otherwise be wasted with people who can use it. It feels great."

Support student projects like Meal Matchup through the Dean's Fund for Excellence:

giving.uw.edu/engineering-excellence

ROBOFLY takes off

The wireless insect-sized flying robot takes its first flaps.

By Sarah McQuate

Insect-sized flying robots could help with tasks like surveying crop growth or sniffing out gas leaks. These robots soar by fluttering tiny wings because they are too small to use propellers, like those seen on their larger drone cousins. Their small size is advantageous: The robots are cheap to make and can easily slip into tight places that are inaccessible to big drones.

> "Before now, the concept of wireless insect-sized flying robots was science fiction."

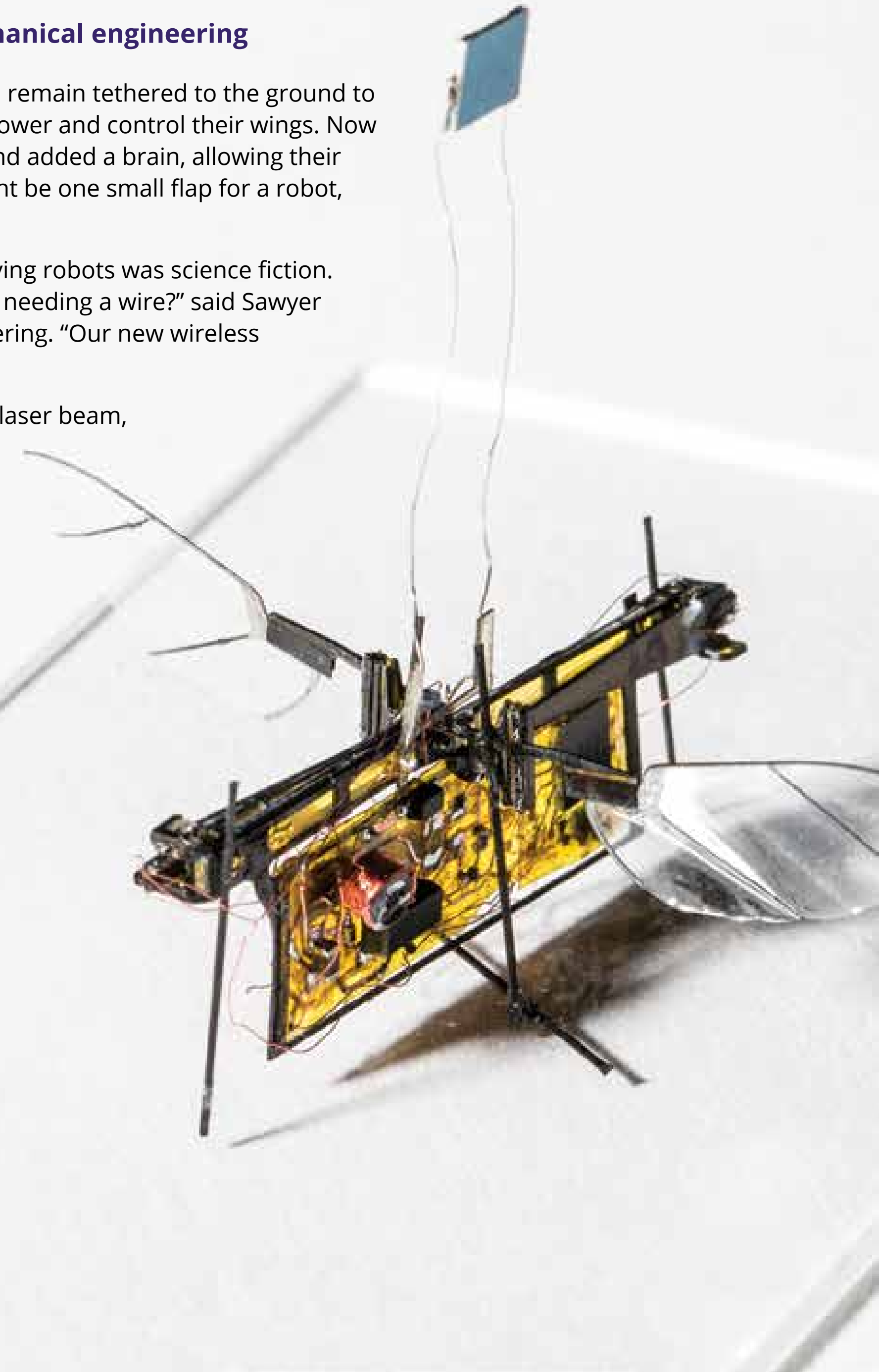
- Sawyer Fuller, assistant professor of mechanical engineering

Until recently, current flying robo-insects needed to remain tethered to the ground to accommodate the heavy electronics necessary to power and control their wings. Now UW engineers have for the first time cut the cord and added a brain, allowing their RoboFly to take its first independent flaps. This might be one small flap for a robot, but it's one giant leap for robot-kind.

"Before now, the concept of wireless insect-sized flying robots was science fiction. Would we ever be able to make them work without needing a wire?" said Sawyer Fuller, an assistant professor in mechanical engineering. "Our new wireless RoboFly shows they're much closer to real life."

Slightly heavier than a toothpick and powered by a laser beam, RoboFly uses a tiny onboard circuit that converts the laser energy into enough electricity to operate its wings. The laser alone does not provide enough voltage to move the wings, so the team designed a circuit to boost the voltage needed for flight. They also added a microcontroller to the circuit to send voltage in waves to mimic the fluttering of a real insect's wings.

For now, RoboFly can only take off and land, but the team is working on making it possible for RoboFly to hover and fly around.



ADVANCING ENGINEERING ACROSS THE STATE

UW Engineering faculty are elected to the Washington State Academy of Sciences.

Michael B. Bragg, dean of the College of Engineering and professor of aeronautics and astronautics, and **Suzie Pun,** professor of bioengineering, are among the 14 UW scientists, physicians and engineers to be elected this year to the Washington State Academy of Sciences.

Members are selected for their outstanding record of scientific achievement and willingness to work on behalf of the academy in bringing the best available science to bear on issues within the state of Washington. With this new crop of members from the UW and other state institutions, the academy's total membership stands at 286.

Michael B. Bragg

Suzie Pun

BIO-INSPIRED DESIGN AND ASSEMBLY

New research center will explore the rules of how order emerges from the interaction of simple building blocks.

The U.S. Department of Energy has awarded a $10.75 million, four-year grant to the UW, the Pacific Northwest National Laboratory and other partner institutions for a new interdisciplinary research center to define the rules that govern how molecular-scale building blocks assemble into ordered structures — and give rise to complex hierarchical materials.

The Center for the Science of Synthesis Across Scales (CSSAS) will bring together researchers from biology, engineering and the physical sciences to uncover insights into how molecular interactions control assembly and apply these principles toward creating new materials with novel and revolutionary properties for applications in energy technology.

Breakthroughs

Read more research news at engr.uw.edu/news

Crowdsourced exercise vs. personal trainers

UW and Seattle University researchers have created CrowdFit, a platform for exercise planning that relies on crowdsourcing from nonexperts to create workout regimens guided by national exercise recommendations and tailored to users' needs. In a field evaluation, nonexperts could create exercise plans as effective as personal trainers under certain conditions. The research team includes HCDE doctoral student Elena Agapie and faculty members Sean Munson and Gary Hsieh.

(A lot) less power needed

Wearable cameras such as Snap Spectacles promise to share videos of live concerts or surgeries instantaneously, but their small batteries are not suited to high-definition video streaming. A UW engineering team led by Allen School associate professor Shyam Gollakota and Allen School and ECE associate professor Joshua Smith has developed a new HD video streaming method that skips the power-hungry parts and has something else — like a smartphone — process the video instead.

Giving perovskites a boost

A team of UW engineers and scientists reports that a prototype semiconductor thin-film has performed even better than today's best solar cell materials at emitting light. The team achieved a record performance in this material, known as a lead-halide perovskite. They chemically treated it through a process known as "surface passivation," which treats imperfections and reduces the likelihood that the absorbed photons will end up wasted rather than converted to useful energy.

No GPS needed

Drones use GPS to guide them without a pilot. However, GPS signals can be easily blocked by skyscrapers or trees — leaving drones lost. Aeronautics and astronautics researchers have developed a way to give aircraft a backup system in case GPS fails: An antenna on the ground that can tell a drone where it is. This fall they will partner with T-Mobile to use cellphone towers to perform the same function, allowing drones to cover larger distances.

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2018 Engineering Lecture Series

Engineering for Social Good: Assistive Robots, Environmental Equity and Disaster Relief

Building a Robot Butler: Towards Fluent Human Robot Interaction
Siddhartha Srinivasa, *Boeing Endowed Professor, Paul G. Allen School of Computer Science & Engineering*
Thursday, October 11
Human collaboration is a delicate dance of prediction, inference and action. Building robots with the capability to interact with humans as equals has potential to improve the daily lives of those who require assistive care, such as the elderly or mobility impaired. Learn how researchers are developing these robots using mathematical models and physics-based manipulation.

Clearing the Air: Environmental Justice and Air Quality
Julian Marshall, *John R. Kiely Endowed Professor of Civil & Environmental Engineering*
Tuesday, October 30
Air pollution is the leading environmental health risk in the United States, causing thousands of deaths each year. Research has revealed that, on average, people of color are exposed to more air pollution. By modeling changes in specific sources, Julian Marshall is examining how air pollution impacts groups differently, and testing solutions to reduce the exposure disparity.

Meeting Our Global Obligations: The Hurricane Maria Energy & Health Project
Lilo Pozzo, *Weyerhaeuser Associate Professor of Chemical Engineering*
Tuesday, November 13
In September 2017, Hurricane Maria devastated the island of Puerto Rico and left its residents without power, water and sanitation systems. A group led by associate professor Lilo Pozzo initiated a combined research and service project to assess the disaster's impact on the health of rural residents. Learn more about this project to provide emergency clean energy to help vulnerable people when power grids fail.

All lectures are at 7:30 p.m., Kane Hall, UW Campus – FREE! Registration required at events.uw.edu/Lecture2018.
Presented by the College of Engineering in partnership with UW Alumni Association.