

# THE INTEGRATOR

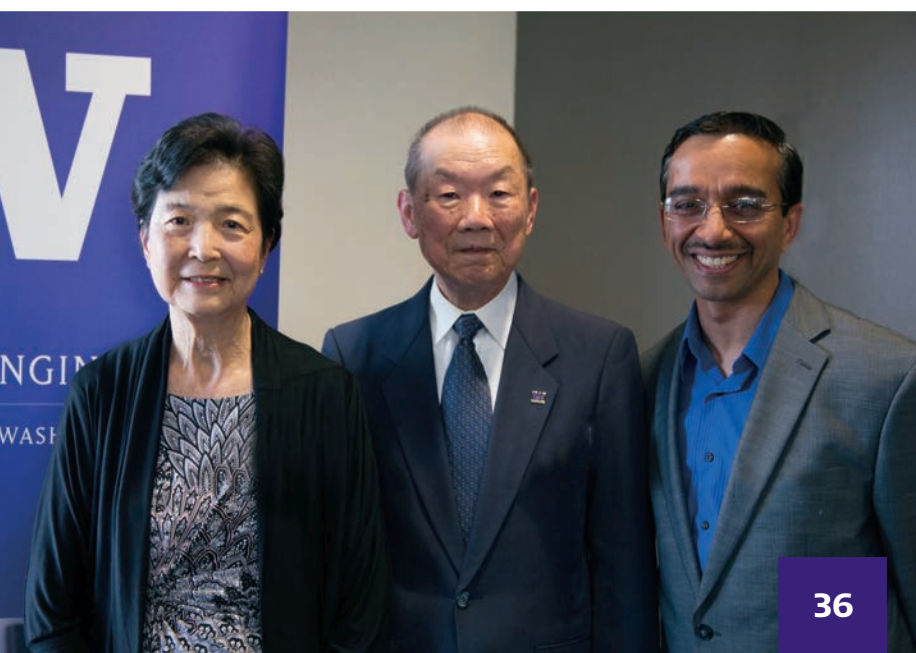
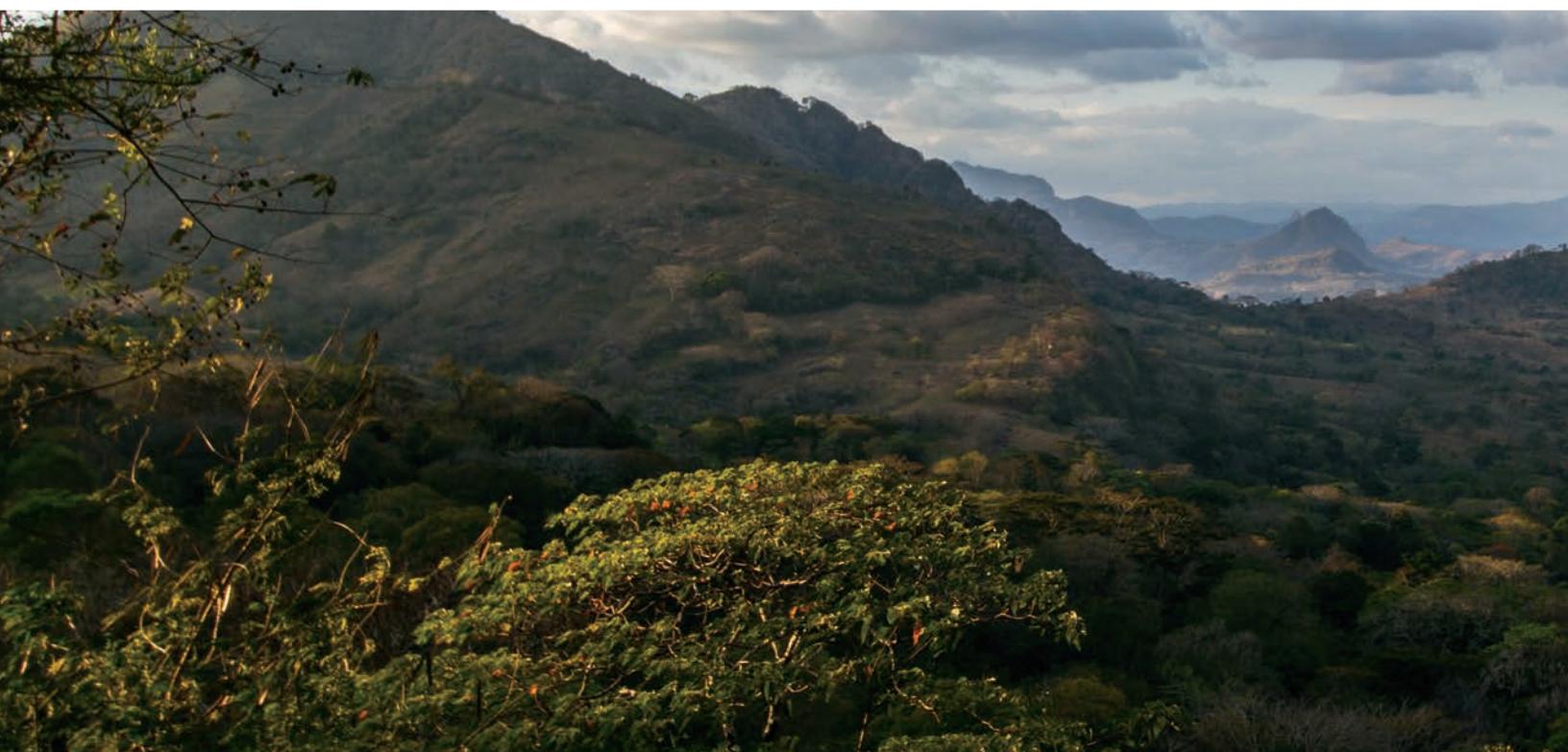
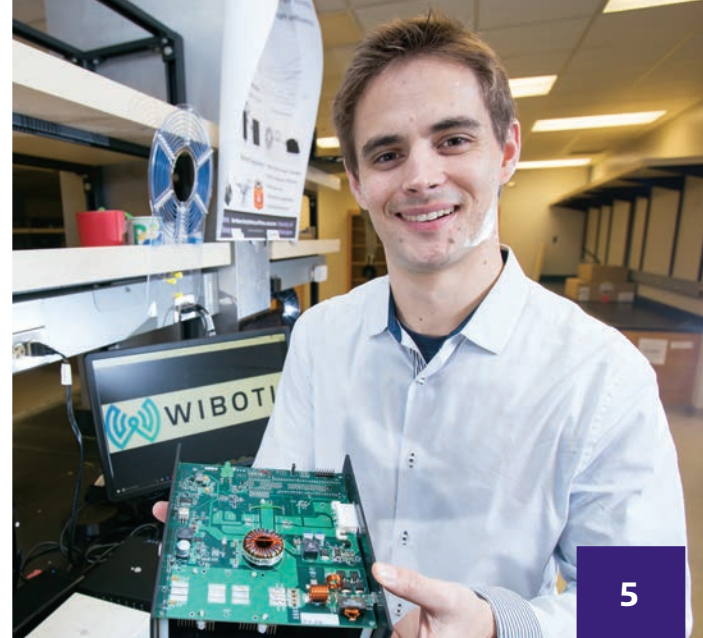
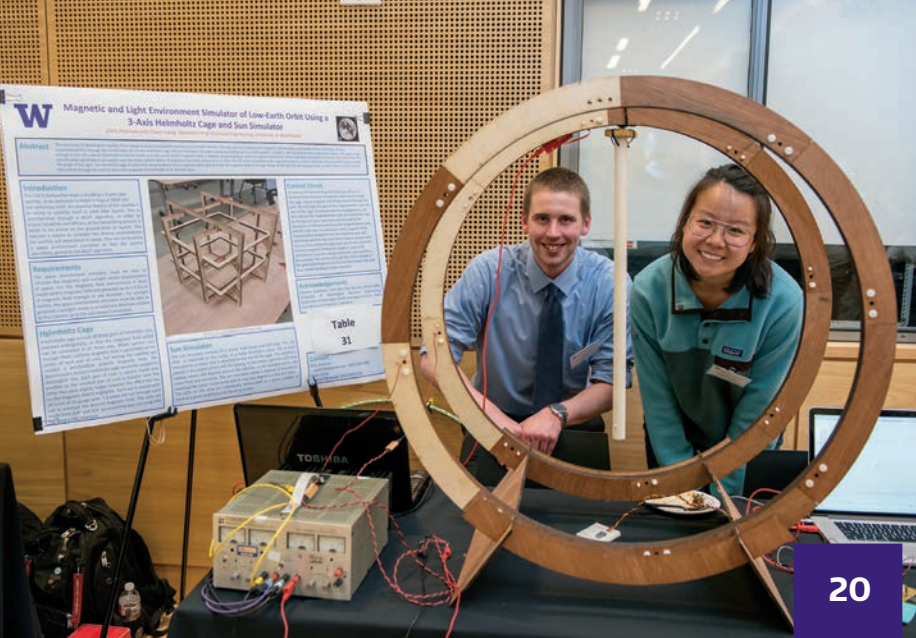
Fall 2017



**MILTON ZEUSCHEL**

A TRAILBLAZING  
ALUM WITH A HEART  
FOR ENGINEERING  
ENTREPRENEURSHIP

W





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# SNAPSHOTS

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## PUBLISHER

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## Our global impact lives in our alums

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*Dear Alumni & Friends,*

I am very pleased to share with you a snapshot of what you, our valued UW EE alums, are accomplishing. From the beginning of your careers to retirement, you never stop innovating. Between these pages, you will see the story of young entrepreneurs, with the energy and enthusiasm to change the world. You will see the story of a retired engineer, who has built a laboratory in his home, a space to churn out patent after patent in antenna communication. It is important to establish endowments to support emerging areas. You will see the stories of four separate alums, who use their passions in entrepreneurship, rehabilitation technologies and renewable energy to build UW EE's research in these areas for maximum global impact.

Our research has taken on new heights. Recently, Professor Joshua Smith and his collaborators developed a cellphone that can operate without a battery. Professor Georg Seelig and his team have used spatial organization (or aptly-named "DNA dominoes") to build nanoscale computational circuits made of synthetic DNA, marrying biology and technology with shrewd brilliance. Our research in smart cities was elevated through new partnerships. A new center on smart, connected communities - The CMMB Vision-UW Center on Satellite Multimedia and Connected Vehicles - was established to develop the next generation of smart cars and ubiquitous connectivity. An MoU between the UW and Indian Institute of Technology Hyderabad (IITH) propels our research in cyber-physical systems (CPS) and smart cities.

The accomplishments of our students and alums are what make me most proud as UW EE chair. Alum Vamsi Talla (Ph.D. '16) was recently awarded his third award for his dissertation on ambient backscatter, receiving the ACM SIGCOMM 2016 Doctoral Dissertation Award, which is the first

of its kind for the department. Undergraduate student Megan Swanson attended the SUBERB-ITS summer program at Berkeley. For Megan, this takes her one step closer to receiving her Ph.D. in embedded systems within electrical engineering.

UW EE alums change the world through their incredible academic and professional pursuits, and through unparalleled levels of philanthropy. Alum Milton "Milt" Zeutschel and his wife, Delia Zeutschel, endowed the department's entrepreneurial endeavors, giving future students the opportunity to change the world.

*How are you changing the world? And how can the Department of Electrical Engineering collaborate with you in your efforts?*



**RADHA POOVENDRAN**

PROFESSOR AND CHAIR  
ELECTRICAL ENGINEERING

A long-exposure photograph of a starry night sky, showing concentric circular star trails in shades of blue and white, creating a tunnel-like effect.

# VISION

## FOR GLOBAL IMPACT

**Alums and industry are joining forces with UW Electrical Engineering to foster an entrepreneurial culture in the department.**

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## FROM UNDERWATER ROBOTS TO WIRELESSLY POWERED DRONES, UW EE GRADS HAVE A KNACK FOR BIG IDEAS

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### BLUHAPTICS

BluHaptics' software pioneers new technology for augmented robotics. While a graduate student, Fredrik Rydén (Ph.D. '13) founded the company with UW EE Professor Howard Chizeck. BluHaptics initially focused its software to underwater operations, helping operators control underwater robots, such as those used in the oil and gas industry. However, a recent \$1.3 million NASA grant has taken the software company to new heights - space.



Ben Waters



Fredrik Rydén



### WIBOTIC

WiBotic develops wirelessly powered drones and robotic devices. The devices are used to deliver medical supplies in developing nations, reduce excess water usage in agriculture, strengthen safe extraction of offshore oil and gas, monitor contamination levels in the ocean and respond to emergency situations more quickly. Ben Waters (Ph.D. '15) founded the company while he was a graduate student in Professor Joshua Smith's lab. Waters recently secured \$2.5 million to enhance product development.

## GATE

Gate is the world's first camera-equipped smart lock, featuring a motion-activated camera, speaker, call button and keypad. The device utilizes an individual's mobile device, enabling remote and secure access to his or her home. Co-founders Ehsan Saeedi (Ph.D. '10) and Harvey Ho (MSEE '07) released the device on crowdfunding site, Indiegogo. Within one week, Gate exceeded its total fundraising goals. The device is now in pre-sales and is estimated to be released this fall.



*Charlie Matlack*

*Ehsan Saeedi and Harvey Ho*

## POTAVIDA

PotaVida enables aid and emergency relief organizations to make better decisions by collecting accurate data from the field in real time and distilling it into actionable insights. The company's first product, the Smart Solar Purifier, disinfects water using just sunlight for household use in disaster relief and refugee contexts. The data collected is captured and sent to decision makers. Charlie Matlack (Ph.D. '14) started the company while he was a graduate student at UW EE.

# W

## ELECTRICAL ENGINEERING

UNIVERSITY of WASHINGTON



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Alum Milton “Milt” Zeuschel (BSEE ‘60) and his wife, Delia Zeuschel, sign the endowment to support entrepreneurial excellence in the UW Department of Electrical Engineering alongside Professor and Chair Radha Poovendran.

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# ENDOWING ENTREPRENEURSHIP

*UW EE Alum Milton “Milt” Zeuschel (BSEE ‘60) and his wife, Delia, invest in electrical engineering students’ potential.*

**T**he UW Department of Electrical Engineering (UW EE) strengthened its legacy as an entrepreneurial hub with a generous gift from UW EE alum Milton “Milt” Zeuschel (BSEE ‘60) and UW College of Education alum Delia Zeuschel (BA ‘58). The initial endowment supports the growth of the department’s Engineering Entrepreneurial Capstone program (ENGINE), enabling current and future UW EE students to engage in real-world industry partnerships and giving local companies an opportunity to benefit from the vibrant innovation culture at UW EE. A component of the endowment also establishes the Milton and Delia Zeuschel Professorship in Entrepreneurial Excellence. This professorship supports the department in recruiting and retaining entrepreneurially driven faculty, who will help build and sustain an engineering entrepreneurial ecosystem at the UW.

For Milt Zeuschel, who built his personal success from independence and drive on a farm in rural North Dakota, entrepreneurship was just a part of the journey. He paid for his electrical engineering education with the GI Bill stipend he received for his service in the U.S. Navy. He was the first member of his family to graduate from high school. He continued to push forward, being the first of his family to attend college.

An education at UW EE proved a fruitful step along the journey, providing Mr. Zeuschel with the technical skills to become an entrepreneur. The apt combination of education and personal discipline propelled Mr. Zeuschel to start from the ground up. Over the course of his career, he founded five companies, three of which – Zetec, Data I/O Corp. and Zetron, Inc – were met with resounding success.

His first company, Zetec, developed non-destructive testing equipment and offered testing services to the nuclear power industry. The last company he founded, Zetron, makes Mr. Zeuschel most proud. Zetron produces 911-emergency dispatch equipment, particularly radio and telephone communications infrastructure. For Mr. Zeuschel, all of the real-world experiences – from farm to company – led him to a successful career, something he believes is a valuable experience to all engineering students.

“Engineering students need to be able to think of the big picture,” Mr. Zeuschel said. “Having a program that gives them an opportunity to connect early on with industry professionals gives them important lessons in not only entrepreneurship, but in working in the real world.”

The ENGINE program, which was rolled out in winter quarter 2016, offers students the mentorship of engineering professionals. Students work on industry-sponsored projects, developing their skills in innovation, systems engineering, project management and project development. For Mr. Zeuschel, a program of this caliber lends to real-world readiness, an advantage often not available in standard electrical engineering curricula.

“Over the years, I learned a lot of what to do and what not to do to run a company,” Mr. Zeuschel said. “A lot of new engineers think that solid engineering sells a company. But it’s more than that. To be successful, you need to create a product that sells to the customer and that the customer is willing to pay for. Having interactions early on in your education about all that it takes is key.”

Since 2016, the ENGINE program has already seen significant growth from interested students and local companies. In its second year, more than 50 percent of the UW EE undergraduate graduating class is enrolled in the program. Students work on cutting-edge projects, including drone radar, transit apps, space communications and clean energy.

“We are very grateful to Milt and Delia for their generous contributions to our students,” said UW EE Professor and Chair Radha Poovendran. “The graduates of the UW EE ENGINE program will make a positive impact that will have a ripple effect throughout the entire

State of Washington.”

Graduates’ ENGINE knowledge will guide them while seeking entrepreneurial endeavors and industry employment, fostering economic opportunity and energizing innovation throughout the state.

As an entrepreneur and a philanthropist, there could be no better partner to ENGINE than Mr. Zeuschel. From the beginning, he has invested his resources into ENGINE, a program he says would have greatly benefited him while in college. Mr. Zeuschel’s commitment to the program will endure.

“I want to continue to engage in the program every way I can,” Mr. Zeuschel said. “I would love to be a resource for students and professors.”

For both Zeuschels, the UW provided a valuable educational experience that followed them throughout their careers. For Delia Zeuschel, her time studying at the UW College of Education laid the foundation for her work as a teacher. Mrs. Zeuschel sought to promote inclusivity and provide other students with this rewarding foundation, giving to both the Haring Center in the UW College of Education and to the Instructional Center in the UW Office of Minority Affairs and Diversity.

The Haring Center is an integrated early childhood program, which is dedicated to improving the lives of children with developmental disabilities and other special needs. The Instructional Center promotes the academic achievement, retention and successful graduation of under-represented minority, first-generation college and economically disadvantaged students.

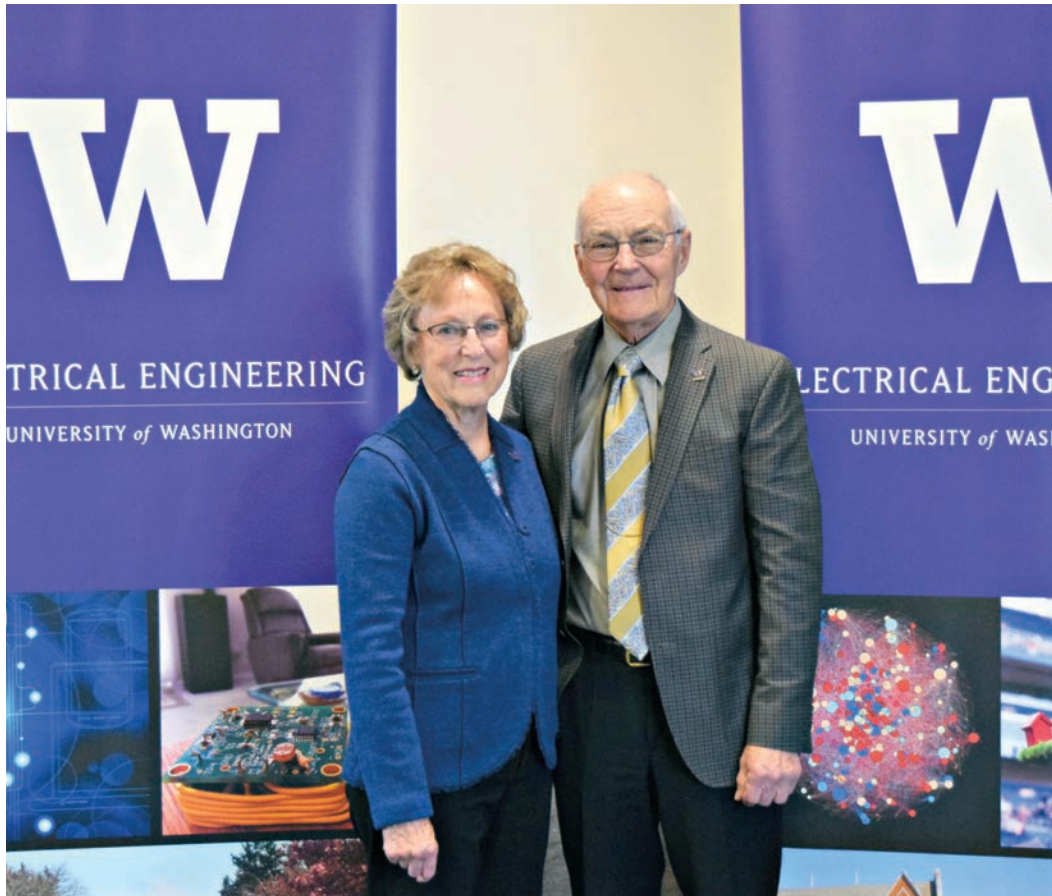
For Mrs. Zeuschel, promoting and sharing education is a passion. Her vision transcends the walls of academia, touching all lives. From an educational standpoint, the ENGINE program supports this concept, including student and community participation. From a personal perspective, the ENGINE program honors her husband’s legacy of hard work and dedication.

“Endowing the ENGINE program was important to me as a witness to Milt’s achievements,” Mrs. Zeuschel said. “I’ve had the joy of seeing him work hard and find success. Inviting others into this process is very special to me.” ■

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**“Engineering students need to be able to think of the big picture. Having a program that gives them an opportunity to connect early on with industry professionals gives them important lessons in not only entrepreneurship, but in working in the real world.”**

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*Milton "Milt" Zeuschel and Delia Zeuschel came to the Seattle campus to sign the endowment, which provides students with opportunities in entrepreneurship.*

For additional information on the ENGINE program, please visit:

**[www.ee.washington.edu/ENGINE](http://www.ee.washington.edu/ENGINE)**



**Right:** *Milt Zeuschel receives the 2015 Diamond Award for Entrepreneurial Excellence from College of Engineering Dean Michael Bragg. Over his career, Zeuschel established three successful companies, which continue to have an impact in today's marketplace.*

**Left:** *Milt Zeuschel listens as UW EE Professor and Chair Radha Poovendran presents the opening remarks at the 2017 UW EE Capstone Fair. The fair presented student projects on a variety of research areas. Zeuschel's endowment of the ENGINE program supports student projects, which were presented at the 2017 fair.*

Larry Keith Albertson  
Earl C. Bacon  
James M. Baggiore  
William A. Baker  
William J. Banks  
Vernon A. Barber  
Gary Barrett  
Douglas B. Bingham  
Phillip G. Black  
Robert B. Boswell  
Robert L. Brear  
Brian J. Brees  
Lawrence G. Brenden  
James R. Brown  
Thomas Allen Brown  
Douglas H. Brown  
Roy L. Brown  
Douglas H. Brown  
Kenneth M. Bruce  
L.D. Lamar Bundy  
Robert F. Callahan  
Richard A. Carlson  
F. Paul Carlson  
William V. Castaneda  
John J. Christensen  
Russell Cicotte  
Robert G. Clapham  
Neal H. Clark  
Thomas Coe  
John F. Coltart  
Michael W. Cramer  
Arthur B. Dahlberg  
Robert B. Day  
Gary Thomas Deleo  
Lloyd F. Dieu  
Robert E. Dinning  
Charles J. Dixon  
Terril A. Efird  
Jerry Egashira  
Ronald G. Eguchi  
William P. Enderlein

James Lorenzo Erskine  
Sam C. Ewing  
John D. Fornadley  
Dennis N. Fox  
Shelby L. Fuller  
Richard J. Fulthorp  
Donald R. Gardner  
Charles H. Golm  
J. E. Grady, Jr.  
John Martin Graef  
Paul E. Gregory  
Gary F. Groh  
Alvin R. Habbestad  
Henry F. Harder  
Phillip M. Hargiss  
E. Thomas Hart  
Melvin J. Hartsook  
Gary D. Henn  
Robert E. Hill  
Francis K. Hirakami  
Henry S. Ho,  
John A. Holmes  
Neal L. Imeson  
Merrill T. Ito  
Philip G. Jensen  
Richard W. Kataoka  
Richard L. Kegel  
Frank Mitsuo Kikuchi  
Mark E. Kindred  
James H. Kling  
Tim Koch  
Edward W. Kozdrowicki  
Jerry M. Kronk  
Edgar Kuplis  
Robert C. Lahmann  
Henry Wayne Lahore  
David L. Lee  
Foo Lee  
Gary L. Liebrecht  
Graig S. Lingle  
Alexis K. Lo

Robert W. Lorentzen  
W. George Macomber  
Thomas A. Marsland  
George L. May  
Max S. Mickey  
David J. Miller  
Donald L. Miller  
Ronald G. Mills  
Gordon E. Mills  
Jerald G. Modrow  
Ronald D. Moe  
James P. Murphy  
Ronald R. Murray  
Hiroyuki Nagata  
George U. Okoli  
Larry B. Olson  
Don J. Ong  
Don J. Ong  
Robert C. Owens  
Sant R. Pallan  
Richard D. Palm  
Leicester W. Palmer, Jr.  
Clement V. Paulson  
Cheryle Gayle Pinson  
Neil D. Poussier  
John A. Ringo  
Daniel A. Ritchie  
John M. Rivas  
Ronald H. Rowlands  
Michael W. Sasnett  
Mark A. Schinman  
Donald F. Scott  
Maurice A. Secrest  
Edward M. Sedenquist  
Richard M. Shanafelt  
Robert E. Shanafelt  
David L. Shipway  
Bruce R. Simon  
Theodore W. Sjoding  
Gerald W. Snyder  
Wayne S. Spencer

# CLASS OF

# 1967

Darrell E. Stamper  
Frank H. Starr  
Richard N. Steenis  
James D. Stevens  
Edward W. Swanson  
Gordon H. Syms  
James S. Takeuchi  
Jansey D. Tieden  
Paul B. Ting  
Dale E. Torvik  
Tim B. Trueblood  
Roger C. Ulsky  
Richard E. Van Antwerp  
David B. Van Leuven  
Lawrence E. Vik  
Ronald G. Wallace  
Geoffrey O. White  
Marvin J. Whitney  
James W. Wonn  
Allan L. Wright  
Stanley L. Wu  
Frederick A. Yearian  
James K. Zook

## 50 years ago

We were entangled in a race to space, enraptured by the cosmic frontier. For the world, space became an ever unraveling mystery. On February 5, 1967, the United States launched the Lunar Orbiter 3, discovering new complexities and textures to our Moon's surface. On October 19, 1967, Mariner 5 glided past Venus, releasing data that the planet was hotter than we imagined.

Today, we are still fascinated with the cosmos. Hundreds of billions of galaxies lay out before us, blinking at us, demanding exploration. Fifty years after the Surveyor 3 probe landed on the Moon, the Moon swallowed the sun. On August 21, 2017, the country gathered in the eclipse's path of totality, witnessing the land drop into darkness, the sun a ring around the moon.

Exploration has always permeated the country's idealism. In 1967, students in the Department of Electrical Engineering (UW EE) were a part of this mode of thought, developing projects that were a part of the future.

On July 7, 2017, UW EE honored these graduates. Six graduates returned to campus to be a part of the 2017 ceremony. Showing what each graduate had accomplished in 50 years, they offered inspiration to the Class of 2017.

Guillermo Castaneda, John Coltart, Donald Gardner, Professor and Chair Radha Poovendran, Rob Shanafelt, Gary Liebrecht and Don Iverson (BSEE '65) attended the department's Founder's Club Reception. At the reception, award winners and reunion attendees were able to meet with UW EE faculty and the Chair to talk about current department research, as well as reminisce about life in the UW EE department in 1967.

Also in attendance was UW EE Professor Emeritus



*The Class of 1967 receives an honorary stole from the UW EE Chair. From left: Guillermo Castaneda, John Coltart, Donald Gardner, Professor and Chair Radha Poovendran, Rob Shanafelt, Gary Liebrecht and Don Iverson ('65).*

Akira Ishimaru. Professor Ishimaru was a member of the core faculty in 1967, and many of the 50-year reunion attendees had him as a teacher.

Within the last 50 years, the graduates have accomplished a lot, both professionally and personally. The reunion attendees shared their stories with the Class of 2017.

Guillermo Castaneda graduated with his bachelor's degree from the department. He spent his career implementing and guiding projects to help poor people, including farmworker families. These projects included initiating the state's family Women, Infants and Children nutritional program in 1972, implementing low-income medical and dental clinics, as well as implementing a special program designed to teach families to build their own homes and make a budget to pay off their bank loan.

John Coltart graduated with his bachelor's degree from the department and had a 36-year career at Chevron. He is a Vietnam-era veteran with four years in the Air Force. John created a scholarship in UW EE with first priority towards military students. He and his wife enjoy travelling and nature photography.

Donald Gardner graduated magna cum laude with a bachelor's degree from the department. Donald attended Stanford for his master's degree with a scholarship from Bell Labs, where he worked for one year following graduation from UW EE. After receiving his master's degree, he began his 27 years with the Boeing Company, which included

a nine-year gap while developing electronics for startup Quantum Medical Systems in Issaquah.

Don Iverson graduated from the department with a bachelor's degree and was honored to join the Engineering Honorary Tau Beta Pi. He embarked on a career as a systems engineer with IBM, ending in a management position. Don is enjoying his retirement with his wife and grandchildren.

Gary Liebrecht graduated from the department with his bachelor's degree. He worked as an RF/microwave design engineer for several aerospace companies on missiles, aircraft and RF communications in California, Texas and Washington state. In retirement, Gary and his wife of 49 years, who he met at the

University of Washington, enjoy the Cannon Beach area of Oregon as a second home.

Rob Shanafelt received his bachelor's degree from the department and went on to work most of his career in the defense industry. He co-founded and was CEO of a company and helped raise venture funding for two others related to the wireless world. Upon retiring, he consulted for a few years and returned to his real passion – engineering. He enjoys golf, playing racquetball and traveling.

These are only a few of the stories of the 147 graduates from 1967. At UW EE, each student leaves a mark, using a passion for exploration to build a rich innovation culture within the department. Although 50 years have passed, this remains constant. ■



*Graduates from the Class of 1967 sit wearing their stoles with UW EE faculty.*



## GRADUATING THROUGH THE GENERATIONS

**"Dr. Huang is an excellent example of entrepreneurial vision and success - a true motivator to the UW EE Class of 2017. I look forward to his grandson, Aaron, becoming a future Husky!"**

-Professor and Chair  
Radha Poovendran

**F**or Dr. George Huang (Ph.D. '73), being a top industry leader involves demonstrating significant societal impact. Over the years, he witnessed numerous successful business accomplishments. Particularly, his impact on green desktop technology paved the way for other companies to follow.

As CEO and chairman of Award Software, a BIOS manufacturer in California, Dr. Huang established industry standards for the production and use of green BIOS. This type of firmware notices when the computer is not in use and will power down to preserve energy.

Award utilized the brainpower of two strong tech companies to develop additional green features, including the ACPI (Advanced Configuration Power Interface). The ACPI is an open standard that operating systems can use to perform power management (i.e. a computer "going to sleep"). Today, almost all PC manufac-

turers have adopted the ACPI standards that Huang's company developed.

With over 30 years of business experience, Dr. Huang continues to make an impact. He began in 1984 at GCH Systems (a company he founded), which develops and markets embedded controllers, ASICs and PC systems. After acquiring Award Software and merging with Phoenix Technologies, he has brought his extensive corporate management skills as the current chairman and CEO of FutureDial. The company is a leading provider-of-choice of mobile device processing solutions.

In 2009, Dr. Huang was selected by Venrock, a VC Rockefeller fund, as one of the 40 most successful entrepreneurs. He continues to expand the boundary of what's possible in technology and leaves a generous legacy for other companies to follow.

At the June 7 graduation ceremony, Dr. Huang encouraged students to follow their own path, innovate and think outside the box to realize all potential opportunities.

"What I would suggest to you is to live your own life, and don't try to follow someone else's," Dr. Huang said to 2017 graduates. "Don't be constrained by the lives set by other people."

From one generation to the next, there is one significant theme that is found among UW EE alumni - innovation. ■



*From left: Professor and Chair Radha Poovendran and the Huang family.*

## HOW ALUM GUILLERMO CASTANEDA BUILT A LIFE DEDICATED TO SERVING OTHERS

# Grit



*Guillermo Castaneda (BSEE '67) attends the 50-year UW EE college reunion, holding a slide rule he used often during his college days.*

**G**rowing up in a large family in the coal-mining towns of Southern Colorado where his Mexican immigrant father was a coal miner, Guillermo (William) Castaneda (BSEE '67) witnessed his parents' yearly struggles of poverty. There in the 1940s and 1950s, his father had to move the family several times in search of mining work, and even became a farmer for a short time. Guillermo decided that education would be an important tool to overcoming adversity. In his hometown, he knew it was not uncommon for children of coal mining families to drop out of school, or to not go to college. For Guillermo, he was determined to go to college.

Guillermo began at the University of Washington in 1962 and graduated from the Department of Electrical Engineering in 1967 with his bachelor's. For Guillermo, his experiences at UW EE supported his commitment to education and in helping others.

"The University's rigid course of engineering study gave me the mathematical tools and the fortitude, the self-confidence, and the self-direction to enable me to attain those high school dreams I cultivated while living in the poverty-stricken areas of the coal-mining towns of Southern Colorado," Guillermo said. "While in high school, I had a dream of becoming a math teacher and an electrical engineer and of helping poor families in obtaining housing and proper health care."

After college, Guillermo fulfilled his high school promise; he taught physics and geometry at Seattle's Franklin High

School.

Guillermo would later become the first Mexican-American physics and chemistry teacher in the Yakima Valley. At Toppenish High School, he encouraged many minority students, including girls, to pursue the sciences.

Outside of teaching, Guillermo continued to dedicate his time and resources to helping others.

"Because of my degree, I was also able to use its fundamentals for helping families for over forty years in health and housing," Guillermo said. "In 1972, I was instrumental in the nutritional Women, Infants and Children program as it was being initiated in our state. My degree also enabled me to solve obstacle problems in establishing services of pharmacy, health care, dental, and mental health in Central Washington."

Guillermo's first pharmacy for farm worker families was in Toppenish in 1975. Next followed medical, dental and mental health clinics in Moses Lake, Pasco and Kennewick, and a dental clinic at Yakima's Neighborhood Health Services. All services exist today and have expanded.

In 1993, Guillermo focused on another goal – enabling people with limited resources to build their own home.

"In 1993, while director of the La Clinica Community Health Clinic, with our management team, the Self-Help Housing program was implemented," Guillermo said. "In this program, groups of families in five counties built their own three and four bedroom homes in unison. This accomplishment is very special to me, as it is something I always wanted – to give families the path and plan to build their own homes."

Within the last 50 years, Guillermo has made a significant impact in his community. For him, his accomplishments are rooted in his childhood dream and UW education. His wife, Pegi, is a 1965 UW chemistry grad. Their children are also college graduates.

"I am so happy that my high school dreams came true," Guillermo said. "My rigid course studies at UW EE were the key to seeing them come true." ■

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"The University's rigid course of engineering study gave me the mathematical tools and the fortitude, the self-confidence and the self-direction to enable me to attain those high school dreams I cultivated while living in the poverty-stricken areas of the coal-mining towns of Southern Colorado."

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# PUGET SOUND

## ALUMNI MIXER

In May, the Department of Electrical Engineering and Amazon hosted an alumni mixer on Amazon's Seattle campus.

See more online!

Head to our Facebook page for even more photos from the 2017 alumni mixer.

[facebook.com/ee.washington](https://facebook.com/ee.washington)



### JOIN US FOR OUR NEXT PUGET SOUND MIXER!

Save the date for our 2018 Puget Sound Alumni Mixer on **March 29** at Microsoft. A formal save the date will be sent out early next year.

### STAY UP TO DATE ON FUTURE EVENTS!

Please visit our alum engagement page for future event announcements and quarterly lab tour dates.

[ee.washington.edu/engage/alumni/get-involved](https://ee.washington.edu/engage/alumni/get-involved)



### **BEN WATERS (Ph.D. '15)**

Ben Waters' company, WiBotic, was named a GeekWire "Top Ten." GeekWire announced which top Seattle startups were transforming the tech scene. In order to join this prestigious list, a company had to exhibit a world-changing business idea. WiBotic's innovative design and functionality makes it particularly unique and adaptive in today's market.

# **ALUM AWARDS**

**WE'VE ALWAYS KNOWN OUR  
ALUMS ARE SOME OF THE BEST  
AROUND. HERE ARE SOME  
OF THE RECENT AWARDS  
REPRESENTED BY UW EE ALUMS.**



### **JEAN WANG (MSEE '04, Ph.D. '07)**

Jean Wang has been awarded the University of Washington College of Engineering Diamond Award for Early Career Achievement. In addition to her work on Project Glass, Wang was a founding member of the robotic surgery team at Google Life Sciences. Her cutting-edge work focuses on advancing the technology to aid in everyday life.



### **C.J. HWANG (MSEE '64, Ph.D. '66)**

Cherng Jia "CJ" Hwang received the University of Washington College of Engineering Diamond Award for Entrepreneurial Excellence. As the creative force behind semiconductor lasers and the founder of three companies, Hwang was honored for his dedication to societal impact and for his groundbreaking achievements in laser development.

### **VAMSI TALLA (Ph.D. '16)**

Vamsi Talla received the 2016 WAGS/UMI Outstanding Innovation in Technology award for his UW EE doctoral thesis. The award given by the Western Association of Graduate Schools (WAGS) and University Microfilms International (UMI) recognizes the innovative application of technology to scholarship in a master's thesis or dissertation.



### **TONG ZHANG (Ph.D. '17)**

Tong Zhang received the highly competitive University of Washington 2017 Graduate School Distinguished Dissertation Award in Mathematics, Physical Sciences and Engineering for his UW EE dissertation, entitled "Integrated Wideband Self-interference Cancellation Techniques for FDD and Full-duplex Wireless Communication."



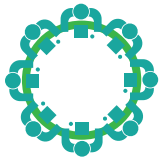
a**FAIR**

The 2017 UW Electrical Engineering Capstone  
Fair showcased innovative student projects

# TO REMEMBER

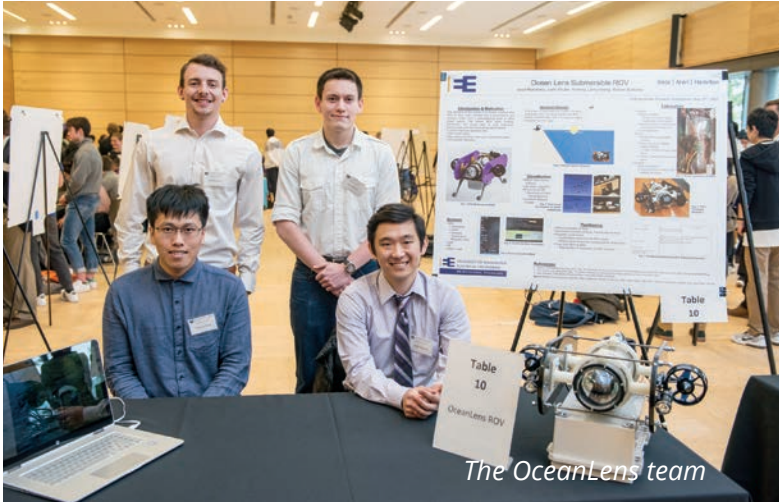


*Alum Xinyi Xu (BSEE '17) wears the prototype for her group's project, "Blinkshot," at the 2017 Capstone Fair*



## ENGINE

The UW EE Engineering Entrepreneurial Capstone Program (ENGINE) launched in winter quarter 2016 to develop students' skills in innovation, systems engineering and project management. Only in its third year, ENGINE has witnessed significant growth; forty percent of graduating EE seniors participated in the program for the 2016-2017 academic year. Mentorship with top companies yielded high-impact results. These projects were showcased at the 2017 capstone fair.



*The OceanLens team*

### WINNING TEAM

Throughout the Capstone Fair, peers, industry partners and faculty voted on the best capstone project. The Booz Allen Hamilton OceanLens team received the grand prize presented to a project. OceanLens is an underwater ROV that takes sensor and video/imaging data to map the surrounding environment. Congratulations to the team: Yicheng Wang, Will Butterton, Justin Skubic and Jared Nakahara (from left).

### AREAS OF IMPACT

The projects at the capstone fair were dedicated to societal impact, including healthcare, the environment, energy and security. From mapping our underwater world to simulating space's complex atmosphere, no project topic was off limits. To view the complete list of projects, see our online program:

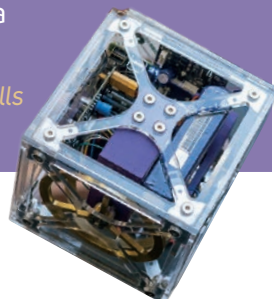
[www.ee.uw.edu/spotlights/2017-engine](http://www.ee.uw.edu/spotlights/2017-engine)

### PROJECT HIGHLIGHT

#### A SELF-BALANCING CUBE

The cube uses reaction wheels and a feedback loop to balance.

*Team: Athina Ebert, Kyle Hess, Ryan Mills and Peter Zhang*

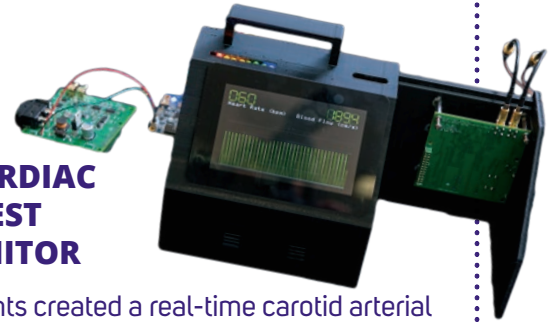


### PROJECT HIGHLIGHT

#### A CARDIAC ARREST MONITOR

Students created a real-time carotid arterial flow measurement system to aid in cardiac monitoring and resuscitation.

*Team: Nate Broughton, Paula Cieszkiewicz, Han Baek Lee and Scott Yoshida*



*Alum Clement Chung (BSEE '17) shows his project "Remote-less Skateboard"*

See more photos on our Facebook page:  
[facebook.com/ee.washington](https://www.facebook.com/ee.washington)

# CONNECTING COMMU



# UNITIES

The background image is a photograph of a weathered wall. On the left, there is a vertical strip of teal paint. The main wall is light-colored and peeling. In the lower-left, there is a brick archway. To the right is a wooden door with teal paint, partially covered by a translucent blue rectangular overlay.

ENGINEERING STUDENTS  
BRING WATER TO TORTUGA,  
NICARAGUA, THROUGH  
THE ENGINEERS WITHOUT  
BORDERS PROGRAM

**N**estled between the Pacific Ocean and the Caribbean Sea is a country lacking water. Nicaragua's land is patterned with restless volcanoes, with jungles of tangled trees, with untrammelled beaches. Rural communities dot the Central American country like an afterthought, miles of wild land stretching between them. For many people living in these small villages, water access is an everyday project.

From his home in Tortuga, Nicaragua, 80-year-old Patrosiño Valle walks half a mile to the nearest well to collect water for himself and his wife. For Valle, the hike to the water is not his most serious concern – what's in the water is.

Much of the well water in these rural areas contains dangerous levels of bacteria and calcium, which can spread a host of water-borne diseases and illnesses.

In his village, Valle's house is one of 18 homes not connected to the primary water system. For these homes, the lack of water pressure contributes to the absence of central water. In order to live healthy and productive lives, the community is searching for ways to make clean water a right to all.

"We can live without power and with washed-out roads, but without water there is no life," Valle said.

To help address this infrastructure need, the University of Washington chapter of Engineers Without Borders (UW EWB) is partnering with the community for a minimum of five years.

The EWB helps meet human needs through engineering projects that focus on clean water, energy, sanitation, agriculture and structures. Currently, the UW EWB has an ongoing project in Guatemala and recently completed a project in Ghana. New projects are secured through the national Engineers Without Borders organization after student chapters throughout the U.S. apply to work with

specific communities. Working in Tortuga was the UW team's top choice.

Fifteen UW engineering students traveled to Tortuga for an eight-day visit in December 2016. While there, they assessed the community's needs and current setbacks. The students met with residents to discuss improvements they would like to see in the community. For the residents, healthy water and electricity connectivity was a priority.

While there, the students investigated current water conditions and the existing water structure, collecting data points to bring back home. They met with the village's water and sanitation committee, the Comité de Agua Potable y Saneamiento.

For UW EE alum Bryan Bednarski (BSEE '17), an electrical engineering education offered him the tools to give

back to communities around the world.

"EWB inspired me to be an ambassador for the resources of our privileged community in parts of the world where improved access to shelter, food and water make an important difference in day-to-day life for the people," Bednarski said. "The opportunity to practice a design-build engineering process in a foreign

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**"We can live without power and with washed-out roads, but without water, there is no life."**

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*A cross-disciplinary group of engineers make up the UW EWB team: ME student Chris Cole, professional mentor David Schwartz, CEE student MaKenzie Fockler, UW EE alum Bryan Bednarski (BSEE '17), professional mentor Bob Wicklein and CAPS president Arsenio Yubank Serrano, from left.*



*Patrosiño Valle at his home in Tortuga, Nicaragua*

language while earning the respect of the community by getting directly involved in construction was truly special.”

After their December 2016 trip, the students returned to the UW to complete the designing, prototyping and planning work on campus. Each week, the students met to review their strategies. Coming from different engineering focuses, from electrical to mechanical to civil and environmental, the students offered a valuable variety of perspectives.

The engineers evaluated the needs and came up with several priority projects for the region, including the installation of solar-panelled water pumps for increased water access, the addition of strategically placed pipes for stronger water pressure and the connection of households to the electrical grid.

The students returned to Tortuga this past summer to begin the work. They will return again this December to check on the status of their projects, including the improved condition of Patrosiño Valle’s

access to water.

“We expect Pastrino Valle’s house to have received potable drinking water by the time of our arrival for implementation in December,” Bednarski said. “His house was a part of a synchronous effort by the water committee to bring water to a nearby set of local homes and demonstrate the benefit of expanding the water system on a smaller scale. We will be surveying these homes in December in order to improve on our own designs in the future.” ■

## NICARAGUA



For more of UW EWB’s work, please visit  
[www.ewbuw.weebly.com](http://www.ewbuw.weebly.com)

*A special thanks to Brooke Fisher for supplying many of the photos and quotes for this article.*

# CLOSING THE DIGITAL DIVIDE

Broadband access for rural and remote areas



*Professor and Chair Radha Poovendran signs the CMMB-UW EE agreement for a new center with CMMB CEO Charles Wong and Dean Michael Bragg.*

## A partnership with CMMB Vision leads to a new center on smart, connected communities at UW EE.

CMMB Vision (CMMB) has awarded the University of Washington Department of Electrical Engineering (UW EE) a \$1.5 million gift to establish a new research center. The CMMB Vision-UW Center on Satellite Multimedia and Connected Vehicles will focus on the development of the next generation of smart cars and ubiquitous connectivity.

"We picked a vehicle, because it is simply a smart phone on wheels," CMMB President and CEO Charles Wong said. "It is a mobile device in itself. It allows for the most mobility and ubiquity, which cannot be accommo-

dated by the existing cellular network."

As self-driving cars become more of a reality, CMMB focuses on delivering data to the vehicles with unprecedented speed, scale, low-cost and universal connectivity. The company uses next-generation satellite and broadcast technologies to deliver the broadband data, multimedia data and big data to vehicles and mobile devices. "We've expanded satellite broadcasting from radio to video and internet data," Mr. Wong said. "Our technology is global. We have two satellites – one over Asia and one over the Middle East and Africa. From Asia to Africa, we cover 6 billion people and over 143 countries."

Many developing nations do not have the infrastructure to support current broadcasting technologies. According to Mr. Wong, mobile devices can become that less expensive option to connect resource-poor communities.

"The whole world can eventually be quite well connected," Mr. Wong said. "One of the most important fac-

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**“The whole world can eventually be quite well connected. One of the most important factors that this technology supports in developing nations is education. It allows for students to have access to teaching resources.”**

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the innovation to support it.

“We have all of the confidence that we picked the right place to further the study and technology of mobile multimedia broadcast,” Mr. Wong said. “A technology that is coming out of UW can be globalized.”

For Dr. Liu, who was a professor in UW EE, he remembers the university and department’s dedication to entrepreneurship and invention. For a technology that is the first of its kind, creative thought is important.

“The UW is one of the foremost innovative universities in the country – something we are really looking for in the development of this technology,” Dr. Liu said.

The center comes at a time when smart cities research is flourishing. In fall quarter 2015, UW EE signed a “Smart Cities” agreement with leaders from the School of Electrical Information and Electrical Engineering at Shanghai Jiao Tong University (SJTU). The agreement formalized the commitment of both universities to work together on smart cities research, teaching and collaboration.

Within the past year, UW EE researchers have promoted the development of smart cities around the country through the development of smart posters and clothing, the redesign of spectrum wireless usage and the tackling of urban mobility challenges in the cities of Seattle and Nashville.

“UW EE is dedicated to the advance-

tors that this technology supports in developing nations is education. It allows for students to have access to teaching resources.”

For CMMB CEO Mr. Wong and CMMB Vice Chairman and CTO Hui Liu, the University of Washington reflects this global vision and possesses

ment of smart cities,” UW EE Professor and Chair Radha Poovendran said. “This partnership with CMMB further advances this mission and will foster impact on a global level.” ■

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For more on the CMMB Vision-UW Center, please visit [www.cmmb.ee.washington.edu](http://www.cmmb.ee.washington.edu)

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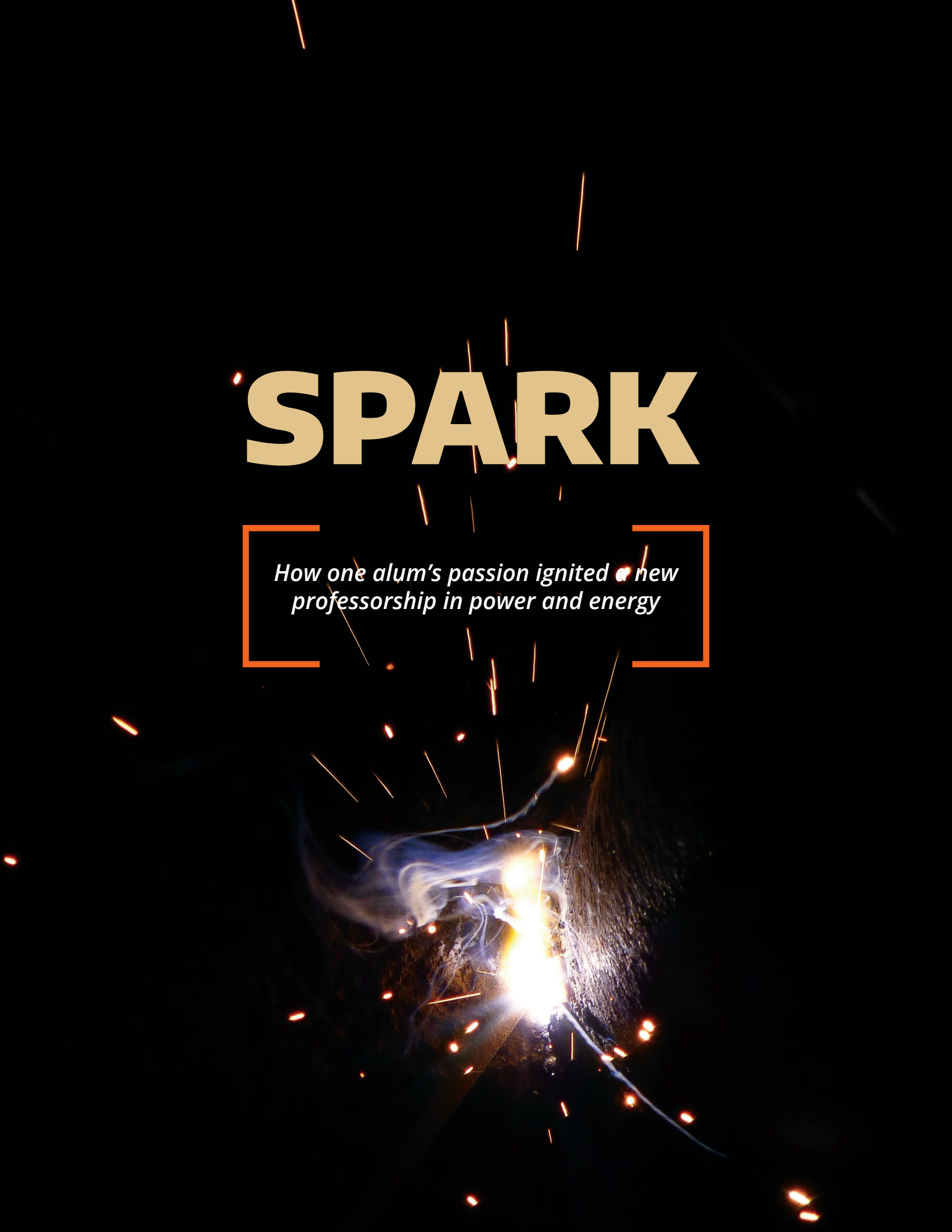


*UW EE Professor Sumit Roy serves as the Executive Director of the new CMMB Vision-UW Center on Satellite Multimedia and Connected Vehicles.*



*CMMB Vice-Chairman and CTO Hui Lui, UW EE Professor and Chair Radha Poovencran, UW College of Engineering Dean Michael Bragg and CMMB President and CEO Charles Wong, from left.*

# SPARK

The background of the entire page is a high-contrast, close-up photograph of a welding process. A bright, intense yellow and white light from the welding arc is visible in the lower right quadrant, surrounded by a dense spray of glowing orange and yellow sparks that radiate outwards in all directions. The sparks vary in length and brightness, creating a dynamic and energetic visual field against the deep black background.

*How one alum's passion ignited a new  
professorship in power and energy*

Over 40 years ago, Keith Rattie (BSEE '76) received a phone call that would change his life. In August 1975, Rattie was entering his senior year in the University of Washington Department of Electrical Engineering (UW EE). UW EE chair at the time, Daniel Dow, shared the news with Rattie that Standard Oil of California (now Chevron) would be awarding a \$1,000 scholarship to a senior electrical engineering student specializing in power systems. Dow recommended Rattie as the recipient, spurring a future career and passion for the energy industry.

After graduating from UW EE, Rattie relocated to California to begin his career in the company's Corporate Engineering Department in San Francisco. Rattie spent 19 years with Chevron in a variety of assignments, rising to general manager of the company's International Natural Gas Development Unit. During these years, Rattie spent time traveling to different countries around the world, noticing one common fixture among nations – prosperity and access to affordable energy go hand in hand.

"There may be no greater challenge facing mankind today than figuring out how to meet the energy needs of a planet that could have nine billion people living on it in 2050," Rattie said. "The magnitude of that challenge becomes even more daunting when one considers that, of the nearly seven billion people on the planet today, more than a billion people worldwide are living without electricity."



*From left: UW EE Professor and Chair Radha Poovendran, Keith and Nancy Rattie Endowed Career Development Professor Baosen Zhang, Keith Rattie and Vice Dean Greg Miller.*



*From left: Professor and Chair Radha Poovendran, Keith Rattie and Vice Dean Greg Miller*

"Today, America and the world run on oil, natural gas and coal" Rattie said. "That will continue to be the case until we overcome the technological and economic barriers to large-scale solar power and other renewable alternatives."

In the meantime, Rattie remains a staunch advocate for greater use of natural gas in electric power generation and other end-use markets, due to availability and environmental advantages. Additionally, Rattie stresses that a confluence of technologies – battery storage, electric vehicles, self-driving cars and solar photovoltaic systems – have the potential to dramatically change the world's energy consumption over the next two to three decades.

Over the next several decades, Rattie sees distributed energy supply displacing the old-world order in which power is generated in large, central power plants and transmitted over long distances for distribution to end-use markets. Electrical engineers in general, and the UW EE department in particular, can play a central role in that transition.

When deciding how best to support the development and application of next-generation technologies, Rattie knew that UW EE held a reputation for expanding the boundaries of innovation through creative thought and rich collaboration. Additionally, the department holds a talented faculty base in power and energy systems. Based on this, he selected UW EE to establish and grow the Keith and Nancy Rattie Endowed Career Development Professorship.

"We are deeply grateful to Keith and Nancy

and their foundation for their support and commitment to build an excellent program here at UW EE," Professor and Chair Radha Poovendran said. "Our relationship with Keith and Nancy is very special and deeply meaningful to the department. And we are incredibly proud of Keith and of his astounding accomplishments as a UW EE alum."

When envisioning the right candidate for the professorship, Rattie knew that the

individual would have to think towards the future, investigating all facets of renewable technologies, such as solar and wind power and electric cars and autonomous vehicles. For Rattie, UW EE Professor Baosen Zhang fits the profile perfectly.

"Nancy and I are thrilled that the UW EE department has chosen Baosen for this professorship," Rattie said. "The work that he is doing on addressing urban congestion is critical to how we will address energy usage. I look forward to great things from Baosen's work"

Zhang joined the UW EE faculty in spring quarter 2015, further enhancing the department's power and energy group. Zhang utilizes mathematical insights to control cyberphysical systems, such as the electrical grid and the urban transportation system to make them more efficient and reliable. For example, he has resolved the long-standing open problem of characterizing the geometry of the feasible power flow region of electricity networks. This result allows power systems engineers to optimally allocate resources in a large network, greatly increasing the efficiency of the system.

Zhang's recent projects are in the area of integrating energy storage into the grid and controlling urban congestion through better parking management, establishing partnerships with the Seattle Department of Transportation, Microsoft and Seattle City Light. In addition to his position as assistant professor with UW EE, Zhang is an affiliate professor with the

**“There may be no greater challenge facing mankind today than figuring out how to meet the energy needs of a planet that could have 9 billion people living on it in 2050.”**

university’s Clean Energy Institute (CEI). The institute supports the advancement of next-generation solar energy and battery materials and devices, as well as their integration with systems and the grid.

For Zhang, the professorship goes beyond research funding; it supports the future generation of renewable energy visionaries – his students.

“It is a great honor to receive the Keith and Nancy Rattie Professorship,” Zhang said. “This gift enables us to get started on solving hard problems and make real world impact without waiting for funding. It prepares our students to face some of the world’s most complex challenges for future generations. There are a few important questions we will investigate: how do we improve the reliability of the grid, and how do we make the grid system better? As a professor, the most important thing that I can do is educate and support my students – the next generation of researchers. With the Keith and Nancy Rattie Professorship, I can do just that.”

Although this is the beginning of Zhang’s illustrious career, Rattie’s reputation as a leader in the field has already been well-established. Rattie served as president and CEO of Questar, an integrated natural gas company headquartered in Salt Lake City. As



*Nancy and Keith Rattie*

Questar CEO, he shifted the corporate strategy to focus on the company’s exploration and production (E&P) subsidiary and capitalize on the growing demand for clean-burning natural gas for electric power generation. As a result, Questar became one of the fastest growing natural gas producers in the country.

During Rattie’s tenure as Questar CEO, the company was recognized three times by Business Week magazine as one of the top performers in the S&P 500. Questar ranked #5 in both 2007 and 2008 and #18 in 2009. Rattie was also recognized as one of America’s top chief executives by Institutional Investor magazine, in annual surveys of more than 1,500 institutional investors and analysts.

Although a recognized name, Rattie will continue to make a global impact on renewable energy solutions for generations to come through the establishment of the Keith and Nancy Rattie Endowed Career Development Professorship.

Zhang’s professorship is the third bestowed to UW EE’s power and energy systems group. Other endowed professors include Close Professor Dan Kirschen and WRF Innovation Assistant Professor of Clean Energy Brian Johnson, who will join UW EE in spring 2018.

“To build a world-class program in power and energy is a top priority for the department,” Poovendran said. “The Keith and Nancy Rattie Endowed Professorship is a critical step in achieving this goal and ensuring future generations have the tools to carry this vision.” ■



*From left: Keith Rattie and Daniel Dow*



# DIRECTOR'S CUT

*Alum Basel Alomair's journey to become KACST  
Managing Director of Information Security*

As a graduate student in the UW Department of Electrical Engineering (UW EE), alum Dr. Basel Alomair (Ph.D. '11) received the 2010 IEEE-IFIP William C. Carter Award from the Fault-Tolerant Computer Community and Dependable Computing Community. He also received numerous best paper awards. After graduating from UW EE, Alomair joined King Abdulaziz City for Science and Technology (KACST) as an assistant professor. Based in Saudi Arabia's capital city of Riyadh, KACST, the National Science Foundation of Saudi Arabia, is situated as a hub for scientific discovery. The institution was founded to enhance science and technology through innovation and discovery in the Kingdom of Saudi Arabia. A little over two years after joining KACST faculty, Alomair would found the National Center for Cybersecurity Technologies. The center was established by the President of KACST to address the country's need for increased research on information and cybersecurity.

"The center was founded back in 2014 to address the country's need to excel in information and cyber security research and help securing its infrastructure," Alomair said. "It took a few months to prepare the physical location, but building the human capabilities is an ongoing process. When the president of KACST signed the executive order to establish the center, there was only one member: myself. Now we have about 60 researchers."

Alomair's dedication to building a strong program can in part be attributed to his time at UW EE, while working as a graduate student in Professor and Chair Radha Poovendran's Network Security Lab (NSL).

**Alomair credits much of his success with, and interest in, cybersecurity to his time spent in the Network Security Lab (NSL) with UW faculty members, including Professor Radha Poovendran, who taught him the value of working on important global problems.**

"Joining the NSL at UW helped me in understanding a lot about security by working with a group of excellent graduate students at the lab," Alomair said. "The most influence, however, came from Radha. He taught me, by example, that hard working is the key for success. He used to tell me: 'keep your head down and work on the important problems that have meaning to society.' Basically, the UW pro-

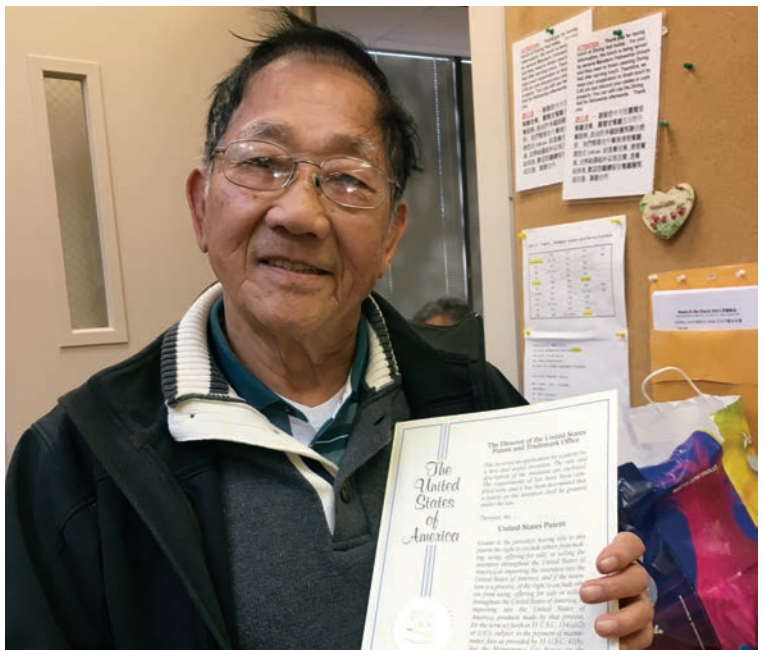
vided me with the right environment and mentorship to be where I am now."

Alomair continues to collaborate with UW EE. UW's commitment to a student-first approach is something Alomair has adopted as a leader of his own institution.

In July 2017, after his success with establishing the National Center for Cybersecurity Technologies, Alomair was appointed to a senior leadership position at KACST - a managing director and Information Security Directorate at the institute.

As managing director, Alomair is responsible for heading information security efforts at the whole institute. In this role, he will continue to bring visibility to the National Center for Cybersecurity Technologies and to the role cybersecurity research plays in supporting the development and sustainability of a nation. ■

For more on the UW Network Security Lab, please visit [www2.ee.washington.edu/research/nsl/faculty/radha/](http://www2.ee.washington.edu/research/nsl/faculty/radha/)



## HOME STUDY

**How UW EE alum Gary Wong built a world of innovation**

From his home in Los Angeles, California, Gary Wong (BSEE '60) has created an engineer's playhouse. "My work station is like a wonderland," Wong said. "It has allowed me to accomplish things beyond my dreams and imagination."

Wong's small home laboratory competes with the stock of a specialized antenna retailer and is equipped with all of the necessities - a network analyzer for the evaluation of antenna performance and antenna fabrication equipment.

Although retired, Wong's passion for innovation and entrepreneurship hasn't wavered. Because he no longer has access to the company work space, he has built his own.

Under this new creative space, he has invented an advanced antenna that can receive more than 160 channels and has the same capabilities of much larger antennas. To achieve this, Wong's device holds unique features that allow it to implement arrays to produce high gain beams of omnidirectional coverage for both Wi-Fi and HDTV reception.

(See HOME, next page)

(Continued from page 33)

Prior to retirement, Wong worked for nearly 30 years in communication antenna development at TRW Inc. For Wong, one of his most gratifying assignments was his work on the development of an antenna element for a Tracking and Data Relay Satellite System (TDRSS). Wong played an integral role in identifying the multi-access (MA) element needed for satellite development.

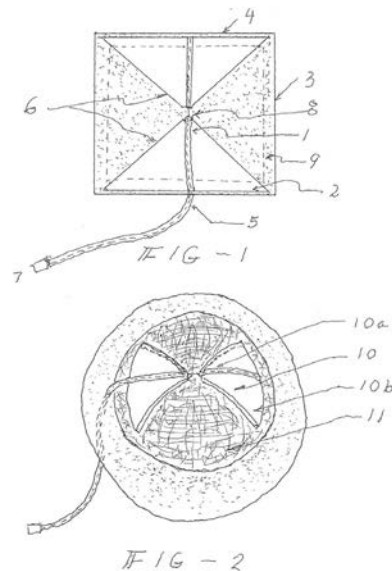
"Because the layout of a spacecraft could not begin until the MA element is well defined, I provided a solution by designing an MA element such that its performance was unaffected by the spacecraft structure," Wong said.

Over his career, Wong has patented several antennas integral to current communication systems, providing more efficient reception of over-the-air signals for HDTV.

Of his patents, Wong developed a group of highly compact antennas that can operate on a helmet or attach onto the surface of a backpack for communication application. Another patent design uniquely operates from a single zigzag-fed line antenna by applying electrical shorts symmetrically at cross points along the feed line.

Each of Wong's technical accomplishments inspire the next. Wong has captured his earlier work on high gain beam antennas and taken it to the next level.

"I am currently working on a group of antennas that form a high gain beam pointing constantly at a satellite or a ground station, while the antenna is fixed to a moving vehicle or moving vessel," Wong said. "This is



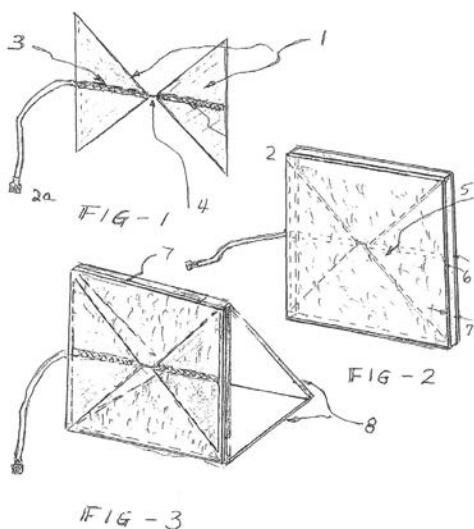
accomplished without mechanical moving parts, and the entire system is electronically implemented."

This passion for innovation and entrepreneurship has inspired Wong his whole life. However, this passion truly took hold while Wong was a first year student at the UW Department of Electrical Engineering (UW EE) in the 1950s. Even though the experience was over 60 years ago, Wong could still list off the professors that inspired him.

"I learned so much from Dr. Akira Ishimaru, who was a brilliant lecturer and an excellent mentor," Wong remembered. "As the first person to receive a Ph.D. from the EE department, Dr. Ishimaru was an inspiration. Other professors who were instrumental in developing my career path were Dr. Gary Held, Dr. Harrison and Dr. Harssergen."

For Wong, the education he received at UW EE prepared him for a career grounded in ingenuity.

"I am sincerely grateful for the excellent education I received....Because of the diverse education offered, I could launch myself into a successful career and become the person I am today," Wong said. ■



**Bottom left and top right:** These drawings of the internal design of the photo antennas are a part of Wong's most recent patent.

**Bottom right:** A section of Wong's home work space, which he refers to as the "antenna farm."





*From left:*

**Dean Michael Bragg**

UW College of Engineering

**Dr. Uday Desai**

Director, IIT - Hyderabad

**Vice Provost Jeff Reidinger**

University of Washington

**Professor Sumit Roy**

UW EE

# GLOBAL SMART CITIES

**A new MoU between the UW and the Indian Institute of Technology-Hyderabad builds a partnership on cyberphysical systems and smart cities**

Although the Indian Institute of Technology - Hyderabad (IITH) and the University of Washington (UW) are over 7,700 miles away, research interests draw the two institutions closer together.

In May, IITH and the UW Department of Electrical Engineering (UW EE) joined forces through a memorandum of understanding (MoU), fostering a partnership on cyber-physical systems (CPS) and smart cities.

As director of the Indian Institute of Technology - Hyderabad (IITH), Dr. Uday Desai has a passion for education and research. In particular, his research focuses on smart cities, cybersecurity and Internet of Things (IoT) for smart health care.

Past collaborations and experience in the field drew him to UW EE as a potential collaborator. Within the last few years, UW EE has elevated its strong smart cities research through a new collaboration with the cities of Seattle and Nashville and a new center on smart, connected communities. UW researchers as a collective are partnering more than ever before on making urban spaces less congested and more eco-friendly.

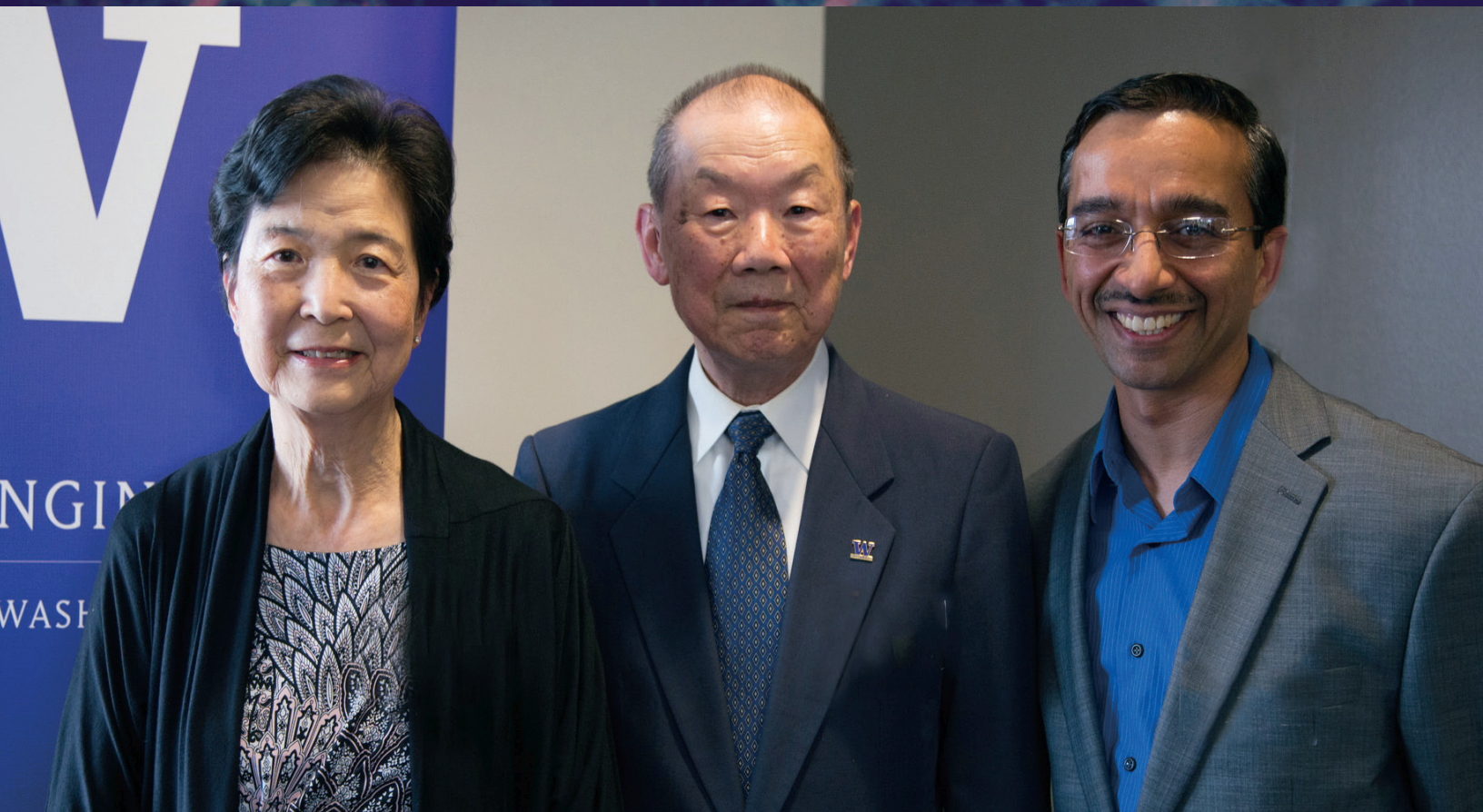
A new UW-housed collective, Urban@UW, works with scholars, policymakers and community stakeholders to develop cross-disciplinary and cross-sector collaborative research. As a hub for innovation and as a space betrothed by urban conditions, Seattle is a hotbed for this research.

However, it's not just Seattle that is honing in on this research. Cities in India are innovating around technology and data-collection in ways that will be important for learning and developing best practices and implementation, as well.

A partnership between IITH and UW EE offers immense opportunities to develop this research for future impact - from India to the United States, with thousands of cities in between.

By offering opportunities in smart city research and urban scholarship, this collaboration builds student experience and student commitment to societal issues. When equipped with the top researchers and educators, the future of cities looks bright. ■

COMM



# MITMENT TO CARE

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**Elizabeth Yun Hwang and UW EE Alum Cherng Jia “C.J.” Hwang (Ph.D. ‘66) stand next to Professor Raj Rao. Rao was named the Cherng Jia and Elizabeth Yun Hwang Endowed Professor.**

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*How a passion for device-driven rehabilitation for those with spinal cord injury and stroke spurred the development of a large UW Electrical Engineering endowment*

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In the months after their daughter Karen’s car accident and spinal cord injury, Cherng Jia “C.J.” Hwang (Ph.D. ‘66) and Elizabeth Yun Hwang (MLIS ‘65) sought care that would improve their daughter’s overall quality of life. While doctors encouraged adjustment to the new paralytic condition, the Hwangs believed their daughter Karen’s care should not focus solely on simple, day-to-day functioning.

With no prior knowledge on caring for those with quadriplegia, they searched for answers, for current treatments and for groundbreaking solutions. In this search, they learned of promises of nerve regeneration and damaged nerve bypass – grand treatments that could someday transform paralysis diagnoses. However, there were no solutions that offered immediate impact for those already suffering from spinal cord injury.

The Hwangs wanted to do more. With a passion for innovation and a commitment to those suffering from spinal cord injury, they launched their own research initiative – The Cherng Jia and Elizabeth Yun Hwang Endowed Professorship – that is housed in the University of Washington Department of Electrical Engineering (UW EE).

This professorship is built on the Hwangs’ shared vision of making life better for those with paralysis. It supports the critical advancement of rehabilitation technologies for spinal cord injury and stroke. The nature of this research requires a multi-disciplinary approach. UW EE is uniquely positioned to achieve this. The department’s depth of collaboration spans multiple departments and disciplines with ten faculty in joint appointments and over a dozen adjunct faculty appointments.

Because of this dedication to collaboration, the department has established valuable partnerships with the UW School of Medicine and Center for Sensorimotor Neural Engineering (CSNE), offering expertise in all areas of device rehabilitation design.

For the Hwangs, the UW EE department is the ideal place to fulfill their vision, and they look forward to the growth of the endowment in the future.

"I hope that device-based rehabilitation and accessibility technology for improving the quality of life of the spinal cord and brain injured persons, initiated and funded by the Hwang endowment, will grow into sustainable research activities at the University of Washington," Mr. Hwang said. "The ultimate goal would be for it to grow into the nation's number one for such activities, based on the unique integration of the available resources at the university."

Selecting the best champion for the endowed professorship was a critical decision. From his groundbreaking work on brain-computer interfaces, Paul G. Allen School of Computer Science & Engineering Professor and Director of CSNE Raj Rao leads device-driven rehabilitation technologies. Rao's lab focuses on computational neuroscience and brain-computer interfacing (BCI), building computer models to understand how neural circuits work in the brain. This knowledge helps Rao's lab develop BCIs that can be used to enable communication, control prosthetic devices and facilitate rehabilitation in paralyzed individuals.

"The selection of Professor Rao is ideal," Mr. Hwang said. "His work lays the groundwork for research on developing a device-based rehabilitation technology to improve the quality of life of people with spinal cord injury and brain damage. He is well qualified for the Hwang Professorship. Chair Poovendran certainly made a brilliant choice. We are very pleased to have him installed as the first endowed professor."

The Hwangs' gift supports research at a top university with significant expertise in device-driven rehabilitation technologies. However, as UW alums, Mr. and Mrs. Hwang are giving to a place of significant, personal meaning.

While a Ph.D. student in UW EE, Mr. Hwang received an education that prepared him for a lasting career at

Bell Telephone Labs, something he attributes to the great mentorship by his adviser Professor Lynn Watt.

"The EE department of the UW gave me all the education I needed to enter the job market, and it was Professor Lynn Watt who had the greatest influence on my career path," Mr. Hwang said. "He guided me into the field of semiconductor by offering me a research assistantship. He also recommended me to the recruiter from Bell Telephone Labs, which gave me the opportunity to work in their laser group. This is the place where I was engaged in the development of semiconductor lasers and later used the technology to start the first company."

Mr. Hwang would go on to found two more companies during his career: General Optronics Corp, which was the world's first semiconductor laser manufacturer; Applied Optronics Corp, the world's first company producing high power semiconductor lasers and subsystems for medical surgical applications; and Optronics International Corp, the first Taiwanese company developing and commercializing semiconductor lasers and subsystems for high-speed fiber optic communications.

Within each decade, Mr. Hwang remained at the frontier of laser research, taking his prior discovery and implementing it at an advanced level of operation. His discoveries have had a substantive, profound impact on the develop-



*C.J. Hwang and Elizabeth Hwang with their daughter, Karen.*

**“The ultimate goal would be for it [Hwang Professorship research] to grow into the nation’s number one for such activities, based on the unique integration of the available resources at the university.”**

ment of opto-electronics and communication in the United States, as well as abroad. However, for Mr. Hwang, his lasting legacy is the The Cherng Jia and Elizabeth Yun Hwang Endowed Professorship.

“C.J.’s vision for this professorship comes from years of dedication to innovation and entrepreneurship,” UW EE Professor and Chair Radha Poovendran said. “If C.J. had stopped early on in his career, accepting the standard applications for semiconductor lasers, the ubiquity of lasers may not be what it is today. We are honored to have C.J. and Elizabeth as top collaborators for this important research.”

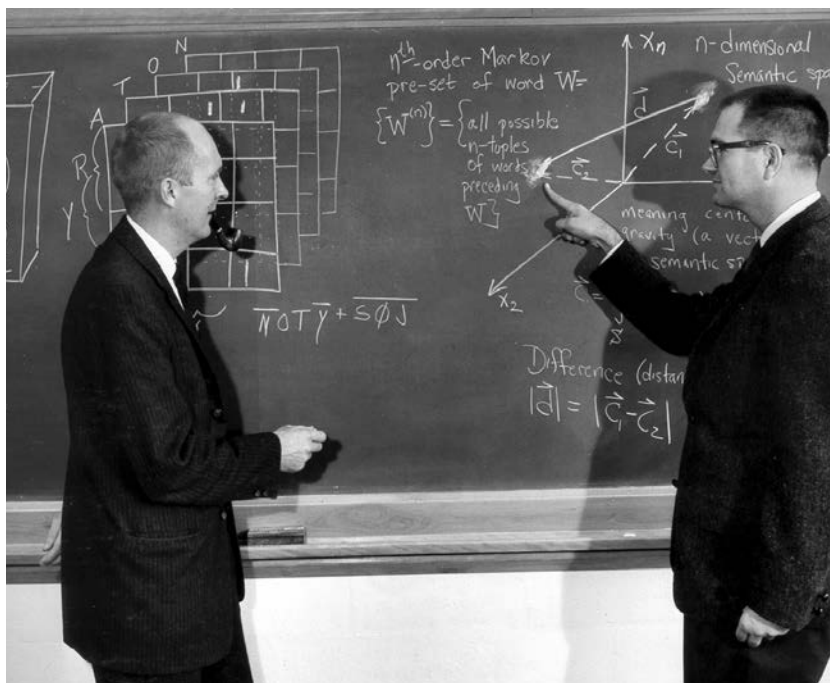
This sense of collaboration spurs all facets of the The Cherng Jia and Elizabeth Yun Hwang Endowed Professorship. For Rao, a dedication to collaboration has built and will continue to grow his lab’s research. He is grateful to the Hwang family for their generous contributions to critical research that may have large-scale societal impact.

“I am truly honored to be named the inaugural C.J. and Elizabeth Hwang Professor of CSE and EE,” Rao said. “I regard the Professorship as a recognition of the great collaborative effort of the students, faculty and staff at our center [CSNE] over the past 6

years that has made UW a premier destination for neural engineering in the world. We are extremely grateful to the Hwang family for their generosity in accelerating the center’s efforts to build devices that will improve the quality of life of people with spinal cord injury and other neurological conditions.” ■

*C.J. Hwang and Elizabeth Hwang at the Cherng Jia and Elizabeth Hwang Professorship Investiture.*





## 10 YEARS OF COMMUNITY KNOWLEDGE SHARING

The Lytle Lecture honors the late Professor Dean W. Lytle, who began his career as an assistant professor in 1958 in the Department of Electrical Engineering (UW EE). Professor Lytle's teaching, research and high-impact consulting reached into telecommunications, networks and probability to signal processing. This year marked the 10th year since the department's inaugural lecture. The Dean W. Lytle Endowed Lecture was made possible through a collective fundraising effort by the Lytle Family and Dr. Louis Scharf. Together with the alumni, friends and colleagues, who were positively impacted by Professor Lytle during his 40-year career at UW, they provided the capital to make the lecture possible. Professor Lytle's daughter, Marilyn, attended the lecture. Three of their daughters, Allison Perrin, Heidi Benton and Lisa Appelgate, attended the lecture with their husbands. Professor Lytle's student, Dr. Louis Scharf, was in attendance at the 2017 lecture.



From left: Professor and Chair Radha Poovendran, Marilyn Lytle, Dr. Louis Scharf and Professor Robert Heath.



Back row, from left: Director of Advancement Mahnaz Shafiei, Professor Linda Bushnell, Professor Emeritus Daniel S. Bernstein, Kathleen Dow, Lisa Appelgate, Allison Perrin, Tim Benton, Heidi Benton, Professor Les Atlas, Dr. Louis Scharf, Jim Scharf, Professor Jim Ritcey and Associate Director of Advancement Jessie Muhm.

Front row, from left: Marilyn Lytle, Professor Robert Heath and Professor and Chair Radha Poovendran

# THE 10TH ANNUAL DEAN W. LYTLE LECTURE

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AT THE OCTOBER 2ND LECTURE, UNIVERSITY OF TEXAS AT AUSTIN PROFESSOR ROBERT HEATH ADDRESSED THE NEED OF MILLIMETER WAVES TO EXPAND THE DWINDLING SPACE OF OUR CURRENT ELECTROMAGNETIC SPECTRUM. PROFESSOR HEATH EXPLORED APPLICATIONS FROM CARS TO DRONES TO DEEP SEA OPERATIONS.

## THE FUTURE IS MILLIMETER WAVE COMMUNICATION

Wedge between microwave and infrared waves on the spectrum are millimeter waves (mmWaves). These tiny wavelengths are about the size of a pencil point. However, mmWaves are packed with high bandwidth channels, leading to limitless opportunities for high-speed broadband applications.

For several years, researchers have discussed the possibility of using mmWave to usher in a new age of mobile wireless communications – 5G. MmWave networks are different than those at conventional frequencies, due to different propagation characteristics and hardware limitations. However, as research grows and technology improves, 5G becomes a very real possibility, and the value of mmWaves expands to other wireless applications.

For the 2017 Dean W. Lytle Lecture, University of Texas at Austin Cullen Trust for Higher Education Endowed Professor in the Department of Electrical and Computer Engineering Robert Heath explored mmWave communication as an incubator for the re-birth of wireless communications.

The use of mmWave as a tool for wireless communication is not a new concept; wireless communications to satellites has existed for many years. However, as Professor Heath said in his speech, the new applications for millimeter wave communications is a fascinating challenge, with the potential to direct the future of technology - from self-driving cars, to enhanced drone communication, to the ability for cars to take flight. ■



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# TO UW ELECTRICAL ENGINEERING, WITH LOVE

*How two UW alums' gift to  
the Department of Electrical  
Engineering continues to give to  
new generations of researchers*

**O**n March 1, 1935, Ruth Mary Larsen finds herself going to a winter formal with a man she has never met. The date, which was held in the Pompeiian Room of the Washington Athletic Club, was orchestrated by a close friend. Ruth Mary reveals her hesitation for the encounter in her diary.

"Tuesday, Bill Dansie called up and wants me to go to informal with someone - don't know who he is," she recounts. "I tried to find out from Quent and Bill about him. A person would have to be perfect to live up to their recommendations. Time will tell."

The person that Ruth Mary would meet would be Donald "Don" Close. After the dance on March 1, Ruth Mary finalized her notes.

"Went to Pilgrim Club with Don Close," Ruth noted. "Had a perfect time."

Two years after the dance that changed both of their lives, Don would graduate with an engineering degree from the UW Department of Electrical Engineering. A year later, Ruth Mary would graduate with her bachelor's degree in accounting from the business school.

On August 19, 1938, Don and Ruth Mary would be married in a ceremony that could only be described with elegance, in the bound typset of an old newspaper.

"The bridal aisle was garlanded with white zinnias, larkspur and dahlias, and at the candelit altar were great bouquets of white gladiolus," the 1938 article shares.

As an ode to where they met, the Closes' informal introductions transformed into formal beginnings - a life of service and love.



*Top left:* Even though over 80 years have passed, Ruth Close keeps a memento - a dance card - from the night she and Don first met.

*Bottom left and right:* In the spring of 1935, Donald and Ruth Close meet while students at the University of Washington. The below photos show the young couple after their engagement on a Pacific Northwest beach.



After graduating from UW Electrical Engineering, Don worked various engineering jobs before starting his own company in 1947 - the Donald W. Close Company.

Although the creation of the Closes' company would be a lucrative business decision, the company was always rooted in giving back to workers and to the community. In fact, its origins were founded on sharing its success.

"Tradition states that Donald Wyman Close quit his employer when they ceased giving employees turkeys as Christmas bonuses," an excerpt from the DW Close Company website states. "[Don] founded the DW Close Company based on the principle that he would share his success with his employees."

Although it is unclear whether turkeys became a regular holiday bonus for DW Close Company workers, what the company and family did accomplish was a legacy of service.

From illuminating Seattle streets with upgraded lights to connecting communities through the Hood Canal Bridge electrical installation, the Closes moved the region forward.

Don's dedication to progress proliferated to his vision for the future of electrical engineering - an investment to grow power and energy research in the UW Electrical Engineering department.



On August 1, 2011, five years after his father, Don Close, passed away at the age of 91, Frank Close delivered a speech on his father's legacy at the University of Washington Department of Electrical Engineering Close Professorship Installation.

"His passion was energy," Frank says of his father in his speech. "He was always firm in believing that with everyone involved in information technology, innovation would be needed to keep all of the computers running. Among his own innovations were the design, implementation and completion of a garbage-to-power plant with his eldest son Richard, which is still in operation today."

Don believed it was important to involve UW students in exploring the challenges of electricity as a source of power, while gaining hands on experience with industry.

At the installation ceremony, Dan Kirschen was named the first Close Professor. A talented researcher and student advocate, Professor Kirschen shares the same values as Don and Ruth Mary on energy usage - that energy should not come at a cost to the environment.

"We have a world-class institution in the University of Washington and we are asking for a world-class smart grid technology center," Frank ended his speech. "But we have one last request. We don't want the environment compromised. We and Dad never believed that there was a conflict between good engineering and the environment. So, with that, I will pass the torch. "

Six years after receiving the professorship, Kirschen continues to advance the Closes' vision.



In fall 2017, Professor Kirschen was a member of the UW Clean Energy Institute team that launched the transformative Clean Energy Testbeds. The testbeds facilitate leading-edge research that will reduce the time, energy and money needed to turn innovative discoveries into scalable clean energy products.

Time is a critical component in the race to meet demand for alternatives to fossil fuels and ultimately combat climate change. The testbeds offer a community space for researchers to come and take advantage of access to unique instruments to rapidly develop technologies in solar harvesting, energy storage and grid integration.

As Professor Kirschen noted in an October 2017 NPR Marketplace special on rebuilding post-hurricane Puerto Rico to take advantage of a renewable energy infrastructure, clean energy is expensive. Having a space that offers unique equipment is a great opportunity for renewable energy development and advancements.

The Close family professorship became a transformative catalyst for emboldening the power and energy research at UW Electrical Engineering. In the 2017-2018 academic year, the department welcomed one new hire, Brian Johnson, with expertise in power electronics, and the department celebrated a new professorship - the Keith and Nancy Rattie Endowed Career Development Professorship - for Baosen Zhang.

For power and energy research in the UW Department of Electrical Engineering, this is just the beginning of a long legacy of innovative, pioneering research. For the Close family, they look forward to

seeing the legacy continue.

"Change is one of the few guarantees in life, especially when you are talking about technology," says Don Close's grandson, Dan O'Neill. "The Close professorship helps ensure UW EE's relevance to the problems of energy generation, transmission, and storage. This is especially critical given all the technology shifts occurring today. Our family's hope is that the professorship will help equip the very people - the youth of today and tomorrow - who will be leading us through these changes."

Although renewable energy solutions require creative research and thoughtful application, there is one fateful and critical component to Don Close's success - the night he met Ruth.



"Ruth Mary was the anchor reinforcing all of their shared values," Frank Close relays in his speech. "The University of Washington was the place where he found his partner for life and the place he received an education to give him an immense opportunity for himself and his

family and his community. This [professorship] is as much a gift of that wonderful life as it is for Don and Ruth Mary."

And although it couldn't be foreseen on that night in 1935, Don and Ruth Mary would share much more than a life together; their union would put forth in motion many more years of service through their professorship and through their family, the impact of which will be palpable in the way the world rethinks energy. ■

**Left page, bottom left:** Professor Dan Kirschen and Ruth Mary Close at the Close Professorship Investiture.

**Left page, top right:** Don Close after founding his new company - the DW Close Company.

**Right page, center:** The Close family as they celebrate Ruth Mary's 100th birthday.

# UW EE BEAT



*From left: Denis Jivaikin, James Goin, Joanna Mazer, Ting-Yu (Jacky) Wang and Professor Bruce Darling.*

At the national competition, the **UW EcoCAR team** took first place in the innovation topic paper and presentation for the NSF Innovation Award. EE Professor Bruce Darling is a team adviser.



*The team includes Professor Noah Smith, Maarten Sap, Ari Holtzman, Professor Mari Ostendorf, Elizabeth Clark, Hao Fang, Professor Yejin Choi and Hao Cheng.*

The UW team is one of three finalists worldwide for **Amazon's \$2.5 million Alexa Prize**. Amazon challenges students to build a "socialbot" that can have intelligent conversations with users.

Researchers construct **computational circuit boards with DNA**. The research, led by UW EE Professor Georg Seelig, uses spatial organization to create "DNA Dominoes."

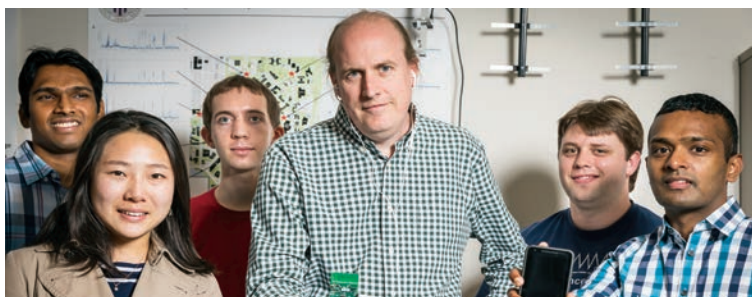


*Professor Georg Seelig*

Researchers develop a new app to **screen for pancreatic cancer**. BiliScreen uses a smartphone camera, computer vision algorithms and machine learning tools to detect bilirubin levels in an eye.



*Alex Marikakis,  
Ph.D. student*

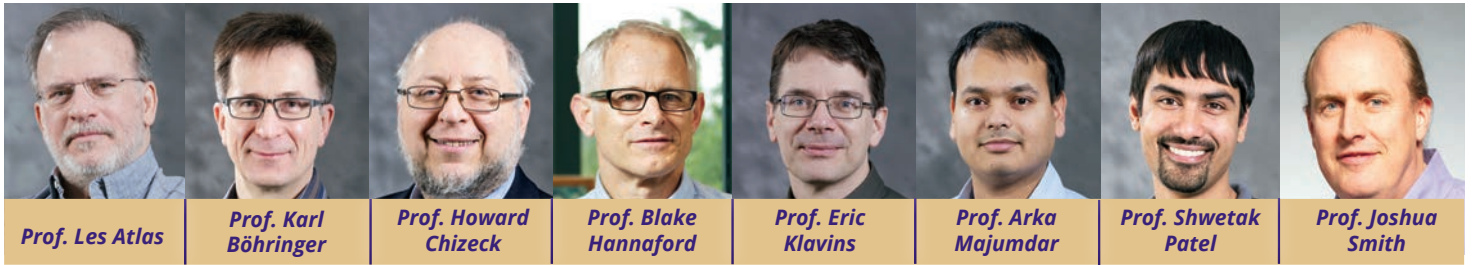


*From left: Vamsi Talla, Wu Meiling, Sam Crow, Professor Joshua Smith, Bryce Kellogg and Shyam Gollakota.*

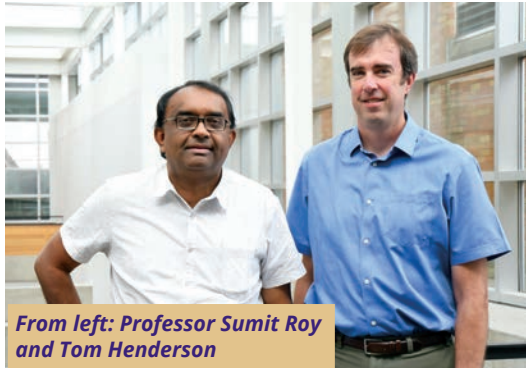
Researchers develop **world's first battery-free phone**. The phone powers up through ambient signals in the air, such as radio waves and light.

For more UW EE news, visit [www.ee.washington.edu](http://www.ee.washington.edu).

To share your news with UW EE, please email: [apell@uw.edu](mailto:apell@uw.edu)

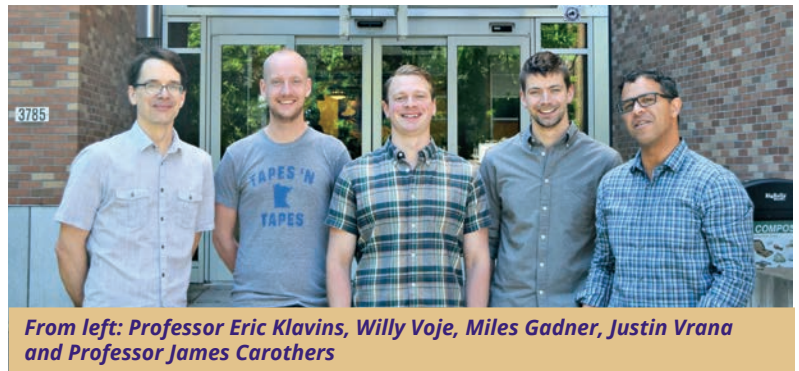


Eight UW EE faculty were named **2017 Amazon Catalyst Fellows**. In a partnership with the University of Washington, Amazon Catalyst supports bold solutions to world problems. The 2017 EE fellows are (from left to right): Professors Les Atlas, Karl Böhringer, Howard Chizeck, Blake Hannaford, Eric Klavins, Arka Majumdar, Shwetak Patel and Joshua Smith. Their projects covered a range of areas, including health, security, the environment and entertainment.

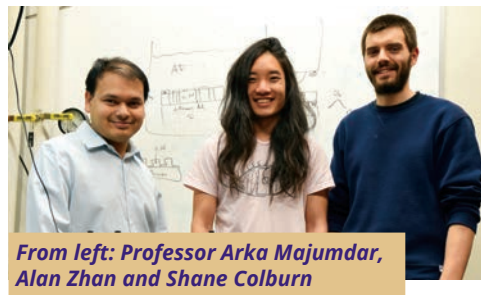


UW EE leads **NIST PSKR grant** to develop performance analysis tools for the next-generation broadband LTE based FirstNet.

Borrowing from electronics, researchers build **largest circuits to date** in living eukaryotic cells. This research delivers a new method for digital information processing in living cells.



Researchers achieve a factor of 10 performance improvement for **BCI systems**.



Researchers deliver the **future in optical display through freeform optics**, using materials called metasurfaces.



Professor Sreeram Kannan receives an **NSF Early CAREER Award** for RNA analytics research.



Two UW EE students are named **the Husky 100**. The award recognizes the 100 most impactful students.

# ELECTRICAL ENGINEERING

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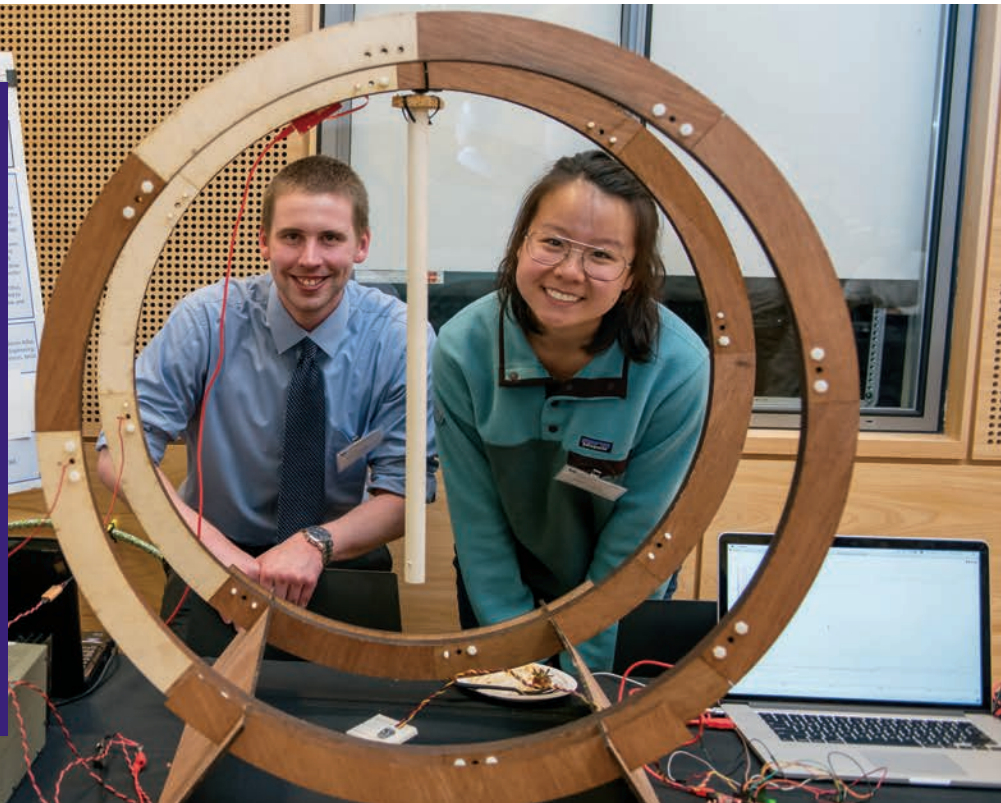


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