

ARIZONA ENGINEER

INSIDE THIS EDITION



7 Smooth Operator
Jerzy Rozenblit gets \$1.9M to design surgery training system



9 Homecoming 2016
Let's put an engineer in the White House



12 Go Wildcaterpillars!
Caterpillar executives enroll in new certificate program

Engineering Alumni and Students Critical to OSIRIS-REX Mission

From modeling the asteroid to steering the spacecraft, Wildcat engineers are helping ensure that all systems are go.

When NASA's OSIRIS-REx spacecraft lifted off aboard an Atlas V rocket from the John F. Kennedy Space Center in Cape Canaveral, Florida, dozens of College of Engineering students and alumni were there to witness their handiwork. Others at ground control will monitor and steer the asteroid-bound spacecraft.

"OSIRIS-REx has given a young engineer like me a once-in-a-lifetime opportunity."

Master's graduate Bradley Williams, a systems engineer for the UA-built OSIRIS-REx Camera Suite, was among the select engineers giving the "All Systems Go" signal on Sept. 8. Williams is now working on uplinking commands to the cameras and evaluating the data coming down from them.

The UA-led OSIRIS-REx mission is the first U.S. attempt to sample an asteroid and return it to Earth, and the first NASA deep-space mission involving a large cohort of engineering students from a public research university.



UA/Symeon Platts

Suits You, Sir—Systems engineer Bradley Williams (BS/ME 2013) with the OSIRIS-REx spacecraft in the Lockheed Martin cleanroom.

"OSIRIS-REx has given a young engineer like me a once-in-a-lifetime opportunity to have a hands-on role on a space mission," said Sara Balram Knutson, who earned her UA master's in engineering management in 2012 and is now a senior operations engineer for the OSIRIS-REx mission at the UA.

CONTINUED ON PAGE 10

Inclusivity Reinforces Humanitarian Nature of Engineering

A quality mix of practical, disciplined students means a better outlook for the state, nation and world.

With the conclusion of the fall semester on the horizon, excitement about this academic year is already dialed up for the home stretch, and the best is still to come!

Successes are stacking up. ABET accreditation visits went smoothly, with positive decisions expected next



August. Industry needs are spurring new academic and extracurricular programs. Research is translating to new products at unprecedented rates. And an impressive lineup of alumni were honored at Homecoming 2016.

About 500 people attended the Homecoming Engineers Breakfast. Keynote speaker Claire Tomkins moved the audience with a call for engineers to be more involved in public policy and to promote inclusivity.

The College's enrollment of women and underrepresented groups is above national averages, with women at 25 percent of the student population and people from underrepresented groups at 35 percent. We are making UA Engineering even more inviting by incorporating entrepreneurial strands throughout degree programs, establishing more graduate funding for underrepresented groups, and further strengthening industry partnerships for greater career opportunities.

The Pac-12 Conference isn't just about athletics. Its schools are known for academic excellence. In October eight

deans gathered at USC and UCLA for the first Pac-12 Engineering Deans meeting. We shared best practices and identified opportunities to partner on education and research, as well as administration. Membership in such a strong group of peers will enable us to enhance our already sound fiscal management strategy to ensure the College prospers in the face of ever-growing financial constraints.

We are also looking toward making this alumni magazine the best it can be. So please carve out a few minutes today to take the Arizona Engineer survey.

Mark your calendars for Design Day, Monday, May 1, and the da Vinci Circle Dinner, Sunday, April 30, and we will see you at the double header!

Thank you to alumni, faculty, staff, students, industry partners, donors – everyone who is a part of the College's successes. Bear Down!

Jeff Goldberg, Dean
jgoldberg@arizona.edu • 520.621.6594
@UA_ENGR_Jeff_G

ARIZONA ENGINEER

fall 2016 • volume 39 number 2

The University of Arizona
College of Engineering
P.O. Box 210072
Tucson, AZ 85721-0072

editor/designer pete brown
520.621.3754 • news@engr.arizona.edu

contributors pete brown, jill goetz, emily litvack, tiana velez

engineering.arizona.edu

Arizona Engineer is published twice a year for alumni and friends of the University of Arizona College of Engineering.

Stories in this print edition have been edited for length, and it is not feasible to include related multimedia such as photo galleries, video and audio files, and links to related websites. Visit Arizona Engineer online at news.engr.arizona.edu for full stories, news archive, people profiles, and photo and video galleries.

All contents © 2016 Arizona Board of Regents. All rights reserved.

The University of Arizona is an equal opportunity, affirmative action institution. The University prohibits discrimination in its programs and activities on the basis of race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation or gender identity, and is committed to maintaining an environment free from sexual harassment and retaliation.

\$1M NSF Grant Supports Minority Grad Students

The National Science Foundation has awarded \$1.07 million to the College of Engineering to help increase diversity among domestic students planning to pursue doctorates in science, technology, engineering and math, or STEM, fields.

The NSF Bridge to the Doctorate award, funded through the Louis Stokes Alliances for Minority Participation, covers tuition and provides \$32,000 in fellowships for two years for 12 underrepresented minority students in STEM.

The goal is to help more individuals from these minority groups, which represent nearly a third of the U.S. population but less than a tenth of Americans with doctorates, pursue graduate degrees in STEM disciplines and increase workforce diversity, said Jim Field, assistant dean of graduate education and the project's principal investigator.

"The University of Arizona has been a leader in efforts to increase diversity among graduate students, with nearly 20 percent of our graduate students in fall 2015 from underrepresented minority



David Hostetler

Bridge Partners—Principal investigator Jim Field, second from right at back, poses on the steps of Old Main with a few of the latest UA Bridge to the Doctorate students.

groups," he said. "The NSF Bridge to the Doctorate grant will expand this work and raise our profile as a destination campus for people from diverse backgrounds who seek high-quality graduate degrees in STEM-related fields."

The benefit could be especially great in Pima County, Arizona, where Hispanic and Native American populations exceed the national average, he added. The NSF Bridge to the Doctorate program is named

for the late Louis Stokes, Ohio's first African-American congressman, who advocated for broadening educational opportunities during his 15 terms in the U.S. House of Representatives.

The award is dedicated to Maria Teresa Velez, an associate dean of the UA's Graduate College and mentor to generations of students until her death from cancer in April 2016. She is listed as a co-principal investigator on the project.

Environmental Sustainability Draws College's Newest University Fellows



Junmo Ahn

Junmo Ahn and José Luis Ruiz Duarte, international graduate students with high marks from their alma maters, have joined the College as 2016-2017 University Fellows.

Ahn, a doctoral student from South Korea in mining and geological engineering, is studying how biotechnology can reduce the environmental effects of mining waste while also extracting valuable resources from it.

He has a bachelor's degree in environmental engineering from Konkuk University and a master's in civil and environmental engineering from Seoul National University.

Duarte, a doctoral student from Mexico in systems and industrial engineering, has a bachelor's degree in industrial and systems



José Luis Ruiz Duarte

engineering and a master's in industrial engineering from the University of Sonora, Mexico, where he conducted research on optimization and data analytics. At the UA, he is investigating how these and other systems engineering disciplines can be used to develop and integrate solar energy systems.

"I hope to transfer the knowledge I obtain from this research to my hometown, Hermosillo, which gets about 300 days of sunshine each year but has very few houses and organizations that use solar energy," Duarte said.

Fellows are selected and recruited by the Graduate Center in collaboration with deans and academic program coordinators throughout the University.

This year's 24 University Fellows come from four continents and include members of underrepresented minority groups and 13 women.

Potter Gets Mentor Award for Work with Solar Go-Kart Teams

Tech Parks Arizona celebrated the fifth year of its high school competition, Racing the Sun, with a special award presentation for longtime mentors like Kelly Potter, a UA professor in electrical and computer engineering and optical sciences.

“Kelly has been with the program since the beginning, and we wanted to give her the Five-Year Mentor Award in recognition of the valuable contributions she’s made,” said Brenda Hough, program coordinator for Racing the Sun and community outreach coordinator for Tech Parks Arizona, a unit of Tech Launch Arizona, the University’s technology commercialization arm.



Kelly Potter

Potter, a fellow of the American Ceramic Society, is renowned for her research on radiation-hardened optics, photosensitive materials, and solar and renewable energy – the last being especially useful to Racing the Sun participants.

The yearlong program engages teens across Southern Arizona and Phoenix in the design, construction and testing of solar-powered go-karts, and ends with an event at which teams race their go-karts for a chance to win awards for fastest lap, most laps and originality. Industry and university mentors



Racing the Sun/Tech Parks Arizona

Photon-Fueled—Solar go-karts head for the track at Musselman Honda Circuit in Tucson, Arizona. Kelly Potter has been mentoring teams since the program’s inception.

serve as advisers to the students on topics such as electronics, automotive design and solar panels.

Potter joined the program in 2011, when just three teams competed. Thirteen teams competed in 2016, building a total of 20 go-karts. “She’s been involved since year one advising, judging and mentoring,” said Hough. “This year she helped students troubleshoot their karts, and she continues to advise program coordinators on safety issues, competition guidelines and technical aspects.”

Professor and Alumna Honored for Promoting Diversity in STEM

Two women Wildcat engineers have been honored for their professional achievements and contributions to diversity in science, technology, engineering and math, or STEM.

Erica Corral, associate professor of materials science and engineering, received the 2016 Dr. Eugene Garcia Outstanding Latina/o Faculty Research in Higher Education Award from the Victoria Foundation at an awards breakfast in Tempe, Arizona, in September.

The Phoenix-based Victoria Foundation works to increase educational and faculty opportunities for Latinos and Latinas. “It is an honor to be recognized by the Victoria Foundation for my faculty research and my



Erica Corral

work in training students for careers in STEM,” Corral said. Corral is one of few scientists worldwide working on novel thermal protection systems for extreme conditions in air and space flight. She and her research team are developing high-temperature nanocomposite ceramic materials.

Marla Peterson, who has held increasingly responsible positions as an engineer at Honeywell Aerospace since earning her bachelor’s degree in systems engineering from the UA in 1983, received a 2016 Advocating Women in Engineering Award in October from the Society of Women Engineers. The award recognizes women



Marla Peterson

from industry and academia who have demonstrated professional excellence in their chosen STEM fields and advocated for women in engineering.

Peterson frequently visits the UA campus to recruit, mentor, support and inspire students. She serves on the UA Systems and Industrial Engineering Advisory Board and has served as scholarship chair for the UA Phoenix Alumni Board and president of the UA Engineering Alumni Council. As Honeywell’s campus manager, she has played a key role in recruiting students and graduates for full-time employment, internships and other professional development opportunities at Honeywell.



Pete Brown

Directing Traffic—Larry Head, right, and grad student Sara Khosravi demonstrate their connected infrastructure and vehicle technology in Anthem, Arizona.

Larry Head Leads Newly Established Transportation Research Institute

The UA has established the new Arizona Transportation Research Institute, or AzTRI, and equipped it with the interdisciplinary expertise necessary to tackle the problems of an ever-evolving transportation ecosystem and an eye toward partnerships and innovation.

The institute includes researchers from across the UA campus. Systems and industrial engineering professor Larry Head is the interim director, and UA systems engineering alumna Ann Wilkey is associate director. They will work closely with Sally Stevens, professor of gender and women's studies, and Jeff Burgess, associate dean for research in the Mel and Enid Zuckerman College of Public Health.

Also involved are the Eller College of Management, James E. Rogers College of Law, College of Social and Behavioral Sciences, College of Optical Sciences, College of Science, and College of Architecture, Planning and Landscape Architecture. The average urban commuter in the United States lost 42 hours stuck in traffic last year, at an estimated cost of \$160 billion, which includes lost productivity, fuel consumed while idling, and wear and tear on vehicles and roadways.

"Traffic congestion is at an all-time high. Commutes are longer, and air pollution has increased," said Kimberly Andrews Espy, senior vice president for research at the UA. "I am thrilled that the researchers at AzTRI will be able to better the lives of Arizonans by creating innovative solutions to transportation problems."

Head said the solution to this problem no longer is simply "building more roads."



Pete Brown

Currying Favor—Supapan Seraphin, right, and some of her students have some fun in the residence hall kitchen preparing pots of Thai curry for hungry students.

Pioneering Champion of Diversity in STEM Retires After 25 Years at UA

Retiring professor of materials science and engineering Supapan Seraphin leaves generations of students with memories to savor.

As the youngest of four daughters raised in Thailand, Seraphin recalls how local women pitied her mother because she had no sons. In an era when a woman's place was in the home, they were puzzled by her mother's resolve that all of her daughters would be educated.

Seraphin earned bachelor's and master's degrees in chemistry and energy technology in Thailand before coming to America to earn her doctorate in materials science and engineering from Arizona State University in 1990.

Later that year she joined the UA department of materials science and engineering as its first female faculty member and as the first director of what is now the UA Spectroscopy and Imaging Facilities.

As principal or co-principal investigator on National Science Foundation grants totaling about \$10 million, Seraphin has conducted research on nanomaterials and led education and outreach grants to extend research opportunities to pre-college, undergraduate and graduate students – particularly women and members of minority groups – and science teachers.

She described some of her favorite UA memories as: "When pre-college students and K-12 teachers would tell me I provided them with life-changing experiences, and when I heard the news that one of my students had received a National Science Foundation Graduate Research Fellowship."

She shared her passion for research and discovery in classrooms, laboratories and many other settings – most memorably, perhaps, in residence hall kitchens.

Water Reuse Filtration System Wins 2016 Best Project Award

A wastewater-treatment system designed and tested by the University of Arizona, the global engineering firm CH2M, and Tucson Water could aid in Arizona's looming shortage of drinking water.

The UA and collaborators have received the 2016 WaterReuse Arizona Project of the Year Award for their system from the WaterReuse Research Foundation.

"The evaluation of alternative methods for water reuse is critical to our state and our region," said project

co-investigator Shane Snyder, UA professor of chemical and environmental engineering and member of the UA BIO5 Institute. "We have demonstrated



Shane Snyder

a novel design that is more efficient and effective than conventional water reuse systems." Snyder's co-principal investigators included UA professor

of chemical and environmental engineering Bob Arnold.



Bob Arnold

The research was one of the first major projects involving the UA Water & Energy

Sustainable Technology Center. Snyder co-directs the center, which opened in 2015 a few miles from the main UA campus at the Pima County Water Energy Sustainability campus.

The engineers used a variety of filtration technologies, including membranes, ozone and activated carbon, to remove pathogens and chemical impurities from effluent and produce high-quality drinking water. Wastewater is pretreated by natural biological processes as it passes through soil, which reduces the amount of energy required for the subsequent engineered treatment steps.



Pete Brown

Grains of Truth—Clockwise from top left: Katerina Aifantis, mechanical engineering undergraduates Andrew Barr and Fabian Medina, and postdoctoral researcher Haokun Deng prepare materials for electron microscopy in the lab.

Predicting Materials Failure from Tiny Grains

Katerina Aifantis – whose father was teaching her about negative numbers when she was 3 years old – started college at 16, earned a bachelor's degree in engineering at 19 and a master's in materials engineering at 20. At 21, she became the Netherlands' youngest-ever recipient of a doctorate, in applied physics.

Now 30 and in her fourth year as associate professor of civil engineering and engineering mechanics at the UA, Aifantis has reached another milestone. She is principal investigator on a nanotechnology-based collaborative research project between the UA and Michigan Technology University with funding from the U.S. Department of Energy Office of Basic Energy Sciences.

With the three-year, renewable award of nearly \$840,000, Aifantis is studying and predicting how metallic solids break down at the atomic level.

"What happens at the atomic level when we compress metals for microelectronics? Do the metals grow harder or softer?" she asked. "By understanding and modeling mechanics at the atomic level, we can

help manufacturers develop alloys for more effective jet-engine turbines, or tiny batteries for medical implants that won't crack or run down prematurely, or car components that better withstand high-speed crashes," she said.

"I got started trying to understand what my dad's work was about," said Aifantis, who was raised in Greece and Michigan. Her father, Elias Aifantis, is a Michigan Tech professor emeritus of mechanical engineering and professor of mechanics at Aristotle University of Thessaloniki in Greece.

"I was always asking him about the gradient plasticity theory he formulated, and I even tried studying it with him when I was at Michigan Tech, but we never managed to talk science for more than 10 minutes," she said. "We could only act as father-daughter and not professor-student. He encouraged me to study mechanics on my own."

After earning her BS, Aifantis won a National Science Foundation graduate research fellowship to study at the University of Cambridge.

Jerzy Rozenblit Gives Doctors Better Feel for Laparoscopic Surgery

Laparoscopy is routine for many surgeries, such as gallbladder and appendix removal. In these minimally invasive procedures, surgical instruments are inserted into a patient's body via a small incision along with a fiber-optic camera and lighting system.

Laparoscopic surgery can reduce complications and speed patient recovery, but it presents unique challenges for surgeons.

Unlike open surgery, laparoscopy limits a surgeon's visual field, which compromises hand-eye coordination. It also precludes the haptic, or tactile, feedback that tells a surgeon when an instrument is headed in the wrong direction.

The National Science Foundation has awarded \$1.9 million over four years to principal investigator Jerzy Rozenblit, UA Distinguished Professor in the department



Pete Brown

Helping Hands—Distinguished Professor Jerzy Rozenblit demonstrates his Computer-Aided Surgical Trainer.

of electrical and computer engineering with a joint appointment in the department of surgery, to develop and test his Computer-Aided Surgical Trainer. The CAST system will be the first to provide haptic guidance and augmented reality images for trainees directly manipulating surgical instruments.

“Nobody is developing haptic guidance technology like we are,” said Rozenblit, a former head of his department and the Raymond J. Oglethorpe Endowed Chair. “We anticipate the CAST system will speed up learning, reinforce good habits and techniques and discourage bad ones, and, ultimately lead to better surgical outcomes and improved patient safety.”

NIH Awards \$1.3M for Ovarian Cancer Screening Device

Professor of biomedical engineering Jennifer Barton has been awarded a four-year National Institutes of Health grant totaling nearly \$1.3 million for development of a tool to identify the earliest signs of ovarian cancer.

Currently there is no acceptable screening method for ovarian cancer, and most cases are detected when the disease is widespread and likely to be deadly. Although the overall five-year survival rate for ovarian cancer patients is only



Jennifer Barton

46 percent, the rate for patients whose cancer is discovered when it is still confined to the ovary is more than 90 percent. But just 15 percent of cases of are diagnosed at this stage.

Barton's new device, called a salpingoscope, will enable high-sensitivity, high-resolution imaging of the fallopian tube, ovaries and uterine wall. The scope would be used under local anesthesia in an office setting.

“This is a new way of thinking about accessing the ovary in a minimally invasive way,” said Barton, adding that this type of access is similar to approved egg-harvesting procedures for *in vitro* fertilization.

“Effective screening for early detection is a compelling problem and a fantastic technical challenge because there's no perfect solution today,” said Barton, interim director of the UA

BIO5 Institute and member of the UA Cancer Center.

“This research highlights the collaborative approach Dr. Barton's team is using to detect ovarian cancer, one of the deadliest forms of cancer among women,” said UA President Ann Weaver Hart. “Combining expertise from engineering, optical sciences, and obstetrics and gynecology, the team is a wonderful example of the UA's strength in transdisciplinary research, and the innovative technology Dr. Barton and her colleagues are developing will have vital impact in the lives of people here in Arizona and around the world.”



Brett May

Organic Matters—“Having two women principal investigators on a project like this is really cool,” said MSE assistant professor Erin Ratcliff, pictured here in her lab. She works to increase diversity in engineering and serves on the UA Commission on the Status of Women.

NSF Funds UA Research into Organic Semiconductors

Most people aren’t accustomed to hearing “organic” and “semiconductor” in the same sentence. But the words flow naturally for Erin Ratcliff, a UA assistant professor of materials science and engineering.

Ratcliff is co-principal investigator on a research project funded by the National Science Foundation to better understand and improve the viability of organic semiconductor materials, which are being used more and more in the manufacturing of digital display screens and electronic devices.

The \$590,000, three-year award teams Ratcliff with Jeanne Pemberton, a UA Regents’ Professor of Chemistry and Biochemistry in the College of Science and principal investigator on the study.

“I’m incredibly excited to receive this award and to have Jeanne Pemberton

as my co-investigator,” said Ratcliff, who joined the UA faculty in 2014. “Her research and discoveries in analytical chemistry have led to major advancements in the field.”

Organic semiconductors are carbon-based molecules and polymers with electrical conductivity. They are used to make organic light-emitting diode, or OLED, digital display screens for mobile phones, TVs and tablets. Future prospects for organic semiconductor materials include solar energy and wearable devices.

“Organic semiconductors hold exceptional promise in a number of existing and emerging technologies,” Ratcliff said. “But degradation is a major problem for using them commercially. This research project will set a foundation for better understanding and solving this complicated issue.”

UA Researching Smart Radios and Better Wi-Fi

Electrical and computer engineering professors Marwan Krunz and Hao Xin are working to change how we design wireless systems to eliminate wireless scarcity.



Marwan Krunz

The surge in Wi-Fi-enabled devices has been a boon for society but a strain on the wireless spectrum that provides the frequencies. Many

of the frequencies are fixed, having been allocated exclusively for radio, television, military, mobile and other operators. What remains is limited.

Krunz’s solution to frequency scarcity lies in dynamic spectrum access, or DSA, which classifies frequency users as primary or secondary and encourages sharing between



Hao Xin

“There are a lot of wireless users, but their traffic fluctuates depending on the time of day and location – for example, at night or in rural areas,” Krunz said. “Those frequencies are not well utilized.”

Teaching Smart Radios How to Learn

Hamed Asadi thinks machines can learn a lot from humans.

The UA graduate research assistant’s work in cognitive radio engines often draws parallels between an infant’s growth into adulthood and an engine’s artificial intelligence: going so far as to label an engine’s learning stages as “infant, childhood, teenager and adult.”

the two. Primary users get priority; however, when they’re not using the frequency, secondary users have the opportunity to temporarily access it.

“In the infant stage, the engine has a lot to learn and is at its most unstable,” Asadi said. “By the time it reaches the adult stage, the engine has learned most of what it needs to maintain a steady link and perform optimally.”

Asadi’s training algorithm even incorporates what he calls the “forgetfulness factor,” allowing the engine to delete or forget



Hamed Asadi

older, less useful information about possible configurations.

For the second year in a row, Asadi’s research earned him an award at WInnComm, an annual conference

hosted by Wireless Innovation Forum on wireless communication and software-defined or cognitive radio technologies. Last year Asadi’s paper was one of four to receive Best Paper. This year he alone won Paper of the Year.

We Should Elect an Engineer President



Claire Tomkins

Whether providing communities with potable water, rescuing people at sea, transferring data in the cloud or adding convenience in the home, this year's honorees were proof positive of engineers' propensity for good.

Guest speakers and honorees at the College of Engineering's 2016 Homecoming on Oct. 28 and 29 captured the essence of the profession: forward-thinking problem solvers with heart. Working with people from the depths of poverty to the pinnacles of power, College alumni demonstrated how engineers improve lives.

"How can we expect to be a superpower and a great nation if our leaders don't understand the very foundations of our growth – technology and innovation?" Claire Tomkins asked in her Engineers Breakfast keynote address, "Why We Need an Engineer in the White House."

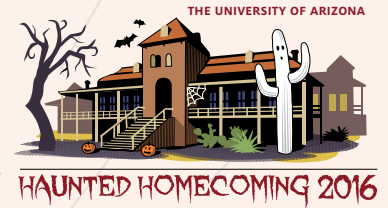
She holds a BA in systems and industrial engineering and public policy from the UA and a doctorate from Stanford University.

"Only about 10 percent of members of Congress have backgrounds in science, technology, engineering or math," she said. "As a technological and science-based society, we need to elect leaders who understand technology and know how to leverage data. We engineers see the world a certain way. We are practical and disciplined. We build things and fix things.

"In some ways, that's a good job description for a president."

Tomkins also noted that less than 20 percent of engineers are women and that less than 4 percent of Fortune 500 companies are run by women.

"When I read these statistics, it makes me sad – for the lost potential of young women and the lost potential of our society," she said. "It also fills me with a desire to change things." Her advice? "Raise your daughter to be an engineer."



2016 Homecoming Awards

ALUMNUS OF THE YEAR

John Somerhalder

Chairman and CEO, AGL Resources

PROFESSIONAL ACHIEVEMENT

KD Hallman

Vice President, World Wide IT, Microsoft Corp. (retired)

PROFESSIONAL ACHIEVEMENT

Sunil Kishen

Vice President, Sales and Product Management, Aviatrix Systems

YOUNG PROFESSIONAL ACHIEVEMENT

Bala Krishnan

Founder, President and Chief Product Officer, Peel Technologies Inc.

BEAR DOWN

Sara McCoy

Plant Manager, Agua Fria Generating Station, Salt River Project

LEO B. HART HUMANITARIAN AWARD

Anthony Mulligan

CEO, Hydronalix Inc.



Pete Brown

Class Act—Alumni from the class of 1966 attending the Engineers Breakfast include, from left, Ralph Wege, Jesse Cude, Glen Garrett, Robert Shaff and Caroll Sherman.

Record Number of Teachers Sign Up for High School Engineering 102

Arizona high school teachers were at the University of Arizona and Omni Tucson National Resort in July learning about educational projects in science, technology, engineering and math, or STEM, that they can take back to their own classrooms.

At the annual summer workshops for ENGR 102 High School, 31 teachers built solar ovens and solar trackers, catapults and quadcopters, load-bearing barges and simulated networks of brain cells.

ENGR 102 HS is an adapted version of the introductory course required for first-year UA College of Engineering students. The program introduces high school students, mostly seniors, to engineering and can give them a head start on their UA Engineering degrees.

Nine of this year's 38 ENGR 102 HS instructors will be teaching it for the first time.

"Your students will learn about some of the biggest challenges facing humanity, like how to ensure availability of clean drinking water, and how engineers are going to help solve them," Jim Clark, a Hamilton High School teacher and pioneer of the program, told workshop attendees. "Your students will



Pete Brown

Teachers Taught—High school teachers grapple with NeuroBytes, which they can use to teach their students about neural pathways.

be doing really good math, really good science and really good engineering. And they will really be creating something!"

The program has enrolled more than 1,800 students attending 37 high schools, including one in California, since it began in 2008 with 21 students at one Arizona school. Of the approximately 600 students expected to take the course in 2016-2017, about half will take it for College credit, said Jill Rogers, ENGR 102 HS assistant director at the UA.

OSIRIS-REX Mission-Critical

CONTINUED FROM FRONT PAGE

Knutson oversees day-to-day operations for the spacecraft's scientific instruments to ensure the spacecraft will be able to map the asteroid Bennu, select a sample site and obtain a sample.

So daunting is the task that the spacecraft will spend two years circumnavigating Bennu – 500 meters in diameter – before it extends its retractable arm, releases a burst of nitrogen gas to stir up enough soil to capture a sample, and retracts the arm with the sample securely in tow. OSIRIS-REx will have just three opportunities at only five seconds each to make the grab.

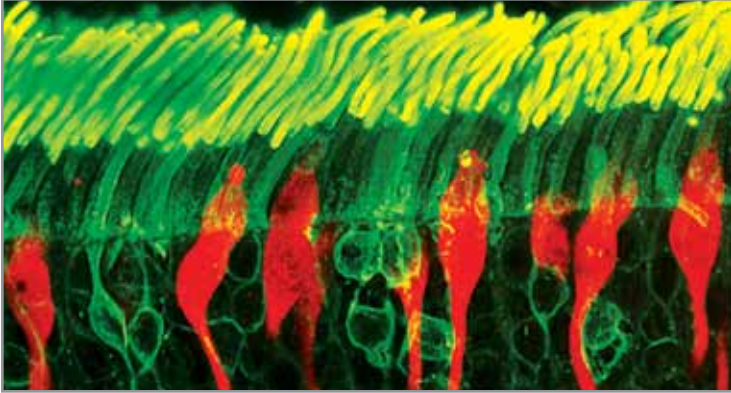
NASA chose the UA to lead OSIRIS-REX in 2011 and appointed Roberto Furfaro, director of the College of Engineering's Space Systems Engineering Laboratory, to lead the systems engineering team



for the mission's Science Processing and Operations Center, which is responsible for the software that operates the spacecraft.

Furfaro immediately started training undergraduate students in the lab, helping many obtain prestigious NASA Space Grants, hiring them when they became graduate students to work on OSIRIS-REX, and supporting their transitions to UA employees working on the mission.

"The opportunity to work on a NASA-funded mission while obtaining a graduate degree seemed too good to be true," said Kristofer Drozd, a doctoral student studying systems engineering who connected with Furfaro while finishing his UA bachelor's degree in aerospace engineering. "I am part of a mission that will directly enhance our knowledge of the solar system – all while still being in school."



Robert Fariss

Eyes Have It—Rod (green) and cone (red) photoreceptors in a human retina.

Retina Researcher Erika Eggers Sheds Light on Vision's Mysteries

One of the more studied parts of the human anatomy, the retina – the neural layer at the back of the eye that senses light – still has secrets to reveal.

“Researchers have known for decades that increased levels of light increase visual acuity,” said Erika Eggers, associate professor of biomedical engineering, physiology and neuroscience and member of the BIO5 Institute at the University of Arizona. “But we still don’t understand the mechanisms behind this process. It seems like it should be relatively simple, but it’s really very complicated.”

Eggers is principal investigator of a \$1.9 million project funded by the National Eye Institute of the National Institutes of



Erika Eggers

Health, with additional support from the International Retinal Research Foundation, to study “Retinal Neuronal Signaling in Early Diabetes.”

Eggers and Heddwen Brooks, UA professor of physiology and pharmacology and member of the BIO5 Institute, are taking physiological measurements from individual cells in an intact retina from a diabetic mouse model to identify

signaling processes that may lead to diabetic retinopathy, the No. 1 cause of blindness in American adults.

By the time people with diabetes lose their sight, blood vessels in the retina have been seriously compromised. The harm may begin years or even decades earlier. “Researchers have found that long before diabetic retinopathy sets in, neural activity in the retina is changing,” Eggers said. “If we can better recognize and understand these specific neuronal processes, we may be able to develop cell-based models for drugs that slow down or even reverse the damage and prevent blindness.”

UA Engineers Twist Physics Laws to Boost Sonic Science

Materials science engineer Pierre Deymier is bending sound waves in nature-defying ways that could quiet our cities, heal our bodies, provide new sources of energy, and compute and process information.



Pierre Deymier

Advances in electronics and optics typically drive progress in information technology, energy and biomedicine. Now UA researchers are pioneering a new field – phononics, the science of sound.

“If engineers can get acoustic waves to travel in unnatural ways, as they are starting to do with light waves, our world could look and sound radically different,”

said Pierre Deymier, UA professor and head of materials science and engineering and a member of the BIO5 Institute.

Imagine a wall that lets you whisper to a person on the other side but does not let you hear that person. Or a Band-Aid that images tissue through the vibrations it emits. Or a computer that uses phonons – a type of particle that carries sound and heat – to store, transport and process information in ways unimaginable with conventional electronics.

“It may sound like weird science, but I believe it is the wave of the future.”

Deymier has received \$1.9 million from the National Science Foundation’s Emerging Frontiers in Research and Innovation, or EFRI, program to lead a four-year study on manipulating how sound waves behave.

Most modern technologies are based on manipulation of electrons and photons. Deymier is one of the pioneers in the emerging discipline of phononics, which encompasses many disciplines, including quantum physics and mechanics, materials science engineering and applied mathematics.

He has developed specialized phononic crystals — artificial and elastic structures with unusual capabilities, such as the ability to increase the resolution of ultrasound imaging with super lenses or to process information with sound-based circuits.

“Working with phonons is incredibly exciting. We’re going to change the way people think about sound and are opening an entire new world.”

Caterpillar Executives Sign Up for New Online Mining Course

As a bulldozer bearing the “Cat” logo prepped the grounds for a new exhibit on the UA Mall, Caterpillar Inc. leaders gathered inside Old Main with UA faculty and staff to inaugurate Mining 360, an online graduate certificate program for high-level company employees.

The Fortune 100 company’s decision to relocate its surface mining operations from Peoria, Illinois, and other locations to Tucson was announced earlier this year and could create \$1.9 billion in economic benefits to the region, with a \$600 million economic impact over the next five years, according to state and local officials.

John Kemeny, professor and head of the UA Department of Mining and Geological Engineering, played a key role in developing Mining 360 and said the department’s and University’s reputations and long-standing relationships with the mining industry helped bring Caterpillar to town.

“Caterpillar’s move to Tucson is one of the biggest things to happen here in the last 25 years,” Kemeny said. “The research, educational and economic opportunities – for our department, College and University, as well as our community – are limitless.”

In this first student cohort, 12 Caterpillar employees, with titles such as engineering technical lead, product support supervisor, mining sales manager and large mining truck marketing manager, are looking to increase their understanding of the mining industry and better serve customers.



Caterpillar

Caterpillar Tracks—The first cohort of 12 Caterpillar and Cat dealer employees to begin coursework under a new partnership with UA Online includes high-performing leaders from engineering, operations, product support and marketing.

Participating faculty include seven in mining and geological engineering, four in geosciences and one in global mining law. Topics covered by the program include exploration, design, production, regulation, reclamation, safety and sustainable resource development.

Caterpillar is sponsoring six senior design projects this year. “This will give our students opportunities to work with and learn from Caterpillar engineers,” said College of Engineering Dean Jeff Goldberg, “while Caterpillar will gain a chance to test-drive some of our top students as future employees and get their help developing prototypes and moving them into the marketplace.”

Agricultural and Biosystems Engineering Alumna Wins National Prize in Mexico

At age 14 Tania Eulalia Martínez Cruz of the Mixe indigenous community in Mexico’s Oaxaca state left her mountain home on a bus for Texcoco, more than 12 hours away, to attend high school.

It was the start of an amazing journey that would lead to a bachelor’s degree in irrigation engineering from Texcoco’s Chapingo Autonomous University in 2008, a master’s in agricultural and biosystems engineering from the University of Arizona in 2012, and Mexico’s National Youth Prize for academic achievement in 2016.



Tania Martínez Cruz

“My UA degree expanded my research and knowledge, particularly in using irrigation for bioethanol production,” said Cruz. “I also gained confidence in a second language, as I had to manage of team of English-speaking research assistants, and in my skills as a researcher, thanks to an excellent supervisor who motivated and supported me.” That

Mexican President Enrique Peña Nieto presented the award to Martínez Cruz and 17 others, selected from over 22,000 applicants, at his official residence in Mexico City in August.

adviser was Donald Slack, UA professor of agricultural and biosystems engineering, watershed management and eco-hydrology. “Simply put, Tania is the best graduate student I have ever had,” said Slack, the Cecil H. Miller Jr. & Cecil H. Miller Sr. Families Dean’s Chair for Excellence in Agriculture and Life Sciences.

Martínez Cruz is pursuing her doctorate with the Knowledge, Technology and Innovation Group at Wageningen University in the Netherlands. “I want not just to create technologies and techniques to solve problems, but to understand the lives of indigenous peoples and farmers, so I can be more efficient as a scientist in helping them,” she said. “I am an engineer learning to be a social scientist.”



Aerospace Engineering Alumnus Aims to Send Glider to Record 90,000 Feet

Ed Warnock

The Airbus Perlan 2 Glider waits to be shipped from a port in Long Beach, California, to Chile and then trucked over the Andes to Argentina's Patagonia region.

In 2017 the powerless aircraft will be lifted by tow plane from El Calafate at the foot of the Andes and released at 12,000 feet to surf powerful stratospheric mountain waves generated by the Antarctic polar vortex. Mountainous regions near the Earth's poles produce these massive stratospheric mountain waves, and some of the biggest occur over El Calafate.

When conditions are right, the glider is capable of reaching 90,000 feet in four to six hours. When it achieves this height, the Perlan 2 will become the highest-flying unpowered aircraft in history. Planes powered by jet engines have reached over 120,000 feet. That's the plan according to UA College of Engineering alumnus Ed Warnock (BS/AE 1968), CEO of the Perlan Project, a high-altitude research organization.

Perlan 2, which Warnock dubs a "spacecraft with wings," is small. It

Aiming High—Ed Warnock, front, and the Perlan crew exhibit their glider at the Experimental Aircraft Association AirVenture show in July 2015 at Wittman Regional Airport in Oshkosh, Wisconsin.

has a wingspan of 84 feet and weighs 1,800 pounds with two pilots and all equipment aboard. Made of extremely strong but lightweight carbon fiber, it can fly up to 400 mph on stratospheric mountain waves. Glider pilot Jim Payne, who holds several world soaring records, and a co-pilot will steer Perlan 2 on its audacious journey over Patagonia.

College's Civil Engineering Alumni at Helm of ASCE

The University of Arizona Department of Civil Engineering and Engineering Mechanics is celebrating the election of alumna Kristina Swallow as 2017 president-elect of the American Society of Civil Engineers, close on the heels of 2016 president Mark Woodson.

Mark Woodson, who earned his bachelor's degree in civil engineering and a master's in business administration from the UA in 1979 and 1985, respectively, is president and owner of Woodson Engineering & Surveying, based in Flagstaff, Arizona.

He will be succeeded by 2017 ASCE president Norma Jean Mattei, a graduate of



Kristina Swallow

Mark Woodson

Tulane University, at which point Swallow will become president-elect of ASCE, the nation's oldest professional organization for civil engineers with 150,000 members in 177 countries. She will serve as president for 2018.

Swallow, who received her UA bachelor's degree in civil engineering in 1994, will be the fourth woman elected president of the ASCE since its founding in 1852 and the first to succeed another woman in the position.

After college, Swallow spent 15 years in the private sector, working mostly in land development at several companies, including her own. In 2009 she joined the public sector to become transportation policy lead for Sen. Tom Udall, D-N.M., in Washington, D.C., where she worked on the Surface Transportation Reauthorization Act, MAP-21, among other bills. In 2012 she joined a team of engineers responsible for delivering public works projects and planning the sanitary sewer collection system for the city of Las Vegas.



Brian Jecker

Brian Jecker
BS/CE 1983

Jecker was recently promoted to associate vice president and business unit manager in the New Haven, Connecticut, office of Dewberry, a professional services firm. He has 30 years of experience in the design, construction, inspection and rehabilitation of bridges, culverts and other transportation-related structures, and is a registered professional engineer in Connecticut, Delaware, New Jersey and New York.

Carl Lehne
BS/EE 1958

Lehne moved to St. Louis after graduating and worked in military electronics during the 1960s, which involved extensive travel, including flying more than 100,000 miles a year. He became an executive for an urban developer that specialized in restoring entire neighborhoods and was involved in the historical rehabilitation of almost 3,000 homes. He tried retiring when he was 58 but a year later joined a

residential homebuilder as vice president. One of his projects was developing a golf course for investors. "Do not go into the golf course business unless you are very rich," he advised. He has traveled to all 50 states and beyond and is now really retired, playing his grand piano for other retirees. "I still get weepy when I see the big A," he said.

Kanth Krishnan
MS/IE 1986

Krishnan was recently recognized by Supply & Demand Chain Executive magazine. "It is truly an honor to be recognized by SDCE as a 'Pro to Know,'" said Krishnan, vice president of Intrigo Systems, a supply chain management company based in Fremont, California, where his customers have included Intel, Coca-Cola and Nvidia.

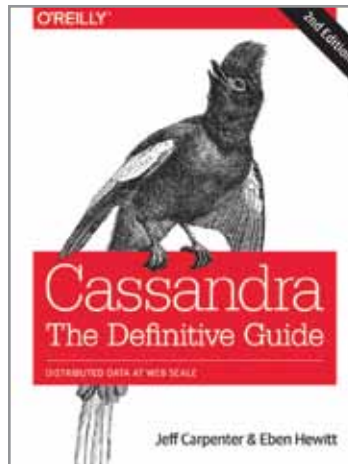
Jerry Corn
BS/CE 1983

Corn is a senior engineer in the Transmission Engineering Systems division of Southern California Edison in Pomona. He's interested in contacting fellow Wildcats on LinkedIn, and said: "The UA provided a quality education, which has served me well. It's a great school for engineers!"

Jeff Carpenter
BS/CE 1996

"I fondly remember my time at the UA, including the support given by my ECE adviser, Dr. Martinez, and studying artificial intelligence under Dr. Rozenblit," reminisced Carpenter on the 20th

anniversary of his graduation. After graduating he spent 17 years as a software developer and architect with Motorola and General Dynamics in Scottsdale, Arizona, supporting command and control systems for the U.S. military. His work with international customers included battle-planning and 3-D battlefield visualization systems. He is now a systems architect for a hotel chain replacing legacy systems with a cloud-based Cassandra database that will serve over 6,000 hotels worldwide, which he said put him in an ideal position to write the second edition of *Cassandra: The Definitive Guide*, published in 2016 by O'Reilly Media.



Walid Sabbagh
BS/EE 1999

Sabbagh moved to Irvine, California, after graduating and worked for companies such as Nortel, Sprint and AT&T. He is the CEO of ScriptoPro, a web-based learning management system and quiz-maker that allows educators and trainers to develop and deliver courses online and track and report on students' progress. Sabbagh



Walid Sabbagh

co-founded ScriptoPro with his partner Meena Singhal, a UA graduate (PhD/Second Language Acquisition and Teaching 1999) and former associate vice president at Long Beach City College's Pacific Coast campus.

Darrell Gillette
BS/AE 1987

Gillette is co-founder, president and CEO of DZYNE Technologies, which develops unmanned aircraft systems. Based in Tucson, Arizona, DZYNE was recently awarded a contract by the Defense Advanced Research Projects Agency to develop vanishing unmanned air vehicles for precise delivery of critical supplies. "The concept is to develop a glider that not only delivers 3 pounds of critical equipment over a distance of 150 km, but then disintegrates within hours after landing," said Mark Page, DZYNE vice president and chief scientist. Such a system could be used for emergency relief missions with no accumulation of parachutes and shipping materials, reducing environmental impact.

All Annual Gifts to the College Make a Difference



Gifts from alumni and friends of the College guide students toward success in their studies and careers and enable researchers to solve some of today's greatest challenges.

Incredible new systems are within reach, and with your help the students and faculty of UA Engineering can improve water access and quality, discover treatments for the most evasive cancers, track the 22,000 objects orbiting earth, establish vehicle-to-vehicle communication, and secure cyberspace.

Your annual gift builds our ability to attract and retain the most promising undergraduate and graduate students and esteemed faculty members who steer life-changing research. In the coming year, your philanthropic investment will help the College:

- Start an undergraduate **entrepreneurship** program and expand the honors experience.
- Give more than 600 students opportunities to hone their essential skills in leadership, communication and collaboration through participation in **student clubs**.

- Position our 14 degree programs to deepen out-of-classroom experiences such as **internships**, senior **design** projects, and meaningful roles in faculty **research**.
- Foster the growth of graduate students on their journeys to **academia** or government research **labs** and **industry** positions.

With respect for tradition and in anticipation of the next big discovery, the College of Engineering and its eight departments, with philanthropic partners like you, continue to connect students and faculty with opportunities that will influence society for generations to come.

For more information on making a year-end gift, please contact:

Margie Puerta Edson

Senior Director of Development
puertaedson@email.arizona.edu
520.626.0572 or 520.400.8022 (cell)

Mike McKelvey

Senior Director of Development
mikem1@email.arizona.edu
520.621.7685 or 503.828.5705 (cell)

Thank you!

CONNECT WITH UA ENGINEERING

It has never been easier to get all the latest news and information about the people and programs at UA Engineering.



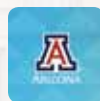
FACEBOOK
facebook.com/UACollegeofEngineering



YOUTUBE
youtube.com/user/uaeng



TWITTER
twitter.com/azengineering



EMAIL NEWSLETTER
news.engr.arizona.edu

The University of Arizona
College of Engineering
P.O. Box 210072
Tucson, AZ 85721-0072



Available Now.

UA College of Engineering Research Review

Arizona Engineering Research showcases the flagship projects in the UA College of Engineering's rich and diverse portfolio of critical interdisciplinary research.

Order your copy now at 520.621.2496. Preview at engineering.arizona.edu/research.



Have you been in the news recently?

Let us know if you've been getting some media attention. Just email the URL to us and we'll continue to spread the news via the College website and social media sites.



Calling all alumni!

Where has life taken you since graduation? We'd like to know and so would your College classmates. Please email us with details (about 300 words) and be sure to include the following information:

- Name and year you graduated
- Major
- Degree (BS, MS, PhD, etc.)
- Details of your activities

We'd also be interested to see – and share – pictures of your family, your latest project at work, or that boat or hot rod you just finished building in your garage. Vacation photos are great, too. We'll publish your news and photos online and in the next print edition.

Please send your email to news@engr.arizona.edu

Scan these tags with your mobile device for instant access to **Arizona Engineer Online**



Download the free Microsoft tag (left) reader from **gettag.mobi** to your mobile device and start reading *Arizona Engineer Online* on the go right now. Or download the QR code (right) reader app from your favorite app store.

You'll get instant access to the full range of multimedia – videos, photos, information, websites, reports, and more – available online.

▶▶▶ news.engr.arizona.edu