

# ARIZONA ENGINEER

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**azengineering**



Pete Brown/UA Engineering

**Top of the Pops**—Robotic Ordnance Neutralizer team members stand by their IED-detonating robot at UA Engineering Design Day 2015. From left are Cassie Kammerman, Greg Stanford, Jaime Lara Martinez, Elisa Duarte, Mark Roche and Jeremy Gin. The team won the \$1,000 Raytheon Sensintel Best Overall Design, First Prize.

## Design Day: More Students, More Projects, More Prizes

More than 400 students showed what they and their projects were made of as robots to protect troops and slides for medical samples took top honors at Engineering Design Day 2015.

A whirlwind of creativity, innovation and excitement marked the 13th Annual Engineering Design Day on the University of Arizona campus May 5 as 77 senior design teams competed for \$18,000 in prizes.

Top prizes for best overall design went to a robot protecting soldiers from “toe

poppers” and to a system for keeping biomedical samples on slides at a controlled temperature.

Some 45 sponsors from industry, academia and government supported the teams of seniors, who displayed their projects on the UA Mall and in the Student Union.

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## We are shaping whole new engineers – to tackle whole new challenges

Technical skills alone won't cut it. Engineering needs joy, trust, courage, openness and connectedness.

*"I really enjoyed this experience. I saw how proud all the engineers were and how happy they were. They were happy because they were on the top of a mountain that they've been climbing for four years. I cannot wait for this moment."*



The feelings expressed in this engineering sophomore's words about Senior Design Day (our biggest yet) speak volumes about the magnitude of the tasks we set for our students, and about how we prepare them for industry and graduate school.

This year's Design Day – involving 80 projects, 400-plus students, and more departments than ever before – was not the only peak reached this semester.

More than 200 guests attended our annual da Vinci Circle dinner, at which Ricardo Valerdi described how his Science of Sport program has connected almost 100,000 middle and high school students to STEM education.

We have worked on more than a dozen large research proposals in areas of national and global importance, including integration of energy, water and food systems; tracking and prediction of space objects in Earth orbit; and transportation systems that interconnect cars and road networks.

And three College faculty startup companies won UA awards for entrepreneurship.

The critical goal of making our students more workforce ready and relevant to society is paramount. New programs include the residence-hall-based Engineering Leadership Community, engineering classes with a significant entrepreneurship component, and a Collegewide leadership class.

Our pledge to undergraduates is that we guarantee they will have at least one internship or research experience during their four years, and we are investing staff resources to work with our industry partners to fulfill this pledge.

We are on the right track. I thank you for your help and support, and I look forward to seeing each of you in the future.

Have a great summer and Bear Down!

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Courtesy of SynCardia Systems Inc.

**Following Her Heart**—Michael Garippa, left, SynCardia Systems Inc. CEO and president, presents the 2014 Anna Salazar Memorial Engineering Scholarship for Women to Justine Bacchus, a UA biomedical engineering student in her junior year.

## BME Junior Wins SynCardia Scholarship

Biomedical engineering junior Justine Bacchus was awarded the 2014 Anna Salazar Memorial Engineering Scholarship for Women by SynCardia Systems Inc.

The scholarship was created in honor of Anna Salazar, a senior quality engineer who joined SynCardia in 2012 and made a lasting impression on her colleagues at the company before her death later that year at the age of 49.

In presenting the \$5,000 award to Bacchus, SynCardia CEO and president Michael Garippa said, “We hope that this scholarship will allow outstanding women engineering students to reach their academic and professional goals and, like Anna, contribute to society in astounding ways.”

Tucson is the international headquarters of SynCardia, which owns and manufactures the only total artificial heart in the world approved by the Food and Drug Administration, Health Canada and CE (European Union).

Bacchus learned of SynCardia while attending a biomedical engineering colloquium as a UA student.

“I thought it was really neat that synthetic hearts were manufactured in Tucson and are used around the world today,” she said. “I feel a sense of hometown pride in knowing this technology comes from Tucson.”

Bacchus, who has been fascinated with biomedical engineering since high school, said, “I considered many options for majors during my first few semesters in college, but my heart is truly with the medical side of engineering. I want to help people directly with their health.”



Laura-Ann Chin

## UA Alumna Named Young Chemical Engineer of the Year

Laura-Ann Chin, a 2010 College of Engineering alumna who credits the UA with sparking her passion and launching a rewarding career, was named the American Institute of Chemical Engineers Delaware Valley section’s 2015 Young Chemical Engineer of the Year.

“The UA has played a pivotal role in laying down a sound foundation when it comes to the technical training, people skills and extracurricular activities that have shaped my passion for my career in chemical engineering each day,” said Chin, a process engineer at Jacobs Engineering. “The UA has and always will be very close to my heart.”

Born in Malaysia and raised in Tucson, Chin was a College of Engineering ambassador, Honors College student, president of the UA Malaysian Student Organization and president of the UA chapter of the Society of Women Engineers.

While pursuing her bachelor’s degree in chemical engineering at the UA, she participated in several research projects on endocrine-disrupting compounds in wastewater and on the genetic stability of *E. coli*, and for her senior capstone design project she designed an automated zebrafish-tracking system.

“Laura-Ann always seemed to be involved with a hundred things, staying positive even when the workload seemed overwhelming,” said UA Distinguished Professor Paul Blowers of the chemical and environmental engineering department. “I’m not surprised to see that she is receiving this honor, since she never seemed to rest!”

Chin went on to earn a master’s degree in chemical engineering from Villanova University, where she conducted research on biomass conversion and biofuels and received the Outstanding Graduate Student Award. By the time she was 22, she had authored or co-authored articles published in five engineering journals.



Jill Goetz/UA College of Engineering

**Career Building**—UA alumnus Dylan Moriarty attended iExpo to recruit students for Sandia National Labs in Albuquerque, New Mexico, where he conducts research on energy efficiency. A Gates Millennium Scholarship allowed him to attend the UA, where he won a Centennial Achievement Award in 2011.

## 50 Employers Recruit at iExpo 2015

Fifty employers recruited students for engineering internships and full-time jobs at the 23rd Annual iExpo Industry Career Fair, held on the University of Arizona campus on February 16, 2015. Many of the 700-plus College of Engineering students attending scheduled interviews, some for the very same day, anticipating that job offers would follow.

Presented annually by the UA Engineering Student Council, iExpo is the state of Arizona's largest student-run career fair specifically for engineers.

Recruiters from Honeywell, Intel, American Express, Tucson Electric Power, United Health Group, Garmin International, BNSF Railway Company, and other major employers advertised hundreds of jobs around the United States and the world.

Kelly Maroney, a sophomore majoring in systems engineering, helped organize the program. "iExpo is really cool because it is totally student-run," she said. "We organize it completely on our own. Every company was brought here by us."

Dozens of recruiters were UA College of Engineering alumni who returned to campus from across the United States.

Honeywell, one of the largest employers of UA Engineering students and graduates, sent three alumni to iExpo to recruit for 30 internships and full-time positions nationally and overseas.

"Year after year, UA students are recognized within Honeywell as highly motivated and enthusiastic employees bringing fresh ideas to the workplace," said Julie Riccitello, who earned her bachelor's degree in systems engineering in 1986 and works in strategic product development at the company's Phoenix and Tucson offices, where several UA alumni from the class of 2014 are now working.



Courtesy of Gwen Woods

**Giving Peace a Chance**—Peace Corps volunteer and environmental engineering student Gwen Woods (right) stands with some Vanuatu residents.

## Returning Peace Corps Workers Are Doing a World of Engineering Good

Most students choose UA Engineering because it will help them make positive changes in people's lives. Graduate students returning from Peace Corps assignments are some of the most committed to public service.

"The University of Arizona, and particularly the environmental engineering program, has been very fortunate in attracting a number of exceptional returning Peace Corps volunteers," said Wendell Ela, professor of chemical and environmental engineering. "Only certain types of people will consider allocating two years of their young lives to a Peace Corps assignment. It requires a vision much bigger than oneself, tolerance, acceptance of uncertainty and willingness to give up short-term gain for long-term achievement."

The University of Arizona hosts the second-largest academic fellows program for returned Peace Corps volunteers in the United States, after the University of Denver.

Gwendolyn Woods earned her master's in environmental engineering at the UA and is pursuing her doctoral degree. She served in the Peace Corps from 2006 to 2008, teaching vocational and health care skills in the Republic of Vanuatu, a nation of some 80 islands in the Pacific Ocean.

Most Peace Corps workers live independently and are assigned a local host family to introduce them to residents and help them feel at home. But Woods' host family took that responsibility a step further. "My host family insisted I stay with them," Woods said. "Living with my host family provided many opportunities for cultural exchange and discussion on topics ranging from traditional cooking methods to the electoral process."

# Solar-Powered Ingenuity

The scene was sizzling on the UA Mall Oct. 21, when 450 freshmen positioned 100 hand-crafted solar ovens with foil reflectors and hunkered down to catch the sun's rays.

But the Solar Oven Throw Down, now in its fifth year, wasn't about getting a tan. It was the centerpiece of the College of Engineering's introductory course, ENGR 102, a dazzling display of first-year students' mathematical modeling, engineering design and teamwork skills.

Their main challenge was to design an oven, build it as designed, then compare its performance – particularly the temperature it would reach – against that predicted using their mathematical model.

While building the solar ovens is challenging and fun, it is the modeling that is the most important part of the solar oven project, said Kathie Melde, ECE professor and ENGR 102 instructor. "The idea of the solar oven project is for students to experience how engineers create models, test assumptions, review what worked and what didn't, and then improve," Melde said. "Engineers must do a lot of modeling, or simulation, and we want to be sure students can understand and apply modeling techniques."

One of the instructors, Kasi Kiehlbaugh, put a new twist on the solar oven project by getting students to perform a water pasteurization test using a water pasteurization indicator and small jar of water. "One of the main needs in developing countries is access to safe drinking water," she said. "As my students learned firsthand, boiling is not necessary for pasteurization. A lot of fuel is wasted in bringing water to a boil unnecessarily."



Pete Brown/UA College of Engineering

**Double Oven**—Identical twins and ENGR 102 students Rodrigo (left) and Gerardo Valenzuela show their solar oven at the 2014 Solar Oven Throw Down.

For the third consecutive year, the Solar Oven Throw Down was sponsored by technology company W.L. Gore & Associates. Representatives from Gore's medical products division in Phoenix attended the event to talk shop with students and select a winner for Gore's All-in-the-Same-Boat Award, recognizing outstanding teamwork. This year's winner was "US-Be-Engineers."

## ECE Honor Society Wins International Award

Iota Xi, the UA student chapter of the Institute of Electrical and Electronics Engineers-Eta Kappa Nu honor society, or IEEE-HKN, has received the organization's Outstanding Chapter Award.

The UA was selected from more than 180 active chapters around the globe for its programs and activities to foster student success and provide outreach.

"Iota Xi is an extremely active chapter, and the IEEE-HKN board of governors was impressed by several of the programs we described in our annual report," said Megan Pritchard, chapter vice president and ECE junior.



Courtesy Iota Xi

**With Honors**—From left: Students Megan Pritchard, Greg DePaul and Jake Rockland at their induction into Iota Xi, the UA student chapter of the IEEE-Eta Kappa Nu.

They include research tech talks, in which the chapter brought in speakers from industry to speak to UA students on campus;

establishment of a Student Excellence Award program to honor outstanding ECE undergraduates; and demonstrations of electricity and electromagnetism for children at the Wheeler Taft Abbett Sr. Public Library in Tucson.

This marks the fourth time the UA chapter has received the Outstanding Chapter Award since it was established in 1933, and the first time in more than 20 years.

- Six current members of the College of Engineering faculty have been named IEEE fellows for extraordinary accomplishments in the profession. The IEEE is the world's largest professional association for the advancement of technology, with more than 395,000 members in 160 countries.



### **Erdogan Madenci / ASME Fellow**

Professor Erdogan Madenci of the department of aerospace and mechanical engineering has been named a fellow of the American Society of Mechanical Engineers, or ASME, the highest level of distinction for members.

He was one of 144 ASME fellows chosen in 2014 and joins an elite group of just 3,305 ASME fellows in an organization with more than 140,000 members. Fellows are nominated by their peers for outstanding contributions to engineering and approved by the ASME board of governors. Madenci is the fourth ASME fellow at the University of Arizona.

A member of the UA faculty since 1989, Madenci has conducted research in areas such as structural dynamics, fracture mechanics,



### **Ricardo Valerdi / UK RAE Fellow**

Ricardo Valerdi, associate professor of systems and industrial engineering, is a 2014-2015 Distinguished Visiting Fellow of the United Kingdom's Royal Academy of Engineering. He is the first researcher from the UA to receive the fellowship.

"This is a tremendous honor in recognition of Ricardo Valerdi's expertise and scholarship," said UA College of Engineering Dean Jeff Goldberg. "We are extremely proud of him."

The U.K.'s engineering academy provides funding to engineering departments at British universities to host international experts, strengthen engineering education and capability, and promote international research collaborations. Between 50 and 60 researchers around the world receive the honor each year.



### **Shane Snyder / EPA Adviser**

Professor of chemical and environmental engineering Shane Snyder is serving a three-year term on the Safe and Sustainable Water Resources Subcommittee of the U.S. Environmental Protection Agency's Board of Scientific Counselors.

Snyder joined the UA College of Engineering in 2010. He holds joint appointments in the department of soil, water and environmental science and the Mel and Enid Zuckerman College of Public Health and co-directs the University's Laboratory for Emerging Contaminants and the Water and Energy Sustainable Technology, or WEST, facility.

"Dr. Snyder's expertise in the measurement and quantification of human health and ecosystem vulnerability to chemicals and

failure analysis, and buckling of aerospace structures. In recent years, his research has focused on the emerging field of peridynamics, a theoretical framework for modeling material fracture and failure that can be more accurate than other computational methods.

Madenci is leading a \$7.5 million multidisciplinary university research project funded by the Air Force Office of Scientific Research. He and his colleagues are applying peridynamic theory to predict failure in microchips and other electronics components for aircraft and submarines under harsh environmental and loading conditions. The goal is to identify ways to design and build stronger and safer components.

Valerdi's Distinguished Visiting Fellowship is being hosted by Linda Newnes, who heads the cost estimation program in the mechanical engineering department at the University of Bath. She has collaborated on several projects with Valerdi and serves on the editorial board of the *Journal of Cost Analysis and Parametrics*, of which Valerdi is editor-in-chief.

During his trip Valerdi discussed his theories and research at a costing workshop for engineers and others from the British defense ministry; military and civil manufacturing and other service suppliers, including Rolls-Royce Submarines, British Aerospace and BAE Systems; and the National Grid gas and electricity company.

pathogens, as well as his research interests in identification, fate and health relevance of emerging water pollutants, will assist the EPA Office of Water in addressing their programmatic challenges," said environmental scientist Cindy Roberts, the subcommittee's designated federal official.

Snyder also serves on the Drinking Water Committee of the EPA's Science Advisory Board and the Drinking Water Advisory Group and Water Reuse Guideline Development Expert Panel of the World Health Organization. He was a member of the National Academy of Sciences' National Research Council Committee on Water Reuse and has testified three times before the U.S. Congress on water quality issues.

## Art Gmitro / *New Head of BME*

Arthur F. Gmitro, a professor and researcher in the UA colleges of medicine and optical sciences, is the new chair of BME. He succeeds associate professor and interim department head Urs Utzinger.



"The appointment of Art Gmitro as head of BME reflects the University's growing recognition of biomedical engineering's increasing importance to effective health care," said College of Engineering Dean Jeff Goldberg.

Gmitro has been director of the Biomedical Imaging and Spectroscopy Training Grant Program and co-director of the Cancer Imaging Program in the UA Cancer Center, where he became the Fenton Maynard Endowed Chair in Cancer Imaging in 2009. He is a fellow of the American Institute for Medical and Biological Engineering.

"As a young department and a relatively young discipline, BME offers opportunities for innovations not only in the curriculum but in teaching strategies," said Gmitro. "I thoroughly enjoy interacting with and learning from my students, and I will strive to hire new faculty who view teaching not only as a major commitment, but also as something they enjoy and want to do well."

## John Kemeny / *New Head of MGE*

John Kemeny, a longtime MGE faculty member, is now chair of the department.



Kemeny's goals for the department include building the curriculum and expanding cross-disciplinary and cross-cultural research initiatives, to increase opportunities for students and faculty and to tackle the global problems of sustainable resource use.

He succeeds Mary Poulton, who chaired the MGE department for 14 years and is director of the UA Lowell Institute for Mineral Resources.

His plans include a new master's degree in tunneling, a multidisciplinary research center in geomechanics, and expanded online and distance-learning offerings, all in collaboration with other UA departments, such as civil engineering and engineering mechanics, chemical and environmental engineering, systems and industrial engineering, and geosciences.

"The focus of this department should always be mining engineering, where we have a long history and many strengths and collaborations," Kemeny said. "But our College stands to gain much by pursuing new directions in teaching and research."

## Design Day: More Students, More Projects, More Prizes

Attendees included 90 judges from sponsoring organizations; UA faculty; several groups of middle-school students from the Tucson Unified School District;



David Hostetler/UA College of Engineering

**Drone Fan**—Aerospace engineering student Steven Rishor (left) describes the Sabino Canyon UAV to UA President Ann Weaver Hart at Design Day 2015.

and participating seniors' family members and friends, many from out of state.

"I was so pleased to be able to get a glimpse of the talent that UA Engineering students have at Design Day," said University of Arizona President Ann Weaver Hart, who visited the projects exhibited on the UA Mall. "The event is a wonderful example of the way that UA Engineering students apply what they have learned in a realistic setting. Through opportunities to interact with industry, community organizations, and K-12 students, this day and the work leading up to it help to fulfill the University of Arizona's commitments to 100 percent student engagement and partnership."

### Protecting Troops on Patrol

First prize for overall best design, sponsored by Raytheon Sensintel, went to the team that created the Robotic Ordnance Neutralizer, or RON, sponsored by Raytheon Missile Systems. The robot triggers small, hard-to-find improvised explosive devices – known as "toe-poppers" for their low explosive



Pete Brown/UA College of Engineering

**In Tents Competition**—Some of the Design Day projects were too big or noisy to house inside the Student Union ballroom, so an outdoor display area was set up on the UA Mall in front of Old Main.

charge – in the paths of troops on patrol. The unmanned ground vehicle system is designed to detonate hidden IEDs by applying a certain pressure to the ground as it moves along ahead of military

## Design Day Prizes & Winners

**Raytheon Sensintel Best Overall Design, First Prize • \$1,000**  
*Robotic ordnance neutralizer (RON)*

**Design team:** Elisa Duarte, Jeremy Gin, Cassie Kammerman, Mark Roche, Greg Stanford, Jaime Lara Martinez

**Project sponsor:** Raytheon Missile Systems

**Raytheon Sensintel Best Overall Design, Second Prize • \$750**  
*Super-stainer precision thermal control*

**Design team:** Marissa Lopez-Pier, Amy Vaughn, Ziad Alrayes, Cody Kalmick, Koriel Lambson, Chris Sanford

**Project sponsor:** Ventana Medical Systems

**Bly Family Innovation in Energy Production, Supply or Use, First Prize • \$1,500**

*Building a smarter grid*

**Design team:** Jacob Chess, Peter Lankisch, Viviana Llano, Daniel McLeod, Alex Moser, Eric Sahr

**Project sponsor:** Tucson Electric Power

**Bly Family Innovation in Energy Production, Supply or Use, Second Prize • \$500**

*Dynamic soaring of UAVs*

**Design team:** Katherine Borg, Elizabeth Yakoob, Brent Reichert, Aaron Woodard

**Project sponsor:** UA department of aerospace and mechanical engineering

**Thorlabs Photonics Is the Future • \$1,500**

*Automated optical surface defect detection tool*

**Design team:** Shabeeb Shah, Benjamin Cromey, Lisa Li, Nicholas Smith, Rafael Haro, Michael McDermott

**Project sponsor:** Edmund Optics

**Rincon Research Best Presentation • \$1,000**

*Electromechanical shaft disconnect for generators*

**Design team:** Jose Luttmann, Isaiah Bruno, Michel Mora, Ivy Hasman

**Project sponsor:** Honeywell

**Texas Instruments Analog Design Contest • \$1,000**

*Strain gauge based cycling power meter*

**Design team:** Tasia Nash, Vincent Carknard, Adam Osman, Vincent Hunt, Cameron Clementson

**Project sponsor:** Texas Instruments

**Ventana Innovation in Engineering • \$1,000**

*Sabino Canyon VTOL UAV*

**Design team:** Rita Ezeugwu, Nestor Franco, Nicollet Herve, Youra Jun, Sean Parker, Steven Rishor, Yiming Zhang

**Project sponsor:** Rincon Research Corp.

**ACSS/L-3 Communications Most Robust Systems Engineering • \$750**

*Boeing teammate awareness device*

**Design team:** Amanda Coldren, Vincent Cordasco, Anthony Giang, David Schwartz, Xue Meng, Matthew Ware

**Project sponsor:** Boeing Mesa Helicopter Company

**CAID Industries Innovation in Manufacturing • \$750**

*X-56A DART: Dynamically scaled aircraft for research and testing*

**Design team:** Phillip Greenberg, Brianna Grembowski, Harry Powell, Rosanna Bether, Kristofer Drozd

**Project sponsors:** NASA, Lockheed-Martin, Air Force Office of Scientific Research

**Edmund Optics Perseverance and Recovery • \$750**

*Advanced farrier system*

**Design team:** Lindsay Bahureksa, Lindsey Conklin, Matt Ellison, Jacob Landsiedel, Quinn McIntosh, Jovan Vance

**Project sponsor:** Brethren Systems

**W.L. Gore and Associates Most Creative Solution • \$750**

*Variable-pitch propeller for UAVs*

**Design team:** Kym Beeston, Grant Province, Zane Sheets, Zach Spaulding, Chris Van Cleave, Jeff Williams

**Project sponsor:** Northrop Grumman

**PADT Best Use of Prototyping • \$750**

*Delivery of an endovascular device for a bifurcating vascular anatomy*

**Design team:** Andrea Acuna, Carmelo Moraila, Marysol Luna, Matthew Davis, Matthew Kirk, Sean Ashley

**Project sponsor:** UA Soft Tissue Biomechanics Lab

**Raytheon Best Engineering Analysis • \$750**

*Wireless flow sensor for cerebrospinal fluid shunts*

**Design team:** Brianna Moon, Han Zhao, Jessica Mergener, LaRay Graner, Lyndsay Batman, Megan Cornman

**Project sponsor:** Texas Instruments

**Sargent Aerospace & Defense Voltaire Design • \$750**

*Advanced farrier system*

**Design team:** Lindsay Bahureksa, Lindsey Conklin, Matt





control. Team members from biomedical, industrial, mechanical and electrical engineering developed a system for Ventana that can hold a standard-size microscope slide and maintain its temperature to precise specifications.

Other big winners included a drone to monitor transmission lines for Tucson Electric Power, a system to diagnose equine health by monitoring hoof condition, and hologram-based headgear for pilots to safely land aircraft at zero visibility.

More than 6,000 people from several countries tuned in to Facebook throughout the day to follow the action live and cheer on their teams.

College of Engineering Dean Jeff Goldberg expressed admiration for the students' perseverance and fortitude, and gratitude to the sponsoring organizations, judges, faculty and other mentors and staff who made the event possible.

"In nine months, it's not so easy to get something fully functional that can be put into use," he said. Noting that the cost

personnel. "This award means the world to me, because I know all the work that went into it and all the roadblocks we faced," said RON team member and systems engineering student Elisa Duarte, who is spending this summer at her second internship with Raytheon.

Second prize for overall design went to the super-stainer precision thermal



Pete Brown/UA College of Engineering

**Green Machine**—Biosystems engineering student Elizabeth De Vogelaere sets up her team's senior design project: an evaporator that dries and solidifies algae.

of the projects this year was half a million dollars, he thanked the judges, company sponsors, faculty and staff, adding, "Without you, we would not be able to do something of this magnitude."

Ellison, Jacob Landsiedel, Quinn McIntosh, Jovan Vance  
**Project sponsor:** Brethren Systems

**Technical Documentation Consultants of Arizona Best Design Documentation • \$750**

*Remote imaging system acquisition (RISA) project*

**Design team:** Luis Ballesteros, Nicole Sheesley, Braden Smith, Joseph Tang, Yusuke Watanabe

**Project sponsor:** NASA Johnson Space Center

**TRAX International Best Implementation of Agile Methodology • \$750**

*Design of multistory historical LEED building*

**Design team:** Mireya Moleres, Joel Amarillas, Haley Koesters, Nawar Sadeq, Gabriela Brambila, Blake Brennan

**Project sponsor:** UA department of civil engineering and engineering mechanics

**Arizona Center for Innovation Most Marketable Design • \$500**

*Smartphone integrated gun lock*

**Design team:** Ariel Austin, Aaron Clark, Christopher Downs, Edward Enhelder, Aaron Grabowska, Simon Noudelman

**Project sponsor:** Christopher J. Downs & Associates

**Dataforth Corporation Best Design Using a Data Acquisition and Control System • \$500**

*A method for the morphing actuation of continuous control surfaces*

**Design team:** Austin Smith, Ruben Adkins, Josef Merki, Zachary Miller, David Springer, Wen Quan Tan

**Project sponsor:** UA Student Chapter of American Institute of Aeronautics and Astronautics

**Honeywell Team Leadership 1 • \$250**

*Delivery of an endovascular device for a bifurcating vascular anatomy*

**Design team:** Andrea Acuna (winner), Carmelo Moraila, Marysol Luna, Matthew Davis, Matthew Kirk, Sean Ashley

**Project sponsor:** UA Soft Tissue Biomechanics Lab

**Honeywell Team Leadership 2 • \$250**

*Design and demonstration of a head-up display*

**Design team:** Erick Leon (winner), Adam Blumer, Matthew Hart, Michael Green, Nick Paco, Stephania Vasilieva

**Project sponsor:** Honeywell Aerospace

**II-VI Optical Systems Best Use of Optical Design and Technology • \$500**

*Design and demonstration of a head-up display*

**Design team:** Adam Blumer, Erick Leon, Matthew Hart, Michael Green, Nick Paco, Stephania Vasilieva

**Project sponsor:** Honeywell Aerospace

**Latitude Engineering Best Physical Implementation of Analytically Driven Design • \$500**

*Composite autotransformer thermal improvement*

**Design team:** Ji Ma, Michael McCabe, John McKearney, Zachary Prince, Erik Wise

**Project sponsor:** Honeywell Aerospace

**Universal Avionics Best Integration and Test Philosophy • \$500**  
*Air quality sensor system*

**Design team:** Rodrigo Toler, Mary Coffelt, Wellington Lee, Toshifumi Tanabe, Edward Baumann

**Project sponsor:** Honeywell Aerospace

**UA Center on Aging: Arizona Center on Geriatrics • \$500**

*Android platform hearing assist device refinement and form factor @ usability assessment*

**Design team:** Temesgen Fesahazion, Richard Gonzales, Alexandra Hoeger, Saradadevi

Thanikachalam, Jill Wynne, Jue Zhang, Michael Ziccarelli

**Project sponsor:** Arizona Center on Aging

**Honeywell Excellence in Aerospace Electronic System Design • \$400**

*Design and demonstration of a head-up display*

**Design team:** Adam Blumer, Erick Leon, Matthew Hart, Michael Green, Nick Paco, Stephania Vasilieva

**Project sponsor:** Honeywell Aerospace

**Kristy Pearson Fish Out of Water, First Prize • \$250**

*Composite autotransformer thermal improvement*

**Design team:** John McKearney (winner), Ji Ma, Michael McCabe, Zachary Prince, Erik Wise

**Project sponsor:** Honeywell Aerospace

**Kristy Pearson Fish Out of Water, Second Prize • \$150**

*Air quality sensor system*

**Design team:** Mary Coffelt (winner), Rodrigo Toler, Wellington Lee, Toshifumi Tanabe, Edward Baumann

**Project sponsor:** Honeywell Aerospace

## Probing the Amazing Powers of Graphene



**Qing Hao**

Qing Hao, an assistant professor of aerospace and mechanical engineering, has received a Young Investigator Award from the Air Force Office of Scientific Research

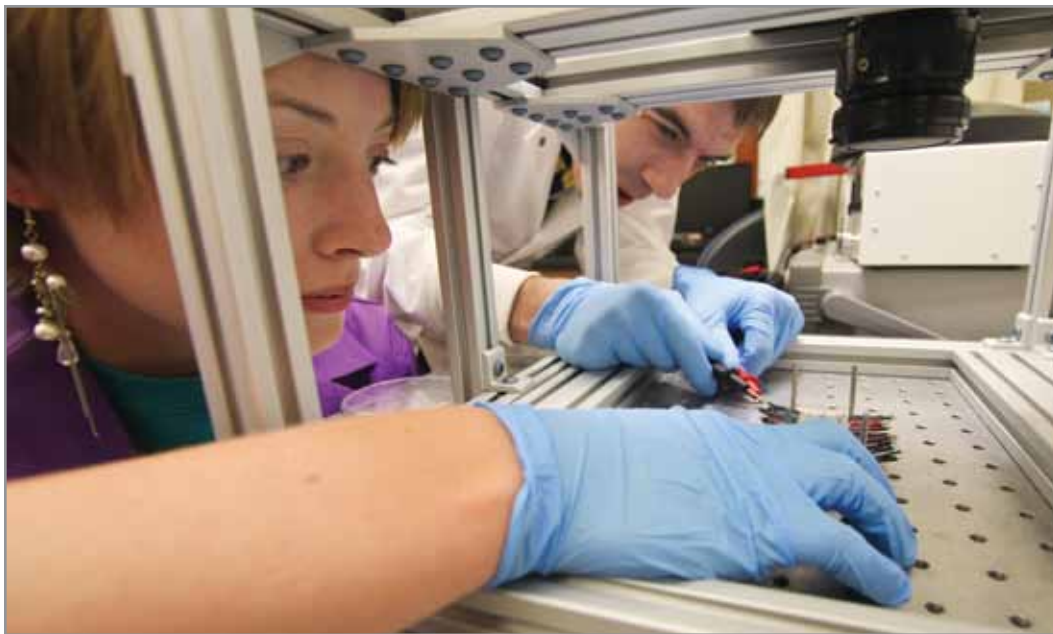
to probe graphene's amazing abilities. Through AFOSR's complex materials and devices program, he will receive \$360,569 over three years for his project, titled "Transport Property Studies of Structurally Modified Graphene."

"This project reaches beyond existing work with pure graphene and attempts to understand how its transport properties, such as its thermal and electrical conductivities, can be altered by manipulating graphene's atomic or nano-sized patterns," said Hao, director of the Nano-Electronics and Advanced Materials Research Lab.

"This will be crucial for developing the material for future applications, including electronic and optoelectronic devices, magnetics, spintronics and waveguides."

Hao, who obtained the pure graphene from Krishna Muralidharan in the UA department of materials science and engineering, joins researchers around the world in a race to create new forms of graphene, which could result in faster computer chips and longer-lasting batteries as well as super-strong lightweight plastics that conduct electricity and heat better than copper.

Such materials may lead to flexible touch screens for mobile phones, faster broadband, longer-lasting food packaging, more efficient solar panels and wind turbines, and lighter airplanes and satellites.



Pete Brown/UA College of Engineering

**Healing Hands**—Members of Pak Kin Wong's student research group – Stephanie Wellington, left, a freshman studying veterinary science and biomedical engineering, and PhD candidate Zachary Dean – work on a microfluidic device to manipulate cells.

## Research Team Led by Engineering Faculty Unlocks the Mysteries of Wound Healing

Researchers at the UA, led by Pak Kin Wong, associate professor of aerospace and mechanical engineering, have discovered what causes and regulates collective cell migration, one of the most universal but least understood biological processes in all living organisms.

The findings, published recently in *Nature Communications*, shed light on the mechanisms of cell migration, particularly in the wound-healing process. The results represent a major advancement for regenerative medicine, in which biomedical engineers and other researchers manipulate cells' form and function to create new tissues, and even organs, to repair, restore or replace those damaged by injury or disease.

"The results significantly increase our understanding of how tissue regeneration is regulated, and advance our ability to guide these processes," said Wong.

"In recent years, researchers have gained a better understanding of the molecular

machinery of cell migration, but not what directs it to happen in the first place," he said. "What, exactly, is orchestrating this system common to all living organisms?"

The answer, it turns out, involves delicate interactions between biomechanical stress, or force, which living cells exert on one another, and genetic signaling.

The same migration processes for wound healing and tissue development also apply to cancer spreading, the researchers noted. The combination of mechanical force and genetic signaling stimulates cancer cells to collectively migrate and invade healthy tissue.

With this new knowledge, researchers can re-create, at the cellular and molecular levels, the chain of events that brings about the formation of human tissue. Bioengineers now have the information they need to direct normal cells to heal damaged tissue, or prevent cancer cells from invading healthy tissue.

## Turning Smartphones into Eye-Screening Tools

Researchers at the UA are developing technology to convert smartphones into powerful eye-examining instruments that could prevent millions from going blind.

Wolfgang Fink, professor of electrical and computer engineering and biomedical engineering, is principal investigator on a new NSF-funded project to create “smart ophthalmoscopes,” specialized instruments for examining the eye’s interior. The devices, which can be attached to any smartphone, and accompanying software will enable health care providers, particularly in remote areas, to quickly and easily determine if patients are at risk of losing their vision.

“Our hand-held ophthalmoscopes will permit eye exams in places they would otherwise be impossible,” said Fink.

Fink said they would be comparable to typical eye exam equipment used in an eye doctor’s office, yet they would be affordable, highly portable and mobile, and easy to use.

“All that’s needed is a person on a bicycle with a smart ophthalmoscope. They can visit and examine clients of any age, in any language – anywhere, any



Pete Brown/UA College of Engineering

**Eye Phone**—Biomedical engineering senior Jerri-Lynn Kincade gets an eye test by Wolfgang Fink using a smartphone hooked up to an ophthalmoscope. Kincade is a Black Alumni Scholar and vice president of the UA chapter of the National Society of Black Engineers, which Fink advises.

time. No trucks, heavy equipment or extensive training required. I believe this portable vision-screening capability will revolutionize the availability and economy of rural health care, and the field of ophthalmology at large.”

Using the ophthalmoscope is easy: The user – who might be a health care provider, aid worker, nurse, paramedic or caregiver – attaches the ophthalmoscope to a smartphone, points it at the eye and takes a picture. Then the user runs a custom app on the smartphone that

relays these images to a remote “expert system” – which uses intelligent software to suggest diagnoses much like a human medical expert – for processing and analysis. In seconds, the results are relayed back to the user and displayed on the smartphone’s screen.

A single health care provider could conduct as many as 100 initial assessments in one day and immediately put patients on the fast track to accurate diagnosis and treatment for potentially vision-robbing ailments.

## Metamaterials Research Brings Invisibility Closer

Hao Xin, professor of electrical and computer engineering, has made a discovery with metamaterials that may take engineers one step closer to building microscopes with superlenses that see molecular-level details, or shields that conceal military airplanes and even people.

Xin reported his findings with co-authors in an article titled “Microwave Gain Medium with Negative Refractive Index,” published in the online journal *Nature Communications*.

Xin uses a 3-D printer to make metamaterials from metals, plastics and other substances, which are configured in precise geometrical patterns to bend waves of energy in unnatural ways. In particular, they exhibit a property called negative refraction, meaning they can bend a wave backwards.



Hao Xin

In a more futuristic scenario, a someone looking at a person wearing a cloak with artificially designed refraction properties would see part or none of the person, depending on the cloak’s refractive index distribution and whether the light bouncing off of it reached the viewer’s eye.

Metamaterials with negative refraction have presented a vexing physics problem for engineers: They reduce the strength of the wave. “One of the biggest problems with metamaterials is that they produce energy loss,” Xin said. “The waves decay as they pass through the artificial material. We have designed a metamaterial that retains negative refraction but does not diminish energy.”



**Bob Rieger**

## New Tech/Business Degree Focuses on Sustainability

The UA College of Engineering has a new master's degree to help engineers and companies bridge the gap between product conceptualization and commercialization and get products to market quickly.

"To be first to market with new products in today's world, you need to move fast," said Bob Rieger, associate director of the Master of Engineering in Innovation, Sustainability and Entrepreneurship, or ME-ISE, program. "This means you do not have the luxury of exploring every innovation and conducting every test imaginable before deciding if there's a chance of commercial success – you need skills and techniques, both technical and business-oriented, to accelerate the process."

The master's program, which will be offered starting in fall 2015, is geared to professionals working in industry or starting their own companies. Students will take an equal number of credit hours in engineering and business, with traditional and online options available for most classes. All classes are expected to have online options within 18 months.

ME-ISE business courses cover intellectual property and regulatory law, finance, fundraising, decision-making, and sales and marketing.

## UA Joins NAE-Backed National Engineering Education Initiative

The University of Arizona is among more than 120 U.S. engineering schools leading a transformative movement in engineering education announced March 23 at the White House.

In a letter presented to President Barack Obama, the UA and other signatory institutions committed to establish special educational programs designed to prepare undergraduates to solve "Grand Challenges" – complex yet achievable goals defined by the National Academy of Engineering to improve national and international health, security, sustainability and quality of life in the 21st century. Together, the schools plan to graduate more than 20,000 formally recognized "Grand Challenge Engineers" over the next decade.

"The NAE Grand Challenges outline a framework of critical societal problems



Pete Souza/Official White House Photo

**Grand Challengers**—President Barack Obama (left) greets NAE President C. D. Mote Jr., during the 2015 White House Science Fair, in the Map Room of the White House.

for which engineering ideas provide solutions," said Jeff Goldberg, dean of the UA College of Engineering. "The College of Engineering is in the business of creating leaders," Goldberg added. "These leaders need to be strong in design and technical ideas, of course, but success at this scale requires skills in communication, leadership, teamwork, trust, delegation, and intuition, and our programs are designed to endow our students with these skills."

## UA Graduate Engineering Programs Among the Best in the Nation

The UA's graduate engineering programs are ranked among the top 50 nationwide in *U.S. News & World Report's* 2016 edition of "Best Graduate Schools," released March 10, 2015.

The UA is ranked 49th out of 195 reporting schools, a climb of six places since last year.

In the College of Engineering, graduate student enrollment, including full-time and part-time students, rose from 653 in 2013 to 723 in 2014. The numbers of doctoral and master's degrees awarded in the



College have also increased. The College granted 53 PhDs in 2014, reflecting a steady annual increase since 2010, and 122 MS degrees in 2014, a 16 percent increase from the previous year.

Average research expenditure per College faculty member rose from \$232,000 in 2013 to

\$247,800 in 2014. College research spending rose more than \$1 million, from \$27.4 million in 2013 to \$28.5 million in 2014.

"The across-the-board excellence of the University of Arizona is reflected in the U.S. News graduate school rankings," said UA President Ann Weaver Hart. "Our Never Settle strategic plan has brought greater focus to our efforts at a time of enormous funding challenges. Without question, our faculty have been more resourceful than ever at preparing students for the future."

**Wolfgang Fink**

## Wolfgang Fink Named 2015 da Vinci Fellow

Like many men of science, Wolfgang Fink works in diverse disciplines and enjoys eclectic avocations. He's a physicist, an engineer, an educator, an inventor, a licensed helicopter pilot and a classically trained pianist. You might call him a Renaissance man.

Fink, associate professor of electrical and computer engineering and biomedical engineering and inaugural Edward & Maria Keonjian Endowed Chair at the UA College of Engineering, has been recognized as the da Vinci Fellow for 2015 – a major College of Engineering honor named for the ultimate Renaissance man.

Each year, the College selects one member of the Engineering faculty as a da Vinci Fellow in recognition of excellence in teaching or research excellence. The award includes a one-time grant of \$10,000, which Fink says he will convert into student research scholarships.

"I am very humbled to be named da Vinci Fellow for 2015," said Fink, who holds joint appointments in the UA departments of systems and industrial engineering, aerospace and mechanical engineering and ophthalmology and vision science. "This award will enable me to pursue bold new ideas that might be considered speculative by funding agencies or are beyond their purview."

"Through his pioneering work on artificial vision technologies, Wolfgang Fink is taking College and University research initiatives in exciting directions with profound implications for human health," said Arthur F. Gmitro, the new head of the department of biomedical engineering. "I know Wolfgang to be a committed mentor to students both inside the classroom and out. He is richly deserving of the da Vinci Fellowship, and I look forward to working with him in the department."

**Deans Dick Swalin (left) and Richard Gallagher (circa 1985)**

## Visionary Academic Leader Saw Future Direction for College

In the history of the UA College of Engineering, Swalin stands astride two very different centuries. He was appointed dean of the UA College of Mines in 1985 as the UA looked back on its first 100 years and pondered its next 100: "Between two worlds, one dead, one struggling to be born," as James P. McCormick paraphrased in his centennial history of UA Engineering, *Rah for the Engineers! A Century of Change*.

Swalin proved more than equal to the task of guiding UA Engineering into its second century. He successfully reunited the College of Engineering and the College of Mines, and in his contribution to McCormick's book he identified nascent technologies that would come to form major planks of the College of Engineering's research portfolio 40 years later: microelectronics, artificial intelligence, superceramics, advanced manufacturing, and biotechnology.

"Society will benefit greatly by such developments," Swalin wrote. "With continued investment, Arizona will be in a good position to attract and develop these new high technology industries."

"Dick Swalin was an individual of warm humanity and great accomplishment," said Don Uhlmann, UA professor of materials science and engineering. "Among his many attractive characteristics were his keen intelligence, the breadth of his knowledge and interests in matters both technical and nontechnical, his ability to get to the heart of matters even through a fog of detritus, the sagacity of his counsel, ... and his devotion as a husband and father."

Swalin loved dogs, the outdoors, sailing and fishing. He was an avid skier, and was inducted into the Million Mile Club in Jackson Hole, Wyoming. He was also a member of the Minneapolis Club and Phi Delta Theta.



Contact the da Vinci Circle at  
520.621.8051 • ariasc@email.arizona.edu

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### Farrell Landrum Kenimer BS/ME 1963

Last year a short article on this page described how retired Air Force missile combat crew commander Farrell Kenimer was getting involved in community affairs in Phoenix. He has now expanded his neighborhood role to include mentoring young children. With the help of Shaw Butte School, he established Hats for Tots, which served the dual purpose of introducing neighborhood children to local law enforcement while volunteers crocheted hats for about 50 children aged 3 to 5. "I'm also working to obtain resources for school gardening projects," Kenimer said. "And I'm a Duet volunteer to help the homebound."



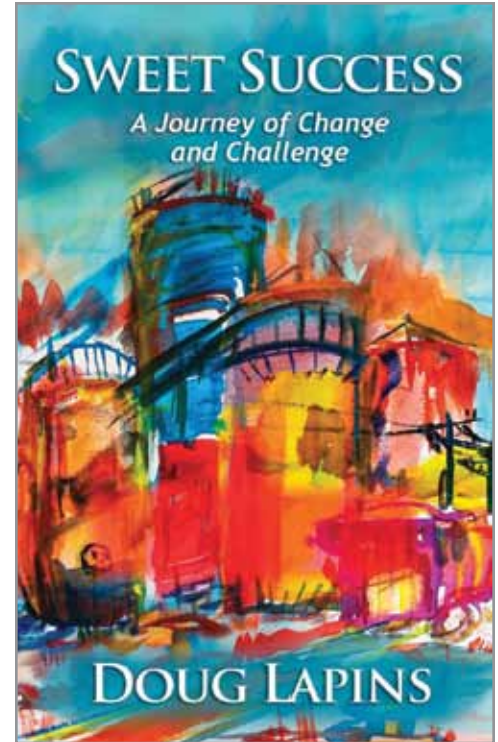
Photo courtesy of Farrell Kenimer

**Kidding Around**—Farrell Kenimer entertains tots at a neighborhood outreach event in Phoenix.

Phoenix-based Duet works to improve the quality of life for homebound elders and adults with disabilities, family caregivers, and grandparents raising grandchildren.

### Doug Lapins BS/ME 1961

Lapins has written *Sweet Success: A Journey of Change and Challenge* (Foursome Publishing; douglapins.com). Blending personal narrative with business insight, he takes readers on his journey of growth and corporate success in this memoir. With his passion for learning how to embrace and lead organizations through change, he grew from young engineer at a sugar factory to CEO of a billion-dollar company. His story is a lesson in how unwavering principles can see you through the most challenging situations. Lapins confessed to not being the best student, but added: "The U of A must have done something pretty good to prepare me for my journey." Talking about the book, Lapins described how he "navigated trouble and triumph alike with the same straight talk, ethical standards, and timeless principles" that guided him in business and in life. "Along the way I discovered that management is a craft," he said. "I worked at my craft just as one might study to be become a master electrician, or a talented fly fisherman." His career began



on the plant floor and he rose to CEO of Western Sugar Company and of A.E. Staley, which turned over a billion dollars per year. After 31 years in business and seven years as a CEO, he left corporate life and became a volunteer management consultant for overseas companies in Eastern Europe and South America, where he helped struggling companies build strong management teams and develop solid business practices. He is now retired and lives in Pinehurst, North Carolina, with his wife, Ginny.

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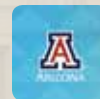
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