THE UNIVERSITY OF ARIZONA

VOLUME 37 NUMBER 1
SPRING 2014

arizonaengineer

Published by the UA College of Engineering • Online at www.engineering.arizona.edu/news

INSIDE THIS EDITION

azengineering

Pete Brown/UA Engineering

Higher Plane—Aerospace engineering seniors Savannah Rodgers, left, and Samantha Lowden demonstrate their team's Silver Fox unmanned aerial vehicle on the UA Mall during Design Day 2014. The team was sponsored by Sensintel and won the $750 Raytheon Best Engineering Analysis Award. Not pictured are team members Paul Neff and Juan Rivera.

Ingenuity Reigns at Design Day 2014

A thousand enthralled visitors crowded Design Day 2014 to marvel at 64 design projects engineered by more than 350 students. The event crammed the student union ballroom and spilled out onto the UA Mall.

Solar power ruled, rockets fascinated, cameras detected, medical devices remedied, and sustainability was front and center at the 2014 Engineering Design Day, held May 6 in the UA Student Union Memorial Center and on the UA Mall. Top design teams took home more than $14,000 in prizes.

There was the modification of a street sweeper to make it into an efficient onion bulb harvester. For their clean, low-cost design that simply worked well, the multidisciplinary team won the Sargent Aerospace and Defense Voltaire Design Award.

A coveted $1,000 Texas Instruments Analog Design Award went to the team of electrical engineering and systems engineering students who created a meter to detect the power consumption of different devices in homes and businesses.

CONTINUED ON PAGE 8

Now is the time for the College of Engineering!

In a banner year, "now" is an appropriate slogan, but we are always focused on "next."

The academic year ends on multiple high notes for the College: our academic and research programs are now established as major planks of the University's Never Settle strategic plan, undergraduate retention is at an all-time high, each freshman class is better than the last, and the number of graduates is increasing. We have successfully landed several large-scale multidisciplinary research projects – funded at $5 million or more – and major research thrusts are under way in intelligent sensor systems, biomedical systems and devices, and sustainable infrastructure in energy, water and transportation.

This year also saw significant philanthropic success – more than $15 million raised in cash, pledges and planned estate gifts, plus we reached one-third of our fundraising goal for the Engineering Innovation Building. We have also played a significant part – more than $40 million raised so far – in the University's ongoing "Arizona Now" campaign to raise $1.5 billion.

I am extremely proud of all the hard work and accomplishments of our students, staff and faculty. The quality of our work was evident at Design Day, which broke records in terms of student participation and number of attendees, and at our recent awards lunch for staff and faculty. Four of our faculty were promoted and given tenure, we had two Fulbright award winners, four faculty members were elevated to fellows of their respective professional societies, and six staff members were nominated for the Cosart Award for outstanding service, which was won by ECE's Nancy Emptage.

If you missed the excitement and engineering excellence at Design Day 2014, I recommend saving the date for next year's event: May 5, 2015. Turn to page 15 for tips on the many ways you can stay in the know about College news and events.

If you are in the neighborhood, stop in and see us. Have a great summer!

Email: jgoldberg@arizona.edu
Telephone: 520.621.6594
Twitter: @UA_ENGR_Jeff_G

arizona engineer

spring 2014 • volume 37 number 1

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

editor/designer pete brown
telephone 520.621.3754
email pnb@email.arizona.edu

www.engineering.arizona.edu

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

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

All contents © 2014 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.

Pete Brown/UA Engineering

Maker Plan—Undergraduate advisers Diana Rix and Arvind Raman promote the College of Engineering to Maketopolis attendees.

Out of the Workshop and Into the World

Students, staff and faculty from the College of Engineering turned out in force March 1 to support Tucson's first maker festival, Maketopolis.

Students from the Baja, Formula, IEEE and video game developers clubs, plus student advisors and faculty-supported teams from the Tucson Pumpkin Toss and Bit Buckets robotics club, all pitched in to help put Southern Arizona's biggest maker fair firmly on the map.

Maketopolis featured local do-it-yourselfers, roboticists, inventors, hobbyists, artists, metalworkers, potters, hackers, steampunks, builders, woodcrafters, sculptors, tinkerers, programmers, and more – all united by the same rallying cry: "Out of the Workshop and Into the World."

Beyond the fun and games, Maketopolis addressed issues critical to Arizona's future, such as science, technology, engineering and math – or STEM – education, and workforce development and retention.

"Hands-on involvement in STEM activities is known to establish excitement and interest in the minds of young children and to provide relevance to what they learn in school," said Engineering alum Patrick Marcus, president of Marcus Engineering, one of the event's sponsors.

"Maketopolis will stimulate this interest, as well as creating a dense community of collaborators and skill-sharing outside of the work environment, which will help retain our talented workforce and maintain a sense that there are many opportunities locally."

The original Maker Faire was held in San Mateo, California, in 2006. Since then maker fairs have exploded in number in the United States, and become an international phenomenon.

Pete Brown/UA Engineering

Wayward Bun—Grace Ritchey of team Carry on My Wayward Sun lugs her oven home after the Solar Oven Throw Down.

Dough Down for the Throw Down

They were not required to serve the crowd a gourmet meal, just cook a single bun from raw dough. Although some of the solar ovens rapidly reached 400 degrees Fahrenheit in the hot Arizona sun, temperature was not necessarily the determining factor in this competition.

The real challenge at the University of Arizona's Solar Oven Throw Down was applying engineering concepts to accurately calculate oven performance.

About 500 engineering students, faculty and industry representatives turned out for the mass solar oven cookoff on the UA Mall Oct. 22, 2013. In ENGR 102's solar oven project, freshmen work in teams to design the best possible solar oven within timeline and budget specifications and using simple materials.

They predict the temperature their ovens will reach based on a performance index mathematical model and at the Solar Oven Throw Down test their ovens to determine the accuracy of their predictions.

Team We Showed Up took both awards associated with performance index – highest performance index and highest average performance index.

For the second year, the event was sponsored by Delaware-based technology company W.L. Gore and Associates. A half dozen or more Gore employees were on hand to judge and help choose the team that displayed the best teamwork as well as share their professional knowledge with the nation's next generation of engineers.

Gore's All-in-the-Same-Boat award went to tying teams Carry on My Wayward Sun and Oozma Kappa.

Courtesy UA SME

Reaching Out—Mining engineering seniors Ashlyn Hooten, left rear, and Danielle Taran, right rear, work at the Flandrau Center on the UA campus inspiring young girls to follow STEM careers.

UA Chapter of SME Wins Top Outreach Prize

The Minerals Education Coalition of the Society for Mining, Metallurgy & Exploration has honored the UA student chapter of SME for its K-12 outreach. The student chapter received the award during the 2014 SME Annual Meeting and Exhibit in Salt Lake City in February.

"They're quality students, and they make a quality impression on the young people," said Pam Wilkinson, adviser for the chapter and outreach coordinator with the UA's Lowell Institute for Mineral Resources. "They speak the same language."

Members of the mining student group volunteer their time and talent so the next generation will know the importance of mining, and maybe even become mining engineers or geologists themselves.

"We let them know that mining is important in their lives, that without it we would not have cars, cell phones, computers – the list is endless," said Danielle Taran, president of the UA student chapter of SME. "We teach them that we need mining."

Teachers also benefit from the chapter's outreach. "Many of the teachers did not know a lot about mining," said chapter secretary Ashlyn Hooten, who along with her fellow chapter members joined an assembly line of industry professionals in Phoenix last fall putting together hundreds of mineral kits for teachers who would be attending the regional National Science Teachers Association conference.

Pete Brown/UA Engineering

Centennial Achiever—Marianna Yanes, right, with assistant professor Lingling An, who nominated Yanes as an outstanding senior of the fall 2013 semester, shows the gift she received from the College in recognition of her outstanding qualities as a senior.

Biosystems Engineering Senior Receives 2013 Centennial Achievement Award

In addition to being named an outstanding senior, biosystems engineering student Marianna Yanes has been honored with one of two annual UA Undergraduate Centennial Achievement Awards, recognizing her outstanding integrity, perseverance and volunteerism.

"We are filled with pride for Marianna," said Donald Slack, interim head of the department of agricultural and biosystems engineering. "She is a unique and very deserving individual."

Yanes, who moved to Arizona from Nogales, Mexico, when she was 17, says life is far too short to dwell on personal difficulties when there are so many serious problems in the world. She plans to attend graduate school in the fall and hopes to one day start a greenhouse company that will provide food for those who need it most, in a sustainable, environmentally responsible way.

For the last year and a half, Yanes has worked monitoring plants that grow without soil at the UA lunar greenhouse and the University's model greenhouse at the Chicago Museum of Science and Industry. She was a NASA Space Grant intern for two consecutive years and is a member of Tau Beta Pi, Alpha Epsilon and the Society of Hispanic Professional Engineers.

Yanes, who has done volunteer work for a number of organizations in Tucson, credits her mother, co-founder of an organization that provides food, clothing and toys to children in Nogales, with teaching her how important it is to give back.

UA Honors Supapan Seraphin with Distinguished Outreach Accolade

Since joining UA Engineering's department of materials science and engineering nearly a quarter-century ago, Supapan Seraphin has been a tireless ambassador for science and engineering education – especially for women and minorities who imagined such a career to be out of reach.

Seraphin has received the 2014 University of Arizona Distinguished Outreach Faculty Award, given to faculty with "a significant record of conducting outreach policy, practices, and implementation at the University of Arizona; a record of distinguished creative scholarship; and the sustained application of scholarship in non-formal classrooms."

As a principal or co-principal investigator on National Science Foundation grants totaling nearly $10 million, she has guided countless people of all ages and backgrounds toward successful, rewarding careers in science and engineering.

She has spearheaded dozens of innovative and influential science education programs, including one in which hundreds of first-year UA students and pre-college students visit the UA electron microscopy lab.

"I love when first-year students in Engineering 102 say, 'I know you! I remember you from my high school field trip!'" Seraphin said. "One of my highest rewards is when students and K-12 teachers tell me I have provided them with a life-changing experience and had a positive impact on their career."

Seraphin actively promotes science education to K-12 students and teachers around the U.S. – including on Indian lands – and abroad, in such countries as Thailand, Kenya, Peru and Brazil.

Pete Brown/UA Engineering

Food for Thought—Supapan Seraphin, right, and some of her students have some fun in the residence hall kitchen preparing vast quantities of Thai curry for hungry students.

New SIE Head Named IIE Fellow

Young-Jun Son

Young-Jun Son, recently appointed head of the SIE department, has been made a fellow of the IIE, the society's highest class of membership.

Son directs diverse research projects involving several UA colleges, as well as government agencies and private industry. Topics include manufacturing systems, crowd control, driving behavior, energy network distribution, and coordination of unmanned military vehicles.

Different though they are, these projects seek to better understand systems and employ the latest technologies to improve the systems' performance and people's lives – which, Son readily points out, is the underlying theme of systems and industrial engineering.

He earned his BS in industrial engineering at South Korea's Pohang University of Science and Technology, or POSTECH, and his MS and PhD in industrial and manufacturing engineering from Penn State before joining SIE in 2000.

Dessureault Enters Hall of Fame

Sean Dessureault

Sean Dessureault has spent nearly two decades advancing technology to increase efficiency and improve sustainability and safety in the mining industry. In recognition of his work, Dessureault received an American Mining Hall of Fame Medal of Merit from the Mining Foundation of the Southwest.

"Great mining technology and many legends in the industry have come out of this University," said Dessureault, an associate professor of mining and geological engineering who has been at the UA since 2002. "I am honored to be representing the UA College of Engineering."

Dessureault directs the UA's Mine Intelligence Research Group, or MIRG, where he uses an integrated control center to test new technologies in mine automation. "Information technology and training of the new mining workforce on how to use integrated data sets is the most critical investment for mining companies today," he said.

The Sound of Destruction

What do kidney stones, a shrimp's lunch, and firefighting foam have in common? The answer lies in the destructive power of sound waves, which College researchers are investigating as a means of eliminating toxic chemicals

Manish Keswani

Reyes Sierra

Researchers at the UA College of Engineering have come up with a novel way to help the U.S. Air Force dispose of stockpiles of dangerous chemicals – using nothing more than sound waves.

The Air Force has a large stockpile – almost 11 million liters – of fire-extinguishing foam, which contains environmentally damaging organic compounds. Manish Keswani, an assistant professor in the department of materials science and engineering, and Reyes Sierra, a professor in the department of chemical and environmental engineering, have been awarded a contract by the Air Force Civil Engineering Center to destroy the chemicals using a novel sonochemical process, which uses sound waves to break down complex and toxic molecules into nothing more than carbon dioxide and water.

"Sonolysis relies on the process of cavitation for its success," Keswani said. "Under certain conditions, sound waves cause the formation of small bubbles that rapidly implode and release an intense shock wave that produces enormous amounts of heat energy and a variety of highly active radicals, which can completely destroy adjacent material."

Cavitation is used in certain medical procedures and is also found in nature. Shock-wave lithotripsy relies on cavitation to destroy kidney stones, and mantis shrimps use cavitation to stun or kill prey.

The heat energy unleashed by cavitation destroys the bonds that tie large molecules together, such as the perfluoroalkyl sulfonates and carboxylates, or PFCs, found in firefighting foams. These toxic PFCs are hard to break down and tend to persist in the environment, and in body tissue, which is why the Air Force will be investigating cavitation as a cost-effective method of producing temperatures in excess of 10,000 degrees Fahrenheit, more than enough to incinerate the problem chemicals.

Ryan Revock/Arizona Daily Wildcat

The Eyes Have It—Wolfgang Fink demonstrates his new retinal implant and stimulation methodology in his ECE lab.

Breakthrough in Retinal Implants Could Restore Sight to the Blind

Researchers at the University of Arizona and University of Tübingen have made a breakthrough in retinal implant technology that could help people who have lost their sight see more than just light and vague shapes.

Wolfgang Fink, an associate professor in the UA departments of electrical and computer engineering and biomedical engineering, is researching new implant design and methods of electrical stimulation of the retina that will enable implants to produce much clearer images. His research partner is Erich Schmid, professor emeritus of theoretical atomic and nuclear physics at the University of Tübingen, Germany.

"Current technologies and methods are far behind what can be done," said Fink, who is working with Tech Launch Arizona to patent the new technology and license it to retinal implant developers.

In an attempt to achieve greater resolution, some companies are developing implants with more densely packed electrodes while maintaining the array's same small footprint. Just adding more electrodes, however, is not the answer, Fink said.

Fink and Schmid have developed a method whereby electrical fields from auxiliary electrodes on a retinal implant chip can shape a central stimulating field and give it more precise focus.

For example, an electrode's stimulating field can be shaped by fields from adjacent electrodes into what the team calls a "fountain" – a tall, focused electric field that pushes upward directly into a localized region of the retina and then cascades down, fountain-like, to the return electrodes on the chip.

Israel Wygnanski: A Tail of Innovation

Active flow control pioneer sees his technology integrated into airplane design and predicts that it could forever change the look of aircraft.

Israel Wygnanski's active flow control systems may well be pushing the aircraft industry to the brink of the next major shift in design.

"This new tool could change the entire way we design airplanes," said Wygnanski, UA professor of aerospace and mechanical engineering.

Wygnanski has been developing, testing and perfecting active flow control technology for 40 years. For the last four years, he has worked with Emilio Graff, director of the Lucas Wind Tunnel at Caltech, creating active flow control technology that promises to usher in smaller, lighter, quieter, more efficient airplanes.

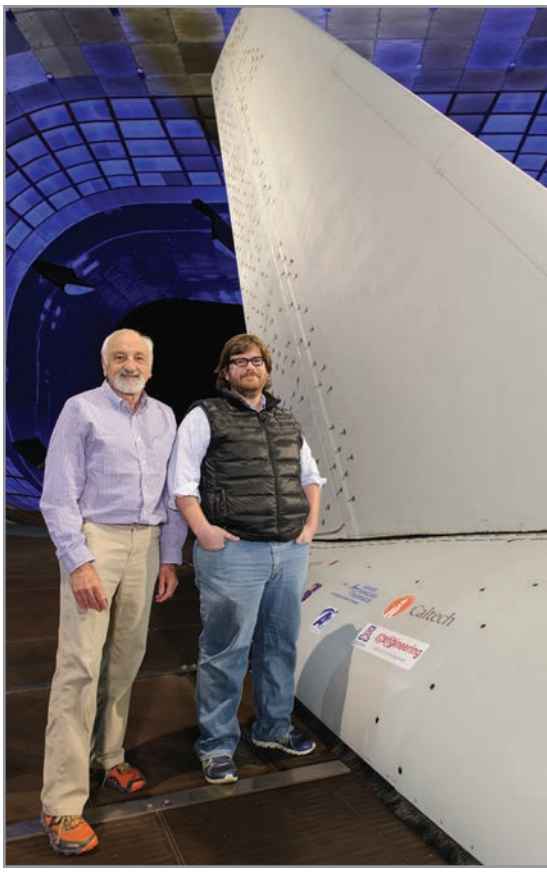
Active flow control refers to the manipulation of a flow field – through the addition of energy – to improve the performance of a solid body moving in a fluid, such as an airplane moving through the air.

Their research led to NASA's Ames Research Center wind tunnel in California and tests on a full-size Boeing 757 vertical tail outfitted with 37 tiny sweeping jet actuators. In November 2013 the tests confirmed that the system was up to the job of manipulating air flow enough to allow for smaller, lower-drag vertical tails on jet airliners.

Wygnanski, a private pilot, spotted the 25-foot-tall Boeing 757 tail in an Arizona boneyard on one of his flights between Tucson and California while working on the project with Graff.

Their vertical tail active flow control system is scheduled to fly on Boeing's ecoDemonstrator 757 in 2015.

• *Wygnanski joined the UA College of Engineering in 1985 and for the next 19 years had a dual appointment at Tel Aviv University in Israel, where he held the Lazarus Chair of Aerodynamics. At the 2014 Israel Annual Conference on Aerospace Sciences in February, he was presented with the Meir Hanin International Memorial Prize, which recognizes substantial achievements in aerospace sciences.*



NASA Ames Research Center

Trick of the Tail—Israel Wygnanski (left), professor of aerospace and mechanical engineering, and Caltech collaborator Emilio Graff introduced and developed the active flow control system tested recently on this Boeing 757 vertical tail in the wind tunnel at NASA Ames Research Center.

Control by Design

Aircraft have undergone a fundamental shift in design every 50 to 60 years, starting with the Wright brothers' first powered flight in 1903 and progressing to the likes of the Boeing 707, which went into service in 1958. If the pattern holds true, the UA's Israel Wygnanski may hold the ticket to the next big change.

To be at their most efficient – produce the least amount of drag and use the least amount of fuel – airplanes could be designed as flying wings like the manta ray or have smaller wings and tails. The only reason the vertical tail is so big is that the pilot needs it to control the plane in the rare instance of engine failure, particularly at takeoff. "Otherwise, the large tail is a parasite," said Wygnanski.

Under normal flying conditions, a smaller, lighter tail would provide the directional control needed. When an engine fails, the thrust comes from the opposite side of the airplane.

To compensate for the asymmetrical thrust, the rudder on the vertical tail is deflected to generate side force for directional control. The bigger the surface of the vertical tail and its rudder, the more force that can be exerted.

Nevertheless, said Wygnanski, "you can use an oscillatory thrust, or momentum input, in place of the large tail," which is what the jet actuators tested on the 757 tail accomplished. The jet actuators at the trailing edge of the Boeing 757 vertical stabilizer force air back and forth in a sweeping motion, like an oscillating electric fan, only at hundreds of cycles per second.

Patrick McArdle

Sustainable Schooling—Agricultural and biosystems engineering senior Aaron Tirado describes the Tanque Verde High School aquaponics project, which won the Rosemont Copper Best Sustainable Engineering Award, to Design Day visitors on the UA Mall.

Ingenuity Reigns at Design Day 2014

CONTINUED FROM PAGE 1

Students at Tanque Verde High School in Tucson, Arizona, have new educational opportunities and home-grown vegetables and fish, thanks to an agricultural and biosystems engineering team on the greenhouse aquaponics project. They won the Rosemont Copper Best Sustainable Engineering Award.

Two teams created award-winning solar-powered camera systems for a desert environment – one for detecting border crossers, another for monitoring soil erosion.

Patrick McArdle

Time Lapse of Honor—Members of the automated time-lapse camera team demonstrate their camera on the UA Mall at Design Day. The multidisciplinary team won the Technical Documentation Consultants of Arizona Best Design Documentation Award.

A $770 automated time-lapse camera system to remotely monitor soil erosion was ready to start collecting data this monsoon season in the Walnut Gulch Experimental Watershed near Tombstone, Arizona. When the system senses rain, it will start taking photos at 30-second intervals. The photos will then be delivered on demand to scientists at the Southwest Watershed Research Center.

"Before, someone had to be there on site to monitor the erosion," said team member Deanna Johnson, a mechanical engineering major, adding that she felt fortunate to work on a "customer-oriented, industry-related project with a client who did a great job of working with us." The team's work was rewarded with a $750 Best Design Documentation Award from Technical Documentation Consultants of Arizona.

Design Day Prize Winners

Sensintel Best Overall Design, First Prize • $1,000
Design of a high-powered rocket altitude targeting system
Design team: Matt Dusard, Tianna Stefano, Daniel Guyll, Varun Patel, Austin Mills
Project sponsor: UA student chapter of AIAA

Sensintel Best Overall Design, Second Prize • $750
Vision system for automotive cluster (dashboard)
Design team: Zhe Cao, Lee Johnson, Jeremy Katz, Abraham Lemus, Thomas Lundstrom
Project sponsor: Continental Automotive

Rincon Research Best Presentation • $1,000
MACO: modular aircraft for conceptual operations
Design team: Joshua Alexander, Anthony Colbert, Dana Cordova, Jeff Gluck, Ian Haubert, John Inman
Project sponsor: Hermann Fasel

Texas Instruments Best Analog Design • $1,000
Smart grid intelligent power meter
Design team: Tani Abraham, Ryan Carnaghi, Will DeCook, Sankar Unnithan, Matt Yalung, Wenhan Yang
Project sponsor: Texas Instruments

Ventana Innovation in Engineering • $1,000
Wireless flow sensor using GMR magnetic sensors for cerebral spinal fluid
Design team: Michael Martinez, Jose Valdez, Brett Lenz, Mervyn Abraham, Ernesto Barraza-Valdez, Deon Eakins
Project sponsor: Texas Instruments

AGM Container Controls Most Manufacturable Design • $750
Saguaro border surveillance system
Design team: Jeff Wilhite, Jason Wrona, Robbie McCarthy, Leah Herlihy, Jeff Colet, Sean Baker
Project sponsor: Raytheon Missile Systems

Edmund Optics Perseverance and Recovery • $750
NASA remote imaging system acquisition (RISA) project
Design team: Jeff Asman, Alex Felli, Justin Mortara, Noah Neff, Lucie Parks, Adrianna Vera
Project sponsor: NASA Johnson Space Center

W.L. Gore & Associates Best Creative Solution • $750
Universal hybrid conversion kit
Design team: Robert Futch, Angel Cecena, Clint Robison, Matt Vaughn, Kris Savage, Dominic Badillo
Project sponsor: UA Electric Vehicle Club

PADT Best Use of Prototyping • $750
Self-administered at-home tonometer
Design team: Shelly Garland, Michael Bollig, Alex Aames, Timothy Hill, Daniel Okiyama, Amy Nipp
Project sponsor: Texas Instruments

Raytheon Best Engineering Analysis • $750
Silver Fox Next Generation
Design team: Samantha Lowden, Paul Neff, Juan Rivera, Savannah Rodgers
Project sponsor: Sensintel

Sargent Aerospace & Defense Voltaire Design • $750
Onion bulb harvester
Design team: Nicholas Junk, Joshua Holmes, Andrew Keller
Project sponsor: Sunbelt Transplants Inc.

Technical Documentation Consultants of Arizona Best Design Documentation • $750
Automated time-lapse camera system
Design team: Hassan Alyousef, Taylor Christenson, Thomas Fumo, Deanna Johnson, Katherine Psyk, PengWang Song
Project sponsor: Southwest Watershed Research Center

Judges deemed the proof of concept design for a saguaro border surveillance system the most manufacturable of the projects on display, and the team took home a $750 prize, sponsored by AGM Container Controls. The solar-powered network of cameras hidden inside saguaro cacti was created to stream images to border patrol agents and help them identify illegal border crossers. Seismic sensors in use now detect movement, but they cannot identify what is causing the movement, explained team member Sean Baker, a mechanical engineering student.

Pete Brown/UA Engineering

Rocket-Propelled Design—The award for best overall design at UA Engineering Design Day 2014 went to the team that designed a high-powered rocket altitude-targeting system, pictured here standing in front of their test rocket. From left: Austin Mills, Tianna Stefano, Varun Patel, Matt Dusard and Daniel Guyll.

"They can't tell the difference between a cow and a person," he said. "Agents do not always know what type of situation they are walking into or they use valuable time investigating nonincidents, so this will actually monitor what is out there."

In the medical arena, award winners included a wireless flow sensor for cerebral spinal fluid, a self-administered tonometer to measure interocular pressure related to glaucoma, a wearable clinical frailty meter to help identify and treat instability and other problems associated with aging, and a cell phone amplifier for people with hearing difficulties.

An aerospace engineering team won the first-place Sensintel Systems Best Overall Design Award for its high-powered rocket altitude-targeting system. The impressive 10-foot black rocket, constructed partially from additive manufacturing, or 3-D printed, components, towered above more than 1,000 people who turned out to see the Design Day creations.

The most exciting part of the project for many of the aerospace engineering team members: the test launch, of course!

"It was a heart-stopping experience," exclaimed Austin Mills, who also said he was relieved to see the parachute deploy and the rocket return after its 2,000-foot climb. "Sometimes they don't."

Avilés Best Project That Exemplifies the Innate Art and Beauty of Engineering • $500
Soaring design team
Design team: Phillip Tindall, Maira Garcia, Matthew Ashton, Nick Griffis, Joel Mueting
Project sponsors: Ricardo Sanfelice and Hermann Fasel

Honeywell Best Team Leadership 1 • $250
NASA remote imaging system acquisition (RISA) project
Design team: Jeff Asman (winner), Alex Felli, Justin Mortara, Noah Neff, Lucie Parks, Adrianna Vera
Project sponsor: NASA Johnson Space Center

Honeywell Best Team Leadership 2 • $250
Clinical frailty meter
Design team: Erika McMahan (winner), Lance Frazer, Shih-Wei Lin, Michael Adam Schurr, Robert Welch
Project sponsor: Arizona Center on Aging

Latitude Engineering Best Physical Implementation of an Analytically Driven Design • $500
Clinical frailty meter
Design team: Lance Frazer, Shih-Wei Lin, Erika McMahan, Michael Adam Schurr, Robert Welch
Project sponsor: Arizona Center on Aging

Prototron Best Printed Circuit Design • $250
Applying ZigBee wireless technology to a production line
Design team: Jesse A. Dobson, John Bergquist, Bader Alushaim, Chao Wu, Hanqing Wen, Jafar Almousa
Project sponsor: Continental Automotive Systems

Rosemont Copper Best Sustainable Engineering • ($500)
Tanque Verde High School greenhouse aquaponics project
Design team: Aaron Tirado, Isaac Hung, Alison Burton
Project sponsor: Tanque Verde School District

Universal Avionics Best Integration and Test Philosophy • ($500)
Cabin pressure control system pressure rate sensor
Design team: Albert Martinez, Claudia Aster, Gordon Hardy, John Mothershed, Kelly Reid, Kimberly Schlecht
Project sponsor: Honeywell Aerospace

University of Arizona Center on Aging: Bioengineering Solutions to Aging Issues • ($500)
Design of a cell phone amplification device for older adults with hearing loss
Design team: Seung-Hyun Francis Baek, Kokou Serge Dogbevi, Peter W. Hall, Roberto Reyes, Benjie Tong
Project sponsor: Arizona Center on Aging

Honeywell Excellence in Aerospace Electronic System Design • $400
Electromechanical shaft disconnect for generators
Design team: Janiece Cooper, Mason Fritz, Matthew Groff, Tovi Johnson, Eric Watters, Matthew Yturralde
Project sponsor: Honeywell Aerospace

Krysty Pearson Fish Out of Water, First Prize • $250
Clinical frailty meter
Design team: Michael Adam Schurr (winner), Lance Frazer, Shih-Wei Lin, Erika McMahan, Robert Welch
Project sponsor: Arizona Center on Aging

Krysty Pearson Fish Out of Water, Second Prize • $150
Design of a high-powered rocket altitude targeting system
Design team: Varun Patel (winner), Matt Dusard, Tianna Stefano, Daniel Guyll, Austin Mills
Project sponsor: UA student chapter of AIAA

Keeping Our Nukes Safe and Ready

In 2010 the Pentagon revealed it had a total of 5,113 warheads in its nuclear stockpile, down from a peak of 31,225 at the height of the Cold War in 1967.

Even our newest nuclear weapons are at least 20 years old, and some are as old as 40. Such weapons were never designed to last indefinitely, and they can fail or become unpredictable as they age. Various treaties preclude nuclear weapons testing, so how do we assess and maintain the safety and readiness of those weapons remaining in our stockpile?

The only way is through simulations. This is the task of the National Nuclear Security Administration, which is responsible for the management and security of the nation's nuclear weapons, nuclear nonproliferation and naval reactor programs.

Jeff Jacobs

Jeff Jacobs, Elwin G. Wood Distinguished Professor and head of the department of aerospace and mechanical engineering, has been working with Lawrence Livermore National Laboratory and Los Alamos National Laboratory on NNSA-funded projects for more than 20 years to safeguard our nuclear stockpile, heading up a UA research effort that has brought in almost $8 million in research awards.

Jacobs' fundamental research in fluid instability generates experimental data to help national laboratories validate their simulations.

"The whole idea is that if we can't test nuclear weapons, we'll simulate them using huge computers," Jacobs said, referring to NNSA's Sequoia system, the fastest supercomputer in the world. "There are huge multiscale, multiphysics problems to be solved," added Jacobs, who is director of the Experimental Fluid Mechanics and Instability Laboratory at the UA College of Engineering.

Stewardship also involves ensuring a steady supply of qualified engineers and scientists to carry this work into the future. To this end, Jacobs also works with the NNSA's Stewardship Science Academic Alliances Program.

"The people who helped design nuclear weapons are quickly retiring," Jacobs said. "Part of my role is to provide graduates with the training appropriate to work in these national labs. That's what stockpile stewardship means – we have to safeguard it for the future."

Courtesy Armin Sorooshian

Particle Counter—Aboard the Navy Twin Otter, Armin Sorooshian readies instruments for a flight above the California coast.

Pinning Down Aerosols to Shed Light on Visibility, Clouds, Climate Change

Armin Sorooshian, a UA assistant professor of chemical and environmental engineering, and his research team are on a mission to find missing pieces of an atmospheric puzzle that will help scientists better understand aerosol-cloud interactions and predict climate change.

Funded by NASA and the Navy, he and his team spent summer 2013 in the air above the United States aboard a Twin Otter and a DC-8 chasing what looked like haze, dust and smoke – those little-understood ubiquitous aerosol particles – to study their properties and help shed light on one of the biggest uncertainties of climate sensitivity.

Aerosols float around in Earth's atmosphere for a few hours, days or weeks before being washed away by rainfall or crashing to the ground. Though tiny and short-lived, these particles can have huge environmental and health effects.

"The properties of aerosol particles – their size, their shape, their chemistry – are incredibly complicated," said Sorooshian. "It is difficult to measure these things, and you really need knowledge of the properties to know how they will influence health, air quality and visibility, and climate."

The 300-plus hours of flight time and mountains of data collected will help fill in the blanks of the global-warming debate, which had the UN Intergovernmental Panel on Climate Change finding in its September 2013 assessment report that the most uncertain force of climate change is aerosols. The data are also important to understanding and forecasting environmental factors critical to Navy operations.

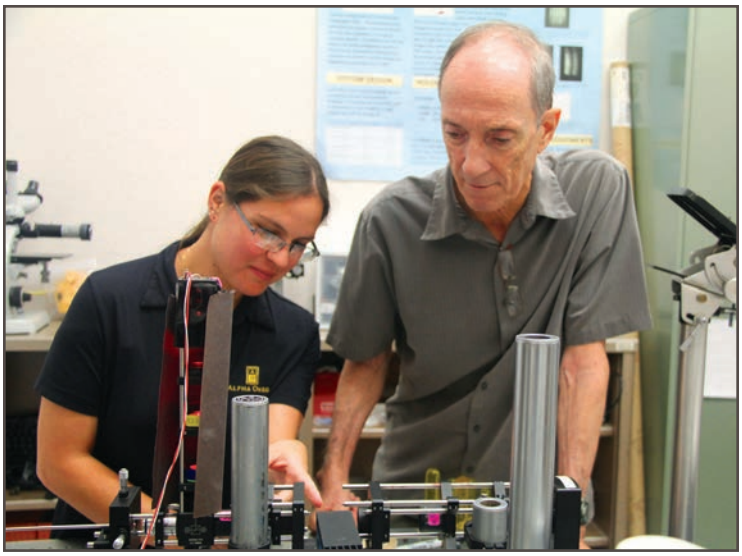
Mini Holographic Imaging System Promises Early Cancer Detection

Raymond Kostuk, who holds a joint appointment in the ECE department and the College of Optical Sciences, and his research team have developed a bench-top version of an instrument capable of detecting ovarian cancer.

The bench-top version of the volume holographic imaging system, which shows promise for detecting ovarian cancer *in situ*, uses holographic components in a microscope to generate images capable of detecting subtle tissue microstructure changes as well as fluorescent biochemical signatures.

Kostuk and colleagues have completed a study of cancerous and noncancerous ovarian tissue in which the imaging system successfully identified abnormal spatial and spectral markers of cancerous ovarian tissue removed during surgery.

Now the team is working on a miniature endoscopic version that further enhances imagery, achieves even greater contrast, and is capable of reliably diagnosing ovarian cancer in real time during noninvasive laparoscopic procedures. "The instrument is cost effective, easy to use, and holds the promise of saving lives," said Kostuk.



Pete Brown/UA Engineering

Image Force—Ray Kostuk, right, and grad student Isela Howlett test the new bench-top imaging instrument.

The National Institutes of Health has provided funding for the research, and patents and invention disclosures have attracted the attention of several investment groups. "Commercialization of the instrumentation may not be far off," Kostuk said.

Advancing Detection of Bombs and Breast Cancer

ECE professor Hao Xin is principal investigator on a $1.6 million Defense Advanced Research Projects Agency, or DARPA, project that will adapt the technology he and his colleagues have developed to detect early breast cancer – to the detection of explosives in opaque materials.

"We started our research in 2009 with no funding but kept working because we knew it would make a huge difference," said Xin, director of the UA Millimeter Wave Circuits and Antennas Laboratory.

The types of materials often used to conceal explosive devices – mud and meat, for example – share a trait with breast tissue: high water content, which makes it difficult to identify objects or abnormalities using existing ultrasound or microwave imaging techniques. Ultrasound images show a clear shape, but the properties cannot be delineated. Microwave images have contrast, but shapes are not clear.

The new hybrid technology will combine the advantages of high-contrast microwave imaging with high-resolution ultrasound imaging to detect improvised explosive devices, or IEDs. The technology also mitigates the harmful radiation effects of traditional X-ray imaging and works without making contact with the material in which the explosive is concealed.

"We take advantage of both technologies and avoid the disadvantages to increase detection specificity," Xin said.

Like bomb detection, breast cancer detection has seen myriad advances in recent years, with a number of competing technologies emerging. But none has overcome the challenges associated with identifying the specific properties of abnormal tissue.

College Honors Brown Family's Long-Standing Commitment to UA

The Thomas R. Brown Foundations, led by sisters Sarah Brown Smallhouse and Mary Brown Bernal, has a long history of supporting the College of Engineering and University of Arizona through generous student scholarships, research and faculty endowments, and most recently a $3 million investment in the new Engineering Innovation Building.

The College of Engineering, along with the College of Science, which also recently received a $3 million endowment, honored the foundations at a recent reception.

The gift for the Engineering Innovation Building will go toward a research wing named after Thomas R. Brown. It will provide world-renowned researchers the space and equipment to advance technology in autonomous systems, energy storage, materials processing and medical devices, to name a few areas.

"The UA is one of our most important assets to leverage expertise and create things of value for humankind," said Sarah Brown Smallhouse, president of the foundations.

The Thomas R. Brown Foundations, which received the 2013 William McWhorter Award as part of the Governor's Celebration of Innovation, has contributed more than $20 million in gifts to the University.

"Its leadership has strategically invested resources to spur innovation, support students and faculty, and increase UA's prominence globally," said College of Engineering Dean Jeff Goldberg.

Pete Brown/UA Engineering

Family Lunch—Assorted Brown Foundations members, scholars, faculty, fellows and alumni get together for a portrait following the 2013 Brown Foundations annual luncheon. Front row from left: Sarah Brown Smallhouse, Thomas R. Brown Distinguished Chair in Bioengineering Linda Powers, and Mary Brown Bernal. Middle row from left: Engineering alum and former scholar Mark Lauer; and 2013 Brown Engineering Scholars Jeannie Wilkening, Suhitha Veeravelli, Madison Egan, and Jacob Rockland. Back row from left: College of Engineering Dean Jeff Goldberg, Brown Foundations board member John Carter, Brown Engineering Scholar Dominique Rodriguez, foundations board member Gerald Swanson, and Engineering scholars Mireya Moleres and Rachel Braun.

Tom Brown, who died in 2002, founded the Tucson-based semiconductor firm Burr-Brown Research Corp. in 1956 in his garage with partner Page Burr, whom Brown later bought out. He sold the company to Texas Instruments 14 years ago in a stock deal worth more than $7.6 billion, the highest price ever paid for a private Arizona company.

Arizona Now Campaign Raising Funds for Innovation Building and School of Mineral and Energy Resources

The University has launched its largest-ever fundraising campaign, Arizona Now, which aims to raise $1.5 billion. Some of the funds raised will go toward College of Engineering projects such as the new Engineering Innovation Building and establishment of the International School of Mineral and Energy Resources. Overall, the funds will enable UA to advance research, boost the state's economy and provide real-world experiences for all students. The UA has already raised $859 million through donations that came in before the campaign's public phase. Tucson philanthropist and longtime College of Engineering supporter Sarah Brown Smallhouse is co-chairing the campaign.

ARIZONA NOW

The Campaign *for* The University *of* Arizona

Special Dinner Recognizes 2014 da Vinci Scholars and Fellow

The da Vinci Circle, UA College of Engineering's philanthropic society, honored talented and resourceful faculty and students May 9 at its annual dinner.

Among the honorees was bioreactor design expert and biofuels researcher Kim Ogden, professor of chemical and environmental engineering, who was chosen as the 2014 da Vinci Fellow.

Ogden has taken on the challenge of determining whether algae can become a sustainable source of fuel for transportation, feed for animals, fertilizer for crops, and high-value products such as bioplastics and pharmaceuticals.

"We want to make a biofuels industry in America," she said.

Ogden will receive a $10,000 grant to support her research and teaching. "I am going to use the funding to replace some older equipment in my lab," Ogden said, thanking da Vinci Circle members for the fellowship.

Also honored were 11 da Vinci Scholars, who each received $2,500, thanks to Community Finance Corp., a Tucson-based nonprofit that in 2010 awarded $100,000 over four years to fund the da Vinci scholarship program.

One thing all the da Vinci Scholars have in common is a deep desire to make the world a better place.

Ariel Nymeyer, a biomedical engineering senior who got hooked on engineering in middle school after attending a STEM program for girls, has for the last two years worked in the UA Tissue Optics Lab. Now the da Vinci scholarship is making it possible for her to work on her own cancer imaging research projects.

Courtesy Ariel Nymeyer

Cat Scholar—Da Vinci scholar Ariel Nymeyer, front center, and fellow Wildcat fans show some pride at a recent sporting event.

Pete Brown/UA Engineering

The Wisest Fuel—Da Vinci fellow Kim Ogden inspects the raceway she uses to grow algae for her biofuels research.

"Cancer research is one way I can strive to make a difference and work to improve the quality of life of many individuals," said Nymeyer, the eldest of four children and a first-generation college student. "I hope I can be a good example to my younger siblings."

For Dana Cordova, who is earning his BS in aerospace engineering, making a difference means working in space exploration. "After seeing numerous shuttle launches as a kid, I knew that one day I wanted to be a part of helping humanity delve deeper and deeper into the cosmos," said Cordova, an honors student interning at Northrop Grumman Corp.

2014 da Vinci Scholars

Ariel Dana Caquias-Nymeyer
Biomedical Engineering

Dana Cordova
Aerospace Engineering

Bryan Lizon
Electrical & Computer Engineering

Kholiqov Oybek
Optical Sciences & Engineering

Kyle Province
Electrical & Computer Engineering

Jennifer Ramin
Chemical & Environmental Engineering

Alaric Sessions
Electrical & Computer Engineering

Nicholas Smith
Optical Sciences & Engineering

Michael Thille
Mining Engineering

Patrick Thrasher
Optical Sciences & Engineering

Alex Warren
Electrical & Computer Engineering

Wilbur Wildcat and Lou Schlesinger

Lou Schlesinger

Lou Schlesinger attended UA from 1969 until 1974, majoring in metallurgical engineering. One class stood between him and a BS degree when he had to withdraw for personal reasons. He completed the missing class and got his BS at West Virginia University, but he still feels like a Wildcat. "I am a UA alum. I consider UA my undergrad in metallurgical engineering," said Schlesinger, who lives in Spruce Pine, N.C., and manages mineral process research for Unimin Corp. In the following Q&A, he shares undergrad memories and hopes for UA's future.

How has your UA education benefited you?
Not only did I receive a solid technical education from the outstanding engineering faculty, but also I gained an appreciation of the humanities and social sciences from the liberal arts faculty.

What is your favorite memory from your time at UA?
Organizing a UA Colloquium for Technology with another engineering student, Don Osborne, during my junior year. We brought some dynamic individuals to campus as speakers, including Buckminster Fuller, Arthur C. Clarke, and Gene Roddenberry. I was a good ping-pong player, but Arthur C. Clarke beat me in three straight games!

Tell us something about yourself that might surprise people
I am writing a novel and learning that it is far more difficult than writing research papers or designing greenfield plants! Spoiler alert – one of the main characters is a 15-year-old girl from Superior, Ariz.

What are your reasons for supporting UA financially?
I cannot come close to repaying what I received from UA, but I want to give back what I can. I know how expensive higher education has become from the experiences of my four children, and I want today's UA students to have the same advantages and complete their studies debt-free, as I did.

What are your hopes for the future of UA?
I hope UA continues its roles as a leading research university and a cultural beacon through promotion of the arts and humanities. I would like to see the continued cultivation of women for careers in science and engineering and affordable accessibility for a student body that represents the state of Arizona geographically, ethnically and economically.

Farrell Landrum Kenimer BS/ME 1963

After Kenimer retired from the U.S. Air Force, where he attained the rank of first lieutenant as a missile combat crew commander, he joined the U.S. Bureau of Indian Affairs as a supervisory engineer for design and facilities management. He is now retired and living in Phoenix, and helping to raise two grandsons – he has two children, five grandchildren and four great grandchildren. He is now 80 and described himself as "active in community affairs promoting NextDoor.com, a neighborhood social network, and Phoenix Neighborhood Patrol."

Scott Cote BS/Engr. Math 1992

After graduation, Cote started out as a software engineer at Texas Instruments. He then worked as an employee or consultant for a variety of companies, such as Bank of America, Nokia, Blockbuster Video, and QuickOffice. After Google bought QuickOffice, Cote and a few other former QuickOffice engineers started their own business: DealEntra Corp. In October 2013, the company launched YoBelly (yobellyapp.com), which Cote described as "a free mobile app that finds locally served food

Scott Cote

from restaurants that we recommend based on your personal appetite profile." Cote has been married to his wife, Judy, for 18 years. "We have two children who help me keep it real," he said.

Jerry G. Fossum BS/EE 1966, MS/EE 1967, PhD/EE 1971

In 2013, Cambridge University Press published Fossum's textbook, *Fundamentals of Ultra-Thin-Body MOSFETs and FinFETs*, co-authored by Vishal Trivedi. Fossum, a distinguished professor emeritus at the University of Florida, Gainesville, said the book "presents the basic physics of the latest (revolutionary) semiconductor transistors for CMOS applications." Fossum's career in semiconductor research began at Sandia Labs in New Mexico, where he

worked on silicon solar cells for photovoltaic systems. He has been at the electrical and computer engineering department at the University of Florida, Gainesville, since 1978. He is a fellow of the IEEE and in 2004 won the IEEE/EDS J.J. Ebers Award for "outstanding contributions to the advancement of SOI CMOS devices and circuits through modeling."

James A. Archer MS/CE 1965

Jim Archer retired from the U.S. Air Force in 1980 after serving for 20 years as a civil engineering officer. After working as a public works director in Texas, he retired again and in 1999 moved to Washington state, where he rediscovered trombone playing after a 42-year hiatus. He now describes himself as an "itinerant bass trombonist" and plays for the American Legion Band based in Lacey, Washington.

Harry E. "Gene" Krumlauf Jr. BS/Mining Engr. 1958

"I more or less majored in explosives," said Gene Krumlauf, who joined the U.S. Army as soon as he graduated. His 20 years of service included two tours in Vietnam: 1966-1967 with the 196th Light Infantry Brigade, and 1971-1972 with the U.S. Military Assistance Command, Vietnam. He commanded an ammunition depot in Korea, and later ran the Army's explosive ordnance disposal units in Europe and supported the Secret Service during European visits by Presidents Ford and Nixon. Krumlauf's father, Harry Krumlauf Sr., taught mining engineering at Michigan Tech in Houghton, Michigan. In January 1945 the Krumlaufs headed for UA, where Krumlauf Sr. had been offered a full professorship. The younger Krumlauf attended Mansfeld Junior High and Tucson High, and then followed in his father's footsteps by majoring in mining engineering, all while the whole family lived on the UA campus. "My parents always knew how I was doing in school," he joked. He said his memories of UA include "the returning Korean vets and how serious they were about their education," and "burning and whitewashing" the letter up on "A" Mountain. Krumlauf Jr. married UA English major Vicky Verity in 1964 and they now have four children and three grandchildren. The couple lived all over America and Europe and finally settled in Medford, Oregon, where they both got into the real estate business before retiring.

Courtesy Gene Krumlauf

Back in the USSR—Gene Krumlauf poses for a photo on a balcony overlooking Red Square in Moscow during President Nixon's visit to the Soviet Union in 1972.

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

YOUTUBE
youtube.com/user/uaeng

FACEBOOK
facebook.com/UACollegeofEngineering

EMAIL NEWSLETTER
news.engr.arizona.edu

TWITTER
twitter.com/azengineering

RSS FEED
news.engr.arizona.edu/feed/rss.xml

COLLEGE OF ENGINEERING

NONPROFIT ORG
US POSTAGE PAID
TUCSON AZ
PERMIT NO. 190

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

NEW! 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*.

Mixed Sources
Product group from well-managed forests and other controlled sources
www.fsc.org Cert no. SCS-COC-001503
© 1996 Forest Stewardship Council

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

Download the free Microsoft tag (left) reader from **http://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 at **www.engineering.arizona.edu/news**.

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 this magazine.

SEND US AN EMAIL!

Where has life taken you since graduation? We'd like to know and so would your former engineering classmates.

Please email us (300 words or less) and include the following information:

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

Don't forget to include a digital picture of your family, 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 e-mail to **pnb@email.arizona.edu**