Birds and Bees Influence Design of Unmanned Aircraft

University of Arizona aerospace and mechanical engineers are studying bird and bee flight to develop unmanned vehicles that stay aloft longer and cope with sudden and severe changes in airflow.

The UA College of Engineering’s Hybrid Dynamics and Control Laboratory is developing mathematical analysis and design methods that could radically advance the capabilities of unmanned aircraft and ground vehicles, as well as many other systems that rely on autonomous decision making.

Researchers in the lab design computer control systems that may one day allow robotic surveillance aircraft to stay aloft indefinitely. These systems also might be used to safely guide aircraft and automobiles through small openings as they enter buildings. Or they could help airplanes and ground vehicles navigate in cluttered environments without colliding.

“What we do here in our lab is mainly theory,” said Ricardo Sanfelice, an assistant professor of aerospace and mechanical engineering, who directs the lab. “We model dynamical
Growth and Self-Sufficiency Key to Survival

The quality is good, but financial reality means we must work on upping the quantity

It has been quite an adventure in the college with the recent major changes in the campus budget system. As we become less dependent on state appropriations, UA colleges will increasingly finance the majority of their missions through undergraduate and graduate student tuition. For UA Engineering, this means adopting strategies that increase enrollment and boost graduation rates at all levels.

We have improved undergraduate quality during the past 5 years and it is now time to increase student quantity. Some of you will remember being lined up with your fellow freshmen and being asked to look to your left and to look to your right, and then being told that only one of you would finish. Those days are long gone, and we now need to look at strategies to support students to completion.

We are assembling a group of our best teaching faculty to work more with freshman and sophomores. We recently received special tuition authorization for reducing class size, adding more teaching assistants, and increasing tutoring programs. We are also developing a student innovation center for our student club activities and for senior design project teams (more on this new building in future issues!). If we want the best students joining the college, then we need the best facilities and the best teaching and retention strategies to go with our strong professors and staff.

At the graduate level we are developing master's degree and certificate programs that reflect industry needs by providing flexible class schedules and online distance learning. We will be rolling out programs in engineering management, systems engineering, mining engineering, sustainability, solar energy, and construction management. Programs in electrical and computer engineering and aerospace and mechanical engineering are scheduled for 2012-2013. The goal is to provide a base of programs in a wide range of engineering disciplines that help alumni, professionals, and companies enhance their technical skills.

I want to thank you for your continued support. Over the next few years, our strategy is to grow and become more financially self-sufficient. We cannot do this without the generous support of our alumni and friends.

Go Cats!

jgoldberg@arizona.edu
520.621.6594
E-Week Brings Engineering to Campus and Community

UA Engineers Week was organized by the Engineering Student Council in February and featured a series of competitive events run and organized by various engineering clubs, organizations, and societies within the UA College of Engineering.

Events included spaghetti tower and model aircraft design competitions, assorted sporting events and quizzes, the i-Expo career fair, tours and recruitment events, and lots of community outreach. The week finished with the Western Region Rube Goldberg Competition and the gala awards night.

“E-Week is a great way for us to support our students’ involvement in extracurricular activities on campus,” said Kiona Meade, junior engineering student and E-Week coordinator for the Engineering Student Council.

“It’s a great way to promote engineering to the campus and the community,” said Jeff Goldberg, dean of the UA College of Engineering. “E-Week shows that engineers can improve society and help people, and have some fun while they do it. And it’s a great opportunity to get kids interested in a career in engineering.”

Rocks Bored, Crowd Thrilled

Mining and geological engineering students drew a large and curious audience at their annual rock-drilling competition, which required them to bore into a 20-ton rock outside Old Main for 3 minutes to see how deep they could get.

Math and mining engineering student Bree McMaster won the women’s rock-drilling competition, and in keeping with tradition was dunked in the Old Main fountain for her prowess. Such was her confidence, she wore a swimsuit under her rock-drilling clothes.

Mining engineering student Nick Caruso won the men’s event, which also earned him a soaking. His victory was witnessed by his mom, who competed in the rock-drilling competition about 20 years ago. Both she and Nick’s dad are UA mining engineering graduates.

Rock Stars—Mining engineering students Nick Caruso, above, and Bree McMaster, right, winners of the 2011 rock-drilling competition. Both got dunked in the Old Main fountain.
‘Exemplary’ UA Engineer is First Recipient of YWCA Leadership Award

Erica Corral, assistant professor in the UA materials science and engineering department and BIO5 member, recently became the first recipient of YWCA Tucson’s Women on the Move Emerging Leader Award.

YWCA Tucson described Corral as an “exemplary emerging leader and example of excellence for young women and girls.” In fact, YWCA Tucson was so impressed with Corral as a role model, that the award was created specifically with Corral in mind as the first recipient.

“I am really honored to be recognized by the YWCA as a role model for young women to pursue science and engineering,” Corral said. “It’s a part of the job I really enjoy doing.”

Corral received her award at the 29th annual Women on the Move Awards Banquet in February 2011 at the Westin La Paloma resort in Tucson, Ariz.

“The awards banquet was created to honor and recognize women who go beyond to enhance the quality of life for women and for the community,” Corral said. “Leaders at the YMCA are really dedicated to empowering all women of all ages.”

YWCA Tucson describes its mission as “eliminating racism, empowering women, and promoting peace, justice, freedom and dignity for all.” It was established in 1917 and, despite those initials, welcomes all genders and has no religious affiliation.

UA’s High School Engineering Program Wins Education Award

In November 2010, the Arizona Department of Education awarded a 2010 Spotlight on Success award to the UA College of Engineering’s pioneering program to teach Engineering 102 in high schools. Students in participating schools who take the class earn credit hours toward an engineering degree at UA.

The Spotlight on Success award recognizes educators, schools, and programs for their exemplary efforts in providing quality education to Arizona’s students. The award was made jointly to the UA College of Engineering and four participating high schools with career technical education programs: Sabino, Ironwood Ridge, Flowing Wells, and Marana Mountain View.

“Congratulations on this model program of study,” said Milt Erickson, deputy associate superintendent and state director for career and technical education at the Arizona Department of Education, in a letter to Jim Baygents, associate dean for academic affairs at the UA College of Engineering. “It is the work of initiatives such as this that will propel Arizona students into a successful future.”

• The Solar Oven Project has been around for more than a decade, according to Brian Cunningham, ENGR 102 coordinator. “As far as I know this is the first throw down ever,” he said. “The students are used to seeing six to eight different ovens in their own class, but this will give them a chance to see up to 80 different ovens,” Cunningham said. “Every semester we try to do something that will give the students the opportunity to see the work of their peers.”
Ringing Endorsement—Professor Supapan Seraphin, left, with Ben’s Bells co-founder Jeanette Maré.

Eduardo Saez Named University Distinguished Professor

Eduardo Sáez of the department of chemical and environmental engineering has been named University Distinguished Professor for 2011. Only one faculty member per year is selected for this honor, which will be presented to Sáez by the Arizona Board of Regents in a special ceremony in December 2011.

“The ChEE department is proud of Dr. Sáez on this recognition for providing a high level of teaching excellence for many years,” said Jim Field, chemical and environmental engineering department head.

“The students are very appreciative of Dr. Sáez’s extra effort in making difficult subject matter understandable, and for his efforts in engaging students in research.”

Sáez is the third recipient of the award from the UA College of Engineering in as many years. Mary Poulton, head of mining and geological engineering, was honored in 2010 and Jerzy Rozenblit, head of the department of electrical and computer engineering, was inducted in 2009.

Distinguished professors have demonstrated outstanding commitment to undergraduate education in several ways. At least half of their teaching assignments include undergraduate teaching, using the highest standards in the classroom combined with effective advising and mentoring of undergraduates. Distinguished professors also have a record of strong research that has been applied in undergraduate classrooms.

Women Engineers Shine at Innovation Day Showcasing UA Research

Two of the five faculty chosen for “UA at the Leading Edge” awards at this year’s UA Innovation Day were College of Engineering female faculty.

Mary Poulton was selected for her work with the Lowell Institute for Mineral Resources, which spans science, engineering, health, business and policy to ensure responsible stewardship and development of the Earth’s mineral resources. And Erica Corral was chosen for her research on high-temperature materials for use in extreme environmental applications, such as spacecraft.

Ben’s Bell Award for Seraphin

Professor Supapan Seraphin of the UA department of materials science and engineering received a Ben’s Bells award in January. She received her Ben’s Bell while she was in the kitchen of UA’s Maricopa residence hall preparing her famous Thai lunch for students.

As students and guests bustled around the kitchen, helping prepare more than 60 pounds of rice, chicken, tofu and veggies, and Seraphin stirred a giant pot of chicken curry, Ben’s Bells co-founder Jeanette Maré walked in and presented Seraphin with the bell in recognition of the care and kindness Seraphin brings to her students and colleagues.

Seraphin said she was “super surprised” by the unexpected honor. “I’m extremely happy and grateful for the recognition of what I do for fun,” she said. “I am happy when students eat healthy and enjoy a little community.”

Seraphin’s Thai lunches are something of a legend on the UA campus, and she uses the lunch gathering as an opportunity to discuss academic concerns with her students. It also allows engineering students from different disciplines to mingle and discover more about the academic interests they share. “These lunches make a connection between students,” she said.

She has been organizing the lunches for 10 years. At one point they became so popular that hundreds of students lined up around the block for a bowl of curry or pad thai.
UA researchers have teamed up with the Maricopa County Department of Transportation, or MCDOT, to create a system that will make intersections safer for emergency responders and the general public.

They are installing a prototype at six intersections in Maricopa County and will test it this summer, according to Larry Head of the systems and industrial engineering department, and Faisal Saleem, MCDOT Intelligent Transportation Systems branch manager.

Their efforts are part of a national push to create smart vehicles that communicate with one another and with traffic control systems. In 2013, the National Highway Traffic Safety Administration may require every vehicle sold in the United States to be equipped with this technology.

The system being installed in Maricopa County could be one of the first steps in deploying a smart-vehicle system throughout the country, Head said. “There’s the question of which comes first, the intelligent cars or the infrastructure to support them,” he said. “If we install a system for emergency vehicles, it could be the core infrastructure and the pathway to deployment. As the nation’s public and private vehicle fleets are renewed, this system could lead the way in making intersections safer.”

Larry Head

Lowell Minerals Institute and Tucson Engineering Firm Test Underground Border Security System

A unique underground surveillance system tested by UA researchers could be used to watch the entire US–Mexico border continuously.

The border-monitoring system, known as Helios, consists of laser pulses transmitted through fiber-optic cables buried in the ground that respond to movements on the surface above. A detector at one or both ends of the cable analyzes these responses.

Helios is sensitive enough to detect a dog and can discriminate between people, horses and trucks. The system can be set to avoid being triggered by small animals, and can also tell if people are running or walking, or digging, and in which direction.

Zonge, a geophysical engineering company based in Tucson, Ariz., installed a Helios test system in the desert near Tucson. The UA’s Lowell Institute for Mineral Resources led the project to evaluate Helios as a tool for border surveillance, assisted by the UA National Center for Border Security and Immigration.

The resolution of the cable can be set to one-meter intervals, which means the location of a cut cable, or people, or vehicles, can be pinpointed instantly to within one meter along a section of cable up to 50 kilometers long.

Moe Momayez, associate professor of mining and geological engineering at the UA Lowell Institute for Mineral Resources, co-authored a report of the Helios tests. “We can install cables up to 50 kilometers in length with only one Helios detector,” he said. “Because the 50-nanosecond laser pulses travel at the speed of light, we can detect any event virtually instantaneously and deploy the appropriate resources to that location.”
NIOSH Awards UA $1.6M for Mine Safety Center

A consortium of three UA colleges has received a three-year grant of $1.6 million to set up the Western Mining Safety and Health Training Resource Center.

The grant was awarded by the National Institute for Occupational Safety and Health, which is part of the Centers for Disease Control and Prevention.

The lead researchers on the project are Mary Poulton, head of the department of mining and geological engineering and director of the Lowell Institute for Mineral Resources; Jeff Burgess, director of the community, environment and policy division at the Mel and Enid Zuckerman College of Public Health; and Patty Anders of the department of teaching, learning and sociocultural studies at the College of Education.

The resource center will be directed by Ros Hill, a professor of practice in the department of mining and geological engineering and director of the San Xavier Underground Mining Laboratory. The center will cover the U.S. west of the Mississippi.

“The training center will address those mining safety and health training issues which could be considered unique to the West,” Hill said. “Our focus is more on metal mining and sand, gravel and stone, as opposed to the coal focus in the East.”

An objective of the center will be the development of new methods and materials to make mine safety training more effective.

“Our goal is for the UA to be a center of excellence in mine health and safety and this grant continues to grow our national prominence,” said Poulton. “We have a unique facility at our San Xavier Mine and recent infrastructure improvements at the mine, funded by Science Foundation Arizona and Freeport McMoRan Copper & Gold, have allowed us to expand the scope of our research and training.”

Deep Breaths — The new director of the Western Mining Safety and Health Training Resource, Ros Hill, left, helps mining engineering junior Allison Hagerman get into a mine rescue breathing apparatus at the San Xavier mining lab. The Drager BG-4 mine rescue rebreathers were a gift to the mine from Barrick, a global gold mining company.

UA Engineering Leads Haiti Earthquake Survey

A team led by UA earthquake engineer Robert B. Fleischman, associate professor in the department of civil engineering and engineering mechanics, traveled to Haiti in 2010 to examine earthquake damage to buildings in Port-Au-Prince.

The magnitude 7.0 earthquake struck Haiti around 5 p.m. on Jan. 12, 2010. In just 30 seconds, nearly a quarter of a million people died. A further 300,000 were injured, and more than a million people were displaced. The primary cause of loss of life was the collapse of nearly 100,000 buildings constructed mostly of reinforced concrete or unreinforced masonry.

Fleischman’s team consisted of UA faculty and graduate students, and engineers from Rutherford & Chekene, a San Francisco earthquake engineering firm. The trip was funded by the National Science Foundation under its Rapid Response Program to gather perishable data in the period directly after a natural disaster.

The team documented engineered structures in Port-Au-Prince that suffered heavy damage but did not collapse. The term “engineered” refers to construction that involved engineers or architects, as opposed to construction carried out by building owners or community members. “Most residential homes in Haiti fall into this latter category,” Fleischman said.

The team also evaluated techniques for seismic assessment of vulnerable structures, and recommended improvements to building practices in Haiti.
Birds and Bees Influence Design

CONTINUED FROM PAGE 1

systems, analyze them mathematically, devise ways to control them, test them in simulations and, when possible, validate them in our test bed.”

Sanfelice and his students currently are studying ways to extract energy from wind gusts and thermals to gain altitude without using power, just like birds do when soaring to greater altitudes. “This is very different from traditional control system design, where you want to nullify the effects of perturbations. Here, we’re exploiting them,” he said.

One project involves autonomous soaring in which the computer “pilot” actively searches for thermals (areas of rapidly rising air) that might occur when sunlight warms a plowed field or stretch of asphalt.

In the lab, fans and wind tunnels generate these mock thermals and wind gusts. “If the plane detects a change in altitude that wasn’t created by the navigation system, the computer begins to explore that area to find the thermal,” Sanfelice said. If the lift occurs off the left wing, for instance, the computer will turn the plane to the left, but if it doesn’t find the thermal during this turn, it will change direction and cut the area at a different angle.

Designing the computer software and other parts of the systems is math-intensive, centering on differential equations and difference equations. Differential equations describe the continuous motion of vehicles. Meanwhile, the controllers may introduce abrupt changes, known as “discontinuities” in the math world, that are best described by difference equations.

This is where the term “hybrid” fits into the lab’s title, meaning analysis of both continuous and discontinuous motion.

A ball bouncing on the ground offers a simple example, Sanfelice said. The ball exhibits a smooth motion between impacts. This can be described by differential equations. But at impacts, there is an almost instantaneous change in velocity, and difference equations are best suited to modeling it.

A similar discontinuity occurs in another area of the lab’s research – flying a model airplane through a window from outdoors to indoors. Bees do this when flying back into a hive, and Sanfelice is recording their motions to see how they do it. “From a control point of view, we may want to mimic the maneuvers the bees are executing, in particular, the maneuvers they use to cope with the discontinuity in the airflow,” he said.

Creating the Internet of Everything

Autonomous cars on our streets driving better than we do. Intelligent wallpaper in our houses measuring temperature, moisture and vibration. Smart dust scattered in our hospitals tracking patients or detecting toxins.

Imagine networking all the above together to create an internet of everything that can sense and control the myriad processes that run silently and anonymously in our backgrounds.

This mostly invisible mesh of wired and wireless sensor networks that coats our existence is at the heart of “cyber-physical systems,” a rapidly growing area of systems engineering.

The UA College of Engineering’s Hybrid Dynamics and Controls Laboratory recently hosted the First Southwest Workshop on Theory and Applications of Cyber-Physical Systems. The event, and its 20 speakers, attracted almost 60 researchers from industry, government and about 10 Southwestern colleges.

Ricardo Sanfelice, director of the Hybrid Dynamics and Control Laboratory and an assistant professor in the aerospace and mechanical engineering department, organized the workshop. The National Science Foundation sponsored the event, which took place in March 2011 at the Four Points by Sheraton hotel in Tucson, Ariz.

Sanfelice noted that the Southwest is active in this area of research. He said this workshop, the first in an ongoing series, “will strengthen much-needed collaboration between universities and laboratories within the region.”
EPA Speaker Describes Our ‘Tragic Trajectory’

Speaking at the recent ICOSSE-11 conference on sustainability, EPA science advisor Paul Anastas said civilization is on a “tragic trajectory.”

Anastas, who is known as the “father of green chemistry,” was speaking at the conference banquet Jan. 12 at the Second International Congress on Sustainability Science and Engineering, hosted by the UA College of Engineering Jan. 9-13 at the JW Marriott Starr Pass Resort in Tucson, Ariz.

Addressing the assembled conference delegates over dinner, Anastas said: “Everyone in this room has dedicated their professional lives and their personal lives to ensuring that things do not continue on the tragic trajectory that we are on as a civilization.”

He was referring to unsustainable methods of energy and materials usage, and to the potential for ecological collapse. Getting off this unsustainable trajectory, Anastas said, is all about leadership in recognizing the “absurdity” of our current reality. The main thrust of Anastas’ talk was that sustainability should be integrated into every aspect of “whatever your widget is ... whatever your production process is.” Otherwise, he said, efforts to achieve true sustainability would be “tweaking around the edges to make something slightly less bad.”

Looking to the Future—EPA Science Advisor Paul Anastas warns of ecological collapse while silhouetted against the ICOSSE website projection during his speech at the sustainability engineering conference hosted by the College of Engineering.

Solar collectors and wind generators hold so much promise for clean energy, but they have a major flaw: they produce no power when the sun doesn’t shine or the wind doesn’t blow.

“If all we had to do was to generate power when the sun is shining, we would actually be in good shape right now,” said Ben Sternberg, a researcher in the University of Arizona’s Compressed Air Energy Storage, or CAES, program. “The crucial issue now is finding economical ways to store energy for large-scale use, either home-by-home over the entire country, or utility scale.”

Energy from compressed air stored underground is cheap, clean and renewable. Researchers at the UA’s School of Sustainable Engineered Systems are designing systems that will run fridges, buildings or power plants.

Batteries have traditionally been used to store energy, but they’re expensive, have a limited number of charge-discharge cycles, and pose resource and disposal problems.

The CAES group is developing cost-competitive energy-storage systems based on compressing air and storing it in man-made containers or below ground in natural reservoirs.

When solar panels shut down and wind generators stop, the compressed air is warmed and released to drive turbines that generate electricity. The compressed air also can be released directly to drive mechanical systems without being converted to electricity.

UA’s CAES research team is working on three projects that range from systems that might power a single air conditioner or refrigerator to building-wide systems, as well as massive storage sites that could store utility-scale energy.
UAV Systems Impress Judges at Engineering Design Day 2011

Unmanned aerial vehicle systems place first and second for best overall design at annual UA Engineering showcase

The award for best overall design went to LAARK, or Low-Altitude Aerial Reconnaissance Kit, at this year’s Engineering Design Day May 3. The UA Aerial Robotics Club, or ARC, sponsored the project because it needed a comprehensive avionics system for its Avatar UAV. The LAARK design team consisted of aerospace and mechanical engineer Malcolm Gibson, electrical engineers Hans Hony and Elliott Liggett, systems engineer James Dianics, and optics engineer Michael Palmer. ARC itself won the best engineering analysis award, sponsored by Raytheon, for its Avatar UAV. ARC will integrate the LAARK system into Avatar before it competes in the Association for Unmanned Vehicle Systems International student UAS competition in June 2011. ARC describes Avatar as its most advanced UAS airframe design yet, and says the integration of LAARK will create one of the most capable student-built avionics systems in the country. Second place in the best overall design category went to Project Shrike, sponsored by Raytheon Missile Systems. The Project Shrike team designed a low-cost, gimbal-less UAV camera system that can provide a stable video stream that compensates for the movement of the UAV as it pitches and rolls in flight. Project Shrike team members were optical engineers Sean Keller, Jeff Knaefelc, Steven Haim and Alex Marty, mechanical engineer Paul Shickling, and Keoki Kimzin from the engineering management program. These projects were just a few among almost 60 designed by UA engineering students and shown at Engineering Design Day, the UA College of Engineering’s premier showcase of student design.

Unmanned aerial vehicle systems place first and second for best overall design at annual UA Engineering showcase

Design Day is organized by the college’s Interdisciplinary Design Program, Engineering 498, and sponsored by BAE Systems and the college. In a surprise announcement during the awards ceremony, Greg Waterfall of Texas Instruments said that the company was awarding two first prizes of $1,500 for best analog design. One of the winners, the human-powered vehicle team, will travel to Dallas to present...
Prize Winners

Best Overall Design, First Place • $1000
Low-altitude aerial reconnaissance kit (LAARK) for integration into an unmanned aerial system
Design team: Malcolm Gibson, Hans Hony, Elliott Liggett, James Dianics, Michael Palmer
Project sponsor: UA Aerial Robotics Club
Prize sponsor: BAE Systems

Best Overall Design, Second Place • $750
Project Shrike low cost UAV gimbal-less camera system
Design team: Sean Keller, Jeff Knafelc, Paul Shickling, Steven Haim, Keoki Kimzin, Alex Marty
Project sponsor: Raytheon Missile Systems
Prize sponsors: BAE Systems

Best Analog Design 1 • $1500
Solar panel power monitoring system
Design team: Robert Benjamin, Alan France, Gautam Hari, Brianna Heersink, Suman Maharjan, Joel Marquez, Ajay Shrestha
Project sponsor: Texas Instruments
Prize sponsor: Texas Instruments

Best Analog Design 2 • $1500
ASME human powered vehicle: utility class
Design team: Andrew Laverty, Roy Green, Christian Schultz, Josh Kaliszewski
Project sponsor: UA ASME club
Prize sponsor: Texas Instruments

Best Computer Modeling/Analysis • $1000
Trench volume measurement tool
Design team: Justin Mamer, Andrew Davenport, Bryan Boone, Jorge Sanchez, Colton Noble
Project sponsor: Caterpillar Inc.
Prize sponsor: Hydronalix

Best Use of Off-the-Shelf Components • $750
Development of a modular unmanned underwater vehicle
Design team: Ammar Al Raisi, Arturo Armijo, Collin Reynolds, Eduardo Moreno, Erick Johnson, Ryan Maish
Project sponsor: Eduardo Moreno, Industrial Tool Die & Engineering, Intel, Pololu, CH Robotics
Prize sponsor: Edmund Optics

Best Use of Prototyping • $750
TI sensor-based monitoring & control system
Design team: Aidan Garza, Christopher Kemsley, Chris Featherstone, Andrew Weatherly, David Mares, Sheng-Hann “Leo” Yang
Project sponsor: Texas Instruments
Prize sponsor: PADT

Best Engineering Analysis • $750
AVATAR – aerial vehicle for autonomous target acquisition and recognition
Design team: Malcolm Gibson, Jun Li, Christopher Poole, James Powell, Joshua Tolliver, Dimitri Ververelli
Project sponsor: UA Aerial Robotics Club
Prize sponsor: Raytheon

Best Presentation • $750
Self-stabilizing helicopter landing platform
Design team: Scott McCall, Phillip Puentes, Mark Jankauski, Diego Gil-Azamar, Logan Rivas
Project sponsor: Boeing Rotorcraft Mesa
Prize sponsor: Rincon Research

Best Design Documentation • $750
Precious gem classifier
Design team: Gabriel Brewer, Joseph Brewer, Mona Eskandari, Julia Harden, Craig Oliver, Monica Rainey
Project sponsor: Alternative Vision Corp.
Prize sponsor: Technical Documentation Consultants of Arizona

Best Team Leadership 1 • $250
CIVOPS IV: cooperative unmanned vehicle operations planning system
Design team: Elizabeth Gyek-Li (winner), Mitchell Kim, Paul Vazquez, Brent McFarland, Richard Phillips, David Warnes
Project sponsor: BAE Systems San Diego
Prize sponsor: Honeywell

Best Team Leadership 2 • $250
Precious gem classifier
Design team: Gabriel Brewer (winner), Joseph Brewer, Mona Eskandari, Julia Harden, Craig Oliver, Monica Rainey
Project sponsor: Alternative Vision Corp.
Prize sponsor: Honeywell

Excellence in Testing and Validation • $500
UA Baja drivetrain
Design team: Josh Spivey, Andrew Sims, Harrison Roberts, Ahmed Al-Binali, Alexandra Hartz, Cade Wilson, Aaron Saint-Amour
Project sponsor: UA Baja Racing
Prize sponsor: Sargent Aerospace & Defense

Fish Out of Water, First Place • $250
Precious gem classifier
Design team: Julia Harden (winner), Gabriel Brewer, Joseph Brewer, Mona Eskandari, Craig Oliver, Monica Rainey
Project sponsor: Alternative Vision Corp.
Prize sponsor: Kristy Pearson

Fish Out of Water, Second Place • $150
Device for measuring the center of gravity of large industrial equipment
Design team: Paul Gastreich and Katherine Palazzo (winners), Kevin Maghran, Mike Main, Jared Wagoner
Project sponsor: Bruker Corp.
Prize sponsor: Kristy Pearson

Not Lacking About—Electrical engineer Elliott Liggett demonstrates the LAARK avionics system, which won the best overall design award. The glass dome contains dual gimbaled machine-vision cameras that can acquire 20-megapixel images at three frames per second.

Elliott Liggett was one of the participants in the 2011 Design Day competition. He and his team worked on a portable brain wave monitor project, which was named after Emeritus Tom Engibous. The portable brain wave monitor was designed to detect the electrical activity of the brain, which can be used to diagnose various medical conditions.

Elliott Liggett, along with his team, was awarded the second place prize of $7,500 in last year’s national TI competition. They used Texas Instruments’ sensor-based monitoring and control system to develop their project.

Seniors competed for almost $11,000 in prize money during Design Day 2011, which this year returned to the Student Union Memorial Center.

collect their prize and compete in a nationwide competition for the $10,000 Engibous prize, named for TI chairman emeritus Tom Engibous. The portable brain wave monitor project, which debuted at UA Design Day 2010, went on to win the second prize of $7,500 in last year’s national TI competition.

Pete Brown
Thank You!

These pages list the companies, organizations and individuals who have contributed to the College of Engineering during fiscal year July 1, 2009 to June 30, 2010.

Their support is vital in providing scholarships, funding programs and supporting research. Without this help, some students would not be able to complete their education. Many other students would not have access to resources that give UA Engineering a margin of excellence for educating tomorrow’s engineering leaders.

We want to take this opportunity to say “thank you” from the students and faculty who have benefited so much from this generous support.

We have made every effort to list all those who contributed to the college and sincerely apologize if we have missed anyone.

If you donated to UA Engineering during 2009-2010 and are not on this list, please let us know, and we will list your name in the next issue of Arizona Engineer.
da Vinci Circle lifetime members and UA alums Craig Berge (BS/ME 1957), left, and Nancy Berge (BA/Edu, 1958), center, with Engineering Dean Jeff Goldberg at a reception for da Vinci Circle members.

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Richard Dobes
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Leah Stanley
Paul and Betty Neuenschwander
Robert Hoover
Robert Simpson
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Lawrence McViegh
Teng-I Wang
William Schiesinger
Andrew and Julie Cole
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Mark Casolora
Walter Love
Omaha Community Foundation
William and Patsy Wright
Kenneth Trout
Tony Werner
Sheila Keyes
Kirk Damron
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Len Manleung Wong
Wayne King
Marion J. Hill
Richard and Janice Harper
Ted Wilson
Richard and Mary
Obee (Mugent)
William Taft
Robert Mills
Joni Rorger
Sun Microsystems
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Shira Wolf
Sherry Hardine
Terra Michaels
Fowl Investments Inc.
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Yarunzi Cheng
Reiif Meesrobin
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Martin and Jo
Ann Gronberg
Thomas Teague
Manzer Masud
Richard Ray
Mary and CJ Leach
Scott Larson
Sheri and Robert Lee
Michael and Catherine
Montegar
Robert and Ann Rutherford
Robert Lepore
Neal and Susan
O’Shaughnessy (Wolf)
Rand and Barbara Drake
Ruth Severnak
Virginia and David
Bonsall (Taylor)
Kermitt and Elaine Whitt
Ronald and Carolyn Stott
Katherine and Richard
Milakovich
Samuel Lee Halliday
Patricia and Gretchen Brown
Kimberly and John
Dangremond (Lichtly)
Paul and Amanda Curtis
Robert Best

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Brown Foundations Award 19 Scholarships

The UA College of Engineering, the Eller College of Management, and the Thomas R. Brown Foundations recently announced 19 new recipients of Thomas R. Brown distinguished scholarships.

Speaking at a recent luncheon to honor the Brown scholars and professors, foundation president Sarah Brown Smallhouse described the scholarship recipients as, “An amazing group of students for us to help on their path.” She added, “Education is something we can’t skimp on... especially economic education.”

The foundations were established in honor of Tom Brown, who in 2001 was named technology executive of the year at the Technology and Management Awards, a collaboration between UA’s College of Engineering and the Eller College of Management to recognize leaders at the intersection of business and technology.

Two students, one from each college, described to the luncheon audience how the scholarships affected them personally. “These gifts allow us to carry on and give back to the community,” said Eller MBA student Jenny Yang. “We are honored to join in this partnership that is changing the world.”

Chris Utter, who aims to graduate in May 2011 with a dual major in math and systems engineering, made the point that many of his peers held down part-time, even full-time, jobs while they sought degrees. “Thanks to the foundation, being an engineering student has been my full-time job,” he said.

Solid Foundation—Brown Foundations trustee Mary Brown Bernal, right, with UA Engineering scholarship recipients, left to right, Lisa Guay, Sumana Veeravelli and Elizabeth Greene.
Therese Berg taught in the Arizona public school system for more than 20 years, was a counselor at Tucson’s Salpointe High for 13 years, and holds bachelor’s and master’s degrees in education. She retired from teaching but returned to work after the passing of her husband, Robert Berg, for whom she has named an education trust.

Berg is a graduate of Tucson High and the University of Arizona, and agreed to answer a few questions for Arizona Engineer.

**How has your UA education benefitted you?**

My UA education prepared me for a life-long career in education.

**What are your favorite memories from your time at UA?**

My time at UA as an undergraduate student was from 1937 to 1942. That’s about 70 years ago! I remember the friends I made, the good times we had together, and how helpful and personal most of my professors were.

**What are your reasons for supporting UA financially?**

I believe in the wonderful work being done in this fantastic research university, and I appreciate being able to contribute in memory of my loved ones and myself through the instruments of gift annuities, so that even when I’m no longer on this earth, the good work will continue. The following trusts have been established:

- The Charles Clifford Hinman Merit Award in Aerospace Engineering, UA College of Engineering
- The Robert L. Berg Fellowship Endowment for Research in the Cancer Biology Doctoral Program at the Arizona Cancer Center, College of Medicine
- The Therese S. and Charles Velasco and Marie Schreiner Fellowship in Cardiovascular Research at the Sarver Heart Center, College of Medicine
- The Charles Clifford Hinman Research Fellowship in Environmental Health, College of Public Health
- The Therese Velasco Berg Endowment for the College of Education, post graduate initial teachers’ fund

**Tell us about your hobbies and pastimes.**

Now that I’m 91 years old my activities are fewer; however, I still swim regularly, play Scrabble with friends, and enjoy my luncheons: once a month with Pima County Retired Teachers, and once a week with Community and Concern (a senior citizen group) and, of course, just with my friends.

**DONOR PROFILE**

**Therese Velasco Berg**

Maiden names are in parentheses. An asterisk indicates 10 or more consecutive years of giving to the College of Engineering.

*Therese V. Berg (Velasco)*

**2009–2010 Alumni Donors by Class**

Maiden names are in parentheses. An asterisk indicates 10 or more consecutive years of giving to the College of Engineering.

1940
Harry J. Garrett

1942
John B. Marx
Robert W. Ageton
Therese V. Berg (Velasco)*

1944
Sanford A. Shuler

1946
Fred D. Ritter
L. D. Osborne

1947
Myron L. Petersen

1948
Richard E. Rhodes
Robert C. Mills

1949
J. David Lowell
Lionel G. Blair
Robert C. Hall
Levon E. Gooding*  

1950
Charles D. Gilson
Charles W. Tandy
Harry H. Haaversen
Herbert H. Holtchikas
Jules K. Ellingboe
Rudolf A. Jimenez

1951
Del L. Pitcher
Harry J. Valentine
Henry G. Grundstodt
James G. Hess
James S. Tolley
Joseph T. Adams
Kenneth P. Worcester
R. L. Vick
S. Jack McDuff
Thomas R. Edwards

1952
Dyer H. Campbell
Fred G. Warner
James F. Wickham
Lawrence M. Dreyer
Morris C. Stephon
Patricia H. Tolley (Hill)
Patricia M. Gardner (McMillan)

1953
Charles E. Phillips
Douglas C. Haag
Fred E. Ruppert
Kenneth J. Harbin
Leonard M. Snyder
William R. Shoemaker

1954
Roger W. Melton
William C. Gardner
William F. Wolfson

1955
Donald W. Gilliam
Lorraine M. Drachman (McCullum)
Richard G. Guthrie
Roland M. Bemenuau
William T. Corbin
William W. Chapin

1956
Charles G. Preble
Howard V. Main
John C. Prator
Joseph K. Gartner

1957
Cris L. Donelson
Jake T. Doss*
Joseph A. Gervasio
Martin J. O’Sullivan
Tallentree B. Sturdivant

1958
Billie D. Boone
David C. Troupe
Gary L. Cooper
James R. Harvey
John J. Kaminsky
Peter F. Kerwin
Ralph B. Miller
Raymond S. Plock
Richard G. Bushree
Robert P. Barkdale
Salvador Espina

1959
Alex A. Richards
Ben L. Allinder
Edward B. Bunnell
Ernest R. Schoop
Glen R. Hiscox
Jeff D. Hardin
John C. Reinhart
John H. Myers
Joseph C. Palais
Kenneth J. Trout
Kenneth S. Atmie
Kim M. Fox
Mary G. Benson (Gonzalez)
Richard J. Viales
Richard L. Therrien
William G. Milam

1960
Anthony Jones
Arvin L. Kolze
George A. Glenday
Gilbert A. Saltzman

1961
Charles E. Backus
Edward A. Conrey
Elis B. Mascarenco
Franklin H. Lee
Fred A. Ruby
George B. Broome
H. Roger Frauenfelder
James G. McCray
John R. Edwards
Joseph D. Grench
Joseph F. Redmond
Carl E. Elers
Kermit W. Whitt
Larry J. Webb
Raphael M. Chen
Russell E. Rogers
Torao Yoshida
William J. Olson

1962
Bruce S. McLaren
Buel W. Woolverton
James E. Marr

1963
Clarence P. James
Frank C. Lenahan
Henri W. Guysard
Oscar L. Ferrell
Patrick L. Brown
Ronald H. Fenelon
Tomory H. Hooten
Wayne E. Dawson

1964
Charles R. Horton
David G. Arendt
Gregten A. Brown
(Gagnon)
James E. Warringer
John M. Christian
Joseph D. Shea
L. Rolf Peterson
Lamar S. Todd
Marino M. Fuentes*
Richard M. Tofel
Sallie S. Tofel (Siegelman)
Steven L. Tofel
Walter H. Higgins
Zoia R. Rosztoczy

1965
Daniel J. Sablich
Gail A. Bock (Foster)
George E. Shirley
Kar C. Fogg
Mitchell G. Allen
Thomas R. Buick
Thomas T. Quege

1966
Bill S. Run
Craig F. Bohren
Donald E. McDonald
Edward A. Nowatzki
Edward G. Preston
George N. Mchins
Leonard R. Shefield
Ralph Wege
Richard C. Carrozzi
Ronald A. Stott
Steven B. Brock
Steven M. Hindall

1967
Archibald M. Brown
Douglas A. Slingerland
Douglas J. Sticht
James R. Rames
John P. Hicks
Jon S. Traw
Larry D. Griffin
Lawrence E. Matthews
McLellan Dixon
Michael D. Peters
Michael J. Kaiserman*
Walter G. Love

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Sidney “Jack” McDuff has served as president of UA alumni clubs in San Francisco, New York and Houston. He’s the recipient of the UA Alumni Association’s A.L. Slonaker Service Award and is a past president of the Bobcat Alumni Association.

He’s also served on the UA Alumni Association’s board of directors, where he chaired the fundraising campaign to name the Alumni Foundation Building in honor of his longtime friend, Marvin D. “Swede” Johnson. He also volunteers for the Sigma Chi fraternity and the YMCA of Southern Arizona.

McDuff was born in September 1926 in Cold Spring, Okla. He moved west to Marana, Ariz., with his family in 1937. His father was the builder and operator of one of the first cotton gins in Southern Arizona. McDuff enrolled at the UA immediately after graduating from Marana High School in 1944, but his studies were interrupted when he joined the U.S. Navy later that year.

He served for 21 months and attained the rank of Electronics Technician Mate Second Class before returning to the UA in September 1946, graduating in 1951 with a BS in metallurgical engineering.

McDuff slowed down from his current duties at the YMCA, the UA President’s Club and the UA College of Engineering’s da Vinci Circle board of advisors long enough to answer a few questions for Arizona Engineer.

### What are your favorite memories from your time at UA?

The five years I spent at the UA were probably the best and most enjoyable of my life. I received a good education and graduated with a BS in metallurgical engineering. It’s where I met and courted my first wife, Lorena DeSanctis McDuff, who also graduated from UA.

I also met and interacted with numerous fellow students who have since become lifelong friends. I pledged and initiated into the Sigma Chi fraternity, where I’ve maintained an active and lifelong involvement.

It helped launch my career with Johns-Manville Sales Corporation, where I rose to the position of division general manager and vice president.
What are your reasons for supporting the UA financially?

The five years that I spent at the University of Arizona formed the basis for all I have earned and accomplished throughout my life, so why wouldn’t I want to give back? In doing so, I like to focus on giving to those who have the opportunity to grow and develop... and hopefully will, in turn, give back to others when they have the capacity to do so. For me, giving helps fill up my emotional tank, and when it is full, I feel good about life, myself and the future.

What are your hopes for the future of UA?

As we move to a more privately funded university, I’m most hopeful our alumni will come forward and support higher education here at the University of Arizona. I believe it is also most critical that incoming students are indoctrinated on this need, and their obligation to support and fund the future needs of the university.

Wildcat Since 1944—Jack McDuff, center, with Chris Utter, left, a recipient of the S. Jack McDuff scholarship, and Jessica Rimsza, a recipient of the Thomas G. Chapman Scholarship.
Systems Engineering Pioneer Dies at 84

Professor Emeritus Wayne Wymore, who in 1960 founded the world’s first academic department of systems engineering at the University of Arizona, died Feb. 24, 2010, age 84.

Wayne Wymore graduated from Ames High School in Iowa in 1944 and after a few months working on a surveying crew, enlisted in the Army Air Force. World War II was ending and Wymore never got to complete flight training. Instead, he was assigned for duty in Panama and Peru, studying and observing weather.

After his discharge in 1947, he attended Iowa State University, where he selected civil engineering as his major. In an autobiographical perspective published in International Journal of General Systems in 2004, Wymore said the engineering curriculum was “not very exciting.” He changed his major to mathematics with minors in physics, statistics and psychology, and left Iowa State with bachelor’s and master’s degrees in mathematics.

In 1957, he accepted the position of director of the Numerical Analysis Laboratory and professor of electrical engineering at UA, and stayed at UA until he retired in 1987. In 1960, at the request of College of Engineering Dean Thomas Martin, Wymore established and headed the world’s first academic department of systems engineering.

UA Engineering Alum Tipped for AZ Leadership

Engineering alum Patrick Marcus has been selected as a future civic leader in the state of Arizona.

The Phoenix-based Arizona Center for Civic Leadership announced March 2 that Marcus is one of 25 fellows in the inaugural class of the Flinn-Brown Civic Leadership Academy, which is sponsored by the Flinn Foundation and the Thomas R. Brown Foundations.

The Flinn and Brown foundations created the statewide civic leadership center because, although Arizona has local and regional organizations that train civic leaders, the foundations perceived no such organizations at the state level.

Marcus graduated from UA in 2006 with a doctorate in biomedical engineering, with a minor in neurosciences. He also got his bachelor’s in electrical engineering from UA, and is a graduate of the Eller College McGuire Center for Entrepreneurship.

He is currently vice president of engineering at Tucson-based MC Power Systems, which he recently spun off from parent company General Plasma, which is also based in Tucson. MC Power Systems designs plasma power supplies for the solar, architectural glass, and liquid crystal display industries.

“I grew up here, and Tucson and the UA are very dear to me,” Marcus said. “I’d love to contribute and make a difference to Arizona’s future.”

When he’s not managing multiple solar manufacturing installations, he’s working as part of an organization called Solar Sculptures with artist partner Stephen Fairfield on creating interactive, computer-controlled public sculptures.

Public installations include Skyburst 2 at Plaza Colonial in Tucson, Ariz. As people approach Skyburst, a motion detector sets off rapidly flashing light-emitting diodes to grab their attention. Marcus designed and built the electronics and wrote the computer program that operates the motion detector and controls the LEDs. Fairfield came up with the original concept and built the physical structure.

Marcus has incorporated his neuroscience expertise into the light sculptures, in the form of psychophysical algorithms that conserve energy while creating the intense optical effects.

“It has actually been a pretty exciting month,” Marcus said. “In addition to being selected as a civic fellow, my art partner and I received two sculpture commissions: one for the Glendale Jazz and Blues festival and another for a big river underpass project in Green Bay.”
Cynthia Tay
BA/EM 2010

After she graduated, Tay traveled far and wide in Southeast Asia and Europe. “I have visited many different countries, some on my own, and others with friends and family,” Tay said. “I was fortunate enough to have 3 months off before I started work for Procter & Gamble in April.” Even though it’s only a few months since she graduated, Tay said, “I’m finished with my travels for now and just entered the working world. Thanks for keeping alums in the loop. It feels good to still be connected!”

Follow Tay’s travels on her blog at http://ctaytravels.tumblr.com/archive.

James “Jay” Gomes Jr.
BS/CE 2004

Gomes is a resident engineer in highway construction at the Arizona Department of Transportation, which recently completed the Twin Peaks Traffic Interchange Project on I-10 in Marana, Ariz. The $50.5 million project included four major concrete bridges. “There was over 1 million yards of roadway excavation and borrow, 14 box culverts, and over 5,000 feet of mechanically stabilized earth-retaining walls,” Gomes said, and added that the big challenges of this project were overcome by “major coordination efforts between the town of Marana, ADOT, the contractor, Union Pacific Railroad, and major utility companies.”

Handsome Twosome—The Twin Peaks Road rammed earth median artwork is in the median of Twin Peaks Road between the Santa Cruz River Bridge and Tiffany Loop Road. Solar panels on the top of each tower power LED lights around the base at night. Each structure has a concrete foundation and metal panels inscribed with cottonwood tree leaf and branch motifs. It was designed by Wheat Scharf Associates.
Send us an e-mail!

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

Please e-mail us (200 words or less) and include the following:

- 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.

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