

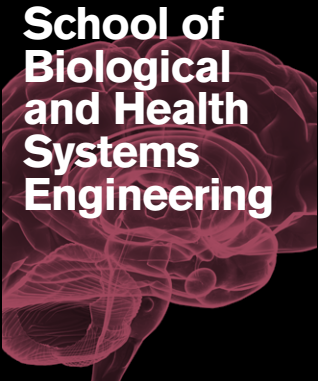
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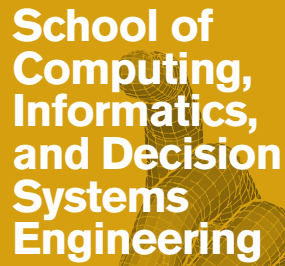
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Engineering the Future



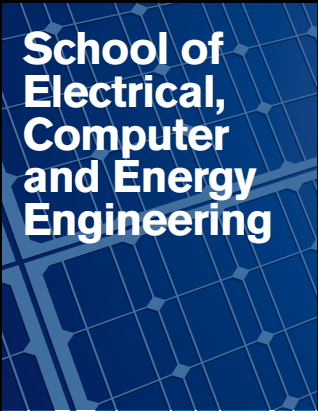
School of Biological and Health Systems Engineering

Marco Santello, director
biomedical engineering,
biological design



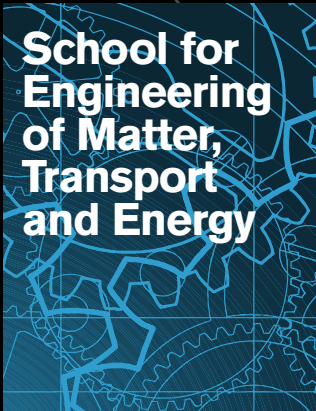
School of Computing, Informatics, and Decision Systems Engineering

Ronald Askin, director
computer science, computer
systems engineering, computer
engineering, engineering
management, industrial
engineering, informatics,
software engineering



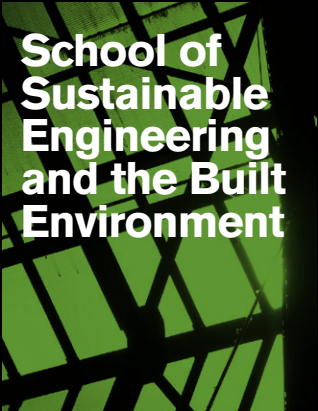
School of Electrical, Computer and Energy Engineering

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School for Engineering of Matter, Transport and Energy

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commercialization



School of Sustainable Engineering and the Built Environment

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engineering



The Polytechnic School

Ann McKenna, director
aviation, engineering,
environmental and resource
management, graphic
information technology,
human systems engineering,
information technology,
manufacturing engineering,
technological entrepreneurship
and management

Ira A. Fulton Schools of Engineering

Building problem solvers and entrepreneurs

Building builders

Building engineers from day one

In the Ira A. Fulton Schools of Engineering, we believe that engineering is more than a discipline—it's a mindset, a way of looking at the world. Students in the Fulton Schools of Engineering are part of a community of problem solvers, people who are passionate about designing and making innovative and entrepreneurial solutions. Our community has grown to nearly 17,000 students from all 50 states and 111 countries—and the Fulton Schools have attracted a record number of incoming freshmen in each of the last five years.

We are dedicated to “the Fulton Difference,” with degree programs that combine a strong core foundation with hands-on experience; personalized advising; our innovative E2 program to welcome freshmen; top faculty, including a Nobel Laureate and members of the national academies of Engineering, Sciences and Construction; and a reputation for graduating students who are aggressively recruited by top companies or become superior candidates for graduate studies in medicine, law, engineering and science.

The Fulton Schools emphasize discovery, design, innovation, entrepreneurship and societal impact. Our faculty and students are solving challenges in energy, health, sustainability, education and security.

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The Center for Negative Carbon Emissions' air capture technology is designed to pull CO₂ from the air.
Illustration by Michael Hagelberg.

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A monument to innovation and construction



Young faculty rapidly building a track record of innovation and high performance



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Morgan Kelley, right, the latest Fulton Schools recipient of the Goldwater Scholarship, worked to provide nighttime lighting solutions for students in Fiji as part of the Engineering Projects in Community Service (EPICS) team Fiji Lights.



Engineers from day one: Students achieving excellence

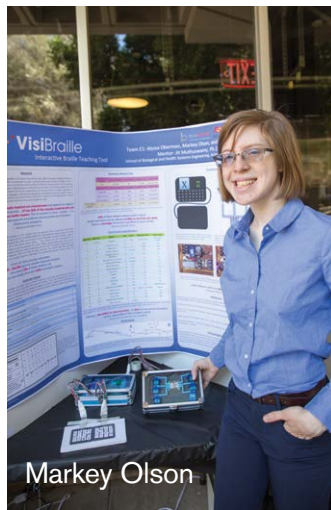
Chemical engineering major awarded prestigious Goldwater Scholarship

Morgan Kelley is among the recent academic high-achievers throughout the country to be awarded a Goldwater Scholarship, considered the premier undergraduate scholarship for mathematics, science and engineering majors. From more than 1,200 nominees, Kelley is one of 260 students, and one of 68 engineering majors, selected to receive the award. It provides up to \$7,500 per year to support completion of an undergraduate degree.

Kelley, who grew up in Glendale, Arizona, has led student projects to deliver portable technologies to provide nighttime lighting to students in Fiji and Uganda. She also is involved in research aimed at engineering more effective ways to keep ocean and other water environments cleaner and healthier. Kelley is also a student in Barrett, The Honors College. Her plan is to attend graduate school, a path encouraged by the Goldwater Scholarship Program.

Grand Challenge Scholar starts business venture to develop Braille teaching tool

Reverse-engineering the brain was always on Markey Olson's mind as she engaged in research, community service and entrepreneurial efforts in the Grand Challenge Scholars Program (GCSP) at Arizona State University.



Olson decided to focus on reverse-engineering the brain because the brain is critical to a multitude of bodily functions. Her research aimed to solve this problem by using sensory cues as opposed to visual cues.

In 2008, the National Academy of Engineering (NAE) identified reverse-engineering the brain as one of 14 "Grand Challenges for Engineering in the 21st Century,"

ASU's Ira A. Fulton Schools of Engineering is among 20 leading engineering schools to establish an undergraduate program guided by the NAE's Grand Challenges. The program now serves as the Fulton Schools of Engineering Scholar Academy — an individualized program for high-achieving students.

This spring, Olson became the program's second graduate, receiving a bachelor's degree in biomedical engineering. That made her the first to graduate from the inaugural group of freshman students invited to be a Grand Challenge Scholar.

Classes on topics related to entrepreneurship along with her capstone course enabled Olson and two other biomedical engineering seniors, Alyssa Oberman and Robert Valenza, to turn their senior capstone project into a startup company called VisiBraille. The idea developed as Olson taught Braille to her sister. The tool allows people, who may not know Braille themselves, to teach Braille to students with visual impairments.

Although the tool is designed to facilitate learning, Olson relates it to her chosen Grand Challenge because "it's essential to first understand the neural mechanisms at play," she said.

The venture team is now at work on the manufacturing and distribution systems needed to get the VisiBraille device into the marketplace. Olson also plans to continue her research by beginning a doctoral program in biomedical engineering at ASU next year.



Online student secures funding for patient care startup

A year and a half ago Andrew Ninh spent the night of his high school graduation in intensive care after he experienced spontaneous pneumothorax, what he describes as his "lung exploding."

Ninh's observations at the hospital were the basis for his emerging health informatics startup company known as DocBot, which enables physicians to make well-informed decisions about patient care quickly. The technology runs rapid analytics on electronic health record and clinical sources, providing physicians with quick and accurate data.

The electrical engineering major has been working with his business partner, Tyler Dao, to raise funding for DocBot. Ninh earned a \$5,000 stipend after participating in the Microsoft Idea Camp last summer, and has been accepted to Singularity University's Startup Lab Accelerator Program in Silicon Valley this fall. He will receive \$100,000 in seed funding as part of the 10-week experience where he will further develop DocBot.

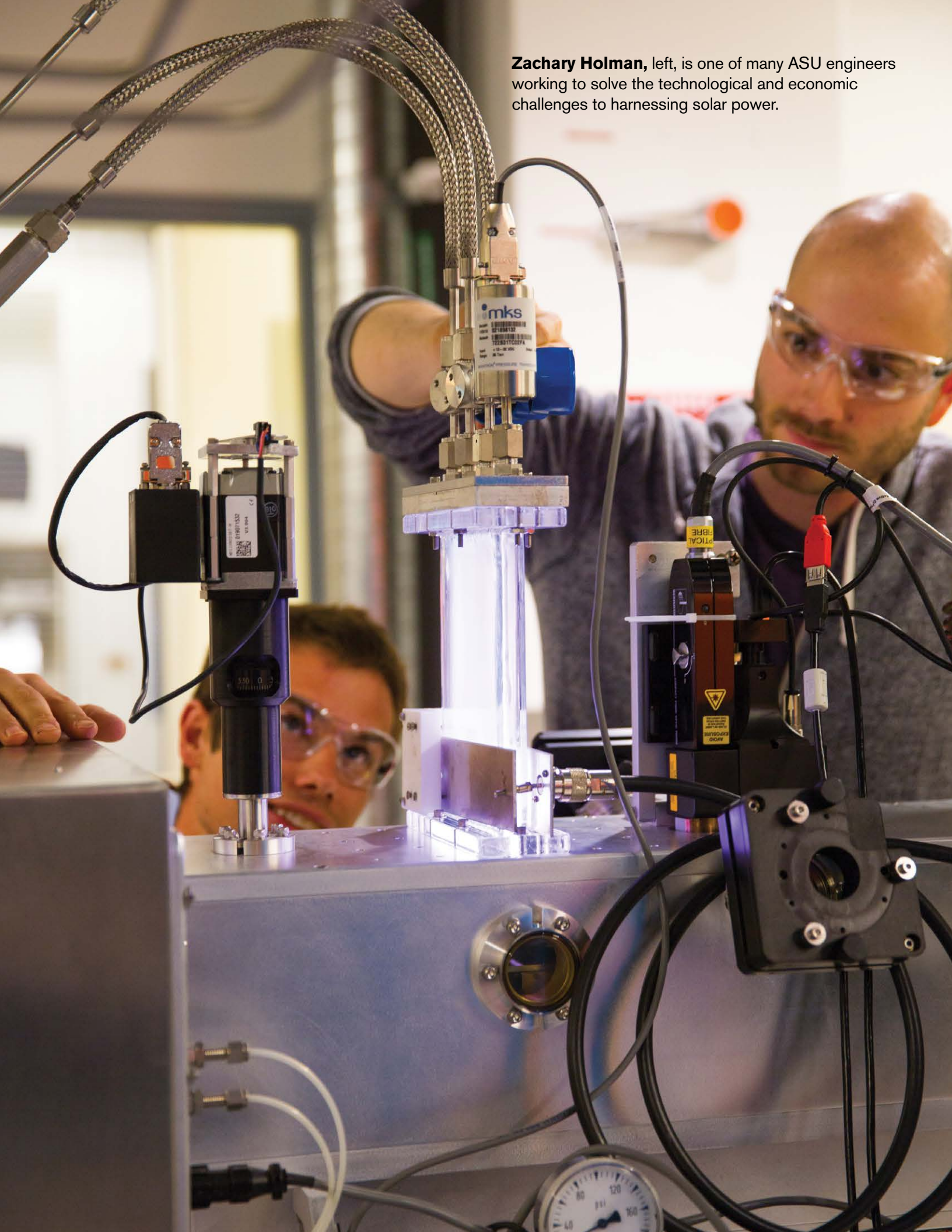
GlobalResolve constructs aquaponics farm for Peruvian orphanage

From designing greenhouses to inspiring future engineers, members of GlobalResolve have completed a series of projects aimed at improving quality of life at the Azul Wasi orphanage in Oropesa, Peru. GlobalResolve, a program of the Fulton Schools, designs solutions to help mitigate the effects of poverty in the developing world, while also helping to create business ventures to provide sustainable economic development.

This year students traveled to Peru during ASU's spring break to construct an aquaponics farm for Azul Wasi. They also offered STEM learning opportunities for the 22 children housed there. Aquaponics is a system for farming fish and plants together in a mutually beneficial cycle — fish produce waste, which fertilizes plants and the plants in turn purify the water for the fish.

The ASU students were accompanied by Gerald Polesky, a lecturer in the Polytechnic School, who has worked on various engineering projects at the orphanage since his daughter, ASU alumna Tiffany Brown, founded it in 2006. In addition to improving the orphanage's living conditions, funds from the aquaponics farm will allow the facility to house more children.

Zachary Holman, left, is one of many ASU engineers working to solve the technological and economic challenges to harnessing solar power.



Innovating a better world: Highlights from research

Collaborations with industry boost solar energy technology

ASU engineers Mariana Bertoni and Stuart Bowden have roles in partnerships with industry that are part of an effort by the U.S. Department of Energy to aid photovoltaic manufacturing and supply-chain companies to advance their technologies. The \$24 million Department of Energy (DOE) program supports development of innovative technology for novel manufacturing equipment and processes that will reduce costs and increase efficiency.

Bertoni is working with Oregon-based SolarWorld Industries America Inc. to develop technology for a novel silicon ingot growth, the process by which the material for solar cells is manufactured. DOE funding will help transition SolarWorld's proprietary NeoGrowth manufacturing process from a pilot stage into early-stage production.

Bowden is working with Technic Inc., a Rhode Island-based company, to eliminate the use of silver in the manufacturing of solar energy cells, replacing it with copper, a more abundant and less costly material. The goal is to develop a copper-plating technique that will reduce the cost of making solar cells without a decrease in performance quality. The solar photovoltaic industry presently uses 15 percent of the world's silver supply.

These projects boost ASU's growing research activity in photovoltaic technologies for solar energy generation. The largest part of that research portfolio is Quantum Energy and Sustainable Solar Technologies — or QESST — an Engineering Research Center supported by the National Science Foundation and the Department of Energy to solve technological and economic challenges to harnessing solar power at a large scale.

Working to make mobile payment more secure

Consumers are well aware of several recent security breaches regarding the credit and debit cards they use on a daily basis: Target, Home Depot, Neiman Marcus and more.

Gail-Joon Ahn, a Fulton Entrepreneurial Professor in the School of Computing, Informatics, and Decision Systems Engineering, is working on tools that will make transactions more secure and allow individuals to control the privacy of their information. He was recently issued five new patents for that technology, and eight more patents are pending related to secure mobile payment.

Here's how it works. An individual would give the information to the bank and, when he or she wanted to purchase something, the retailer would send an invoice that would be routed to the bank and paid. The individual also would be able to set privacy parameters on their cards, say allowing one-time use only, or no release of specific types of information, like their address. The retailer wouldn't have any of the restricted information, reducing the potential for it being stolen.

Ahn said his team currently is testing a demo of the technology.



Gail-Joon Ahn

Emerging technology would improve diagnosis, treatment of eye disorders

Biomedical engineering researchers at ASU are working with an industry partner to advance development of technology enabling the use of tear fluid samples to diagnose and monitor health. Advanced Tear Diagnostics, a medical products company based in Birmingham, Alabama, is providing funding and technical support for research led by Jeffrey La Belle to improve and expand the use of tear fluid as a biomarker to detect various ocular (eye) disorders.

La Belle is an assistant professor in the School of Biological and Health Systems Engineering.

For the project with Advanced Tear Diagnostics, La Belle's team will be measuring concentrations of immunoglobulin E and lactoferrin in tear fluid. The measurements will help in the diagnosis and treatment of a variety of ocular surface disorders — particularly in detecting and differentiating between bacterial and viral infections, including one of the most common eye infections, conjunctivitis, also known as pinkeye.

For the past few years, La Belle's lab has been refining a device that allows people living with diabetes to monitor their condition by taking tear samples to measure their blood sugar (glucose) levels, rather than pricking the skin to draw blood. The project has led to research collaborations and funding support from Mayo Clinic in Arizona. A patent on the device was recently awarded to La Belle and co-inventor Daniel Bishop, a 2009 graduate from ASU and co-founder and chief innovation officer of Qualaris Healthcare Solutions, a Pittsburgh-based medical product development company.



Jeffrey La Belle, center



Re-engineering the student experience

The student experience and the core belief that students need more than traditional coursework to be competitive and successful in their engineering career are some of the top priorities at the Ira A. Fulton Schools of Engineering, and what sets it apart. In the Fulton Schools, students have the opportunity to create their own unique path, complementing the knowledge their professors impart in the classroom with internships, research, community service and participation in student organizations.

It is a model of success that has contributed to phenomenal growth and rise in excellence. For the fifth consecutive year, the Fulton Schools enrolled a record number of freshmen with the incoming class totaling more than 2,500 students. With six schools offering more than 60 degree options, the overall student body has grown to nearly 17,000 strong, granting more than 2,500 degrees in 2013-2014. But the Fulton Schools have grown not only in size, but renown and opportunities as well.

Now ranked in the top 25 percent of undergraduate engineering programs by U.S. News & World Report, the Fulton Schools can offer new and innovative experiences to tomorrow's engineers enhancing its reputation in tandem with its ever-increasing student population.

"One of the things we learned early on, and it's particularly true with how many students we have, is that they all have different interests and passions and they all need different pathways to graduation," said Paul Johnson, dean emeritus of the Fulton Schools of Engineering.

Determining those different pathways is all about providing diverse learning experiences for students, so they can discover their passion or drive, and ultimately what becoming an engineer means to them.

It all starts with E2, more than your typical orientation

Students strike out on their individual paths of discovery starting at E2 camp, an off-campus experience running throughout the month of August. Established in 2008, E2 sends students to camps near Prescott, Arizona, for two or three days to meet staff, faculty, upperclass mentors and other incoming freshmen. The camps serve as an introduction to the Fulton Schools; students participate in team building,

critical thinking and problem solving exercises, offering them the first taste of their engineering education.

"The fact that it's off campus shows that we want students to think about their experience in the Fulton Schools as more than just the in-classroom experience," said Carrie Robinson, associate director of academic achievement.

The off-campus setting and overall messaging of E2 goes a long way in setting the tone of the Fulton experience for students. It instills in students that they are engineers from day one, that experiential learning is paramount to their development and that vital lessons can take place outside of the classroom.

"Getting to meet their instructor for Intro to Engineering before classes start can help them to see instructors as people, and not just a talking head in front of the classroom," said Robinson.

In addition to introducing students to the Fulton Schools community and experience, another goal of E2 is to get students involved in the community, be it through student organizations, competitions, undergraduate research or local community engagement opportunities.

"The students going to the camps learn about the activities that camp counselors, students a year or two older than them, are involved in and passionate about," said Jim Collofello, associate dean for Academic and Student Affairs. "The result is that when they come back to campus, it's in their mindset to get involved."

Learning and living together

Upon leaving E2 and starting classes, students enter their residential community, where students live and learn together grouped by school. On the Tempe campus Fulton Schools freshmen are housed together in University Towers and Palo Verde East, as well as Barrett Honors College community.

In July 2014, the Polytechnic School, located in Mesa, Arizona, officially became a part of the Fulton Schools community. Formerly the College of Technology and Innovation, the Polytechnic School adds a host of new programs and majors to the Fulton Schools. Students in the Polytechnic School reside in Century Hall.



Man standing on shoulders, wearing a black t-shirt with a yellow 'E2' logo and a name tag.

Man on the left, wearing a black t-shirt with a yellow 'E2' logo and a name tag.

Man in the middle-left, wearing a black t-shirt with a yellow 'E2' logo and a name tag.

Man in the middle, wearing a black t-shirt with a yellow 'E2' logo and a name tag.

Man on the middle-right, wearing a black t-shirt with a yellow 'E2' logo and a name tag.

Man on the right, wearing a black t-shirt with a yellow 'E2' logo and a name tag.

Woman kneeling in the front, wearing a maroon t-shirt with a yellow 'E2' logo and a name tag.

By grouping Fulton Schools students together in the same residence hall, the sense of community fostered at E2 can continue to grow.

"Though we have a really strong identity on the Polytechnic campus, one of the things that has been exciting is to work with the dean and the other directors and think of interesting ways we can build collaborations across the schools," said Ann McKenna, director of the Polytechnic School.

Maintaining a sense of community and collaboration provides a support system that encourages students to explore the wide array of opportunities within the Fulton Schools.

Engineering a career

"When Fulton Schools students step onto the ASU campuses, they're going to hear about how to connect with their passion and there are resources to do that," said Robin Hammond, founding director of the Fulton Schools Career Center.

The Fulton Schools Career Center is dedicated to helping students find their passion within the world of engineering and technology by providing career coaches, workshops and events. The center aims to have students ready for an internship within their first four semesters, not only so they can sample different aspects of engineering but also so they'll have the required experience employers look for in a candidate.

"We're very focused on helping students understand what engineers do, what's inspiring about what engineers do, and how they can meet and connect with people to build on those interests," said Hammond.

Solving engineering problems through research

One way students are encouraged to explore their interests is through the number of programs Fulton Schools offers to engage students outside of the classroom.

"All these programs are geared toward developing skills that employers want, but aren't necessarily gained in the classroom," said Amy Sever, associate director of Undergraduate Engagement.

The Fulton Undergraduate Research Initiative (FURI), for example, is a research program that allows undergraduate students to work and connect with a faculty member on a funded research project.

"Many of the students in the program are thinking about graduate school, so it gives them a look at what it means to be on a research team," said Sever.

While cutting their teeth on a research project and research processes, students learn valuable skills, like proposal writing, and can present their research findings at the semi-annual FURI Symposium.

Another program is Engineering Projects in Community Service, (EPICS) which pairs multidisciplinary teams of students from various engineering majors with a project that helps a community, nonprofit or government agency solve an engineering problem. Students learn to draw up plans, pitch a budget, solicit funding, work with other disciplines and interface with a community member or organization.

"Through EPICS, students are learning 'soft' skills they might not pick up in a classroom — brainstorming, presentation skills, developing project plans and seeing them through to completion," said Sever. "They get the opportunity to assess and meet a customer's need."

EPICS also provides a community service opportunity and shows students how engineering can make a difference in the world. House of Refuge, a nonprofit organization that provides transitional housing and support to homeless families, has partnered with multiple EPICS teams to improve and strengthen their facilities.

While some students are actively working to improve the local community, there are also opportunities to tackle global engineering problems through the National Academy of Engineering's Grand Challenge Scholars program. ASU is one of 20 universities participating in the program, which invites top freshman students to study and develop solutions for a range of technological and engineering advances that will improve the world in the future. Students are pushed to look

at the interdisciplinary and global nature of these challenges as well, prompting them to approach the problem from a different perspective and broaden their mindset.

Collaborating outside the classroom

There are also approximately 60 student organizations, clubs and competitive teams that provide outlets for students' interests and creativity. Everything from honors organizations, to major-specific groups with national affiliations to clubs dedicated to specific endeavors such as robotics and aeronautics are represented.

In addition to clubs and organizations that tap into individual interests, the Fulton Schools is home to organizations like Advancing Women in Construction (AWIC) and Advancing Minorities in Construction (AMIC), which seek to support female and minority students by connecting them with industry mentors.

"When students are ready to engage, there's a safety net, a group out there that's willing and ready to be an advocate for them," said Matt Eicher, assistant director of the School of Sustainable Engineering and the Built Environment.

After a concerning number of Native American students were leaving the construction program, one safety net was founded. Construction in Indian Country, a nonprofit organization, is a collaborative group focused on quality management among American Indian sovereignties and providing educational opportunities for American Indian students. Now the Del E. Webb School of Construction has one of the highest Native American student populations in the nation.

To date, Construction in Indian Country has raised approximately \$300,000 toward scholarships for Native American students in construction, according to Edd Gibson, director of the School of Sustainable Engineering and the Built Environment.

Transferring to the Fulton Schools of Engineering

There are a variety of programs and initiatives that focus on acclimating transfer or nontraditional students to the college. A newly established Transfer Success in Engineering class was designed to introduce first-semester transfer students to resources and opportunities. The needs of transfer students ranging from those coming from a community college, a different university, professionals with years of experience who simply need a degree or veterans are taken into account.

"We offer an array of options to students, knowing they come in with varied backgrounds and are looking for different experiences so they can customize their experience at ASU," said Robinson.

Building the 'Fulton Difference'

All of the programs and opportunities that engage students creatively, socially and educationally are geared toward crafting a well-rounded experience at the Fulton Schools. A diverse experience leads to a unique résumé that sets Fulton Schools students apart.

"I always tell students that in their first job interview, interviewers are going to spend 30 seconds on that top third of the résumé — their name, address, major and GPA. The remaining 29 and a half minutes are going to be focused on everything beneath that — the things that you did outside the classroom," said Johnson. "That's when students get to talk about their experiences, that's when their passion comes out, who they are, what they care about and their ability to accomplish their goals."

Looking to the future, the Fulton Schools are focused on expanding opportunities for students to explore their interests and in turn, produce the best engineers possible.

"Our goals are to continue to grow a portfolio of engagement opportunities for our students. We're adding more student organizations, more competitions, and more opportunities to be engaged both in and out of the classroom," said Collofello. "We're hoping more and more students will take advantage of these opportunities as they find something that specifically appeals to them."

Students in the Fulton Schools are active members in organizations and professional societies like MAES — Latinos in Science and Engineering. In addition to the networking experiences these societies provide, students engage in outreach to help spark an interest in engineering among K-12 students.



Achieving prominence through exceptional students

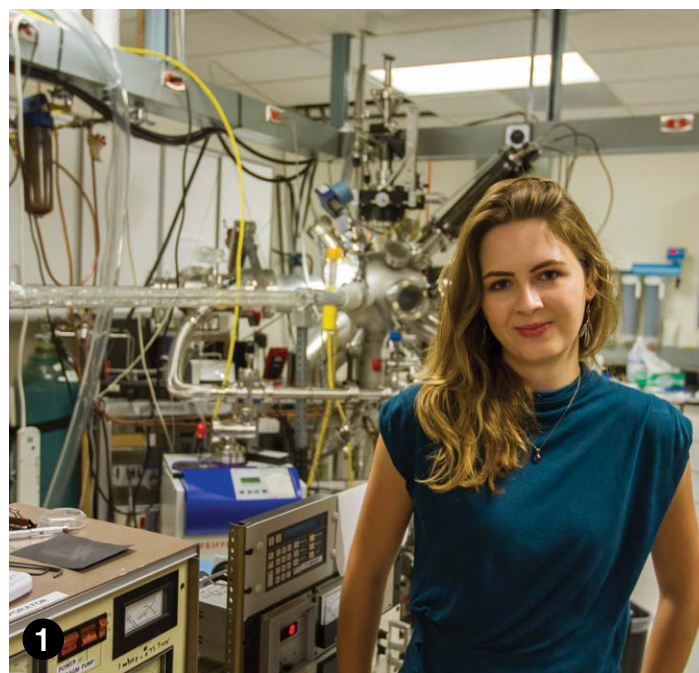
The students of the Fulton Schools are known as high achievers who make a difference in the world each and every day. We are extremely proud of the students we see every day and we take a personal stake in their success and celebrate the many ways they are making an impact. Here are some recent success stories from within the Fulton Schools:

Freshman named future innovator of the year

① Sarah Galvin, a freshman electrical engineering student, was presented one of four Future Innovators of the Year Awards at the 2014 Governor's Celebration of Innovation in Arizona. The award recognizes Galvin's research, which involves experimentation with using combinations of various materials to make devices that could help pave the way for the next generation of electronics. Earlier this year, the project earned her a first-place prize in the electrical and mechanical engineering category in the Intel International Science and Technology Fair for high school students.

NSF fellowship boosts engineering student's materials research

② Doctoral student Tyler Stannard is working on research to better comprehend the dynamics of materials stress, corrosion and fatigue, and to develop new metal alloys. Now his intense interest in the field, backed by strong academic and research efforts, has earned him a National Science Foundation (NSF) Graduate Research Fellowship. The fellowship award will provide \$32,000 per year for up to three years for Stannard to complete the materials science and engineering doctoral program in the School for Engineering of Matter, Transport and Energy.



Materials students finish among leaders in geodesic dome competition

③ Two teams of ASU material science and engineering majors finished among the leaders in a student geodesic dome-building competition at the national Materials Science & Technology conference. The ASU Iron Lotus team — juniors Michael Moorehead and Nathan Rodkey — placed third overall, winning a \$500 prize. The ASU Golden Dome team placed fourth in the maximum load category, based on how much weight dome structures could bear before yielding. The team was the youngest group of competitors at the event and included freshmen Hassan Al Mousa, Jacob Kintz, Ayan Rafique, Chris Nelson and Alex Crawley.

ASU team's robot driver in top 10 at Cornell cup

④ A student team from the Fulton Schools, which taught a robot to drive an electric car, placed in the top 10 of 34 finalists at the 2014 Cornell Cup USA, an embedded technology competition presented by Intel. The annual competition, designed to encourage students to use embedded technology, provided teams with Intel development boards featuring Atom processors. ASU's six-member team was led by Sami Mian and included Joe Boeding, Ryan Sterry, Mila Arezina, Cameron Stewart and Bijan Fakhri, all seniors in computer systems engineering.

Teams shine in construction management competition

⑤ Three of the nine teams from the Del E. Webb School of Construction earned third place in their categories in the 2014 Reno Competition, the largest construction management competition in the United States. Members of the design build team included Russell Wisniewski, Isaac Bates, Jesse Pruitt, Evan Sherwood, Erika White and Cole Woodward.

Fulton Schools Team wins ASU Academic Bowl for the third straight year

⑥ The Fulton Schools Maroon team won ASU's prestigious Academic Bowl this year, taking home the grand prize of \$24,000 in scholarships. Team members included Wesley Fullmer and Prad Kadambi, electrical engineering majors; Rohan Murty, a chemical engineering major; Daniel Martin, a computer systems engineering major; and Matthew Askins, an aerospace engineering major.



ASU teams take home scholarship awards from Avnet Tech Games

7 Three teams of engineering and computer science students in the Fulton Schools were top award winners at the recent Avnet Tech Games. The ASU students were among the 31 students on winning teams to receive Avnet Tech Games scholarship awards of \$1,000. Avnet is a Fortune 500 company and one of the largest distributors of electronic components, computer products and embedded technology.

Engineering students chosen for prestigious Fulbright Summer Institute

8 Two Fulton Schools students were invited to the Fulbright Summer Institute — one of the most prestigious and selective summer programs operating worldwide. Kaleigh Johnson, a chemical engineering junior, and Brandon Dorr, a biomedical engineering sophomore, traveled to the United Kingdom for four weeks to live and study at leading institutions. Dorr studied at the University of Bristol, while Johnson studied at the University of Exeter. Both are students in Barrett, The Honors College at Arizona State University.

Peela nets top 10 at American Association for Cancer Research meeting

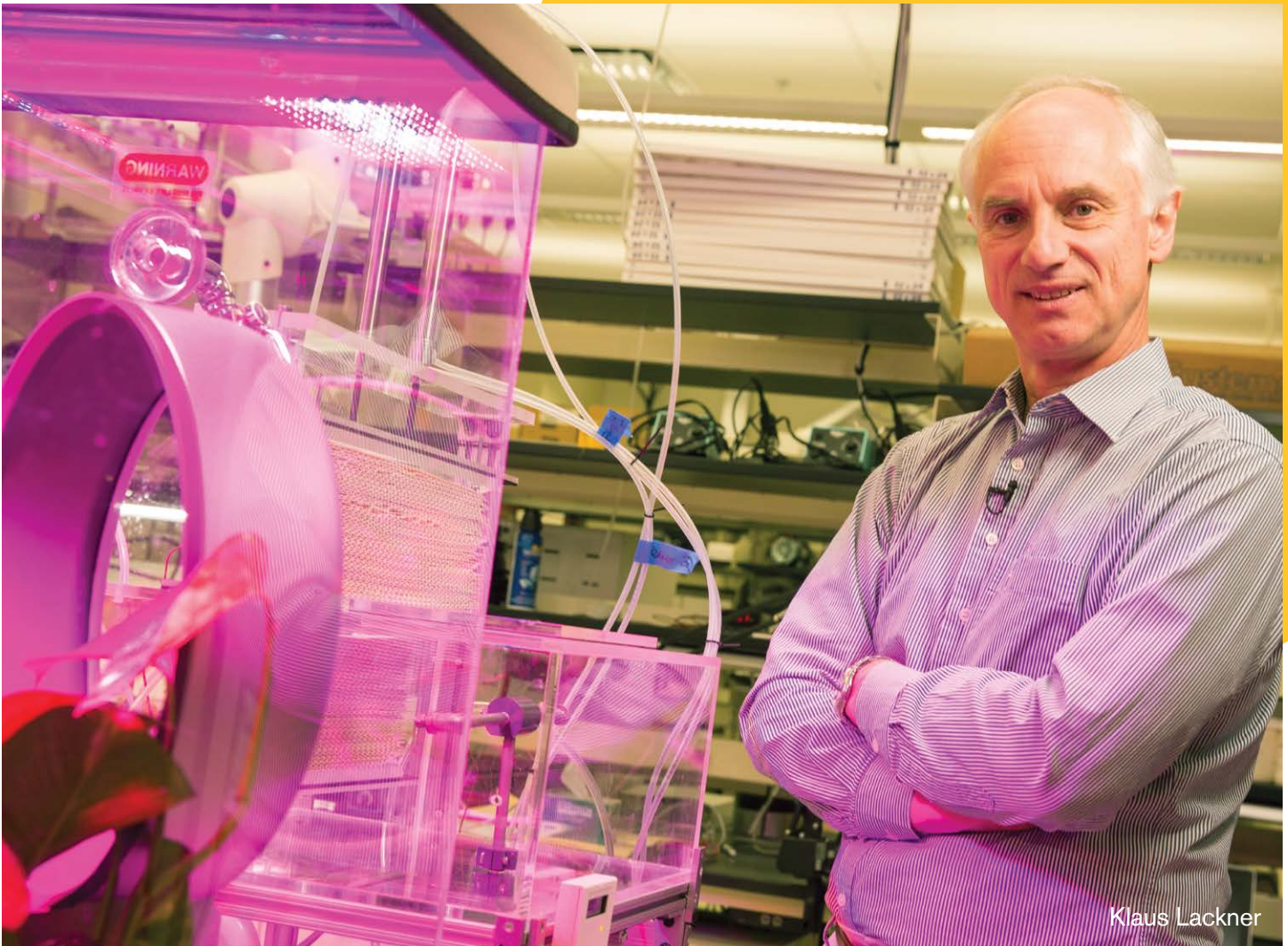
9 Nitish Peela, a sophomore studying biomedical engineering, received a top 10 award for his poster presentation at the American Association for Cancer Research (AACR) Annual Meeting in Philadelphia, Pennsylvania, this year. Peela's presentation was entitled "Breast Cancer Cell Invasion in a Highly Organized Three-Dimensional (3-D) Tumor Model." The Fulton Undergraduate Research Initiative (FURI) — a program that supports undergraduate student participation in research under the mentorship of ASU engineering faculty members — supports Peela's research. In addition to offering a research stipend, FURI provided funding for Peela's travel costs and conference fees.

Kenya project earns students national award

10 ASU's student chapter of Engineers Without Borders (EWB) received a 2014 Premier Project Award — one of only three nationally — from the national EWB-USA organization. The chapter was recognized for its work to design and construct sustainable water infrastructure in a rural community in Kenya. About 25 students were involved in the project, but since it began as many as 50 students have participated in some way.

Read more: engineering.asu.edu/achieve





Klaus Lackner

New ASU center aims for negative carbon emissions

What if we had the ability to not only reduce greenhouse gas emissions, but also remove excess carbon dioxide from the atmosphere? If we could, where would we store it, and how could it be used in a positive way?

A new research center at Arizona State University, led by faculty in the Ira A. Fulton Schools of Engineering, aims to show that capturing excess carbon dioxide from air is a viable strategy to stabilize and reduce greenhouse gases in the atmosphere.

The captured gas also is a valuable resource that could be recycled to help power the production of synthetic fuels, as well as provide an essential food source for plants in greenhouses. This air capture technology developed by researchers at the Center for Negative Carbon Emissions transcends the limitations of traditional carbon reduction approaches by actually scrubbing carbon dioxide from the air.

“There is a limit to the amount of carbon dioxide we can have in the atmosphere; if the limit is surpassed, life becomes intolerable,” said Klaus Lackner, the center’s director and a new professor in the

School of Sustainable Engineering and the Built Environment, one of the Fulton Schools of Engineering.

“Stabilizing our carbon emissions at net-zero is the only way to avoid crossing the secure threshold. But with global emissions rising, this effort is increasingly expensive and difficult,” Lackner said.

Achieving net-zero emissions requires new technologies, such as air capture, that can manage the carbon balance in the atmosphere by capturing and permanently storing carbon dioxide, resulting in negative carbon emissions.

The center’s novel air capture technology features a plastic resin that captures carbon dioxide when dry, and releases it when moist.

Its discovery emerged from collaborative work between Lackner and the center’s executive director Allen Wright, while they were at Columbia University and Global Research Technologies, the first privately held air capture company.

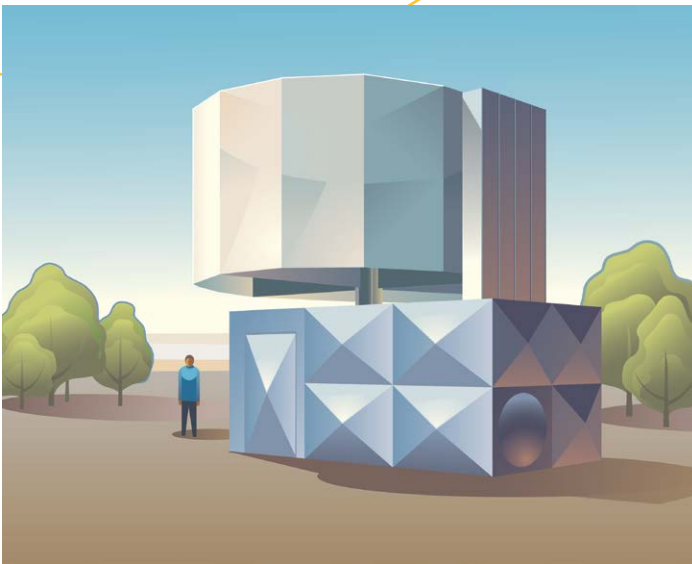
Paving the way for carbon recycling

Capturing carbon dioxide is just part of the agenda for the Center for Negative Carbon Emissions. The center’s researchers also are looking at ways to use what is captured to expand a sustainable economy through efforts like carbon recycling.

“Before we start capturing and storing carbon dioxide on the scale required for negative emissions, we need to prove that air capture is economically efficient,” said Christophe Jospe, the center’s chief strategist.



Allen Wright



“Bootstrapping our technology to commercial endeavors where carbon dioxide is a valuable resource is a logical way to promote critical developments in this field,” said Jospe.

Greenhouses and algae-based biofuels which require less concentrated streams of carbon dioxide could enhance their yield using the carbon dioxide collected by the center’s air capture units — making them natural first candidates for efforts to optimize this technology for commercial use. The center also aims to supply carbon dioxide to manufacturers of synthetic fuels, a sustainable alternative to fossil fuels.

Teaming up for sustainable solutions

Lackner, Wright and Jospe moved to ASU from the Lenfest Center for Sustainable Energy at Columbia University to take advantage of Arizona’s climate and solar energy resources. “Our technology performs best in dry climates and can be powered by renewable energy. The desert, with abundant solar power and dry climate, is ideal for us to expand our work from the lab to an outside operating environment,” Wright said.

The Center for Negative Carbon Emissions plans to find its place within the larger sustainable solutions framework at ASU, alongside endeavors such as LightWorks and PlanetWorks and the Global Institute of Sustainability.

“Technology advances do not happen in a vacuum and there is world-class innovation in many facets of sustainability here at ASU,” Lackner said. “There is a natural connection between our work and research being done at ASU that can lead to excellent collaborations.”

“We are fortunate to have attracted Lackner and his team to ASU. I feel confident that other research efforts will gain synergy from the work and intellectual capabilities that they bring to the university,” said Edd Gibson, director of the School of Sustainable Engineering and the Built Environment.

The center has already attracted students through outreach with the Fulton Undergraduate Research Initiative (known as FURI) and the faculty members said they look forward to providing more student opportunities for research.

“We offer a holistic systems approach that allows students to get involved in diverse ways, including with the design and construction of various apparatuses, computational simulation, experimental work, automation of processes and political and economic analyses of the availability of this technology,” Jospe said.

Making a case for air capture

Along with pursuing advances in negative carbon emissions, the center’s researchers are eager to increase public awareness about the challenges surrounding the buildup of carbon dioxide in the atmosphere and the achievable solutions negative carbon emissions can provide.

“We are enthusiastic about engaging in the public debate, showing the consequences that different decisions will have and providing opportunities for decision-makers to shape desirable outcomes,” Jospe said.

For the center’s researchers, the urgency of the challenge is clear. “The longer we wait, the more carbon dioxide remains in the atmosphere and the greater the risk of a catastrophic event becomes,” Lackner said.

“Air capture provides a way to clean up after ourselves, while making an array of sustainable and carbon management solutions possible,” said Lackner. “But first we must clearly demonstrate in the public domain that we can and should take up the case for air capture technology.”

The Polytechnic School, one of the Fulton Schools, is a leader in project-based learning, exemplified by the Startup Labs, where students design, build and test their ideas. Faculty members working on this new grant will further develop previously tested and refined engineering education research and scale it up within the school. Their results will be shared nationally.



NSF awards faculty \$2 million to redesign undergraduate engineering and computer science education

Arizona State University is launching a project to revolutionize engineering education by creating a learning environment that values risk taking, making, innovation and creativity among its students and faculty.

Faculty of the Polytechnic School, one of the six Ira A. Fulton Schools of Engineering, will lead the project. The school, under the leadership of director Ann McKenna, has been selected to receive one of only six \$2 million grants awarded recently by the National Science Foundation (NSF).

Other universities and colleges chosen to lead this effort include Purdue University, Colorado State University, the University of North Carolina at Charlotte, the University of San Diego and Oregon State University. The awards are part of NSF's Revolutionizing Engineering Departments program known as RED.

"An underlying premise of RED is that department heads can be critical levers for change," said Donna Riley, NSF program director for engineering education research. "RED focuses on transforming department structure and faculty reward systems to stimulate comprehensive change in policies, practices and curricula."

McKenna is the principal investigator on the grant, with the team including co-investigators Samantha Brunhaver, Shawn Jordan, Nadia Kellam and Micah Lande. Their project, titled "Additive Innovation: An Educational Ecosystem of Making and Risk Taking," will focus on the Polytechnic School's engineering and manufacturing engineering programs, and will further develop previously tested and refined engineering education research done by the group.

According to McKenna, the project will provide the foundation to build upon successful innovations in the programs' project-based sequence to improve the entire undergraduate experience, including technical

core courses — such as mechanics and electrical theory — taught during sophomore and junior years.

The premise is that students learn complex theories better when they are actively engaged in applying the concepts to solve real-life, meaningful problems.

"Engineering schools have done a great job introducing students to project-based learning in first-year courses and implementing it in senior projects, but teaching of the core curriculum has remained relatively unchanged," McKenna said. "We are looking at the entire ecosystem, which includes the students and faculty, and that requires embracing and supporting a mindset all the way up through the administration that values and rewards innovation and entrepreneurial ideas."

The Polytechnic School already focuses on an education ecosystem that empowers faculty to be agents of change in the way they teach courses, and the plan is to grow this to include all faculty members. A defining focus of the school is the four-year project sequence. Students are considered "engineers from day one," exemplifying what sets the Fulton Schools apart. The pioneering eProjects program brings students, faculty and industry together to find innovative solutions to real-world problems.

"We are able to attract and retain students of the highest potential because of the exemplary interdisciplinary team-based learning experiences that these projects provide," McKenna said. "The longer-term impacts of creating a culture that values risk taking and making include attracting a new kind of student to the field of engineering. In particular, students who seek career options in which they can make a positive impact on the world, or in their specific community, who may not have traditionally considered engineering."

The project will take place over five years. As first steps the research team is creating a business model canvas, which is a strategic management tool used by Lean startups. The team will identify the current engineering education ecosystem, talk to members of the faculty, students and industry partners to gather input and determine what they need to redesign and revolutionize undergraduate engineering education.

What they learn will help them create workshops for faculty where they will share tools and techniques to empower them to reinvent their own courses — part of the additive innovation philosophy. Students also will be resources for faculty in helping them learn to use tools and manufacturing equipment they may not be familiar with in the Startup Labs, a facility on the Polytechnic campus.

"By empowering and rewarding risk taking, making and additive innovation among faculty and students we create a culture of change agents in the organization where everyone is able to modify and innovate the curriculum and learning experience, and this can lead to amazing transformation," McKenna said.



Jeremi London, Samantha Brunhaver, Nadia Kellam, Adam Carberry, Jennifer Bekki, Ann McKenna, Shawn Jordan, Micah Lande



College Avenue Commons: A monument to innovation and construction

It began as a simple need for space. But out of the minds and the hands of dedicated ASU donors, alumni and students, ASU's College Avenue Commons stands today as a glowing example of the New American University and home of the Del E. Webb School of Construction, part of the School of Sustainable Engineering and the Built Environment.

The building is the most recent in a line of infrastructure improvements to support the Ira A. Fulton Schools of Engineering's growing student body, faculty and excellent research portfolio. Over the last five years major infrastructure initiatives have included eSpace, innovative hands-on learning spaces for students, and the Interdisciplinary Science and Technology Building 4 (ISTB4), the largest research facility in the history of ASU.

College Avenue Commons is a testament to the dedicated industry partners and alumni who made it happen. A capital campaign helped bring in \$8 million and the level of investment by industry was nearly \$18 million in endowments. Sun Devil alumni also worked on the project from site demolition and architectural drawings, to framing and concrete finishings.

With everyone's support, the building exemplifies the innovative and sustainable design principles championed by the Del E. Webb Construction Company. It is Gold LEED certified, embracing the

university's core value of sustainability. What makes the building truly special is its novel design that creates an atmosphere of team building. With the three-story "mixing chamber" space, students, industry partners and faculty can meet and talk. The inner workings of the building through exposed structural members and building systems, slide-out barn doors that reveal "behind-the-wall" models and real-time monitoring that shows how systems work present a unique learning environment.

College Avenue Commons also is a first for the university as a mixed-use space. In addition to housing classrooms and faculty offices, it houses retail space and is home to the Future Sun Devil Welcome Center. Outdoor spaces, lawns, patios and balconies create a gathering place for graduation celebrations and game-day parties and have become a place where town and gown can mingle.

As one of the largest construction programs in the country, with 400 students and 17 faculty members, the Del E. Webb School of Construction is pushing the boundaries of construction practice. College Avenue Commons gives them a new home reflective of its excellence and indicative of its future.

John Meredith, an alumnus and architect in ASU's Office of the University Architect, explained that university buildings are based first on practical needs. This building, originally given the nondescript name Block 12, was envisioned as administrative offices, and costs calculated accordingly: \$54.5 million.

"We basically had a budget for a six-story stucco box," Meredith said.

Upon reflection of the role the building would play in the university landscape, it was given more high-profile tenants and a much broader mission.

Photo by Tim Trumble

Young engineering faculty rapidly building a track record of innovation and high performance

New awards this year bring two-year total to more than \$11.5 million

High-performing innovation teams require the perfect combination of bright new talent and more experienced players.

It's a strategy that is paying off for the Ira A. Fulton Schools of Engineering, which is building a track record of high performance by its young faculty members. A total of 20 prestigious awards have been netted over the past two years, bringing more than \$11.5 million to support both research and education in the Fulton Schools.

These early career honors include the National Science Foundation (NSF) Early Faculty Development (CAREER) Program Awards, Air Force Office of Scientific Research Young Investigator Research Program (AFOSR YIP) Awards, National Institute of Health (NIH) Director's and Career Development Awards, and Defense Advanced Research Projects Agency (DARPA) Young Faculty Awards.

This year already eight members of the faculty have been awarded CAREER and AFOSR YIP Awards. One researcher has doubled-down, receiving both a CAREER and YIP Award.

"These highly competitive and prestigious grants are awarded to young faculty with the best ideas in the United States. Our young faculty are amazingly innovative and are already pushing the boundaries of their fields," said Paul Johnson, dean emeritus of the Ira A. Fulton Schools of Engineering. "In addition to being outstanding researchers, they are exceptional teachers, and their grant activities involve outreach to inspire the next generation of engineers."

According to NSF, the CAREER Award "supports junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations."

This year's CAREER Award winners include:

1 Pavan Turaga, assistant professor in the School of Electrical, Computer and Energy Engineering and School for Arts, Media + Engineering.

This award supports research to create new algorithms that can uncover underlying qualities of human movement. Turaga will create systems that can assess movement quality in home-based interventions for mobility disorders. This educational and outreach project focuses on informing technological innovations with humanistic insights, encouraging engineering students to draw on perspectives from the humanities and arts (and vice versa) and building hybrid digital-physical systems with interdisciplinary teams of students. Turaga teaches a course on motion capture for integrative systems where students from across disciplines create projects that span from interactive art installations to scientific projects involving interventions for mobility disorders.

2 Liping Wang, assistant professor in the School for Engineering of Matter, Transport and Energy.

The fast depleting reserves of conventional energy sources and ever-changing environmental impacts have resulted in an urgent need for high-efficiency renewable energy sources and energy-saving materials. Wang will use this award to focus on selectively controlling thermal radiation with novel man-made nanostructures. He will also develop an educational and outreach program including graduate and undergraduate student mentoring, invited seminars, international student/scholar exchange and K-12 education.

3 Jagannathan Rajagopalan, assistant professor in the School for Engineering of Matter, Transport and Energy.

This award supports fundamental research that lays the foundation to employ nanocrystalline metals and alloys as smart, functional materials that have applications in aerospace, medicine and robotics. The research activity is integrated with materials science education and outreach through a new mentoring program and scientific demonstrations for high school students, teacher workshops, course enhancements, and training of undergraduate and graduate students in multidisciplinary materials research.

4 Sarah Stabenfeldt, assistant professor in the School of Biological and Health Systems Engineering.

This award supports research that addresses fundamental gaps in understanding and modulating neural regeneration after brain injury. It will provide substantive research skill sets for the next generation of engineers and scientists. A unique educational program will be developed for students ranging from high school to graduate school in order to actively conduct the proposed research. Additionally, Stabenfeldt will develop a guided-inquiry scientific module for high school students aimed at developing scientific analytical skills.

5 Pingbo Tang, assistant professor in the School of Sustainable Engineering and the Built Environment.

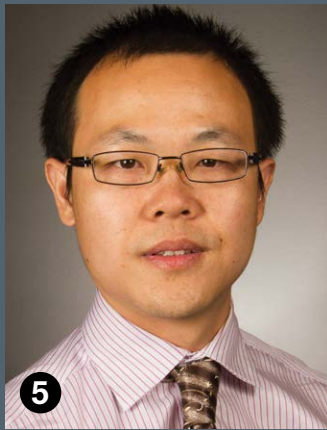
This award will help pioneer a change-based risk analysis method that uses diverse spatiotemporal data for predictive defect detection of aging civil infrastructure systems and early warning of structural collapse for proactive infrastructure management. Change analysis games developed in this effort are to be integrated into the engineering curriculum, K-12 summer workshops and industry outreach activities. A focus of this award is to engage people from underrepresented groups, especially Hispanics and Native Americans.

6 Srabanti Chowdhury, assistant professor in the School of Electrical, Computer and Energy Engineering.

A significant amount of energy — more than 10 percent — is wasted as heat due to inefficient power conversion. This award will help Chowdhury develop a very low loss power transistor with an integrated drive circuit for power conversion applications. This will reduce or eliminate the wasted energy, thereby effectively extending the lifetime of available energy resources, increasing global energy security and reducing greenhouse gas emissions. The educational and outreach components are aimed at fostering interest in science, technology, engineering and mathematics (STEM) disciplines and developing scientific knowledge at the undergraduate and K-12 levels. These activities are focused on working with a diverse group of students, particularly women and other underrepresented groups.

7 Oliver Kosut, assistant professor in the School of Electrical, Computer and Energy Engineering.

Wireless and wired network systems are subject to attack, and cannot be considered trustworthy until they operate reliably in the presence of an active adversary that alters the natural behavior of the system. This award supports research that proposes new techniques to bolster the resilience of communication networks in the presence of potentially damaging attacks, with an eye toward the fundamental



trade-offs between security and performance. To be effective, these solutions need to be correctly understood and used. Kosut will also develop an education and outreach program for students of all ages focused on security vulnerabilities and protections for networked systems.

Air Force Office of Scientific Research Young Investigator Research Program

The AFOSR YIP Award supports scientists and engineers who "show exceptional ability and promise for conducting basic research ... and enhance early career development of outstanding young investigators."

This year's YIP awardees include:

8 Paulo Shakarian, assistant professor in the School of Computing, Informatics, and Decision Systems Engineering.

Getting a communication to "go viral" on social media is the goal of many public information and marketing efforts. Yet large information cascades are rare, suggesting they are difficult in practice to engineer. This award will advance research aimed at identifying the "inhibitory characteristics" in a social network that cause a message to stop spreading and eventually die out. Shakarian's work could help public service announcements reach the public during a health crisis or natural disaster.

9 Srabanti Chowdhury, assistant professor in the School of Electrical, Computer and Energy Engineering.

This award will advance research on transistor scaling technology that enables today's high-speed electronics, like wireless communication, advanced imaging and radar, to operate at higher performance levels. This project takes a design-oriented approach exploiting the unique features of reciprocal space using III-nitrides and zinc oxide to simultaneously achieve high power and high frequency performance.

Last year, 10 junior faculty members were recognized with prestigious early career awards, totaling 11 separate awards.

NSF CAREER:

10 Vikram Kodibagkar, assistant professor in the School of Biological and Health Systems Engineering, "Quantitative Imaging of Tissue Oxygenation"

11 Ross Maciejewski, assistant professor in the School of Computing, Informatics, and Decision Systems Engineering, "A Visual Analytics Approach to Space-Time Data Exploration"

12 Georgios Fainekos, assistant professor in the School of Computing, Informatics, and Decision Systems Engineering, "Robustness Guided Testing and Verification for Cyber-Physical Systems"

13 Lalitha Sankar, assistant professor in the School of Electrical, Computer and Energy Engineering, "Privacy-Guaranteed Distribution Interactions in Critical Infrastructure Networks"

14 Shawn Jordan, assistant professor in the Polytechnic School, "Engineering Design Across Navajo Culture Community and Society"



NIH Director's Award/Career Development Award:

15 Sarah Stabenfeldt (Director's Award), assistant professor in the School of Biological and Health Systems Engineering, "Detecting and Treating Traumatic Brain Injury Pathology Progression from the Inside-Out"

16 Karmella Haynes (Training/Career Development Award), assistant professor in the School of Biological and Health Systems Engineering, "Synthetic Chromatin for Cancer Research"

Defense Advanced Research Projects Agency (DARPA) Young Faculty Awards:

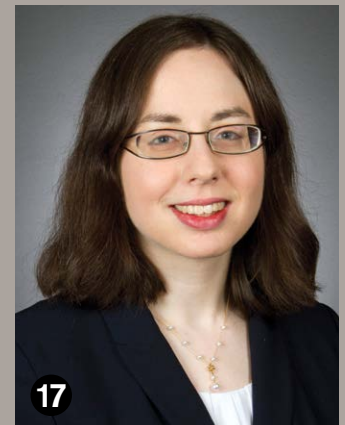
17 Spring Berman, assistant professor in the School for Engineering of Matter, Transport and Energy, "Specification and Control of Customizable Multi-Robot Systems for Distributed Sensing and Cooperative Manipulation"

18 Yang Jiao, assistant professor in the School for Engineering of Matter, Transport and Energy, "Integrated Computational Scheme for the Characterization Modeling and Predicting of Microstructure Evolution and Fatigue Response in Titanium Alloys"

19 Panagiotis Artemiadis, assistant professor in the School for Engineering of Matter, Transport and Energy, "Optimizing human supervision of multi-agent systems"

Air Force Office of Scientific Research Young Investigator Research Program (AFOSR YIP) Award:

20 Panagiotis Artemiadis, assistant professor in the School for Engineering of Matter, Transport and Energy, "Perception and action interfaces in the symbiosis of humans and multi-agent systems"





Students early in their college experience speak with professionals to explore career paths. At the 2014 Career Exploration event, one industry guest attended for every five students.

Our industry engagement efforts pay dividends for student career opportunities and the curriculum

It's the dreaded question that weighs on every college senior: "What next?" Graduation initiates a new phase in a person's life, complete with a new set of responsibilities and concerns.

Fortunately for students at the Fulton Schools of Engineering, the transition might be a lot smoother thanks to the expanse of opportunities available to work, learn and grow their skill sets through industry interaction. By working with industry in the Valley and around the world, the Fulton Schools provide students with a variety of ways to make connections within businesses and ultimately aid them in finding a career path.

Exploring careers

Avenues to connect are laid early, just a few weeks into a student's first semester in the Fulton Schools. As part of the first-year student success course and transfer student success course, Career Exploration Night brings engineering and technical professionals to campus to meet with students.

More than 300 professionals from every facet of industry — from aerospace and manufacturing to construction and aviation, industrial and civil engineering as well as biomedical and environmental and resource management — are brought together for students to talk to and learn about their professions.

"Freshmen are given the opportunity to meet with industry members and find what inspires them as an engineer, and hopefully in turn, be inspired as well," said Robin Hammond, director of the Fulton Schools Career Center.

Career Fairs

The Career Center hosts multiple career fairs throughout the year and holds the record for the single largest career event attendance at ASU. A significant accomplishment, considering there are university-wide events, notes Hammond. The careers fairs have grown so much they will become three-day events starting in fall 2015.

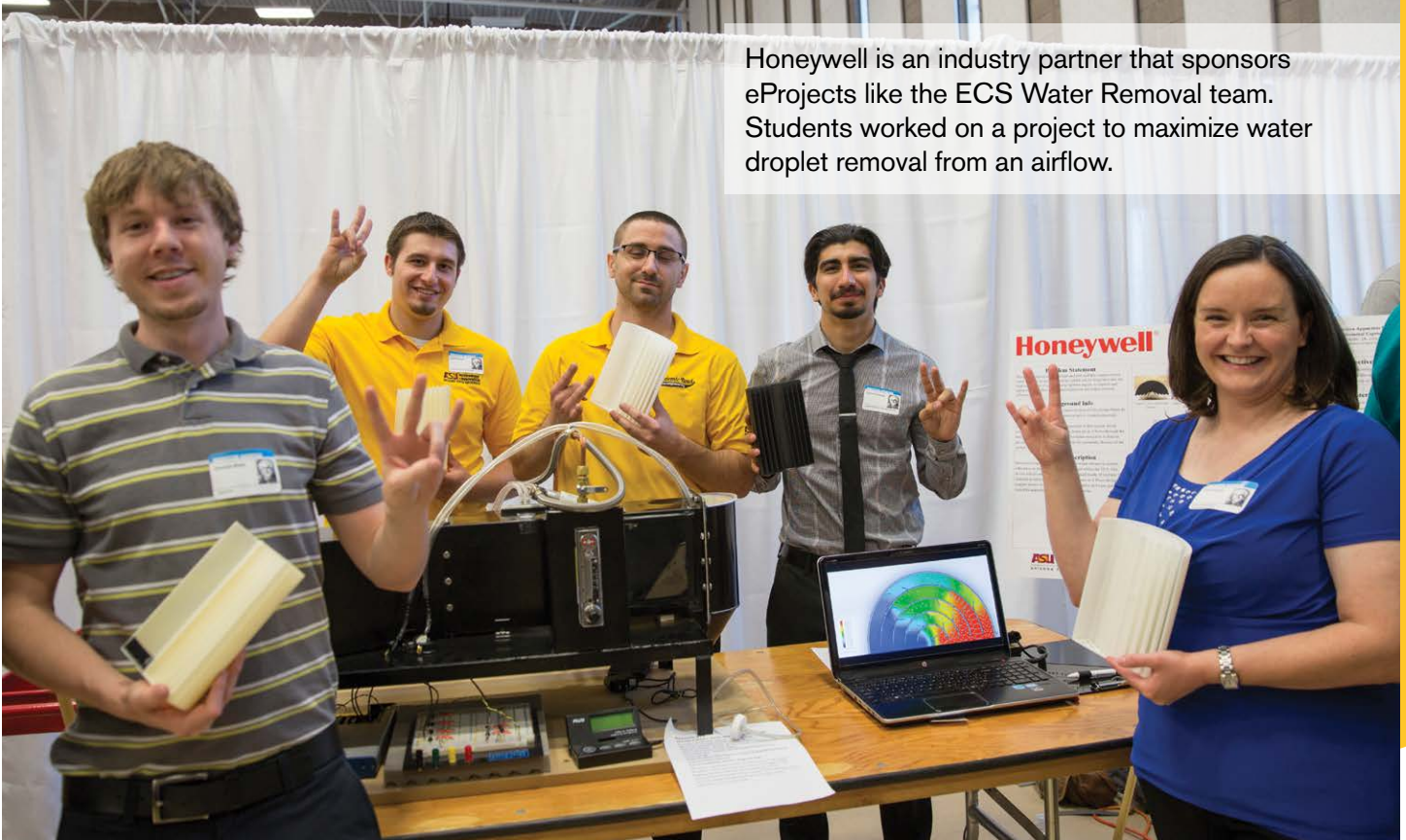
Beyond simply facilitating career fairs, the Fulton Schools Career Center partners with industry to provide both preparation and follow-up.

"For four weeks leading up to a career fair, every Friday we sponsor a prep day," said Hammond. "We bring in industry members to help students with rapid résumé critiques."

Students are coached to treat every interaction as a potential face-to-face interview and not simply an exchange of information.

600 interviews held in conjunction with the fall 2014 Career Fair

Honeywell is an industry partner that sponsors eProjects like the ECS Water Removal team. Students worked on a project to maximize water droplet removal from an airflow.



Behind the scenes, the Career Center facilitates interview days the week following a career fair. Previously, more than 55 rooms across campus were dedicated to interviews, totaling up to around 600 interviews in October alone.

"It's important to us that when companies make the decision to come to a career fair, we want to give them the opportunity to immediately interview students," said Hammond.

Partnering on research

Another way students are able to interact with industry is by letting their work speak for itself at events like the Innovation Showcase, hosted by the Polytechnic School at the end of each semester. More than 160 projects were exhibited in 2014. These projects tackled issues in biomedicine, crop storage and aeronautics.

"It's important to facilitate industry-student interactions. Employers see that our students are capable of taking on these projects and that often translates to job opportunities," said Ann McKenna, director of the Polytechnic School. "Industry partners often get to experience the work of our best students."

According to Brandon Bowsworth, a manufacturing engineering technology major who worked on a Mayo Clinic Telemedicine eProject,

being involved with industry projects helps students see their work come to life and hopefully get implemented.

"Our goal was to create a proof-of-concept device that allows technical professionals to capture exterior images of a patient's eye and transfer them to a specialist for diagnosis," said Bowsworth. "We saw this technology being used in situations like cruise ships, places where there are large numbers of people and where accessing an eye doctor could be challenging."

According to Lindsay Clark, senior analyst and program manager for Mayo Clinic, what the students developed was "beyond words," in that it was developed "in time, on scope and in budget," with consideration for both patient and care team.

"It was good to have the extra energy and creativity the students brought from the outside," said Clark.

Connecting employers to talent is perhaps the most obvious form of industry interaction with an academic institution, but it's only one way that the Fulton Schools interface with industry. In addition, industry is engaged on both philanthropic and research fronts.

**Innovation Showcase
more than**

160 projects
exhibited
in **2014**



Neurophysiologist **Marco Santello**, right, professor and director of the School of Biological and Health Systems Engineering, works on robotics technology that promises to boost performance in prosthetic hands.

At Global Outreach and Extended Education in the Fulton Schools, director Jeff Goss is focused on ensuring that the partnership with industry is a two-way conversation, with set goals and outcomes that both Fulton Schools and corporate partners have stakes in.

"We will do quarterly reporting with both the ASU and industry leadership. All stakeholders can track progress on the goals and outcomes," said Goss. "We maintain an ongoing dialogue to understand partner needs and work toward continuous improvement."

Regarding research partnerships, Goss stresses that GOEE takes a strategic, measured approach so both sides of consortia understand the big picture and are more directed in how they collaborate.

"Everything we do is linked to a higher level goal within the school," said Goss. "We are approaching 17,000 engineering students, so it's our job to make sure we're providing them the best, most relevant and highest quality program experience possible."

Collaborating on curriculum

Close, collaborative partnering with industry ensures that curricula within Fulton Schools are up-to-date and prepare students for the constantly shifting workforce.

For instance, the rapidly changing, kinetic environment that is the medical industry means Marco Santello, director of the School of Biological and Health Systems Engineering, has a responsibility to maintain industry relationships and build new ones to best prepare students entering the field.

In addition to their partnerships with companies such as National Instruments, Bard Medical, Medtronic and Gore Medical, Santello's school has close relationships with physicians.

"It's really important for our students to not only be engineers but to understand medical needs," said Santello. "There's nothing better than actually shadowing a physician. The technical details are important, but understanding what the patient needs is even more important."



Serving a patient's needs is not easily taught in the classroom, which is why students have the opportunity to intern at a variety of locations across the Valley, including the Mayo Clinic, Barrow Neurological Institute, Banner Health and Phoenix Children's Hospital.

At the School of Sustainable Engineering and the Built Environment, director Edd Gibson finds a similar benefit to working with the nearly 100 companies that are involved with construction and environmental engineering programs in his school.

"What it does is ground us in what's happening in the industry," said Gibson. "It leads us to take action and improve programs based on the observations from our interns and from interaction with the companies. You can tweak your curriculum based on the feedback you get from our students and what happens in our programs."

Bechtel Corporation has been a longtime supporter of the Del E. Webb School of Construction (DEWSC), providing scholarships and support for interns within the program for more than 20 years. Two years ago, Bechtel sponsored DEWSC's first Vesting Ceremony.

"As a graduate of the program, it is great to come to campus and see the enthusiasm and potential in the students. It is amazing to see how the program has evolved and also to see the increase in the number of women in the program since I was a student," said Susan McCullough, global manager of compensation and benefits at Bechtel who graduated from the school in 1984 with a bachelor's degree in construction.

Co-ops and experiential learning

Beyond improving research and curricula within the Fulton Schools, ties with industry also reaps rewarding experience for students outside the classroom.

The Career Center recently established a co-op program. Students work six to seven consecutive months of full-time degree-related employment gaining valuable industry experience. Co-op students maintain their ASU status by enrolling in a single credit co-op course, staying on track to graduate in four to five years.

Different in scope and responsibility than an internship, Hammond described them as an "additional mechanism in experiential learning," and something she was committed to bringing to the Fulton Schools.

The School for Engineering of Matter, Transport and Energy has taken advantage of this new opportunity and established a co-op program with Orbital Sciences that began this fall semester. While small, it's another dimension that Kyle Squires, vice dean, believes adds to the robust programs that make the Fulton Schools attractive.

"These industry engagements are vital if we're going to have a top-shelf engineering program," said Squires. "We're really lucky to be in the Valley, where we have a lot of really diverse industry and connections all the way from small sized companies to big ones."

Fulton Schools students on the cusp of graduation might still find themselves wondering "what's next," but thanks to the wide range of opportunities to interact and work with industry, they won't be short of options.

Boeing Innovation Center inspired by eSpaces

The Boeing Company recently opened an innovative new workspace at their Mesa facility that was inspired, in part, by engineering facilities at Arizona State University.

The 4,000 square foot Vertical Lift-West Innovation Center had its ribbon cutting ceremony December 2013. It is the first of several “innovation cells” to be developed at various Boeing locations.

In July 2013, Pari Griffith, manager of Facilities and Planning at Boeing Mesa, and several other project administrators visited ASU's Tempe campus to tour various facilities used by students in the Ira A. Fulton Schools of Engineering. Their goal was to glean some ideas that would inform the construction of the new Innovation Center.

“We wanted to see how Fulton Engineering constructs innovative and collaborative spaces for their engineering students,” said Griffith.

Two spaces that particularly captured Boeing's attention were the eSpace design, integration and prototyping studios and the Engineering Student Center at the Tempe campus.

These spaces were both introduced at a time when the Fulton Schools were making a significant effort to transform the engineering learning experience.

Boeing was interested in these spaces because, like their Innovation Center, they focus on bringing people together to create and innovate while offering a built environment that “stimulates the brain to be more creative,” said Griffith.

Boeing's new center was created to “elevate Boeing's value creation system using organic innovation,” said Brian Ritter, senior manager, Boeing Phantom Works/Advanced Vertical Lift — West. “It is a nonstandard work environment where individuals and groups can share ideas and create teams to develop those ideas into projects,” said Ritter.

Similar to the Engineering Student Center, the space is broken up into work areas that provide seating and countertop space for individual and group work.

“To date we have had project ideas ranging from aircraft concepts to new manufacturing techniques for our operations areas developed at this facility,” said Ritter. The site has even attracted Boeing special project teams from other sites that work for consecutive days, insulated from the everyday distractions of their regular job environment.

Griffith says they walked away from their facility tour at ASU with the idea to implement an outdoor component that takes advantage of the beautiful Arizona weather, similar to the patio space behind the Engineering Student Center. “We also realized the value of making these spaces visible from all sides and centrally located,” said Griffith.

The eSpaces epitomize visibility, with glass-paneled walls that allow passing students to see the hands-on engineering projects being developed by freshman students in their introduction to engineering courses, garnering attention for engineering at ASU.

The eSpace studios are part of a larger initiative that brings innovative, hands-on learning experiences to students throughout their education.





Drawing from eSpace, Boeing also implemented writeable glass walls and tabletops that make collaboration easy and accessible. “We walked away from our tour with great concepts and ideas that were modified to fit our particular work environment,” said Griffith. This includes using colors and circular construction techniques that recall aircraft designs.

Other notable features include chairs that resemble Boeing 787 first-class airplane seats and a collaborative group space that features a computer and 70-inch plasma touch screen.

A growing partnership

These new spaces are just one of the ways that Boeing connects with and benefits from their strong relationship with the Ira A. Fulton Schools of Engineering.

“The Boeing Company continually experiences terrific successes with our partnership with Fulton Engineering,” said Kathy Collins, Functional Chief Engineer at Boeing Mesa.

Boeing representatives frequent engineering career fairs and industry events at ASU “allowing college students to get an idea of what Boeing is all about from several perspectives,” said Collins.

This familiarity helps students recognize the areas they need to focus on if Boeing is the type of company they want to work for. “Our presence at ASU results in interns and graduate new-hires who are ready to perform as junior engineers as soon as they step foot on a Boeing site,” said Collins.

This gives ASU hires a unique confidence as they interact with their mentors and new teams at Boeing, said Collins. “It’s a win-win situation.”



Diane '61 and Gary Tooker (right) '62, '96, established the Gary and Diane Tooker Scholarship for Engineering and the Diane and Gary Tooker Chair and Professorships for Effective Education in Science, Technology, Engineering and Math (STEM). Gary was selected into membership of the National Academy of Engineering in 1996. He is only one of three alumni from our engineering program to receive this distinction. Miles Johnson, left, receives support from the scholarship and met Mr. Tooker at an annual breakfast.

Donor Honor Roll

Gifts to the Ira A. Fulton Schools of Engineering July 1, 2013 through June 30, 2014

\$1,000,000 and above

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CenterPoint Energy
The D.L. Withers Foundation
Duke Energy Corporation
Janie Eslick Johnson Trust
Exelon Corporation
ExxonMobil Corporation
FirstEnergy Corporation
Freeport-McMoRan Copper &
Gold
General Electric Company
IREQ Institut de recherche
d'Hydro
ISO New England, Inc.

ITC Holdings Corporation
Johnson & Johnson Services, Inc.
Kitchell
Midwest ISO
National Rural Electric
Cooperative Assn
New York Independent System
Operator
ON Semiconductor
Pacific Gas & Electric Company
PJM Interconnection
Rummel Construction, Inc.
Southern Company Services
Southwest Power Pool
Space Micro, Inc.
Tri-State Generation &
Transmission
W.L. Gore & Associates, Inc.
Western Area Power
Administration

\$25,000 to \$49,999

AT4 Wireless Inc.
Achen-Gardner Construction, LLC
Air Products & Chemicals, Inc.
Anonymous
Anonymous
Broadcom Foundation
Crestron Electronics, Inc.
Edge 3 Technologies, Inc.
FORTA Corporation
Kristine Friesen '01 and Cody
Friesen '00
Gail Howard and G. Gibson
Henkel Consumer Goods
Elyse and Paul Johnson
MWI Laboratories LLC
MaxLinear, Inc.
Mitsubishi Electric & Electronics
USA
Douglas Montgomery
O'Neil Industries, Inc.
PowerWorld Corporation
RTE France
Raytheon Company
Ridgetop Group, Inc.
Southwest Patrons
Sunland Inc
TD Industries

Thank you

Every effort has been made to ensure the accuracy of this list. If an error or omission has occurred, please contact the Ira A. Fulton Schools of Engineering Development Office at 480-965-9646 so that we may acknowledge your support.

\$5,000 to \$24,999

Abbie Gregg, Inc.
Altera Corporation
Anonymous
Anonymous
Anonymous
Anonymous
Architekton
Arrington Watkins Architects,
L.L.C.
The Autism Research Institute
Aztec
Beavers Charitable Trust
Bechtel Construction Company
Brown & Associates
Buesing Corporation
Lois Butler and John Butler '62
'64 '71
Capstone Therapeutics
Robert Carey '02
Carollo Engineers, Inc.
Centennial Contractors
Enterprises, Inc.

Eric Chu
Corbin Revocable Living Trust
Core Construction
City of Chandler
DPR Construction, Inc.
Desert Diamond Casinos &
Entertainment
Annamarie and Stephen
DeTommaso '75
ETRI
Estate of Arlo Richardson
FNF Construction, Inc.
First
Friends of the Earth
Gensler & Associates
Gilbane Building Company
Haydon Building Corp.
Henderson Engineers, Inc.
Gerald Heydt
The Holder Construction
Foundation
Ruth Hwang and Joseph Hui
Hunt Construction Group, Inc.
IASOTEK, LLC

IM Flash Technologies, LLC
JCJ Architecture
Johnson Controls, Inc.
Kearney Electric, Inc.
Kiewit Infrastructure West Co.
Klondyke Construction, LLC
Narayan Kovvali
Markham Contracting Co., Inc.
Midstate Mechanical, Inc.
Leslie Moat
Nth Degree Technologies
Worldwide, Inc.
Navajo Housing Authority
Northrop Grumman Systems,
Corp.
The O'Neil Foundation
Vicki and John Panhuse
Phoenix Cement Company
Pierson Construction Corporation
Patti and Charles Rasmussen
Cynthia Rodgers and Ronald
Rodgers '77
Rosendin Electric, Inc.
SDB, Inc.

SRC Education Alliance
Peter Sauer
Marilyn Miller and James
Schmidlin '79
State of Arizona Department of
Housing
Stevens Leinweber Construction
Incorporated
Aina Summerfelt
Sundt Construction Inc.
Terex USA, LLC
ThermAir Systems
Sharon Thomas and Ronald
Thomas '77 '84 '95
Time Warner Cable Shared
Service Center
UDC, Inc.
The Vinnell Foundation
The Weitz Company, LLC
Weyerhaeuser Company
Wheeler Foundation
Wilson Electric Services Corp.
Yahoo! Incorporated

Girish Jampani: Making the most of his chance and paying it forward

Girish Jampani is a big believer in collaboration.

"Earning my master's degree at Arizona State University taught me that answering the biggest questions requires the coordinated contributions of many talented people, not just me," said Jampani. During his master's studies in industrial engineering, Jampani underwent a "radical transformation" in the way he approaches a new enterprise — a transformation he credits to ASU's "unconventional approach to education."

Instead of trying to answer, "Am I the smartest person in the room?" or, "Is my idea the best?" Jampani says his mentors at ASU taught him to ask: "How can I pool the intelligence and resources around me to achieve a positive result?"

A native of Chennai, India, Jampani graduated from ASU in 2012, but returned in spring 2015 to continue his education as an industrial engineering doctoral student in the School of Computing, Informatics, and Decision Systems Engineering, one of the Ira A. Fulton Schools of Engineering.

Before his doctoral studies, Jampani worked as an Analytics Engineer for Lattice Engines, a Texas-based startup company. In this position, Jampani worked to provide predictive analytic solutions for marketing and sales teams of business to business (B2B) companies.



During his doctoral studies Jampani will focus on questions in the field of operations research and decision sciences — a field that uses mathematics to make applied, day-to-day decisions. "In operations research we combine the elegance of math with human creativity to help organizations and decision-makers tackle the uncertainty that comes with making big decisions," Jampani said.

After graduation, Jampani plans to utilize his mastery in this field to help business organizations in the Asia Pacific region to successfully navigate important decisions.

"I strongly believe in and support ASU's efforts to define itself by the people it includes rather than the people it excludes," said Jampani. "ASU sends a message that any motivated student deserves a chance, regardless of his or her past academic record."

In addition to being technically-equipped, Jampani feels prepared to succeed in a global workforce because the collaborative atmosphere of the Fulton Schools of Engineering "reinforced the importance of values such as tolerance, respect and courtesy while working with team members from diverse backgrounds and cultures."

ASU's stance on education combined with his positive experience as a graduate student prompted Jampani to make an alumni donation to support the Fulton Schools of Engineering. "I see my donation as a token of gratitude and a way of paying it forward for the benefits I've already received as a result of my Fulton Schools education," said Jampani.

Jampani is certainly making the most of his chance and his gift helps ensure that other students have their chance, too.

Luz Osuna: Reaching forward, giving back

Recent alumna Luz Osuna is giving back to the school and student organizations that have helped her to reach her career goals.

“Student organizations create valuable support systems that help students from diverse backgrounds adjust to campus life, while providing friends, study groups and leadership opportunities,” said Osuna. “And those are the type of organizations I want to support, because they once supported me.”

Osuna completed a bachelor’s degree in industrial engineering in 2010, followed by a master’s degree in industrial engineering in 2011, as part of the accelerated 4+1 program offered by the School for Computing, Informatics, and Decision Systems Engineering.

Osuna works as a strategic capacity industrial engineer — meeting production goals at the lowest cost — at Intel Corporation in Chandler, Arizona. Before that, she optimized factory space as a layout industrial engineer, also for Intel.

Osuna attributes her successful transition from an engineering student to an engineering professional to her experiences in student organizations during her years in the Fulton Schools of Engineering.

“As a student in the Fulton Schools I learned critical and strategic thinking skills that have helped me to become a problem solver for Intel Corporation,” said Osuna. But just as valuable, “the Fulton Schools taught me how to work in a team. By being involved in extracurricular organizations, I refined my interpersonal and leadership skills,” she said.

As an undergraduate, Osuna was president of the Society of Hispanic Professional Engineers — known as SHPE de ASU. SHPE de ASU seeks to empower the Hispanic community by providing awareness, access and support for science, technology, engineering and math (STEM) educational programs.

As president of SHPE de ASU, Osuna wrote funding proposals, coordinated events, meetings and volunteers, and increased membership. Osuna worked hard to promote weekly study groups for members called “SHPE Studies” and also started an Academic Olympiad team that competed at the SHPE national conference. One of her most memorable experiences was hosting the first Noche de Ciencias (Science Night) — a STEM outreach event for elementary school students and their parents.

Through SHPE de ASU, Osuna met Carlos Flores, a student who was working to revive the ASU chapter of MAES — Latinos in Science and Engineering, formerly known as the Society of Mexican American Engineers and Scientists, which supports Latinos interested in earning a STEM education.

“During my final semester, Flores started to turn MAES around and has since put it back on its feet,” said Osuna. After her graduation, Osuna continued to follow and applaud the work being done by

MAES and SHPE de ASU, and she was recently invited to be the keynote speaker at the MAES end-of-year banquet. “I think I was invited to be a keynote speaker because others know how student organizations have helped me to achieve my goals. I could speak with first-hand experience about the benefits organizations such as SHPE and MAES offer their members and the importance of continuously supporting such organizations,” said Osuna.

In addition to donating her time, Osuna has made monetary donations to support MAES and SHPE de ASU.

“I have always been a strong supporter of organizations that promote the advancement of Latinos or Hispanics in STEM, and I appreciate the vision laid out by organizations like MAES and SHPE de ASU,” said Osuna.

While she was a student, Osuna received scholarships from donors including the Friendly House, the Armstrong Family Foundation, SHPE de ASU, the National Action Council for Minorities in Education (NACME), the National Science Foundation (NSF), the League of United Latin American Citizens (LULAC), the Motivated Engineering Transfer Students Program (METS), John and Helen Butler, and the Intel Scholars Program.

Now that she is in a position to give back she thinks it is important to do so. “Whether you’re donating time or money, any contribution an alumnus can make will help the next generation of engineers reach their goals,” said Osuna.





Engineering Arizona's next economy

The Fulton Schools of Engineering at Arizona State University are designing the future of Arizona now, with:

- Nearly 17,000 students in 2014-2015, one of the five largest engineering schools in the country
- More than 300 faculty members dedicated to teaching and discovery
- More than 60 outstanding degree options covering nearly every engineering discipline
- Engagement with major industry partners
- \$100 million in government and industry research contracts
- Entrepreneurial faculty with more than 160 invention disclosures in FY 2015

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