The Polytechnic School
ONE OF THE IRA A. FULTON SCHOOLS OF ENGINEERING AT ASU

poly-: a prefix meaning many

Many programs
Many ideas
Many solutions

For us, “poly” is more than the number and variety of degrees that we offer. Poly is a way of thinking: agile, adaptive, creative and entrepreneurial.

It’s thinking about systems and the ways those systems interact, intersect and complement each other.

It’s being indispensable to Arizona — especially our East Valley community — and engaged globally, connected to countless communities through our faculty and increasing numbers of poly-oriented alumni.

We are a growing, collaborative and vibrant community of master learners. We are an anchor on the Polytechnic campus with an eye toward the future of innovation: robotics, design, manufacturing, energy, safety, transportation, learning, human-machine interaction and anything else we can imagine.

Visit us and discover a place where anything is possible.

Programs
Aviation
Engineering and Manufacturing Engineering
Environmental and Resource Management
Graphic Information Technology
Human Systems Engineering
Information Technology
Technological Entrepreneurship and Management

Faculty
44 Tenured/Tenure-track
34 Lecturers
2 Professors of Practice

Enrollment
4,033 Fall 2015 enrollment
18% increase over 2014-2015

3,782 undergraduate students
251 graduate students
1,600 online students
51% transfer students
576 degrees granted in 2014-2015

Research $

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<th>2014</th>
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<td>Proposals</td>
<td>22,931,299</td>
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Proposals Awards Expenditures

2014 2015 Increase
2,865 3,430 4,033

Enrollment Fall 2013 Fall 2014 Fall 2015
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NSF award to redesign engineering education
Research and Innovation
State-of-the-art facilities for hands-on learning
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OUTREACH: Creating the SPARK: engaging kids in coding ACE Academy DiscoverE Day Creating solutions now with eProjects

Sustained excellence: Milt Sommerfeld’s algae research
Shawn Jordan: education innovator

On the cover: Tom Sugar is building wearable robotics to enhance human performance.

up next: Additive manufacturing
Dear Friends and Colleagues,

Welcome to the first annual report for the Polytechnic School. This report highlights a few of the many accomplishments of our programs, faculty, and students over this fast-paced and exciting year. As the examples illustrate, the Polytechnic School is true to its name; it is a school of “many” — we embrace a diverse range of degree programs, perspectives and research activities all of which are in support of achieving the design aspirations of the New American University.

From the wearable ‘Jet Pack’ that increases a runner’s speed, to the CareerWISE program that increases persistence of women in science and engineering doctoral programs, to PilotEdge a new flight simulator software that links to live air traffic control and flight paths that simulate real-life experience, this report illustrates our commitment to engaged learning, use-inspired research and solving real-world problems. We make a difference.

We are proud of our students and their accomplishments. Our students have achieved international scholarships, traveled to three Baja Endurance race competitions and placed 10th out of 105 teams, and won top awards for their work with the local Clean Cities coalitions to host events, develop outreach products and spread the word about alternative fuels and advanced vehicle technologies. Mentor Dida, who received a Fulton Schools’ outstanding graduate student award, is a wonderful example of our entrepreneurial spirit to engage globally and enact positive change.

At Innovation Showcase, we display our students’ creative solutions to eProjects — current challenges faced by our industry and community partners. This signature event highlights our partnerships with industry and the professional work our students do before they graduate with a college degree. Much of this work is done in the Polytechnic School’s facilities where our students and faculty have access to resources, equipment and expertise to realize idea generation, prototyping, experimenting, testing and analysis of the next generation of technical solutions.

The “poly” in our school name not only represents our diversity of programs, it also represents diversity in our perspectives. We value a full range of knowledge and ways of knowing, and respect the multiple disciplinary viewpoints that are necessary to develop meaningful solutions to complex technical challenges. We are integrators and systems-thinkers, as well as entrepreneurs and innovators.

We hope you enjoy reading this report. The Polytechnic School is strong, stable and poised for the future. We can’t wait to see what next year will bring!

Best wishes,

Ann McKenna, Ph.D.
Director, The Polytechnic School
Students from the Polytechnic School demonstrate an unmanned aerial vehicle during DiscoverE Days, a Fulton Schools event that brings teachers and K-12 classes to campus to learn more about technology and engineering.
Aviation Programs

The Aviation programs within the Polytechnic School are organized around four major curricular areas: air traffic management, air transportation management, professional flight and unmanned aerial systems (UAS). Additional program offerings include a master's degree in aviation management and human factors, and an aviation management B.A.S. program for students entering ASU with an A.A.S. degree.

The undergraduate curricula are designed to provide a thorough aviation background combined with an interdisciplinary general university education. The aviation graduate is prepared to assume responsibilities in a wide area of managerial and technically related areas of aviation. From the aviation core courses, the student gains a background in aircraft structures, reciprocating and turbine engines, aircraft performance and design, management skills, business principles, systems analysis and a variety of course work specific to aircraft flight, airport and airline operations and air transportation systems. Graduates are prepared for entry into the aviation industry or graduate study.

Courses consist of a lecture and a lab taught by instructors with aviation industry experience. State-of-the-art simulation is used to enhance learning in all of the concentrations and students in the professional flight program fly new Cessna 172 and Seminole aircraft. The air traffic management, air transportation management and professional flight programs are accredited by the Aviation Accreditation Board International (AABI) and during the most recent reaffirmation, September 2014, instructional strategies were noted as ‘best practices’ in collegiate aviation education.

Engineering

The Engineering and Manufacturing Engineering programs experienced significant growth in 2014-2015 to a combined headcount of about 900 students. The manufacturing engineering program produced its first graduates in 2014-2015. It will undergo its initial ABET accreditation in 2015-2016; the engineering program will undergo ABET re-accreditation.

The engineering and manufacturing engineering capstone project courses continue to be innovative and connected to local industry sponsors through eProjects. In the two-course capstone sequence, students work on interdisciplinary teams to complete eProjects, to solve real-world problem with engineering support and guidance from industry partners. In 2014-2015, engineering had 43 projects with more than 180 seniors participating; there were 27 companies and sponsors with mentoring from 55 corporate engineers and staff.

A masters of science in engineering also is offered as a cross-disciplinary degree that includes aspects of several traditional engineering disciplines. This program has expanded the graduate offerings within the Fulton Schools of Engineering and builds on the industry-focused and interdisciplinary systems approach taken in the undergraduate programs. The curriculum was designed to reflect the diversity of the faculty and align with the
philosophy of the Polytechnic School, in which diverse specialists focus their talents on systems-level problems, which requires more than a single disciplinary perspective. The program includes specialization focus areas in alternative energy systems, robotic systems, mechanical systems and manufacturing. The core requirements include courses in deterministic and stochastic methods for evaluation of systems, simulation, complex systems design and design and innovation.

**Environmental & Resource Management**

The Environmental and Resource Management (ERM) program offers bachelor’s and master’s degrees to students who want to combine a technical background in the sciences and engineering with a comprehensive understanding of regulatory and policy issues in order to mitigate the environmental impact of our modern society, ensure compliance with environmental regulations, provide a safe workplace and manage and preserve natural resources. ERM faculty members engage students in real-world problems with research funded by the Environmental Protection Agency, the Border Environment Cooperation Commission and the National Institute of Environmental Health Sciences, the National Science Foundation and DOE. The master’s in ERM is available online and in a traditional classroom format and attracts students from all over the world. Thirty-seven master’s degree students graduated in 2014-2015.

In spring 2015, ERM offered a course on tribal environmental and resource management, the first of its kind at ASU and one of just a few such courses in the country. ERM also sponsors a water management certificate program in conjunction with the Morrison School of Agribusiness and the Agribusiness and Water Council of Arizona aimed at engaging the next generation of water leaders throughout the Southwest with the significant challenges they will face. A water resources management concentration within the M.S. degree is being developed.

**Graphic Information Technology**

The Graphic Information Technology (GIT) program offers students a creative, technological and managerial understanding of graphic communication technology and content creation in areas such as web, print, photography, video and 2D/3D animation. The cross-media nature of the graphic information industry requires tomorrow’s graduates to understand the full spectrum of graphic technology, publishing processes and current business practices. This major encompasses an intensive program of study emphasizing theory and hands-on laboratory practice. Students develop the skills in commercial photography and video, multimedia and interactive technologies, digital publishing and print technologies, user experience design, Web design and development and 2D/3D animation and motion graphics.
Program highlights

The GIT program is part of the Adobe Partners by Design program, a global community committed to design innovation. Known nationally for creative students, many GIT graduates have gone on to work for companies such as Google, Amazon, Adobe, Apple, GoDaddy, Quad Graphics, PayPal and more. This program offers access to professional quality contextual learning in the Commercial Photography Studio, the Print and Imaging Lab and the Device Usability Learning Lab. The GIT bachelor’s degree and master’s degree in technology programs are offered in two delivery modes, campus-based and fully online (digitally immersed).

Human Systems Engineering

The Human Systems Engineering program applies cognitive science to products, services, systems and environments. The program and faculty conduct research in learning technologies, virtual reality, human-computer interaction, unmanned aerial systems, cyber security, intelligence analysis, medical human factors, human-robot interaction and more. It also has access to world-class simulators and test beds that provide a context for much of the research and is involved in collaborations with several Fulton Schools faculty. Students can earn a bachelor’s degree in Human Systems Engineering (HSE) or a Ph.D. in Simulation, Modeling and Applied Cognitive Science. A minor, integrated bachelor’s plus master’s 4+1 program and master’s degrees will be offered.

Information Technology

The Information Technology program has three primary focus areas: networking and security; databases; and enterprise computing. Networking and security prepare students to work as network architects and security analysts in this age of vulnerable electronic systems. The databases concentration prepares students to create, architect and manage databases, including cloud based systems, big data systems and database protection and monitoring. Enterprise computing prepares students to work with industry in integrating network technology into all aspects of a business enterprise. The bachelor’s program is offered in two delivery modes, campus-based and fully online (digitally immersed) as well as a campus-based master’s degree in IT.

Technological Entrepreneurship and Management

The Technological Entrepreneurship and Management (TEM) program enjoys a unique space in the Ira A. Fulton Schools of Engineering. Of the major universities in the United States, TEM is the only entrepreneurship program housed in an engineering college. Since its inception in 2011, TEM has seen growth exceeding 20 percent per year and is continuing to experience impressive growth. Programs are offered via two delivery modes, on campus and fully online. Many students, with the help and mentorship of the faculty, start and launch ventures simultaneously with their degree program.

One such student, Mentor Dida, formed two organizations to fight poverty through youth empowerment in Kosovo. After earning his undergraduate degree, Dida completed TEM’s Masters in Technology–Global Technology and Entrepreneurship program, and continues his work in Kosovo as a program coordinator at Ashoka’s Youth Ventures.

TEM students are involved in various initiatives within ASU, the Fulton Schools of Engineering, and national and worldwide organizations that promote entrepreneurship and social change.

The faculty is comprised of experts from the entrepreneurial, engineering and high-tech industries and, collectively, have authored or contributed to more than 30 patents as well as numerous startup ventures or businesses, both for-profit and not-for-profit. The faculty participates in a collaborative environment to provide an interdisciplinary approach to entrepreneurship. They currently serve as startup co-founders, board members, community leaders and academic professionals in their respective expertise. TEM also formed an industry advisory board in 2014-2015 comprised of members from across the United States to include national and international corporations as well as local startup companies.
Giving pilots an edge:
First in the world to integrate PilotEdge into flight training

**System provides students a link to live air traffic control and real flight paths**

Students training to be pilots in the aviation programs at Arizona State University have a wing up on their peers. The university’s Polytechnic School is the first in the world to integrate a system called PilotEdge with its flight simulator in two advanced academic flight courses. It provides a link to live air traffic control (ATC) and flight paths that simulate an experience as close to real life as you can get.

According to instructor Jim Anderson, a retired captain from Southwest Airlines and 20-year U.S. Air Force pilot, “The use of PilotEdge was noted in our recent AABI [Aviation Accreditation Board International] as a ‘best practice,’ putting the ASU flight program at the head of the class.”

Airline pilots train in flight simulators, devices that artificially re-create aircraft flight and the environment in which it flies. It includes the cockpit and flight controls, as well as a visual system that virtually replicates what it looks like when the pilot is “flying.” ASU instructors are using the ELITE Simulation Solutions King Air Simulator with PilotEdge.

Students in the aviation programs are using PilotEdge for airline crew training. Many are already private pilots, but learning to be a commercial pilot requires skills in working with another pilot in the cockpit.

With PilotEdge they practice skills such as picking up instrument flight rule (IFR) clearances, taxiing at large, complex airports, instrument approaches, the coordination of multiple practice approaches, and a wide variety of point-to-point flights.

What makes PilotEdge unique is the use of real people working all the ATC positions. Other companies have provided synthetic ATC solutions using voice recognition systems.

“They are completely ineffective in terms of placing any pressure on the pilots, causing any kind of ‘mic fright,’ or conveying the sense that there is any kind of consequence to the pilot’s actions. There’s a huge difference between flying with synthetic ATC and human-driven ATC,” said Keith Smith, a representative from PilotEdge. “Those who have experienced PilotEdge have been blown away by the fidelity and realism it offers.”

Students Katryna Novelozo, David Mizrahi and Tyler Faber demonstrated how PilotEdge operates on a simulated flight to the Santa Barbara airport. Faculty associate Mike Hampshire showed the iPad interface that allows the pilots to track their flight path.

“I’m currently trained to be the only pilot, and this training helps teach me how to work with someone else in an airline crew setting,” Faber said. “You learn to talk to air traffic control, to set the course. It feels very real.”
The Graphic Information Technology (GIT) program is preparing students to creatively present information in the ever-changing graphics industry.

“We graduate creative technologists who use both their left and right brains,” said Penny Ann Dolin, associate professor of practice and chair of the program. “They have the creative knowledge and also understand production value. When our students build a website, it has to look good, and it has to work. It’s fine arts and technology, combined. But, unlike fine arts for self expression, we always assume we’re designing for a client.”

The program was the first to move to ASU’s East campus, now the Polytechnic campus, and one of the first to build online courses. It is part of the Polytechnic School.

“Graphic Information Technology encompasses communication and graphical presentation very broadly: web, photo, multimedia, visual and print,” said Ann McKenna, professor and director of the Polytechnic School. “It’s part of the ‘poly’ nature of the program,” McKenna said. “All technical challenges are interdisciplinary. In engineering, you need to be able to explain your ideas and designs. Engineering plays a critical role in technical solutions and the Graphic Information Technology program helps advance the message through design.”

Students have a highly engaged faculty and access to the latest technology through opportunities like the Print and Imaging Lab, a professional print service run by students that serves ASU and other clients. In addition, there is the GIT Commercial Photography Studio, where students work with professional quality equipment and produce photo shoots for ASU clients; and the Device and Usability Lab, a collection of computers, mobile phones, tablets and other devices available for website testing and usability research.

Graduates are in high demand, often having multiple job offers. They have gone to work for national and international companies. They also work for design firms, start their own companies, and go on to graduate school.
Finding the right fit

Ross Greenblat, who graduated in 2010, now works as a producer at Leo Burnett, Chicago, one of the largest advertising agencies in the world.

Greenblat visited ASU and decided it was a good fit. He planned on working as a commercial printer, and during his sophomore year, interned in the Print and Imaging Lab. But one day, a representative from Leo Burnett came to speak.

“After hearing what she had to say and speaking with her at length about the advertising industry, and specifically Leo Burnett, I knew that was the industry that I wanted to go into,” Greenblat said.

He interned after his sophomore and junior years, and upon graduation was hired as a sourcing analyst, then became an associate producer and currently is a producer, creating content for clients, including print, radio and TV commercials.

Greenblat said the GIT program helped expand his knowledge of the graphic communications industry, including the management side and how to communicate with internal teams, as well as clients.

“Students come in with one idea of what they want to do, but get a taste of everything,” said Laurie Ralston, a lecturer in the program. “We also are developing people who are going to be managers. We want them to be the bosses, the company owner, the entrepreneur.”

Dolin said the emphasis is on learning to learn.

“Technology keeps changing and evolving, but the skills and talent to create it are constant,” she said. “The ability to visually problem solve using whatever the current technology may be is what GIT is all about.”

ASU’s engineering, journalism schools announce innovative dual degree program

The Walter Cronkite School of Journalism and Mass Communication and the Ira A. Fulton Schools of Engineering began offering dual degrees in journalism and graphic information technology in fall 2015. The initiative allows students to pursue two separate degrees in less time by streamlining the admissions process and course requirements.

Under the Cronkite-Fulton partnership, students can simultaneously earn a Bachelor of Arts in journalism and mass communication and a Bachelor of Science in graphic information technology by taking between 122 and 137 credit hours, depending on English and foreign language placement. Prior to the program, students would typically take more than 170 credit hours for the two degrees.

Students pursuing dual degrees in journalism and graphic information technology will engage in immersive, hands-on learning in areas such as digital reporting, videography, news writing, Web design and development, and news game creation.

With the graphic information technology degree, students select between Web development and gaming animation as an area of focus. Cronkite’s journalism degree requires a professional internship as well as participation in the school’s New Media Innovation and Entrepreneurship Lab, where students design and create cutting-edge digital media products for regional and national media companies and other organizations.
Tom Sugar doesn't consider himself a modern-day Iron Man, but he does marvel at how his specialty, wearable robotics and exoskeletons, have taken off and achieved something of blockbuster proportions.

Sugar has worked in the field since 1999, when he first set up Arizona State University's Human Machine Integration Lab. “I’ve never seen wearable robotics as hot as now,” said Sugar, a professor in the Polytechnic School. “When I was at the International Conference on Robotics and Automation everyone was there — Amazon robotics, Google robotics and new companies like Robotis. The conference normally attracts 1,500 people. There were 2,700 attendees this time. It’s just booming.”

That interest in exoskeletons has expanded at ASU too, which has hired two new assistant professors in robotics. A far cry from the days when Sugar was the only robotics professor at ASU.

**Augmenting performance**

In his lab — a rectangular room that is part tech shop and part tinkerer’s paradise with gadgets, test instruments and tools strewn about — Sugar leads a team of ASU researchers and students in building devices to help people overcome a physical disability or provide enhanced performance.

Today, Sugar and his collaborators have five workable, wearable robotic systems, including one that has graduated from the lab and moved on to commercial applications.

The devices run the gamut — from a wearable jetpack device that can boost a runner’s speed, to another backpack device designed to alleviate the physical stress of carrying a heavy load, to a small refrigerated suit to keep soldiers cool in a desert environment.

“The overall goal is to build a device that will augment or assist a user,” Sugar said of his exoskeletons. “It doesn’t have to be only for people with disabilities. It can be able bodied people, soldiers, obese people or frail people.”

The challenge is creating devices that assist the wearer without also adversely burdening them with the device.

“Ninety-nine percent of the robots add weight, like 10 to 15 pounds for motors and batteries and sensors, but don’t pay for the weight penalty,” Sugar said. “So when you put it on, it’s actually harder to perform than when you are not wearing it.”

Sugar and his group have come up with two innovative designs that achieve “metabolic augmentation,” which means they overcome their weight gain and improve the user's performance.

“There are only two groups in the world that have achieved metabolic augmentation. A group at MIT and us,” Sugar said.
The Sugar Lab’s exosuits

Hanging on a rack in the lab is a device called Jet Pack, which is exactly what its name implies. It has two small air jets that are strapped to the user’s back. Its design is to give a push to the runner, making performance less taxing and improving overall run time.

Developed as part of the military’s 4MM project (for 4-minute mile), it provides up to 30 percent metabolic augmentation, but at a cost.

“It only lasts four to six minutes,” Sugar said. “At 24 volts and 100 amps, it just kills the batteries.”

Air Legs is a device that also can aid a runner, help a hiker or help somebody carrying a heavy load. It is much more efficient than the Jet Pack in how it assists the user.

Air Legs is powered from a high-pressure air tank, similar to those used in paintball markers. The tank is charged externally, then is mounted to the system. The system itself assists the user by pushing and pulling on the upper legs at precise intervals.

It operates on a real-time control system that uses a phase controller to calculate the exact time to trigger the air solenoids. It demonstrated 10 percent metabolic augmentation at the Army Research Labs in September 2013.

A third exosuit hanging on the rack in the Sugar lab is the Cool Suit, which includes a small refrigeration unit strapped to the back of a user. Developed for the Air Force, it circulates a cooled liquid across the upper body of the user. It was designed to aid soldiers in harsh and hot desert environments.

Yet another device, the Pogo Suit, is designed to help a soldier carry a heavy backpack by oscillating the weight being carried.

When a soldier is walking with a 100-pound backpack strapped to him, it doesn’t move with his body but instead moves as a reaction to his movement. The Pogo Suit is designed to move the backpack with the natural rhythm of walking by oscillating the pack up and down as the person walks, saving energy in the process.

While they differ dramatically in what they try to do, each of these exosuits share a common trait. They deliver a mechanical assist to the user at a precisely timed interval.

“Timing is critical,” Sugar explained. “We use a phase controller so the user controls the robot, the robot doesn’t control the user.

“Say with Air Legs, if you are running and you give the force at the wrong time, the user will trip or fall. The assist must be delivered at precisely the right time or the gait will be off, and the metabolic process will shoot through the roof.”

Education assist

Back in Sugar’s lab, senior Eduardo Fernandez explains what Cool Suit means to him. Fernandez is something of a robotics prodigy. He first began tinkering with them while in middle school, and several LEGO robotics competitions later he made his way to ASU and Sugar’s lab.

“I used building robots as a way to motivate myself and learn more,” Fernandez said.

“This is my education,” he added. “In order to do the Cool Suit project I had to learn all of the thermodynamics before I even started; just to understand the way things work. Once I actually built it, the thermodynamics became much clearer. That’s when the light bulb went off. The system is really simple and all of the math got simpler as well, because I understood what went on fundamentally.”

DARPA funded

The majority of Sugar’s research is funded through the U.S. military. An early project was to develop a spring-loaded ankle for lower leg amputees. Having such an ankle would give the user greater range in mobility and greater comfort than traditional prostheses that are simply strapped on and carried by the user. The Army was interested in such a device to get an injured soldier back to walking normally.

An early prototype was called SPARKy, for Spring Ankle with Regenerative Kinetics. That device was improved upon and resulted in Odyssey. Sugar and some of his students at the time helped create SpringActive, a company to commercialize the device. He says the group is now on the cusp of delivering commercial devices for lower leg amputees.

While many of his projects have been funded through the military and the Defense Advanced Research Projects Agency (DARPA), Sugar said the future of wearable robotics is going to be commercial.

“The future will be a long consumer push into this arena,” Sugar said. “They are interested in building devices that can help you hike the Grand Canyon, or devices that help logistics companies for their workers making deliveries or working long hours in the warehouse.

“My belief is that the younger baby boom generation will want to stay active and they like technology. They will wear these types of devices,” he added. “So instead of a walker or a cane that assists, they might want to wear one of these devices.”
Robotics advances open life-enhancing possibilities

Improvements in robotics are being made at a steady pace, promising progress particularly in technologies to help restore human physical capabilities.

The topic was explored prior to the third annual Rehabilitation Robotics Workshop at Arizona State University, when ASU researchers Bradley Greger and Thomas Sugar were interviewed on “Horizon,” the news and public affairs program on KAET-Channel 8, the PBS affiliate in the Phoenix metropolitan area.

Sugar is a professor of engineering and Greger is an associate professor of biomedical engineering in the School of Biological and Health Systems Engineering.

They described how experts in a variety of engineering, science and medical fields are collaborating on research and technology development to make devices that are breaking ground in human-robotic interaction.

Greger and Sugar pointed to advances in sensors, microprocessors, batteries, biomechanical and neural interface systems, exoskeletons and other wearable robotics.

Together the improved technologies are enhancing physical therapy treatment, and expanding capabilities to restore motor functions and rehabilitate stroke victims, they said.

In coming years, they see robotics as primary components of systems that link the brain and nervous system to robotic prosthetics and other devices that could restore vision, sense of touch and other natural functions.
Jennifer Bekki calls herself a “Sun Devil Lifer.” She has been a student or faculty member at ASU since August 1994. Not only did she receive three degrees and grow up watching Sun Devil baseball and basketball games, but she was recently granted tenure — making her one of only three faculty members to do so since the Polytechnic School became one of the Ira A. Fulton Schools of Engineering.

Bekki, an associate professor, is part of a team of researchers from the Polytechnic School that recently received a $2 million grant as part of the National Science Foundation’s (NSF) Revolutionizing Engineering Departments program — known as RED — to advance research in engineering education.

“We already have a lot to be proud of regarding the Polytechnic School’s innovative undergraduate engineering programs, but the RED project will focus on ways to even better prepare students,” said Bekki, who hopes their discoveries will enable other programs to likewise institute impactful changes.

She is also the co-principal investigator for the interdisciplinary CareerWISE research program, which has received $3.2 million in funding from NSF since 2006. The program strives to understand the experience of accomplished women in science and engineering doctoral programs and to increase their persistence in these programs through an online resilience-training tool. In connection with CareerWISE, Bekki has mentored and worked with 15 graduate students from a variety of disciplines.

“Many of these students have publications from their work on CareerWISE, and several have gone on to faculty positions at other institutions,” she said.

Since joining the ASU faculty in 2008, Bekki has published more than 30 refereed journal and conference papers, book chapters and conference presentations — with 10 of these published in the last year.

So what’s next for her as a newly tenured professor? Bekki looks forward to serving as a leader in the development of a new doctoral program called Engineering Education Systems and Design that focuses on engineering education research.

She also plans to devote considerable efforts to increasing the number of women in the Polytechnic School.

“I want to further my reach in terms of recruiting women and making sure they have a great experience while they’re here,” said Bekki.
Mark Henderson’s colleagues and students said he was true to form in accepting the Tempe Sister Cities organization’s Making a World of Difference Award for his humanitarian endeavors. The engineering professor didn’t bask in the spotlight, but instead directed attention to people he has led and collaborated with in efforts to empower communities.

“The important thing is that this award is a chance for all of them to get recognition for the amazing work they are getting done through GlobalResolve, and I’m hoping that maybe this brings us more support and encourages more people to get involved with us,” he said.

Henderson is the director of GlobalResolve, which he co-founded in 2006 with three fellow ASU faculty members, including engineering professor Brad Rogers, who became the program’s research and development director.

The group wanted to create opportunities to put the skills of the engineering faculty and students to work helping communities in underdeveloped countries improve their living conditions.

Since then, GlobalResolve has involved more than 500 students in such projects. More than 200 students and 15 faculty members are participating each year in the social entrepreneurship and sustainability program. They are contributing annually to almost 50 projects in 10 countries that focus on upgrading community infrastructure and resources for water, sanitation, energy, agriculture, health and education — and on boosting local economies.

The primary mission of GlobalResolve, Henderson said, “is to give our students opportunities for life-changing experiences that make them more globally aware, and empower them to feel they can change the world just as much as anyone else can.” Students said the goal is being fulfilled, due to Henderson’s role as mentor and motivator.

“Mark really cares about changing the world. He is an inspiration. He has boundless energy and he never runs out of passion,” said Kathleen Stefanik, who graduated with a degree in industrial and organizational psychology.

With Henderson’s guidance and help from other faculty and resources at ASU, Stefanik became founder and chief executive officer of GAIA International, a nonprofit humanitarian aid organization that is currently developing crop-production methods to help farming communities in Peru increase their crop yields.

GlobalResolve’s progress has been a factor in establishing a humanitarian engineering program in the Polytechnic School. Students can major in traditional areas of engineering with a concentration in humanitarian engineering. Henderson is helping lead the program with other engineering faculty members Brad Rogers, Kiril Hristovski, Nathan Johnson, Benjamin Ruddell and B. Ramakrishna.

Henderson describes the budding field as engineering that aims specifically to provide the technological solutions and other means to help struggling communities meet their basic needs and lift themselves out of poverty. It’s also about engineers — collaborating with experts in other fields — finding solutions tailored to the cultural and sociological environments of specific communities.
Legacy of research and teaching

Milt Sommerfeld shares his passion for research with students
Faculty

Milton Sommerfeld joined the faculty at Arizona State University right out of graduate school. Forty-seven years later, he is still making his mark at the university as a prominent teacher and researcher.

Sommerfeld is a professor in the Environmental and Resource Management Program in the Polytechnic School and co-director of the Arizona Center for Algae Technology and Innovation (AzCATI).

“I joined the faculty and stayed because ASU developed rapidly as a community of scholars who were engaged with students and their success,” he said. “I was encouraged at all stages of my career by faculty and administrators to grow as part of an aspiring university focused on innovation and performance.”

Sommerfeld’s work in phycology, aquatic ecology, water quality and the use of algae for bioremediation of air and water is recognized nationally.

Among his long list of accolades, Sommerfeld’s algae work garnered him Arizona Technology Enterprise’s 2007 Innovator of the Year, the 2009 Governor’s Celebration of Innovation Award and the Leader of the Year in Technology (AzCATI) from Arizona Capitol Times in 2012.

His algae-based renewable biofuels also landed him at No. 11 on Time Magazine’s 50 Best Inventions list in 2008.

Sommerfeld currently is principal investigator (PI) for a $1 million USDA-funded project, and a co-PI on a DOE-funded $15 million consortium. Through his career he has been a PI or co-PI on more than 100 funded projects totaling $38 million.

He has more than 310 publications, posters and presentations listed in professional journals/meetings abstracts.

Sommerfeld is equally distinguished in working with his students. He has mentored more than 90 graduate students and postdoctoral associates and dozens of undergraduates.

“Working with students is the best part of being a faculty member,” he said. “Seeing them grow through the learning processes in the classroom and laboratory and through interaction with other scholars, as well as publishing their research in scientific journals is very rewarding to me.”

Even after almost half a century at ASU, Sommerfeld says he has no plans of slowing down.

“I love discovering new things and engaging students in the discovery process,” he said. “I hope to successfully complete my funded research projects, guide my graduate students to completion of their degrees and continue to be engaged in the education of the next generation of engineers.”
Jordan brings creative drive to tackling challenges of teaching engineering

Shawn Jordan is establishing himself as a leading innovator in engineering design education.

The assistant professor of engineering in the Polytechnic School earned a place on the teaching team of the National Science Foundation (NSF) Innovation Corps for Learning, and in 2014 the American Society for Engineering Education’s PRISM magazine selected him as one of 20 rising stars among engineering faculty members in the United States under the age of 40.

Jordan also has been awarded the prestigious NSF Early Career Development Award given to young faculty who are considered potential national research and education leaders in their fields.

He co-founded the STEAM Labs Center for K-12 Research and Engagement and the STEAM Machines™ program to create learning environments for young students to apply the principles and skills of science, technology, engineering, art and mathematics to inventing and prototyping.

His activities have attracted more than $4 million in NSF funding to support his engineering education research and scholarship, including grants to create the STEAM Labs Center. He has also received support from ASU Women & Philanthropy. Through the center he is forming partnerships with community organizations in Arizona and academic institutions internationally.

Jordan founded and led two student teams to championships in the national collegiate Rube Goldberg Machine Contest, which challenges students to build chain reaction machines. Jordan held the Guinness world record for the largest number of steps required by a Goldberg machine — 125.

His creativity has led to appearances in a movie and on television — including The History Channel’s “Modern Marvels” show and “Jimmy Kimmel Live” on ABC. He was a behind-the-scenes engineer for season three of “Design Squad,” the PBS engineering design reality TV show.

Jordan says he came to ASU because he “saw a growing community of progressive engineering educators trying to do something new and exciting, and being supported with the resources and autonomy required to be highly successful. As someone who wants to be on the cutting edge of engineering design education and is motivated to make a difference in the world, the Polytechnic School at ASU is an ideal environment in which to foster innovation.”
The Polytechnic School was selected to receive $2 million as part of National Science Foundation’s (NSF) Revolutionizing Engineering Departments program, known as RED. ASU is one of only six RED grants awarded by the NSF. School Director Ann McKenna is the principal investigator on the grant. The team includes 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 school’s engineering and manufacturing engineering programs, and will further develop previously tested and refined engineering education research done by the group.

The project will 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. It will take place over five years, and the team will identify the current engineering education ecosystem, engage with members of the faculty, students and industry partners to gather input.

What they learn will help them create workshops for faculty in which 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.
Nancy Cooke’s work helps save lives by marrying psychology and technology

For her eighth-grade science fair project, Nancy Cooke tested how noise pollution affected human factors. “I exposed mice to my brother’s drumming, to drills and other sounds,” said Cooke, now a professor at the Polytechnic School. “They became obese, lost their hearing and ate their young.”

It was the beginning of a fascination with human factors and human systems for Cooke, who recently won a lifetime achievement award, the Arnold M. Small President’s Distinguished Award from the Human Factors and Ergonomics Society.


She thinks all engineering majors should take at least one class on human systems engineering to raise their awareness of human factors and how they influence the success of engineering designs.

“Everything engineers make is touched by humans,” she said. “A lot of people think the idea is to build a widget, then give it to the human systems engineering expert to make it more human-friendly. But the designer and human systems engineering expert should be working together from the inception. It’s better to collaborate up front than to have to redesign something like a helicopter after the fact.”

Cooke’s research focuses on individual and team cognition and its application to the development of cognitive and knowledge engineering methodologies, healthcare, homeland security systems, remotely piloted aircraft and emergency response systems.

“It’s not just about how to design machines so people can use them better,” Cooke said. “It’s about considering human capabilities and limitations in designing large socio-technical systems like nuclear power plants. So it’s not just how a pilot functions in a single cockpit, but how humans manage national air space with free flight and unmanned systems.”

Cooke’s lab equipment includes several simulation rooms for teams of up to six people to practice everything from hostage rescues to drone missions.

She measures the performance of a group by how effective it is at achieving its goals. “In deciding whether it’s a ‘good team’ or a ‘bad team,’ we’re looking at how the members process interactions,” she said. “We looked at what happens in these teams when you switch out a good team member with a dysfunctional one. Does it make the team dysfunctional?”

Cooke is one of only 28 female fellows in the Human Factors and Ergonomics Society, and said her recent lifetime achievement award was given in part because she was the first female editor of Factors: The Journal of the Human Factors and Ergonomics Society, and the first female chair on the National Research Council’s Board on Human-Systems Integration.

Most of Cooke’s research is focused on military applications and funded by the U.S. Department of Defense. One of her early research projects was on how fighter pilots organize and understand maneuvers, how veteran pilots visualize them differently, how military teams think about themselves as a unit, and whether the “right stuff” for doing the job can be inculcated into younger pilots.

“I have had a passion for national security as long as I can remember,” Cooke said. “On 9/11, my three daughters, who were 1, 4, and 8 at the time, slept in my bedroom. My mother-bear instincts came out, and I remember looking at them sleeping and becoming really angry. I knew I had to do everything I was capable of doing to keep this from happening again.”

“Psychology saves lives,” Cooke said.
ASU engineers have role in national effort to better protect water quality

Arizona State University engineers are working as part of a new national center for research and innovation in small and medium-sized drinking water systems. Kiril Hristovski, an assistant professor in the Polytechnic School, leads the team.

The Design of Risk Reducing, Innovative Implementable Small System Knowledge (DeRISK) Center will develop and test advanced, low-cost methods of reducing, controlling and eliminating water contaminants that present challenges to communities worldwide. It is supported by a $4 million U.S. Environmental Protection Agency grant.

As part of the center’s activities, the researchers plan to develop and prototype novel nanomaterial-based treatment technologies, which can remove nitrate and other contaminants, such as hexavalent chromium, from water by photocatalytic reduction.

Estimates suggest that more than 24 million people in the United States alone are affected by nitrate contamination, making it the most ubiquitous contaminant in drinking water sources, one that poses high risk to human health and the environment. “Nitrate is high on the International Agency for Research on Cancer priority list for upcoming review of possible carcinogenicity," Hristovski said.

“Hexavalent chromium is already a confirmed carcinogen. Development of novel technologies that could eliminate these contaminants from water is of critical importance in the national and global effort to protect public health and the environment," he said.

“By its selection to be part of this EPA-funded multi-university center, ASU is again being recognized as one of the leading research institutions in developing solutions for safeguarding the environment and public health," said Hristovski.

His research partner on the project is Paul Westerhoff, a professor in the School of Sustainable Engineering and the Built Environment and ASU’s vice provost of academic research programming.

The researchers are focused on developing novel photochemical-based applications, including both sunlight and engineered light sources, to improve water quality and provide effective photon-based water treatment for small systems.

Sustainability project aims at boosting water, electrical systems resiliency

Climate forecasts for coming decades predict conditions that could put a severe strain on critical infrastructure systems — particularly in the southwestern United States. It is going to be hotter and water flows will be different, with more intense weather events and forest fires likely. All of this is going to have impacts on water and electricity systems. At the same time, demand for power and water will be increasing.

A Fulton Schools research team has been awarded a three-year $600,000 grant from the Water Sustainability and Climate program of the National Science Foundation and the National Institute of Food and Agriculture to begin boosting the resilience of infrastructure systems against potential threats posed by significant changes in climate.

The research team includes Ben Ruddell, an assistant professor in the Polytechnic School and senior sustainability scientist in the Julie Ann Wrigley Global Institute of Sustainability. Ruddell is a scientist of complex systems (these systems are characterized by highly interconnected relationships and feedback), and his current professional goals are the advancement of the science of complex Coupled Natural-Human (CNH) systems, especially in hydrology, climate, energy, water, ecosystems and in urban environments.

The work based at ASU’s Sustainable Urban Systems Lab will focus primarily on desert regions because they are especially vulnerable to environmental impacts brought on by climate factors. They also rely heavily on thermoelectric power generation that depends on water.

Such interconnectedness of water and power infrastructures means disruption of the operations of any one of them can intensify the overall detrimental impacts on the municipalities and regions served by the systems.
Additive Manufacturing Center at the Polytechnic School is under development, currently completing facility renovations to accommodate the launch of a new 15,000 square foot Additive Manufacturing lab facility. This facility will be one of the largest 3D Printing (also known as additive manufacturing) research and educational centers in the southwestern U.S. and will showcase a comprehensive array of state-of-the-art technologies for manufacturing 3D printed polymer and metal products.

Altitude Chamber is a research and training facility that allows individuals to experience the physiological effects of oxygen deprivation.

Arizona Center for Algae Technology and Innovation (AzCATI), better known as the “algae lab,” focuses on the study and uses of algae and related microorganisms, notably for their potential to produce biomass that can be converted to biofuels and diverse bioproducts, such as feed, food and nutraceuticals. AzCATI, through a U.S. Department of Energy grant titled Algae Testbed Public Private Partnership (ATP3), serves as a national open testbed for algae research that is open to other universities, national laboratories, industries and individuals who wish to exploit algae for their biomass and product potential. To connect with the local community, presentations and tours are provided to student groups from local middle and high schools, community colleges, and other outreach activities.

Commercial Photography Studio and Technical Imaging Lab maintains industry standard equipment and involves students in advertising and observational image capture, including high-speed video and thermal imaging. The studio and lab are also contextual learning labs that provide imaging services to research projects and ASU organizations.

Device and Usability Learning Lab is a collection of computers, mobile phones, tablets and other devices available for website testing and usability research, which allows web design and development to become truly responsive.

Engineering Design Studios include state-of-the-art engineering prototyping equipment to support design and project realization where students learn to innovate and apply engineering principles. The studios provide students with an environment that is conducive to project and problem-based learning. They are able to fabricate and bring innovative ideas to reality.

Flight Simulators and Aviation Labs in the Simulator Building houses state-of-the-art flight simulators that prepare students to take flight before setting foot in an airplane. The building also has an air traffic control simulator room, which displays a virtual 315-degree view of an airport area, depicting operational movement areas, taxiing aircraft, ground vehicle movement, and arriving and departing aircraft.
Human systems engineering (HSE) labs support research on individual and team performance, cognition, and learning in various settings including driving and flight, medical equipment, educational technologies, robots and autonomous vehicles, and intelligence analysis.

The labs, situated in three different buildings on the Polytechnic campus, provide facilities that position human systems research and application in human-centered design in the problem context.

Make Media Lab allows students to record their own videos and photos to promote entrepreneurial startups and class projects. Video and still photography equipment is available for student use and research.

Manufacturing labs in the Simulator building include state of the art CNC machine tools, computer aided design, manufacturing (CAD/CAM), sheetmetal, casting, metrology, welding, automation, assembly and manual machining labs.

Photovoltaics Reliability Lab (PRL) is a world-recognized, core facility in energy reliability and testing on the Polytechnic campus.

Robotics Lab supports research on developing robotic orthoses and prostheses for stroke rehabilitation and mobility, mobile robot navigation and wearable robotics.

Startup Labs allows students the room and tools they need to prototype and build creative projects and features equipment that includes a ShopBot 3D wood router, Epilog Laser engraver, 3D printers, a vinyl cutter, and a variety of hand tools, among other equipment.

STEAM Labs challenges students to learn and apply the engineering design process to build chain reaction STEAM Machines™ in a project-based, cooperative learning environment. The program integrates arts and STEM, and creates a pathway for students to better understand careers in engineering.

ASU Print and Imaging Lab is dedicated to providing hands-on, educational experiences for Arizona State University students. The lab serves as a self-funded academic enterprise that prepares and manufactures general commercial print and marketing collateral for ASU.
Polytechnic SAE Baja team overcomes collision to earn 10th place award

An off-road vehicle built by Polytechnic School students put the endurance in Baja Endurance Race at this year’s Society of Automotive Engineers (SAE) race in Mechanicsville, Maryland.

Built by the Polytechnic SAE Baja team, the off-road vehicle finished 10th overall after enduring a collision and on-the-spot repairs during their four-hour race in May. The competition brought together 105 teams from across the country.

In addition to their race time, the team was judged on the car’s construction cost, design and a sales presentation.

Composed of eight students, four team members had to rush back to Arizona before the awards ceremony to attend their graduation ceremonies. With an award in one hand and a degree in the other, it made for a pretty good week for graduating members of the Polytechnic SAE Baja team.

“In a short three seasons of racing these students have brought Polytechnic’s SAE Baja team from an inexperienced startup team to a top five contender,” said Jim Contes, the team’s faculty advisor and an automotive engineering senior lecturer in the Polytechnic School.
Lindsey Baker, Graphic Information Technology

Lindsay Baker went from dropping out of high school to the Dean's List, a 4.0 GPA, and being named Outstanding Graduate Student. That's her story, and it’s an inspiration for those who might think that college is out of reach.

Baker, who earned her GED after leaving high school, was undoubtedly a smart woman who saw a bright future for herself. She chose Mesa Community College to get her career started and, after earning her associate degree in applied science degree,决定了 to keep going at ASU.

“I'm a creative-minded person, and also persuasive,” she said. "I chose graphic design and GIT because it wasn't just graphics, it has an engineering component”

Baker says she was able to get the most out of her undergraduate experience, thanks to public and private support she received that allowed her go to school full time. Some of the scholarships and awards she received include the San Tan Ford Scholarship, Donald & Dorothy Colee Scholarship, Harry A. Findor & O'Neil Printing Scholarship, Ethelmae S. Merriam Endowment and the Transfer Achievement Award.

While Baker said she focused most of her attention on academics, she was able to attend one of the hack-a-thon events on the Polytechnic Campus. It was there that she ended up meeting friends with whom she would go on the start her own business. Called Small Emperor, the technology business develops web applications.

“One of the most rewarding things about ASU has been the networks I have built,” said Baker. “I have been able to start my own business and I am so grateful that ASU provided me with so many opportunities. It has been life changing.”

Baker noted that the faculty of the Polytechnic School is exceptional, and she had particularly fond praise for lecturers Deb Prewitt and Laurie Ralston.

Baker is back at the Polytechnic School for her master’s degree and will continue to grow her tech company.

Chris Brown, Environmental and Resource Management

“Majoring in environmental and resource management was the perfect fit for me, because it aligned with things that were important to me growing up, namely the environment,” said Chris Brown. “I grew up outside and it's something I want my kids to be able to enjoy as they are growing up.”

Brown was raised in Austin, Texas, and worked at Dell and Seletron Technologies before coming to ASU. He drew from his childhood passion to find his career path.

He felt right at home at the Polytechnic School because of its diverse community that includes many nontraditional age students like him. In addition to his course work he did a paid
Students

Internship with lecturer Albert Brown and assistant professor Kiril Hristovski on the Border 2020 Project. They worked on wastewater systems along the border in Mexico.

Brown earned a 3.76 GPA and was on the Dean’s List each semester. In addition to his course work he was involved in several co-curricular activities, including the ERM student organization and as safety officer for ASU’s EcoCAR 3 team. He also was a teaching assistant in ERM, where he taught water and wastewater treatment.

After graduating with his bachelor’s degree, Brown has returned to ASU to pursue his master’s degree in environmental and resource management. He hopes to eventually work in the water treatment, HAZMAT or the wastewater industry.

If Brown could give words of advice to those considering college, it would be this: “You are never too old to go back to school.”

Shinya Ishizaki, Industrial and Organizational Psychology

Shinya Ishizaki earned his first degree in economics in Japan. During his studies he became curious about irrational behavior in the marketplace and turned to behavioral economics to help explain it.

“The experience triggered me to want to study more about the micro approach to human behavior, and that is why I wanted to study industrial and organizational psychology,” he said.

Ishizaki came to ASU as a New American University Scholar. He found the Polytechnic campus to be a perfect fit.

“There are two reasons that ASU attracted me: kindness and spirit of loyalty,” he said. “ASU students are very kind and helpful, not only for friends but also for strangers. They also love their university. I like the Sun Devil spirit!”

Ishizaki said the most rewarding experience of his undergraduate years was his selection for the Fulton Undergraduate Research Initiative (FURI). He conducted his own research, under the mentorship of assistant professor Hyunjin Song, which explored how the difficulty of reading affects the evaluation of résumés.

“When people evaluate someone, biases caused by their minds are critical problems that disturb fair evaluations,” Ishizaki said. “It was my first experience with funded research and I learned about both the stress and pleasure of it.”

After commencement, Ishizaki planned to continue his graduate studies in industrial and organizational psychology in the UK. Career-wise, he would like to be a psychologist working at a company that is seeking to make a better workplace for its employees. This would be a place where he could use the knowledge from his research in his job.

Logan Salaki, Aviation Programs

Logan Salaki grew up in Versailles, Missouri, watching B-2 Spirits fly regularly over his house. It was then that his interest of aviation was sparked.

After visiting control towers in Missouri and “seeing how cool the job was,” he decided he wanted to be an air traffic controller.

Salaki chose ASU because he knew “that the Polytechnic campus would be a great place to pursue an aviation management education. It has high-tech aviation facilities and simulators, and a great location right next to the Phoenix-Mesa Gateway Airport.”

A Barrett, the Honors College student and recipient of a Provost Scholarship, Hendrick Foundation Scholarship and San Tan Ford Scholarship, among others, Salaki maintained a 4.0 GPA. His majors included air traffic management and aeronautical management technology.

Salaki noted that there isn’t one faculty member who stood out above the rest because “all of the faculty at ASU took me under their wing and helped me succeed.”

Salaki has worked for the Phoenix-Mesa Gateway Airport in airport operations as an intern since 2014. He also interned with the FAA at Phoenix Sky Harbor Airport last summer. He hopes to become an air traffic controller at a large airport, and possibly work his way into air traffic management.

Until then, he plans to continue working at Phoenix-Mesa Gateway after graduation.

Carl Scott, Manufacturing Engineering

That “ah-ha!” moment came for Carl Scott when he saw his daughter’s first ultrasound. Right then and there he knew he was on the right life path.

“Pursuing engineering not only fit well with my skills and interests, but also will let me provide comforts for my family,” he said.

A career in manufacturing engineering was an easy decision. Scott considers himself a “math-minded person, very analytical,” and engineering makes sense for him. He chose ASU because it had “great rankings” and he could stay close to home.

At ASU, Scott was a member of the Society of Automotive Engineers Baja Team. He is especially proud to be part of the team that designed the gearbox that won the AeroDef Competition in 2014, the industry’s most acclaimed manufacturing event (hosted by the Society of Manufacturing Engineers, SME). He also volunteered for SAE World in Motion and worked with junior high school students on their engineering projects. SAE International is focused on mobility engineering.
Students

“Let’s stop for a minute,” I said. “The most challenging part of school was finding time to sleep.”

Scott already had a job offer waiting for him after graduation. He moved into a manufacturing engineer position at Benchmark Electronics, managing cleanroom assembly and machining. He hopes in the future that he will be an engineering department manager and, being a quick study, is open to any industry sector or company where an opportunity might arise.

Randi Taylor, Engineering

It was by chance, Randi Taylor said, that she enrolled in the engineering program at the Polytechnic School. It turned out to be one of the best decisions she ever made.

Taylor was an engineering major when she attended Rice University in the late 1990s. She changed her major to linguistics for a number of reasons, but one of them was that she did not see engineering as an opportunity to help people around her.

“One thing that became clear to me during my time at ASU is that engineers play an important role in shaping the way our society will function and interact with our environment and societies around the world,” Taylor said.

Her desire to help people led her to a career in social services. She worked in that field for seven years, helping children and families. The married mother of four children, ages 8, 6, and 4-year-old twins, also worked as a stay-at-home mom.

Calling herself an “introvert,” Taylor realized that she was not suited for social services, a “very emotionally taxing field.” While the Altadena, California, native moved around a lot, she graduated high school from Mountain View in Mesa, so the Polytechnic campus was a good place to make a change.

Taylor said the challenges of being an older student balancing family needs, school and a job could be daunting. The biggest hurdle, however, was finding her self-confidence.

“My first day of classes I was literally sick to my stomach. I remember thinking, ‘What have I gotten myself into?’ But I stuck with it,” she said.

Taylor achieved a 3.89 GPA and worked on the STEAM Machine Clubs Pilot Program for the past two years, where she coordinated the implementation of 35 engineering-oriented after school programs for middle school students.

She is now attending graduate school and working on a doctorate in mechanical engineering at the University of Maryland. After graduate school Taylor hopes to work at a national lab on issues related to energy and sustainability.

David Wolfgramm, Engineering Technology

David Wolfgramm alternates the cups in his cupboard one up, one down. Without even thinking, he did this to be more space efficient. And it works.

“I know it is a silly example, but my mind works in this manner with almost everything,” he said. “I have always enjoyed making things more efficient, or ‘lean’ as they say in manufacturing, whether it be time, cost, space efficiency, whatever. It is like a game to me, to look at a process and see how to make it better.”

Wolfgramm, who hails from Kennewick, Washington, had his associate degree and had worked at Lockheed Martin for more than five years. He decided to move his family to Arizona to complete his education and chose the manufacturing engineering program at the Polytechnic School because he felt it was the best in the western United States.

Wolfgramm loved the Polytechnic campus and commended the faculty for preparing students for the real world and “to think outside the box.”

Approaching graduation Wolfgramm was still trying to figure out his longer-term career goal. His interest in materials science was piqued when a guest speaker in one of his classes explained how it can be used to determine airplane failure in an emergency landing or crash.

“I would love to have a job like that someday,” he said.

“However, additive manufacturing, 3D printing — being so up and coming — I feel like now would be a great time to be studying this. I would like to understand all the property changes that materials may go through during this process, as well as help figure out all that additive manufacturing could do.”
Mentor Dida, Outstanding Graduate Student, Spring 2015

Mentor Dida received his master’s degree in global technology and entrepreneurship. A “double Devil,” he also received his bachelor’s degree in electronics engineering technology with a focus on alternative energy technology from ASU.

Originally from Kosovo, Dida moved to America as a high school exchange student. He was nine years old when Serbian police forced his Albanian family out of their home, herding them onto trains headed for the Macedonian border as refugees.

He describes himself as a “simple, young and ambitious entrepreneur who does not miss an opportunity to help others.”

Dida was incredibly active and involved with initiatives in the Polytechnic School and at the Polytechnic campus. Among his many accomplishments, he was co-founder and member of Startup Village Student Organization; co-founder and member of the Innovation Creativity and Entrepreneurship Club; chair for special events at Changemaker Central and lead change agent at Changemaker Polytechnic. He also was the keynote speaker for Arizona FIRST LEGO League and at the Oxfam Hunger Banquet.

As an undergraduate, Dida became involved with GlobalResolve, a social entrepreneurship program in which students work on semester-long projects that improve the lives of underprivileged people in underdeveloped nations. He also worked with engineering professor Mark Henderson on the Two Dollar Challenge, a movement to increase global awareness of poverty.

“Mentor is a self-starter with big ideas that he makes into realistic events and activities,” Henderson said. “One of his primary goals is to help fellow Kosovo citizens. His background gives him a sense of justice and equality that you won’t find in many people his age. He truly cares.”

Dida has started his own nongovernmental organization, Prosperity Initiative in Kosovo, to encourage the country’s young people to participate in public service and community work, increasing the impact of youth decision-making.

Dida was recently hired to join Ashoka, the largest network of social entrepreneurs worldwide, to help build a vibrant network of social innovators, partners and changemakers. He is program coordinator of Ashoka’s Youth Venture.

Nicholas Radda, Distinguished Undergraduate Student, Spring 2015

Nicholas Radda found balancing his course work with co-curricular activities to be the biggest challenge of his undergraduate years.

It is easy to see why. The Barrett Honors student and Medallion Scholar was co-founder of the Rossum Rumblers Robotics student organization. He watched the organization grow from 13 to 60 members in one semester as the love for all-things-robot exploded. He also was vice president of Honors Devils, the Barrett Honors students who assist with the college’s outreach activities.

Radda grew up in Fountain Hills, Arizona. He said there was an “excellent” robotics program at his high school and it was during a summer scholars program at ASU’s Polytechnic campus that he met the faculty and became “super interested” in the program. He decided that ASU was a perfect fit and decided to major in engineering, with a concentration in robotics.

“I always wanted to study biomedical engineering, and my goal is to someday work in the field, particularly with prosthetics,” Radda said.

When his mother was young, she had to get a pacemaker, Radda said. The time he spent with her in the hospital sparked his interest in the biomedical field. His dream now is to earn his doctorate in neuroscience, and then he wants to own a business to create prosthetics. He is taking a bit of an academic break to work before continuing with his studies.

“Most of all, I think I will remember being in the lab with other students until 3 a.m. And, all of a sudden, our project finally worked,” Radda said. “That feeling of elation that we did it. I was exhausted and energized at the same time. I have had so many great moments here.”

Graphic Information Technology student wins Canadian graduate scholarship

Anna Witcraft, who recently graduated with her degree in Graphic Information Technology (GIT), won a prestigious scholarship to pursue a master’s degree in Canada.

The award of $26,500 a year for two years is funded through Alberta Innovates Technology Futures, a research and innovation system that encourages interaction of government, industry and academia to develop solutions to global challenges.
It will allow Witcraft to pursue a master of science degree in computational media design at the University of Calgary. Witcraft planned to study how to assist communication between families and loved ones in assisted living. She will work with Anthony Tang, an assistant professor in Calgary’s computer science department.

Witcraft was inspired to create the programs after visiting her boyfriend’s grandmother in assisted living, and doing some research on the increasing numbers of dementia patients. Alzheimer’s Disease International predicts the number of cases will triple from more than 44 million today to 135 million by 2050.

“I was inspired to try to help connect families with loved ones after visiting the assisted living facility and seeing how difficult it is for people to stay in contact,” Witcraft said. “I want to make a software system to make it easier.”

Assigned to the battalion’s communications and electronics shop, Bock maintained, prepared and repaired missile systems, radio communications devices, night-vision goggles and the electronic frequency jammers that prevented remote detonation of deadly IEDs — improvised explosive devices — used by enemy combatants.

He earned two Army commendation medals for his contributions to the combat mission, and by his third year of military service rose to the rank of sergeant and became leader of the communications and electronics operation.

Throughout those transformative years, “that idea of going to ASU stayed in my mind,” Bock said.

Once back in the United States, he set out on path to get there. He enrolled in a general studies program at Central Texas College, which specializes in online education for military personnel. For more than a year, he took on a full load of studies while still on full-time active duty in the Army.

“It was work and study, work and study, all day, every day” during that time, he said.

Eventually, he was accepted to ASU as a transfer student for the fall 2013 semester. At first he was considering majoring in business, but in scouring ASU’s website he found the Technological Entrepreneurship and Management program in the Polytechnic School.

“It looked like a great fit for me,” he said, one that would allow him to build on his tech work and leadership duties in the Army. He is on course to earn his bachelor’s degree by the end of 2015.

Bock is getting additional education through a student internship with a growing company that manufactures, installs and services point-of-sale technology systems for businesses, primarily restaurants and hotels.

He is also gaining skills in a student worker job with the Polytechnic campus office of ASU’s Pat Tillman Veterans Center. In that role he is assisting military veterans at ASU with the transition back into civilian life, and aiding veterans who are entering or returning to college. He also is serving as president of the ASU veterans’ social club at the Polytechnic campus, helping to foster a sense of community among military veterans at the university.

Bock is not yet fully in post-military mode. He joined the National Guard in California as a reserve, now serving as an intelligence analyst. His National Guard unit is designated for disaster and crisis response deployment. So he must be prepared to step away from studies and jobs to rush to duty if called.

“It would be nice to graduate before getting a call for that duty, but I’m ready for it at any time,” he said.
Students

EcoCAR 3: University teams creating a fuel-efficient future for an automotive icon

EcoCAR 3 teams across the United States, including ASU’s team from the Polytechnic School, are working together with their local Clean Cities coalitions to host events, develop outreach products, and spread the word about alternative fuels and advanced vehicle technologies.

Two EcoCAR 3 teams received awards this year for videos they developed highlighting their teams’ collaboration with local Clean Cities coalitions. At its awards ceremony, the EcoCAR 3 program recognized ASU, which worked with the Valley of the Sun Clean Cities Coalition, and the University of Alabama, which teamed up with the Alabama Clean Fuels Coalition.

EcoCAR 3, a four-year program that runs through 2018, tasks students from 16 different universities to re-engineer a Chevrolet Camaro. Student teams are challenged to keep the Camaro’s iconic body design, while increasing fuel efficiency, maintaining performance and safety, and meeting high consumer standards.

The teams also focus on developing technologies that will lower emissions by incorporating alternative fuels.

The partnership between the Valley of the Sun Clean Cities coalition and the ASU EcoCAR 3 team was mutually beneficial. Thanks to the coalition, the student team got the chance to meet with local fleets that run alternative fuel vehicles and were able to establish relationships with vendors who helped with the team’s outreach and events.

The EcoCAR 3 team also helped promote and collect student surveys at an Odyssey Day event on the coalition’s behalf.

“I would personally like to thank the Valley of the Sun Clean Cities for giving us the opportunity to work with a group that’s doing something so meaningful,” said communication manager Ashley Yost, who graduated in 2015 with a master’s degree in graphic information technology. “We’re both working towards something that is not only going to have an impact on our future, but our community’s future.”

Story by: Kendall Septon, National Renewable Energy Laboratory, and Amanda McAlpin, Argonne National Laboratory
ASU partners with Gilbert, Google to spark high schoolers’ interest in computer science

By the year 2020 it is projected that there will be one million more computer science jobs than there are students. According to Code.org, nine out of 10 high schools do not offer computer programming classes.

The town of Gilbert, Arizona, is helping to fill this gap with a mobile application development competition for high school students called SPARK App League. The goal: develop a new tourism mobile app for Gilbert.

Gilbert partnered with Google and Arizona State University to teach kids the basics of mobile application development from design to code implementation. The hope is to pique student interest in computer science as a potential career.

The competition, in its third year, kicked off with a daylong event in January at the Polytechnic School, where more than 250 students learned the basics of code implementation, design and usability.

Christina Carrasquilla and Susan Squires, Graphic Information Technology (GIT) lecturers, student Matt Ludwigs, and Ashish Amresh, assistant professor in the School of Computing, Informatics, and Decision Systems Engineering, created the curriculum and taught it at the kickoff.

They created a streamlined “How to Make an App” curriculum that covered content, wireframing, design, code (HTML, CSS, JavaScript) and developing touch software. Google software engineer Jessie Chavez was invited to participate and be a judge.

“This competition is awesome compared to others because we’re actually bringing such a wide array of students from many different schools and have a strong mentorship team from the university partner,” Chavez said.

After the initial meeting, students worked in teams with their school mentor. Some of the teams had the project embedded into their curriculum, and the teachers and the Town of Gilbert offered assistance throughout the process.

In May, a ceremony was held to celebrate the competition winners, a team from Foothills Academy College Prep in Scottsdale, Arizona. Carrasquilla was one of the judges along with Chavez, John Lewis, mayor of Gilbert, the Gilbert Digital Team, and local industry.

“Outreach events such as SPARK are a great opportunity for the Polytechnic School to show the community our amazing resources,” Carrasquilla said. “For high school students, it’s a chance to get a college experience. We create a pipeline for their future and they inspire us with their imaginations.”
ACE Academy brings young students to ASU’s aviation program

Middle school and high school students from the Phoenix area participated in the Aviation Career Education (ACE) Academy. They used flight simulators, learned about piston engines and even used riveters on a visit to the aviation program at the Polytechnic School.

The ACE Academy is sponsored by the Archer Ragsdale Arizona Chapter of the Tuskegee Airmen, Inc., and the Organization of Black Aerospace Professionals.

The campus tour, hosted annually by ASU, was facilitated by Jim Anderson, professor emeritus in the Polytechnic School and a retired Southwest Airlines captain.

“We want to expose the young students to college education,” said Larry “Jet” Jackson, director of the Academy, who had a 20-year career as a fighter pilot in the U.S. Air Force and is now a captain for Southwest Airlines. Jackson and Anderson knew each in the Air Force, and regularly share their experiences with youth.

“Aviation is just the hook,” Jackson said. “Some of the students may be interested in aviation, others may not be. We want to encourage them in the STEM areas: science, technology, engineering and math.”

The students visited Southwest Airlines at Sky Harbor Airport where they saw a Boeing 737 up close, and visited Luke Air Force Base. They also met African-American pioneers in the field of aviation, including Lt. Col. Robert Ashby, the first black captain for Frontier Airlines and one of the Original Tuskegee Airmen.

Jonathan Nash, 13, an eighth-grader at Cotton Boll Elementary School in Peoria, had never flown in a plane or seen one on the ground before participating in the Academy program.

“I want to be a safety director in the Air Force,” Nash said. “I want to travel the world. I like the science behind aviation. And I like the idea of climbing up into the sky and seeing the scenery from up there.”

Kids get hands-on engineering experiences at DiscoverE Day

DiscoverE Day is the premier open house of the Fulton Schools of Engineering, designed to spark youngsters’ interest in the world of engineering and the broad range of career opportunities in the field.

For this fourth year of DiscoverE Day events, ASU hosted close to 2,500 students in third through eighth grades on its Polytechnic and Tempe campuses. The students, teachers and chaperones came from about 100 public, private and charter elementary schools — as well as home school groups.

Students got a look at a diverse array of engineering applications from almost 90 exhibits presented by more than 300 Fulton Schools of Engineering students and staff volunteers, as well as about 25 teacher candidates from ASU’s Mary Lou Fulton Teachers College.

Kino Junior High School in Mesa sent a large group to DiscoverE Day — about 50 students from the school’s Advancement Via Individual Determination (AVID) program. AVID students are typically representative of groups that have not traditionally pursued college education due to socioeconomic factors, said teacher Rochelle Deriso.

“We come [to DiscoverE Day] every year. It exposes them to college culture. We want to get them here on the campus interacting with college students,” Deriso said. “We want to open doors for them and get them motivated, and these kinds of hands-on experiences help do that.”
From an eye-imaging system for Mayo Clinic, to a device that could improve railroad-crossing safety, to a robotic-guided glove to help teach sign language, students in the Polytechnic School are creating technologies to solve real-world problems.

This year’s Innovation Showcases at the Polytechnic campus, held during both the fall and spring semesters, highlighted the work of student teams that created innovative and imaginative solutions to meet a variety of challenges.

“It’s not just the solutions that impress us, but also the process in which students work directly with faculty mentors and industry leaders who partner with our students for new ideas,” said Paul Johnson, dean emeritus of the Ira A. Fulton Schools of Engineering. “This collaboration is enriching for both sides and provides an introduction to industry for our students. The relationships that develop are rewarding and often result in job offers.”

The Innovation Showcase includes high school projects, senior-year capstone design projects, eProjects, and undergraduate and graduate student projects. The event highlights the process of invention and creation.

One of the outstanding undertakings this year was the Mayo Clinic Telemedicine eProject, which brought together engineering and manufacturing engineering students Joseph Blaylock, Brandon Bosworth, David Cadis, Lance Cardey and Stephen Ginos, working under the mentorship of Jerry Gintz, senior lecturer in the Polytechnic School.

The scope of their project was to research and evaluate existing commercially available components that could be integrated into an iOS-based camera system.

“The 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 Bosworth. “We see this technology being used in situations like on cruise ships, where there are large numbers of people in places where accessing an eye doctor could be challenging.”

The team’s device was a 3D-printed prototype that enables a person to look closely through a lens that takes a picture and transfers it to an iPad for transfer to a medical specialist for diagnosis.

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

“We had the software and concept developed, and wanted to work with ASU engineering to create the hardware and integrate the pieces,” Clark said. “It was good to have the extra energy and creativity the students brought from the outside. Very impressive.”

There are 43 eProjects underway.
Adding new strengths
Additive manufacturing center creates new opportunities for innovations and partnerships

The largest additive manufacturing research facility in the southwest is taking shape at ASU’s Polytechnic campus, thanks to a partnership with Concept Laser, Honeywell, Stratasys and PADT. This new and emerging field promises to radically change the products we use every day and accelerate innovation in virtually all industries.

The 15,000-square-foot center is home to $2 million of cutting edge plastic, polymer and metal 3D printing equipment, along with advanced processing and analysis capabilities that will allow students, faculty and industry partners stay on the forefront of the rapidly growing additive manufacturing sector.

Additive manufacturing is the process of creating a 3D-modeled object layer-by-layer via computer control. While various methods can be used, such as melting or softening materials, fusing powders using a laser or curing liquid materials, all technologies successively layer the raw material until an object is complete.

“This provides a unique opportunity for us to enhance our industry partnerships, and also provide the capability for us to do additional research and enhance our education programs,” said Ann McKenna, director of the Polytechnic School. “With so few of these types of centers, this really positions us regionally to be the go-to place that can work with academic partners, federal agencies and industry to advance a new and emerging field. It really puts in place that structure that not only advances ASU, but the economic growth of Arizona as well.”

As part of their continued investment in the facility, Honeywell Aerospace has the opportunity to outsource research and development that can’t currently be staffed.

“We want to use the ASU lab to engage students to help us understand the science behind some of the things we’re doing,” said Donald Godfrey, engineering fellow for additive manufacturing at Honeywell Aerospace. “We really want to help develop the ASU additive manufacturing lab with the objective of drawing young, brilliant minds into this exciting new field.”

By taking advantage of research opportunities, students can better position themselves as more competitive hires once they graduate.

“There’s an insufficient talent pipeline going into manufacturing engineering and these companies need knowledge about these new technologies,” said Malcolm Green, associate director of corporate engagement at the Fulton Schools. “They need to recruit the next generation of manufacturing professionals, so we’re serving the needs of industry and only through partnership can we do that.”

The Polytechnic School is a natural home for the center. It offers the only manufacturing engineering undergraduate degree in Arizona and one of only 21 in the United States.

“This center draws on manufacturing expertise that resides at the Polytechnic School and helps build the infrastructure to support our faculty, as well as faculty in other schools within the Fulton Schools,” said McKenna. “We envision this facility as a way of setting up a collaborative model for how we can work across the Fulton Schools, and it can be a signature activity here at the Polytechnic campus.”
The Polytechnic School this year will launch the premier additive manufacturing and research center in the Southwest. It will include more than $2 million of state-of-the-art equipment, including a Concept Laser M2 and Mlab for 3D metal printing.

Additive manufacturing uses technologies to build 3D objects by adding layer-upon-layer of material. It is a game-changer for manufacturing parts for aerospace, defense, automotive and medical applications.