Engineering

PENN STATE

The Magazine of the Penn State College of Engineering

Fall/Winter 2017

INSIDE:

Advancing Boldly for a Better World

The new Harold and Inge Marcus Dean of Engineering, Dr. Justin Schwartz, discusses his goals and visions for the College of Engineering.

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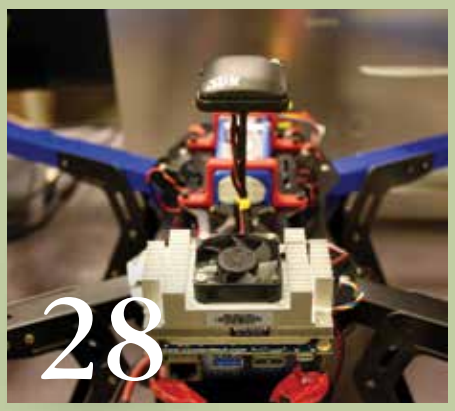
Contents

THE DEAN'S MESSAGE

NEWS & NOTES

FEATURES



ABOUT THE COVER

Anuja Jonnalagadda is a senior majoring in mechanical engineering from Wayne, Pennsylvania, which is "just outside of Philly." Anuja is involved with the Women in Engineering Program (WEP), serving as a mentor for their orientation and spirit lead this past summer. She is also a teaching intern and part of the Society of Women Engineers (SWE). Anuja has been involved in Homecoming in the past as a royalty captain and is currently a part of the 2017 Homecoming Executive Committee as the royalty director.

BONUS CONTENT

Look out for these icons to access bonus videos and photos as well as links to stories to learn more.

Video Photos Story

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"Throughout my life I've been inspired by the bold."

the DEAN'S MESSAGE

Inspired Engineering

First, I want to thank the College of Engineering family for such a warm welcome to Happy Valley and the Penn State family. My family and I have enjoyed getting to know the people and places that make Penn State special.

This special community has emerged from the College's 121-year history of successes and provides the foundation for our bold future. In my first few months at Penn State, I have started on the course for a number of bold goals for the College, including:

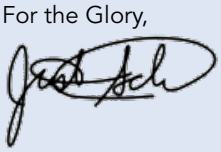
- **Achieving gender equity among our undergraduate student population within six years,**
- **Becoming known throughout the world as the College of Engineering with a central focus of impacting humanity,**
- **Expanding the scale and impact of our research portfolio, including leadership in large, federally-funded programs, building new, zero-energy engineering facilities, and growing our college infrastructure to 1,000,000 assignable square feet.**

Throughout my life I've been inspired by the bold. One of the most historic acts of boldness, which had profound impact on the engineering community in the United States and abroad, was President John F. Kennedy's declaration, in 1962, that the United States would land on the moon within the decade. In his speech, President Kennedy articulated the "why" for bold, aggressive goals, and I find this part of his speech particularly relevant to our College's goals:

> *"…we choose to go to the Moon in this decade…not because [it] is easy, but because [it] is hard; because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one we intend to win…"*

As an elite College of Engineering, we should accept no less than these bold goals…and with the community's support, we will achieve them.

For the Glory,



Justin Schwartz, Harold and Inge Marcus Dean of Engineering

Pritchett appointed head of aerospace engineering

Amy R. Pritchett was named head of the Department of Aerospace Engineering, effective August 15.

Pritchett took over department head duties from **Philip J. Morris**, Boeing/A.D. Welliver Professor of Aerospace Engineering, who had served as interim department head since the departure of **George Lesieutre**, who accepted a position as associate dean for research in the College of Engineering in August 2016. Morris will remain as a professor within the department.

Prior to joining Penn State, Pritchett was the David S. Lewis Professor in the Daniel Guggenheim School of Aerospace Engineering at the Georgia Institute of Technology. She was also the director of Georgia Tech's Cognitive Engineering Center and was a joint professor in the Stewart School of Industrial and Systems Engineering. She is a Fellow of the Human Factors and Ergonomics Society and an Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA).

Pritchett earned her bachelor's, master's, and doctoral degrees in aeronautics and astronautics from MIT.

Research supported by a grant from the Kaufman Foundation may reveal new cancer therapy targets

Scott Medina

James Marden

Scott Medina, assistant professor of biomedical engineering, and **James Marden**, professor of biology, have received a New Initiatives Grant from the Charles E. Kaufman Foundation. The grant program fosters interdisciplinary collaboration by supporting research that takes a novel approach to address fundamental scientific questions.

Medina and Marden will investigate how newly discovered lectin proteins interact with sugar molecules on cancer cells. Lectin proteins inhibit cancer cells in unusual ways, and lab evidence suggests they do not noticeably compromise healthy cells. Variation among these proteins may counteract common cancer cell mutations that cause resistance to treatment. In addition to their therapeutic potential, lectin proteins may provide biochemical tools to identify glycans, sugars that can affect human diseases if altered, on cancer cells. Using proteins to understand glycans could reveal potential new targets for therapy.

Chemical engineering's Danner celebrates 50 years at Penn State

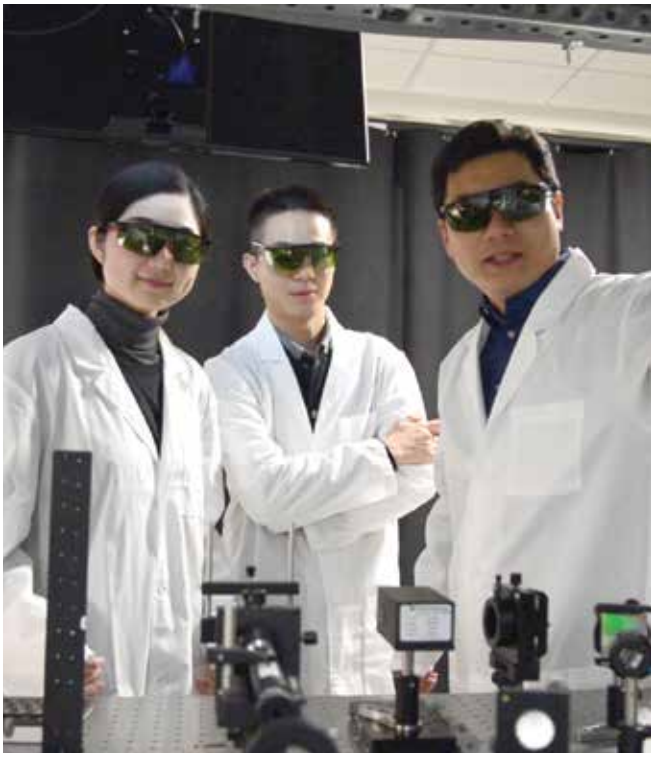
Ronald Danner

Ronald Danner, professor emeritus of chemical engineering, marked fifty years of employment with the Department of Chemical Engineering on July 1.

Danner joined the Penn State faculty as an assistant professor in 1967. During his long tenure with the chemical engineering department, his research has covered a variety of areas, including separation of gases, data for the petroleum and chemical industries, and improvements in the production of plastics.

Over the course of his academic career, Danner has presented at conferences throughout the United States, Europe, South America, and East Asia; has published more than 140 technical papers and five books; and has taught many classes on thermodynamics.

Although he officially retired in 2001, Danner continues to work with students in the classroom and the laboratory on a daily basis. He said, "I never thought I would still be here so long, but I found no reason to stop."



NASA recognizes Ni's work on tiny spectrometer

NASA has awarded an Early Career Faculty for Space Technology Research Grant to **Xingjie Ni** (right), the Charles H. Fetter Assistant Professor of Electrical Engineering.

The NASA grant program honors outstanding faculty researchers early in their careers as they conduct space technology development that is a high priority to NASA. Ni was recognized for his work in developing a new, small-footprint, lightweight, versatile spectrometer that can be integrated into a photonic chip.

A spectrometer is a powerful tool that splits light into an array of different wavelength components and measures their intensities. Spectrometers are used in many areas, such as chemical and biological sensing, material characterization, and analysis of astronomical objects.

Ni will use a metasurface, ultrathin layer of nanostructure that can freely manipulate light, as the key element to sort light. "We have demonstrated ultrathin flat lenses, high-resolution holograms and even an invisibility cloak using the metasurface technology," he said. "Now we plan to leverage it for the creation of a fully integrated on-chip spectrometer, which will be potentially useful for portable or wearable devices to further increase their functionality."

To learn more about Ni's work, visit the Nanophotonics and Optoelectronics Laboratory website at nanolight.psu.edu.

Architectural engineering assistant professor receives Sloan Foundation grant

Donghyun Rim

Donghyun Rim, James L. Henderson Jr. Memorial Professor and assistant professor of architectural engineering, is part of a research team awarded an Alfred P. Sloan Foundation science research grant to study the chemistry of indoor environments.

The project, "MOdelling Consortium for Chemistry of Indoor Environments (MOCCIE)," will focus on creating integrated physical-chemical models that will realistically represent how buildings influence indoor chemical processes ranging from microscale to macroscale. Rim and faculty members from the University of California, Irvine; York University (UK); Drexel University and the University of North Carolina at Chapel Hill will study how people, indoor activities and heating, ventilation and air conditioning (HVAC) systems affect the gas-phase, aerosol-phase, and surface chemistry of indoor environments.

Rim's work will focus on the computational fluid dynamics modeling of distributions of particles and reactive chemicals around humans in indoor environments. Computational fluid dynamics simulations are ideal for studying the varying airflow and pollutant movement within indoor environments. These simulations help to provide insight into the processes underlying chemical reactions with human skin and heterogeneous pollutant distributions in building systems.

The Alfred P. Sloan Foundation supports original research in the science, technology, engineering, mathematics, and economics fields. The science program within the Foundation directly supports research completed in the Chemistry of Indoor Environments, the Deep Carbon Observatory, Microbiology of the Built Environment, and the Sloan Digital Sky Survey.

Russell and Vigeant receive Acoustical Society of America recognition

Two College of Engineering faculty members have been recognized by the Acoustical Society of America (ASA).

Daniel Russell

Michelle Vigeant

Daniel Russell, professor of acoustics, is the recipient of the ASA's 2017 Student Council Mentor Award. The award recognizes a person who has demonstrated exceptional ability in guiding the academic and/or professional growth of his or her students and junior colleagues. Nominees must demonstrate success in assisting research and publications, exhibiting interpersonal and motivational skills, and promoting career development.

Russell was hired by the College of Engineering's Graduate Program in Acoustics in 2011 to coordinate the acoustics distance education program. He teaches graduate-level courses in acoustics and vibration to both resident and distance education students. Since joining Penn State, he has mentored 40 graduate acoustics students by serving as their thesis or capstone paper adviser or dissertation supervisor.

Prior to accepting his acoustics faculty position at Penn State, Russell was a physics professor at Kettering University in Flint, Michigan, for 16 years. At Kettering, he taught introductory and advanced physics to all levels of undergraduate students; taught acoustics and vibration to junior and senior engineering and applied physics majors; and advised more than 35 undergraduate thesis students.

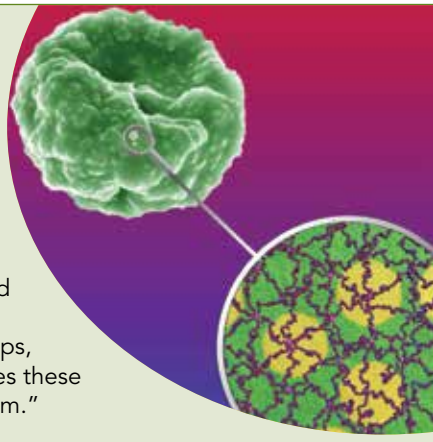
Michelle Vigeant, assistant professor of acoustics and architectural engineering, has been elected a member of the ASA Executive Council. Her three-year term began on July 1.

Vigeant joined Penn State in 2012. The overarching goal of her research is to quantify the perceptual, cognitive, and physiological effects of room acoustics and noise on humans. She leads the Sound Perception and Room Acoustics Laboratory (SPRAL), where her research focuses on concert hall acoustics, spatial audio reproduction, effects of office noise on task performance, and annoyance due to aircraft noise. For the majority of her work, the research approach is to either measure or simulate sound fields, and then conduct listening tests to obtain the human response to the acoustic stimuli.

Prior to her Penn State appointment, Vigeant served four years as an assistant professor in the undergraduate acoustics program at the University of Hartford.

Vigeant is a recent recipient of the 3M Non-tenured Faculty Award (NTFA) and is one of only three faculty at Penn State who have received this award.

Researchers receive seed grant to predict red blood cell deformability



A multidisciplinary team led by **Sulin Zhang**, professor of engineering science and mechanics, has received a $25,000 seed grant from the Penn State Institute for CyberScience. The award will be used to develop a modeling platform to predict the deformability of diseased and aged red blood cells (RBC).

As RBCs circulate through the human body, they frequently squeeze through narrow capillaries, demonstrating two features: a discoid shape and a remarkable deformability. However, these features can be critically compromised by genetic disorders, upon RBC aging, and through infection with malaria parasites.

Less deformable RBCs take longer to traverse through microcirculation, resulting in diminished oxygen and nutrient delivery to organs. They can also become sequestered in the microvasculature, leading to capillary obstruction and organ dysfunction.

"Upon malaria infection or aging, the RBC membrane gets altered," said Zhang. "For example, malaria will import many different surface proteins that will change its architecture and deformability, changing its architecture by making it larger and more rigid. By focusing on specific microstructure-property relationships, we hope to understand what causes these alterations and how to prevent them."

Success in predicting RBC deformability could lead to improved drug screening for malaria, reduced time and costs of novel anti-malaria drug development, and extended storage time of blood through improved blood storage lesions.

Members of Zhang's team include Weihua Guan, assistant professor of electrical engineering, **Manuel Llinás**, professor of biochemistry and molecular biology in the Eberly College of Science, and Leann Tilley, professor of biochemistry and molecular biology at The University of Melbourne, Australia.

Mechanical and nuclear engineering's Thole honored by ABET

Karen Thole, distinguished professor and department head of mechanical and nuclear engineering, is a recipient of the 2017 ABET Claire L. Felbinger Award for Diversity.

ABET is a professional accreditation agency in applied and natural science, computing, engineering, and engineering technology education. The Felbinger Award recognizes "extraordinary success in achieving or facilitating diversity and inclusiveness in the technological segments of our society."

Thole has spent her academic career educating students, leading research in turbine heat transfer, and promoting diversity and inclusion through her service leadership.

Early in her career, while at Virginia Tech, Thole served as co-PI on an NSF grant that supported institutional transformation to ensure success of women faculty. Later, at Penn State, she co-founded Penn State's Engineering Ambassador Program, which quickly grew to a national network of 20 institutions across the United States. The network is a professional development program for undergraduate students, most of whom are women or other underrepresented students.

Also at Penn State, Thole initiated robust mentoring programs in the Department of Mechanical and Nuclear Engineering for both students and early-career faculty.

In her roles as an educator, researcher, and mentor, Thole has received numerous awards, including being recognized by the United States White House as a Champion of Change for STEM in 2011.

Watch 2017 ABET Claire L. Felbinger Award for Diversity Winner Karen Thole

"I Am An Engineer" is a platform to showcase some of the extraordinarily talented industrial engineering graduate students at Penn State, and the faculty that are helping to shape their careers.

Read their stories, in their own words.

Follow along here or on Facebook, Instagram, or Twitter by searching #IAmAnEngineer.

Beyond the RED KETTLES

by Danica Laub

In Coeur d'Alene, Idaho, a little boy in a wheelchair is playing basketball and rock climbing. A single father in San Diego is able to work while his son participates in a summer day camp program, thanks to a scholarship program. A woman from Augusta, Ga. has lost more than 120 pounds and dramatically improved her quality of life. These are just some of the real-life stories from people across the country who have benefited from the programs offered by the Ray & Joan Kroc Corps Community Centers, an extension of The Salvation Army. The Centers provide underserved communities family-friendly options for indoor and outdoor recreation, health and fitness, performing arts, after-school programs, and more.

Like any facility, part of the success of the Centers can be attributed to quality management and maintenance. Much larger and more complex than typical facilities owned by The Salvation Army, the Kroc Centers require significantly more manpower and cost to maintain.

Enter the Penn State Facilities Engineering Institute (PSFEI), which partnered with the Kroc Centers in April 2017. To ensure the Centers are safe, clean, and efficient for community members that benefit from the Centers' programs, the PSFEI education team provides a variety of facilities management courses for Kroc Center employees. Designed for facility maintenance technicians, supervisors, and property managers, the PSFEI courses focus on operation, maintenance, facility management, program management, and safety.

"In addition to instruction on topics like circuit breaker maintenance, reading electrical prints, and general safety issues, one of the project management exercises we offer focuses on leading teams with various knowledge levels to complete projects," said **William Lash**, PSFEI educational program manager. "This is critical, since The Salvation Army utilizes a considerable amount of volunteer labor."

Following a pilot program that kicked off in The Salvation Army's Southern Territory in April 2017, PSFEI and The Salvation Army are currently working to bring the management courses to other regions across the country.

"The PSFEI team is able to provide the programs and personalities that are a really good fit for our facilities operations," said Ross Wheeler, capital renewal plan manager for The Salvation Army. Highlighting key components of the program, including electrical hazards, safety, and maintenance, Wheeler added, "The benefits of this program are going to be exponential and not only affect the Kroc Centers, but all Salvation Army properties in the Southern Territory, including homeless shelters, worship and community centers, family stores, camp facilities, and many more."

"It's just a really good thing to be part of a story that affects the lives of so many people," said PSFEI Director **John Hajduk**. "The opportunities the Kroc Centers bring to these communities across the country are pretty impressive. And, it is humbling to know our staff here at PSFEI is able to use our expertise to help make such important community centers safer and more efficient."

For more information about the Ray & Joan Kroc Corps Community Centers, visit kroccenter.org.

(above) A state-of-the-art aquatics facility offers endless fun for families at The Salvation Army's Ray & Joan Kroc Community Center in Hampton Roads, VA. (below) A look inside The Salvation Army's Ray & Joan Kroc Community Center in Atlanta. Photos: The Salvation Army

Advancing Boldly

for a Better World

by Dana Marsh

Engineering Penn State sat down with Dr. Justin Schwartz, who started as Harold and Inge Marcus Dean of Engineering on August 15, 2017. We are pleased to share that conversation with you.

Engineering Penn State (EPS): What drew you to Penn State?

Dean Justin Schwartz (JS): When thinking about becoming a dean, you look at the institution and college—its history—before you think about finer scale details, and if you want to do big things then you need to be at a big place. So what does Penn State bring to the table as a potential employer for a dean of engineering?

Well, it has a 121-year history of really outstanding engineering leadership in the community. It has that long history of being a land-grant university and all of the mission that a land grant brings. Penn State really continues to embrace what it means to have a land grant in its mission and meaning—and not all the land grants do. There are outstanding faculty members in so many different departments that bring the ability to build and do great things.

The other thing I've come to learn at Penn State is that because it's big, it has tremendous breadth. So in these 12 departments and multiple institutes and centers that we have, we have the traditional big departments that really form the base of what we do—we are world class in mechanical engineering, electrical, computer science, civil engineering, chemical engineering—the departments you expect to see in every big land-grant engineering school. But we also have maintained a commitment to what I would call the smaller jewels in the crown. A crown has to have a big, solid golden base, but it also has to have the jewels that set it apart. We're just about the only place that still has architectural engineering, where we are arguably the strongest in the country. We still have a commitment to an acoustics graduate program that really makes us stand out in that domain, and in our School of Engineering Design, Technology, and Professional Programs (SEDTAPP), we have a school that encompasses not just all the commitments we need to make to our young, incoming engineering students, but programs like the Engineering Leadership program, where we were the first in the country and even seven years ago—the last time someone assessed them—ranked number one.

We have the Humanitarian Engineering and Social Entrepreneurship program (HESE) that I described as being a marriage between Wall Street and the Peace Corps that brings in 50 percent of its students from engineering and 50 percent from around campus, to really bring to fruition that mindset of engineering humanity that we espouse.

Also the Entrepreneurship program, which is now really strong across campus and a University-wide initiative, continues to thrive as an engineering program as well. We have smaller programs, like Engineering Science and Mechanics that bridges science, engineering, and mechanics together in a way that always tries to be one step ahead of the cutting edge of where the community is going. Penn State has that balance between breadth and depth, history and modernity, and vision for a future that is hard not to be attracted to.

***EPS:* You've accomplished a lot in your career so far. What prepared you to be Dean of the College of Engineering?**

JS: I think one of the things in my career that is maybe unique in terms of dean preparation—well, actually two things—is I have an academic history in my family. My parents were all in the professorhood in a variety of different disciplines and institutions, so I had a different perspective coming from them.

Throughout my career as I've moved from institution to institution, I've never been in the same discipline twice. My degree is in nuclear engineering, my first academic appointment was in nuclear engineering; I then spent sixteen years in mechanical engineering, eight years in materials and sciences engineering, but early on I became an affiliate of the Institute of Electrical and Electronics Engineers (IEEE). I never really fit into one discipline, so in some ways I feel more comfortable as a dean because I have that broader, multidisciplinary reach that's harder to maintain when you're in just one department.

***EPS:* What do you find most exciting about this position?**

JS: This position is particularly exciting because I believe it affords me the chance to impact the world in a way I otherwise might not have been able to do.

I have a good friend at another major private school of high repute who just got into the National Academy, and her comment to me when I congratulated her was that I would have far more impact on the world as dean at Penn State than she ever would at the National Academy achieving research. I can debate her on that because she's done tremendous things, but I really do see the opportunity here because of our size, history, scale, and perhaps most importantly, the underlying enthusiasm of our faculty, students, and alumni who want to change the world, who want engineering to continue to change the lives of the people of Pennsylvania, the United States, and the entire globe.

***EPS:* The College of Engineering is known for great ideas, great leaders, and great advancements for society. What impact do you hope to make while at Penn State?**

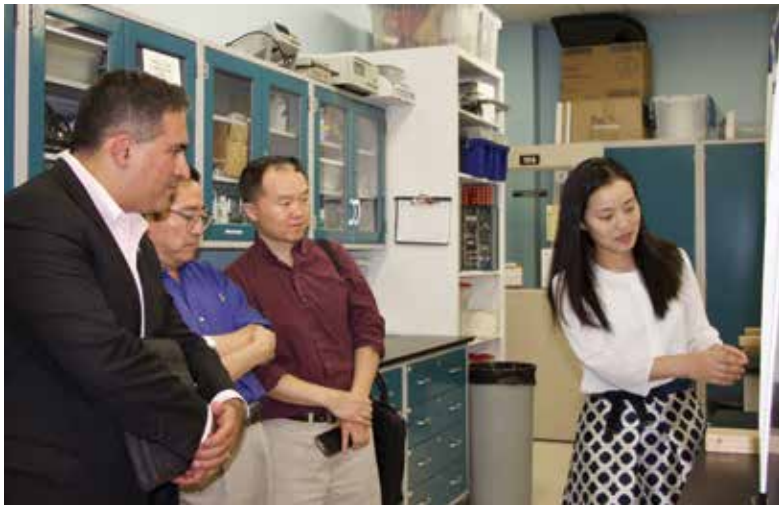
JS: I think right now, Penn State is poised to really take on the mantle for where the engineering community needs to go in the 21st century. The National Academy came out with its grand challenges for engineering ten years back, and the United Nations also has its list of issues that humanity is facing, which isn't called grand challenges for engineering, but pretty much every one of them requires engineering to play a role in the solution.

Engineering has over a 1000-year history of saving the world, and I think we need to once again step in and fulfill that role. What I'd like to bring to Penn State, and the impact I'd then like Penn State to have within the engineering sphere, is taking on that mantle of leadership and then showing the engineering community that we need to engage in the world more actively. I'd like to see us build intertwined programs with other departments and other colleges. We're having a lengthy discussion about a big initiative in law policy and engineering, but that will really

"Penn State is poised to really take on the mantle for where the engineering community needs to go in the 21st century."

even expand outside of law policy and engineering and bring in science and ethics and all sorts of disciplines across campus.

I also see Penn State engineering taking on a leadership role in some of the classic not-yet-solved problems on the social side in terms of diversity, inclusion, and climate. We've already begun the process of working toward gender equity in our undergraduate program within six years. We'll be the first major land-grant to even come close to it, let alone reach 50 percent, which we will do. That mindset of diversity, inclusion, and climate will go beyond the undergraduate program to the graduate program, the faculty and staff, and also to really create a climate where diversity and inclusion is part and partial of what we do. The ultimate goal is to not have to talk about it anymore, and I'm hoping to put us on the course to getting there.



Dean Schwartz spoke at a Town Hall for faculty, staff, and students to outline his goals for the college. Watch here.

(top) Dean Schwartz learns more about the direction of the Department of Biomedical Engineering at a graduate poster tour. (bottom) Congressman Glenn Thompson visits the Radiation Science & Engineering Center.

"We've already begun the process of working toward gender equity in our undergraduate program within six years. We'll be the first major land-grant to even come close to it, let alone reach 50 percent, which we will do."

***EPS:* And what challenges do you think the College will face in trying to get there?**

JS: There's always challenges when you want to do big things. If they weren't challenges, they would have been done already—that's what I like to remind people.

I think one of the first challenges of gender equity is the belief system, in people believing we can do it. The most common response is, "That's fantastic, but how are you going to do it?" You look at the pipeline figures, the fact that so many girls lose interest in science and math even in middle school, and all the standard things we know about gender equity.

But to me, engineering is all about solving problems. I like to say that when JFK stood forward and said we're going to put a person on the moon by the end of the decade, it took less than seven years from that speech to when Neil Armstrong put his foot down on the moon. If engineering can solve that, we can certainly solve this.

We know from the numbers of our applicant pool and the number of students we admit that we have more than enough very well-qualified female students applying who are interested in an engineering degree from Penn State. Our job now is to increase that number but then do a much better job of getting them into the program, seeing them succeed, and then graduate. I think the main challenge is helping people understand it really is a solvable problem, it's just about the will to do it.

***EPS:* Penn Staters are known as a very energetic and very involved bunch. What plans do you have to go out and meet them?**

JS: This is the end of my seventh week as dean and I would have to say it's been the most social seven weeks I've ever had in my life.

I came into Penn State and it's a big college internally—95,000 living engineering alumni around the world—it's our corporate friends and parents—there are so many layers of people to get to know, not to mention the students we have now which is another 10,000. I'm spending a lot of time getting to know who we are internally, getting to know who we are externally, and starting to talk about where I think we need to go as a college.

Human engagement is critical. We've already started talking about building a team to help us with the gender equity initiative, which includes internal people, alumni, and corporate constituents. We have a fantastic engineering ambassador program that started here at Penn State and has gone elsewhere also, and we've come up with the concept of creating an ambassador for life. You're an ambassador as an undergraduate, but once you leave and go into industry, why should you stop being a Penn State ambassador? Our alumni are so enthusiastic and if there's one thing they want, it's more connectedness to us, and we're going to do everything we can to keep the family close.

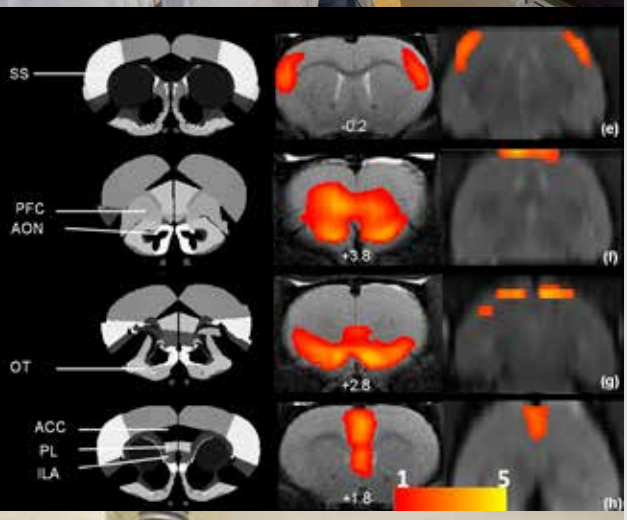
***EPS:* Since you've been at Penn State, you've spoken to many groups about the idea of gender equity across our undergraduate population. Why is that particular initiative so important to you?**

JS: There's probably ten answers as to why gender equity comes across to me as the first major impact area to tackle for engineering on the social side. There's no good reason not to do it, and when people ask me, "Why would you do that?" I ask, "Well, why wouldn't I?"

One can argue gender equity as a core social justice cause: why should one group of Americans have different opportunities than others? You can also make the case for gender equity on the business and economics side. All studies show that when working on a problem, the more diverse a group is, the more successful people are at solving it, and the companies that have the most diversity tend to have the best bottom-line.

One can look at it from a nationalist view. There are two-and-half billion Chinese and Indian natives living on this planet working hard to further their own economies. There's only about 340 million Americans, and if we're going to maintain a competitive league economically in the terms of science and technology impact, we can't waste half our population.

I think gender equity at the undergraduate level is the starting point for something bigger. By starting with the undergraduate population, which is more than 8,000 students, we're taking on the big piece first. I know if we achieve gender equity in our undergraduate population, our graduate gender equity population will follow thereafter, in part because I know so many of our own students will want to stay for graduate school, and in part because Penn State will be known as the large state land-grant university where there's gender equity in engineering. That will then help us rollout equity and inclusion from a multicultural perspective at the undergraduate, graduate, post-doc, and faculty levels, and really across the board. If you solve the biggest problem first, the other challenges come more easily. ■



$3.7 million grant to further national BRAIN initiatives

by Jane Horetsky and Chris Spallino

Two Penn State professors are collaborating to bring real-world solutions to better understand neuroimaging signal through the support of a $3.7 million National Institutes of Health (NIH) Brain Research through Advancing Innovative Neurotechnologies® (BRAIN) Initiative grant focusing on resting state functional magnetic resonance imaging (fMRI).

This NIH grant will allow the two researchers—**Nanyin Zhang**, professor of biomedical and electrical engineering; and **Patrick Drew**, associate professor of engineering science and mechanics, neurosurgery, and biomedical engineering; both serving as co-principal investigators—to take a deeper look into the resting state fMRI technique, which measures connectivity between brain regions. In addition, they will team up with **Xiao Liu**, assistant professor of biomedical engineering, on signal analysis.

The goal of the research is to uncover the neural basis of resting state fMRI signal using multiple approaches in awake rats, including multi-echo fMRI, MRI-compatible calcium signal recording, optogenetics, and multi-laminar electrophysiology. The resting state fMRI technique is a powerful and non-invasive tool to combat diseases such as Alzheimer's, traumatic brain injury, and epilepsy. However, what types of neural activity resting state fMRI actually measures remains poorly understood. Zhang has been conducting research to answer this question.

> *"This grant will bring the biomedical imaging research at Penn State to a new level."*

"The brain has many types of neurons. We are looking to see how activities of different types of neurons contribute to the resting state fMRI signal," said Zhang. "We will develop new techniques that integrate cutting-edge neuroscience tools with fMRI to achieve that goal."

Drew added, "Understanding how the activity of different classes of neurons control cerebral blood flow is a fundamental biological problem, but the answer has immediate utility for interpreting functional MRI scans in humans."

This NIH grant has three components: resting state fMRI, optogenetics, and electrophysiology. The combination of these methods offers unprecedented capacity to unveil the neural basis of resting state fMRI signal.

Zhang's laboratory will manipulate neural activity using optogenetics, and measure calcium as well as resting state fMRI signals while Drew's laboratory will participate in the electrophysiological methods. Liu will contribute to the computational side of the research.

"I personally believe that this grant will bring the biomedical imaging research at Penn State to a new level," said Zhang. "Results from this grant will have immediate impact on the interpretation of human resting state fMRI data. They will also be instrumental in resting state fMRI studies in disease in the future."

Zhang and Drew have also received $2.3 million from the National Institute of Neurological Disorders and Stroke (NINDS) for a separate project to determine how the communication between neurons and cerebral blood vessels changes from post-natal development through adulthood. ■

(top) Nanyin Zhang, biomedical and bioengineering professor, (left) and Dr. Pablo Perez, postdoctoral fellow, run the MRI scanner. (middle) Brain images showing functional connectivity architecture of an awake rat's brain. (bottom) Professor Zhang's graduate students Zilu Ma and David Dopf conducting rat surgery.

Radiation Science and Engineering Center receives $1 million DOE grant

by Jane Harris

Shaina Blunt, senior reactor operator and undergraduate student intern, at the Breazeale Nuclear Reactor control console.

Penn State's Radiation Science and Engineering Center (RSEC) has received a $1 million grant from the U.S. Department of Energy. Supplemented with an additional $600,000 in RSEC funds and equipment donations, the award will be used to update the control console and modernize the safety system at the Penn State Breazeale Reactor (PSBR).

Constructed in 1955 under the "Atoms for Peace" program, the PSBR is the longest operating licensed research nuclear reactor in the United States. The reactor's current control console, installed in 1991, has operated continuously since then with only minor updates of computer components. However, as is the case with all operating nuclear reactors, obsolescence issues must eventually be addressed by replacing both hardware and software.

Kenan Ünlü, director of the RSEC, professor of nuclear engineering, and co-principal investigator for the award, recounted the history of the PSBR's reactor console.

"The original Training, Research, Isotopes, General Atomics (TRIGA) control system, installed in 1965, used first-generation, discrete-component, solid-state devices," he explained. "By the mid-1980s, some components in the 1965 control console had been updated, and a new reactor console system was planned. An Atomic Energy Canada Limited (AECL) console system was installed in 1991."

The AECL console, a "hybrid" system, combined the latest industrial control computers with the newest nuclear-grade analog reactor safety circuits. "The system provided a large inventory of features not previously available to support research and education and proved to be the most reliable full-featured console of its era," stated Ünlü.

The PSBR's new console will be 21st century state-of-the-art, using completely digital technology.

James Turso, assistant director for irradiation services and operations at the RSEC, senior research associate, and principal investigator for the award, noted, "Many older university research reactors in the U.S. are interested in pursuing analog-to-digital upgrades. Penn State's console replacement will be the first of its kind in the country, with off-the-shelf digital control and safety systems, provided by a controls company, that have been proven for decades in industry."

Although the current console continues to provide excellent features and unrivaled reliability, Ünlü, Turso, and their colleagues are looking forward to having a fully digital integrated control and protection system.

> *"Penn State will be the model for successful application of digital control and safety technology, not only for the research reactor community, but for the entire nuclear power industry."*

"This new system will enable students and researchers to implement advanced reactor control algorithms," Ünlü said. "In parallel to this development, new computer code and equipment architecture will be developed for the Penn State TRIGA control system."

Turso added, "Our new console will enhance the capabilities of our already ultra-safe reactor. With its programmable/modular architecture, functions such as power instrument calibration and control rod capability measurements could potentially be automated. Penn State will be the model for successful application of digital control and safety technology, not only for the research reactor community, but for the entire nuclear power industry."

Replacement of the PSBR control console and implementation of the new safety system are expected to be completed by 2021. ■

BUILDING SMARTS

by Samantha Chavanic

Today, energy efficiency, renewable energy practices and sustainability are at the heart of the building industry. Designing buildings for tomorrow pushes architects and engineers to innovate through the use of green materials and smart building systems that reduce energy consumption and waste.

Gregory Pavlak, assistant professor of architectural engineering, is working to make energy systems smarter to allow for more renewable energy use.

"As more distributed renewable generation is connected to the electric grid, new challenges surrounding intermittency and variability are introduced," Pavlak said. "Smart building energy systems can play an important role in addressing these new challenges by dynamically adjusting consumption patterns to better align with the production of renewable energy."

Pavlak's research looks at coordinating portfolios of building systems in order to use less energy, reduce utility costs, and provide beneficial services to the grid. Models and simulations of building system controls are used to determine dynamic operating strategies that consider things such as energy use, cost, peak demand times, and ancillary service opportunities.

He has used this approach to showcase opportunities to increase the efficiency and resiliency of the electric grid.

"Coordinating system operations from a portfolio perspective has shown the potential to save energy when compared to optimizing building operations on an individual basis," Pavlak said. "This raises important questions regarding the development of effective mechanisms for communicating and incentivizing advanced coordination strategies."

Additionally, enabling increased demand flexibility by pushing more intelligence toward the edge of the grid allows buildings to be more responsive to local conditions. For example, smart building systems can help keep microgrids operating if failures were to occur in the larger electric grid. Equipping smaller pieces of the electric grid with the capability of operating independently can increase the resilience of the electric system by proactively preventing problems and mitigating the impact of unavoidable outages.

To aid building operators, Pavlak has also worked on a prototype energy signal tool that can assess specific system and entire building energy usage. The signal tool would provide operators with energy metrics from a building, allowing for the tracking of standard and unusual energy use. The tool resembles a traffic light, but displays light colors by comparing expected energy use to actual use.

"As building automation and controls advance, more operational data is being produced. Developing analysis tools that transform data into important decision-making information is critical to being able to close the loop and implement more sustainable actions," Pavlak said. ■

The Road to Reality of Autonomous Vehicles

by Danica Laub

Envision a world in which drivers are actually passengers. Consider a morning commute that gives employees an extra one, two, or three hours of sleep, or an evening commute that equally extends the workday. Imagine a mid-week evening or Saturday morning when "soccer" moms and dads no longer need to shuttle their children. To some, this may already be reality, because they have been using subways, buses, or trains for decades. But, for a large majority of people across the country and around the globe, who rely on personal vehicles, the future of transportation is closer than they may think.

According to industry experts, autonomous vehicles are expected to hit the road as early as 2020, in just three short years. But, there are real questions and concerns about what is expected to be the most revolutionary change in transportation since Henry Ford introduced the Model T. How will public policy change? What will highways, rural roads, and city streets look like? How should government and planning organizations prepare their infrastructure and other programs? How will the introduction of autonomous vehicles affect the economy? How will autonomous vehicles impact traffic fatalities? These were just some of the questions that were addressed when thought leaders, academic and industry experts, public officials, and planners from across the state gathered for the first Pennsylvania Automated Vehicle Summit, held Sept. 11-12, in State College.

"You need to participate in the process. You need to own it to make sure your needs are met," urged Renee Sigel, Pennsylvania division administrator with the Federal Highway Administration, during her opening remarks at the summit. From more accessibility for Americans with disabilities and the elderly to a reduction in the number of highway fatalities, Sigel touched on some of the anticipated benefits of connected and autonomous vehicles. But, Sigel also stressed the importance of communication and cooperation among key stakeholders to ensure the transition is as smooth as possible. Sigel said this includes partnerships between industry and academia, where much of the automated vehicle research begins.

For a hands-on experience, summit attendees headed to the Thomas D. Larson Transportation Institute (LTI) test track in Bellefonte, Pennsylvania. In addition to a display of Uber's self-driving Volvo XC90 SUV and test rides in Carnegie Mellon University's autonomous Cadillac SRX, attendees had the opportunity to climb into the cab of LTI's automated Volvo truck to take a lap around the test track.

To provide a better understanding of the research that goes into autonomous vehicles, Penn State students, under the direction of **Sean Brennan**, professor of mechanical and nuclear engineering, offered demonstrations of heavy-duty fuel economy estimation and powertrain characterization, a real-time six-degrees of freedom map-based vehicle pose estimator, and a highway driving simulator to measure risk acceptance.

The highway driving simulator was one of the most popular stations at the summit. With research funded by the National Science Foundation (NSF), Brennan's students are using the driving simulator to test how drivers adhere to rules of the road differently in real life versus a simulated environment.

Denny Kovalick, test track manager for The Larson Transportation Institute, takes the highway driving simulator for a test drive before the 2017 Pennsylvania Automated Vehicle Summit commenced at the LTI test track on Sept. 12.

"There are fundamental behavioral differences among virtual reality, augmented reality, and real environment interactions," said **Nick Dow**, a graduate student studying mechanical engineering. "This research will measure how levels of user immersion affect risk-taking and other behaviors."

Meanwhile, **Bobby Leary**, a doctoral student studying mechanical engineering, explained the mobile road-mapping platform.

"We have a Larson Transportation mapping vehicle we use to map out the test track using lasers and cameras and our GPS system, so we're able to actually obtain centimeter-level positioning of particular features on our test track," said Leary, "Literally, we could throw change down onto the track and be able to detect where the change is at using our sensors."

Leary's work takes the road data and samples it down to just the lane markers, which are then used to estimate the position of the vehicle within the map. Ultimately, by lining up the vehicle with what he describes as bread crumbs on the road, Leary is able to command a steering angle for a vehicle to make the vehicle follow a specific path.

Much of the research Brennan and his students gather comes from work they conduct on site at the LTI test track. Designated as one of 10 federal autonomous vehicle proving grounds in the nation, the LTI proving grounds offer many of the core capabilities needed to perform connected, automated, and autonomous vehicle tests. Two of the most significant capabilities are a secure and safe testing environment and the ability to control the test parameters.

"Pavement markings, signage, signal systems, roadway infrastructure, and weather are key factors in the development and testing of autonomous and connected vehicles,"

> **"We could throw change down onto the track and be able to detect where the change is at using our sensors."**

said **Eric Donnell**, professor of civil engineering at Penn State and director of LTI. "Our closed-loop test track at LTI allows our researchers to safely test these things, away from the public."

The 2017 Pennsylvania Automated Vehicle Summit was the first of its kind to be held in Pennsylvania. As the Commonwealth, country and world continue to navigate the road to autonomous and connected vehicles, one thing is certain: self-driving vehicles are going to be a big part of future transportation. ■

New biomaterial could replace plastic laminates, greatly reduce pollution

Compostable material could eliminate millions of tons of petroleum-based plastic annually

by Jeff Mulhollem

An inexpensive biomaterial that can be used to sustainably replace plastic barrier coatings in packaging and many other applications has been developed by Penn State researchers, who predict its adoption would greatly reduce pollution.

Completely compostable, the material—a polysaccharide polyelectrolyte complex—is comprised of nearly equal parts of treated cellulose pulp from wood or cotton, and chitosan, which is derived from chitin—the primary ingredient in the exoskeletons of arthropods and crustaceans. The main source of chitin is the mountains of leftover shells from lobsters, crabs, and shrimp consumed by humans.

These environmentally friendly barrier coatings have numerous applications ranging from water-resistant paper, to coatings for ceiling tiles and wallboard, to food coatings to seal in freshness, according to lead researcher **Jeffrey Catchmark**, professor of agricultural and biological engineering, College of Agricultural Sciences.

"The material's unexpected strong, insoluble adhesive properties are useful for packaging as well as other applications, such as better performing, fully natural wood-fiber composites for construction and even flooring," he said. "And the technology has the potential to be incorporated into foods to reduce fat uptake during frying and maintain crispness. Since the coating is essentially fiber-based, it is a means of adding fiber to diets."

The amazingly sturdy and durable bond between carboxymethyl cellulose and chitosan is the key, he explained. The two very inexpensive polysaccharides—already used in the food industry and in other industrial sectors—have different molecular charges and lock together in a complex that provides the foundation for impervious films, coatings, adhesives, and more.

The potential reduction of pollution is immense if these barrier coatings replace millions of tons of petroleum-based plastic associated with food packaging used every year in the United States—and much more globally, Catchmark noted.

He pointed out that the global production of plastic is approaching 300 million tons per year. In a recent year, more than 29 million tons of plastic became municipal solid waste in the U.S. and almost half was plastic packaging. It is anticipated that 10 percent of all plastic produced globally will become

ocean debris, representing a significant ecological and human health threat.

The polysaccharide polyelectrolyte complex coatings performed well in research, the findings of which were published recently in *Green Chemistry*. Paperboard coated with the biomaterial, comprised of nanostructured fibrous particles of carboxymethyl cellulose and chitosan, exhibited strong oil and water barrier properties. The coating also resisted toluene, heptane, and salt solutions and exhibited improved wet and dry mechanical and water vapor barrier properties.

"These results show that polysaccharide polyelectrolyte complex-based materials may be competitive barrier alternatives to synthetic polymers for many commercial applications," said Catchmark, who, in concert with Penn State, has applied for a patent on the coatings.

In the research, paperboard coated with the biomaterial exhibited strong oil and water barrier properties. The coating also resisted toluene, heptane and salt solutions and exhibited improved wet and dry mechanical and water vapor barrier properties.

"In addition, this work demonstrates that new, unexpected properties emerge from multi-polysaccharide systems engaged in electrostatic complexation, enabling new high-performance applications."

Catchmark began experimenting with biomaterials that might be used instead of plastics a decade or so ago out of concerns for sustainability. He became interested in cellulose, the main component in wood, because it is the largest volume sustainable, renewable material on earth. Catchmark studied its nanostructure—how it is assembled at the nanoscale.

He believed he could develop natural materials that are more robust and improve their properties, so that they could compete with synthetic materials that are not sustainable and generate pollution—such as the low-density polyethylene laminate applied to paper board, Styrofoam, and solid plastic used in cups and bottles.

"The challenge is, to do that you've got to be able to do it in a way that is manufacturable, and it has to be less expensive than plastic," Catchmark explained. "Because when you make a change to something that is greener or sustainable, you really have to pay for the switch. So it has to be less expensive in order for companies to actually gain something from it. This creates a problem for sustainable materials—an inertia that has to be overcome with a lower cost."

Funded by a Research Applications for Innovation grant from the College of Agricultural Sciences, Catchmark currently is working to develop commercialization partners in different industry sectors for a wide variety of products.

"We are trying to take the last step now and make a real impact on the world, and get industry people to stop using plastics and instead use these natural materials," he said. "So they (consumers) have a choice—after the biomaterials are used, they can be recycled, buried in the ground, or composted, and they will decompose. Or they can continue to use plastics that will end up in the oceans, where they will persist for thousands of years."

Also involved in the research were Snehasish Basu, postdoctoral scholar, and Adam Plucinski, master's degree student, now instructor of engineering at Penn State Altoona. Staff in Penn State's Material Research Institute provided assistance with the project.

The U.S. Department of Agriculture supported this work. Southern Champion Tray, of Chattanooga, Tennessee, provided paperboard and information on its production for experiments. ■

The amazingly sturdy and durable bond between carboxymethyl cellulose and chitosan is the key. The two very inexpensive polysaccharides, already used in the food industry and in other industrial sectors, have different molecular charges and lock together in a complex that provides the foundation for impervious films, coatings, adhesives, and more.

Research looks at new metamaterial to provide advanced earthquake protection

by Jennifer Matthews

Damage done to an office building by a 2010 earthquake in Concepción, Chile.

Earthquakes and explosions damage thousands of structures worldwide each year, destroying countless lives in their wake, but a team of researchers at Penn State is examining a completely new way of safeguarding key infrastructure, thanks to a $50,000 Multidisciplinary Research Seed Grant provided by the College of Engineering.

"The goal of the project is to protect critical structures," said **Cliff Lissenden**, professor of engineering science and mechanics. "The structural design for earthquakes now requires the whole building to shake, which you can design for, but it's quite an expensive proposition. Our idea is that if you can dissipate the earthquake before it gets to the structure, then you don't have to design it to resist that ground motion."

Parisa Shokouhi, principal investigator on the project and associate professor of civil engineering, and Lissenden will use a mixture of numerical and experimental study to evaluate the effectiveness of a proposed metamaterial in filtering, dissipating, and averting surface waves caused by natural and man-made sources.

"What we are developing right now is a very simple model," said Shokouhi. "We are considering a plate with rods that would act as local resonators, and we are looking into what combination and what geometry of rods will dissipate the incoming energy that is traveling through the plane."

The first step to their project, a numerical study, will focus on finding the ideal size and arrangement of holes and their core elements. The researchers will do that by performing 2D and 3D finite element modeling and simulations. The model parameters will be systematically changed until they can obtain the most desired arrangement.

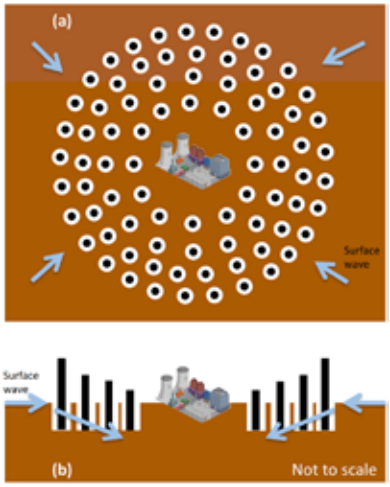


Figure 1. Schematic representation of the proposed seismic meta-material (not to scale): (a) plan view and (b) cross-section. By varying the size of the bore holes as well as the length and mass density of the rods, a broad band-gap will be achieved and the energy will be diverted.

Based on the outcome of the numerical study, the researchers will then build and test a small-scale simplified model using the recommended formation. They will test a small aluminum plate with punched holes and steel rods to simulate the resonating units. A shaker or stack of piezo elements mounted on the plate will serve as the stimulus. The wave field across the plate will then be recorded.

Then, the team will replicate a scaled-down version of a life-size scenario using a soil-filled box on a shake table. The holes will be drilled in the compacted soil and the steel or wooden rods will be inserted. This will allow the team to study the effects of soil heterogeneity, non-elastic and nonlinear behavior, and water saturation on the performance of the metamaterial.

If the results are favorable, this research could lead to a fundamental change in the way engineers design structures to combat the damaging effects of earthquakes and explosions.

"I think there is a lot of potential, but we are trying to investigate the phenomenon from the bottom up to really understand what's going on," said Shokouhi. "We want to know exactly how these resonators stop these waves, so that we can design them effectively." ■

Passonneau named 2017 Teaching and Learning with Technology Fellow

by Rebekka Coakley

Rebecca Passonneau

Rebecca Passonneau, professor of the School of Electrical Engineering and Computer Science, is trying to solve a crisis in reading and writing education that has been documented for several years by the National Assessment of Education Progress—teachers have less time to devote to repetitive and gradually constructive practices. Right now there isn't a whole lot of research that involves automated methods to handle natural language processing.

Her efforts to do so won her a 2017 Teaching and Learning with Technology (TLT) Fellow.

TLT is a Penn State organization that works to guide the University in the appropriate use of technology to enrich teaching and learning. Its focus is to help instructors take advantage of information technology in order to enhance the educational experience of their students.

Fellows will work collaboratively with TLT to identify emerging questions in the field of teaching and learning with technology; create and grow communities to explore topics to inform new practice; support directed research and development; and set up opportunities to develop long-term relationships.

As a Fellow, Passonneau will work with TLT to develop an application to turn her research into a process that could work on a larger scale and in more contexts.

"A potential means to instill stronger language skills would be to develop more sophisticated digital learning environments that allow students to interact with their curricula more consistently in reading, writing, and revision exercises, and that facilitate teachers' ability to monitor and promote students' reading and writing skills through timely analysis of their written work," said Passonneau. "The software for content analysis of summaries that we have developed can identify which ideas students have mastered, versus those they still struggle with, given a small number of models written by proficient individuals."

Over the summer, Passonneau had her students work on a faster automated method to analyze the content of short summaries that don't have much structure.

"You can have a question that elicits a short answer and where it's not relevant why the student is expected to know the answer," she said. "A summary assumes that the students have been presented with some material and they have to select what's important in the material to include in a summary."

From there, she'd like her research group to build to the next level, analyzing essays.

Her goal for this software, which she hopes will be easily accessible to any teacher interested in using it in the classroom, is to not replace the teacher but to give them tools that will help students develop better reading and writing skills.

According to TLT, the goal for their Fellows is to further work that is mutually important and join the organization to create tangible outcomes that can be shared widely with the teaching and learning community through presentations, publications, and new services. ■

NANOTECH

The Next Generation

by Chris Spallino

With two grants awarded by the National Science Foundation (NSF), the Penn State Center for Nanotechnology Education and Utilization (CNEU) will develop a Nanotechnology Professional Development Partnership (NPDP) to continue providing leading-edge nanotechnology education to post-secondary educators and students to address the growing national need for a skilled nanotechnology workforce.

Totaling more than $2.5 million, the awards, administered through the NSF's Advanced Technological Education (ATE) program, will provide funding through August 2020. This financial support will allow CNEU to offer new and more affordable and accessible training to a much larger and diverse nanotechnology audience through its Nanotechnology Applications and Career Knowledge (NACK) Network, which recently became an ATE support center.

"The support center is establishing a larger national infrastructure for more advanced nanotechnology workforce education," said **Osama Awadelkarim**, CNEU director, professor of engineering science and mechanics, and principal investigator. "Several support center initiatives include the creation of national skill standards and certificates via ASTM International, continuing the growth of the Remotely Accessible Instruments for Nanotechnology (RAIN) national network, and ongoing distribution of classroom resources for emerging nanotechnology programs."

(left) An undergraduate student in Nanofabrication Manufacturing Technology Capstone Semester, one of the many educational programs offered through CNEU, gains hands-on experience with state-of-the-art nanotechnology equipment in the CNEU Teaching Cleanroom. (right) Undergraduate students from across Pennsylvania work in teams as they gain valuable nanotechnology experience from the Center for Nanotechnology Education and Utilization's Nanofabrication Manufacturing Technology Capstone Semester.

Since 2008, NACK has functioned as an ATE national center, establishing itself as a national leader in nanotechnology workforce development, primarily for students and educators at four-year universities and two-year community colleges and technical colleges. NACK offered hands-on professional development workshops on the University Park campus several times per year. These intensive, three-to-four-day workshops included classroom instruction, as well as laboratory training.

Although highly successful, the workshops, due to their length and singular location, could be difficult for individuals from across the country to attend. Also, the majority of NSF funding was used to conduct these workshops and provide travel support for participants, thereby limiting financial resources required to offer new and improved methods of educating a larger future nanotechnology workforce.

With NACK functioning as a support center, CNEU will redirect its funding towards developing free, live-streaming, fully-interactive workshops for any educator at any level—at any location—thus, increasing its reach and effectiveness to a much broader audience.

"For many years, CNEU has worked with multiple entities across the country that are dedicated to preparing the nanotechnology workforce," said **Bob Ehrmann**, CNEU managing director. "This exciting new project will enable a subset of these educators to assist us in providing real-time, diverse, effective, and affordable professional development to a much larger audience. We are eager to take on the challenge of creating and evaluating a cutting-edge multimodal professional development model."

The live-streaming workshops will include new content and adapted versions of the lectures, demonstrations, and courses offered from the in-person workshops: "Introduction to Nanotechnology" and "Nanotechnology Course Resource I/II." The new workshops will also include virtual labs and cleanroom experiences with remote access to nanoscale measurement equipment at different NACK partner sites that will allow attendees to access state-of-the-art characterization tools and lab software to conduct simulated experiments and data analysis exercises.

Remote access to the equipment will also provide opportunities for individuals at rural colleges or K-12 schools, who aren't necessarily able to attend the in-person workshops, to gain valuable nanotechnology knowledge and experience.

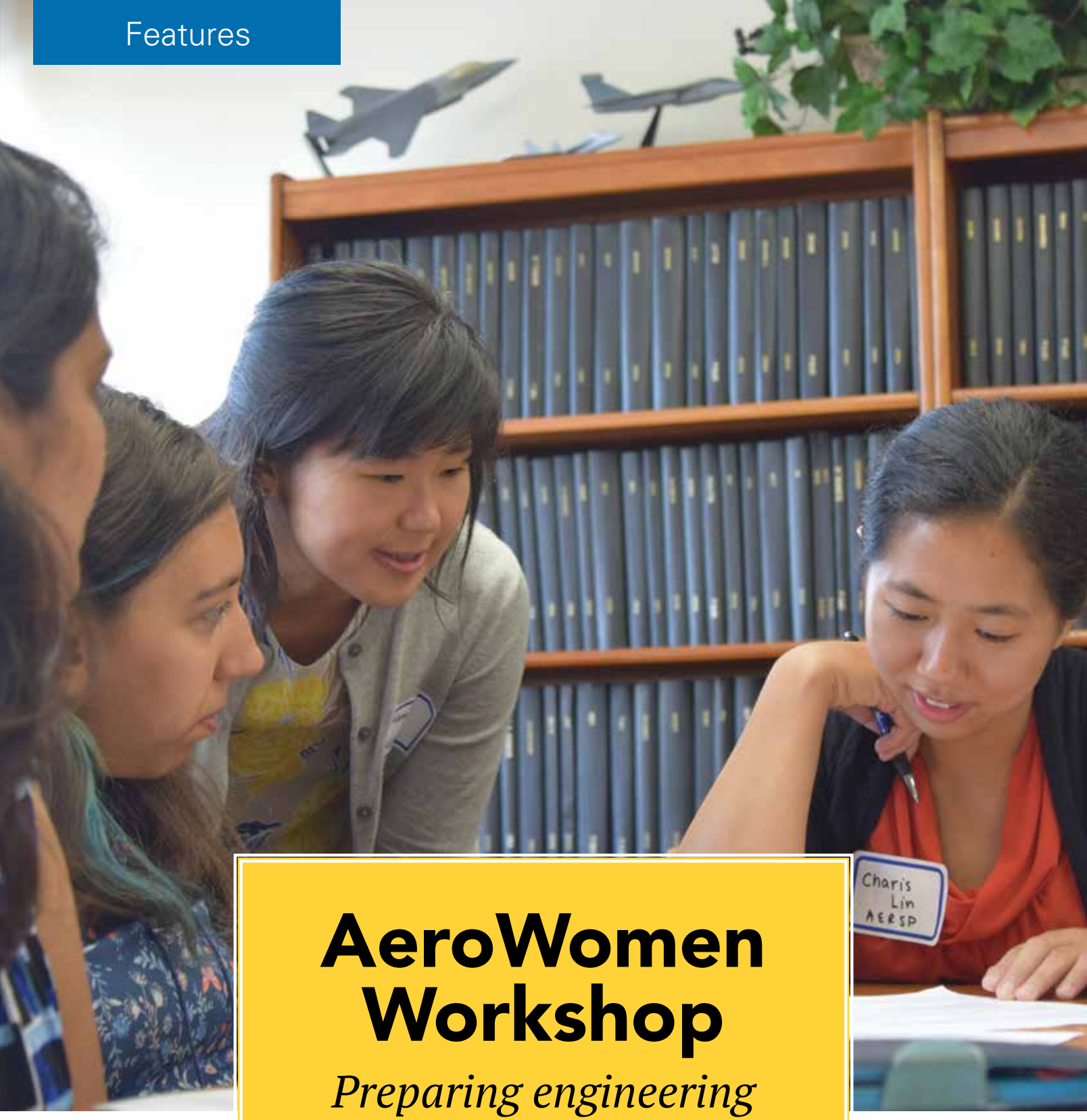
CNEU will utilize its university and college partners located across the country to help conduct the workshops and provide hands-on experiences within their respective labs for those individuals who are able to travel to a physical location.

As part of the NPDP and via strategic partnerships, CNEU will increase its outreach to underrepresented student groups to increase participation in science, technology, engineering, and mathematics education, in general, and participation in nanotechnology, in particular. Special efforts will be made to bring the professional development workshops to the attention of educators and administrators at historically black colleges and universities and Hispanic-serving institutions.

Along with its new program offerings, CNEU will continue to provide hands-on, in-person workshops for educators who are able to secure funding from their respective institutions or companies. CNEU will also continue to provide online nanotechnology courses, webinars, and mini-workshops as part of its program offerings to secondary and post-secondary students, educators, and industry personnel.

CNEU is dedicated to research, development, and education across all aspects of micro- and nanotechnology, and its resources are focused on the incorporation of nanotechnology into secondary education, post-secondary education, and industry applications. The Center is the home of the Pennsylvania Nanofabrication Manufacturing Technology (NMT) Partnership—a higher education collaborative dedicated to creating and updating a workforce in Pennsylvania, trained in the rapidly advancing and exciting field of nanotechnology.

CNEU partners in the NPDP project include Ivy Tech Community College of Indiana, South Bend, Indiana; Forsyth Technical Community College, Winston-Salem, North Carolina; Erie Community College, Buffalo, New York; North Seattle College, Seattle, Washington; Atlanta Technical College, Atlanta, Georgia; and Northwest Vista College, San Antonio, Texas. Additional collaborators include Coppin State University, ATE Central, and nanoHUB. ■



AeroWomen Workshop

Preparing engineering graduate students for STEM careers

by Chris Spallino

Eighteen graduate students from aerospace engineering and other Penn State engineering programs took part in the first-ever Graduate AeroWomen Professional Development Workshop on Aug. 25 and 26 at the University Park campus.

The workshop, hosted by the aerospace engineering department, was created to help prepare female engineering graduate students for successful and sustainable STEM careers through the understanding and mastering of non-technical aspects.

"The AeroWomen Workshop was truly inspiring," said **Sema Erten**, doctorate candidate in engineering science and mechanics. "It is crucial to have an open and evolving conversation about exciting, engaging, inspiring and empowering women in engineering fields and to have a platform to share ideas and experiences."

The two-day event kicked off with keynote presentations by **Amy Pritchett**, aerospace engineering department head, and aerospace engineering alumna **Pamela Gomez**, NextGen Performance and Outreach, Federal Aviation Administration.

Additional sessions included the following:

- Career panel discussion with Gomez; Swati Saxena, project and program manager at ESI Group R&D; Sunny Wicks, research engineer at Lockheed Martin; **Peggy Johnson**, dean of Penn State Schreyer Honors College and professor of civil engineering; and **Julianna Simon**, assistant professor of acoustics
- Professional skills exercises on self-marketing, negotiation tactics and problem solving conducted by **Namiko Yamamoto**, co-organizer of the workshop and assistant professor of aerospace engineering, and **Susan Stewart**, co-organizer and senior research associate and associate professor of aerospace engineering and architectural engineering
- Inclusivity seminar by **Thomas Litzinger**, assistant dean for educational innovation and accreditation and director of the Leonhard Center
- Networking activities with fellow participants, engineering faculty, and University personnel

"When I was a graduate student, I had this 'unarticulated anxiety' about my future career in engineering. It went away only after talking to senior professionals," said Yamamoto. "From their stories and advice, I developed healthy expectations and felt supported in my career decisions. Our goal with the workshop was to pay it forward with the same type of advice and support from successful professionals across industry, government, and academia."

Feedback from the participants was positive.

"The workshop was an enriching experience. It also reaffirmed my belief in the limitless possibilities for personal and professional development in the fields of science and engineering," said **Shreya Trivedi**, graduate student in aerospace engineering.

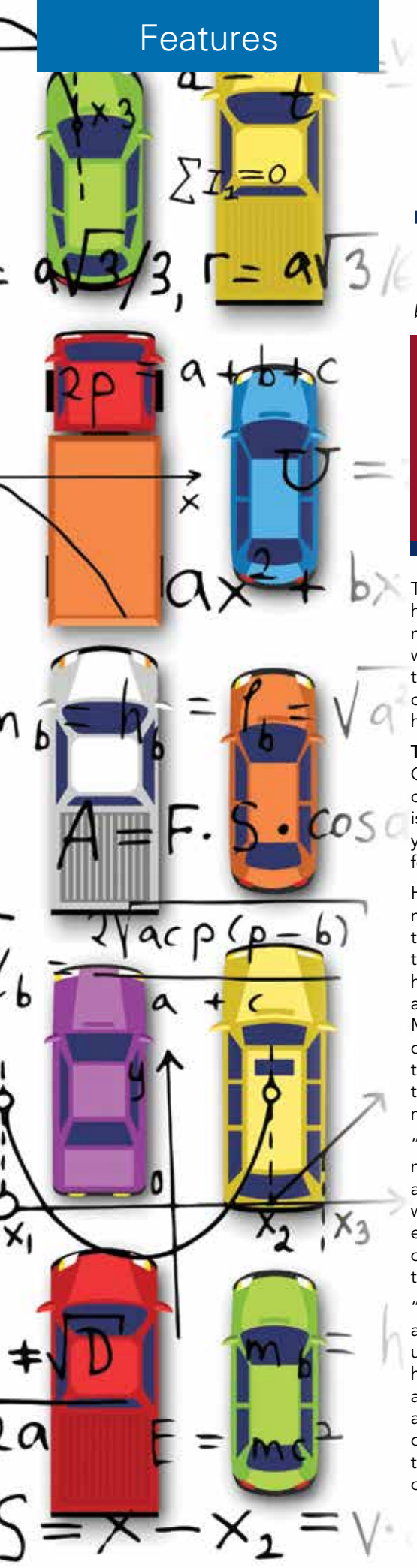
Yamamoto and Stewart hope to build on the success of the event and conduct future workshops with expanded offerings.

"We are engineers, so we are capable of scoping challenges and coming up with good solutions as a team," said Stewart. "We hope to continue what we started with this workshop, and participation from the vast Penn State alumni network, including both women and men, would make a huge difference in its growth and continued success."

The AeroWomen Workshop was sponsored by the University's Equal Opportunity Planning Committee. **Michelle Vigeant**, assistant professor of acoustics and architectural engineering, also was a co-organizer of the workshop.

For individuals who are interested in being involved with future AeroWomen workshops or activities, contact Namiko Yamamoto at nuy12@psu.edu. ■

Namiko Yamamoto works with female engineering graduate students during a professional skills exercise at the inaugural Graduate AeroWomen Professional Development Workshop.



CONQUERING TRAFFIC with math

by Pam Wertz

NSF funds research on driver and urban supply chain networks to reduce congestion

The National Science Foundation (NSF) has awarded more than $446,000 for a new collaborative engineering project that will allow drivers to make more informed travel decisions and allow government organizations to better regulate travel within heavily congested major metropolitan areas.

Terry Friesz, Harold and Inge Marcus Chaired Professor in the Marcus department of Industrial and Manufacturing Engineering, is the principal investigator (PI) on the two-year study dealing with "Statistical Learning for Dynamic Traffic Assignments (DTA)."

Historically, scientists that explore traffic networks have built mathematical models that are intended to provide insights on how traffic evolves from day to day but have not had much impact on transportation planning and control for within day/time scales. Models and theories of within-day traffic can quickly become so large and complex that they cannot be solved when applied to the transportation networks of major metropolitan regions, explained Friesz.

"This research grant aims to make the numerical computation of departure rates and route choice substantially faster than what has been possible in the past by exploiting the notion of machine learning to develop statistical models of a spectrum of traffic models," said Friesz.

"This idea of making a model of a model, also known as metamodeling, has been used successfully in other disciplines, and has the potential to make possible rapid and accurate computation of traffic flows a few seconds, minutes, or hours ahead of time, allowing rerouting or diversion to complete other tasks that would not otherwise be attempted."

The envisioned models will also be useful for rapidly modifying urban supply chains of anticipated traffic congestion.

"Now we are considering the fluctuations in traffic on very small time scales with direct implications for route guidance, how and what type of technological investments should be made, where roads should be built, how roads should be operated—including traffic signals and signage—and more," said Friesz. "The within-day models we are studying may also be combined with day-to-day models to forecast consistent traffic levels across all time and spatial considerations."

Srinivas Peeta, Jack and Kay Hockema Professor in the Lyles School of Civil and Environmental Engineering at Purdue University, is the co-PI on the project. Friesz and Peeta are key figures among the international community of scholars who study DTA, which is the term given to modeling the multi-time and multi-spatial scale fluctuations of urban traffic supply chains.

According to a 2015 report released by the Texas Transportation Institute, the average urban commuter in the United States spends approximately 42 hours a year sitting in traffic jams. The report also estimates U.S. highway congestion costs $160 billion a year, including from lost productivity, gas burned while idling in traffic, and additional wear and tear on vehicles.

"As an international community of scholars, we are using modern statistics, simulation experiments, and game theory to better depict and more efficiently compute the behaviors of drivers and urban supply chain operators who rely on highways," added Friesz. "DTA will ultimately allow us to take back some of the time lost to congestion."

The results of this research will also filter into courses that students take as they learn about technologies related to DTA.

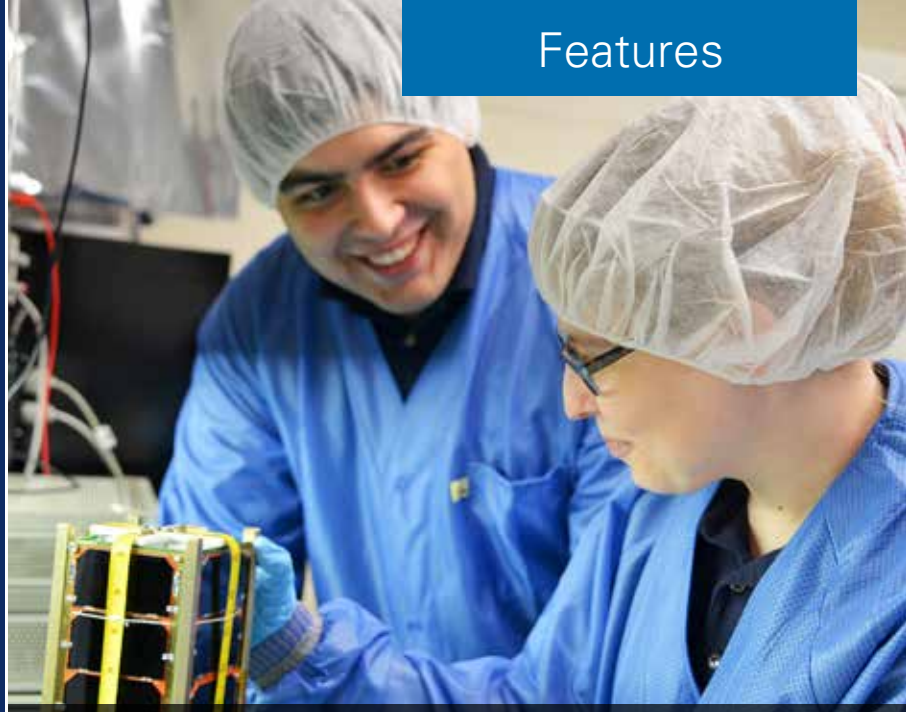
This is the fourth in a series of grants that Freisz has received on the subject of DTA.

The NSF award was issued through NSF's Division of Civil, Mechanical, and Manufacturing Innovation program.

Cosmic Commotion

Student-built satellite aims to provide insight on effects of solar storms

by Rebekka Coakley



SSPL students work on the OSIRIS-3U satellite. The satellite, sent to space over the summer, will be dispatched by astronauts at the space station on November 13.

This summer, astronauts on the International Space Station launched a Penn State student-built satellite into orbit that will help the students learn more about space weather.

The OSIRIS-3U satellite, delivered in its launch configuration in June, was designed and built over the past five years by students working in the Student Space Programs Laboratory (SSPL). Now that it is in orbit, it will provide measurements of the heated ionosphere to better understand space weather phenomena.

Sven Bilén

"When you get up in the morning and want to figure out what to wear, you look at the forecast in a weather app on your phone. We're used to terrestrial weather and how it affects our lives, but we're not very aware of space weather, even though it, too, can have a huge effect on our lives," **Sven Bilén**, director of the lab and professor of engineering design, electrical engineering, aerospace engineering, and department head of the School of Engineering Design, Technology, and Professional Programs, said. "Each day we rely on satellites, fly in airplanes, get power from power grids, and rely on GPS signals. These things are all affected by space weather—and a big weather event, like the massive solar storm in 1859, could devastate modern society. We want to be able to better understand various space weather phenomena."

Because the space weather caused by the Sun is so unpredictable, the students' mission is to create similar effects by heating the ionosphere. The satellite will be able to collect GPS scintillation data and electron density and temperature measurements in this simulated solar storm so the students can learn more about space weather and its ramifications on Earth.

"The results of this mission will provide us with a lot of scientific information," said **Andrew O'Neill**, manager of SSPL and a senior electrical engineering student from West Grove, Pennsylvania. "Hopefully we'll have a better idea of the effects of solar flares and the disruptions of communications they may cause between Earth and our satellites."

According to their proposal to NASA, spearheaded by Penn State electrical engineering alumnus **Kyle Botteon** while he was still a student, with help from Bilén—and which won them the launch—their satellite was designed to fit into a three-unit, or "3U," CubeSat form factor. One unit supports the scientific instruments and two units are devoted to the bus that runs the satellite, which includes the structure, a power distribution system, attitude control system, communications system, and command and data handling system. The bus electronics are built around two stacks of circuit boards.

SSPL partnered with Aerospace Corporation and the Naval Research Lab to provide two of the scientific instruments, and a third was built in-house by students. All instruments will measure different aspects of the plasma environment.

This past semester, students finished the construction and tested all the pieces of the satellite to ensure it could handle the rough journey into space. Funding to complete the satellite came from businesses like Boeing and Lockheed Martin, and from the Pennsylvania Space Grant Consortium. This month, Penn State students delivered the satellite in person to Nanoracks, the company contracted by NASA to coordinate its launch. The satellite will be carried to the ISS on a SpaceX rocket launched from Florida. The data collected by OSIRIS-3U will start to be downlinked by the end of the summer, and students in the lab will write and publish papers on what they've learned.

"SSPL has been very successful in training future engineers," said **Rebecca Arenson**, of Merion Station, Pennsylvania, who graduated with a bachelor's degree in electrical engineering on May 5. "The lab gives students great hands-on experience that they wouldn't get just anywhere and it's very valuable in industry. A lot of the SSPL alumni secured internships at NASA's Jet Propulsion Laboratory or Boeing as students and are now working there full time." ■

"We're poised to have a new generation that's fully capable of accounting for all of the innovative design potential enabled by additive manufacturing."

NSF grant funds research in additive manufacturing's impact on undergraduate engineering education ››

Add[itive] Value

by Samantha Chavanic

Researchers at Penn State have been awarded a grant from the National Science Foundation (NSF) to investigate how formal additive manufacturing education can impact the design learning and creativity of undergraduate engineering students.

Nicholas Meisel, Emmert H. Bashore Faculty Development Professor and assistant professor of engineering design and mechanical engineering, is the principal investigator of the $300,000 project, titled "Making in the Maker Movement: An Investigation into the Impact of Additive Manufacturing on Student Creativity." **Timothy Simpson**, Paul Morrow Professor in Engineering Design and Manufacturing and professor of mechanical and industrial engineering, engineering design and architecture, and **Scarlett Miller**, associate professor of engineering design and industrial engineering, serve as co-principal investigators.

As the additive manufacturing industry continues to flourish, the demand for a 3D-printing workforce increases exponentially. Additive manufacturing has become increasingly popular in industries such as aerospace, medical, and automotive manufacturing. Because additive manufacturing is expected to grow to a global revenue of more than $21 billion by 2020, universities and colleges across the nation have dramatically amplified their additive manufacturing offerings.

Currently, no best practice standards exist to implement design for additive manufacturing education into engineering courses. There is no way for the information and instruction provided to students to be reviewed and critiqued. An absence of scientifically defined standards and requirements can lead to varying topics and levels of instruction, resulting in students that may not be as prepared for a career in the additive manufacturing industry as others.

"We're entering a time when it's becoming more and more common for engineering students to encounter additive manufacturing technology during their education. This means we're poised to have a new generation that's fully capable of accounting for all of the innovative design potential enabled by additive manufacturing," Meisel said. "But, the field as a whole is still lacking a scientifically rigorous approach to teaching with this technology in a way that maximizes its impact on the feasibility and novelty of student designs."

Meisel, Simpson, and Miller will work to better understand the impact of additive manufacturing in design creativity and engineering education. The team will measure the impact design for additive manufacturing education has on student creativity, the impact design complexity and structure has on student creativity during formal design for additive manufacturing instruction, and the impact activity length and education level has on student creativity when formal design for additive manufacturing instruction is used.

This will help the researchers determine which aspects of design for additive manufacturing education are necessary to increase student performance relating to design innovation and achievability. This information will help to identify best practices for additive manufacturing use in engineering design education.

To do so, the researchers will study students from Penn State's ME 340: Mechanical Engineering Design Methodology, ME 440: Mechanical Systems Design Project, IE 480: Capstone Design Project, and EDSGN 100: Introduction to Engineering Design.

"As part of this project, we found it important to look at how design for additive manufacturing education impacts students at both ends of the educational spectrum, both freshmen and seniors. This is because there is a very real chance that students' willingness to take risks with their designs changes as they progress through their education," Meisel said. "We want to see how this impacts the way that they use design for additive manufacturing knowledge. For example, do freshmen embrace the opportunities of additive manufacturing in their designs, while seniors focus on the restrictions inherent in the technology?"

The results from the study will be used to influence design for additive manufacturing education techniques that will be available to educators from various disciplines across Penn State. Researchers look toward future work to expand the implementation of design for additive manufacturing best practices at universities around the world with an interest in 3D printing and design for additive manufacturing. ■

Nicholas Meisel discusses the design potential of additive manufacturing with students enrolled in his EDSGN 497: Introduction to Additive Manufacturing course.

INTELLIGENT ROBOTS

and their role in society

by Chris Spallino

Aerospace engineer to develop integrative studies course focusing on the interdisciplinary nature of robots and ethics

As the robotics industry continues to rapidly grow, so, too, does the controversy surrounding robots and the ethical dilemmas related to their entrance into, and their use and acceptance in, society.

Will robots eventually take people's jobs and cause mass unemployment? Should communities automate law enforcement with robots—and what if a robot shoots a civilian? What role should robots play in the military? There are no answers to these questions at the moment, but there will be a lot of in-depth discussion around them in a new integrative studies course targeted for offering in fall 2018.

Through the Integrative Seed Grant Program, offered through the Penn State Office for General Education, **Alan Wagner**, assistant professor of aerospace engineering, will develop and teach a course titled "Robots and Their Role in Society," which will explore the growing influence and impact of robots and artificial intelligence on society.

"The real purpose of the course is to expose a wide variety of students to the types of benefits and diverse and numerous challenges that robotic technology presents, while posing challenging ethical questions that are not embedded in a single discipline," said Wagner, who is also affiliated with the Penn State Rock Ethics Institute. "In doing so, students will be challenged to evaluate their own value systems, develop their own stances on issues, and develop critical thinking and communication skills."

The course will not be technical in its treatment of robots, but rather, will focus on the previous, current, and upcoming ethics-related dilemmas and problems posed by the advent of intelligent robots. Some of these issues will be unique to robotics, others will fall within the context of computing, in general, and still others will be new manifestations of more general ethical, political, and constitutional laws.

Topics to be covered in the course will include ethical foundations; robots in the military; professional responsibility; robots and privacy; robots as sexual objects; and robots as intelligent, volitional beings, to name a few.

Wagner intends for the course, which will be primarily for juniors and seniors in various majors, to be highly interactive and include a research component with student presentations.

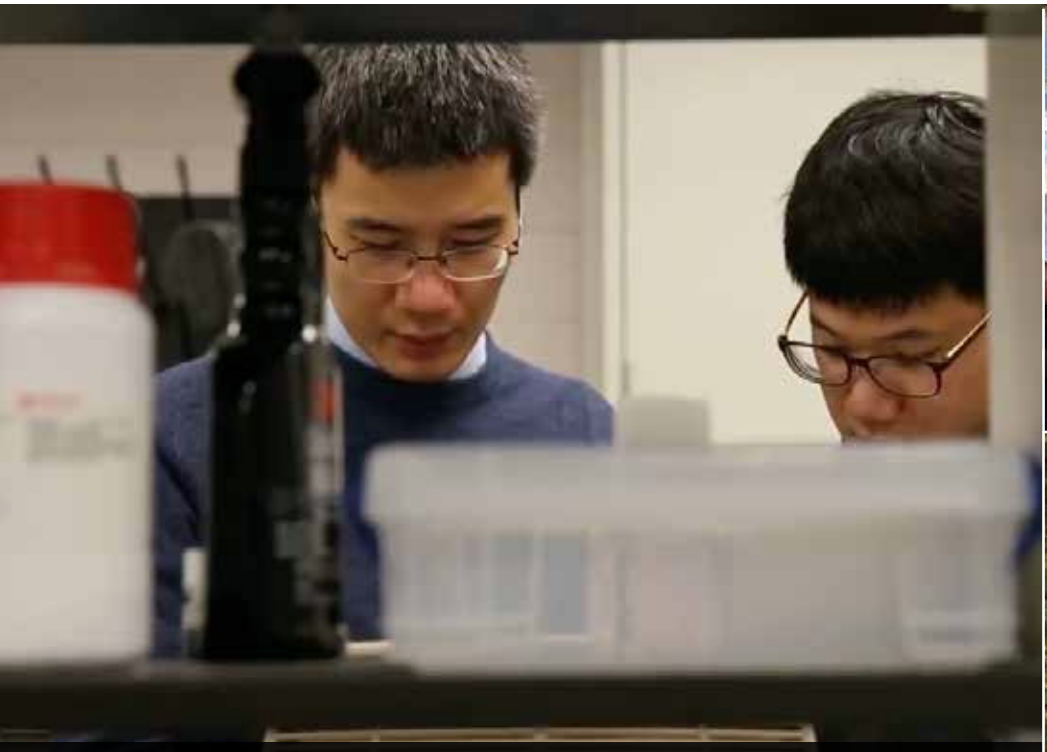
"I think it's important to train students to think for themselves and to come to their own conclusions," said Wagner. "This course will present students with open-ended questions and problems that are important problems for the future, our future, and even more so, their future. It won't be lecture after lecture because there are no answers to these questions yet."

Wagner also plans to collaborate with the Schreyer Honors College to help identify interdisciplinary students who may be interested in the course, and the Leonhard Center for the Enhancement of Engineering Education to help develop new ways to teach ethics to students that will deliver learnings that they can benefit from throughout their careers, no matter what field they go into.

"In the past, ethics courses used to be tack-on courses that outlined more of what an individual should or shouldn't do in a certain situation, or they covered various rules one should follow," said Wagner. "With the increased insertion of robots into society and across many industries, we're now faced with situations, scenarios, and issues where we don't necessarily know what the right thing to do is. Even if students won't interact with robots in their careers, we can teach them to think in different ways, effectively communicate those thoughts, and understand, accept, and respect different viewpoints of others if they do face similar issues."

The seed grant program will support 71 different course development projects this summer. The awarded proposals include faculty from Penn State campuses across the state. ■

(left) Sagar Lakhmani, graduate student in electrical engineering, sets up a connection to the Baxter robot prior to an experiment. (above) Aerospace engineering graduate student Pranjali Padghan teaches the Baxter robot new motions in order to play games. (right) The Baxter robot declares victory after playing a game with a human.



DNA Analysis: Anywhere. Anytime. For anyone.

Assistant Professor Weihua Guan and his graduate student, Gihoon Choi, have created a device that will deliver a disease diagnosis to a patient in 30 minutes.

2017 College of Engineering tailgate

Across the College

New E-knowledge Commons and computer labs now open!

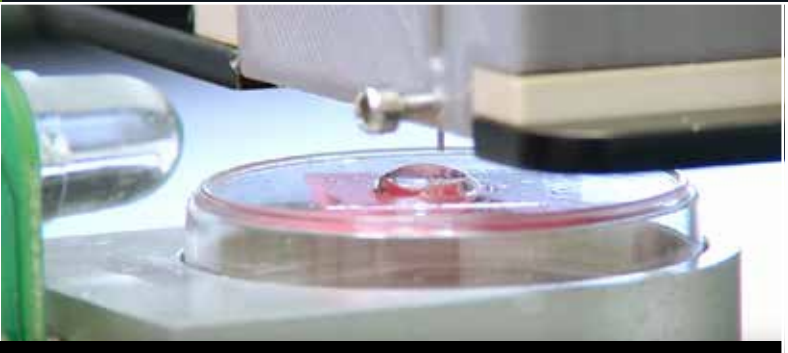
Girls solving societal problems through computer science

Providing essential human rights solutions through ecological wastewater treatment

Dr. Rachel Brennan and her research team built the newest Penn State Eco-Machine to sustainably remove contaminants from our water supply.

Cement solidification in gravity-free environment

Girl Scouts learn about mechanical engineering from WEP students

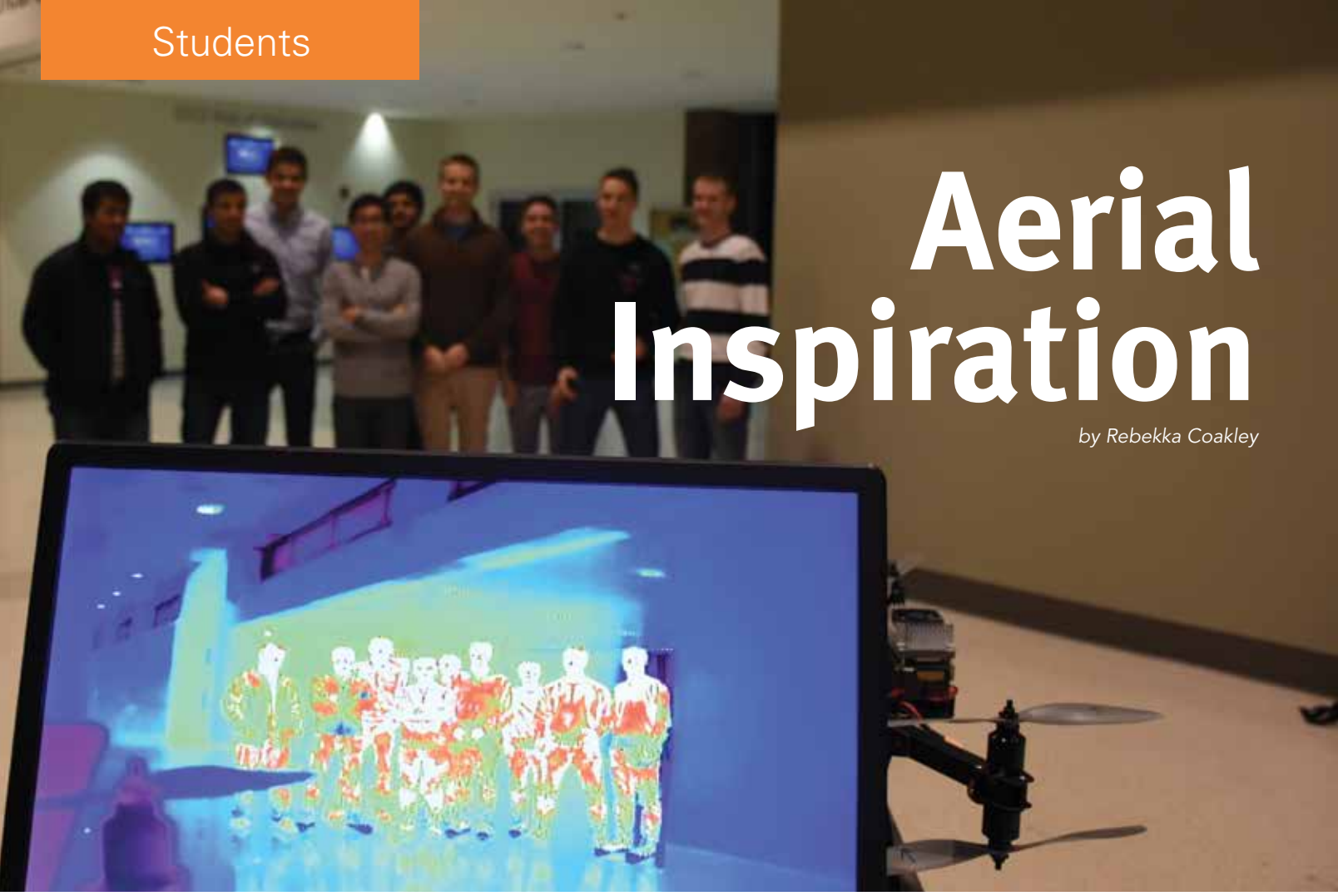


Print your own 3D cartilage: MEDICINE'S NEXT BIG THING?

Define your Penn State graduate bioengineering pathway

The Center for e-Design at Penn State

Working to incorporate new technologies across disciplines to improve the design and manufacturing processes of products and services in a variety of industries.



Aerial Inspiration

by Rebekka Coakley

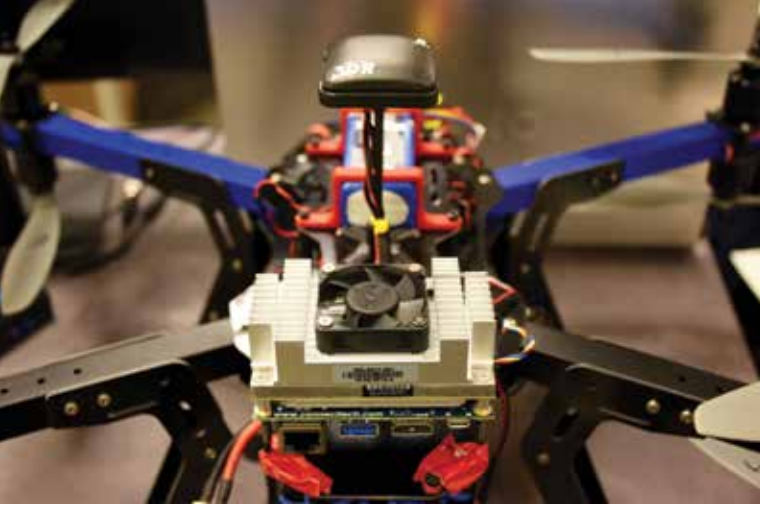
After hours of battling a tenacious wildfire, fueled by wind and dry climate, a firefighter takes a moment to rehydrate, then suddenly realizes he has lost his way in the forest the fire has taken over. He sends a radio signal and after just a few moments, a small drone flies overhead, drops a bottle of water down to him and shows the search and rescue team where he is located.

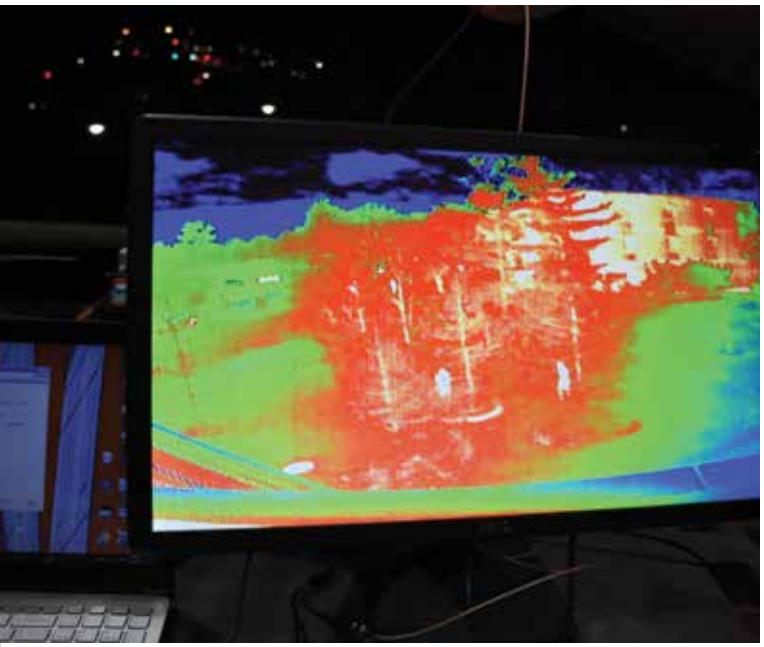
Students competing in the Association for Unmanned Vehicle Systems International Student Unmanned Aerial Systems (SUAS) competition, hosted at Patuxent River Naval Air Station, are working on creating a vehicle that will do just this—fly autonomously, avoid areas where the rescue helicopters are flying, identify and read plywood signs, and locate and deliver water to the fireman. **Jonathan Ready**, who founded Penn State's Unmanned Aerial Systems (UAS) team, is leading the charge.

Ready, a junior from State College, was inspired to create UAS after visiting another university that had a similar program that allowed students from various disciplines to work on the project together.

As a sophomore, Ready started the Penn State group, securing lab space in the Department of Computer Science and Engineering, securing funding, visiting classrooms to recruit students, and bringing **Vijay Narayanan**, Distinguished Professor of Computer Science and Engineering in the School of Electrical Engineering and Computer Science, on as the group's faculty adviser.

"Inspiring students to apply their skills outside the classroom in unstructured environments is vital for their lifelong success," said Narayanan. "Student organization activities are a wonderful way for our students to work together as a team while contributing their individual technical skills. Design of intelligent unmanned aerial vehicles applies many core principles taught in





(top) One of the drones the group uses to test new components, due to its ability to lift heavy things safely. The eight propellers provide redundancy and safety in the event of motor failure. (middle) Holding the drone, Ready and the other members of the club get ready to fly the drone. (bottom) The thermal imaging camera shows the lost "hikers" in the dark.

computer science and engineering and is also an activity that can help others in the community to understand different ways in which computing touches our daily lives."

Ready has built the club to encompass a number of disciplines to play key parts in the creation of the unmanned aerial vehicles. The group has 27 members from computer science, electrical engineering, aerospace engineering, and mechanical engineering majors. The students are able to use the knowledge they've gained from their various curriculums to play a vital role in building the drone.

"The Penn State mission is to promote interdisciplinary collaboration," said Ready. "Each person on the team adds perspective to how to get the work done. We have to trust each other to do a good job."

In addition to finding space, building a team and fundraising, Ready was also able to secure a Vue Pro from FLIR, Systems, Inc. The commercial grade camera is built like a military grade camera used in drones flown by militaries around the world, but it has not been tested to military specifications, so it is sold commercially.

According to David Lee, the marketing communications manager for FLIR Systems, based in Oregon, the corporation has donated a number of cameras to student efforts in robotics and engineering over the years in an effort to familiarize students at universities and trade schools with their technology, since it has the potential to be more prevalent in coming years.

The donation was a huge bonus to the Penn State team, as they continue to fine-tune their craft for the competition, with support from the Department of Computer Science and Engineering.

"Our responsibility as a department is to foster such initiatives and provide an environment for students, so that they can gain valuable experience outside of the classroom, which prepares them for their future careers," explained **John Hannan**, associate professor of computer science and engineering, who has been a major advocate for the group. "The UAS group provides students with an opportunity to work on an interdisciplinary team, applying the knowledge and skills they acquire in the classroom to do what engineers do: design and build exciting artifacts and products that solve difficult problems."

Ready said that while they are focused on the SUAS competition, which takes place June 14-17, they hope to compete in other competitions, like the International Aerial Robotics Challenge, which is designed to encourage new methods for drones to perceive their environments.

Students who want to get involved with UAS may contact Ready at jxr984@psu.edu, visit the team's website or find them on Facebook. ■

Chapic finding ways to lead while still playing the game she loves

by Jeff Rice

Kori Chapic is a defender and mentor for the Cleveland Ambassadors, and this fall she is coaching her former high school soccer team for the first time. Image: Cleveland Ambassadors

Architectural engineering alumna **Kori Chapic**'s playing days aren't nearly over, but the former Penn State women's soccer star and Presidential Leadership Academy (PLA) graduate is already passing on what she has learned about the sport to the next generation of players.

Chapic, a defender who made 93 starts in four seasons for the Nittany Lions, now plays for the Cleveland Ambassadors, a semiprofessional team in the Women's Premier Soccer League (WPSL). She has been able to not only work the soccer around her full-time job as an assistant engineer for Turner Construction Company, but also serve as a mentor for her teammates, many of whom are currently playing or about to play collegiate soccer.

And this fall, Chapic began coaching the girls' soccer team at her alma mater, West Geauga High School in Chesterland, Ohio.

"It's cool to say that hopefully one day I'll be able to affect some of these players like I was affected as a player," Chapic said. "Being able to affect a whole new generation prior to going to college and hopefully inspiring these girls to hit that level as well is the next step."

Chapic, a center back for the Ambassadors, tries to impart one of the chief lessons she took from her head coach at Penn State: Control what you can control.

"Being a voice in their ear and being able to provide insight from the college level is huge," she said. "On top of it, I'm still able to go out there and play at a high level, which is a big benefit to me, because I am competitive."

"Being able to affect a whole new generation prior to going to college and hopefully inspiring these girls to hit that level as well is the next step."

It was a desire to compete, both on the soccer pitch and in the engineering field, that led Chapic to Penn State. When she joined the Presidential Leadership Academy, she said she was able to find perspectives outside her "little silo."

"I was meeting people from all sorts of different majors and all sorts of different interests from different areas of the United States and outside of that as well," she said. "It just opened my eyes a little bit more and showed me how everybody can make an impact in different ways to different people."

Chapic graduated in 2016 with a bachelor of architectural engineering degree. She still follows her former PLA classmates through social media and sees them striving for and reaching lofty goals. Her goals are to play for as long as her body will allow and to help young players reach their own goals.

"If I can make an impact on one player, it's a benefit to the whole program," she said. "That's enough to keep me going." ■

Sarah Torhan will be working on community-based development projects during her Peace Corps service in Paraguay, joining the more than 220 volunteers currently serving in the South American country. Image: Courtesy Sarah Torhan

Chemical engineer begins Peace Corps service in Paraguay

College of Engineering alumna **Sarah Torhan** left for Paraguay on September 11 to begin training as an environment volunteer with the Peace Corps. She will live and work in a community to promote environmental awareness and action at the local level.

Torhan earned a bachelor of science degree in chemical engineering from Penn State in 2014. She also received a minor in Engineering Leadership Development, which encourages engineers to work cross-culturally and internationally. The minor provides students with the understanding of individual, team, and organization leadership; global competencies and multicultural awareness; and innovation and management skills.

Prior to joining the Peace Corps, Torhan served as a process engineer at W. L. Gore & Associates, an academic associate for Arizona State University's Engineering Projects in Community Service Program, and as a professional mentor and university liaison for Engineers Without Borders.

In search of a career path that combined her interests in engineering and community service, Torhan applied to the Peace Corps as a way to fulfill both passions and serve as a launching pad for her profession.

"I have been looking to make a career shift toward sustainable development, human-centered design, and/or humanitarian engineering," said Torhan. "The Peace Corps seemed to be a great gateway for me to become an engineer working in international developing countries by presenting the necessary opportunities to challenge my perspective and shape my worldview."

During her first three months of service, Torhan will live with a host family in Paraguay to become fully immersed in the country's language and culture. After acquiring the necessary skills to assist her community, Torhan will be sworn into service and assigned to a community in Paraguay, where she will live and work for two years with the local people.

"I saw the Peace Corps as the next step to apply my chemical engineering education to eventually design for social impact," Torhan said.

Torhan will work in cooperation with the local people and partner organizations on sustainable, community-based development projects that improve the lives of people in Paraguay, while also developing leadership, technical, and cross-cultural skills that will give her a competitive edge in the job market when she returns home. ■

Betza and Hoffman receive highest Alumni Association award

Two College of Engineering alumni have been named 2017 Penn State Alumni Fellows. **Steven J. Betza** ('82 E E), left, and **Dale T. Hoffman** ('72 E E), right, were among 14 alumni recognized for their outstanding professional accomplishments in their varied careers. They were honored at a ceremony on October 4 and now hold the lifelong title of Alumni Fellow, the highest award given by the Penn State Alumni Association.

Betza is corporate director of the Future Enterprise Initiative at Lockheed Martin. He leads a futurist team to identify emerging business and technology trends and high-impact capabilities in engineering, production, supply chain operations, and logistics.

He has held leadership roles with IBM and Lockheed Martin over a 34-year career. At Lockheed Martin, he has served as corporate director for advanced manufacturing, engineering director, program director, and chief information officer.

Betza currently serves on the board of directors of National Science Olympiad and the board of trustees for Guthrie Healthcare System in Sayre, Pennsylvania. In addition, he chairs the advisory board for the T.J. Watson School of Engineering and Applied Science at Binghamton University and serves on the executive committee for the Digital Manufacturing and Design Innovation Institute in Chicago.

He periodically serves as an adviser to the Department of Defense, the Defense Science Board, the National Security Agency, and U.S. Congress on issues related to trusted electronics, manufacturing innovation, and the U.S. industrial base.

Betza received the College's Outstanding Engineering Alumni Award in 2002. He and his wife, Barbara, live in Endicott, New York.

Hoffman retired in 2008 as technical director of the Aegis Technical Representative Command in Moorestown, New Jersey. The Aegis Program is the U.S. Navy's premier surface-integrated combat and weapon system.

As technical director, Hoffman provided technical oversight of nearly $7.4 billion in Naval Sea Systems Command contracts. He led a team of civilians, support contractors, U.S. Navy sailors, and foreign military liaison officers from Japan, Spain, Norway, Korea, and was responsible for managing design, development, production, testing, logistics and delivery of the Aegis System to the Fleet. His Aegis career spanned 31 years with the delivery of 82 ship systems.

Hoffman received two Department of the Navy Meritorious Civilian Awards in 2001 and 2003, and a Department of the Navy Superior Civilian Award in 2008, the highest honorary the Chief of Naval Operations may bestow on a civilian employee.

He was named a Penn State Outstanding Engineering Alumnus in 2011 and an Alumni Association Volunteer of the Year in 2012. He received the College of Engineering's Distinguished Service Award in 2015.

Since retiring, Hoffman participates in engineering résumé reviews, senior design showcases, and career fairs. He volunteers at the Hintz Family Alumni Center and can be seen welcoming students and parents for Spend A Summer Day and New Student Orientation. He is the current president of the Penn State Engineering Alumni Society.

An active member of the Alumni Association's Centre County Chapter, Hoffman lives in Port Matilda, Pennsylvania.

FROM YOUR PRESIDENT

Securing Our Future

Nearly every day, I read about cyberattacks and hacking of our electronic systems and personal data. Recently, the credit monitoring company Equifax reported a breach that had exposed the social security numbers and other data of about 143 million Americans. I myself have been part of a group whose personal data was breached. What can we do?

As new technologies are developed, more electronic systems and databases are being connected, increasing the risk of cyberattacks. These systems and databases affect all aspects of our lives. We need to "secure our future" by developing a pool of skilled engineers and computer programmers to specifically address and prevent hacking of our systems. We need to encourage our youth to pursue careers in technical fields so that the development of future system designs includes protections to prohibit cyberattacks.

Throughout my career and in recent articles on technology, I have discovered that one large sector of our society isn't going into technical fields and specifically, into engineering and cybersecurity. Our STEM workforce is crucial to America's innovative capacity and global competitiveness. Yet much of what I read and hear in the news is that woman specifically are vastly missing from STEM jobs and among STEM degree holders. Women make up nearly half of the U.S. workforce and half of the college-educated workforce. This leaves an untapped opportunity to expand STEM employment in our country and improve our competitiveness in the world.

Some articles attribute low female graduation rates to a lack of female engineer role models, misconceptions of what it is like to be an engineer, and fewer technical problem-solving opportunities available to K-12 girls compared to boys. This can result in a lack of confidence and encouragement for women to compete with men in technical fields.

Throughout my engineering career, I have seen stereotypes linking masculinity to technology and observed what women must do to compete in the field. We must change this perspective as we move forward. Data has shown that women fill close to half of the jobs in the U.S. but hold less than 25 percent of STEM jobs.

Your Penn State Engineering Alumni Society is in the process of developing and testing a STEM program based on our student engineering ambassadors program that could be shared with our engineering alumni around the country, providing them with the tools to take STEM to their local schools and engage our youth in engineering and STEM fields.

As we move into the future, we need to encourage an increasingly diverse group of young people to pursue careers in the engineering and cybersecurity fields—to address vulnerabilities as we continue to connect our systems worldwide—and to help us "secure our future."

We Are…Penn State

Dale T. Hoffman '72 E E
President, Penn State Engineering Alumni Society
dhoff128@comcast.net

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Building an active, engaged community of engineering alumni since 1959

PSEA

The alumni society provides:

- Membership in a worldwide network of almost 100,000 engineering alumni.
- Fellowship among engineering alumni, faculty, staff, and students.
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We want to hear from you! **Visit PSEAS** on the web to submit your latest news and to learn more about becoming a member.

FOR MORE INFORMATION, CONTACT:

Erin Tench, Director of Alumni Relations,
Events and Volunteer Engagement
101 Hammond, University Park, PA 16802
814-863-3384 | ext120@engr.psu.edu

PennState
College of Engineering

The Pennsylvania State University
101 Hammond Building
University Park, PA 16802-1400

Calendar of Events



December 8	College of Engineering Design Showcase
December 16	Fall Commencement
January 8, 2018	Spring Semester Begins
January 23-25	Engineering Career Week
February 16-18	Interfraternity Council/Panhellenic Dance Marathon
February 18-24	Engineers Week
February 23	Penn State Engineering Alumni Society Board Meeting

March 4-10	Spring Break
March 20-22	Industrial and Professional Advisory Council Meeting
April 20-22	Blue-White Weekend
April 22-23	Outstanding Engineering Alumni Awards
April 26	College of Engineering Design Showcase
May 4-6	Spring Commencement
June 1	Penn State Engineering Alumni Society Board Meeting