

The Ohio State University | Department of Electrical and Computer Engineering

# BITS & SPARKS

ALUMNI MAGAZINE | FALL 2017

**NASA**  
COLLABORATIONS

**MEASURING EARTH'S  
ENVIRONMENT  
FROM SPACE**



# EE/ECE Alumni Society

Note from the President - **Liza Toher-Reed**



**W**e've just wrapped up an outstanding year for the EE/ECE Alumni Society and are planning to keep growing and engaging – so please stay tuned and stay in touch!

For the second year in a row, we achieved Scarlet Status from the OSUAA. This status recognizes the range of engagement events we've planned and hosted, including networking, student engagement, community service, lifelong learning and raising money for our student scholarships. Information on past and future events can be found on our new website:

**[www.ece.alumni.osu.edu/](http://www.ece.alumni.osu.edu/)**

Of particular note, during the April 2017 Buckeye Month of Service, dozens of EE/ECE alumni volunteers donated their time across five projects in the Columbus community. Thank you all for your commitment!

Fall 2017 events will soon be updated online. As a preview, next up for events is our long running "The Next Step" panel, which brings alumni and faculty together as panelists to answer student questions about post-BS options: working, engineering graduate school, MBA, etc. If you are interested in being a panelist (we often include alumni out of state through a video conference), please contact:

**[eeecesociety@osu.edu](mailto:eeecesociety@osu.edu)**

Of course, we attended the College of Engineering Homecoming tailgate on Saturday, October 7, prior to the football game versus the Maryland Terrapins. That same weekend, we hosted a 50th year reunion dinner during Homecoming week for folks in the class of 1967, which we hope will become an annual

tradition.

Last year, we also launched our EE/ECE newsletters to share information about research, alumni, events, and scholarships. In the June newsletter, we highlighted two scholarship recipients. If you have a story to contribute or a new email address to update, please let us know.

The Ohio State ECE Meetup series is going into its fourth year, and organizers are always looking for new locations, topics, and alumni to get involved. As the topics are typically technically focused, these meetups often qualify as continuing education credit, and we can provide certificates upon request. Check out the group:

**[www.meetup.com/OSUECE-Alumni](http://www.meetup.com/OSUECE-Alumni)** and contact program lead **Mark Morscher** with any questions or ideas at: **[markmorscher@gmail.com](mailto:markmorscher@gmail.com)**.

As always, we are seeking ECE Ambassadors in cities outside Columbus to help us host a networking or speaker series, with the goal of bringing our department's leaders, thinkers, and accomplished alumni to you.

Every EE and ECE degree holder from Ohio State is automatically a member of our society. We continue to grow our events to serve your interests. Let us know how we are doing! The Society is always seeking new names and faces to serve on our committees and Board of Directors.

Please contact **[eeecesociety@osu.edu](mailto:eeecesociety@osu.edu)** if you are interested in learning more about any these opportunities, or wish to provide feedback or ideas. ■



EE/ECE  
Alumni Society



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### Bits & Sparks FALL 2017

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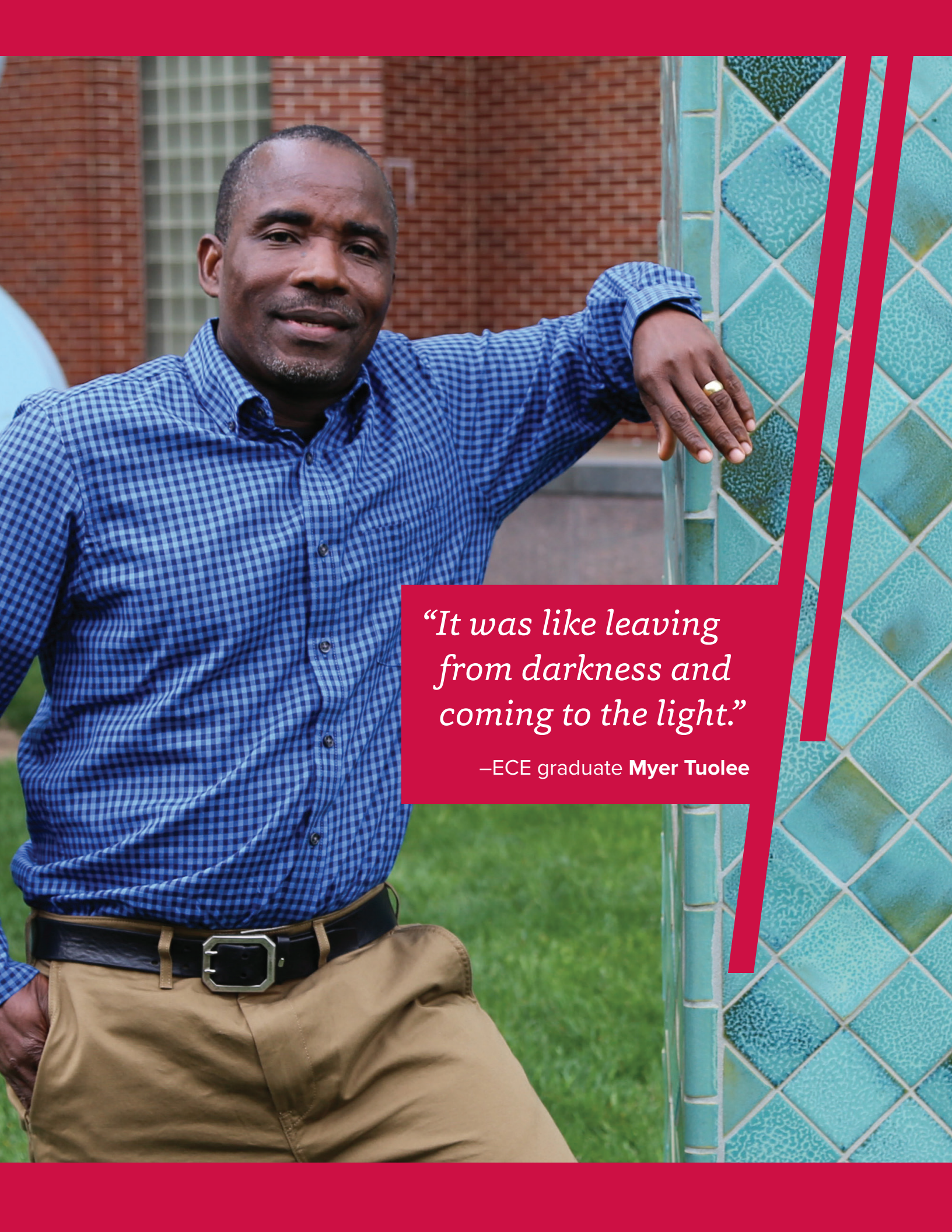


# ALUMNI

**PICTURED:** RECENT ECE GRADUATE **MYER TUOLEE** FOUND SUCCESS AFTER A LONG JOURNEY OF HARDSHIP.







*“It was like leaving  
from darkness and  
coming to the light.”*

—ECE graduate **Myer Tuolee**





**F**or many graduating students, receiving their hard-earned degrees feels like a long time in the making. But for one Buckeye engineer, the path to the podium was a literal journey—one delayed but not stopped by war, a refugee camp, or his immigration to the United States.

**Myer Tuolee**, an electrical engineering major, was one semester shy of receiving his degree when civil war broke out in his native country of Liberia. Very quickly, he went from being a graduating senior to living in a refugee camp in Ghana.

“The refugee commission, was only responsible for relief—food, shelter, medication. They were not providing an education for us,” Tuolee said. “So I was in the camp without school for more than 10



# FROM REFUGEE TO GRADUATE

## ONE UNSTOPPABLE ENGINEER'S JOURNEY

challenges for Tuolee, who was working full-time in order to support his family. He also had to transition from different learning conditions in Liberia to the American system after spending years out of the classroom.

"Liberia is one of the poorest countries in the world. The problem is that they have no good libraries and no updated textbooks," Tuolee said. "It was like leaving from darkness and coming to the light. Here in the United States some of my professors are the authors of the textbooks they teach, so if there is a mistake in the textbook they can make the necessary corrections during lectures. But in Liberia, if there is a mistake in a textbook, nobody knows and you will be learning something that isn't right."

Being a Buckeye has exposed Tuolee to many different people and facets in the engineering industry. He said he learned a lot, not just from his professors, but also from visiting professionals. Tuolee was able to participate in a job shadow program where he was exposed to real-life facilities and gained a firsthand look at how things work.

Learning time management and

working under deadlines, Tuolee even appreciates the strict deadlines set by his professors.

"It gives you a sense of responsibility to have a timeline," he said. "I really appreciate what the professors do here. They give you good experience so when you go outside of school you take your job and time seriously."

Although returning to school has not been easy, Tuolee encourages others to continue learning and staying on top of research and new developments in their area.

"I am grateful for this country," said Tuolee. "This country gave everybody freedom no matter their background, no matter where they came from, to do what they want to advance their potential and gain what they would like and live how they want to live." ■

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*By Emily Lehmkuhl, College  
of Engineering student  
communications assistant*

years."

In September 2009, he left the refugee camp behind and came to the United States to join his girlfriend and daughter. Tuolee got a job in a factory, where he made friends with engineers who encouraged him to go back to school.

"Education is important to live a better life, because education is a gateway for a lot of opportunities," he said.

Returning to school brought new





## THE POWER OF RECOGNITION

### *the Harrison Family Legacy*

**A**ny story about Stan and Doris Harrison, and their scholarship support for The Ohio State University, should begin with a young boy singing the National Anthem at a Rotary event decades ago.

**Stan Harrison**, a 1958 Electrical Engineering honors alumnus from Ohio State, was invited to speak that day as a nationally-recognized industry leader.

It became clear to all; he said, the true hit of the day was the young singer who kicked off the event with his impressive voice.

Motivated to show other people such talent, the Harrisons immediately worked to get him a scholarship to attend a summer music camp. Once enrolled, the young singer excelled. So much so, he was later presented a full scholarship to music school.

Ultimately, the teen decided not to accept, opting instead for a more traditional education.

Stan Harrison often wondered what became of the singer. Thirty-five years later, he finally got his answer. That same talented young man, now a Baptist pastor living in Oklahoma, called the Harrisons and invited them to his next sermon. There, they learned, he never really gave up on his love of music as he became a man.

"All these years later and he is still singing," Stan Harrison said. "He put on a show for hours."

The pastor also testified how the Harrisons made a difference in his life. Their support of his talent was something he never forgot.

The story reflects upon why the Harrisons have continued to give back throughout their lives, through scholarship and award programs. Not only to college-bound students in southern Ohio, but to Ohio State faculty as well. Recognition of talent is often powerful in and of itself.

"Engineering has been good for me," Stan Harrison said. "If it makes a difference in people's lives, why not?"

The Ohio State College of Engineering recently held its annual awards ceremony, at which the couple's prestigious Harrison Faculty Award was presented to ECE Professor Jin Wang for his leadership in electric power research and education.

The couple created the award because they saw the value in encouraging talented faculty.

"I felt we had to do something," Stan Harrison said. "We didn't see anybody else doing this at the time we started it."

In 2011, the longtime scholarship donors also made a new commitment to support future Buckeye engineers, by providing renewable four-year scholarships for up to four engineering students from Gallia, Jackson and Meigs counties in southern Ohio.

Stan Harrison said the scholarship fund was originally established to help the university accomplish its goal



# “IF IT MAKES A DIFFERENCE IN PEOPLE’S LIVES, WHY NOT?”

— STAN HARRISON, 1958 ECE ALUMNUS

of creating new funding opportunities for students in all 88 Ohio counties, especially southern Ohio, where few students were pursuing engineering.

“(The university) recognized the significance of (our fund) to the three-county area,” he said. “Because of the way they managed it, it’s worked out even better than we architected it.”

Although the Harrisons spent decades living in different states, the couple – who met and grew up in Gallia County, Ohio – remain focused on helping new generations find success at Ohio State.

The couple now see the scholarship funds as an extension of their family, with a legacy continuing from generation to generation.

Growing up on a farm as a child, Stan Harrison said, led him to engineering by default. When machines broke down on the farm, the family figured out how to fix them.

“My father and brother ... could fix anything that had to do with farm equipment or cars,” he said. “When there was some kind of electrical problem, I could always figure it out. It was the natural order of things.”

He later expanded on this education in the Army and studying electrical engineering at Ohio State – forming the basis of knowledge in a rapidly-changing industry full of opportunity.

“Ohio State taught me AC/DC, antennas, air/ground communication,” Stan Harrison said. “It was a well-grounded education.”

He went on to become President and Chief Operating Officer of the BDM Corporation, a Northern Virginia-based knowledge company, retiring in the fall of 1988. He also served as Founding Dean Emeritus of the Harry F. Byrd, Jr. School of Business at Shenandoah University, Winchester, Virginia; and as Chairman and President of The Potomac Foundation from 1988-1994, a non-profit corporation in Fairfax, Virginia dedicated to the advancement of knowledge in science and technology, education, social development, and defense.

Stan Harrison is a registered Professional Engineer in the State of Ohio. He holds a MS degree in Electrical Engineering from the University of New Mexico and a B.S. in Electrical Engineering from Ohio State, Honorary Doctorate Degrees from Ohio State and Shenandoah University, as well as Honorary Professorships from two universities in China. He has received academic, business and service awards and is a Member and Paul Harris Fellow of Rotary International. He was a founding member of the Board of the Washington Airports Task Force, serving from 1983 to 1993, and served as its Chairman from 1996 to 2008.

In recognition of his achievements, Ohio State named Stan Harrison a Distinguished Alumnus in 1977 and he received the College of Engineering’s highest honor, the Benjamin G. Lamme Meritorious Achievement Medal, in 1980. ■



Established in 1983 with a gift from Doris and Stanley Harrison ('58, electrical engineering), the prestigious Harrison Faculty Award of Excellence honors an early to mid-career faculty member for skills and qualitative aspects in teaching, exceptional research, or contributions to engineering or architecture concepts.

Electrical and Computer Engineering professor **Jin Wang** was presented the award in 2017 for his leadership in electric power research and education.

Wang leads the High Voltage and Power Electronics Laboratory at Ohio State. The lab focuses mainly on wide bandgap (WBG) power devices and their applications. Its research projects are sponsored by organizations such as the National Science Foundation, Department of Energy, Air Force Research Laboratory, PowerAmerica Institute, Ohio Federal Research Network, Ohio Space Grant Consortium, and leading companies ABB, AEP, Duke, FirstEnergy, Ford, GE Aviation, TI, and Toshiba. Read the full list of previous Ohio State ECE Harrison Award winners:

2016 - **Eylem Ekici**

2011 - **Fernando Teixeira**

2008 - **Hesham El Gamal**

2006 - **Joel Johnson**

1999 - **Steve Ringel**

1998 - **Kevin Passino**

1992 - **Randolph L. Moses**

1983 - **Walter D. Burnside**



# @OhioStateECE MeetUp

## DENVER, COLORADO



**When Department of Electrical and Computer Engineering graduates leave The Ohio State University for the workforce, they often scatter across the nation.** The program's national reputation can particularly open up career options at prestigious companies in Colorado, such as Lockheed Martin, Timken, Raytheon, or Ball Aerospace.

On April 6, ECE took its ongoing Meetup series out west for a stop in Denver, hosted at the home of alumnus **James Pinto** ('91) and his wife **Holly**. Alumni from across the city attended as well.

ECE Chair **Joel Johnson** and development director **Katie Coen** also flew in for the event.

Leadership from the local Alumni Club of Denver was there to relay how alumni can stay connected in the greater Denver area. ■



Find more pictures from the **ECE Denver MeetUp** here: <http://go.osu.edu/ecedenver>



## ECE Department Note from the Chair – Joel Johnson



**G**reetings! The 2016-17 academic year was a year of high activity for The Ohio State University's Department of Electrical and Computer Engineering (ECE). We were very pleased to welcome new faculty members **Sanjay Krishna** (Professor and George R. Smith Chair), **Asimina Kiourti** (Assistant Professor), **Vanesa Chen** (Assistant Professor), and **Irem Eryilmaz** (Assistant Professor of Practice) to our team over the past year. These new faculty members are already making important contribu-

tions to our education and research programs. We also conducted an unprecedented faculty recruitment activity over the past academic year that will result in 10 new faculty members joining the department in 2017-18, including one Professor, five Associate Professors, two Assistant Professors, as well as one Research Assistant Professor and one Assistant Professor of Practice. This major growth in our faculty was enabled by Ohio State's Discovery Themes program; we are thrilled to welcome these new colleagues to the department.

We also will be celebrating the contributions of former ECE chair Prof. **Yuan Zheng** early this Fall, as he retires on Aug. 31, 2017. Prof. Zheng's contributions as Department Chair have made a lasting impact on the department's progress and future success. We also recently recognized the contributions of Prof. **John Volakis** to the Department and the ElectroScience Laboratory as Prof. Volakis departs to become Dean of Engineering and Computing at Florida International University beginning August 2017.

Our latest issue of Bits & Sparks explores the groundbreaking new

research and professional achievements of our students, faculty, and alumni. We'll look into Ohio State ECE collaborations with NASA on several projects, innovative advancements in infrared research and even next-generation neural implants. We will also check in with several alumni on their latest efforts to advance the department and follow several student award winners – including the Ohio State EcoCar program, which just celebrated another win.

We encourage you to join our quarterly ECE MeetUp social/tech events, either in person or online, as we continue to expand ECE events outside of Columbus. Follow along on new research and student stories by joining our ECE Weekly email list. We hope you will enjoy catching up on our journey through 2016-2017, and look forward to your involvement in the coming year. Support from our alumni is crucial to the department's progress and advancement, as well as to our current students; our team would be happy to talk with you if you are interested in playing a role.

As always, we thank you for your continued support.

## Alumnus Earns IEEE Communications Society Young Professionals Award

**E**CE alumnus **Dr. Ahmed Bader** (MS'06) recently received the IEEE Communications Society (ComSoc) Young Professionals (YPs) Best Innovation Award.

The award was bestowed during the IEEE Wireless Communications and Networking Conference (WCNC) in San Francisco in March.

Bader was selected to receive the award in recognition of his work on

the design, development, and commercialization of a novel mobile ad hoc networking technology.

Bader is CEO and co/founder of In-syab, a telecommunications company with global customers, including USA.

During his time at Ohio State, Bader was advised by professor **Eylem Ekici**. ■



Find this story and more in the ECE department newsletter, ECE Weekly at: [ece.osu.edu/ece-weekly-newsletter](http://ece.osu.edu/ece-weekly-newsletter)



## Leading Criterion: **Jugal Vijayvargiya**



**O**pportunities in smart vehicle technologies continue to highlight the value of an Ohio State ECE education.

Alumnus **Jugal K. Vijayvargiya** was named CEO and Director of the Mayfield Heights-based advanced materials supplier, Materion Corp. this year.

The alumnus is a veteran 26-year Delphi Automotive executive, who previously led the company's Electronics & Safety segment, a \$3 billion global business based in Germany. His role provided automated driving, active safety, information/entertainment, user experience and software/services technologies from manufacturing and technology centers in 16 countries.

Vijayvargiya, who earned both BS and MS electrical engineering degrees from Ohio State, succeeds retiring company leader Richard Hipple who held the role since 2006.

The alumnus said Materion "is a well-respected leader in advanced, enabling materials with exceptional organizational values, a deep culture of innovation and a remarkable heritage. I am excited and proud to have the opportunity to lead the company to its next level of long-term success." ■

## **TWO WIN DISTINGUISHED ALUMNI AWARDS**

**B**ridging the fields of engineering and medicine, ECE alumna **Cynthia J. Roberts** holds the Martha G. and Milton Staub Chair for Research in Ophthalmology in the Ohio State College of Medicine with a cross appointment in biomedical engineering where she advises graduate students in vision research.

Roberts has published 110 papers in peer-reviewed journals, contributed to 22 book chapters and co-edited two books. She has given over 190 invited scientific presentations across the globe and over 160 invited lectures in courses for continuing medical education credit or the equivalent.

Roberts serves on the editorial board of two major ophthalmology journals and the selection committee for a Fellowship in vision research offered by Prevent Blindness Ohio. She also consults for multiple medical device companies. Roberts' research interests include corneal and ocular biomechanics in cornea, refractive surgery and glaucoma; in vivo measurement of corneal biomechanical response, and ophthalmic imaging applications, including corneal topography, Scheimpflug tomography and optical coherence tomography. She has received sustained funding in these areas.

Roberts received a BS in nursing from the University of Iowa, as well as an MS (1986) in electrical engineering and a PhD (1989) in biomedical engineering from Ohio State. ■





# A LIFE IN ELECTRICAL ENGINEERING



**E**lectrical and Computer Engineering (ECE) alumnus **Thomas Burns** recently walked engineering students at The Ohio State University through his colorful career path, offering not only insight to the industry, but life in general.

The event was held as a colloquium for students Nov. 4 at Dreese Labs, which he called “My Career as an Electrical Engineer.”

Burns recently won a College of Engineering Distinguished Alumni Award for his career achievements. He remains a formidable voice within the engineering industry.

Burns became an Air Force Officer and went on to earn his MS and PhD degrees in Electrical Engineering at the Air Force Institute of Technology at the Wright-Patterson Air Force Base in Dayton. He then moved on to become a program manager at the Defense Advanced Research Projects Agency, DARPA. After a stint in the entrepreneurial world at two separate companies, he found himself back at DARPA as the Director of the Strategic Technology Office.

Throughout Burns’ discussion with students, he passed along tips he learned and highlighted information useful to students entering into the field. One prominent piece of advice for engineering graduates: specialize. Becoming an expert in a certain sec-

tion of engineering is something they can always fall back on, he said.

The power of effective writing and communication is another trait young engineers cannot afford to leave underdeveloped, he said, as they prepare for the industry. This advice lends itself especially well when managing a team. He said leaders can’t be afraid to take risks and they must be comfortable working as a team. Both traits become easier through the study of effective communication.

Sensing many students in the audience were deciding what to do post-undergrad, Burns suggested some career market paths he noticed firsthand are opening up in the future - artificial intelligence, autonomous systems, bio-engineering, cybersecurity, and Low Earth Orbit (LEO) space systems.

As an employer, Burns also mentioned tips for students applying for jobs. Stability is key in the workforce, he said, and admitted to skipping over applications from candidates who jump around from job to job. While not encouraging students to stay at a job for their entire career, he recommends working for at least three to five years and leaving behind

a reputation for ability.

Toward the end of the discussion, Burns readily admitted to being a natural introvert. He explained that some of the best leaders he knows are introverts who learned how to become effective leaders and organizers.

Burns closed the discussion after bestowing some advice about life outside of the engineering realm. He pushed students to find a hobby or stress outlet they enjoy, something to help carry them through the anxiety of finding a job and working in the industry.

He also reminded students to remain honest with themselves and to evaluate every now and then why they are engineers. Is it about “making monuments or making money?”

Burns smiled as he passed on his last piece of advice.

“Have a motto for life,” he said. “Mine is ‘Have fun. Solve hard problems. Change the world.’” ■

*Article by ECE Student Public Relations Writer Stephanie Wise*

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“HAVE FUN. SOLVE HARD PROBLEMS. CHANGE THE WORLD.” –*Thomas Burns*

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# RESEARCH

**PICTURED:** ECE ASSISTANT  
PROFESSOR **NIMA GHALICHECHIAN**  
DEMONSTRATES WORK IN THE  
NANOTECH WEST RESEARCH LAB.  
SEE FULL STORY, PAGE 25.





*“These are materials that fit into reconfigurable antennas at high frequencies. They are materials that can be conductors or dielectric at two different temperatures,”*  
**Nima Ghalichechian**



# OHIO STATE DISCOVERY THEMES: EARLY DISEASE DETECTION IN FOOD CROPS

**O**ne day a farmer, cup of coffee in hand, may launch a small drone from his back porch to check on the condition of his crops using a simple smart phone app.

Students and faculty at The Ohio State University are already working in the labs, and sweating in the fields, trying to make this vision a reality.

The research is all part of the “Crop Health Monitoring and Early Disease Detection in Food Crops” project, a multi-disciplinary effort at Ohio State that falls within the broader Food and Agricultural Transformation (InFACT) Discovery Themes program.

The Discovery Themes program at Ohio State was created to help advance critical societal needs in the realms of Energy and the Environment, Food Protection and Security, Health and Wellness and the Humanities and the Arts.

Doing their role in this effort, Ohio State Department of Electrical and Computer Engineering (ECE) Assistant Professors-Clinical **Wladimiro Villarroel** and **Lisa Fiorentini**, and their team of students are standing in an unlikely place for electrical engineers – a small farm at the Ohio State Waterman Agricultural and Natural Resources Labo-

ratory. Meanwhile, Professor **Jim Jasinski** of the Ohio State Department of Extension Integrated Pest Management Program, is leading activities at the Ohio State Western Agricultural Research Station in South Charleston, Ohio.

With an unforgiving summer sun overhead, Villarroel points out signs of insect damage on the leaves of a pumpkin crop his team planted back in the spring. Around him, a group of electrical engineering students work to set up a multi-spectral camera for another round of crop images they typically conduct twice a week.

Currently, the FAA does not allow unauthorized drone flights, so Ohio State ECE students improvised by attaching their multi-spectral camera to a 20-foot tripod for research on the main campus. One student is creating an algorithm to correct any camera misalignment. Authorized drone flights were conducted at the Ohio State Western Agricultural Research Station.

When it came to building up a research project of this scope, Villarroel said his initial concern was trying to get enough students to trade in their lab work for farm work. Oddly enough, he said, it wasn't an issue.

“This has been a very attractive project,” Villarroel said.

“Although, initially we were a little bit skeptical about bringing electrical engineers – interested in robotics and signal processing, all of that – to the farm.”

Villarroel said he now has nine students participating in the project.

“The ultimate goal is to have drones, equipped with multi-spectral or hyper-spectral cameras, fly over a crop, which can indicate not only the presence but the development of the disease, all before you are able to see it visually,” he said.

Crops naturally reflect light and other invisible radiation, he said, which can fluctuate according to plant health. Drones equipped to measure that radiation can feasibly spot any development issues in real time, including nitrogen levels.

From there, Villarroel said, an app platform can someday provide a set of actions a farmer should follow to reverse that damage, based on recommended scientific guidelines.

He said catching issues early can result in a better overall crop yield, and more importantly, can prevent the possibility of disease contaminating the plants and neighboring fields.

See **CROPS** on page 21 →

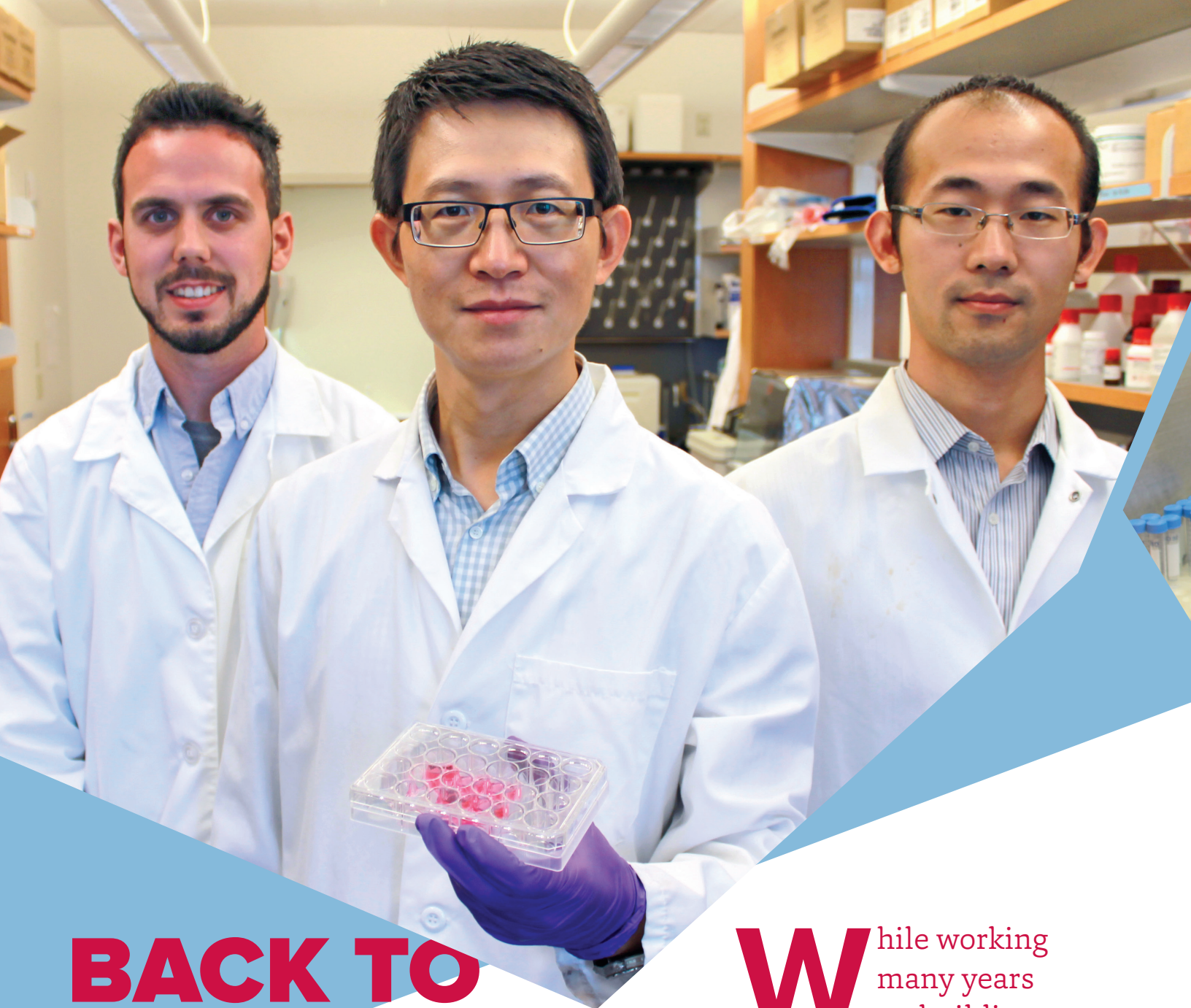


“FROM THIS PROJECT, I LEARN HOW TO DO TEAMWORK  
SKILLS. I LEARN HOW TO COMMUNICATE AND KNOW MANY  
DIFFERENT FRIENDS IN MANY DIFFERENT COUNTRIES  
- LIKE CHINESE, KOREAN, AMERICAN. THAT’S GOOD.”

*Nan Visudchindaporn, ECE student from Thailand*







# BACK TO NATURE:

**GUO WINS DARPA YOUNG FACULTY AWARD FOR NEXT-GEN NEURAL IMPLANT TECHNOLOGY**

**W**hile working many years on building electronic neural implants for disease treatment at The Ohio State University, Electrical and Computer Engineering (ECE) Assistant Professor **Liang Guo** finally took a step back and saw a new vision





for the future. Why are they trying to force the body to accept electronic implants it is not naturally designed to? Research shows it is not a long-term solution. Instead, why not employ living cells performing their natural functions and get better results?

Imagine implanting a cardiac pacemaker, grown from the patient's own cells, back inside the body to assist the diseased heart, powered simply by the natural flow of blood.

This realization made Guo rethink his entire philosophy regarding implantable medical electronics, to the point of veering his research into the new realms of biocircuit engineering to create autologous medical devices.

Guo believes this is the hope of new implantable technology. The question now is, where do they start?

"The best way is to learn from nature," he said. "In this process, we can learn how the neurobiological circuits are designed from living cells. Once we learn enough, we may be able to expand to artificial designs on those biological principles. That's my whole philosophy."

The Defense Advanced Research Projects Agency (DARPA) sees the potential. Guo just received \$499,999 in funding over the next two years by winning the prestigious DARPA Young Faculty Award for his proposal, "Implantable, Programmable Integrated Cellular Circuits."

Guo has a joint faculty appoint-

ment between ECE and Neuroscience. The Neuroscience Research Institute at Ohio State provides its Neuromodulation Lab space for his work in the Biomedical Research Tower to facilitate novel and important innovations in neuromodulation at the university.

With the funding in place, he is visibly excited to begin.

"I was so surprised," Guo said about being selected by DARPA. "We feel so lucky it got funded."

When it comes to looking to nature for simple neurobiological circuits to initiate this engineering endeavor, Guo decided to follow the well-established lead of Columbia University Professor **Eric Kandel**, who won the 2000 Nobel Prize for his research on the physiological basis of memory storage in the simple neurobiological circuits of the *Aplysia californica* (also known as the California sea slug or sea hare).

Ohio State ECE Department Chair and Professor, **Joel Johnson**, said the DARPA Young Faculty Award is a significant achievement for a junior faculty member of the department.

"It's really going to stimulate our

work in the medical cellular circuits area for neural implants,” Johnson said. “This is an exciting area of research. There are a lot of innovations happening in this field at the current time, and the new collaborations we will be building with the Ohio State College of Medicine will lead to even greater research in medical applications in the future.”

Guo said the plan now is to forward engineer the classic gill-withdrawal reflex circuit inside the *Aplysia* from bottom up to recapitulate its natural functions.

“We understand this circuit very well. Cell by cell,” he said. “My goal is, can we isolate those cells and reconstruct the circuit in a culture dish? Furthermore, can we re-implant the constructed circuit back into the animal to see if it can be a substitute?”

Guo said using neurons to engineer neurobiological circuits is not a new idea or concept.

“It has been a few decades that

people have been trying to use neurons to engineer artificially designed circuits and devices, but most of the approaches either lack sufficient controls over the design or are trying to manipulate cells to do something they were not designed to do,” he said. “My idea and research concept is we should use these cells in the way they are designed by nature. We should first replicate their innate circuits, as faithfully as possible.”

Guo said they are on the ground floor of this research, but it shows potential to engineer tissue-like medical devices to eventually assist diseased or malfunctioning organs in the body.

“Once we master the skills and knowledge to engineer these innate cellular circuits, we can expand our capability to advance these, involving more cells and more artificial designs,” Guo said. “The best way to start is to try and mimic what is already there. It is guaranteed that these cells are designed for these circuits. How

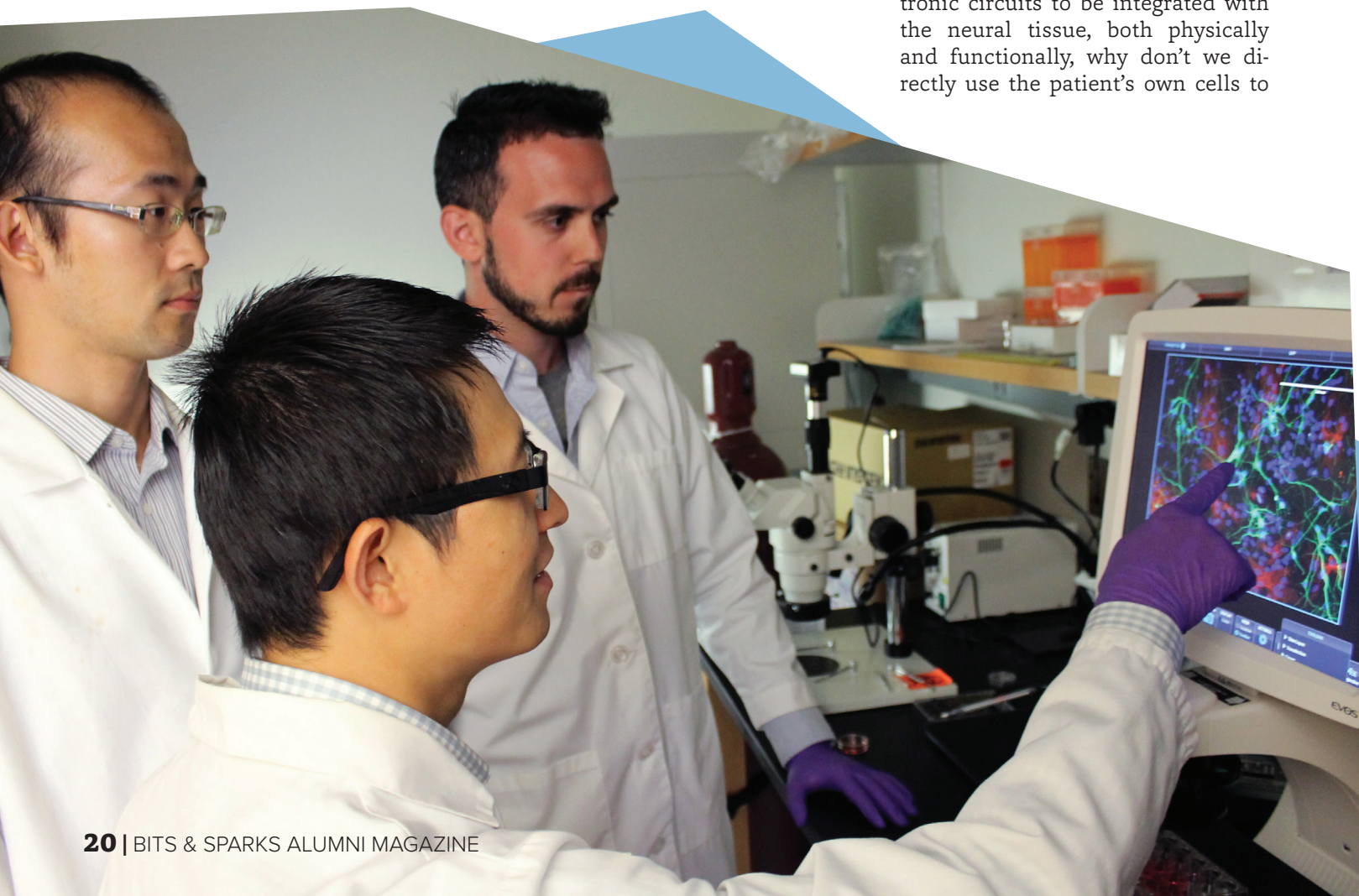
can we make that happen? That’s what we want to pursue in this project.”

He feels this is why DARPA is supporting the research. The goals of this project are logically more feasible.

“We just need to learn how to make it happen,” Guo said. “The funding is going to push this ambition.”

Currently, he said, neural prosthetic implants are already capable of changing behaviors in humans, or suppressing abnormal brain activities to help control Parkinson’s disease and epilepsy. However, existing technology is far from sufficient as a lifetime solution.

“I used to work on the implantable neuroelectronics. We built stretchable neural sensor arrays and we wanted to implant those sensors in the nervous system of the patient. But the foreign implant does not work well with the tissue. The body will not accept it well because it is made of alien materials and functions differently from the biological systems,” Guo said. “Since we want these electronic circuits to be integrated with the neural tissue, both physically and functionally, why don’t we directly use the patient’s own cells to





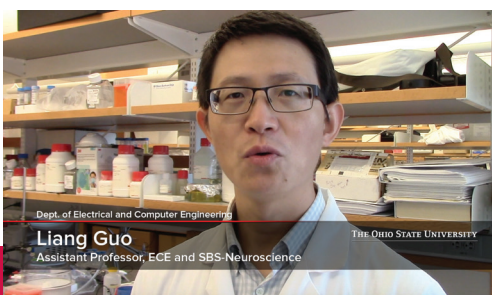
engineer these circuit functionalities, instead? So, that's how I came up from the traditional neuroelectronics research to this new line of biocircuit engineering."

Guo is working on the research with doctoral students, **Yu Wu** in ECE and **Jordan Prox** in the Biomedical Sciences Graduate Program, at the Biomedical Research Tower.

"This is very promising," Wu said about their work. "Aplysia is a very simple animal. It has already been used in textbooks. It has been very extensively studied. Technically, we can overcome many barriers to directly pursue our goal to program the neural circuits to do what we want."

With a background primarily in biochemistry and molecular biology, Prox was attracted to neural engineering because of its emerging technical potential. He sought out Guo for more expertise.

"He is one of the very few neuro-engineers here right now," Prox said. "It's a more simplistic approach compared to our previous projects, taking a design that has already been used and trying to modify it and add different approaches for being able to modulate different behaviors." ■



Watch a short video of Liang Guo discussing his research in the lab: <http://go.osu.edu/guo-vid>

Continued from **CROPS** on page 17 →

The students involved said they see the value of the project for its potential positive impact on mankind.

"I come from Thailand," ECE student **Nan Visudchindaporn** said. "The plant is very special for our economy. If we can develop (this technology) and find the correlation between the disease of the plant, it will be helpful not only to farmers but everyone."

She is also glad to have the extra experience working and becoming friends with students from all over the world.

"Thai students are the minority in electrical engineering," she said. "But I learn how to do teamwork skills. I learn how to communicate and know many different friends in different countries – like Chinese, Korean, American. Yeah, that's good."

Student **Weitong "Alex" Liang** was working with a group to move the camera poles without damaging the crops.

"I really love image processing," Liang said. "This is a hands-on project and you can learn a lot. In the classroom, the teacher or professor, always tells you what you need to do, what you need to look for. But for this project, it is real."

"They see how a team project works," Villarroel said. "There have been some who show leadership traits. I mean, the stuff from the classroom – when you bring it to the real world – it can be completely different. There are many soft skills that have to be developed and this will let them mature in a more professional manner."

The Early Disease Detection in Food Crops program is ultimately a multi-disciplinary project involving Advising Professor Dr. **John Fulton** from the Ohio State Department of Food, Agricultural and Biological Engineering, Professor **Sally Miller** from the Ohio State Department of Plant Pathology, the aforementioned Ohio State professor Jasinski, plus Fiorentini and Villarroel from the Ohio State Department of ECE.

The team continues to develop new proposals for further research in this realm. ■



Watch a video interview with students and faculty on-scene at the farm: <http://go.osu.edu/crops-v>



# NASA

COLLABORATIONS

## Ohio State assists on CYGNSS project, a 'game changer' in hurricane prediction

**T**he "Morning Edition" radio show on NPR featured a June 1 spot on NASA's \$150 million Cyclone Global Navigation Satellite System (CYGNSS) mission, and scientists from The Ohio State University Department of Electrical and Computer Engineering are part of the team that made it a reality.

The December 15, 2016 launch of CYGNSS finally allows for a deeper understanding of how and why hurricanes develop and intensify. The data that comes back may prove key to forecasting accurate and life-saving information.



## Columbus Clippers feature Ohio State CubeSAT research

**T**he Columbus Clippers featured NASA satellite research from The Ohio State University during its recent National Space Weekend campaign.

Located at Huntington Park over May 6 and 7, the events featured interactive displays of space suits, moon rocks, rockets and an appearance by NASA Astronaut **Tom Henricks**.

Ohio State Department of Electrical and Computer Engineering (ECE) research scientist **Christopher Ball**, research associates **Mark Andrews** and **Christa McKelvey**, as well as research assistant professor **Graeme Smith**, also presented their work on the development of NASA's CubeSat Radiometer Radio Frequency Interference Technology

Validation (CubeRRT) project over the two day event. The faculty are based out of the ElectroScience Laboratory at Ohio State.

Ball led interested pedestrians through the basics of Ohio State's CubeRRT research.

Ohio State ECE Department Chair and Professor, **Joel Johnson**, leads the CubeRRT program, which received \$5.6 million from NASA's Science Mission Directorate in 2015.

Ohio State's efforts are part of a larger NASA CubeSat initiative. CubeSats are satellites small enough to fit in the palm of the hand, or as big as a large shoebox, designed to test new technologies in space. NASA is exploring new launch options through the commercial small spacecraft industry in order to fast track many of these technologies.

A previous story on the project and CubeRRT's technologies is outlined in the article, "Navigating the Noise," online at:

<http://go.osu.edu/navigating-ece>

Ball said the people who stopped by to learn about their CubeRRT research project during the Clippers games "overwhelmingly seemed to think that

our work is very cool and fascinating."

According to their research, as humans expand their technological presence across the globe, the growth of manmade radio transmissions is making it increasingly difficult to detect Earth's microwave radiation used for studying atmospheric water vapor or soil moisture from space. This has required new advancements in radio frequency interference (RFI) technology to help separate the manmade signals from the natural.

Johnson and his team at Ohio State specialize in such technology. Ohio State is the only national university in leading one of the four 2015 selected projects for NASA's In-Space Validation of Earth Science Technologies, or InVEST, and is working in partnership with investigators from NASA Jet Propulsion Laboratory and NASA Goddard Space Flight Center.

Johnson said the Clipper's event featured the Cubesat 3-D model with poster information and a video, as well as a NASA activity sheet to allow children to build their own cardboard models. ■

Ohio State ECE Chair and Professor **Joel Johnson** is co-investigator on the CYGNSS Science Team, along with ElectroScience Lab (ESL) Research Scientist **Andrew O'Brien**. The project is led by Atmospheric Science and Electrical Engineering Professor **Chris Ruf** at the University of Michigan.

"Our team has been involved with several aspects of the project, including the development of a tool to simulate the mission and its performance, as well as a ground-based system to help calibrate the satellite measurements," Johnson said.

According to NASA, CYGNSS is a constellation of eight small satellites carried to orbit on a single launch vehicle intended to advance the forecasting and tracking methods of weather on Earth.

As NPR reporter **Paul Flahive** reveals in the story, "Predicting a hurri-

cane's intensity may have gotten easier," this new technology could have warned meteorologists about recent rapid-changing storms, such as Hurricane Matthew, which wrought widespread destruction and catastrophic loss of life during its journey across the Western Atlantic, including parts of Haiti, Cuba, Dominican Republic, the Lucayan Archipelago, the southeastern United States, and the Canadian Maritimes. A total of 603 deaths were attributed to the storm.

"Researchers say CYGNSS could be a game changer because of the amount of quality data it will provide," Flahive said.

Once in orbit, the mission of CYGNSS is to study the relationship between ocean surface properties, moist atmospheric thermodynamics, radiation and convective dynamics to determine how a tropical cyclone forms and

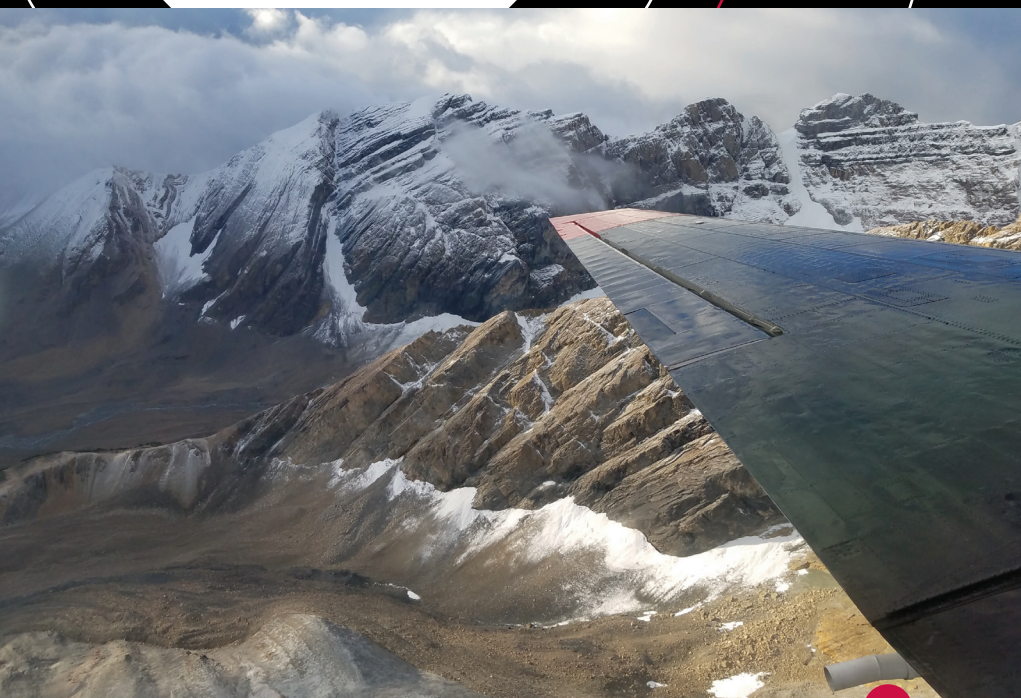
whether it will strengthen or not.

"CYGNSS will be the first to probe the inner core of hurricanes in greater detail to better understand their rapid intensification," Michael Finnerman said, of NASA's Langley Research Center.

Once in orbit, CYGNSS micro-satellite observatories will receive direct and reflected signals from Global Positioning System (GPS) satellites. The direct signals pinpoint CYGNSS observatory positions, while the reflected signals respond to ocean surface roughness, from which wind speed is retrieved.

"This mission will help us get a better idea of the intensity of tropical cyclones," said **Frank Peri**, director of the Earth Systems Science Program Office (ESSPO), based at NASA's Langley Research Center in Hampton, Virginia. ■

For more information about CYGNSS, visit: <https://www.nasa.gov/cygnss>.



## Two researchers from The Ohio State University recently returned from a journey measuring the internal temperatures of the Greenland ice sheet.

**W**hat makes this feat so impressive is for the first time they did it from an airplane. Their work explores options for how scientists gather future data to help advance climate science and further understand the movement of glacial ice around the world.

With the help of NASA funding, Ohio State ElectroScience Laboratory Research Associates **Mark Andrews** and **Domenic Belgiovane** headed north in September to test the technology they created under the project, “UWBRAD: Ultra Wideband Software Defined Microwave Radiometer for Ice Sheet Subsurface Temperature Sensing.”

Project leader **Joel Johnson**, Professor and Chair of Ohio State’s Department of Electrical and Computer Engineering, said the ice sheets of Greenland and

Antarctica play an important role in the global climate. Knowing the temperature of the ice at different depths is central to modeling ice sheet movement behavior.

“They contain about 70 percent of the world’s fresh water, and gauging temperatures deep beneath their surface is a critical way to predict how they might evolve in the future,” he said.

Professor **Ken Jezek**, a glaciology expert with Ohio State Byrd Polar Research Center, said the UWBRAD technology is intended to be “vastly more efficient” at measuring glacier subsurface temperatures over current methods – sending ground crews out to drill boreholes into the ice, up to a mile deep in some locations. He said this drilling is not only dangerous, it’s expensive, and only a few holes were ever created.

Conducting ice sheet thermometry from an airplane or even a spacecraft, he said, is faster, cheaper, and allows for readings over much greater geographic areas.

In this regard, the UWBRAD mission sets a new precedent.

“There is currently no way of getting temperature information below the surface,” Andrews said. “The surface temperature you can get through various means, but that doesn’t tell you much information about what is going on underneath. There hasn’t been any particular way of trying to figure that out yet from remote sensing. So, this is a first attempt at it.”

Belgiovane said his primary role on the mission involved working with project co-leader **Chi-Chih Chen** in the design of the antenna and assisting Andrews on the mission. He was involved in building the antenna from its initial concept and testing to its eventual flight deployment. The antenna had to withstand the rigors that come with being attached to the bottom of a DC-3 aircraft camera port in mid-flight. It did so successfully.

The point of the Ohio State research mission to Greenland this year was to test the hypothesis: Can their microwave radiometer collect information to use in determining subsurface ice temperatures?

Despite some challenges on the trip, Andrews said, the readings proved successful. “(UWBRAD) looks promising,” Andrews said. “We can tell that we’re getting radiometric readings and they are stable.”

The UWBRAD sensor is a specialized microwave radiometer designed to receive the naturally occurring low-frequency microwaves given off by the Earth. Because UWBRAD measures these microwaves at different frequencies, which correspond to different depths inside the ice sheet, it becomes possi-



ble to determine the temperature of ice hundreds of meters below the surface without boring holes.

"One of the ways I usually describe how the instrument works, and radiometry in general, is that literally we are looking at the world in a different light," Andrews said. "This radiometry is an even lower frequency than infrared, that's one way to help people understand what we're looking at."

Andrews said the inspiration for UWBRAD came about because radiometers in space detected a brightness temperature anomaly over Antarctica. That anomaly lined up with the location of Lake Vostok – the largest of Antarctica's almost 400 known lakes hidden underneath the glaciers. This discovery highlighted the potential of their work for observing features occurring beneath the ice sheet surface.

Unfortunately, Andrews said, while retrieving data over Greenland the instruments shut down twice, and man-made radio frequency interference (RFI) emitting from the more heavily populated areas clouded out some results as well.

Despite the challenges, he said, the UWBRAD team presented their data to NASA and were granted authorization to return to Greenland for a second attempt.

"We would definitely would like to go again," Andrews said.

Both researchers said they are grateful for being able to work on the UWBRAD project.

"Not many graduate students get to have such a great experience of having their work be flown on a science campaign and even less get to go along for the ride," Belgiovane said. "I had a very unique opportunity"

One of the downsides to such a scientific mission, Andrews said, was that the team was often too busy making sure everything was working to sit back and enjoy the experience of flying over the glaciers.

"It definitely was an interesting experience," Andrews said. "We're at the airbase and there are these arctic foxes walking around. It was obviously very beautiful looking out the windows of the airplane." ■



## NASA Collaboration: Alexandra Bringer

**A**s part of the ElectroScience Laboratory (ESL) at The Ohio State University, **Alexandra Bringer** is helping to advance the technology behind climate science for future generations as an electrical and computer engineering (ECE) senior researcher associate.

"If we want to live longer on Earth, we have to know how to preserve it," Bringer said. "You cannot just do nothing and see what happens. It is critical to think more about preserving it."

Originally from France, Bringer came to Ohio State to get more involved in remote sensing research. She is part of an Ohio State team currently assisting NASA on several projects in this realm.

For example, Bringer said, the "UWBRAD: Ultra-Wideband Software Defined Microwave Radiometer for Ice Sheet Subsurface Temperature Sensing" project is interesting because the physical temperature of the Greenland ice sheet can be directly retrieved from the multi frequency measurements of its own thermal emissions.

She said knowing the physical temperatures inside the ice sheet is key for understanding its deformation and motion, as well as dynamics. Awareness of these forces within Earth's ice sheets is important for future prediction of ice coverage and rising sea levels. The UWBRAD radiometer provides real data on this front, she said. The tool was first deployed over Greenland in September 2016 and performed a second campaign deployment in September 2017 to back it up.

Meanwhile, the team is also looking for different applications for the instrument, such as detecting mountain snow thickness, or even mapping aquifers trapped "in firn," a technical name for

partially compacted snow leftover on the ice sheets from previous years.

"It's like wet snow in firn instead of 'just ice,'" Bringer said about the aquifers, "but it does not freeze in winter nor throughout the year. The idea is to measure the thermal emission over an aquifer region with the radiometer and try to see if there is a particular signature of the brightness temperature to retrieve some physical information about the aquifer itself."

Between the satellite data and the second UWBRAD flyover deployment over Greenland, she said they hope to combine data and map the aquifers.

"The wetness of the firn aquifer varies with the seasons, which causes a change in the brightness temperature and this signature is noticeable when looking at radiometer data in the course of a year," Bringer said. "We're trying to understand this signature and model that. Thermal emissions from the ice may line up to these."

Remote sensing technology has many different scientific applications. Bringer's research currently focuses on the cryosphere—or portions of the Earth's surface where water is frozen solid.

"I was previously doing my PhD on remote sensing over the ocean," Bringer said. "You can switch from different areas and use the same kind of skills."

Bringer said she feels grateful for being able to work under the guidance of Johnson and the people at ESL, especially on such high-level projects.

"Human activity is really impacting our environment. You can see that, for example, with global warming, which causes the rising sea level. It is really sad when you look at stuff like that and people get skeptical and say that it's not happening, but it is. To be aware of that is really important," Bringer said. "Working in fields like remote sensing, we can monitor climate changes over time and make people aware." ■

Learn more about the UWBRAD project: <http://go.osu.edu/ice-ece>

Learn more about the SMAP project: <http://go.osu.edu/smap-ece>



## ECE TEAM WINS \$3 MILLION TO ADVANCE INFRARED DETECTOR TECHNOLOGIES AT OHIO STATE

LANDING PLANES IN ZERO VISIBILITY.  
DETECTING POLLUTION AT THE NANOSCALE.

A potential \$3 million in new grant funding could help make The Ohio State University a worldwide leader in next-generation infrared detector technologies.

Electrical and computer engineering (ECE) professor **Sanjay Krishna** had only been at Ohio State a month, hired as part of the university's Materials and Manufacturing for Sustainability (M&MS) Discovery Themes initiative, before landing the grant from the Office of Naval Research (ONR).

"This means great things for Ohio State's Materials and Manufacturing for Sustainability Discovery Theme initiative," Ohio State professor **Steve Ringel** said, who leads the M&MS program to create pre-eminence in materials and technologies for sustainability, focusing on innovation and industry deployment.

"Sanjay is the epitome of what M&MS is all about," Ringel said. "Not only is he a world leader in critical areas of science and technology that impact energy and the environment who, through awards such as this, is already enhancing our prominence academically, but he is also dedicated to the translation of those successes into the private sector through his innovative activities as an entrepreneur."

The new grant funding comes on behalf of the High Energy Laser Joint Technology Office (HEL-JTO) Multidisciplinary University Research Initiative (MURI) Program, under the Secretary of Defense for Science and Technology, (DUSDS&T).

It is an alphabet soup of acronyms, for sure, but Krishna said the intention of the grant award is

simple – to explore new realms of infrared camera technologies and set the stage for more advancements decades down the line.

Krishna is a world-leading researcher and innovator in the field of narrow bandgap semiconductors applied to infrared imaging sensors and related technologies.

"I want to make Ohio State the number one research group in this particular area," Krishna said.

His winning research proposal, "Low Excess-noise Avalanche Photodetectors with Superlattices (LEAPS)," outlines research and development toward high performance short wavelength infrared detectors based on III-V semiconductors designed for manufacturing.

"Infrared detectors are important because they can be used for chemical sensing," Krishna said. "If you want to find out what is coming out of a factory, or what pollution is coming out of a car. Usually these hydrocarbons have characteristic signatures



of nature in the infrared. So, if you send a laser beam and watch it come back, you can see that it's nitrogen oxide or carbon dioxide, or even methane."

He said infrared detectors can enhance the ability to see through objects.

"If you are landing a plane in wet and foggy conditions, you can see. If a firefighter or first responder is entering a building, you can see in the infrared beyond what you can see in the visible," Krishna said.

Infrared technology can also study how heat dissipates from the human body.

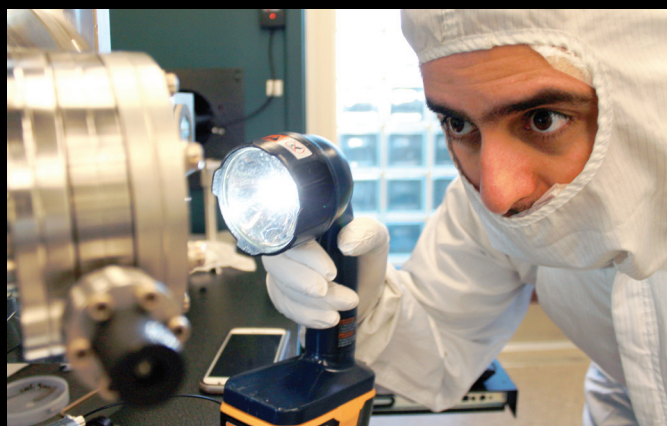
"We are currently emitting photons," he said. "You can use this for not only human detection, but also temperature profiles of human beings. This can be applied for a variety of medical applications, including the early detection of skin cancer."

Krishna said the list goes on to include medical imaging, corrosion detection and food safety applications.

The final task of their grant award is to train new students to take up the proverbial infrared research baton for generations to come, Krishna said.

The professor said he would like to position Ohio State as one of the only two universities in the United States with the ability to undertake "design to camera" research and development in the infrared field.

Collaborators on the project include the University of Virginia, the MIT Lincoln Lab, the University of Illinois, Chicago and industry representative L-3 Cincinnati Electronics. ■



## **FUTURE COLLABORATIVE EFFORTS BETWEEN THE OHIO STATE UNIVERSITY AND NORTHROP GRUMMAN AEROSPACE SYSTEMS COULD BOLSTER UNDER A RECENT FINANCIAL GIFT.**

**N**ima Ghalichechian, an assistant professor in electrical and computer engineering at Ohio State, received a \$40,000 grant from the company this month in support of his research into radio frequency (RF) micro-electro-mechanical (MEMS) and microsystems.

"We are interested in working with Northrop Grumman in the future to develop major programs with DARPA and other defense agencies," he said. "We recently wrote a white paper and are working on future proposals with them. Using PCM for reconfigurable RF microsystems provides a path for millimeter-wave applications where losses are typically large, compared to microwave."

PCM refers to his research into phase change materials. Such materials change their electrical conductivity drastically at a given temperature. The process makes it possible to maximize the performance of antenna systems in orbit.

"These are materials that fit into reconfigurable antennas at high fre-

quencies," he said. "They are materials that can be conductors or dielectric at two different temperatures."

Such systems are used primarily for high-bandwidth, high-data-rate communications, Ghalichechian said.

"The fact that people want to make them reconfigurable," he said, "converts a fixed antenna into a smart system that can adapt and work at different conditions, including multiple frequencies."

Ghalichechian said Northrop Grumman builds a lot of satellite antennas, and remains a "major player" in the fields of wireless communications and remote sensing space applications.

As a result of the company's research gift, he said, one Ohio State graduate student will be hired to assist him on the project over the next year.

Ghalichechian currently leads his research through the Ohio State RF Microsystems group, which performs microfabrication out of the cleanroom facilities inside the Nanotech West Laboratory. ■

# AWARDS

**PICTURED:** ECE LECTURER  
**RYAN MCPHERSON** WON THE  
DISTINGUISHED TEACHING BY A  
LECTURER AWARD FROM THE OHIO  
STATE UNIVERSITY.  
SEE FULL STORY ON PAGE 34.





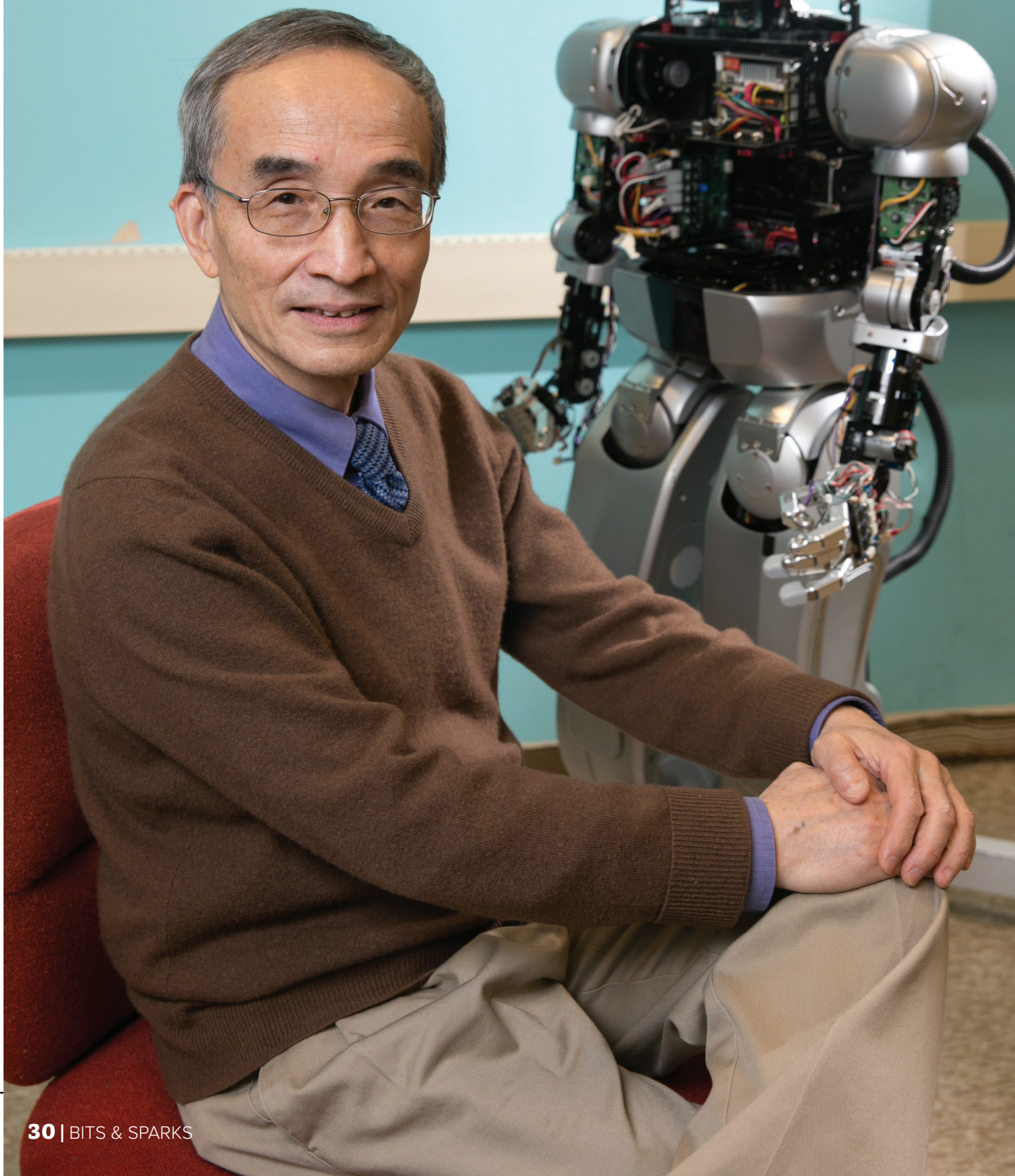


*“There are only six of these awards out of over 3,000 eligible faculty, and these awards actually emerge from the accolades of the students you are teaching,”*  
**Bruce McPheron**, Ohio State Executive VP and Provost.



2016 INNOVATOR OF THE YEAR:

# YUAN ZHENG





A LEADER IN ROBOTICS RESEARCH FOR MORE THAN 35 YEARS, THE OHIO  
STATE UNIVERSITY NAMED ELECTRICAL AND COMPUTER ENGINEERING  
PROFESSOR **YUAN ZHENG** INNOVATOR OF THE YEAR IN 2016.

Article written by Lydia Freudenberg and Ryan Horns

As Ohio State continues to expand its role in the commercialization of research, it is working to create an environment that facilitates and rewards research creativity and entrepreneurship. To support and stimulate entrepreneurial activity among Ohio State researchers, three university-wide awards were presented on January 25, 2017 to Ohio State's most successful entrepreneurs.

In 2014, Zheng developed the Circular Wave Drive (CWD), a compact and co-axial gear head that allows for speed reduction in rotational motions. Speed reducers represent 36% of the total cost of an industrial robot. Zheng's CWD was developed as a replacement for the traditional Harmonic Drive Gear (HDG) technology used widely in the robotics industry. The HDG technology uses a special metal alloy that has to be replaced every two years and requires expensive high precision machining.

Zheng's CWD technology, however, overcomes the shortcomings of the HDG. He developed a low-cost, compact, highly-efficient, ruggedized speed reducing gear system. He increased torque capacity and the life span of the gear by eliminating the use of flexible materials in the design. This invention could mean the formation of a new market of ultra-fast, high-precision steering and automation beyond robotic joints.

IKOVE, a local venture capital company, licensed his technology from the university in 2015 and founded a start-up company called CWD LLC. One U.S. patent was

approved in November, and one international patent is filed. Funding from the Ohio Third Frontier's Technology Validation and Start-up Fund was used to design and fabricate a prototype CWD.

Zheng said faculty and staff of the ECE Department helped develop advanced performance testing of the precision gear box, with a notable contribution from laboratory supervisor **Bill Thalgott**.

The Innovator of the Year awards recognize Ohio State researchers who are working actively to promote commercialization of university intellectual property, through invention disclosures filed, patents applied for and/or received, technologies licensed or spin-off companies formed. These activities support economic development in the Central Ohio region, and serve to attract companies that create a base of operations within the state.

Before he became an internationally recognized robotics researcher, Zheng obtained his bachelors in his home country of China, and then moved to America where he received a Masters and PhD in ECE at Ohio State. By 1989, Zheng returned to teach at Ohio State after spending some time at Clemson University in South Carolina.

Due to his respect amongst the engineering community, Zheng was recently invited by his former PhD student, Dr. **Omar M. Al-Jarrah**, who is now the president of the Jordan University of Science and Technology, to be a keynote speaker for the young researchers at the annual In-

ternational Conference on Information and Communication Systems (ICICS) in Irbid, Jordan.

The conference took place back in the beginning of April, where Zheng spoke about his "studies on the radiation impact to harmonic drive (a speed reducer used in high-end robotic systems), brushless DC motor, and Lithium-ion batteries."

"Perhaps [I can] give them some direction and encouragement to continue the research in what I am doing or even expand the research activity in my field," Zheng said.

His team is curious to see how the radiation would affect the performance of robotics. At the conference, he talked about their theoretical and experimental studies, and made clear that research is still underway to find further results. In the end, he was able to discuss "how to design and develop radiation-hardened components, which can enable a robot to endure radiation-filled environments."

Currently, Zheng is working on robotics that can help disabled people walk. He is also working on starting up his Columbus-based company, Sparrow Robotics, LLC.

"I have already started to prepare a business to commercialize technology I have invented in my laboratory," said Zheng. "[I enjoy doing] research to achieve results and put the results in use to benefit society."

Zheng has been with Ohio State in the ECE department for over 30 years. ■

# OHIO STATE TAKES HOME THIRD-YEAR ECOCAR 3 WIN



The Ohio State University took home first place in the third year of EcoCAR 3, an Advanced Vehicle Technology Competition, sponsored by the U.S. Department of Energy (DOE) and General Motors Co.

Ohio State EcoCAR is a student-run team out of the Center for Automotive Research, recently led by electrical and computer engineering student **Andrew Huster**. The team is made up of scholars in other Ohio State disciplines, such as Industrial Systems, Mechanical Engineering and Communications.

The team was recognized for its outstanding performance across all events of the competition, taking home 15 awards and over \$20,000 in award money.

"I'm extremely proud of all the talented people on the team and the hard work they gave to the project," Huster said. "It's been an honor to be the team leader. And it's great to finish up my

EcoCAR experience with a win."

"They're the best prepared OSU team that I've brought to an EcoCAR competition," Faculty Advisor, Dr. **Shawn Midlam-Mohler** said. "They set the stage for a great competition by putting over 2000 miles on the car prior to coming, and gave so much of their time to the competition."

"We need affordable, secure, domestic, and clean energy technologies to move people and goods across America. Developing innovative technologies that improve vehicle efficiency and enhance mobility will grow our economy and create jobs," said Acting Assistant Secretary for EERE, **Daniel Simmons**. "Students in the EcoCAR 3 program are our future technology leaders that will keep the American automotive industry moving forward."

EcoCAR 3 is a four-year collegiate engineering program that builds on the successful 26-year history of Department of Energy Advanced Vehicle Technology Competitions by giving engineering students the chance to

design and build advanced vehicles that demonstrate leading-edge automotive technologies.

In addition to the coveted trophy and bragging rights, the Buckeyes become this year's best and brightest students in automotive engineering as they unlock solutions to our nation's transportation and energy challenges. The team earned 853.7 out of 1000 overall points while also taking the top spot in multiple categories including, but not limited to Project Management, Vehicle Design Review and Emissions & Energy Consumption.

EcoCAR 3 is the latest Energy Department Advanced Vehicle Technology Competition (AVTC) series and challenges 16 North American university teams to redesign a 2016 Chevrolet Camaro by incorporating cutting-edge advanced powertrains as well as emerging connected and automated vehicle technologies that are helping to re-invent the future of mobility. During development and demonstration, teams must also maintain the engineering mastery





and expectations of this iconic American car. EcoCAR 3 teams have four years (2014-2018) to harness those ideas into the ultimate energy-efficient, high performance vehicle.

The competition included a week of rigorous safety, technical, drive quality and emissions testing of the team Camaros at GM's Milford Proving Ground in Milford, Michigan. Next, teams had several days of presentations to show judges how they have developed as the next generation of engineers and business leaders who will be better prepared for the auto industry and related careers. Presentations took place in Washington, D.C., with students judged by industry and government officials.

"EcoCAR 3 is a great program that fosters future generations of automotive engineers and business people, encouraging them to become true innovators," said **Mark Reuss**, GM executive vice president, Global Product Development, Purchasing and Supply Chain. "This year's winners – and all the teams – are proof of that. It's a competition that GM is proud to support."

This year, the teams gained hands-on experience by building and refining their advanced technology vehicles, and incorporated an industry-standard multi-year vehicle development

process. Teams were able to achieve their goal of presenting a fully integrated vehicle capable of driving in both electric and conventional mode while sustaining a charge.

AVTCs have long provided a real-world training ground that transcends the traditional classroom for college students. Through EcoCAR 3, teams are able to demonstrate emerging automotive technologies to help strengthen American competitiveness.

"Ohio State fully integrated their vehicle with impressive attention to details, and they managed to maintain the legacy of the Camaro while moving it into the future," said **Kristen Wahl**, director of the Advanced Vehicle Technology Competition at Argonne National Laboratory. "Innovative thinking and tireless devotion clearly contributed to the team's success."

"It was awesome winning the Best Project Status Presentation and First-Place Project Management award," Project Manager, recently graduated **Nick Tomczak**, said. "It's been really great to have a team behind me who supported me and worked diligently to produce a reliable vehicle."

Year Three might have just ended, but the team is already looking forward to Year Four, the final year of the competition. **Brandon Bishop**, a first-year Master's student majoring

in mechanical engineering, will be stepping up into the Team Leader/Engineering Manager role next year.

"I'm really glad to step into a higher leadership role and looking forward to continuing our tradition of excellence," Bishop says. "Everyone is so great to work with and coming off a win, everyone is going to be really motivated to keep it going and will be working hard all year long."

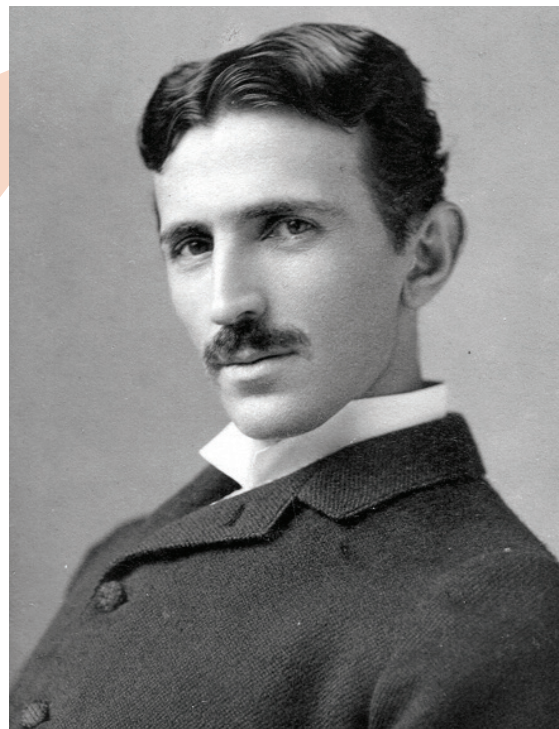
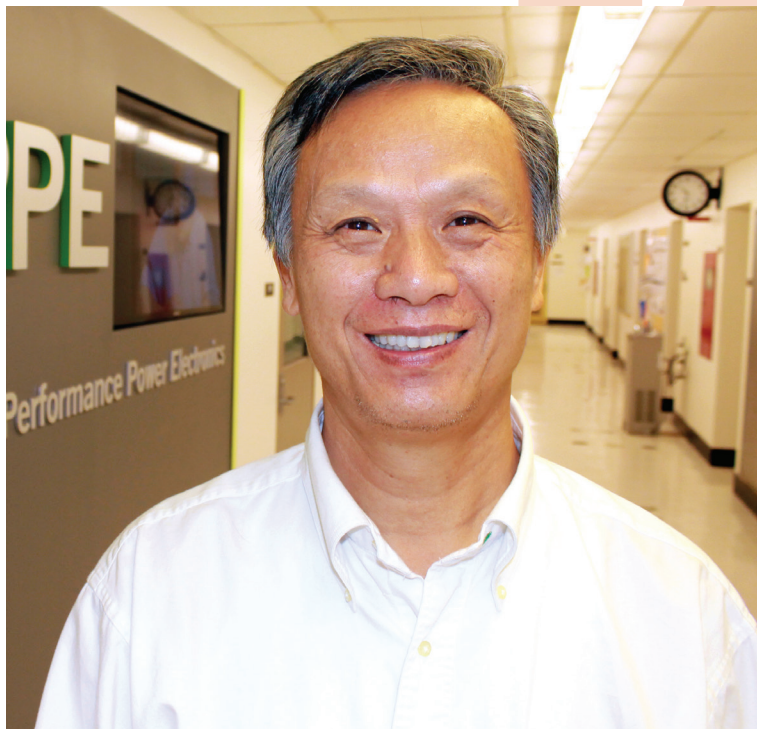
Embry-Riddle Aeronautical University and Georgia Tech took second and third place respectively. The student teams have now developed and integrated their energy efficient powertrains to maximize performance while retaining the safety and high consumer standards of the Chevrolet Camaro. In the final year of competition, teams will focus on controls refinement and market engagement.

Additional sponsors joining the DOE and GM include: MathWorks; National Science Foundation; California Air Resources Board; NXP; AVL Powertrain Engineering; Robert Bosch, LLC; ETAS; PACCAR; dSPACE, Inc.; Snap-on Tools; Siemens PLM Software; GKN Driveline; Transportation Research Center (TRC, Inc.); DENSO; Champlain Cable Corp.; Woodward; Proterra; Ricardo; Mentor Graphics; New Eagle; tesa tape; Vector CANtech, Inc.; Delphi Foundation; EcoMotors; Electric Power Research Institute, Inc.; A123 Systems; Flextronics; and Samsung SDI.

EcoCAR 3 industry sponsors have provided more than \$6.1 million in hardware and cash donations, as well as \$911 million in software to the 16 participating universities in the first three years. Find the EcoCAR 3 program online at: [www.ecocar3.org](http://www.ecocar3.org) ■

**ABOUT ECOCAR 3** | EcoCAR 3 is a four-year collegiate engineering program that builds on the successful 26-year history of Department of Energy (DOE) Advanced Vehicle Technology Competitions (AVTC) by giving engineering students the chance to design and build advanced vehicles that demonstrate leading-edge automotive technologies. General Motors provides each of the 16 competing teams with a 2016 Chevrolet Camaro, as well

as vehicle components, seed money, technical mentoring and operational support. The DOE and its research and development facility, Argonne National Laboratory, provide competition management, team evaluation and logistical support. Through this important public/private partnership, EcoCAR 3 provides invaluable experience and training to promising young minds entering the North American job market. ■



## FIRST AT OHIO STATE: XU TO WIN IEEE TESLA AWARD

An engineering professor from The Ohio State University was selected to become the first winner of the prestigious 2018 Nikola Tesla Award in the school's history.

The honor is presented annually by the Institute of Electrical and Electronics Engineers (IEEE).

Ohio State Department of Electrical and Computer Engineering (ECE) Professor **Longya Xu**, the slated winner, is known for his "contributions to design and control of efficient electric machines for wind power generation and electrified vehicles."

Xu's specific research interests include power electronic converters and control of variable-speed drivers, just to name a few. He serves as Director for the Center for High Performance Power Electronics at Ohio State.

Named in honor of the late electrical engineering icon known for his development of the coil and the A/C induc-

tion motor, Nikola Tesla, the award was established in 1975 as a joint effort between the IEEE Power Engineering Society and the IEEE Board of Directors.

Xu received his PhD from the University of Wisconsin in 1990 and has taught at Ohio State ever since. Originally from China, however, he also consulted for many companies, such as Honeywell, Boeing, General Electric, and Raytheon Company.

"This honor is given to either an individual or a team of up to three researchers," the Technical Field Awards Council reported. "Impact on technology, leadership, and inventive value are just some of the criteria nominees are judged on."

The prize ultimately consists of a bronze medal, certificate and honorarium.



## BRILLSON WINS OHIO STATE 2017 DISTINGUISHED SCHOLAR AWARD



Trying to lure Ohio State Electrical and Computer Engineering (ECE) Professor **Len Brillson** into attending a surprise ceremony for winning the 2017 Distinguished Scholar Award was no easy task.

Behind the scenes, strings were pulled and his own family members helped make it happen, all in the midst of his daughter's wedding shower over the weekend. On April 4, university administrators and ECE faculty successfully presented him with the award.

Ohio State Executive Vice President and Provost, **Bruce McPheron**, said Brillson's academic achievements are outstanding. Only six professors earn the prestigious Distinguished Scholar distinction each year.

Ohio State Senior Vice President of Research, **Caroline Whitacre**, said Brillson is considered one of

the foremost world authorities in electronic material surfaces and interfaces. Twenty years ago he came to Ohio State from Xerox, where he served as Director of Advanced Components. He went on to publish more than 350 articles, write four books and file two patents. He also earned fellowship status across numerous scientific disciplines.

"I was impressed by all the cool stuff you get to work on," Whitacre said. "The cell phones, the lasers, the computers. You deal with all the stuff inside those."

"It's a lot of fun," Brillson said. "Hopefully for the students too."

**Janet Weisenberger**, senior associate vice president for research, said nominations for the award must help relay why a professor's research career is significant and worthy.

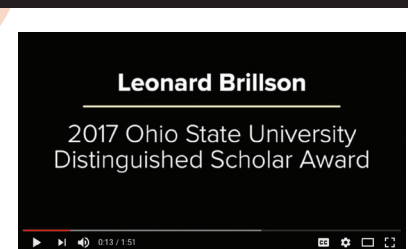
"We're all reading this dossier

about your contributions and we got the sense that if we were to open up our computers, or open up our cell phones, there would be a picture of Len Brillson," she joked.

Each year, the university recognizes and honors six faculty members who demonstrate scholarly activity, research or other creative works which represent exceptional achievements in their fields. Recipients of the award receive a \$20,000 research grant and a \$3,000 honorarium to pursue their scholarly activity.

Brillson is a professor and Center for Materials Research Scholar in the Department of Electrical and Computer Engineering, College of Engineering, and Department of Physics, College of Arts and Sciences.

Recipients are nominated by their departments and chosen by a committee of senior faculty, including past award recipients. Distinguished Scholars receive an honorarium and a research grant to be used over the next three years. The award is supported by the Office of Research.



Watch a video from the surprise award ceremony here:  
<http://go.osu.edu/brillsonvid>



## MCPHERSON WINS DISTINGUISHED TEACHING BY A LECTURER AWARD

In a surprise ceremony, Department of Electrical and Computer Engineering faculty member **Ryan McPherson** learned he won the 2017 Provost's Award for Distinguished Teaching by Lecturer from The Ohio State University.

The award is the highest honor bestowed by the university on lecturers.

Ohio State Executive Vice President and Provost, **Bruce McPherson**, presented the award and joked about the uncanny resemblance of their last names. He also helped put the honor into some perspective.

"There are only six of these

awards out of over 3,000 eligible faculty," he said. "And these awards actually emerge from the accolades of the students you are teaching. So, it's all about what is happening in the classroom."

ECE Chair **Joel Johnson** said having McPherson come on board in 2011 as lecturer resulted in drastic improvements in student ratings in multiple courses, and that his leadership in the department has only grown.

"It's been great. We couldn't have asked for a better member of our team here," Johnson said. "You really deserve this award, so I'm glad to

see you recognized."

An official award reception occurred in May. McPherson will also earn a cash award and have the honor of being recognized in a ceremony on the Ohio State football field during a game.

"To be suitably recognized by over 105,000 potential students," McPherson said.



Watch a video of McPherson receiving the award.  
<http://go.osu.edu/dl-vid>





## IEEE ELECTRON DEVICES SOCIETY HONORS BERGER

For his ongoing work as a Distinguished Lecturer, the IEEE Electron Devices Society (EDS) recently recognized Ohio State electrical and computer engineering (ECE) professor **Paul Berger**.

The professor has served as an EDS lecturer since 2011, and his areas of research focus on nanoelectronics, Si-based tunneling junctions, optoelectronic devices and integrated circuits, polymer-based photonics and electronics, as well as semiconductor materials.

Berger also holds a Courtesy Appointment in the Ohio State Department of Physics.

At Ohio State, the professor is the founder of the Nanoscale Patterning Laboratory and founder of the Nanoelectronics and Optoelectronics Laboratory and the Polymer Device Laboratory.

Berger is currently serving as a FiDiPro Professor and researcher at Tampere University of Technology, Finland.

Recently, his work in organic photovoltaics was featured by The National, in an article detailing the push to make high efficiency solar power more financially viable.



## EKICI NAMED 2017 IEEE FELLOW

For his multi-talented research efforts, Electrical and Computer engineering professor **Eylem Ekici** was just named the newest IEEE Fellow now educating students at The Ohio State University.

The Institute of Electrical and Electronics Engineers (IEEE) Board of Directors recommended to elevate Ekici to the status of Fellow at its November meeting.

The announcement brings the Ohio State ECE department's total number of IEEE Fellows to 20.

According to the organization, Ekici received the honor based on his "contributions to algorithms, protocols, and architectures of multi-hop wireless networks."

IEEE Fellowship status is considered the highest grade of membership, recognized by the technical community as a prestigious honor and an important career achievement.

According to IEEE President and CEO **Howard Michel**, less than 0.1 percent of IEEE voting members are selected for this recognition annually. Recipients are chosen after a "rigorous evaluation procedure" to honor their outstanding record of accomplishments in any of the IEEE fields of interest.

Ekici specializes in cognitive radio

To learn more about IEEE  
or the IEEE Fellow Program,  
visit [www.ieee.org](http://www.ieee.org).

networks, vehicular communication systems, and next generation wireless systems, with a focus on algorithm design, medium access control protocols, resource management, and analysis of network architectures and protocols.

The list of newly elevated 2017 Fellows also included two respected faculty from Ohio State's Computer Science and Engineering (CSE) Department, including Dr. **Tamal Dey** for his contributions to Geometric Computing, and Dr. **Prasun Sinha** for his contributions to Scheduling and Resource Allocations in Wireless Networks. Additionally, Ohio State Mechanical and Aerospace Engineering Professor **Carol Smidts** was named for her contributions to reliability analysis of high-assurance systems.

IEEE is the world's leading professional association for advancing technology for humanity. Through its 400,000 members in 160 countries, the organization is a leading authority on a wide variety of areas ranging from aerospace systems, computers and telecommunications to biomedical engineering, electric power and consumer electronics.

Dedicated to the advancement of technology, the IEEE publishes 30 percent of the world's literature in the electrical and electronics engineering and computer science fields, and has developed more than 900 active industry standards. The association also sponsors or co-sponsors nearly 400 international technical conferences each year.

## THREE ECE WOMEN EARN IREDEFINE AWARDS

The National Science Foundation (NSF) recently highlighted three Ohio State University students for their roles as exemplary women in the field of electrical and computer engineering (ECE).

ECE students **Nicole Tchorowski**, **Mariana Costa** and **Vinita Dahiya** were chosen by NSF to participate in its Workshop on Improving the Diversity of Faculty in Electrical and Computer Engineering (iREDEFINE ECE) and receive a Professional Development Award.

iREDEFINE ECE is an NSF supported project to help “motivate and prepare graduate women and underrepresented minority students to pursue faculty positions in American universities.”

The students were invited to attend the iREDEFINE Workshop held at the annual Electrical and Computer Engineering Department Heads Association (ECEDHA) conference, a venue to reach the highest concentration of ECE department chairs in attendance.

The iREDEFINE attendees present posters on their work to the ECE department chairs, giving them the opportunity to interact closely with the very people they will be contacting during their job search and also practice some of the skills that they learned the day before. The poster session then fed into a reception for Workshop attendees, ECE chairs and industry affiliates, which will offer further networking opportunities. In addition to the Workshop, a mentoring program established to extend beyond the workshop. The project is being evaluated and fine-tuned after the first offering to maximize its impact.

This effort will have a significant impact on the field of ECE and as a result the future of technology. Diversifying the faculty will help enhance the diversity of the student population in ECE by providing role models, and thus diversify the ECE workforce. As ECE is a major enabler in technological discovery, a more diverse practitioner/educator pool will lead to new perspectives on technological innovation and how that serves society. The project also serves as a potential model for improving diversity in STEM disciplines in general.



Husband and wife engineering team, **Atilla** and **Irem Eryilmaz**, won Best Paper at the 15th International Symposium on Modeling and Optimization in Mobile, Ad Hoc and Wireless Networks (WiOPT) in Paris.

## ESL STUDENT AWARDS

ECE student **Shubhendu Bhardwaj** won first place at the International Workshop on Antenna Technologies (iWAT) in Athens, Greece for his research work, “Phaseless Gain Measurement for CP Antennas in mm-wave and Terahertz Band,” authored with advisors **Niru Nhara** and **John Volakis**.



ECE doctoral student **Markus Novak**, a graduate fellow in the ElectroScience Lab, was among the IEEE Antennas and Propagation Society Doctoral Research Grant winners for his research proposal, “Ultra-Wideband RF Architecture for 5G Systems.”





**DEPARTMENT OF ELECTRICAL  
& COMPUTER ENGINEERING**

***Spring Graduate & Undergraduate Class of 2017!***




# SUPPORT

**PICTURED:** CHILDREN AT THE 2017 ROBOZOO MAKEATHON EVENT SHOW OFF THEIR ROBOTICS SKILLS FOR THIS OHIO STATE STUDENT-LED EVENT TO RAISE AWARENESS FOR STEM EDUCATION.







*“It’s a time in your life when  
you’re trying to figure out  
what you want to do,”*


– RoboZoo co-organizer and ECE  
student, **Clayton Greenbaum**



A woman with short, wavy brown hair and glasses perched on her head is smiling. She is wearing a red sweatshirt with "HIO STAT" printed on it. She is leaning her arms on a light-colored wooden deck railing. The railing has the words "HAPPY M" painted in red on it. In the background, there are bare trees and a house under a bright sky.

# **SUCCESSFUL CAMPAIGN: ECOS HITS WHEELCHAIR RAMP GOAL**





Over the past year, Columbus resident **Bonnie Bartee** fell and injured herself several times, simply trying to climb the stairs to her own home.

"I've had MS for 17 or 19 years now. I was falling a lot. It was awful. I cracked my head. I dislocated my knee. I was having all kinds of problems," Bartee said. "My doctor suggested getting a ramp so that I wouldn't trip. I haven't been falling at all since then. It's been great. I really appreciate it."

To support Bartee and many others resigned to life in wheelchairs or living unsteadily on their feet because of health problems, the Engineers for Community Service (ECOS) program at The Ohio State University stepped up to make a difference. Over the past 11 years, the team of student and faculty volunteers built 18 wheelchair ramps across Columbus at a cost of roughly \$1200 each.

Throughout the month of February, however, the ECOS team members sought public donations to continue their work to help others like Bartee, through the new Buckeye Funder campaign.

"I got involved with ECOS my freshman year. I had never used a drill, a saw, any woodworking tools before," ECOS president and ECE student **Mary Scherer** said. "With my electrical engineering background, I never thought that I would get the experience of designing a structure to code."

Scherer said the combination of volunteering and project management involved in each ECOS project has been rewarding.

"I can't think of any other club that really brings together the skills that we learn in the classroom, in such a hands-on way, that is so meaningful," she said. "Your donation helps purchase tools, helps purchase materials for ramps, goes toward the cost of permits. It has an enormous impact on Columbus community members in need." ■

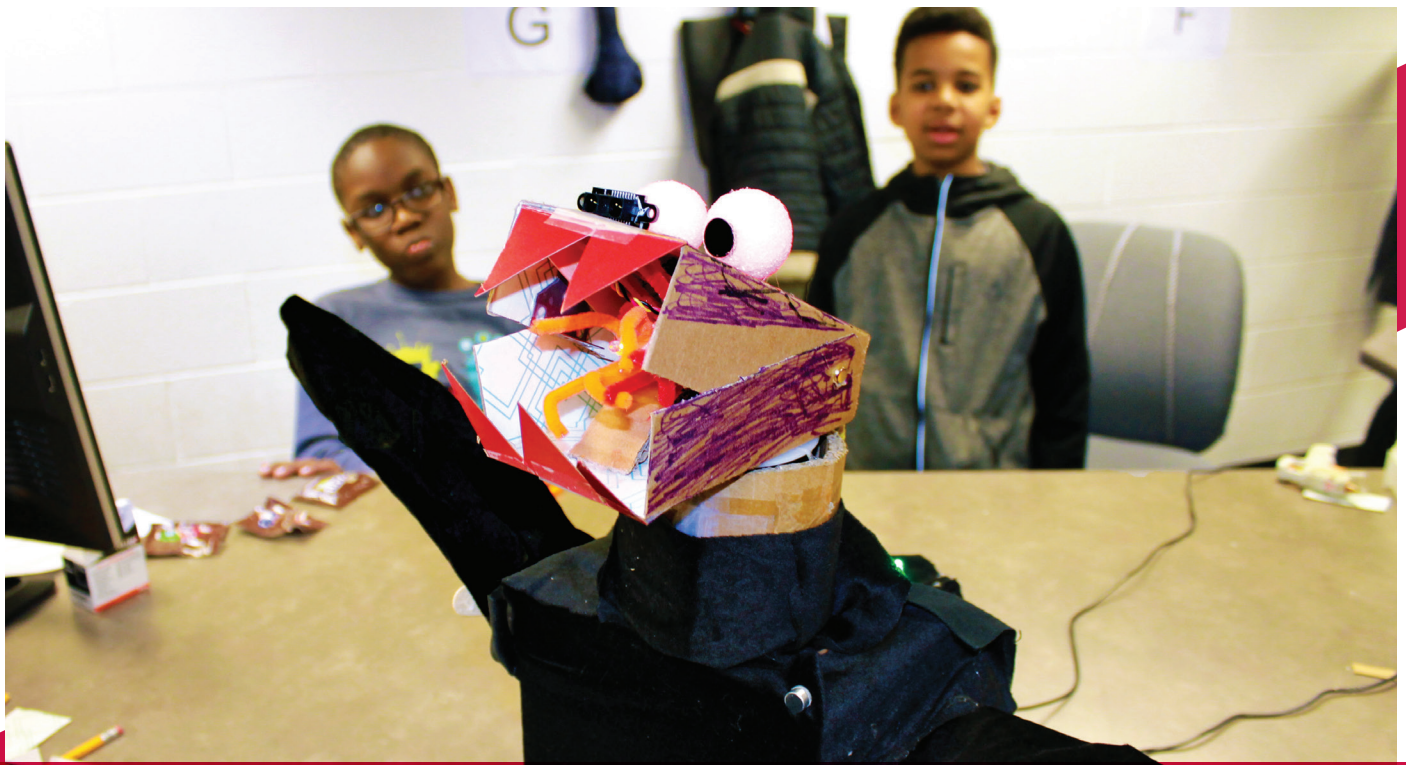
Watch the ECOS at Ohio State Wheelchair Ramp  
BuckeyeFunder Campaign Page:

<https://buckeyefunder.osu.edu/project/2150>

Donate to the ECOS program here:

<http://go.osu.edu/ecos-donate>





# ROBOZOO MAKEATHON INSPIRING NEXT-GEN ENGINEERS



**ROBO**  
*Zoo*

Watch a video recap of the camp and see pictures from the event  
<http://go.osu.edu/osu-robozoo>





**TEARS OF JOY AREN'T  
TYPICALLY ASSOCIATED WITH  
SCIENCE AND TECHNOLOGY,  
BUT THEY WERE INDEED SIDE  
EFFECTS OF THE RECENT  
ROBOZOO STEM CAMP FOR  
CHILDREN AT THE OHIO  
STATE UNIVERSITY.**

Over the course of three days, inside Hitchcock Hall on Ohio State campus, over a dozen youngsters sat coding, cutting cardboard, applying glitter and crafting robotic arms. An alumnus even donated his old Erector Set from the 1950s.

On the final day, parents arrived to see the big reveals.

"I am getting choked up just watching these kids," **Dr. Betty Lise Anderson** said, blinking.

As associate chair of Ohio State's Department of Electrical and Computer Engineering, and a faculty mentor for the camp, Anderson said each child overcame hurdles to be there, economic or personal.

In fact, the bus to Ohio State initially left behind a third-grade girl who was too young to participate. She broke down in tears when the bus left, only to cheer up when everyone collectively decided to turn the bus around and take her anyway.

"I think she is much smarter than most girls her age, so it worked out," Anderson said. "Some of the older girls took her under their wings. She's doing great."

Ohio State engineering students, **Clayton Greenbaum** and **Polina Brodsky**, initially honed in on the idea of creating a robotics camp for kids. The two pitched their "RoboZoo" hack-

athon concept last spring during the TechHub Student Project Development Grant Competition, ending up among the winners greenlighted to move forward into development. The Ohio State Office of Outreach and Engagement matched funds to help make it happen.

Greenbaum and Brodsky said they were motivated by their own experiences taking part in hackathons as college students. They felt that same energy and motivation could inspire children too.

"It's a time in your life when you're trying to figure out what you want to do," Greenbaum said.

For the uninitiated, makeathons are sleepless 24-hour events in which college students design, build and present finished engineering concepts before their peers and industry reps. The event didn't include overnight work, but extended over three days.

Standing in the hallway of Hitchcock Hall on Jan. 29, Greenbaum said the RoboZoo camp turned out much better than he thought.

"They were really enthusiastic about it. I think that our idea of a makeathon for middle schoolers really did work well, and it really engaged them," he said.

From a teaching standpoint, a lot of the plans were scrapped after discovering the kids really just wanted to build the robots.

"We had to do a lot of on-the-fly adaptation of our planning, and less of me lecturing to the students, which was good because I lost my voice this weekend," he laughed.

There was some concern the kids would just glue together some cardboard and nonchalantly say they were done, he said, but the creations that unfolded throughout the camp proved otherwise.

Some highlights: A scary teddy bear monster, a voice-activated penguin with flapping arms, a red-eyed robot with a big attitude, a panther that just wants to be left alone while eating a

steak, and a realistic lion with clamping jaws.

Over in one corner of the room, three boys having trouble working together learned how to compromise – sort of. One wanted to build a turtle, another a rattle snake and the other a fish. They finally agreed on a "Turtle-Rattle-Fish," a rare breed of robot by any definition. They ended up winning the "Most Complex Robot" award.

Hopping along on crutches from a hurt foot, another young girl carefully navigated through the crowded room of kids working on projects, undeterred.

**Taj Bakare** is an engineer with CT Consultants in Columbus who also volunteers with the Delaware Second Ward Community Center. He helped drive some of the middle schoolers back and forth to the RoboZoo camp.

"They enjoyed the last three days. It was awesome," he said. "I think this is one of our best outings from the past two years."

Parents at the event said they were amazed what their kids could build. One woman said RoboZoo was helping to give them all confidence to succeed, and to learn the importance of giving back to their communities.

Anderson gave special thanks to all the RoboZoo volunteers, including **Larsen Marquardt, Lisa Li, Julie Maynard, Chad Holl, Brody Ringle** and **Ryan Patton**.

"I have never volunteered with kids, but I really like working with robots," **Jennifer Semple** said, a welding engineering student at Ohio State and another RoboZoo volunteer. "I thought it would be a really cool experience to be able to teach these guys about robots. It's something that will come in handy for anybody, once they grow up. I hope they keep with it."

As for the third-grade girl who almost didn't get to go because of her age, her team won two awards for engineering and teamwork. ■

Donate to this and other engineering outreach projects:  
<http://go.osu.edu/donate-ece>







# ECE Priorities

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## RECRUIT OUTSTANDING FACULTY:

The new faculty we are recruiting will perform cutting-edge ECE research to impact our future in autonomous vehicles, smart robotics, cancer treatment, concussion prevention/diagnosis, energy systems, and the internet-of-things. Support from our alumni is crucial for helping us to provide start up funds and endowed chair support to enable these innovations and endowed chair positions to attract outstanding new faculty.

## STUDENT LED INNOVATION:

Our graduate students are the driving force behind Ohio State's research progress. Their success builds not only their future career, but also the university's reputation and our nation's critical technologies. Support from our alumni helps us to provide fellowships for the graduate program that enable these students to concentrate on their research rather than day-to-day financial concerns.

## UNDERGRADUATE ACCESS:

Department scholarships enhance the ability of our students to pursue their dreams of an ECE education. These are especially important for the freshman and sophomore years, as students build their skills to pursue future internships and co-ops. We are proud of the generous support ECE alumni have provided to our undergraduate students and hope to build upon this success to further reduce college costs for deserving students in our programs.

## MODERN LEARNING ENVIRONMENTS:

ECE facilities are meeting the needs of our student body, but face challenges moving forward. The replacement of Caldwell Laboratory is a long term goal; more immediate needs include smaller renovations of the Control Systems Laboratory, relocation of the electronics group, improvements in equipment for the sophomore teaching laboratories, enhancements to the laboratory space for our project-based master's program, and the creation of a "maker" space for our undergraduate students to pursue their innovative ideas. Alumni support helps us meet our facility needs going forward.

## OTHER OPPORTUNITIES:

Many opportunities exist for our alumni to make a significant impact. These include endowments to support annual awards recognizing outstanding performance by our graduate or undergraduate students, support for expansion of the ECE-led Humanitarian Engineering program (including support for students to participate in humanitarian projects) and support for the ECE K-12 Engineering Outreach Program that has already taught more than 13,500 young students across Ohio about STEM topics applicable to society.

# SUPPORT

## WAYS TO GIVE

There are many ways to give to the Department of Electrical and Computer Engineering, including establishing an endowed or support fund, or contributing to the ECE fund of your choice.

You can contribute directly to an ECE fund through The Ohio State University Online Giving secure website [giveto.osu.edu](https://giveto.osu.edu). Visit our list of ECE department program support and scholarship funds to find out more: [ece.osu.edu/alumni/support](https://ece.osu.edu/alumni/support)

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## CONTACT US

Please contact **Katie Coen**, ECE Director of Development, at [coen.40@osu.edu](mailto:coen.40@osu.edu) or (614) 688-2212, with any questions or to discuss giving opportunities.





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