Spotlight

BUILDING THE CHIPS OF TOMORROW: THE CLAWS HUB

NC STATE

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475 copies of this public document were printed at a cost of $4234.07 (G.S. 143-170.1).

2023 NUMBERS **AT A GLANCE**

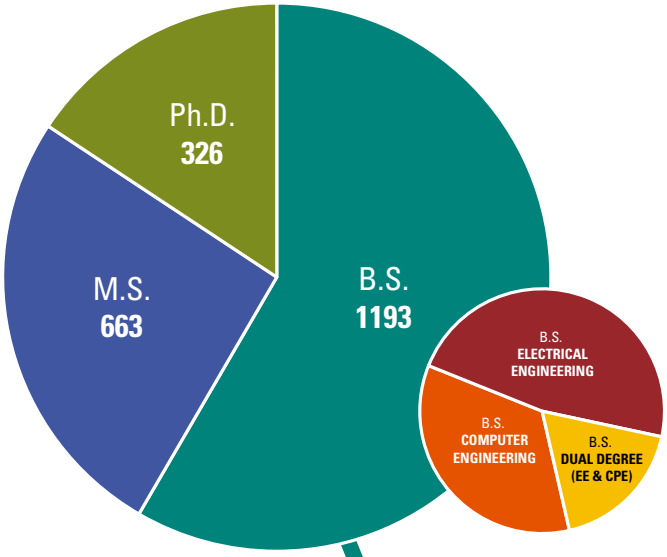
64 Tenured/Tenure-Track

$29M Research Expenditures

22 NSF CAREER Awards

24 IEEE Fellows

3 National Academy of Engineering Members



#5
in number of
EE B.S. degrees
awarded
nationally
(ASEE 2022)

BEST
U.S.News & WORLD REPORT

#5

Best value among public universities nationally

according to U.S. News & World Report 2024

#9

University in the U.S. to study Electrical Engineering

according to ShanghaiRanking's Global Ranking 2022

FROM THE **DEPARTMENT HEAD**

Greetings from the Electrical and Computer Engineering Department at NC State University. I am proud to have the opportunity to lead this department as its interim department head. I want to thank Dan Stancil for his excellent leadership of this department for the last 14 years. ECE has thrived under his leadership and is now well positioned for new opportunities and greater heights. In my last few months, I have thoroughly enjoyed learning about the amazing accomplishments of our students, our faculty and our staff.

In this new edition of the ***Spotlight*** magazine, we are pleased to share with you some of our research successes, our student accomplishments, our thriving partnerships, and our community engagement. We are also thrilled to announce that NC State was successful in winning a DoD Microelectronics Hub: Commercial Leap Ahead Technologies for Wide bandgap Semiconductors (CLAWS) led by faculty from the ECE department. This hub, led by NC State, is a success for our campus and our corporate partnerships and will help take our wideband gap leadership to a global scale. CLAWS will help enable breakthroughs in areas such as 5G/6G communication, quantum computing, artificial intelligence, clean energy, and more. CLAWS will also lead innovative efforts in education to provide the highly skilled workforce to support the mission of the CHIPS act.

We are also excited that the North Carolina General Assembly's budget has provided significant resources for engineering expansion which will directly impact the ECE department in terms of students, faculty, and staff growth. An additional $200M has also been provided for a new engineering classroom building. Through this expansion opportunity, we look forward to growing our community, providing a high impact curriculum, and building state-of-the-art research facilities.

This past year, we have hired four new faculty to expand our expertise in hardware and software for quantum, machine learning, and power systems. This coming year we are targeting hiring in power systems, controls and robotics, hardware for AI as well as semiconductors.

This year, both our CpE and EE degrees have been ranked by US News and World Report as #25 and #26, respectively, a big improvement from last year. ScholarGPS, a research-centric ranking, has ranked us as #18 among all ECE academic institutions in the United States. This ranking uses artificial intelligence including data mining, machine learning, and other data science techniques to rank quantity of individual active scholars and impact of their research.

I want to thank our strategic advisory board, our ECE Connections board, and all our alumni for their commitment to our success.

I hope you enjoy reading this magazine and I invite you to reach out to us and engage in our mission.

Dr. Veena Misra
Interim ECE Department Head

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1893

Electrical Engineering Begins

The first electrical engineering course—Electricity and Magnetism—is offered at the North Carolina College of Agriculture and Mechanic Arts, taught by Lt. Richard Henderson, U.S. Navy.

1917

EE Becomes a Department

Due to the growth of the two programs and diverging needs, Physics is separated from Electrical Engineering, marking the beginning of the Department of Electrical Engineering.

1921

First Woman at NC State

Lucille Thomson became the first woman ever to enroll at NC State. She enrolled in electrical engineering.

1923

School of Engineering

The School of Engineering was formed, consisting of the Electrical Engineering Department, Civil Engineering Department, Physics Department, Textile Engineering, and Mechanical Engineering.

1953

First African-American Student

The first African-American graduate students enrolled at NC State, including Robert Clemons in EE. He would become the first African-American to receive a degree from NC State in 1957.

1979

First Woman on Faculty

Dr. Sarah A. Rajala joined the Electrical Engineering faculty and became the first female Ph.D. faculty member to join the College of Engineering.

1981

Electrical and Computer

With the growth and influence of the modern computer, the department is renamed the Department of Electrical and Computer Engineering.

1982

First NSF Center

Benjamin O'Neal established the first NSF research center in the department: The Center for Communications and Signal Processing, establishing a persisting pattern of cutting edge research.

2012

ASSIST & FREEDM

The ASSIST Center opens, joining the FREEDM Center, which started in 2008, marking the department as the country's only with two concurrent NSF centers.

2014

PowerAmerica

President Obama and the U.S. Department of Energy tap NC State to lead a $140 million advanced manufacturing institute to unite academic, government and industry partners to revolutionize energy efficiency across a wide range of applications.

2018

IBM Quantum Hub

NC State became the first university in North America to establish an IBM Quantum Hub to advance quantum computing.

2019

AERPAW

AERPAW is the nation's first aerial wireless experimentation platform spanning 5G technologies and beyond, which will enable cutting-edge research.

2023

CLAWS Hub

NC State leads the Commercial Leap Ahead for Wide Bandgap Semiconductors Hub as part of the CHIPS-Act-funded Microelectronics Commons.

CHRISTINA KOCH
RETURNS TO SPACE

NASA and the Canadian Space Agency (CSA) announced the four astronauts who will venture around the Moon on Artemis II, the first crewed mission on NASA's path to establishing a long-term presence at the Moon for science and exploration through Artemis. In March 2023, NASA announced the intent for this mission to launch in November 2024, followed by a Moon landing the following year.

"The Artemis II crew represents thousands of people working tirelessly to bring us to the stars. This is their crew, this is our crew, this is humanity's crew," said NASA Administrator Bill Nelson. "NASA astronauts Reid Wiseman, Victor Glover, and Christina Hammock Koch, and CSA astronaut Jeremy Hansen, each has their own story, but, together, they represent our creed: E pluribus unum – out of many, one. Together, we are ushering in a new era of exploration for a new generation of star sailors and dreamers – the Artemis Generation."

The crew assignments are as follows: Commander Reid Wiseman, Pilot Victor Glover, Mission Specialist 1 Christina Hammock Koch, and Mission Specialist 2 Jeremy Hansen. They will work as a team to execute an ambitious set of demonstrations during the flight test.

Koch, who grew up in Jacksonville, North Carolina, earned bachelor's degrees in electrical engineering and physics (2001), and a master's degree in electrical engineering (2002) from North Carolina State University.

Koch started her career as an electrical engineer focusing on space science instrument design at NASA's Goddard Space Flight Center in Greenbelt, Maryland. She went on to work as a research associate with the United States Antarctic Program, completing several deployments including spending the winter at the South Pole. She returned to space science instrument design at the Johns Hopkins University's Applied Physics Laboratory, contributing to such missions as the Juno probe to Jupiter. She then returned to her work at remote scientific research stations, including sessions as a field engineer in the Arctic and as station chief with the National Oceanic and Atmospheric Administration in American Samoa.

> Koch will be making her second flight into space on the Artemis II mission. She served as flight engineer aboard the space station for Expedition 59, 60, and 61. Koch set a record for the longest single spaceflight by a woman with a total of 328 days in space and participated in the first all-female spacewalks.

The approximately 10-day Artemis II flight test will launch on the agency's powerful Space Launch System rocket, prove the Orion spacecraft's life-support systems, and validate the capabilities and techniques needed for humans to live and work in deep space.

The flight, set to build upon the successful uncrewed Artemis I mission completed in December 2022, will set the stage for the first woman and first person of color on the Moon through the Artemis program, paving the way for future for long-term human exploration missions to the Moon, and eventually Mars. This is the agency's Moon to Mars exploration approach.

"For the first time in more than 50 years, these individuals – the Artemis II crew – will be the first humans to fly to the vicinity of the Moon. Among

the crew are the first woman, first person of color, and first Canadian on a lunar mission, and all four astronauts will represent the best of humanity as they explore for the benefit of all," said Director Vanessa Wyche, NASA Johnson.

"I could not be prouder that these brave four will kickstart our journeys to the Moon and beyond," said Director of Flight Operations Norm Knight, NASA Johnson. "They represent exactly what an astronaut corps should be: a mix of highly capable and accomplished individuals with the skills and determination to take on any trial as a team. The Artemis II mission will be challenging, and we'll test our limits as we prepare to put future astronauts on the Moon. With Reid, Victor, Christina, and Jeremy at the controls, I have no doubt we're ready to face every challenge that comes our way."

> Through Artemis missions, NASA will use innovative technologies to explore more of the lunar surface than ever before. We will collaborate with commercial and international partners and establish the first long-term presence on the Moon. Then, we will use what we learn on and around the Moon to take the next giant leap: sending the first astronauts to Mars.

FOSSIL-SORTING ROBOT STUDIES OCEAN HISTORY

Researchers have demonstrated a robot capable of sorting, manipulating, and identifying microscopic marine fossils. The new technology automates a tedious process that plays a key role in advancing our understanding of the world's oceans and climate – both today and in the prehistoric past.

"The beauty of this technology is that it is made using relatively inexpensive off-the-shelf components, and we are making both the designs and the artificial intelligence software open-source," says **Edgar Lobaton**, co-author of a paper on the work and an associate professor of electrical and computer engineering at North Carolina State University. "Our goal is to make this tool widely accessible, so that it can be used by as many researchers as possible to advance our understanding of oceans, biodiversity and climate."

> The technology, called Forabot, uses robotics and artificial intelligence to physically manipulate the remains of organisms called foraminifera, or forams, so that those remains can be isolated, imaged and identified.

Forams are protists, neither plant nor animal, and have been prevalent in our oceans for over 100 million years. When forams die, they leave behind their tiny shells, most less than a millimeter wide. These shells give scientists insights into the characteristics of the oceans as they existed when the forams were alive. For example, different types of foram species thrive in different kinds of ocean environments, and chemical measurements can tell scientists about everything from the ocean's chemistry to its temperature when the shell was formed.

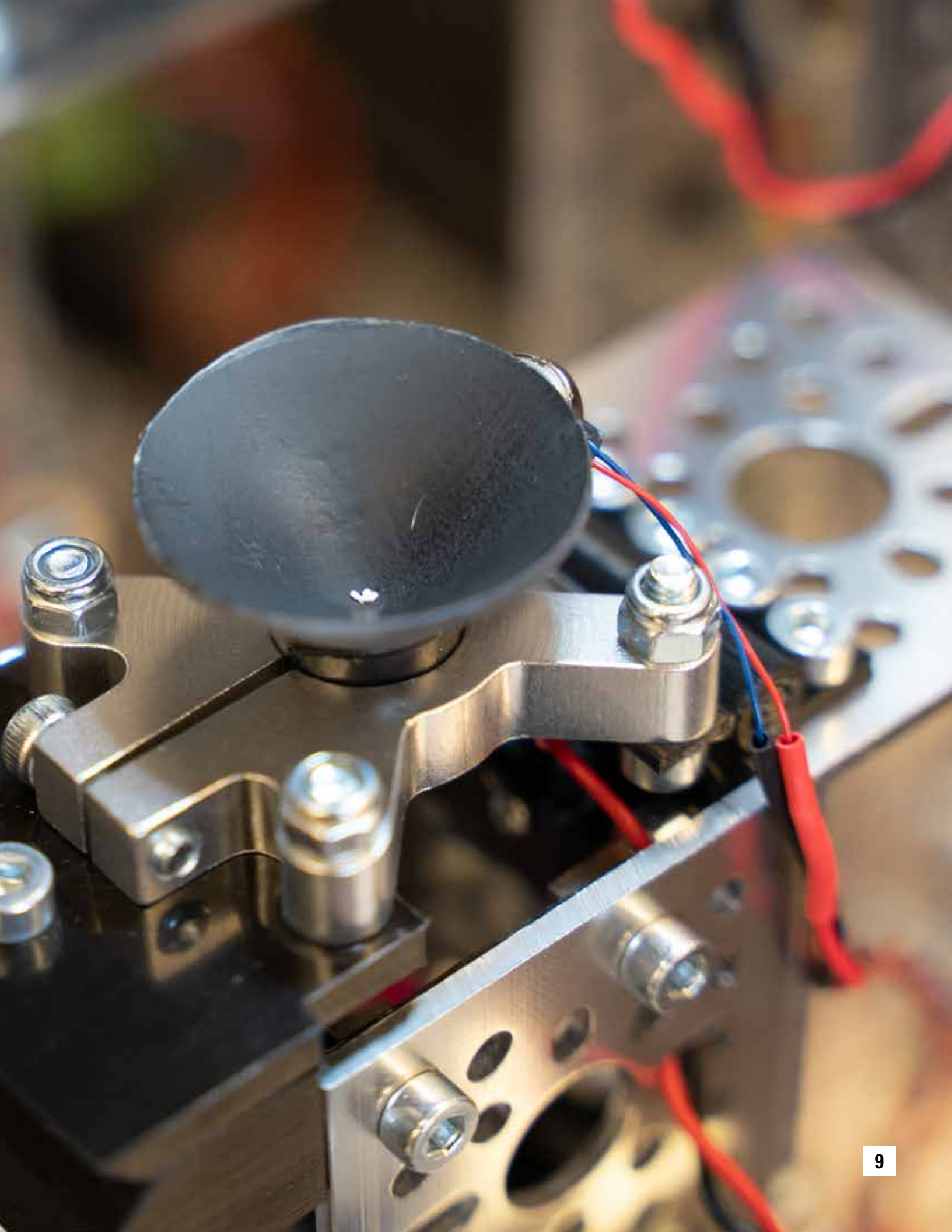
"At this point, Forabot is capable of identifying six different types of forams, and processing 27 forams per hour – but it never gets bored and it never gets tired. It has an accuracy rate of 79% for identifying forams, which is better than most trained humans," Lobaton says. "This is a proof-of-concept prototype, so we'll be expanding the number of foram species it is able to identify. And we're optimistic we'll also be able to improve the number of forams it can process per hour.

Here's how Forabot works: first, users wash and sieve a sample of hundreds of forams, leaving a pile of what looks like sand. The sample is then placed into a container called the isolation tower. A needle at the bottom of the isolation tower projects up through the sample, lifting a single foram so it can be removed via suction into a separate container called the imaging tower. The imaging tower is equipped with an automated, high-resolution camera that captures multiple images of the foram. After the images are taken, the foram is again lifted by a needle until it can be picked up via suction and deposited in the relevant container in a sorting station.

"The idea is that our AI can use the images to identify what type of foram it is, and sort it accordingly," Lobaton says.

"The next step for us is to expand the types of forams the system can identify, and work on optimizing the operational speed," Lobaton adds.

The paper, "Forabot: Automated Planktic Foraminifera Isolation and Imaging," is published in Geochemistry, Geophysics, Geosystems. Corresponding author of the paper is Turner Richmond, a recent Ph.D. graduate from NC State. The paper was co-authored by Jeremy Cole, a Ph.D. graduate of NC State; and by Gabriella Dangler, an undergraduate at NC State.



FRIENDS
BECOME FOUNDERS

ECE master's students, Sam Marcom and Dario Muller, and mechanical engineering alumnus, Josh Cooper, are laying the groundwork for the future of the manufacturing industry with an innovative invention intended to make CNC automation more compact and user-friendly than ever before.

The three all graduated with their bachelor's degrees in MAE and met during the 2021 Fall Semester in their Engineering Entrepreneurs Program (EEP) senior design course. Over the past two years, they not only became close friends but also started their own business after inventing a new manufacturing tool: the CN-Seamless.

Marcom first saw the need for a new solution in CNC Automation while working at a steel mill in Virginia.

"They were always fabricating stuff out on the floor, so there was stuff that would break all the time; and it was big, heavy steel stuff; and they spent hours marking stuff out with a pen and paper and a ruler and they'd cut it all by hand," Marcom said. "I thought they should have a machine to do this."

Enter the CN-Seamless, a lightweight and entirely mobile CNC oxy-acetylene torch-cutting product that Marcom, Muller, and Cooper believe could revolutionize the fabrication process. With an electromagnet base that mounts directly to any steel workpiece, tunable gas control that streamlines finding the perfect fuel ratio, and a user-focused touchscreen controller; the CN-Seamless is intended to be a tool that anyone can learn to use and implement into their workshops or on the job site in a matter of hours.

Cooper, who has now also earned his master's in mechanical engineering, had reservations at first about undertaking the development of this new ambitious tool, and he was not the only one.

"I was skeptical because you have to look at feasibility as one of the categories," Cooper said. "We're basically going to take a plasma table, shrink it, make it better, and make it something anyone can use with a great user experience – the feasibility was questioned, and when we had to present in class, that was one of the biggest pieces of feedback we got: 'this would be great if we could do it, but can you do it?'"

But do it they did.

The team particularly credits EEP Director and electrical and computer engineering lecturer, **Marshall Brain**, for his influence on the development of the CN-Seamless and for pushing the team to go beyond their comfort zones to develop a truly professional product that has the potential to greatly benefit the manufacturing industry.

"He's the soul of that class," Cooper said. "We wouldn't be anywhere close to where we are now without his guidance."

Brain helps guide NC State's VenturePack Challenge, a student competition created to provide resources, mentorship, and cash to NC State student entrepreneurs. Competing against 10 other student-led startups, CN-Seamless won first place in the 2023 competition and $10,000 for further innovation.

Now, the team is selling the CN-Seamless Mach-1 product program and eight companies have already signed letters of intent to purchase, including the steel mill where Marcom first had the idea for the product.

The epitome of the entrepreneurial spirit, the team has fully committed to CN-Seamless, and continues to be laser-focused on making it the best product it can be, going to great lengths and working long hours to perfect their design.

"Sure, we're coworkers at this point. We have a company, we have a website, we're incorporated – we're doing the thing – but we're also really close friends," Cooper said. "We hang out, we enjoy each other's company, and this wouldn't work if I didn't like hanging out with these guys. That's definitely critical to our story."

HELPING AI NAVIGATE
3D SPACE WITH 2D IMAGES

Photos are two-dimensional (2D), but autonomous vehicles and other technologies have to navigate the three-dimensional (3D) world. Researchers have developed a new method to help artificial intelligence (AI) extract 3D information from 2D images, making cameras more useful tools for these emerging technologies.

"Existing techniques for extracting 3D information from 2D images are good, but not good enough," says **Tianfu Wu**, co-author of a paper on the work and an associate professor of electrical and computer engineering at North Carolina State University. "Our new method, called MonoXiver, can be used in conjunction with existing techniques – and makes them significantly more accurate."

The work is particularly useful for applications such as autonomous vehicles. That's because cameras are less expensive than other tools used to navigate 3D spaces, such as LIDAR, which relies on lasers to measure distance. Because cameras are more affordable than these other technologies, designers of autonomous vehicles can install multiple cameras, building redundancy into the system. But that's only useful if the AI in the autonomous vehicle can extract 3D navigational information from the 2D images taken by a camera. This is where MonoXiver comes in.

Existing techniques that extract 3D data from 2D images – such as the MonoCon technique developed by Wu and his collaborators – make use of "bounding boxes." Specifically, these techniques train AI to scan a 2D image and place 3D bounding boxes around objects in the 2D image, such as each car on a street. These boxes are cuboids, which have eight points – think of the corners on a shoebox. The bounding boxes help the AI estimate the dimensions of the objects in an image, and where each object is in relation to other objects. In other words, the bounding boxes can help the AI determine how big a car is, and where it is in relation to the other cars on the road.

> However, the bounding boxes of existing programs are imperfect and often fail to include parts of a vehicle or other objects that appears in a 2D image.

The new MonoXiver method uses each bounding box as a starting point, or anchor, and has the AI perform a second analysis of the area surrounding each bounding box. This second analysis results in the program producing many additional bounding boxes surrounding the anchor.

"We are excited about this work, and will continue to evaluate and fine-tune it for use in autonomous vehicles and other applications," Wu says.

The paper, "Monocular 3D Object Detection with Bounding Box Denoising in 3D by Perceiver," was presented Oct. 4 at the International Conference on Computer Vision in Paris, France. First author of the paper is Xianpeng Liu, a Ph.D. student at NC State. The paper was co-authored by Kelvin Cheng, a former Ph.D. student at NC State; Ce Zheng, of the University of Central Florida; Nan Xue, of Ant Group; and Guo-Jun Qi, of the OPPO Seattle Research Center and Westlake University.

FITBITS
FOR FRESHWATER MUSSELS

Researchers at NC State have designed and demonstrated a new system that allows the remote monitoring of the behavior of freshwater mussels. The system could be used to alert researchers to the presence of toxic substances in aquatic ecosystems.

"When mussels feed, they open their shells; but if there's something noxious in the water, they may immediately close their shells, all at once," says Jay Levine, co-author of a paper on the work and professor of epidemiology at NC State. "Folks have been trying to find ways to measure how widely mussels or oysters open their shells since the 1950s, but there have been a wide variety of challenges. We needed something that allows the animals to move, can be placed in streams and collects data – and now we have it."

"We've basically designed a custom Fitbit to track the activities of mussels," says **Alper Bozkurt**, corresponding author of the paper and a professor of electrical and computer engineering at NC State.

> The fundamental idea for the research stems from the fact that feeding behavior in mussels is generally asynchronous – it's not a coordinated affair. So, if a bunch of mussels close their shells at once, that's likely a warning there's something harmful in the water.

One of the things the researchers are already doing with the new sensor system is monitoring mussel behavior to determine if there are harmless circumstances in which mussels may all close their shells at the same time.

> "Think of it as a canary in the coal mine, except we can detect the presence of toxins without having to wait for the mussels to die," Levine says.

"At the same time, it will help us understand the behavior and monitor the health of the mussels themselves, which could give us insights into how various environmental factors affect their health. Which is important, given that many freshwater mussel species are threatened or endangered."

"To minimize costs, all the components we used to make this prototype sensor system are commercially available – we're just using the technologies in a way nobody used them before," Bozkurt says.

The researchers did more than 250 hours of testing with live mussels in a laboratory fish tank, and found that the sensors were exceptionally accurate – measuring the angle of the mussel's shell opening to within less than one degree.

"You can definitely tell when it's closed, when it's open and by how much," Bozkurt says.

"Our aim is to establish an 'internet-of-mussels' and monitor their individual and collective behavior," Bozkurt says. "This will ultimately enable us to use them as environmental sensors or sentinels."

The U.S. National Science Foundation recently funded this project under the Using Rules of Life to Address Social Challenges program.

The funding supports the use of knowledge learned from studying the Rules of Life — the complex interactions within and between a broad array of living systems across biological scales, and time and space — to tackle pressing societal challenges, including clean water, planet sustainably, carbon capture, biosecurity and antimicrobial resistance to antibiotics.

LIVE
ON AIR

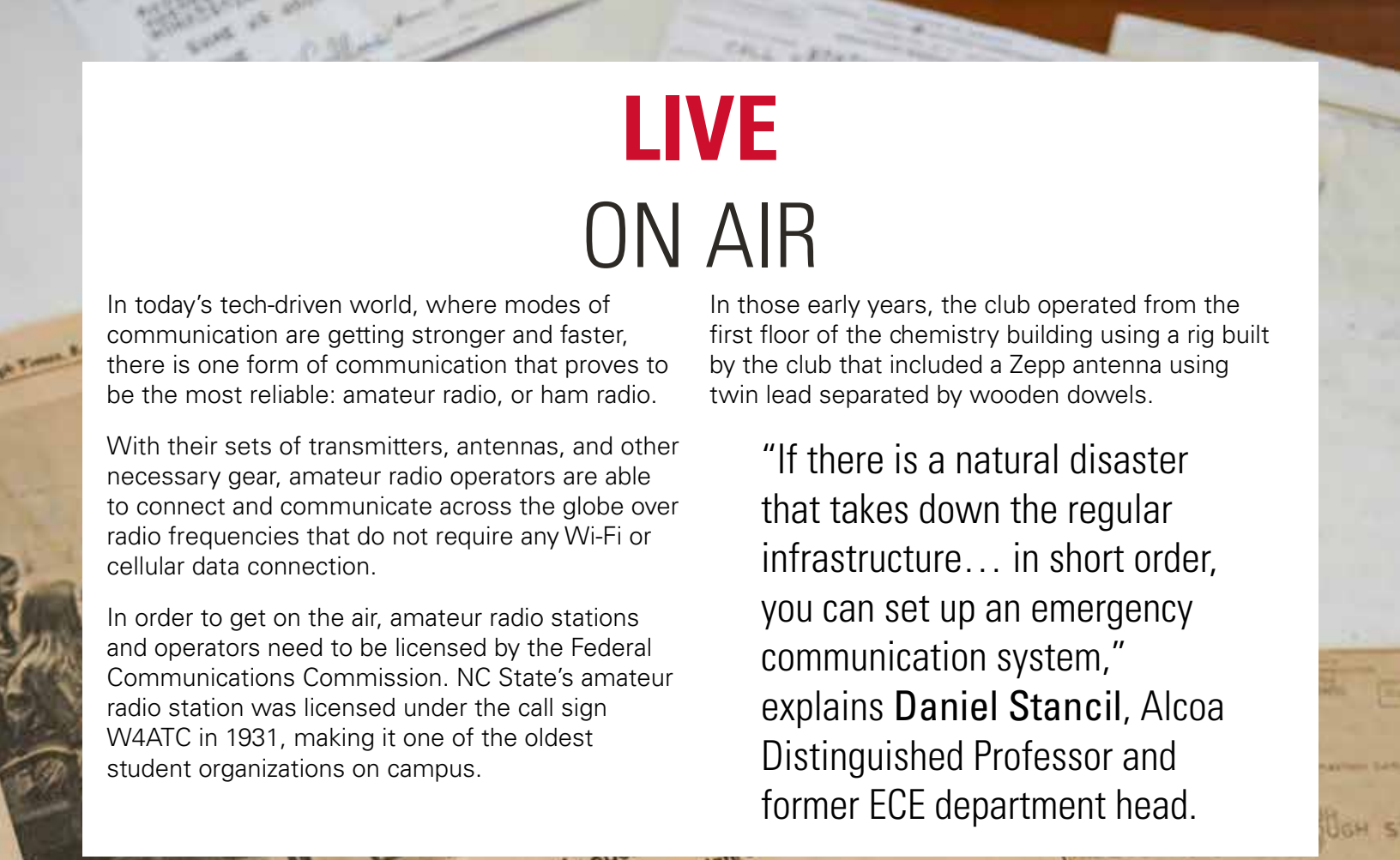
In today's tech-driven world, where modes of communication are getting stronger and faster, there is one form of communication that proves to be the most reliable: amateur radio, or ham radio.

With their sets of transmitters, antennas, and other necessary gear, amateur radio operators are able to connect and communicate across the globe over radio frequencies that do not require any Wi-Fi or cellular data connection.

In order to get on the air, amateur radio stations and operators need to be licensed by the Federal Communications Commission. NC State's amateur radio station was licensed under the call sign W4ATC in 1931, making it one of the oldest student organizations on campus.

In those early years, the club operated from the first floor of the chemistry building using a rig built by the club that included a Zepp antenna using twin lead separated by wooden dowels.

> "If there is a natural disaster that takes down the regular infrastructure… in short order, you can set up an emergency communication system," explains **Daniel Stancil**, Alcoa Distinguished Professor and former ECE department head.



"It's a hobby about communication, but it's also a community service, that's what we pride ourselves on," says Will Rowland, ECE alumnus, and ham radio operator. He adds that the first communications to come from Puerto Rico after the devastation from hurricanes Irma and Maria in 2017 were from ham radio operators.

As important and practical as amateur radio can be in emergency situations, in most cases operators use their equipment as a hobby, connecting with strangers across the world over the air.

At NC State, the hobby is making a resurgence on Centennial Campus. Under new leadership, the Student Amateur Radio Society (StARS) has assisted in moving the club's hardware from its original home at 111 Lampe on North Campus to Engineering Building II.

As their advisor, Stancil was able to facilitate and assist the club with finding a new home and installing a brand-new antenna on EBII's roof.

Rowland says working with amateur radio is "about the fellowship and enjoying the hobby" and added that because of the new club space, "It's a great time for new or interested radio operators to come out and participate."

StARS leaders say that "contesting" is one of the most exciting things they do with the group. Contesting, also called "radiosport," is a competition to see how many other amateur radio stations one can contact within a specific amount of time. Club Secretary and computer science student, Tomas Robinson, participated in a recent contest and shared, "I was astonished by how many people were on the air at the same time… we were able to reach some signals all the way in Italy!"

"This is one of the most exciting times since I've been involved with the club. We have excellent student leaders that are revitalizing the club and attracting new members," says Stancil.

HE'S JUST **PAUL**

Paul Chen has come a long way from watching NC State win the 1983 NCAA basketball championship as a kid growing up in rural western North Carolina.

He had no idea that NC State would be an integral part of his journey to his current role as Head of Global Electronic Design at Mattel, Inc. Recruited by NC State professor emeritus **Joel Trussell** toward the end of his undergraduate program at Georgia Tech, Chen earned a master's degree in electrical engineering in 1995 with Trussell as his mentor and thesis advisor.

Paul quickly realized the amazing opportunity he had: "Though I had great grades, I wasn't really strong at digital signal processing. Dr. Trussell made a connection to that 'challenger spirit' in me. I ultimately improved at color image processing and all of its complexities, and realized that NC State was the best place to get me connected to the working world."

After gaining chip-level experience at Harris Semiconductor and Conexant, Chen transitioned to products and leadership with Canon, Microsoft, Cisco-Linksys, and Western Digital, then corporate engineering leadership and mergers and acquisitions at the start-up Suntsu.

Chen landed the plum role of Head of Global Electronic Design at Mattel, Inc. in 2018. Describing his work, he said, "we're all toy makers and that's fun because of the creative process - we're not waiting for the creative process to provide us with crystal clear engineering requirements. We're a part of the creative process that sets them."

> "We're the great magicians inside the toy if we do it right, and children get to experience that magic."

Mattel is in the zeitgeist right now - even more than they typically are - because of the record-breaking movie, "Barbie." Chen says the real-life team that makes Barbie products are "amazing to work with." His admiration of Lisa McKnight, Executive Vice President and Chief Brand Officer, and Kim Culmone, SVP and Head of Design of dolls, was on full display when he raved, "I'm in awe of Lisa and Kim and what they've done."

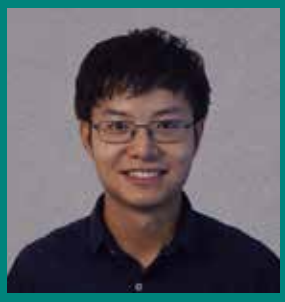
Chen really loves his work, and appreciates Mattel's values-driven workplace culture, adding, "We really do believe in empowering the next generation through play."

Paul Chen was on a team of graduate students doing research on color image processing at NC State. "We were in different stages and doing different work for Dr. Trussell. But as a team, we really supported each other. That allowed us to expect more of ourselves." And this is the mindset that he still carries forward to his current role at Mattel.

EXPANDING **FACULTY**

The Department of Electrical and Computer Engineering is very pleased to announce five new additions to our faculty for the upcoming semesters. As the College of Engineering continues to expand, it is imperative to meet these demands with more professors who can aid the growth of our department and the development of our students.

Dima Farfurnik joined ECE as a tenure-track assistant professor in October 2023. Farfurnik was most recently a postdoctoral associate with Professor Edo Waks at the University of Maryland at College Park, Institute for Research in Electronics & Applied Physics and Joint Quantum Institute. His Ph.D. is from the Hebrew University of Jerusalem, and his research interests include developing hybrid interfaces between single spins and single photons for quantum simulation, networking and sensing.



Yuan Liu will be coming to NC State in January 2024 in a joint faculty position with ECE and computer science as a tenure-track assistant professor. Liu received his Ph.D. in Chemistry from Brown in 2020, and since 2020 has been a post-doctoral researcher at MIT working with Professors Isaac Chuang and Troy Van Voorhis. His research interests include quantum algorithms, electronic structure and dynamics, chemical physics, stochastic algorithms, quantum sensing, continuous-variable quantum information processing, vibrational-electronic dynamics, quantum statistical mechanics, and spectroscopy.

Alyssa Kody will be joining the ECE as a tenure-track assistant professor in January 2024. Kody received her Ph.D. from the University of Michigan and was recently a Maria Goeppert Mayer Postdoctoral Fellow in the Energy Systems Division at Argonne National Laboratory. Her overarching research interest is the development of optimization and control algorithms for power and energy systems, and she will be affiliated with the FREEDM Systems Center.

Kaixiong Zhou will join ECE as a tenure-track assistant professor in August 2024. Zhou completed his Ph.D. in Computer Science at Rice University with Professor Xia Hu in May. He joined MIT as a postdoctoral researcher for 2023-2024. His research interests include large-scale graph machine learning to advance the frontiers of graph data analysis, including deep graph neural networks, efficient graph representation learning, graph quantum computing, and their applications to science problems in biochemical informatics.

Priya Gill, joining as a Professor of the Practive comes from Texas Tech University and has over eight years of experience in academia teaching entrepreneurship, new product development, communication, leadership, project management, and innovation to engineers.She has a BS in Electrical Engineering from Osmania University and an MBA from Georgia Tech. She has over 15 years of experience in the industry. She worked at Engineers India Limited, designing and engineering control and instrumentation systems for refineries and petrochemical plants, and then in the airline industry and power industry as a strategic sourcing and project manager of several large projects.

Visit **ece.ncsu.edu/hiring** to see new faculty positions.

EMBRACING OPPORTUNITY AND BUILDING COMMUNITY

When Rahul Chakraborty defended his thesis in February, more than 100 of his friends came to celebrate over a potluck dinner. He saw just as many friends when he returned to Raleigh for NC State University's commencement ceremony on May 6, 2023. But he didn't start out with such a large support system here.

Chakraborty, who earned his Ph.D. in electrical engineering, is now a level III researcher for transmission system strategic planning and modeling at Dominion Energy in Richmond, Virginia.

> "I have so many friends now in North Carolina," he said. "I am grateful to NC State because it changed my life."

Chakraborty grew up in Kolkata, India. He earned his bachelor of engineering in electrical engineering from Jadavpur University in Kolkata in 2015. He moved to Bangalore, India, for his master of science in electrical engineering, which he received from the Indian Institute of Science in 2017.

Making a move across the world to attend a Ph.D. program was a huge next step for him.

"I wanted to have some level of personal connection with my lab mates and friends," he said. "I felt like when I'm coming out of my own country, to a different country, when I'm leaving my family, there should be at least some element in the new country that will make me feel like (part of) a family."

Chakraborty knew he wanted to pursue a Ph.D. in the U.S. He had NC State on his radar from the start because of its unique lab infrastructure and the strength of its electrical engineering program. The FREEDM Systems Center was a huge draw, and he knew someone who had started a Ph.D. program there who spoke highly of the personal relationships he'd made at NC State.

During his Ph.D. studies, Chakraborty developed three unique algorithms to help the power grid optimize its transmission and distribution system operation, especially as more renewable energy sources enter the grid.

This research led Chakraborty to his current job. The five people on his team specialize in analysis of the power grid's steady state, when everything is running normally. His expertise comes in when there is a disturbance in the grid, called transient disturbance.

"That was part of my Ph.D. study, that I optimize the dynamic performance of the grid," he said. "I am the right fit there. So that's how I add new knowledge to the team."

> Chakraborty is proud of his research accomplishments, but his life outside of the lab was equally important to him. The first nine months were difficult as he adjusted to his coursework and new surroundings, but he was determined to attend all kinds of events at NC State and in Raleigh.

Six years later, Chakraborty has a diverse, close group of friends who have become like family — in large part due to his willingness to put himself out there, but also because of how welcoming NC State students and Raleigh residents were to him.

"I still remember when I first started going to the gym," he said. "I did not like it because I was very thin and not strong at all. And the only thing I kept telling myself is I just need to enter the door in the gym. Once I enter through the door, everything will come to me. "That's my advice to students, to explore and take all the opportunities."

NC VVIRAL

PIONEERING VIRAL VECTOR TECH

NC-VVIRAL (North Carolina Viral Vector Innovation for Research and Application Laboratory) is a collaborative academia-industry-government partnership that aims to transform the biomanufacturing technology and workforce training that is dedicated to the industrial production of viral vectors. Headquartered on the Centennial Campus of NC State University, this initiative is poised to reshape the landscape of viral vector technology. By merging cutting-edge research, innovation, and collaboration, NC-VVIRAL is spearheading advancements in the use of viral vectors for a multitude of applications, including gene therapy, vaccination, agriculture, and veterinary enterprises.

Viral vectors are viruses modified to deliver genetic material into cells for therapeutic or prophylactic purposes. While many viral vectors have been designed to deliver their genomes effectively into target cells, it has been very difficult to produce the necessary quantity and quality of viral vectors to make real impacts. This initiative focuses on the development, optimization, and application of technologies for the efficient and high-quality production of viral vectors for an array of purposes, from treating genetic disorders to advancing vaccine development.

In partnership with the Biomanufacturing Training and Education Center (BTEC), NC-VVIRAL provides demonstrations on bioprocess and analytical equipment, and training modules on viral vector manufacturing; a cohort of postdoc, PhD-, MS-, and BS-level graduates with strong fundamental and hands-on experience is also being trained to enter the North Carolina and regional workforce.

> "Transforming the technology and workforce training dedicated to gene therapy viral vector manufacturing is a key goal for the economic future of North Carolina and health care across the US and world," said Jon Horowitz, associate vice chancellor for research infrastructure and development at NC State University.

The work of NC-VVIRAL holds enormous promise for the future of medicine. By advancing viral vector technology, the initiative is paving the way for more effective and precise treatments for a wide array of genetic and acquired diseases. Moreover, its contributions to vaccine development are not only relevant to the present, as demonstrated during the COVID-19 pandemic, but also essential for managing future public health crises.

"Applying the NC-VVIRAL's capabilities to other applications like agriculture is important too," says ECE associate professor and NC-VVIRAL Co-Founder and Co-Director **Michael Daniele**. Novel technologies to introduce pest resistance and hardiness, and improve nutritional value are critical for a sustainable and secure food future. Accordingly, viral vectors can play a role in designing and engineering more resilient agricultural products and processes through plant and animal vaccinations, acceleration of breeding, and as a tool for fundamental research in plant biology.

"The ambition of NC-VVIRAL is to support the biomanufacturing of viral vectors in North Carolina," says CBE Associate Professor and NC-VVIRAL Co-Founder and Co-Director Stefano Menegatti. "Upon opening, NC-VVIRAL has hit the ground running — and with viral vectors becoming the prevalent tool in medicine and sustainable agriculture, it's shaping up to be an exciting year."

NC-VVIRAL is at the forefront of pioneering advancements in viral vector technology, gene therapy, and vaccine development. Its commitment to research excellence, collaboration, and practical applications is driving profound changes in the field of biomedicine, with far-reaching implications for human health and well-being. As the initiative continues to make remarkable strides, the future of gene therapy and vaccine development in North Carolina looks brighter than ever.

Learn more at vviral.ncsu.edu

POWERAMERICA
RENEWED

The U.S. Department of Energy Advanced Materials and Manufacturing Technologies Office (AMMTO) announced renewed funding for PowerAmerica, DOE's first Clean Energy Manufacturing Innovation Institute, located on NC State's Centennial Campus. PowerAmerica will receive an initial $8 million, with potential funding across four more fiscal years to follow, to continue advancing domestic manufacturing of next-generation WBG semiconductors for power electronics to aid economy-wide decarbonization and electrification.

PowerAmerica joined NC State's campus in 2015 when President Barack Obama announced its creation in person. ECE Professor, **Victor Veliadis**, is currently the Executive Director and CTO. Dozens of other ECE faculty members contribute and support projects within PowerAmerica as well.

WBG semiconductors use cutting-edge materials that enable power electronics that are used in a range of applications—including industrial equipment, data centers, consumer devices, electric vehicles, and more. Silicon carbide (SiC) and gallium nitride (GaN) WBG semiconductor technology makes the power electronic modules significantly more powerful and energy efficient than those made from conventional semiconductor materials, namely silicon. These high-performance power electronics can increase electric vehicle driving range, help integrate renewable energy into the electric grid, and lead to significant energy savings.

"The work PowerAmerica—and its 82 member organizations spanning industry, academia, and national labs—is doing to galvanize commercialization of high-performance power electronics is invaluable to our clean energy future," said AMMTO Director Chris Saldaña. "PowerAmerica has catalyzed an innovation ecosystem that touches nearly every sector up and down each supply chain."

Centennial campus-based PowerAmerica commercialized more than 10 WBG technologies over five years. To date, 40 percent of PowerAmerica's 60 projects have reached or are set to reach commercial status.

Not only is PowerAmerica innovating semiconductors that surpass the operational limitations of traditional silicon-based designs, but it also focuses on training the future workforce of America's manufacturing sector through its strong education and workforce development (EWD) program. Since launching in 2014, PowerAmerica has trained more than 400 masters and Ph.D. students, 300 short course attendees, 1,800 tutorial participants, and 9,000 K 12 students in STEM programs, including 2,000 participants of hands-on training. These numbers are particularly important in addressing the acute workforce shortage the power electronics industry faces, and scaling up PowerAmerica's existing EWD program is a proposed focus of the new federal funding.

This federal funding builds upon initial federal funding of $70 million, in addition to $81 million in cost share from its member partners.

PowerAmerica is one of seven Clean Energy Manufacturing Innovation Institutes supported by two of DOE's Energy Efficiency and Renewable Energy program offices: the Advanced Materials and Manufacturing Technologies Office (AMMTO) and Industrial Efficiency and Decarbonization Office (IEDO).

Learn more at poweramericainstitute.org

POWERAMERICA

Advanced Chip Manufacturing

Resilient Energy Grid

Higher Efficiency Power Conversion

Rugged Power Electronics

NC STATE TO LEAD REGIONAL SEMICONDUCTOR INNOVATION HUB

North Carolina State University has been awarded $39.4 million from the Department of Defense to serve as the leader of a regional innovation hub in wide bandgap semiconductors.

The regional hub, "Commercial Leap Ahead for Wide Bandgap Semiconductors," or CLAWS, also includes one university partner, N.C. A&T State University, as well as six industry partners: Wolfspeed, Coherent Corp., General Electric, Bluglass, Adroit Materials and Kyma Technologies, Inc.

The funding is part of $238 million invested through the "Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act" for the establishment of eight Microelectronics Commons regional innovation hubs spread across the United States.

> "NC State is honored to lead a Microelectronics Commons regional innovation hub to use our breadth and depth of expertise to create better wide bandgap semiconductors that are so important for our nation's defense," said Chancellor Randy Woodson.

"We're thankful for the work of those who developed and passed the 'CHIPS and Science Act' that supports these regional hubs, and for the regional partners who will collaborate on future research and discovery in this critical high-tech sector."

Wide bandgap semiconductors offer higher voltage and temperature capacity than traditional silicon chips. They are used in power electronics, but also in RF and wireless devices for communications and radars, as well as photonic devices for sensing, communications, artificial intelligence, and future quantum technology applications. The hub will also explore next-generation ultra-wide bandgap materials with even greater voltage and temperature capabilities, including diamond and gallium oxide electronics.

"Leveraging NC State's expertise through campus resources like PowerAmerica and the FREEDM Systems Center alongside traditional strengths in electrical and computer engineering as well as computer science should help make this leap ahead for wide bandgap semiconductor technology a reality," said Mladen Vouk, vice chancellor for research and innovation at NC State.

Deputy Secretary of Defense Kathleen Hicks announced the awards on Sept. 20.

"The effort is focused on 'lab to fab' – laboratory to fabrication – capability for wide bandgap semiconductors and is about building capability to make them here in the U.S. and help ensure domestic supply," said **John Muth**, Distinguished Professor of Electrical and Computer Engineering and the primary investigator on the award. "The hub has a nucleus of members that are building this capability, but we will also have hub affiliates and future partners that will be able use the equipment and capability of the hub for Dept. of Defense-funded and commercial projects."

The hub will also enhance the ability to perform a wide range of fundamental research that is core to the university's science and extension mission, Muth added.

CLAWS

Commercial Leap Ahead for Wide Bandgap Semiconductors

"The technologies hold the potential to enable future electric vehicles, power grid technologies, 5G/6G, quantum technologies and artificial intelligence applications," said **Fred Kish**, MC Dean Distinguished Professor of Electrical and Computer Engineering and the director of the new hub. "They are also important for national security applications by providing energy efficiency, size, weight, power, and performance advantages in critical application areas including weapons systems, warfighter outfitting, position/navigation/timing, biotechnical and medical, materials processing, displays, and a host of additional defense needs."

NC State will work with hub partner N.C. A&T State University and community colleges to build technical expertise in semiconductors across the state, Muth added.

Learn more at claws.ncsu.edu

Advanced Chip Manufacturing

Laboratory to Fabrication

Workforce Development

Next Gen Ultrawide Bandgap

BREAKING BARRIERS
IN AERIAL COMMUNICATION

The Aerial Experimentation and Research Platform for Advanced Wireless (AERPAW) program at NC State has been at the forefront of advancing wireless communication technologies and supporting the development of next-generation wireless networks. AERPAW, located on Centennial Campus, is a collaborative initiative involving academic, industry, and government partners. Its primary goal is to provide a testing and experimentation environment for aerial communication networks, including drones and unmanned aerial vehicles (UAVs), to facilitate the integration of 5G and beyond technologies into our daily lives.

AERPAW has recently expanded its infrastructure and testing capabilities, solidifying its position as one of the most comprehensive platforms for aerial communication research in the United States. This expansion includes additional equipment, base stations, and extended coverage areas for advanced experiments. The program has also upgraded its digital twin, allowing experimenters to develop wireless and UAV trajectory control solutions remotely. Once fully developed, these experiments are deployed in the real-world testbed, and the resulting data is provided to experimenters.

Furthermore, AERPAW has strengthened its partnerships with industry leaders and government agencies, such as Ericsson, Keysight, and NI. These collaborations not only provide financial support but also offer valuable insights into practical applications, bridging the gap between theory and real-world implementation.

AERPAW's research focus has evolved to accommodate the demands of the wireless communication industry, with a particular emphasis on urban air mobility (UAM). The program explores how aerial networks can support UAM services, addressing issues related to low-altitude airspace management, communication between autonomous aerial vehicles, and integration with existing ground-based infrastructure.

AERPAW remains committed to nurturing the next generation of engineers and scientists in the field of aerial communication networks. Educational and training initiatives prepare students and researchers to work on cutting-edge technologies. In May 2023, AERPAW organized the ACW 2023 community workshop, with over 100 participants from academia, industry, and government, including nearly 50 students from outside North Carolina, supported by the National Science Foundation. The event featured panel discussions, hands-on training sessions for students, and a drone demonstration at Lake Wheeler.

Following ACW 2023, AERPAW introduced its first UAV competition, the AERPAW Find-a-Rover (AFAR) Challenge. Student teams comprising undergraduate and graduate students program autonomous UAVs to localize unmanned ground vehicles (UGVs) solely based on signal strength observations from the UGV. Over the past months, six student teams have developed and tested various signal processing, artificial intelligence, and trajectory control algorithms. In November, solutions from these teams will be deployed in the real-world AERPAW testbed, with student prizes supported by Galaxy Unmanned Systems, Unmanned Experts, and AnyMile.

With expanded infrastructure, enhanced partnerships, a refined research focus, and active involvement in standardization efforts, AERPAW continues to lead in aerial communication research. Through its experiments and collaborative efforts, it significantly contributes to the development of advanced wireless communication technologies and the seamless integration of aerial networks into daily life. AERPAW's ongoing efforts are poised to shape the future of wireless communication.

Learn more at aerpaw.org

AERPAW

Aerial Experimentation and Research Platform for Advanced Wireless

Smart Agriculture

Autonomous Vehicles

Disaster Relief

Aerial Traffic Control

ASSIST: OVER A DECADE OF WEARABLE DEVICE BREAKTHROUGHS

More than ten years since its founding, the Advanced Self-Powered Systems of Integrated Sensors and Technologies (ASSIST) Center led by NC State has made groundbreaking advances in wearable health monitoring devices.

The center, established in 2012 with the goal of advancing fundamental science in energy harvesting and storage, low-power sensing and low-power electronics, is now increasing its focus on implantable devices as it moves toward a self-sufficient future while building on current initiatives.

"It took us a while to get the systems together, and it took even more time to make them robust and solid," said **Veena Misra**, co-director of ASSIST, interim Department Head and MC Dean Distinguished Professor in the Department of Electrical and Computer Engineering (ECE). "Now we have a prototyping lab, a systems integration team and a thriving education program. … One of the most exciting things I think we can do is take our systems we've built and help patients."

Moving forward, ASSIST will be funded through large grant proposals, support from existing and new industry partners and non-research sources of revenue.

From wearable to implantable

ASSIST has developed several implantable devices, with funding from NSF. Researchers are using ultrasound to power implantable devices made of ASSIST's novel material and sensing technologies that can be used to monitor cardiac health. ASSIST faculty members aim to demonstrate and evaluate ultrasonic, biomaterial and bioelectronic components of cardiac implantable systems through benchtop and in-vivo experiments, and will eventually assemble the components and continue in-vivo and in-vitro experiments with the complete device.

Through industry funding, researchers have also developed implantable devices to monitor farm, companion and working animals to understand and improve their welfare. Researchers aim to miniaturize versions of wearable health monitoring devices — like health-tracking smart watches — into microchip implants that can be injected under animals' skin.

Ideas for and from everyone

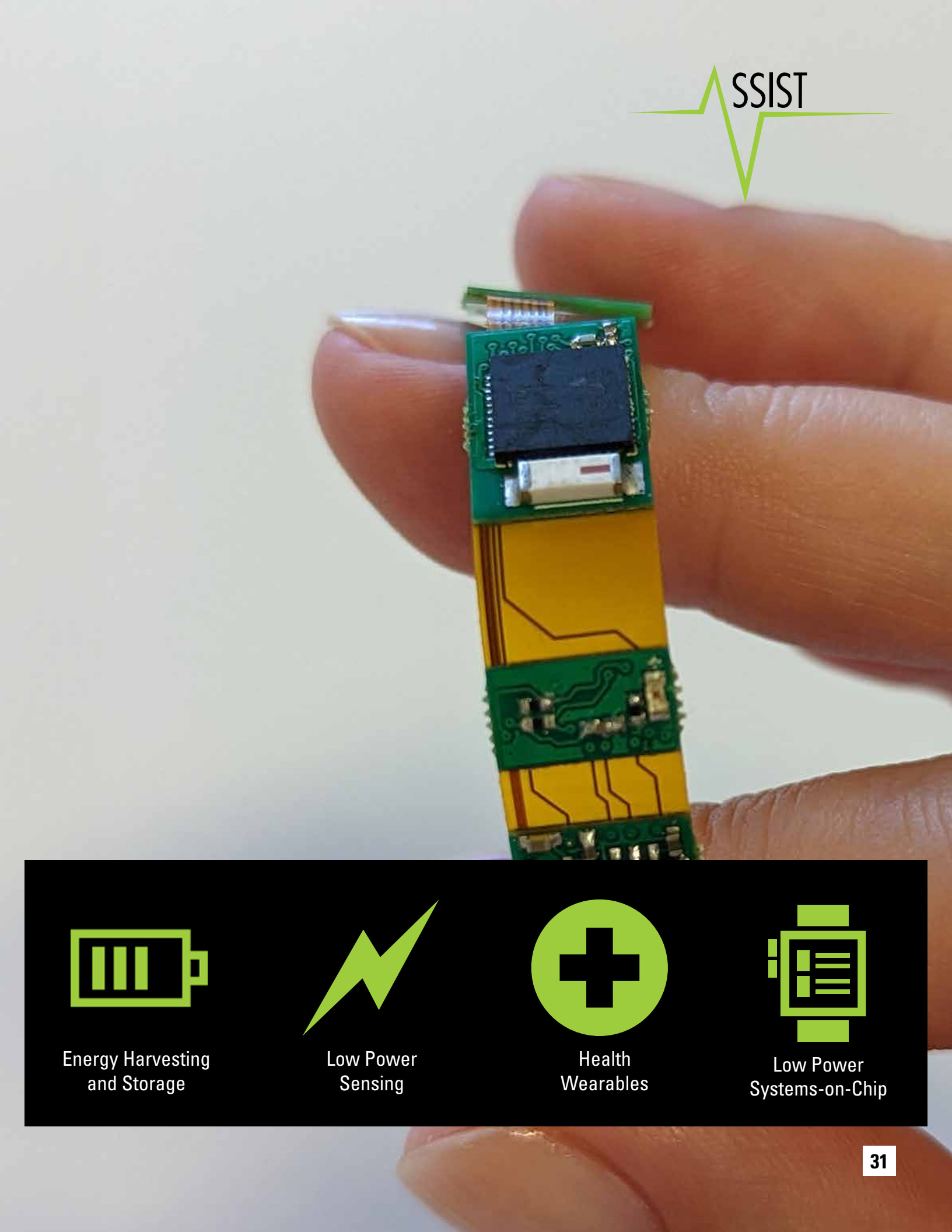
Throughout its 10 years, ASSIST has prioritized professional development opportunities, as well as outreach for students from kindergarten through college, offering summer camps, undergraduate research positions and programs for middle and high school students. Education goes hand-in-hand with ASSIST's research.

Elena Veety, education director for ASSIST and teaching assistant professor in ECE, said these initiatives will continue and expand.

One of its most successful pre-college programs is the Wearable Device Challenge. "They do some really unique things," Veety said. These unique things include a glove that helps alleviate arthritis, a posture detection device and a gait rehabilitation device worn on a sock.

These are all ideas in the same vein as what ASSIST faculty members are developing and researching — and the students devising them might be among the people continuing ASSIST's foundational research as the center looks to the next decade and beyond.

Learn more at assistcenter.org



Energy Harvesting and Storage

Low Power Sensing

Health Wearables

Low Power Systems-on-Chip

FREEDM: SPARKING INNOVATION

The Future Renewable Electric Energy Delivery and Management (FREEDM) Systems Center started as an NSF Engineering Research Center in 2008 with a vision to redesign the electric distribution grid to allow more distributed energy resources through plug and play functionality and distributed control algorithms. With a dozen affiliated faculty and over 100 graduate students, their research today is focused on four pillars: Wide Bandgap (WBG) Semiconductors, Electric Transportation, Modern Power Systems, and Renewable Energy. Their lab capabilities include power device packaging design and testing, Hardware-in the-Loop (HIL) simulation, and a high bay space rated for 1 Megawatt and 15 kV voltage.

Much of the research in WBG is in partnership with PowerAmerica to develop new applications for higher voltage devices or new topologies to achieve higher performance at lower cost. Recent projects include the development of a 2.2-level silicon carbide inverter topology that uses an active filter in parallel with the standard 2-level topology. It achieves zero voltage switching and reduces dV/dt by 10X through unique adaptive gating control while reducing device costs by 40%.

In Electric Transportation, FREEDM is leading the way with novel motor drive designs, new motor topologies with increased power density, and very high power fast chargers. Their research teams deployed a 1 MW Extreme Fast Charger in partnership with the New York Power Authority and ABB, developed a 250 kW traction drive with Ricardo Engineering for evaluation on electric trucks at shipping ports, built a 100kW heavy rare-earth free traction electric motor, and designed a charging network for electric wheelchairs.

FREEDM's power systems research includes software development and highly accurate grid simulations. They develop monitoring systems for grid cybersecurity, algorithms for managing wide area networks of distributed wind resources, and applications of machine learning to forecast loads and generation. One of the FREEDM-affiliated associate professors, **Wenyuan Tang** was awarded two prizes this year for forecasting: one for solar generation potential in multiple US cities and another for hydropower operations optimization.

FREEDM SYSTEMS CENTER

Renewable energy covers the center's research in improving renewable system efficiency, power electronics specifically for renewable resources, and microgrids. In partnership with the Atlantic Marine Energy Center, FREEDM researchers are developing a multi-port converter and control system to manage wave power, solar power, and energy storage for a demonstration microgrid at Jennette's Pier on the Outer Banks of North Carolina. They are building an open source microgrid co-design platform that generates an optimal design and the associated control algorithms.

FREEDM provides a talent pipeline for tomorrow's workforce. The professional science masters degree in Electric Power Systems Engineering has a 100% placement rate for graduates. Its students are leaders in the Graduate Student Association, advocates for gender diversity in power electronics, and nationally recognized through awards and scholarships. One third of FREEDM students find employment with a member company upon graduation with the balance moving to positions in academia, national research labs, and other corporations.

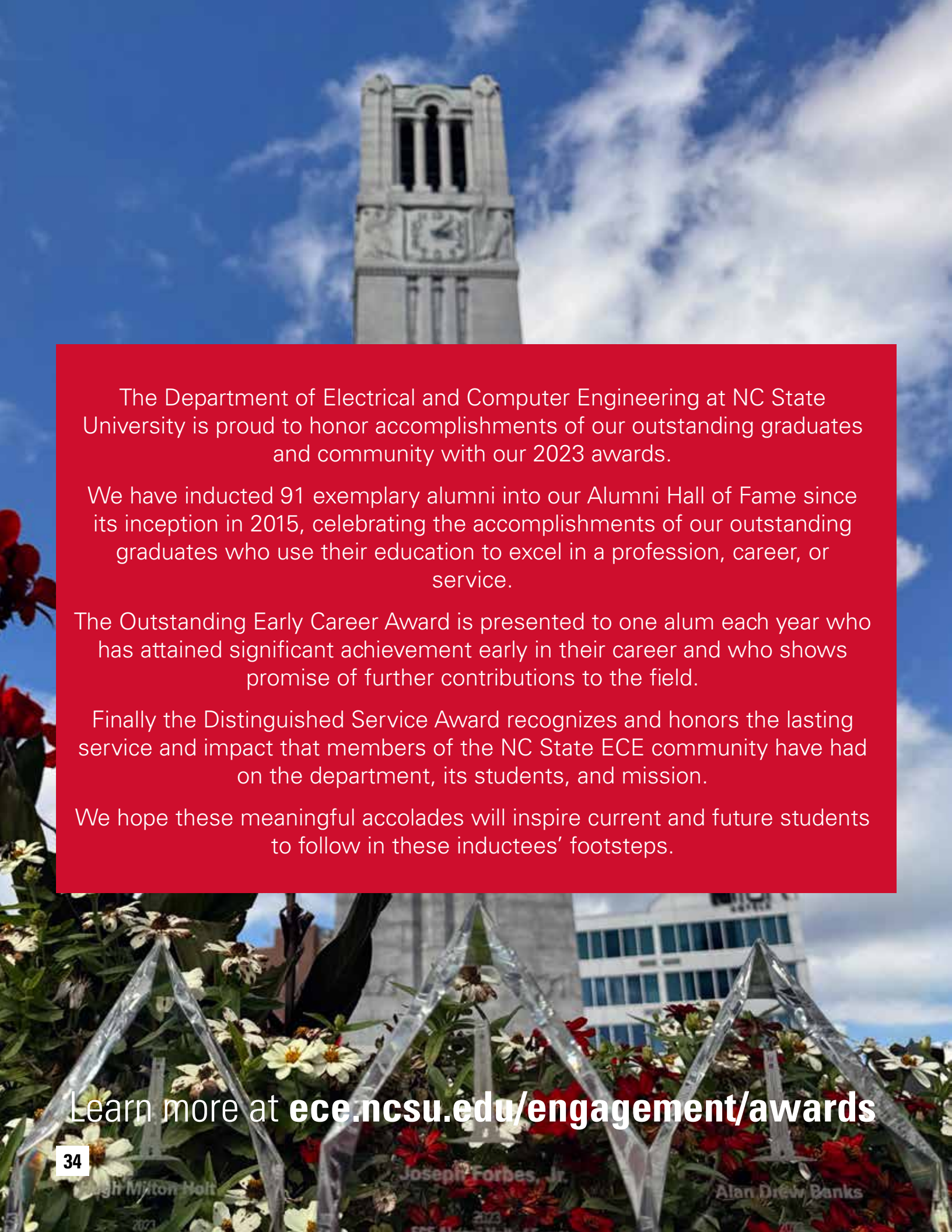
Learn more at freedm.ncsu.edu

Wide Bandgap Power Electronics

Electric Transportation

Modern Power Systems

Renewable Energy Systems



The Department of Electrical and Computer Engineering at NC State University is proud to honor accomplishments of our outstanding graduates and community with our 2023 awards.

We have inducted 91 exemplary alumni into our Alumni Hall of Fame since its inception in 2015, celebrating the accomplishments of our outstanding graduates who use their education to excel in a profession, career, or service.

The Outstanding Early Career Award is presented to one alum each year who has attained significant achievement early in their career and who shows promise of further contributions to the field.

Finally the Distinguished Service Award recognizes and honors the lasting service and impact that members of the NC State ECE community have had on the department, its students, and mission.

We hope these meaningful accolades will inspire current and future students to follow in these inductees' footsteps.

Learn more at **ece.ncsu.edu/engagement/awards**

2023 INDUCTEES OF THE ECE **ALUMNI HALL OF FAME**

Alan Drew Banks
Chief Customer Officer
Drops OÜ
BS EE 1984

Joseph Forbes, Jr.
CEO
Causam Enterprises, Inc.
BS EE 1987

Hugh Milton Holt
President Technology Commercialization Center, Inc.
BS EE 1962

Jeyhan Karaoğuz
Vice President and General Manager
Broadcom
MS EE 1989; Ph.D. EE 1992

Kenneth Wright
Sr. Director Data Center GPU Systems Engineering AMD
BS EE 1993; BS CPE 1993

OUTSTANDING **EARLY CAREER** AWARD

Shubhi Asthana
Research Senior Software Engineer
IBM Research
MS CPE 2014

DISTINGUISHED **SERVICE** AWARD

Larry Monteith
Chancellor Emeritus
NC State University

HONORS AND **ACHIEVEMENTS**

FACULTY AWARDS

Iqbal Husain received the 2022 IEEE Industry Applications Society (IAS) Outstanding Achievement Award in recognition of his outstanding contributions in the application of electricity to industry.

Iqbal Husain also received the 2022 Outstanding Engagement Award from the NC State University Office of Outreach and Engagement. This award is to encourage and recognize outstanding extension, engagement, and economic development activities by faculty and EHRA employees of NC State University.

Amro Awad and **Wenyuan Tang** were named among the 2022-23 class of Goodnight Early Career Innovators. The program recognizes and rewards promising NC State early-career faculty whose scholarship is in STEM or STEM education.

Marshal Brain, director of the Engineering Entrepreneurs Program, received the John S. Risley Entrepreneur of the Year award for his work to help engineering students develop an entrepreneurial mindset and learn about launching new ventures.

Edgar Lobaton received the 2023 William F. Lane Outstanding Teaching Award in recognition of excellence in teaching or educational leadership in the NC State Electrical and Computer Engineering Department.

Amro Awad received the 2022-23 R. Ray Bennett Faculty Fellow Award, which provides support for high- achieving young faculty in the NC State Department of Electrical and Computer Engineering in pursuing their academic and cutting-edge research initiatives.

PAPER AWARDS

Paul Franzon and recent Ph.D. graduate **Priyank Kashyap** won the DesignCon 2023 Best Paper Award for "Data-Driven PAM4 SerDes Modeling with Generative Adversarial Network."

Do Young Eun, Ph.D. student **Jie Hu**, and recent Ph.D. graduate **Vishwarag Doshi** won one of six of the International Conference on Machine Learning (ICML) 2023 Outstanding Paper Awards for "Self-Repellent Random Walks on General Graphs – Achieving Minimal Sampling Variance via Nonlinear Markov Chains."

Subhashish Bhattacharya received two First-Prize Paper Awards at the Energy Conversion Congress and Exposition (ECCE) 2022 conference from the IEEE Industry Applications Society (IAS). Winning papers were "Flux Switching Permanent Magnet Motor with Metal Amorphous Nanocomposite Soft Magnetic Material and Rare Earth Free Permanent Magnets" and "Permeability Engineered Soft Magnetics for Power Dense Energy Conversion."

Nuria González-Prelcic and Ph.D. student **Yun Chen** received the Best Student Paper Award at the 2023 IEEE Signal Processing Advances in Wireless Communications (SPAWC) Conference for "Sparse Recovery with Attention: A Hybrid Data/Model Driven Solution for High Accuracy Position and Channel Tracking at mmWave."

OUTSTANDING NATIONAL AND INTERNATIONAL SERVICE

Leda Lunardi received the IEEE-USA Award for Distinguished Literary Contributions Furthering Public Understanding and the Advancement of the Engineering Profession recognizing professionalism, technical achievement, and literary contributions to public awareness and understanding of the engineering profession in the United States.

Alper Bozkurt received NC State Global's 2023 Outstanding Global Engagement Award, recognizing exceptional accomplishment in globally engaged teaching, research, extension, and/or engagement and economic development.

STUDENT AWARDS

Priyank Kashyup and **Yuejiang Wen** each won the Best Poster Award at the Fall 2022 Semiannual Meeting of the Center for Advanced Electronics Through Machine Learning (CAEML). Kashyup's poster title was GANs for SerDes Modeling and Wen's was High Dimensional Optimization for Electronic Design.

Fin Amin, Tse-Han Pan, Joseph Carlson, and **Nitish Deshpande** were selected as winners of the Qualcomm Innovation Fellowship North America 2023. The fellowship allows Qualcomm to partner with Ph.D. students across the world "in order to cultivate new and forward-thinking ideas."

Mihir Khara was recognized through the 2022-23 College of Engineering Graduate Programs Awards as Master Scholar of the Year in the category Scholarly Achievement.

Ashwini Pondeycherry Ganesh was recognized through the 2022-23 College of Engineering Graduate Programs Awards as Doctoral Scholar of the Year in the category Citizenship and Service.

DOCTORAL DEGREES AWARDED

Mostafa Abdelhamid
Electrical Engineering
InGaN/GaN Light Emitting Diodes on Relaxed InGaN Templates.
Salah M. Bedair (Chair)

Kazi Abu Zubair
Computer Engineering
Improving the Security, Availability, and Reliability of Emerging Non-Volatile Memories.
Amro Awad (Chair)

Rahul Chakraborty
Electrical Engineering
Power Flow Optimization Redesigns for Renewable-Integrated Power Systems: Methods, Architectures, and Risks
Aranya Chakrabortty (Chair)

Yuan Chang
Electrical Engineering
Wideband Millimeter-Wave Phased Arrays with Autonomous Calibration
Brian Floyd (Chair)

Tzu-Hsuan Cheng
Electrical Engineering
Investigation of Ultra-Thin Dielectrics on Coupled Capacitive and Inductive Effects in Laterally Conducting Power Device Packaging
Douglas Hopkins (Chair)

Jisoo Choi
Electrical Engineering
Environmental Signatures Extraction and Analytics for Multimedia Forensics.
Chau-Wai Wong (Chair)

Md Moin Uddin Chowdhury
Electrical Engineering
UAV Trajectory Design and Mobility Management Based on RF Signal Observations.
Ismail Guvenc (Chair)

Jacob Dean
Electrical Engineering
RF to Millimeter-Wave Receivers Employing Frequency-Translated Feedback
Brian Floyd (Chair)

Victor Daldegan Paduani
Electrical Engineering
Real-Time Modeling and Control of DERs with Advanced Grid-Support Functionalities.
Ning Lu (Chair)

Thomas Dotson
Electrical Engineering
Layout Optimization Algorithm for Gallium Nitride PCB
Srdjan Lukic (Chair)

Keith DSouza
Electrical Engineering
A Methodology for Assessing the Adoption of New Devices in a Distribution System with High Penetration DER.
Mesut Baran (Chair)

Amirhassan Fallah Dizche
Electrical Engineering
Machine Learning Methods for Communication Systems and Control of Cyber-Physical Systems.
Alexandra Duel-Hallen (Co-Chair), Aranya Chakrabortty (Co-Chair)

Alex Freij
Computer Engineering
Efficient Crash Consistency in Emerging Secure Persistent Memory Architectures.
Huiyang Zhou (Co-Chair), Yan Solihin (Co-Chair)

Niloofar Ghanbari
Electrical Engineering
DC Microgrid Control and Modeling with Battery Management Capability.
Subhashish Bhattacharya (Chair)

Sandeep Hari
Electrical Engineering
Widely Tunable N-path Receivers and Filters: From RF to mmWave
Brian Floyd (Chair)

Mohannad Ibrahim
Computer Engineering
Architecture-Centric Quantum Computing Algorithms and Software/Hardware Co-Designs.
Gregory Byrd (Chair)

Semih Isik
Electrical Engineering
Reliability Modeling and Improved Redundant Operation for MMC-based MTDC Systems
Subhashish Bhattacharya (Chair)

Bo Jiang
Electrical Engineering
From Neuronal to Artificial Neural Network: Discovering Non-linearity in the Inference Problems
Hamid Krim (Chair)

Ajit Kanale
Electrical Engineering
BaSIC: A Solution to Enhance the Short-Circuit Ruggedness of Silicon and Wide Bandgap Power Devices.
B. Baliga (Co-Chair), Subhashish Bhattacharya (Co-Chair)

Sudhendu Kumar
Computer Engineering
Percentile Delay as a QoS Metric in Modern Computing Environments.
Ioannis Viniotis (Chair)

Taohid Latif
Electrical Engineering
Design, Modeling and Control of Electronic Pole-Changing Induction Motors for Traction Applications.
Iqbal Husain (Chair)

Sung Joon Maeng
Electrical Engineering
Energy Efficient and Secure Communication in UAV Networks.
Huaiyu Dai (Co-Chair), Ismail Guvenc (Co-Chair)

Valliappan Muthukaruppan
Electrical Engineering
Intelligent and Resilient Management of Smart Distribution System with High Renewable Energy Penetration.
Mesut Baran (Chair)

Victor Daldegan Paduani
Electrical Engineering
Real-Time Modeling and Control of DERs with Advanced Grid-Support Functionalities
Ning Lu (Chair)

Yos Prabowo
Electrical Engineering
Solid State Transformer Enabled Substation Architectures toward Grid Resilience and DC-as-a-Service for EV Charger Infrastructure and DC Microgrid
Subhashish Bhattacharya (Chair)

Md Rifat Kaisar Rachi
Electrical Engineering
Fault Management and Protection Coordination in Microgrid with Inverter Based Resources
Iqbal Husain (Chair)

John Ravi
Computer Engineering
Toward Scalable Middleware for Shared HPC Resources
Michela Becchi (Chair)

Turner Richmond
Electrical Engineering
Leveraging Shape in Classification Problems.
Edgar Lobaton (Chair)

Tomas Sadilek
Electrical Engineering
Reduced- and Zero-Voltage Switching Techniques for AC-DC Converters in Electrified Transportation.
Iqbal Husain (Chair)

Grant Scarboro
Electrical Engineering
Sensing of Biological and Chemical Properties Using Hyperspectral and Polarimetric Imaging.
Michael Kudenov (Chair)

Ashwin Shirsat
Electrical Engineering
Towards A Resilient and Intelligent Energy Management System Design for Distribution Networks with High Renewable Energy Penetration.
Wenyuan Tang (Chair)

Simran Singh
Electrical Engineering
Wireless Communications for Reliable UAV Operations.
Ismail Guvenc (Co-Chair), Mihail Sichitiu (Co-Chair)

Priyanka Sinha
Electrical Engineering
RF-based Detection, Localization and Tracking of UAV's
Ismail Guvenc (Chair)

Lidong Song
Electrical Engineering
Deep Learning for Power System Synthetic Data Generation and Anomaly Detection
Ning Lu (Chair)

Tanner Songkakul
Electrical Engineering
Wearable & Wireless Electrochemical Systems for Continuous Correlated Biochemical Monitoring.
Alper Bozkurt (Chair)

Zane Warriner
Electrical Engineering
Binary Geometric-Phase Holograms.
Michael Escuti (Co-Chair), Michael Kudenov (Co-Chair)

Evan Williams
Electrical Engineering
Multimodal Reconfigurable Systems for Tracking of Animals in the Field.
Alper Bozkurt (Chair)

Shougang Yuan
Computer Engineering
Bandwidth Efficient Secure Memory Designs for GPUs
Huiyang Zhou (Chair)

Mingzhi Zhang
Electrical Engineering
Data-driven Voltage Inference and Probabilistic Flexibility Region Estimation for High Renewable-Penetrated Distribution Systems.
Ning Lu (Chair)

FALL 2022 AND SPRING 2023

ECE COLLOQUIA SPEAKERS

NC STATE UNIVERSITY

Quantum Computing Tutorial

Dror Baron

Associate Professor
NC State University

HELLENIC REPUBLIC
National and Kapodistrian University of Athens

Reconfigurable Intelligent Surfaces: Communications, Sensing, and their Integration

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