COLLEGE OF ENGINEERING

BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

VIRGINIA TECH

2024 ANNUAL REPORT

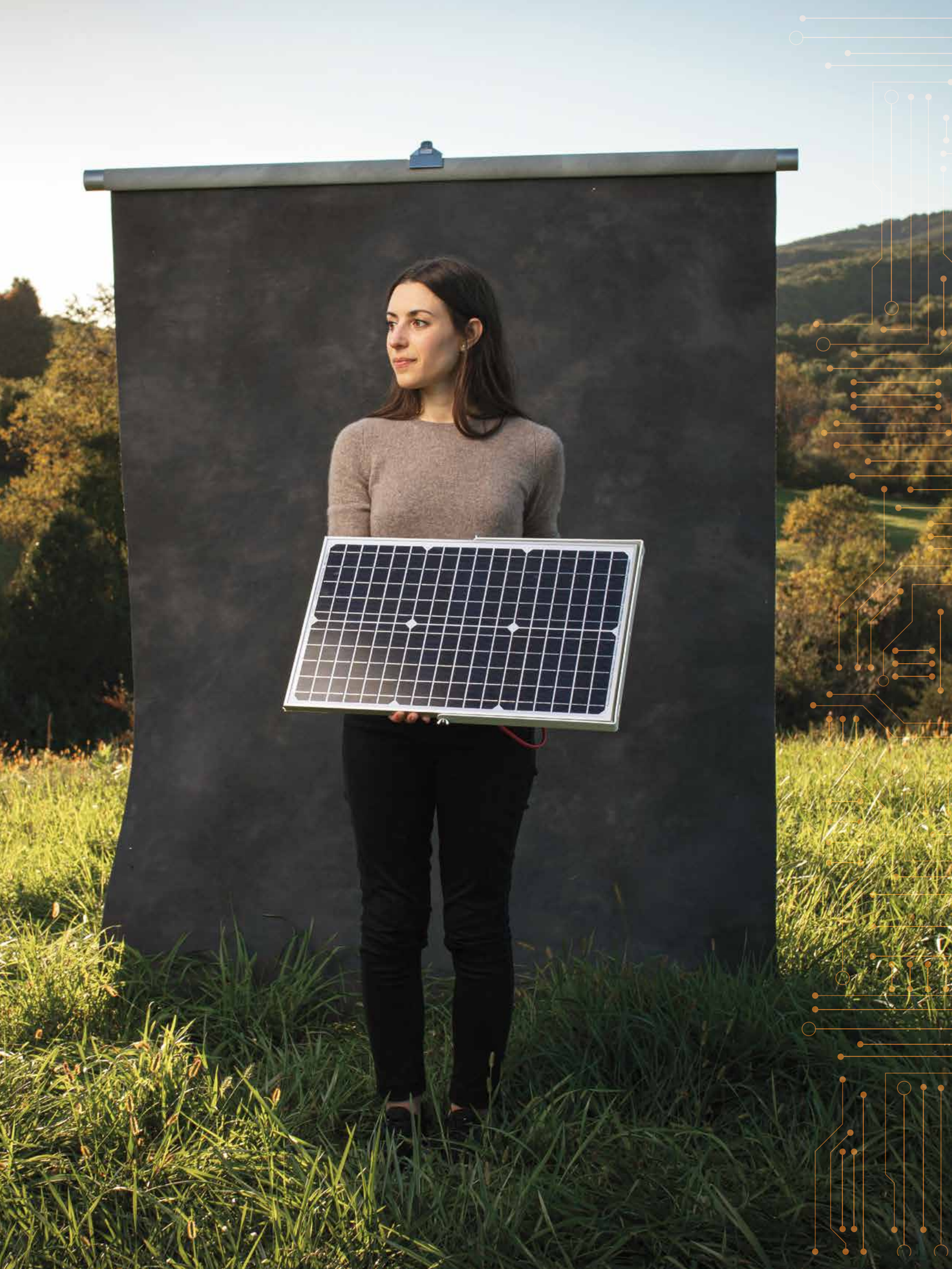
We are pleased to present the following report made possible with funding from

The Harry Lynde Bradley Endowment

Researchers in the College of Engineering know mitigating climate change is critical for a liveable future, and they're applying their engineering prowess to solve the most pressing environmental concerns of our time. Christina DiMarino, assistant professor for the Center for Power Electronics Systems, is just one of the college's climate focused researchers tackling the issues.

Scan to Read the Full Article

Or visit: bit.ly/ECEChristinaMag



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NASA Funds Virginia Tech Research to Investigate Space Weather

The future satellite mission will investigate the region where space weather clashes with the lower atmosphere.

Tiny Tech, Big Impact: Miniaturized Gas-Analyzing Tech Boldly Moves Research Forward

SPOCK is the world's first "miniature" gas chromatograph built with patent-pending technology that analyzes chemical composition and physical properties and delivers real-time results, revolutionizing aerosol work in industry safety, environmental science, and national security.

Faculty Fellows

Celebrate the numerous fellowships and professorships our faculty received this year.

Inventor. Engineer. Hokie.

Since the turn of the millennium, Steven Bathiche '97 has led the Microsoft Applied Sciences Research Group in creating new technology, like inventing the Surface series, or building new artificial intelligence (AI) tools for staple Windows software and the Office apps.

"Our goal is to nurture the next generation of engineers and leaders. I am deeply committed to fostering an inclusive, supportive and welcoming environment, where all students, faculty, and staff can thrive."

Message From the Department Head

As I begin my tenure as the Department Head of the Bradley Department of Electrical and Computer Engineering at Virginia Tech, I am filled with excitement and a deep sense of responsibility. The ECE department has long been recognized for its excellence in education, research, and innovation, and it is a privilege to serve such a dynamic and accomplished department. In the past decade, the ECE department has thrived in numerous ways, from increasing research expenditures to achieving significant improvements in student enrollment and success. Most notably, the department now ranks as #2 in the Global Universities for Electrical and Electronic Engineering in the United States in the U.S. News & World Report, and #8 in Best Online Master of Electrical Engineering program, a testament to the collective effort of our talented faculty, staff, and students.

I look forward to working alongside our exceptional faculty, staff, students, alumni, and partners to further strengthen our educational programs, expand our research impact, and advance our collective vision for the future of ECE. More specifically, we will continue to enhance undergraduate and graduate education, equipping students with the knowledge, skills, and experiences needed to lead in an evolving technological landscape. We will amplify the impact of our research by fostering interdisciplinary collaborations and deepening engagement with industry, government, and funding agencies. Additionally, we will strengthen faculty recruitment, retention, and graduate enrollment to fortify our academic programs and attract top-tier talent. We will also strive to strengthen partnerships across the university, industry, and national and international research communities.

The Virginia Tech Innovation Campus presents an exciting opportunity for the ECE department to expand its impact, drive innovation, and shape the future of technology and education. As department head, I will work closely with our faculty, staff, students, and industry partners through this transformative period, ensuring we meet recruitment, enrollment, and graduation targets while shaping the long-term success of the Innovation Campus. I look forward to building strong connections between our campuses and fostering an ecosystem where faculty, staff, students, and partners can collaborate seamlessly to drive meaningful innovation.

Our goal is to nurture the next generation of engineers and leaders. I am deeply committed to fostering an inclusive, supportive and welcoming environment, where all students, faculty, and staff can thrive.

I will continue to emphasize mentorship and professional development, empowering students and colleagues to reach their full potential. We will work collectively to ensure that the ECE department remains a place where everyone feels welcomed, valued, and respected.

Again I want to express my deep gratitude to the ECE faculty, staff, and students who have already contributed to the department's success. It is your dedication, expertise, and passion that make our department a leader in the field. As we move forward, I encourage each of you to join me in shaping the next chapter of ECE at Virginia Tech. Together, we will continue to push the boundaries of innovation, expand opportunities for our students, and solidify our position as a global leader in electrical and computer engineering.

Rose Qingyang Hu
ECE Department Head

MEET *Rose Hu*

For Rose Qingyang Hu, creating a supportive community is personal.

She developed a passion for STEM at a young age, thanks to the encouragement of her teachers as far back as elementary school. Now, she's hoping to build that same level of support as the first female department head of the Bradley Department of Electrical and Computer Engineering since its inception in 1892.

Hu comes to Virginia Tech from Utah State University, where she served as professor and associate dean for research. Her appointment in the College of Engineering began on Jan. 1, 2025.

"We are thrilled to welcome Rose Qingyang Hu to the Virginia Tech College of Engineering. Her expertise in next-generation wireless research will help pave the way for the future of the department as we expand into the D.C. area and beyond," said Julie Ross, the Paul and Dorothea Torgersen Dean of Engineering. "I look forward to working with Rose to position the department for success in the years to come."

What got you interested in engineering, and subsequently your field of research?

The early guidance I received from elementary school onward inspired me to pursue science and engineering, and today, I am committed to giving back to my students in the same way.

My fascination with how science and technology shape our world ignited my interest in engineering. As my studies progressed, I became particularly drawn to the field of wireless communications and networking, captivated by its beautiful blend of mathematics, physics, and engineering principles.

What excites me most is its power to transform the society by serving as the critical infrastructure across various sectors, such as healthcare, education, autonomous systems, smart cities, agriculture, etc.. These innovations promise not only faster data speeds but also more reliable, scalable systems that can support emerging applications across a range of sectors and create a more connected, efficient, and sustainable world.

What are you looking forward to as one of the newest members of Hokie nation?

I am extremely honored to join Hokie Nation. Being a Hokie means being part of a community that values excellence, innovation, and inclusivity. The university's motto, Ut Prosim (That I May Serve), resonates deeply with me, particularly in my role as the department head. I see my work not just as a leader, but as someone who is helping to create an environment that encourages collaboration, fosters inclusion, and promotes the personal and professional growth of our faculty, staff, and students. I look forward to collaborating with esteemed faculty, dedicated staff, and talented students to advance our research and educational initiatives and push the boundaries of knowledge in the field.

How do you think Virginia Tech (and ECE) is uniquely positioned to help tackle the global challenges facing electrical and computer engineers?

Through a combination of world-class education, interdisciplinary research, and strategic industry and government partnerships, national and international collaboration, Virginia Tech and ECE are tackling grand challenges in sustainable energy and power systems. The Center for Power Electronics Systems (CPES) and Power and Energy Center (PEC) drive innovation in high-efficiency power conversion, energy storage, and future power grid systems. Meanwhile, Virginia Tech's leadership in wireless communications and advanced computing is shaping the future of 6G networks, edge AI, and quantum computing. Through Wireless@VT and the Innovation Campus, the department is addressing the demands of high-speed secure connectivity and next-generation computing architectures. Virginia Tech is also a leader in advancing semiconductor technology and education, and space systems. We have launched the innovative Chip-Scale Integration program, advancing cutting-edge digital and analog electronics for superior performance and efficiency. Research initiatives at Space@VT support innovations in satellite communications, space weather analysis, and deep-space exploration.

One of the most critical areas today is cybersecurity and national security, where threats to digital infrastructure, AI systems, and autonomous networks continue to grow. Working closely with Commonwealth Cyber Initiative (CCI) and the Virginia Tech National Security Institute (VTNSI), ECE is at the forefront of cybersecurity research, developing zero-trust architectures, AI-driven security solutions, and secure communication networks to safeguard national and global infrastructure. By integrating world-class faculty, cutting-edge research centers, and strong industry and government partnerships, ECE is solving today's global engineering challenges while shaping the future of secure, sustainable, and intelligent ecosystems.

MORE ABOUT HU

The internationally renowned researcher has received several prestigious recognitions and awards, including:

AAAS fellow, 2024

IEEE WICE Outstanding Achievement Award, 2023

Asia-Pacific Artificial Intelligence Association fellow, 2021

IEEE fellow, 2020

Hu has published six books and more than 300 journal articles and conference papers throughout her career. She currently serves as editor-in-chief for IEEE Communications Magazine. Prior to joining Virginia Tech, Hu was a professor in the Electrical and Computer Engineering Department at Utah State, and, earlier in career, held various industry and academia positions, actively participating in industry 4G standards, technology development, and system-level simulations. In addition, she has more than 20 patents in her name.

Hu received her Ph.D. in electrical engineering from the University of Kansas in 1998, a master's degree in mechanical engineering from New York University in 1995, and a bachelor's degree in electrical engineering from the University of Science and Technology China in 1992.

Message From the Chair of the Advisory Board

"Today's students don't just learn the theoretical concepts of Electrical Engineering but are exposed to the importance of responsible use, entrepreneurship, integrity and ethics."

This is a very exciting time for the Bradley Department of Electrical and Computer Engineering at Virginia Tech, as we continue forward with new leadership into a time of unprecedented technological change. The addition of Dr. Rose Hu as our department head marks the start of a new era for the department. Her extensive resume of books, papers, and patents is complimented by an outstanding record for mentorship of graduate and postdoctoral researchers. The Virginia Tech ECE Advisory Board is working closely with Dr. Hu to develop new initiatives for the board in support of her priorities for the department in the upcoming years.

Having served on the advisory board for several years now, I have been impressed by how focused the department has been on holistically preparing students for engineering careers in today's workforce. The use of business intelligence has provided deep insight into where the department is succeeding and where challenges remain. The undergraduate curriculum has been refined for flexibility, then tuned to ensure that all students have the opportunity to graduate within a four-year timeframe. The inclusion of majors and the capstone Major Design Experience (MDE) provide both focus and practical applications of foundational knowledge.

Beyond the academics, the recent addition of Heta Lambda Beta (HLB) society for all undergraduates and contributors to the department emphasizes core values of integrity, dignity, and respect. Today's students don't just learn the theoretical concepts of Electrical Engineering but are exposed to the importance of responsible use, entrepreneurship, integrity and ethics.

The research problems before the department are increasingly complex and continue to require more and more resources (students, labs, partnerships, etc.) to advance the body of knowledge. Our new Innovation Campus is just one example of how ECE is rising to this challenge. The department's breadth of expertise in key areas such as semiconductors, quantum, artificial intelligence, power, cybersecurity, biotechnology, and communication networks will need to continue this expansion of collaboration with other departments and colleges as well as government and industry experts.

One of the greatest strengths of the Virginia Tech ECE department continues to be our amazing network of alumni. The advisory board was instrumental in reviving and expanding the Society of Distinguished Alumni, now in its third year. This year the board expanded our contributions by implementing a new process to perform a rolling baseline review of all alumni. Participating in the review of candidates every year gives the advisory board a much better appreciation for the outstanding career contributions and accomplishments of so many ECE alumni.

I would encourage all alumni to find at least one way each year to engage with ECE – opportunities ranging from financial support on Giving Day to attending one of the many fall tailgates and socials, or sponsoring an MDE team, or providing one of the technical talk series at the Northern Virginia Campus. There is so much going on, it is easy to find a way to serve!

Finally, I would like to thank our immediate past department head, Dr. Luke Lester, for all he has done for our beloved ECE department in the last several years. His impact on the department is profound and reflected in all dimensions of the program and will endure for decades to come.

Thomas Drayer

Technical Director, Processing and Analytic Capabilities, U.S. Department of Defense

Chair, ECE Advisory Board

Electrical and Computer Engineering
EARNS HIGH HONORS
in U.S. News & World Report Rankings

VIRGINIA TECH'S BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING HAS ACHIEVED A NEW HEIGHT OF EXCELLENCE: REACHING THE NO. 2 SPOT IN THE U.S. NEWS AND WORLD REPORT RANKINGS FOR BEST GLOBAL UNIVERSITIES.

Rising two spots from the 2022 report, this new ranking in electrical and electronic engineering, highlights Virginia Tech's continued growth in research and reputation.

"Our department is home to many internationally recognized experts in their respective disciplines, including cybersecurity, photonics, power electronics, power systems, quantum engineering, software systems, space science and engineering, and wireless communications and networks," said Harpreet S. Dhillon, 2024 interim department head and the W. Martin Johnson Professor. "With this rather rare combination of breadth and depth, we are well-posed to tackle complex transdisciplinary societal challenges while maintaining a strong presence in each of these disciplines."

These rankings are determined by specific measurable and objective outcomes, such as:

- Global and regional research
- Publications, journal articles, papers, and numbers of citations
- International collaborations

Whether pushing the boundaries of wireless communication and semiconductor technology, or advancing artificial intelligence and the future of the electrical grid, the electrical and computer engineering department contributes to progress across the globe. Its faculty represent half of the inaugural faculty cohort for the Virginia Tech Innovation Campus, including one of Clarivate's most highly-cited researchers, Walid Saad, noted artificial intelligence (AI) and digital twin expert whose work spans globally with Japan.

Its faculty also have established and support high-profile initiatives and an institute with research happening across the university:

- Commonwealth Cyber Initiative
- Virginia Alliance for Semiconductor Technology
- National Security Institute

In addition, multiple research groups like the Power and Energy Center, Space@Virginia Tech, Wireless@ Virginia Tech, and the Center for Power Electronics Systems, make numerous contributions to electrical and computer engineering research. The department's research expenditures have grown exponentially over the last decade, supporting research across all four of the university's research frontiers: health, quantum, AI, and security.

"This ranking is a strong testament to the high productivity of our impressive faculty and the ground-breaking impact of the research conducted in the department over the past decade," said Dhillon. "This recognition reinforces our global reputation, positioning Virginia Tech as a leading choice for high-quality faculty, staff, and students from around the world."

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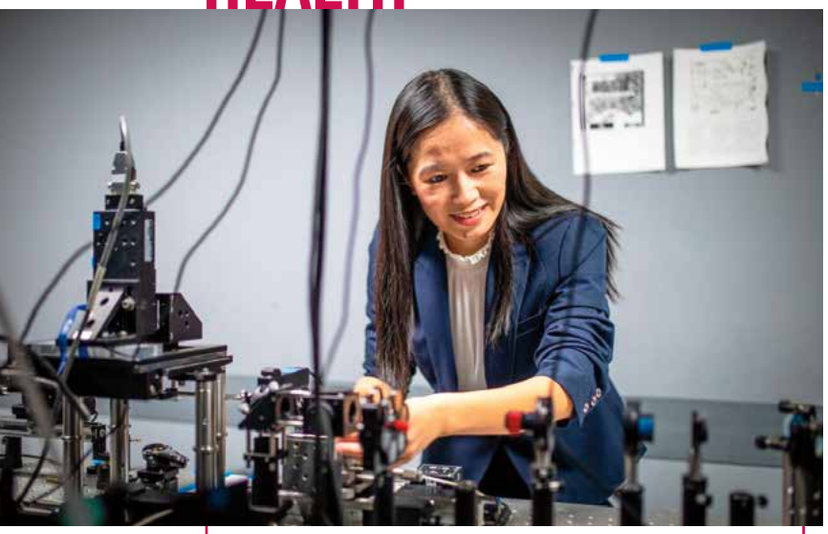
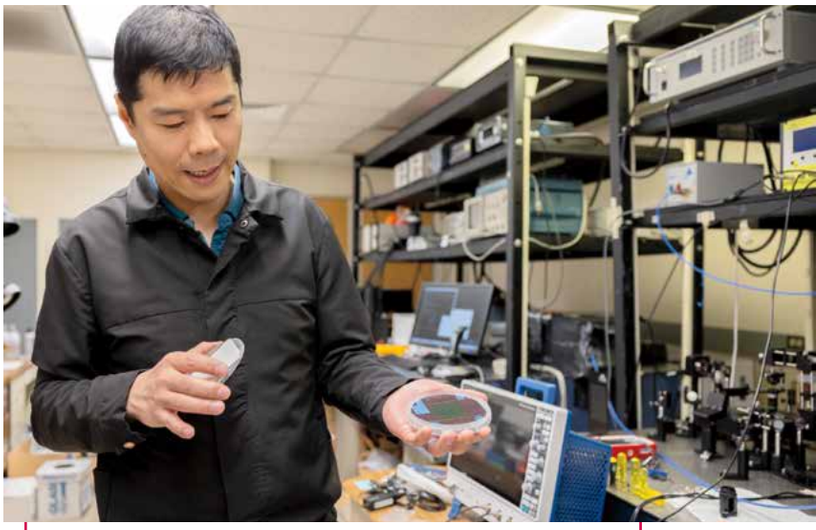
HEALTH



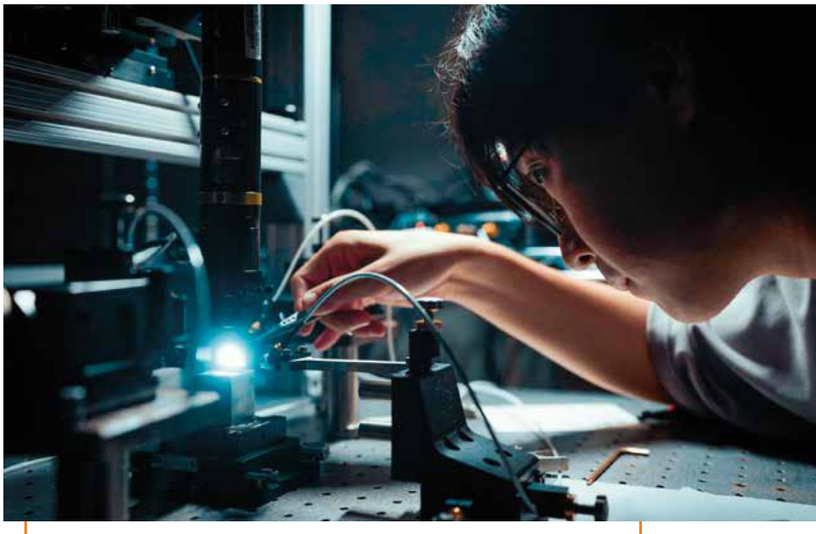
With proprietary, thermally-drawn fibers used for electrical stimulation, drug delivery, and imaging, Xiaoting Jia is working to solve memory loss caused by Alzheimer's disease.



Wei Zhou takes minimally invasive to the next level — the nanoscale. Utilizing microscopic nano-optoelectrodes, which are tools that interface with the human body, Zhou is working to develop a personal wearable device that can track the biochemical and electrical data from inside cells.

QUANTUM

As the J. Byron Maupin Professor of Engineering, Wayne Scales is working to meet the growing demand for a quantum-trained workforce. Scales is supported by a nearly $1 million grant to train faculty members, acquire equipment, and develop quantum curricula in addition to replicating Virginia Tech's quantum experiential learning lab at Virginia State University.



Assistant Professor Linbo Shao is using a "quirky" quantum behavior to transform thermal detection. The mid- and long-wavelength bands of radiation he studies are key to night vision, monitoring body temperature, spotting forest fires, and tracking rackets, missiles, and airplanes.

ARTIFICIAL INTELLIGENCE

Angelos Stavrou is playing games with AI to level up their security capabilities as part of a multi-agent training exerciser. The exerciser is a unique combination of real, emulated, and simulated networks that simultaneously run millions of game variations, training AI agents to best attack and defend against cyberattackers.

Ruoxi Jia, whose research was featured in the New York Times, works to improve machine learning algorithms by studying how to improve the data machine learning is trained on. She's identifying high-quality data sources while eliminating biased data with the goal of creating better AI-powered products and services for all.

SECURITY

As the director of Wireless@Virginia Tech, Lingjia Liu aims to support secure and open wireless networks. His research, funded by the Public Wireless Supply Chain Innovation Fund, is centered on developing an intelligent testing framework for open radio access networks, using reservoir computing, a machine-learning approach by how humans process information.

Wenjie Xiong, a Commonwealth Cyber Initiative faculty fellow, focuses on keeping hardware secure through understanding the "attack surface" – where and how a system is vulnerable. She utilizes a dual perspective that analyzes software and hardware to get into the mindset of an advanced attacker, and explores vulnerabilities in power supply or system outputs.

MORE RESEARCH

Read other stories at **bit.ly/ECERankings**

Story by Niki Hazuda

CCI & Virginia Tech

To Hold Prominent Roles in $42 M Wireless Project

(From left) Assistant Secretary of Commerce for Communications and Information Alan Davidson, U.S. Rep. Don Beyer of Virginia, U.S. Secretary of Commerce Gina Raimondo, and U.S. Sen. Mark Warner of Virginia discussed open radio access networks at an event hosted by the Commonwealth Cyber Initiative and Virginia Tech on Feb. 12 and announced a $42 million wireless innovation project. Photo by Craig Newcomb for Virginia Tech.

"We want to lead the world" in wireless networks, the U.S. secretary of commerce said during the announcement. CCI's xG Testbed at Virginia Tech will lead the project test center in the greater Washington, D.C., metro area.

The Commonwealth Cyber Initiative (CCI) and Virginia Tech will play an instrumental role in a new $42 million wireless innovation project announced by the U.S. Department of Commerce on Monday at the Virginia Tech Research Center — Arlington.

At the event, U.S. Secretary of Commerce Gina Raimondo, Assistant Secretary of Commerce for Communications and Information Alan Davidson, U.S. Sen. Mark Warner of Virginia, U.S. Rep. Don Beyer of Virginia, and industry leaders discussed open radio access networks (O-RAN), which promise to boost competition in a market dominated by a few players, spur innovation, and create jobs.

"When the United States thinks about how … (we'll) meet the greatest challenges of the day, we fall back on core American values – openness, competition, innovation, and working with our allies," Raimondo said. "That's what O-RAN is about. We want to lead the world and outcompete the world, and to do that, we have to out-innovate the world."

Funded by the CHIPS and Science Act of 2022 and administered by the National Telecommunications and Information Administration, the Public Wireless Supply Chain Innovation Fund will invest $1.5 billion in the next decade to support the development of open and interoperable networks. Raimondo credited Warner with including O-RAN investment in the bill.

The Acceleration of Compatibility and Commercialization for the Open RAN Deployments (ACCoRD) Project is a consortium of U.S. carriers, foreign carriers, universities, and equipment suppliers. AT&T and Verizon will lead the project that was announced on Monday.

"CCI made an early strategic decision to invest in O-RAN that has positioned us with unique strengths to contribute to the Wireless Innovation Fund objectives," DaSilva said. "When we talk about the CCI xG Testbed, the tangible part, such as the equipment, is the first thing that comes to mind, but our real strength lies in the expertise we developed and the researchers we have trained. The workforce, and the ability to constantly train new professionals, is the real asset."

With AT&T and Verizon leading, ACCoRD's industry partners include Ericsson, Nokia and Samsung, Fujitsu, Mavenir, Dell Technologies, Intel, Radisys, Rakuten, Red Hat, VMWare by Broadcom, and Wind River Systems. Japanese telecommunications company NTT DOCOMO and India's Reliance Jio are unfunded founding members of the consortium.

Story by Michele McDonald

THE FUTURE OF HEALTH CARE IS IN OUR CELLS

With a groundbreaking technology called nano-optoelectrodes, Virginia Tech associate professor Wei Zhou is working on a new way to make health care more personalized.

In 1994, Ms. Frizzle took her fourth-grade elementary students aboard the Magic School Bus to investigate the inner workings of a classmate's body while he fought off a cold. After they magically shrunk down the bus, they drove through the classmate's bloodstream, observed red and white blood cells working together, and endured almost being eaten by a blood cell when the bus was mistaken for bacteria.

Thirty years later, Wei Zhou is channeling his own inner Ms. Frizzle to make her cartoon adventure a reality with nano-antennas — incredibly tiny electrodes that go inside cells.

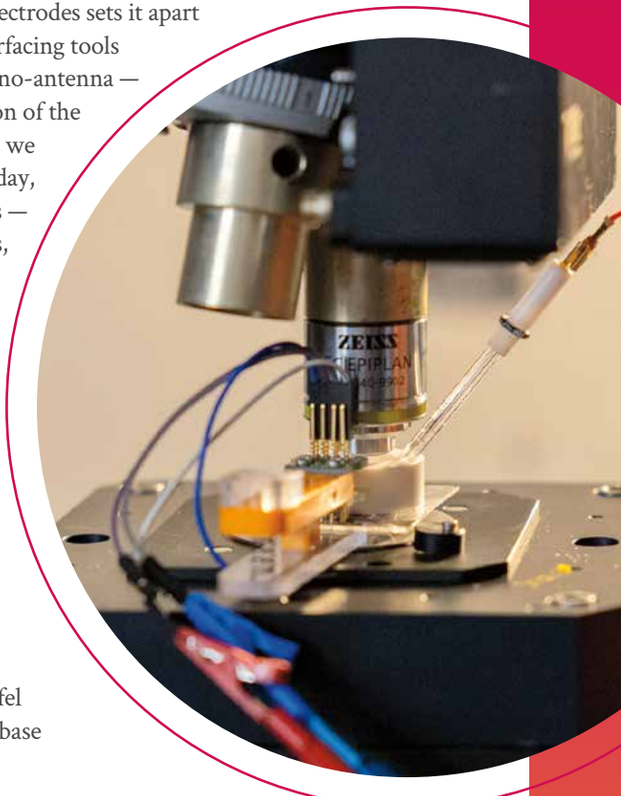
"We want to get information from within the cells," said Zhou, associate professor in the Bradley Department of Electrical and Computer Engineering, "whether metabolite molecules, protein biomarkers, or even genetic information. But getting that information from within the cell without killing it is actually a very difficult challenge."

Today's standard technique of getting cellular information is called endpoint analysis, where cells are extracted for discovery, like when doctors perform a biopsy to diagnose a disease or infection. Using a needle or a scalpel, doctors remove fluid or tissue that is then analyzed for health issues. However, once the cells are extracted in a biopsy, the information they provide is finite — the cells are no longer connected to a living biological system.

Enter the Swiss army knife of small, bio-interfacing tools: nano-optoelectrodes.

Starting Small, Really Small

As hybrid electrical-optical devices and sensors, nano-optoelectrodes are capable of reading both biochemical fingerprints and electrical activities of a cell's molecules in a continuous, real-time stream. The multifunctional nature of the optoelectrodes sets it apart from other bio-interfacing tools because it fuses a nano-antenna — a microscopic version of the large-scale antennas we interact with every day, such as radio towers — and nano-electrodes, which are devices that deliver or take out electricity, like welding tools or batteries.



The optoelectrode design even mimics its full-sized counterparts, built into shape called a nanopillar. At the microscopic level it can look like the Eiffel Tower, with a solid base and a pointy top.

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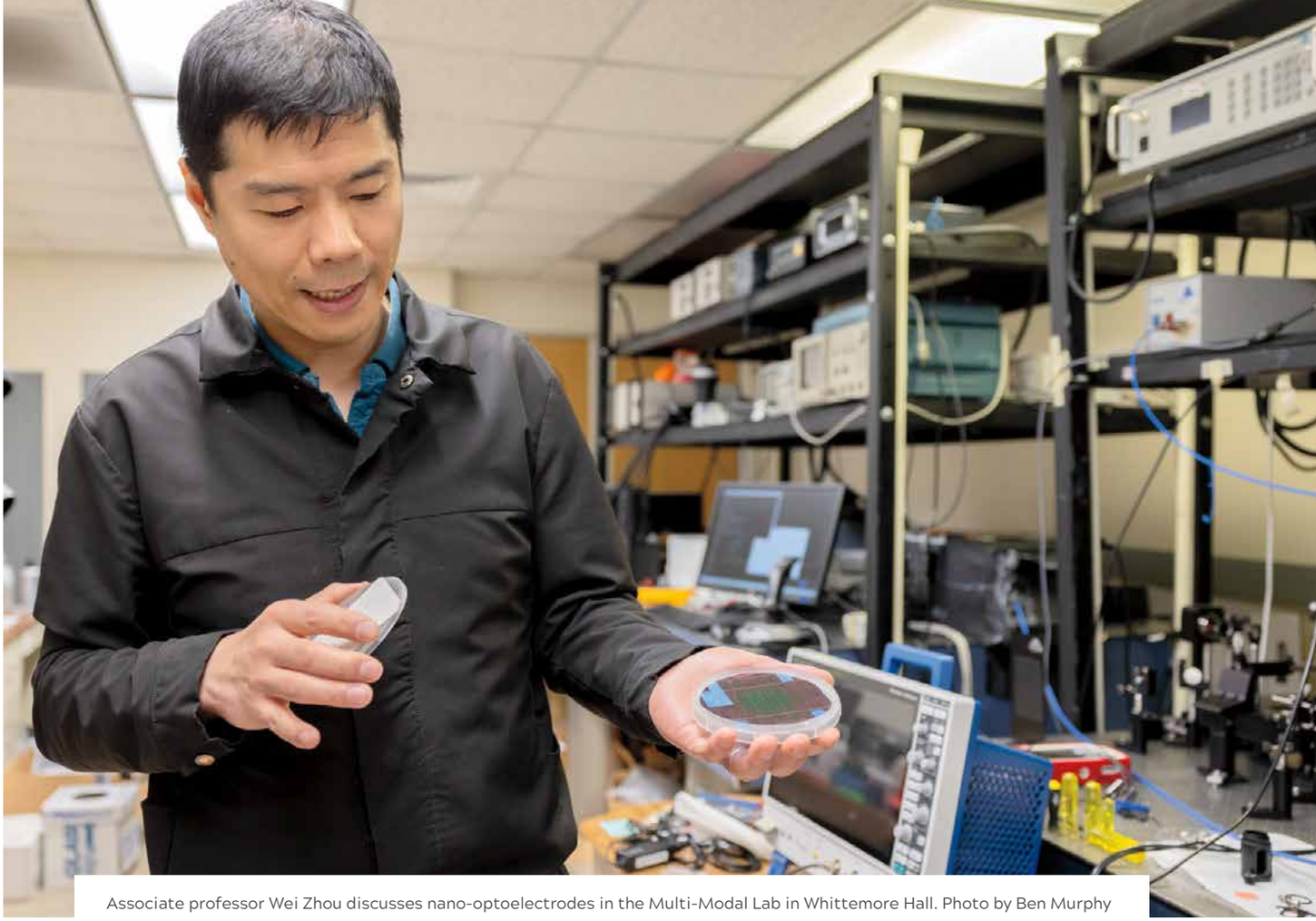


Associate professor Wei Zhou discusses nano-optoelectrodes in the Multi-Modal Lab in Whittemore Hall. Photo by Ben Murphy

"Due to the structure of the nano-optoelectrodes, it can trick the cell into engulfing it," Zhou said. "We use a short-pulsed laser to induce vapor nano-bubble generation, so the device can penetrate through the cell membrane and send out electrical signals."

That nano-bubble generation is called optoporation, a pinpoint bit of heat that temporarily vaporizes a tiny hole in the cell membrane; it's an ultra-precise, minimally invasive nano-surgery that Zhou is helping to pioneer. Unlike in endpoint analysis, where cells are removed from the body and permanently destroyed in the process of extracting data, the optoelectrodes go inside the cells and stay there, no damage necessary.

Once inside the cell, the nano-optoelectrodes will employ artificial intelligence (AI) capable of machine learning to process and send out the intracellular data. It's like having a team of tiny doctors inside your cells, constantly studying, testing, and reevaluating results that get shared with an "outside" team.

While Zhou is starting with a single cell and antenna, the future of his research is to create and deploy large-scale nano-optoelectrode arrays in wearable or implantable devices that go beyond today's fitness trackers, smartwatches, and blood pressure monitors. Zhou is specifically interested in how cancer and neuron cells interact with each other, antibodies, and immunotherapies.

"The living system, the human system, is probably the most complicated system," Zhou said. "We currently lack the tools to pick up information from all the domains within the body or to de-mystify what's really going on."

The Future of Personalized Medicine

The most well-known personalized medicine right now is targeted therapy – a type of cancer treatment specifically designed to target the proteins that control how cancer cells grow, divide, and spread. Due to cancer's ability to potentially develop resistance, these therapies are often used in combination with others, like chemotherapy and radiation, that cause the death of cancerous and healthy cells.

But Zhou's nano-optoelectrodes don't harm cells to help solve medical concerns. The data gathered by the electrode's AI can be utilized by doctors to truly understand – at the cellular level – a patient's disease and develop treatment plans.

"Our nano-optoelectrodes provide higher quality intracellular information and can use machine learning to recognize and understand the detailed patterns between biochemical and bioelectrical activities inside cells," Zhou said. "We can really understand, at the cellular network level, the patient, the cancer, and drug therapies. It can be very helpful to find the best therapeutic plan for personalized treatment."

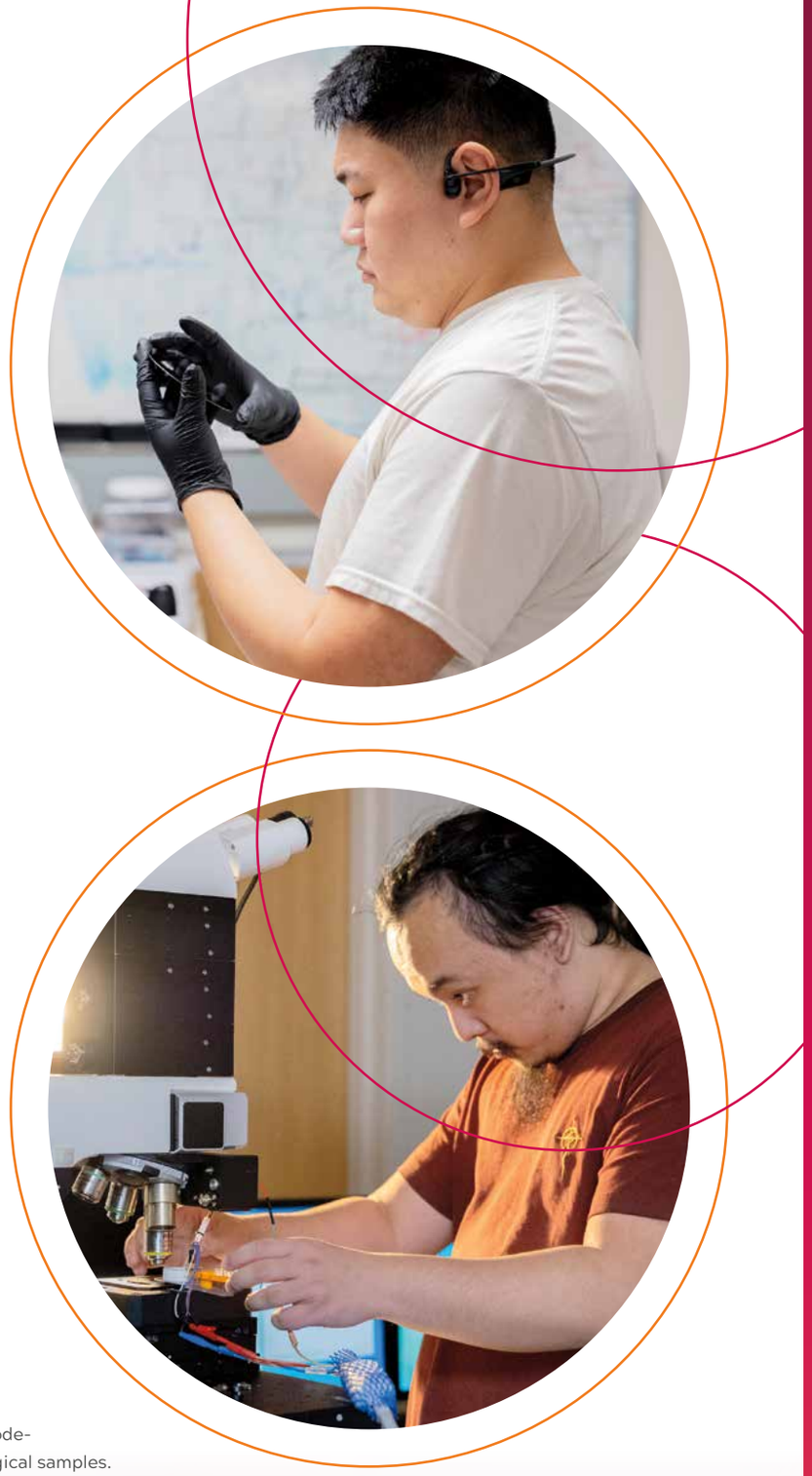
With the ever-evolving nature of cancer treatments and patient-to-patient variations of the disease, individualized tools like nano-optoelectrodes can provide groundbreaking control through AI's ability to analyze data and continuously stream information from inside the body. It also reduces the patient impact, with less need for tissue samples.

For Zhou, one of the most fundamental contributions of these nano-optoelectrodes would be to brain science. Building the devices into a soft, flexible, porous mesh structure, this bio-interfacing tool could be implanted within the brain, picking up bioelectrical and biochemical neural activity. The technology could be used to determine when a patient's onset of a negative health condition, like Parkinson's, or mental illness, like depression.

Much like the boundless imagination of Ms. Frizzle, the applications of nano-optoelectrode arrays are endless.

"It's ultimately a scalable, real-time information conversion interface between cyber-physical and biological-biochemical domains – it can be for the human brain, or it can be for a wastewater system," Zhou said. "We're pursuing collaborations in biology, food science, virus and bacteria detection, and even chronic wound monitoring. So, what we're building isn't really the end product – it's the platform technology. When we have the hardware infrastructure, it can lead to many, many different applications."

Story by Niki Hazuda



Top: Graduate student Chuan Xiao prepares nano-optoelectrode-integrated microfludics biochips for measurements of biological samples. **Bottom:** Graduate student Yuming Zhao works with nano-optolectrodes to take electrical and optical measurements of biological samples. Photos by Ben Murphy.

Virginia Tech Researchers Continue to Innovate UNDERWATER ROBOTICS Missions With Support From the Office of Naval Research

It's been said that we know more about the surface of the moon than the floor of Earth's oceans. For more than two decades, Virginia Tech's Center for Marine Autonomy and Robotics has been developing robots that can find what lies beneath the sea surface with the support of the Office of Naval Research.

Bringing together faculty and students from the College of Engineering and the Virginia Tech National Security Institute, the center is developing advanced underwater robots and autonomy algorithms that enable them to operate intelligently without human oversight. The research team recently was awarded two grants totaling more than $5 million to continue that mission. Two additional grant proposals, totaling about $2.4 million, have been selected by the agency and awards are in process.

"Our positive, growing relationship with the Navy is a direct result of our ability to be responsive to the Navy's needs, including technology development and training of the next generation of Navy science and technology leaders," said Dan Stilwell, electrical and computer engineering professor. "Our students and staff are designing and deploying the next generation of autonomous underwater robots with capabilities that are far beyond those of current Navy systems."

Stilwell, who co-directs the center alongside aerospace and ocean engineering Professor Stefano Brizzolara, noted the strong and long-standing support for the center's work from across the Navy's science and technology enterprise, including various Navy labs and commercial organizations, in addition to the Office of Naval Research.

Applications include:

- Lifeguard-like autonomous rescues
- Taking measurements underneath the waves, providing a novel approach to monitoring and reconnaissance
- Serving as a platform for cameras and sensors to record
- Innovative Autonomous Underwater Vehicles, $2.7 million, Office of Naval Research
- Advanced methods that allow AUVs to operate efficiently and effectively in non-permissive, unpredictable underwater settings
- Minimized energy consumption navigation errors over extended period
- Ability to detect and appropriately respond to other entities in the underwater environment, enhancing craft situational awareness and operational safety

This support from the Office of Naval Research (ONR) highlights Virginia Tech's expertise in pioneering research that enhances the capabilities of underwater vehicle systems in complex environments. The outcomes of these projects could have far-reaching implications for underwater exploration, national defense, and environmental monitoring, and an even greater impact on the students and faculty involved in these projects.

Brizzolara has seen his students work on these high-level projects and go on to tackle successful careers in national security, commercial robotics, and more.

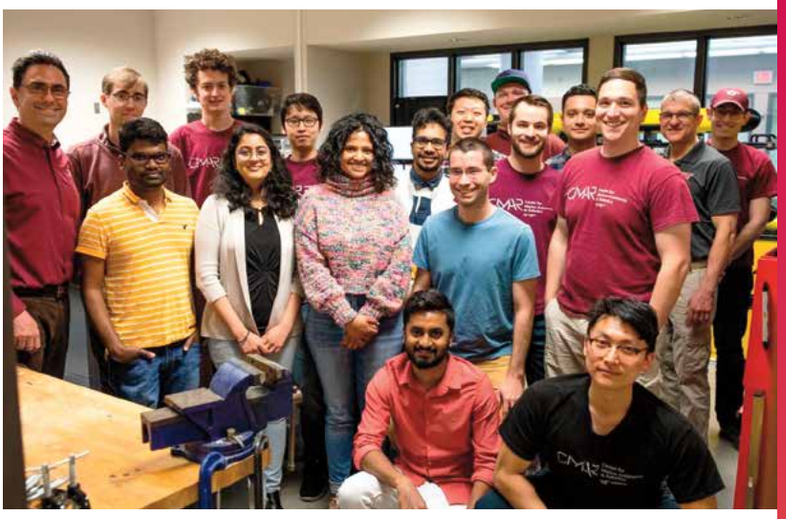
"The partnership we have with the Office of Naval Research is one that is mutually beneficial," Brizzolara said. "Yes, we are helping solve problems and innovate technologies, but we are also preparing these students in a way that can't be done in a traditional classroom setting. I know when my students leave here, they will be prime candidates for jobs at the ONR or anywhere else for that matter."

Many of the students and alumni of the Center for Marine Autonomy and Robotics started working in the lab because of their fascination with autonomy and robotics. For Biggs, he appreciates the expertise he gained during his Ph.D. as it is serving him well in his engineering role at the Johns Hopkins University Applied Physics Laboratory, but his fondest memories of the work were on the lake where it all comes together.

"The wonder of it all is something that just can't be explained," said Biggs. "It's almost like magic, to see and understand how these robots work. That feeling of wonder has been a driving force for me. At Virginia Tech, I just wanted to learn more and it's only grown from there. The beauty of seeing these systems work in the real world is an incredible thing."

This is an abridged version of the article published at **bit.ly/ECENaval**

Story by Chelsea Seeber



Left page: Center for Marine Autonomy and Robotics students and Co-Director Dan Stilwell (second from left) with underwater autonomous subs at Claytor Lake, near Virginia Tech's Blacksburg campus. **Right page, left to right:** Dan Stilwell has been working with graduate students to develop unique underwater submarine capabilities for the Navy for more than two decades. | The Center for Marine Autonomy and Robotics has students from electrical and computer engineering and aerospace and ocean engineering. The collaborative work results in new advancements for autonomous underwater vehicle technology. Photos by Peter Means.

LEVELING UP

VIRGINIA TECH'S ANGELOS STAVROU IS TRAINING ARTIFICIAL INTELLIGENCE TO DEFEND COMPUTER NETWORKS THROUGH A $16 MILLION COLLABORATIVE CYBERSECURITY PROJECT.

Playing games is a universal human experience. Every country and culture plays games unique and ubiquitous to its people, from the ancient Chinese game Go to modern computer games such as SimCity.

But games are more than a human hobby. They're a training ground for artificial intelligence (AI) to learn fundamental decision-making skills, handle uncertainty, and tackle complex interactions. AI's ability to tirelessly explore thousands of possibilities makes it the perfect tool for finding strategies humans might overlook.

Angelos Stavrou, professor in the Bradley Department of Electrical and Computer Engineering and founder of mobile security startup A2 Labs, plans to take AI training to the next level with a multi-agent training exerciser (MATrEx). Through this "matrix," AI faces a new opponent — other AI — but the implications go beyond a fun game.

"What we want to do is take a network, like the Virginia Tech network, copy it into a virtual environment, and then run simulations of attacks and defenses with logic generated by AI agents," said Stavrou, who's also entrepreneurship lead for the Virginia Tech Innovation Campus. "AI can play billions of game variations so they can actually characterize the cybersecurity start of the system, and decide which attacks or defenses are superior."

Playing the Game

In a world plagued by persistent and never-ending cyber threats, improving the security of computer networks by minimizing vulnerabilities is essential for protecting cell phones, the 5G wireless system, and the thousands of data centers in the United States. The process is called "network hardening." It's like adding strong locks to a home and reinforcing its walls.

MATrEx is a $16 million project funded by the Defense Advanced Research Projects Agency as part of Cyber Agents for Testing and Learning Environments. It's a trailblazing way to train AI in a three-tiered gaming system – simulations, emulations, and a real network. Within the MATrEx, AI agents are grouped into two categories:

Red agents, that need to learn the gaming network and how best to break through system defenses for attacks

Blue agents that understand the network fully, including defense capabilities

The "games" are scenarios red and blue agents run against each other. Researchers will study what attacks break through, which defenses stop the attacks, what happens during a specific attack, and more.

"The idea is that we'll create a loop, so the AI can play in a network that will start from a real network, then emulate it and simulate it," said Stavrou. "The real system is accurate, but it's slow. The simulation is fast, but it's not as accurate. So you need to play the game across

CYBERSECURITY THROUGH AI GAMES

all these environments, transferring knowledge from the real network to the simulated. Then you transfer strategies from the simulated back to the real network."

The distinctive combination of real, simulated, and emulated networks sets MATrEx apart from any other AI training system in the world. Each network provides a training ground – and researcher data set – for the AI.

Real network: This is the physical computer or wireless network used by people every day. It has actual switches, routers, cables and devices that connect together to transmit data. In MATrEx, this is a copy of a company's real network, provided and hosted by the company themselves.

Emulated network: This "digital twin" of the real network is a collection of virtual machines that run the actual operating system from the real network, and also mirrors its network configuration.

Simulated network: Also called a "state machine," this network captures the behaviors of the computers within a network, without having to utilize the network's real operating system. Because of that, actions can run much faster than in real time.

As the AI agents run games through each of these networks, the agents grow smarter and the networks increase in complexity, providing clients the ability to bulk up or restrategize their real, non-MATrEx networks.

Securing the Future

Security is an arms race, and the "good guys," like researchers in cybersecurity, aren't the only ones with access to AI agents.

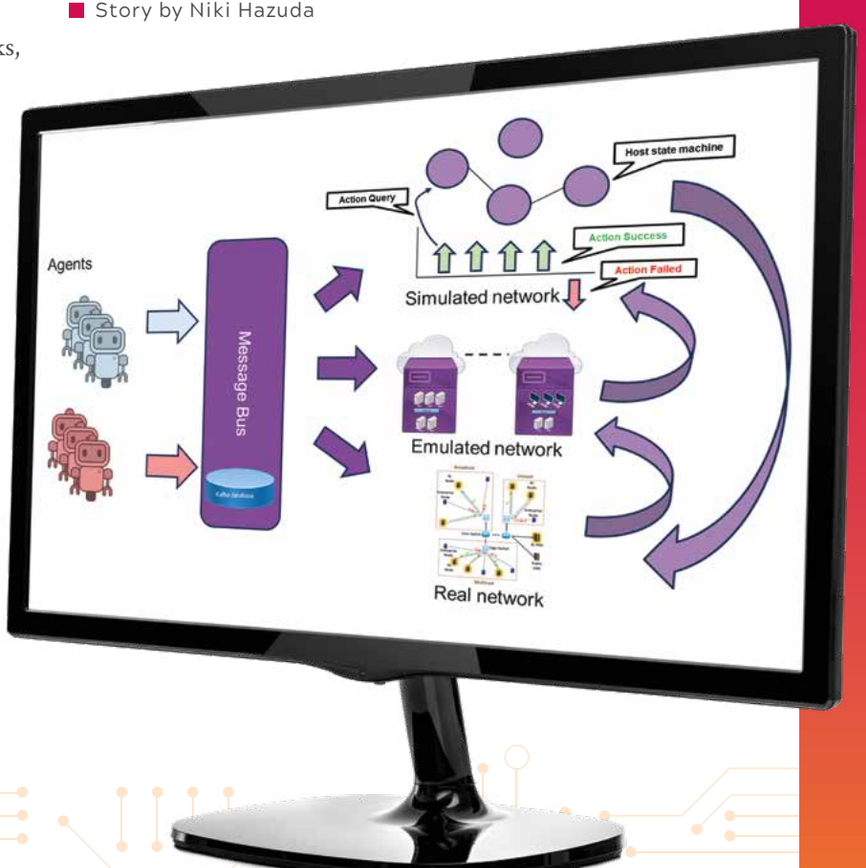
"The work hackers do opens up many more possibilities for attack than it does defense, because attackers only have to succeed once, even if they fail 1,000 times," said Stavrou. "We're opening Pandora's box, but we're trying to understand the effects of AI in cybersecurity."

The end for MATrEx is to scientifically assess the red agent capabilities – what new strategies will they develop – and to teach the blue agents to outsmart their attackers. MATrEx will be designed for companies to run the program internally, so their protected data never leaves and all developed agent strategies stay contained. It's the first training environment that will not only test on traditional network-connected servers, but also 5G.

"There has never been a 5G system connected to a cybersecurity testbed with this level of emulation," said Stavrou. "5G networks are fairly new, and they're usually enclosed within big companies. This will allow us to see what will happen when AI agents attack or defend that type of network and connectivity."

This is an abridged version of the article published at **bit.ly/ECECyberAI**

Story by Niki Hazuda



Left: Adam Gorski installs xG Testbed components for the Commonwealth Cyber Initiative, which has capabilities of securing 5G and next-generation mobile networks and AI assurance. MATrEx will utilize a 5G system, making it a one-of-a-kind cybersecurity test bed. Photo by Anthony Wright. **Right:** A descriptive graphic of how the red and blue agents interact with the different networks within the MATrEx. The graphic demonstrates how red and blue agents go through a message bus to receive instructions prior to entering one of the networks for gameplay. Graphic courtesy of Angelos Stavrou.

GOING GREEN

TRANSFORMING THE GLOBAL ELECTRIC GRID

Today's electric grid is 140 years old, used by a world Thomas Edison and Nikola Tesla could only imagine. But can it stand up to the demands of an increasingly electrified society?

Plugging a phone into an outlet taps into the 140-year-old electrical grid developed by famous inventors Thomas Edison, Nikola Tesla, and Samuel Insull.

Today's grid, called Grid 2.0, is a MacGyvered combination of historical innovations, modern computing, and sensing and monitoring technologies. Thousands of generators are linked together across the United States to power businesses and homes.

When President Joe Biden's administration passed Executive Order 14057, it established a climate goal to achieve carbon pollution-free electricity by 2035.

To achieve that goal, today's power grid will have to transform completely.

"The world is becoming more and more electrified," said Richard Zhang '98, the Hugh P. and Ethel C. Kelly professor in the Bradley Department of Electrical and Computer Engineering. "There's a profound transformation ongoing today in how to generate, transport, store, and consume electrical energy, accelerated by climate change. This new transformation requires very different thinking and calls for numerous new technologies to be created and developed across the entire domain of the electrical infrastructure."

Because alternative energy sources like wind and solar emit no carbon dioxide during production, they're the obvious choice for reaching the clean energy reality – just not with our current grid. Grid 2.0 is unable to meet the growing demand for alternative energies, including the increasing usage of electric vehicles, meaning only one thing: It's time for Grid 3.0.

Thinking Green

Virginia Tech is positioned at the forefront of research on building Grid 3.0 through the Electrified Green Infrastructure Power Conversion lab (eGIPC), which is an expansion to the Center for Power Electronics space in the Virginia Tech Research Center — Arlington.

The space was upgraded this spring and boasts a test bed with special capabilities for academic research and industry projects utilizing programmable emulators for alternating current (AC) and direct current (DC) bulk grids and microgrids.

The emulators are tools that mimic the behavior of real, full-scale power grids with diverse energy sources such as solar or wind farms, battery energy storage systems, and emerging and fast-growing electrical loads, including large data centers. The emulators create controlled and safe environments for researchers to invent and validate novel components, circuits, advanced control algorithms, and system architectures.

The test bed will support sustained and long-term research for high-, medium-, and low-voltage research for applications, including:

- AC and DC microgrids, which are electrical grids designed for one specific area, such as a single building or even a small town, and have diverse energy sources and utility-scale energy storage
- Multi-terminal high-voltage direct current transmission, a technology that transmits electricity over long distances, to multiple locations, and is crucial for integration of renewable energy, such as offshore wind farms and solar farms
- Off-shore wind and solar farms, such as the future wind farms outside of New York and New Jersey that will power more than 700,000 homes
- Electric vehicle charging infrastructure, which includes at-home and public charging stations
- Green hydrogen production systems through electrolysis. Hydrogen's natural state is gas, so it's not easily accessible for use as a clean energy source. Using production systems, hydrogen can be produced for energy sources like fuel cells, which don't emit greenhouse gases.

Utilizing this one-of-a-kind testing facility, Center for Power Electronics faculty and students can conduct cutting-edge research needed for establishing Grid 3.0.

"The most exciting part about our research on electrified green infrastructure is the prospect of contributing to a carbon neutral world," said Haris Bin Ashraf, third-year electrical engineering Ph.D. student advised by Zhang. "My research focus is on creating the grid of the future with power electrics, specifically developing control methods that enable the formation of a 100 percent power electronics-based AC grid, which is super critical for achieving a renewable energy grid and carbon neutrality. The eGIPC expanded lab space will enable me to evaluate new control methods with real hardware."

Building the future electrical grid is more than individual activity. Researchers across the country will have to collaborate.

Calling for Collaboration

"We need to work together to create the grid of the future because getting it wrong – the consequences are too big," said Zhang. "The grid is evolving, but the question is, what innovations will be needed? What goals should we have in mind? And what ecosystem do we need to create to foster and accelerate innovation and impact?"

As part of the Center for Power Electronics Systems annual conference, experts from the Department of Energy, the National Renewable Energy Laboratory, Google, Georgia Tech Center for Distributed Energy, and many others came together to tackle those questions, share their expertise, and discuss global challenges and opportunities, such as

- Features of the modernized grid such as being reliable, resilient, sustainable, flexible, secure, and above all, affordable
- The Department of Energy's Energy Earthshots initiatives, which includes the Affordable Home Energy Shot, the goal to decrease resident energy costs by at least 20 percent within a decade and increase accessibility of home energy efficiency improvements for homeowners
- The future electric consumer, called the "prosumer," who will not only use the grid but also actively produce energy, through renewable resources like solar or wind

Much like the original inception of the electrical grid, transforming the brainchild of Edison, Tesla, and Insull will take more than a day of conversation to create viable solutions.

But it is a starting place.

"We've been going through evolution, but now I think we're really at the beginning of a revolution," said Zhang. "It's exciting, with new opportunities to motivate us as researchers."

■ Story by Niki Hazuda

Top: A Graduate student Jack Knoll (at back) presents Modular Coaxial Power Converter for High Density Integration with Medium-Voltage Cables at the Center for Power Electronics annual conference in Arlington. Photo by Rowan Al-ghafafi. **Bottom:** A worker installs solar panels on top of the Perry Street Parking garage in 2012. The panels generate 13 percent of the garage's annual electricity usage and are an essential part of developing a more sustainable campus. Photo by Logan Wallace.

World Wide Wireless

VIRGINIA TECH RESEARCHER AND WIRELESS EXPERT LINGJIA LIU HAS WORKED FOR NEARLY TWO DECADES TO MAINTAIN, SECURE, AND EXPAND THE GLOBAL WIRELESS INFRASTRUCTURE.

Lingjia Liu has a deep understanding of society's dependence on wireless connections – for work, play, and survival. He conducts critical research on wireless network security, the prevention of outages caused by natural disasters, and the future of telecommunications.

"Wireless is everywhere. It's an essential, critical infrastructure you only feel when it's gone," said Liu, director of Wireless@Virginia Tech. "When we look at what happened with the 2023 wildfires in Hawaii, hundreds of people died because of disconnected power and communications. This is one of the many reasons we need to maintain a secure, connected infrastructure."

A professor in the Bradley Department of Electrical and Computer Engineering, Liu has a research portfolio that currently spans more than $10 million, including support and collaboration from agencies such as the U.S. Department of Defense, National Science Foundation, and National Telecommunications and Information Administration.

From his earliest days in industry, it was not only Liu's technical expertise, but also his ability to rally others around common goals that elevated his work.

"Lingjia's energy and passion toward technology and innovation really set him apart," said Charlie Zhang, senior vice president Samsung Research America. "And he was able to communicate and explain complex technology and solutions in simple and intuitive ways."

Today, Liu's research impact knows no boundaries, even without his direct involvement. Collaborators from Samsung Research recently built a test bed that verified the theoretical analysis in one of Liu's published papers on nonlinear distortion and its limitations on the applications of higher order modulation. The paper introduces an artificial intelligence-enabled signal distortion compensation method that aims to avoid the performance degradation from unknown nonlinear distortion. This enables opportunities to utilize higher order quadrature amplitude modulation (QAM) signals, such as 256QAM, 1024QAM and 4096QAM, for NextG systems and networks.

The test bed is just one example of the type of connections and collaborations Liu has built throughout the telecommunications community, during the last two decades.

> "Wireless is everywhere. It's an essential, critical infrastructure you only feel when it's gone."
>
> Lingjia Liu
> *Director, Wireless@Virginia Tech*

Building the Future at Virginia Tech

Since joining his fellow Virginia Tech researchers in 2017, Liu has collaborated with Reed and other colleagues on millions of dollars' worth of projects that work to secure the global wireless infrastructure, including work that connects back to his time in industry, including:

- A $9 million grant from the U.S. Department of Defense, one of the largest awards ever received by a College of Engineering faculty member.
- Learning-Based O-RAN Testing, a $2 million project supported by the Public Wireless Supply Chain Innovation Fund from the National Telecommunications and Information Administration that utilizes reservoir computing.
- Nearly $1 million from the National Science Foundation to support bridging the Digital Divide by creating the next generation mobile broadband networks.

In 2022, Liu took over as the director of Wireless@Virginia Tech from Michael Buehrer, with an eye on national and international recognition for the group and Virginia Tech.

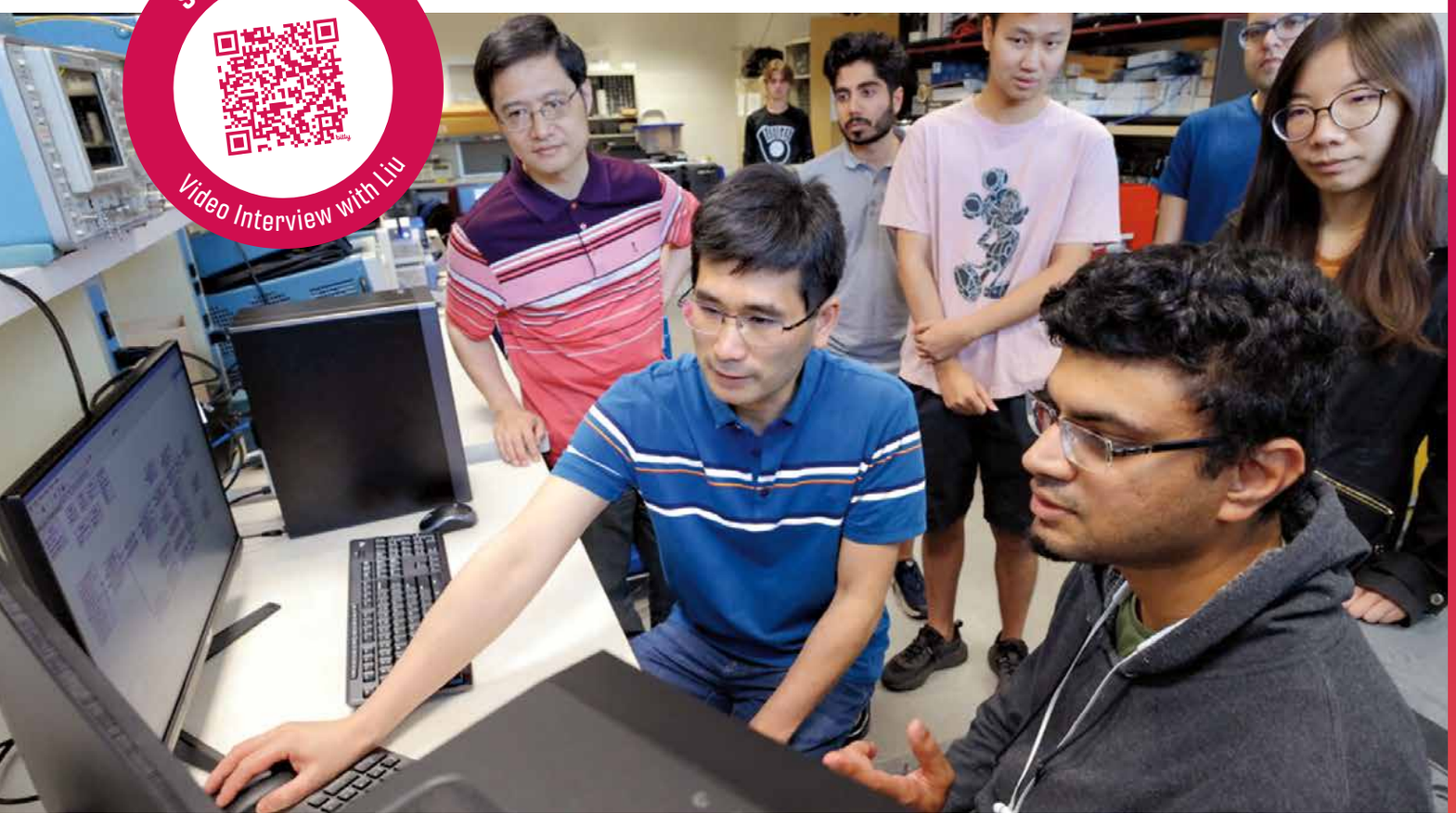
"We're building a strategy for how we want to work together on a national and global level, what our signature will be, what we want to uniquely do," Liu said. "As a university, we're trying to harmonize together – Wireless@ Virginia Tech, the Commonwealth Cyber Initiative, the Virginia Tech National Security Institute, and the Innovation Campus – to work together on advancing wireless and positioning Virginia Tech as a global leader."

This is an abridged version of the article published at **bit.ly/ECEWirelessWorld.**

Story by Niki Hazuda

SCAN TO WATCH

Video Interview With Liu



Lingjia Liu works with his graduate students on the learning-based O-RAN testing project supported by the Public Wireless Supply Chain Innovation Fund.

Using Engineering to Study the Effects

ELECTRICAL ENGINEERING AND NEUROSCIENCE RESEARCHERS COLLABORATE TO CREATE A DEVICE THAT CAN HELP UNDERSTAND THE EFFECTS OF CANNABIS ON MEMORY AND LEARNING.

For the last three years, Xiaoting Jia, associate professor in the College of Engineering, and Dan English, assistant professor in the College of Science, have collaborated on a research project that explores how cannabis changes the activity of the brain. Specifically, their focus centers on the effect of cannabinoids, compounds naturally occurring in plants of the genus Cannabis, on the hippocampus, an area of the brain that plays a major role in learning and memory. While cannabis use is known to affect memory in humans, the mechanisms are not well understood.

This partnership started shortly after the pandemic and builds on English's longtime research on the neural circuit function within the brain that supports spatial navigation — the brain's GPS — and memory.

His research in this area is growing in importance. Jonathan Caulkins, a cannabis policy researcher at Carnegie Mellon University, said in a recent Associated Press report that "a good 40 percent of current cannabis users are using it daily or near daily, a pattern that is more associated with tobacco use than typical alcohol use."

In addition, a recent Gallup poll showed that 17 percent of Americans reported smoking marijuana in 2023, up from 7 percent in 2013.

"It's having much more of an impact on public health today," English said. "We really need to ramp up our research on all fronts of understanding cannabinoids."

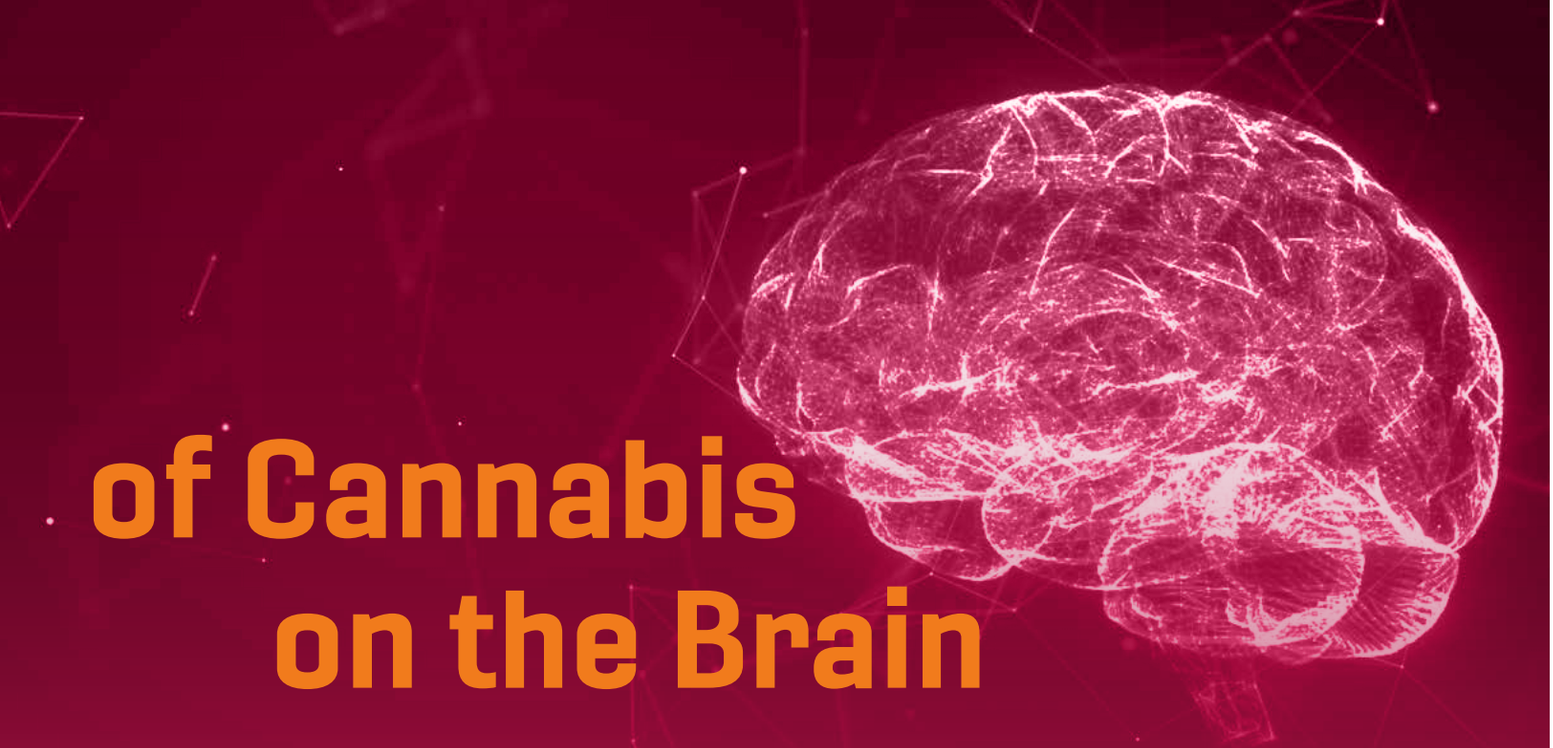
To do his part, English sought a way to study how cannabinoids change activity in specific neural circuit cells. Through extensive collaboration, Jia produced a novel device to answer these questions.

Probing the Brain

Jia, professor in the Bradley Department of Electrical and Computer Engineering, has been developing advanced multifunctional probes since she was a postdoctoral fellowship at the Massachusetts Institute of Technology. While there, she and groups of other postdoctoral fellows and graduate students started working on probes to insert into the brain to help understand its function.

These probes – no wider than a strand of hair – contain electrodes that record electrical signals from the neurons within the brain.

The probe is so thin, flexible, and minimally invasive that the brain hardly knows it's there. Jia developed one of the first fiber-based neural probes and was one of the leading authors of a paper published in Nature Biotechnology in 2015.



# of Cannabis on the Brain

"We were asking then, 'What happens if we put this flexible, functional fiber into the brain?'" Jia said. "This seems to be a very natural platform for communicating with the brain. When I joined Virginia Tech, I basically built the same platform that allowed me to continue in this very exciting direction. Since then, we have made significant advancements in developing more complex fibers with advanced functionalities and three-dimensional interfacing capability."

English worked with engineers at New York University and the University of Michigan during his time as a postdoctoral fellow and quickly learned how to leverage collaborations with engineers to make neuroscience discoveries. When he interviewed for the position at Virginia Tech's School of Neuroscience, he met Jia and the two quickly bonded over a common professional interest.

To support English's research, the two of them and four doctoral students – two from electrical engineering and two from neuroscience – made a probe out of a polymer matrix composite material that allowed for flexibility and biocompatibility. The probe was tapered on one end with a small tip that provides the ability to go deep into hippocampus region of the brain.

"We can do this without causing significant damage, without disturbing the natural neural activities or the circuit behavior in the hippocampus," Jia said. "In the meantime, we can connect multiple electrodes, optical waveguides, and drug delivery channels on the back end and record the neural signals and moderate neural activities."

The probe allowed English and his team to pick up electrical signals from the neurons in that vicinity, and they were able to shine a small light into the brain. The probe also included a microfluidic channel that allowed for the application of drugs – in this case, cannabinoids – to the cells.

"In most studies, drugs have been applied systemically, affecting all cells," English said. "But that's obviously affecting the other parts of the brain too. We isolated the function of this circuit because the probe is so small and multifunctional and can do all these things in such a small volume of the brain."

Student Collaboration

An indirect benefit of this project centered on student involvement. Each of the four students involved worked on every part of the project. For example, the neuroscience doctoral students went to Jia's lab and helped with the design and the building of the probe while the electrical engineering students conducted neuroscience experiments.

This transdisciplinary experience helps students understand future research and makes them more competitive when seeking positions at other universities or in the private sector.

"And the part of Xiaoting's team that works with us, they learned the neuroscience, and my students learned the engineering side," English said. "They all could explain every figure in the paper because of this level of collaborative training. Bigger or smaller, they were all involved in both the neuroscience and the engineering, so for the students, it was an amazing experience."

Jia agreed and said the technology can be mass produced for the marketplace.

"The advantage of our probe is that it's low cost and scalable," Jia said. "There is great potential for commercialization."

Story by Jimmy Robertson

NASA Funds Virginia Tech Research to Investigate Space Weather

THE FUTURE SATELLITE MISSION WILL INVESTIGATE THE REGION WHERE SPACE WEATHER CLASHES WITH THE LOWER ATMOSPHERE.

Rain delays at a sporting event. Tornado damage to a rural town in the Great Plains. Icy roads during a morning work commute in the winter months. We've all experienced the impacts of inclement weather, but did you know weather conditions high in our atmosphere also can affect our everyday lives?

"While space weather can spark the beautiful auroras across our skies, it also has the potential to cause disruptions for us here on Earth and can be dangerous for our spacecraft and astronauts in space," said Nicola Fox, associate administrator of the Science Mission Directorate at NASA Headquarters in Washington, D.C.

Space weather can interfere with satellite communications, GPS signals, and even our electrical grid, but there has been limited research about these complex factors in the upper atmosphere and how these factors are impacted by effects from the Earth's surface.

Virginia Tech researchers in the College of Engineering, along with several partners and collaborators, are seeking the answers to these relatively unexplored impacts that loom just beyond the clouds. With the help of a $2 million grant from NASA, they hope to use next generation instrumentation to shed light on the upper atmosphere and how its motions are driven by both the sun and weather at the Earth's surface.

"I could not be more proud of the team and the robust, comprehensive plan we put together to answer NASA's DYNAMIC objectives," said principal investigator Scott Bailey, director of Space@VT and professor in the Bradley Department of Electrical and Computer Engineering. "I'm grateful for all of our partners, everyone who participated in the proposals, and Virginia Tech for supporting the effort at all levels of the administration."

STEP 01 | Three Proposals. Nine Months. $2 Million.

This is the first of a two-step selection process to investigate the complex region of space that surrounds our planet and how it's influenced by Earth's dynamic atmosphere. Virginia Tech is one of just three academic institutions selected, and future funding of $250 million — in 2023 dollars — will be up for grabs after the nine-month concept study is completed.

"This project will address very important gaps in our knowledge with a data set that will revolutionize our understanding of the upper atmosphere and how different regions of the atmosphere affect each other," Bailey said.

Similar to the ocean, the upper atmosphere has tides that vary from day to day, Bailey said, but we've not been able to observe those variations because of limits in satellite technology.

"Our novel design and use of multiple satellites will allow us to gather more data and see the changes in tides and other weather phenomena every three hours or so in comparison with previous instruments that could collect data only once every 24 hours," Bailey said.

To make this project a success requires expertise in many areas: engineering and building the instruments, operating the instruments and the spacecraft, analyzing the data, knowledge of the dynamics and chemistry of the upper atmosphere, and expertise in running numerical simulations of the near-Earth space environment.

"A mission of this scope requires expertise and resources from different institutions," said Scott England, associate professor in the Kevin T. Crofton Department of Aerospace and Ocean Engineering and principal investigator on one of the three instruments. "The best people to put together the key elements of the spacecraft may be found at a university, a national lab, or a private company. We've done our best to find the individuals at the forefront of each of those disciplines and bring them together. For a project of this magnitude it takes many people working all across the U.S. to provide the breadth of expertise necessary to succeed."

STEP 02 | A DYNAMIC Mission

The DYNAMIC mission is designed to make measurements within Earth's upper atmosphere between about 50 to 125 miles, or 80 to 200 kilometers, in altitude. After a nine-month initial phase, NASA will select one proposed satellite technology for mission implementation. If chosen for flight, Virginia Tech's proposed plan includes two satellites with state-of-the-art instrumentation, priced at $250 million in 2023 dollars for a duration of 10 years.

"We designed a mission that uses two satellites instead of one, and a new technique that can collect data during day and night conditions," Bailey said. "Because the instrument looks out both sides of the two satellites, it can collect two to four times as much information as our competitors."

With multiple spacecraft, DYNAMIC's simultaneous observations from different locations will give scientists a more complete picture of how waves propagate upward through this part of the atmosphere, expanding our understanding of how space weather influences our home planet.

"The DYNAMIC mission represents a groundbreaking effort to understand the intricate interplay between Earth's lower atmosphere and space weather. Our concept will deliver transformational observations, throughout the mesosphere and lower thermosphere, that will forever change the way we think about weather in the upper atmosphere," said Lynn Harvey, mission deputy principal investigator and research scientist at the Laboratory for Atmospheric and Space Physics at the University of Colorado, Boulder.

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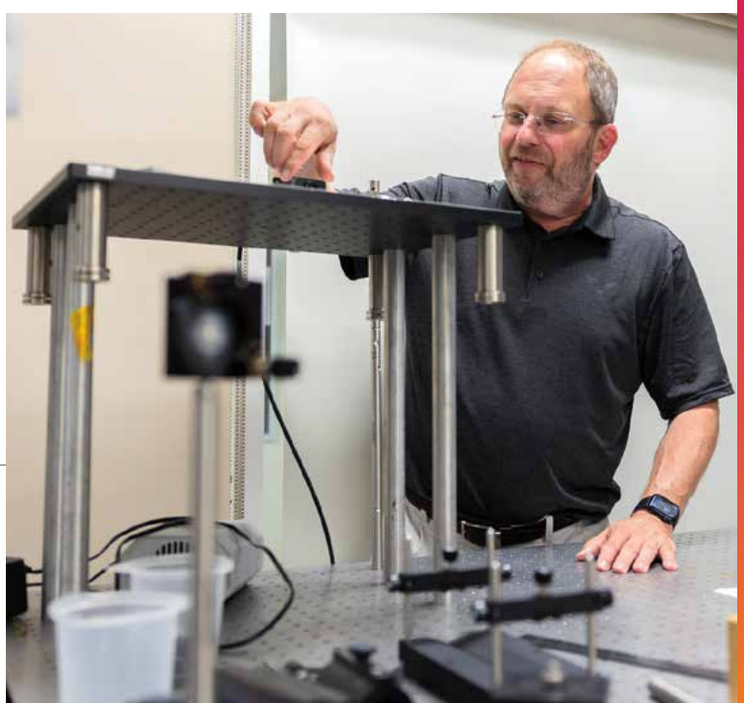
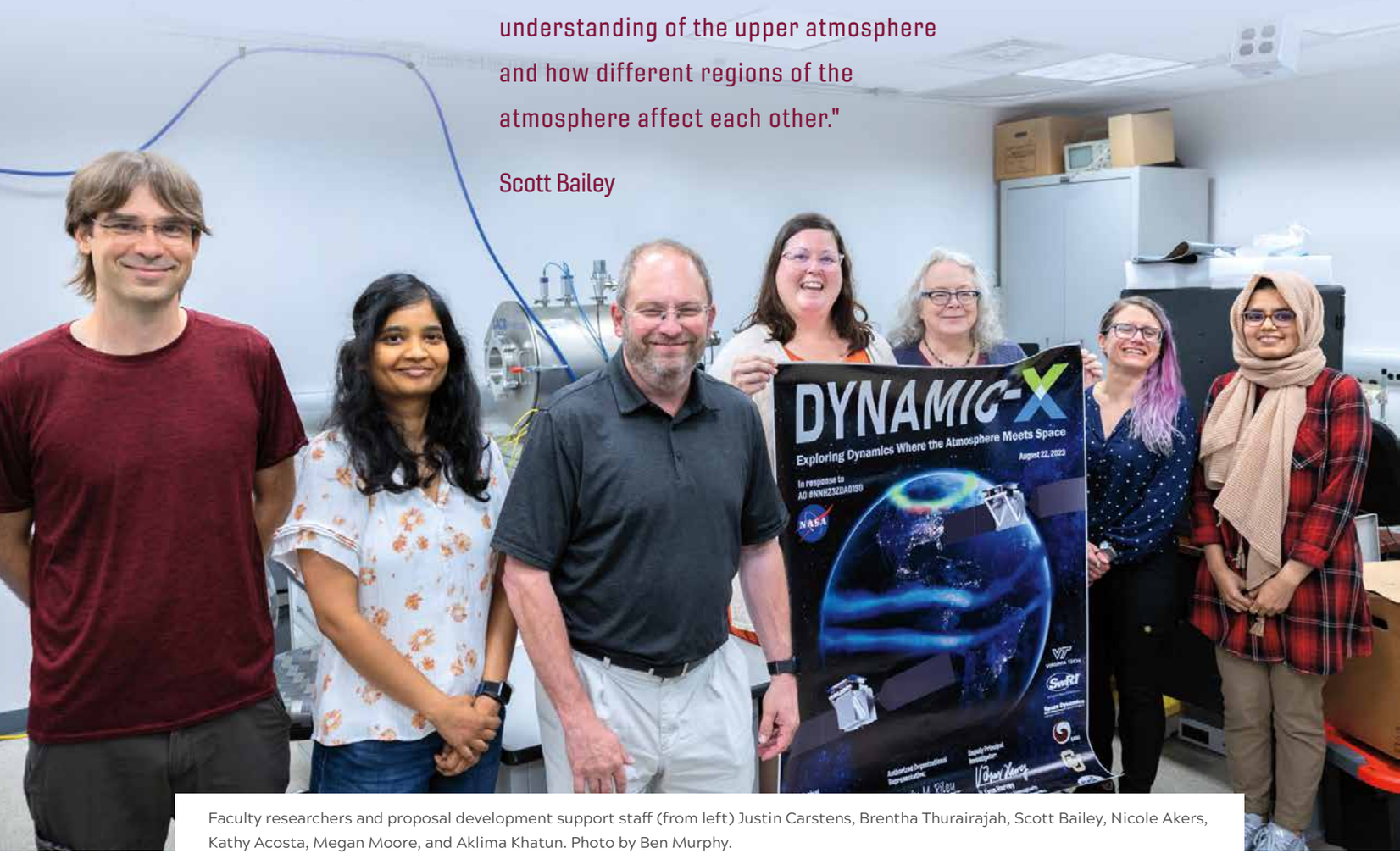


Scott Bailey with optics equipment. Photo by Ben Murphy.

> "This project will address very important gaps in our knowledge with a data set that will revolutionize our understanding of the upper atmosphere and how different regions of the atmosphere affect each other."
>
> Scott Bailey



Faculty researchers and proposal development support staff (from left) Justin Carstens, Brentha Thurairajah, Scott Bailey, Nicole Akers, Kathy Acosta, Megan Moore, and Aklima Khatun. Photo by Ben Murphy.

THE GOALS

Beyond understanding the intricacies of Earth's upper atmosphere better, this technology could also help with increasing air traffic concerns from the number of satellites being launched. People have sent about 16,000 objects into space in the last 65 years. Since 2020, we have added almost 7,000 satellites with 2,600 of those launched in 2023 alone. Policies have not been created quickly enough to safely accommodate the exponential growth.

"When Elon Musk recently launched hundreds of satellites in a short time, there was a 1 percent chance that it would hit another satellite already in orbit, one in which Virginia Tech has a leadership role. That sounds small, but when you consider the cost of losing a satellite, this is a significant risk," Bailey said. "As times go forward, this risk will only increase. Space regulation hasn't been able to move fast enough to keep up with the influx of technology. Our mission could help address this situation and allow for better prediction of satellite orbits and better quantification of the risks."

Story by Chelsea Seeber & Florence Gonsalves

Strengthening America's Wireless Leadership With $9.9 Million Collaboration

VIRGINIA TECH AND RAMPART COMMUNICATIONS RECEIVED NEARLY $10 MILLION FROM THE PUBLIC WIRELESS SUPPLY CHAIN INNOVATION FUND, SUPPORTED BY THE CHIPS ACT, TO DEVELOP RESILIENT WIRELESS NETWORKS.

Virginia Tech and Rampart Communications – a Maryland-based wireless technologies company – have joined together in a brand-new partnership to develop and enhance secure, resilient wireless technology.

The partnership is funded by a $9.9 million grant from the Public Wireless Supply Chain Innovation Fund, a federal initiative to support open wireless networks, and drive competition; strengthen global supply chain resilience; and lower costs for consumers and networks operators.

"At Rampart, we are committed to advancing wireless technologies that enhance both security and performance," said Matt Ball, CEO of Rampart Communications. "This collaboration enables us to push the boundaries of spectral efficiency and link capacity, ensuring that the next generation of networks is not only resilient, but also optimized for the evolving demands of wireless connectivity."

The Virginia Tech team comprises three main faculty:

- Daniel Jakubisin, PI, research assistant professor, Spectrum Dominance Division in Virginia Tech National Security Institute (NSI), and Bradley Department of Electrical and Computer Engineering (ECE), by courtesy
- Jeff Reed, Willis G. Worcester Professor, ECE
- Nishith Tripathi, Research Associate Professor, ECE

In addition to multiple graduate students and research faculty, the team represents collaborations from across the university: NSI, Hume Center, Commonwealth Cyber Initiative, and Wireless@Virginia Tech.

The team's research will establish foundational resilient-by-design wireless technologies for the next generation of cellular networks: 6G. They're investigating a variety of techniques, including advanced machine learning algorithms, to build interference suppression, or mitigation, for real-time network protection and handling complex signal environments with unknown variables.

Interference suppression handles unwanted signals that disrupt the network, while preserving the desired signal – leaving users none the wiser.

"That's what we're seeking with our work – next generation networks with the ability to mitigate disruptions before the network is impacted," Jakubisin said. "As networks get more complex, and potential bad actors get more competent in their ability to create disruptions, we're advancing our own interference mitigation tactics to get to a place where we're preempting, not reacting, to these challenges."

Jakubisin, Reed, and Tripathi also collaborate with Lingjia Liu, co-director of Wireless@Virginia Tech at the Virginia Tech Innovation Campus, on the $9 million Department of Defense project, mobile distributed mobile-input, mobile-output (dMIMO), which focuses on large-scale networks for FutureG technology and research for the development of 6G networks.

Read more about the dMIMO project at **bit.ly/FutureGResearch.**

Story by Niki Hazuda

TINY TECH BIG IMPACT

Miniaturized **Gas-Analyzing Tech Boldly *Moves Research Forward***

SPOCK is the world's first "miniature" gas chromatograph built with patent-pending technology that analyzes chemical composition and physical properties and delivers real-time results, revolutionizing aerosol work in industry safety, environmental science, and national security.

Since his introduction as a character in the 1960s science fiction show "Star Trek," Spock has had a worldwide impact on pop culture.

Masoud Agah, director of the Virginia Alliance for Semiconductor Technology, hopes to make an equal impact with his own SPOCK: the first-ever "miniature" chromatograph.

Although it sounds like something out of "Star Trek," a chromatograph is a tool that analyzes the chemical composition of materials, such as water, soil, drugs, food, pollutants, and in the case of Agah's size-segregated particle odor chromatograph kernel, or SPOCK, gases and aerosols.

"It's the first of its kind, a truly miniaturized platform," said Agah, who is also the Virginia Microelectronics Consortium Professor in the Bradley Department of Electrical and Computer Engineering. "There's no equivalent with this size platform that also measures the chemical composition and physical properties of aerosols."

Gas chromatographs like SPOCK analyze the chemical composition of gases, aerosols, or vapors to identify components, concentration, and impurities. These instruments are used in a wide variety of fields, including forensics, pharmaceuticals, the food industry, and environmental science.

How Small Can a Chromatograph Go?

The instruments vary in size, from industrial machines that take up entire rooms to the more portable versions about the size of a mini fridge. SPOCK, however, takes chromatography to its most portable and comprehensive version yet: a backpack-style instrument weighing less than 5 pounds that can identify chemical composition and morphologically reconstruct the aerosols in real-time — something that's never been done at this scale.

Morphological reconstruction is basically the digital picture of an aerosol that reveals the size and shape of the particles. It's an essential process for studying cloud formation, air pollution, climate change, and even optimizing the design of aerosol filters.

"In the atmospheric science community, our current chromatographs are portable but not like SPOCK," said Gabriel Isaacman-VanWertz, associate professor in the Charles E. Via, Jr. Department of Civil and Environmental Engineering who has spent the last 15 years researching air quality and atmospheric chemistry. "With SPOCK, we can take it on the subway, bring it to a rainforest, take it on a walk – we can answer scientific questions and public security ones too."

Because of its portability, applications for SPOCK are numerous, including national security, environmental monitoring, and industry safety.

Powered by Futuristic Tech

Packed with cutting-edge technology to reach its lightweight size and dual-

continued >

Graduate students (from left) Vikas Goel and Suman Dewanjee work on the aerosol impactor. Photo by Ben Murphy.

function, SPOCK is made possible through patent-pending fluidic and electrical modular architecture (FEMI) invented by graduate students in Agah's research group, Virginia Tech Microelectromechanical Systems.

Current non-modular systems use permanent glues or epoxies, meaning, if something goes wrong, breaks, or a microchip gets fried, the entire system has to be replaced. With FEMI, changes can be made quickly, and this removable mechanism is critical for the efficiency of SPOCK's main systems and keeps it affordable for researchers like Isaacman-VanWertz.

In addition to the fluidic architecture, SPOCK has two main systems powered by an electronic computing unit:

- Modular Size-Segregated Aerosol Impact and Chromatograph (MoSAIC): Much like its full-size counterparts, MoSAIC takes a sample of aerosol, vapor, or gas and then analyzes it with a "sniffer" that identifies chemical compounds, all on site.
- Particle Imaging and Counting Cell (PIXEL): This imager uses an advanced chip-scale scattering-based optical device, which are tiny structures or particles that interact with light on a microchip. It's basically a very tiny camera that analyzes the physical data of the aerosol samples.

Machine Learning "On the Edge"

As the director of a research group focused on machine learning and core faculty at the Sanghani Center for Artificial Intelligence and Data Analysis, Hoda Eldardiry's expertise in machine learning "on the edge" — an advancing field of research — helps make SPOCK possible.

"The interesting thing about machine learning on the edge is you really want something that's good enough to do the job and simple enough to run on the device itself – the machine's edge," said Eldardiry, associate professor in computer science. "The hope for our models is that they'll be lightweight enough that they won't require a lot of complex circuitry, making them time efficient and able to run real-time."

Eldardiry will collaborate with the hardware teams working to build MoSAIC and PIXEL in an iterative design process to find the sweet spot of sensor size and computational power, ensuring it all fits in the planned backpack-size of SPOCK and maintains its powerful portability.

When the initiative concludes in about a year, this interdisciplinary and cross-country collaboration will not only result in a groundbreaking portable gas and aerosol analyzer, but also pave the way for future innovations in environmental monitoring and atmospheric science.

"What I'm really excited about is taking our gas chromatography research and shrinking it down," Isaacman-VanWertz said. "By really taking advantage of technologies Masoud Agah is working on and combining it with Hoda Eldardiry's machine learning, SPOCK will have an impact, and help advance the work of the atmospheric science community."

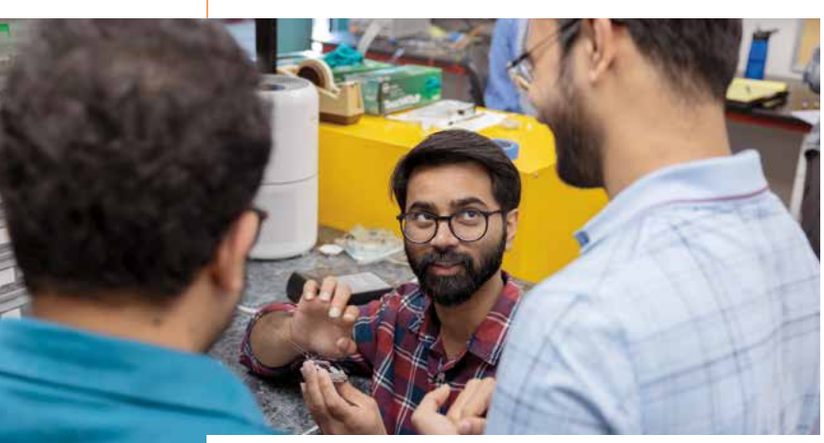
Story by Niki Hazuda

Team Members

Virginia Tech Faculty
Masoud Agah | Hoda Eldardiry | Gabriel Isaacman-VanWertz

Consultant
Kevin Schug '02

Companies
CellsBin | Zebra Analytix | Aerosol Dynamics



Left: (From left) Mustahsin Chowdhury, Nipun Thamatam, and Suman Dewanjee examine a microelectromechanical system pre-concentrator. Photo by Ben Murphy. **Right:** The U.S. government test and evaluation team is briefed on the apparatus in Isaacman-VanWertz's lab for aerosol generation. Photo by Masoud Agah.

Master of Engineering Capstone Courses Provide Students With Real World Industry Experience

Most people don't realize what goes into hacking an autonomous truck. But the students in the capstone course taught by Virginia Tech Bradley Department of Electrical and Computer Engineering Professors Almuatazbellah Boker and Ravi Raghunathan do.

Paola Cando Bojorque, Ramida Theeravachirakul, Spurthi Mohan, and Max Aedo Espicto spent their fall and spring semesters dedicated to addressing this issue in their capstone project with Torc Robotics. The goal seemed simple enough: prevent the vehicle from colliding with objects and create pedestrian safety. The journey, though, proved challenging – but nothing they couldn't overcome.

"At the start of the fall semester, we didn't have a clear path," said Cando Bojorque, a Virginia Tech Innovation Campus Master of Engineering in computer engineering student involved in the project. "But we knew we'd be working on a project that involved machine learning and cybersecurity."

The team was correct. They received their final directive: develop a software to track new threats and vulnerabilities in the autonomous truck's software and notify Torc staff through a tracking system. The four students first had to consider the systems that allow an autonomous vehicle to function – specifically the laser detection and ranging systems (LiDAR). LiDAR scans around the vehicle and uses the data to inform it of its surroundings: people, other cars, traffic lights, police, road abnormalities (like roadwork), and more.

"That's where our team comes in," said Cando Borjoque. "Those systems have to work just right or otherwise a lot can go wrong. These sensors are easy to hack and jam."

Every autonomous vehicle sends its data through an Internet of Things (IoT), which is a collective network of connected devices and the technology that facilitates communication between devices and the cloud. They also have a security system that utilizes WiFi. Because there is a constant cycle of information sent to the cloud and back to the vehicle, weaknesses are easy for hackers to spot.

Normally, cybersecurity departments use information from vulnerability management systems (VMS) to make a list of the technical components of a vehicle, analyze them, identify which software or hardware has a vulnerability, and then patch the issue to ensure the security of the system. Once created, these patches are then uploaded to the National Institute of Standards and Technology (NIST) database.

The student team "dissected what went into a vulnerability," Aedo Espicto said, and created a faster way to analyze an autonomous vehicle's security weaknesses. Their VMS automatically connects to the NIST database and another managed by MITRE, enabling the team to discover issues and make patches quickly. Future work includes creating a complimentary system that tracks vulnerabilities and notifies Torc staff of them.

"When you're in school, you're turning the concepts you learn into papers," said Cando Borjoque. "In working directly with a company, you're developing a project that might be used in the industry. You're managing stakeholder expectations. You're working with a team that is pushing toward a mutual goal. At the end of the day, your client needs that project."

These teams work directly with a representative from the sponsor company. The Torc capstone team was assigned Bill Rushmore, lead cybersecurity engineer. Rushmore served as the project's subject matter expert, shared what Torc needed from the team, and helped them achieve it.

Capstone projects are a component of the Innovation Campus' project-based learning model. At full build, the Campus hopes the curriculum will be between a third and up to a half of project-based learning. Additional student teams worked on projects with companies like The Boeing Company, the U.S. Marine Corps, and Collins Aerospace. This course is designed for students to build real-world skills within the comfort of a collegiate environment, so when they graduate and begin their first job, they are confident and prepared.

Story by Lydia Fahey

Trust Us, We're Experts

Christina DiMarino

The Need for Women in STEM is Greater Than Ever

Women make up only 35% of the workforce in science, technology, engineering and math (STEM) - the greatest disparities occurring in engineering and computer sciences. Christina DiMarino, an engineering professor at Virginia Tech, said now is the time to flip the script and explained why it is so important that education for women and underrepresented groups about STEM fields starts early in life.

The Problem: Gender Imbalance

DiMarino says the absence of women in the field is something she sees regularly, but also views it as a great opportunity for growing women leaders in STEM for the future.

"STEM career environments that have been cultivated by men over generations have struggled to adapt to be more inclusive for women and other underrepresented individuals," DiMarino said. "There have been strong pushes for increasing diversity in STEM, but cultivating that representative community is going to take time."

Losing Power: Modernize the Electrical Grid Before Climate Change Gets Worse

With the influx of green energy and the push to decrease fossil fuels, there are more uses for electricity than ever, and they're straining our power grid. Climate change is only making these power outages more frequent and severe, but researchers at Virginia Tech have a solution to streamline the structure.

"The power grid technology in the United States is more than 100 years old. Because of this outdated grid technology, it's more susceptible to power outages — especially as we experience more and more extreme weather," said Christina DiMarino, electrical and computer engineering professor at Virginia Tech. "When you add in the increased penetration of renewable energy sources and charging capabilities, it's putting a significant demand on our grid, which it was not originally designed to fulfill."

Walid Saad

Enabling Self-Sufficient Communication Systems

Walid Saad, a professor of electrical and computer engineering and the Next-G wireless lead at the Virginia Tech Innovation Campus, enthuses about the next steps in the evolution of AI and how it could intersect with forthcoming 6G wireless systems.

"The central challenge for the upcoming years lies in equipping AI systems with common sense abilities, enabling these systems to think critically, reason logically, and plan proactively," Walid said. "This marks an initial stride toward the development of what's known as artificial general intelligence (AGI), aiming to approach intelligence levels seen in animals, if not eventually reaching human-level intelligence.

"Nevertheless, as we peer into a more distant horizon, the notion of AI-native wireless systems presents limitations," he said. "AGI could potentially herald a revolutionary paradigm in wireless technology by enabling systems capable of human-like cognition.

New iPhone Integrates AI: What Does That Really Mean for Users?

For iPhone users, Apple Intelligence promises a more personal experience, but what exactly does that look like?

"AI will enable a broad range of features on the iPhone ranging from improving Siri and its conversational abilities to improving search functions and enhancing the tool set that can be used for writing purposes," Saad said. This includes analyzing photos or documents and composing emails and other messages.

Users also will have new ways to compose and create photos, images, and other creative content.

"Indeed, we can see that a big common theme among those features is personalization, making the day-to-day features aware of their users' preferences, actions, and needs to provide user-centered assistance and experience," Saad said.

Whether it's building tomorrow's workforce, modernizing the electrical grid, or examining AI's daily impact, our experts show how ECE plays an essential role in developing the critical technology and innovation needed to address contemporary challenges.

Ali Mehrizi-Sani

The Role Utility Companies Could Play in Stopping Wildfires

Coordinated power shut offs could help control the wildfires spreading across New York and New Jersey, according to a Virginia Tech expert. These shutoffs could mitigate the risk posed by unseasonably dry conditions and challenging terrain, both of which have made containment efforts especially difficult, said Professor Ali Mehrizi-Sani, a Virginia Tech electrical engineering researcher.

Planned power shutoffs, also called public safety power shutoffs, are coordinated local outages aimed at reducing wildfire risks and protecting both infrastructure and residents, he explained. These shutoffs rely on models that assess fire spread patterns and the specific risks of keeping certain power lines energized. Based on this data, power providers decide when and where to shut off lines to reduce fire hazards.

Downed power lines contribute to wildfires in two ways, Mehrizi-Sani said. Directly, they can generate sparks that ignite dry vegetation like grass, trees, and shrubs, especially when high winds spread embers over large areas. Indirectly, downed lines interfere with firefighting efforts by disrupting electricity and water supplies.

Beyond individual lines, substations are also at risk. "This can cause physical damage to substation equipment such as transformers and circuit breakers," Mehrizi-Sani said. Even if flames don't directly reach them, extreme heat can cause overheating and reduce equipment lifespan. Smoke also corrodes sensitive equipment, potentially leading to costly repairs or replacements.

Kendall Giles

Artificial Intelligence and Sustainability

In a 2021 international survey by Pew Research, 71 percent of respondents said they were somewhat concerned or very concerned about global climate change. With growing environmental concerns, there has been an increased focus on finding innovative solutions.

Artificial intelligence (AI) and the Internet of Behaviors (IoB) are two emerging technologies that have become an integral part of the sustainability conversation — especially regarding their applications in urban development.

Kendall Giles, a professor with Pamplin College of Business' Master of Information Technology and College of Engineering research centers around how AI and IoB can work together to make city living more sustainable, from energy optimization to efficient resource allocation. His classes also reflect a changing view of how to teach engineering, embedding concerns about sustainability as practice, making sure students are exposed to and considering ethical issues presented by the work they're doing.

Scan to Read Their Full Articles

Or visit: bit.ly/ECE24experts

OUR FACULTY

ECE on the Small Screen

Exploring the Potential of Robotics With VT CRO

The Competitive Robotics Organization at VT is a student-run club made up of multiple engineering and support teams. With help from their main sponsor, Boeing, VT CRO allows students to design and build robots using emerging technology.

Teens Fabricate Semiconductors at Virginia Tech Camp

University Partnership for Workforce Advancement and Research & Development in Semiconductors (UPWARDS) is a two week summer camp that is focused on the microelectronics industry, cleanroom fabrication and career opportunities. The camp is hosted by the Center for the Enhancement of Engineering Diversity (CEED) and is designed and intended for rising junior and senior high school girls.

Exploring Engineering and Campus Life With C-Tech² at Virginia Tech

C-Tech² offers an opportunity to learn about college life--from residence halls to classrooms and everything in-between, and gives students experience with a broad range of engineering disciplines. The C-Tech² program is designed and intended for rising junior and senior high school girls.

Undergraduate Researchers Combine Neuroscience and Engineering

A team of neuroscience, biomechanical engineering, and electrical engineering students are studying how low-cost EEG caps can be used to control prosthetics. The group is one of many GrayUR teams led by Collegiate Assistant Professor David Gray.

Advancing Real World Applications for Phased Array Microphonics

The project is looking to create a stationary, expandable system of microphones that can pinpoint and amplify specific positions within a given space. Kyle Gruen and his team in the GrayUR undergraduate research program are hoping their system can be used in classrooms, theaters, and other places that use traditional microphone equipment.

Paving the Way for the Next Generation of Wireless

Virginia Tech researcher Lingjia Liu works with collaborators on research that will impact the future of wireless technology and its infrastructure. With his team, Liu is leading research to develop Open Radio Access Network technology that will create a more competitive wireless network market that lowers costs and creates jobs, both nationally and internationally.

Cutting-Edge xG Testbed Research Opens Door to Next-Generation Mobile Networks

The Commonwealth Cyber Initiative (CCI) xG Testbed supports experimentation and prototyping with next-generation technologies in networks and artificial intelligence solutions. Students and researchers, along with industry and government partners, are working collaboratively in the design, development, and deployment of solutions for next-generation mobile networks, including open radio access networks (Open-RAN).

Scan to watch the videos

Or visit: bit.ly/ECEVideos

IN THE MEDIA

ECE on the Radio & Web

Kendall Giles is a collegiate assistant professor and also teaches in the Master of Information Technology and Master of Engineering programs. One of the courses he teaches focuses on educating graduate engineering students on how to be better critical thinkers, which was the subject of his Radio IQ interview, "Helping AI developers and future tech leaders practice ethical reasoning as they create new technologies."

Scan to read the story and listen to the interview

Or visit: bit.ly/ECEKendall

Professor Ali Mehrizi-Sani, director of the Power and Energy Center, shared his expertise with ABC 7 News about the California wildfires. He focused on how public safety power shut offs can be preventive in anticipation of high fire risk.

Scan to read the story

Or visit: abc7ne.ws/4gf44X7

'Curious Conversations' Podcast

"Curious Conversations" is a series of free-flowing conversations that take place at the intersection of world-class research and everyday life. Produced by Virginia Tech's Office of Research and Innovation and hosted by writer and editor Travis Williams, university researchers share their expertise and motivations, as well as the practical applications of their work, during interviews that more closely resemble chats at a cookout than classroom lecture.

Luiz DaSilva Talks About the Future of Wireless Networks and CCI's Test Beds

Three Takeaways from the Conversation

- Each generation of wireless networks brings new capabilities and applications, driving the evolution of technology and the way we interact with each other.
- Key metrics for evaluating network performance include speed, latency, and reliability.
- Test beds play a crucial role in developing new wireless technologies, allowing researchers to experiment, break things, and demonstrate the feasibility of new ideas. CCI's test beds stands out for their indoor and outdoor components, use of open radio access networks, and partnerships with universities, operators, vendors, and small businesses.

Scan to listen

Lingjia Liu Talks About the Future of Wireless Networks

Three Takeaways From the Conversation

- Advancing to 6G networks and beyond will be critical to supporting a variety of emerging technology, such as smart cities and autonomous vehicles.
- Open radio access networks promote innovation by increasing access to wireless interfaces to a greater number of people.
- Convergence between Wi-Fi and cellular technology will be a critical component of future networks.

Scan to listen

Jeff Reed Elected Fellow of the National Academy of Inventors

Over the course of his 30-year career at Virginia Tech, Reed has mentored countless students; received $86 million in research funding, and holds 20 U.S. patents and six foreign patents in the field of wireless communications.

Jeff Reed, a renowned leader in wireless research and technology, has been named a 2024 fellow of the National Academy of Inventors.

The Willis G. Rocester professor for the Bradley Department of Electrical and Computer Engineering (ECE) joins an elite group of fellows, including Virginia Tech President Tim Sands and ECE colleagues Eric Burger and Alan Michaels.

"Dr. Reed's groundbreaking work has made a significant impact through innovations in spectrum sharing, modem design, smart antennas, side-channel analysis, and software radios," Sands said. "He's an internationally recognized researcher and inventor who has inspired and encouraged future researchers and inventors who will impact our society for generations to come. I'm honored to welcome Dr. Reed to the National Academy of Inventors as a fellow."

Patented Global Impact

Reed holds 20 U.S. patents and six foreign patents in the field of wireless communications and cybersecurity signal processing, nine of which have been licensed. His seminal patent, System and method for heterogeneous spectrum sharing between commercial cellular operators and legacy incumbent users in wireless networks, is the cornerstone of one of the companies he co-founded, Federated Wireless, which is a market leader in shared spectrum. The patent protects both distributed spectrum sharing and spectrum-sensing, and use of geo-reference databases.

In addition to Federated Wireless, Reed co-founded PFP Cybersecurity (formerly Power Fingerprinting), Cirrus360, and Cognitive Radio Technologies.

Leading Research and Innovation

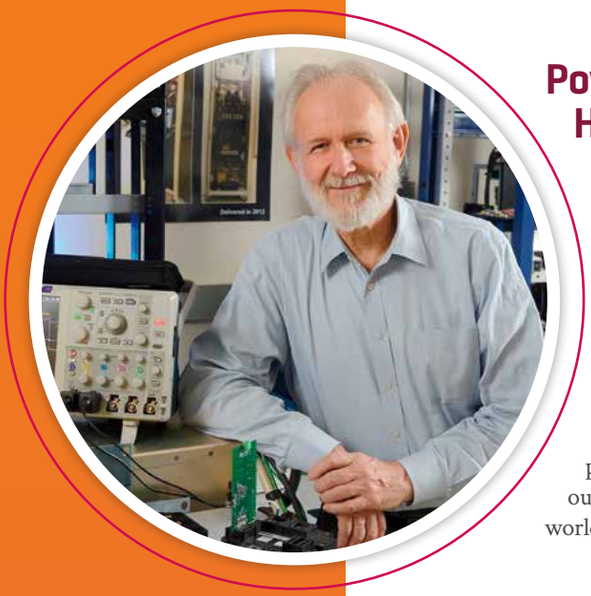
Over the course of his 30-year career at Virginia Tech, Reed has mentored countless students, received $86 million in research funding, was the founding director of the Hume Center for National Security and Technology, and founded Wireless@ Virginia Tech – one of the largest and most comprehensive university wireless research groups in the U.S. He also serves as the chief technology officer for the Commonwealth Cyber Initiative, for which he was the founding executive director.

In 2005, Reed was named a fellow of the Institute for Electrical and Electronics Engineers for contributions to software radio and communications signal processing and leadership in engineering education. In 2013, he received the international achievement award from the Wireless Innovations Forum for his impactful research.

Reed has authored over 20 books, including his leading work on software-defined radio, and more than 300 publications in leading journals and conference proceedings. He has led or co-led over 100 research projects focused on software radios, smart antennas, cognitive communications, and signal processing.

Reed has his bachelor's, master's, and doctoral degrees in electrical and computer engineering from the University of California, Davis.

Story by Niki Hazuda



Powerhouse Professor Receives Honorary Doctorate for Contributions to Power Electronics

For Dushan Boroyevich, power electronics isn't just a career or area of research, it's a passion. That passion was recognized by the University of West Bohemia in the Czech Republic, where Boroyevich was awarded with the honorary title of doctor honoris causa.

"This honorary Ph.D. is not just an honor to me, but to Virginia Tech," said Boroyevich. "It represents a partnership. Students here, and at RICE, are being exposed to expertise in power electronics from a global perspective. If we want to expand ourselves, it means partnering with universities from around the world, and that's exactly what this exchange with RICE will do."

Read the full story here: **bit.ly/DushanHonorary**

Ting-Chung Poon Awarded the Prestigious Emmett Leith Medal for Holography

For four decades, Virginia Tech researcher Ting-Chung "T.-C." Poon has explored the field of holography – the technique of using light to create three-dimensional (3D), lifelike images – that has inspired the world of science fiction for years. He's published nearly 100 articles on the subject, and helped pioneer a modern approach to holography called optical scanning holography. And now, he's been awarded one of the most prestigious honors in the field: the Emmett N. Leith medal.

"The grants I secured led to the development of a new approach: optical scanning holography," Poon said. "It represents a radical departure from conventional thinking because of its single pixel recording scheme. It has applications in 3D holographic fluorescence and phase-contrast microscopy, 3D pattern recognition, holographic cryptography, and more.

Read the full story here: **bit.ly/TCPoonMedal**

Walid Saad has been named a 2024 Clarivate Highly Cited Researcher

Saad was awarded for demonstrating significant influence in his field or across multiple fields through the publication of multiple highly cited papers during the last decade. This is the sixth time he has received this recognition. Along with his Virginia Tech colleagues Wenjing Lou, Linsey Marr, Linda Quan, Kwok-Leun Tsui, and Viswanath Venkatesh, this group of researchers represents about 1 in 1,000 of the scientists and social scientists in the world.

Honors & Achievements

Honors & Awards

Nagender Aneja | Second Round Judge, QS Reimagine Education Awards 2024

Arthur Ball | Received the SEC Undergraduate Organization Advisor Award in 2024

Named Bradley Faculty Fellow of Education in 2024

Harpreet S. Dhillon | Served as the interim head of ECE from August to December 2024. Since December 2024, he has been the Associate Dean for Research and Innovation at the Virginia Tech College of Engineering

Named the W. Martin Johnson Professor of Engineering

Named a Fellow of the Commonwealth Cyber Initiative (CCI)

Harpreet S. Dhillon, Lingjia Liu and Yang (Cindy) Yi | Named Dean's Fellows in the Virginia Tech College of Engineering

Christina DiMarino | Received the IEEE Power Electronics Society (PELS) Richard M. Bass Outstanding Young Power Electronics Engineer Award in 2024

Kendall Giles | Received the Dean's Award for Excellence in Teaching from the College of Engineering, Virginia Tech, April 2024

Rose Qingyang Hu | Received the highest USU research award D. Wynne Thorne Career Research Award at Utah State University

Elected to AAAS Fellow in 2024

Tom Hou | Recipient of Dr. Vanu Bose Best Paper Award at IEEE Military Communications Conference (MILCOM 2024), October 28 – November 1, 2024, Washington, DC, USA

Recipient of a Best Paper Award at IEEE Conference on Communications and Network Security (CNS), September 30 – October 3, 2024, Taipei, Taiwan

Xiaoting Jia | Awarded the Faculty Fellow by the College of Engineering at Virginia Tech in 2024

Tom Martin | Received the Department of Health and Human Services Office of Grants "Stronger Together Award" in 2024 as a member of the leadership team for the NSF-NIH Smart Health interagency program, along with his NSF colleague Goli Yamini and his NIH colleagues Dana Wolff-Hughes, Natalia Komissarova, Yanli Wang, and David Zahavi

Ali Mehrizi-Sani | College of Engineering Dean's Fellow, 2023-2024

Alan Michaels | Selected by College of Engineering as the Northrop Grumman Sr. Faculty Fellow

T.-C. Poon | Received the 2024 Optica's Emmett N. Leith Medal

Elected fellow of the Asia-Pacific Artificial Intelligence Association (AIAA) in 2024

Inducted into the International Order of Holoknights — an elite group of holographers from around the world

Saifur Rahman | Received the "Global NRB Award for Outstanding Achievement in Science and Technology" in Dhaka, Bangladesh on Dec. 26, 2024, for contributions to promoting clean-tech solutions for Climate Sustainability. This award is given for outstanding achievements among non-resident Bangladeshis (NRB)

Jeff Reed | Elected fellow of the National Academy of Inventors in 2024

Joao Santos | NSF CISE CORE: Small award part of the NSF U.S.-Ireland R&D Partnership Program

NSF CIRC Planning-C award

Wayne Scales | Received the Virginia Tech Alumni Award for Excellence in International Research

Angelos Stavrou | Received the 2024 IEEE Reliability Society Lifetime Award

Jeffrey Walling | Chair of the North American Regional Subcommittee for ISSCC 2025

IEEE Solid-State Circuits Society Distinguished Lecturer (2023-2024)

Cindy Yang Yi | Received 2024 Sally Bohland Award for Innovative Service at Virginia Tech

Wei Zhou | Received a Commonwealth Health Research Board (CHRB) Grant Award in 2024

2024 Dean's Awards for Excellence

The Dean's Awards for Excellence recognize our faculty members' incredible work, which has directly or indirectly impacted the success of our students.

Kristie Cooper & Kendall Giles
Excellence in Teaching

Yang (Cindy) Yi | *Excellence in Research*

Luiz DaSilva & Saifur Rahman | *Excellence in Service*

Dong Dong & Xiaoting Jia | *Faculty Fellow*

Ruoxi Jia & Wenjie Xiong
Outstanding New Assistant Professor

Short Courses & Lecture Series

Nagender Aneja | Speaker, Retrieval-Augmented Generation (RAG) in Healthcare at ATAL Online 6 Day Faculty Development Programmes on Smart Healthcare Systems: Enhancing Patient Care with IoT and AI by Amity University, Noida, India

Jordan Budhu | Delivered a one day short course on *"Integral Equation Based Synthesis of Metasurfaces"* at both the 2025 European Conference on Antennas and Propagation (EuCAP) and the 2025 IEEE Antennas and Propagation Society International Symposium

Luiz DaSilva | Organized the first US/European Cybersecurity Workshop, in Leuven, Belgium, May 22-24, 2024. This invitation-only event brought together 60 experts from academia, industry, and government, representing 35 institutions in 10 countries

Scott Dunning | Delivered two weeks of instruction in Electrical Transient Circuit Analysis to Shanghai Normal University in conjunction with the University of Dayton

Xiaoting Jia | Delivered a lecture on *"Multimaterial Multifunctional Fibers for Biomedical Applications"* for graduate course ECE297 in UCLA

Ali Mehrizi-Sani | Delivered a four-day industry course on *"Grid-Forming Inverters"* at Monash University in Australia with Dr. Behrooz Bahrani in summer 2024

Delivered a week-long course on Electric Machines and Drives at ESIGELEC in France in March 2024

Jeff Reed | Prepared Non Terrestrial Network Tutorial for IEEE MILCOM, Oct. 28, 2024

Dr. Abhijit Sarkar and Dr. Lynn Abbott | Conducted a tutorial on *"Ubiquitous Health Monitoring and Assessment of Human Psychophysiology using Remote Measurement and AI".* The tutorial took place at the 15th International Conference on Applied Human Factors and Ergonomics (AHFE), Nice, France, July 2024

Richard Zhang | Delivered a half-day lecture on *"Power Electronics for Renewables and Next Generation Grids"* at European Ph.D. School, May 2024, Gaeta, Italy

Keynote Addresses

Nagender Aneja
"Big Data Innovation for Sustainable Cognitive Computing"
EAI BDCC 2024 - 7th EAI International Conference, Coimbatore, India, December 20-21, 2024

Luiz DaSilva
"Building an Open Testbed for the Next Generation of Networks"
3rd Workshop on Testbeds, Brasilia, Brazil, July 24, 2024

Rose Qingyang Hu
"Revolutionizing 6G: Cognitive Semantic Communication's Impact On Wireless Intelligence And Beyond" | IEEE International Conference on Communications, June 2024

T.-C. Poon
"Optical Scanning Approach to Computer-Generated Holography"
2024 Light Conference, Changchun, China, June 17-21

"Optical Image Processing and its Application to Object Recognition"
6th International Conference on Control and Computer Vision (ICCCV), Tianjin, China, (Virtual), June 13-15, 2024

"Computer-Generated Holography: An Overview"
16th International Conference on Digital Image Processing (ICDIP), Haikou, China, May 24-26, 2024

Jeff Reed
"Signal Reuse for Spectrum Efficiency" | 2024 IEEE DySPAN Workshop, Washington, DC, U.S.A., May 13, 2024

Saifur Rahman
"Role of the Smart Grid in Facilitating the Integration of Renewables into the Power Grid" | IEEE ICREGA '24, PMU, Al Khobar, Saudi Arabia, April 22, 2024, 37p

"Role of ICT in Optimal Management of Smart Buildings, Smart Cities and Smart Grids" | 6th IEEE International Conference on Electrical Engineering and Information and Communication Technology (ICEEICT), MIST, Dhaka, Bangladesh, May 2-4, 2024, 39p

"Technology Solutions for Climate Sustainability"
Technical Experts' Forum IEEE Bangladesh Section, Dhaka, Bangladesh, May 4, 2024, 49p

"A Low-Carbon Electricity Paradigm to Help With Decarbonization" | IEEE PEEIA Conference, RUET, Rajshahi, Bangladesh, September 13, 2024, 34p

"Smart Grid and the Evolving Power System" | IEEE North Karnataka Conference 2024, India, September 21, 2024, 26p

Walid Saad
"Artificial General Intelligence (AGI)-Native Wireless Systems With Common Sense" | International Conference on Advanced Technologies for Communications, Ho Chi Minh City, Vietnam, October 2024

"Artificial General Intelligence (AGI)-Native Wireless Systems With Common Sense" | IEEE International Mediterranean Conference on Communications and Networking, Workshop on Semantic Communications, Madrid, Spain, July 2024

"Less Data, More Knowledge: Reasoning Foundations of Semantic Communication Networks" | 38th International Conference on Information Networking (ICOIN), January 2024

Haining Wang
"New Security Challenges in Ever-changing Computing Environments and Their Solutions" | IEEE 4th International Conference on Blockchain Technology and Information Security, August 2024 (Virtual)

Richard Zhang
"Ecosystem for Innovations Towards Electrified Green Infrastructure" | VT Electrified Green Infrastructure Workshop, Arlington, VA, April 2024

"HV DCCB - State-of-the-Art Technologies, Challenges and Opportunities" | DOE's High Voltage DC Circuit Breaker Workshop, Washington DC, U.S.A., May 2024

"Role of Power Electronics for Grid 3.0 & Electrified Green Infrastructure" | ABB Electrification Business, Bergamo, Italy, May 2024

"Role of Power Electronics for Grid 3.0 & Electrified Green Infrastructure" | Aalborg University, Aalborg, Denmark, May 2024

"Towards Electrified Green Infrastructure Power Conversion"
Hitachi Energy HVDC and Hitachi Energy Research Center, Ludvika, Sweden & Vasteras, Sweden

"Power Electronics and the Grid of the Future – Technologies, Opportunities and Challenges" | Delta Electronics University New Power Electronics Technologies Conference, Nanjing, China, June 2024

"Role of Power Electronics for Grid 3.0 & Electrified Green Infrastructure" | IEEE PELS Day at Huazhong University of Science and Technology, Wuhan, China, June 2024

"Role of Power Electronics for Grid 3.0 & Electrified Green Infrastructure" | IEEE PELS Day at Northern China Electric Power University, Beijing, China, June 2024

"Role of Power Electronics for Grid 3.0 & Electrified Green Infrastructure" | IEEE PELS Day at Tsinghua University, Beijing, China, June 2024

"Towards Electrified Green Infrastructure and Grid 3.0"
IEEE PELS Day at Zhejiang University, Hangzhou, China, September 2024

"Impact and Inspiration" | IEEE ECCE Conference Luminary Session, Phoenix, AZ, October 2024

"Emergence of DC Grids" | GE Electrification Symposium, Niskayuna, NY, October 2024

Conference Chairs

Jordan Budhu | *Special Session Chair* | Recent Advances in the Numerical Synthesis of Metasurfaces, 2024 IEEE Antennas and Propagation Society International Symposium

Special Session Chair | Advances in AI and Data-Driven Metasurface and Metamaterial Design, 2025 IEEE Antennas and Propagation Society International Symposium

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Harpreet S. Dhillon | *Technical Program Committee Co-Chair* | IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC), Valencia, Spain, Sept. 2024

General Co-Chair | BlockSecSDN: Blockchain for Secure Software-defined Networking in Smart Communities, IEEE Globecom, Cape Town, South Africa, Dec. 2024

General Co-Chair | Spatial Stochastic Models for Wireless Networks (SpaSWiN) workshop, WiOpt 2024, Seoul, South Korea, Oct. 2024

General Co-Chair | 3rd Workshop on Synergies of Communication, Localization, and Sensing Towards 6G, IEEE ICC, Denver, CO, June 2024

General Co-Chair | BlockSecSDN: Blockchain for Secure Software-defined Networking in Smart Communities, IEEE ICC, Denver, CO, June 2024

General Co-Chair | DroneCom: 7th International Workshop on Drone-Assisted Wireless Communications for 5G and Beyond, IEEE INFOCOM, Vancouver, Canada, May 2024

Tom Hou | *Conference Operations Chair* | IEEE INFOCOM, May 2024, Vancouver, Canada

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T.-C. Poon | *General Chair* | 6th International Conference on Control and Computer Vision (ICCCV 2024), Tianjin, China, June 13-15

Chair | Holography, Diffractive Optics and Applications XIV, SPIE Photonics Asia 2024, October 12 - 14, Nantong, China

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Saifur Rahman | *General Co-Chair* | International Conference on Electrical Engineering and Information and Communication Technologies, 2-4 May 2024, Dhaka, Bangladesh

General Chair | IEEE-ITU Symposium on Achieving Climate Resilience, 12-13 Dec. 2024, Geneva, Switzerland

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Ali Mehrizi-Sani | *Symposium Chair* | "Control and Operation" at the 16th IEEE SmartGridComm, 2024-2025

Scientific Committee Member | 1st International Conference and the 7th National Conference on Electrical Engineering and Intelligent Systems, Mar. 2024

Publication Committee | IEEE Smart Grid Technologies (ISGT), 2023–2024

Joao Santos | *Demo Chair* | IEEE Military Communications Conference (MILCOM), Los Angeles, California, 6–16 Oct. 2025

Local Arrangements Co-Chair | ACM Conference on Security and Privacy in Wireless and Mobile Networks (WiSec), Arlington, Virginia, USA, 30 Jun.–3 Jul., 2025

Student Travel Grant Chair | IEEE International Conference on Cloud Networking (CloudNet), Rio de Janeiro, Brazil, 27–29 Nov. 2024

Student Travel Grant Chair | IEEE International Symposium on Dynamic Spectrum Access Networks (DySPAN), Washington DC, USA, 13–16 May, 2024

Cindy Yang Yi | *General Chair* | IEEE International Symposium on Quality Electronic Design (ISQED)

Books

Y. Zhang and T.-C. Poon

Modern Information Optics | Cambridge University Press, Bilingual (Chinese/English) Version Published by Higher Education Press, China, 2024

Nagender Aneja, Co-Editor

Artificial Intelligence and Machine Learning for Sustainable Development Innovations, Challenges and Applications

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Jordan Budhu

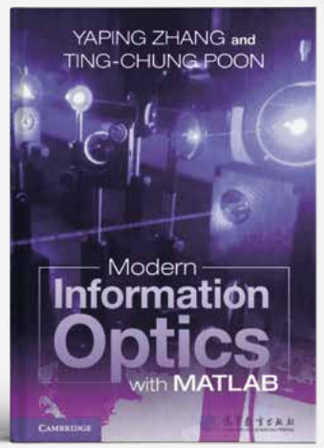
Book Chapter - *Aperiodic Metasurface Synthesis Techniques and Designs* | In the book Metamaterials-By-Design, edited by Andrea Alu, Nader Engheta, Adrea Massa, Giocomo Oliveri, published in 2024

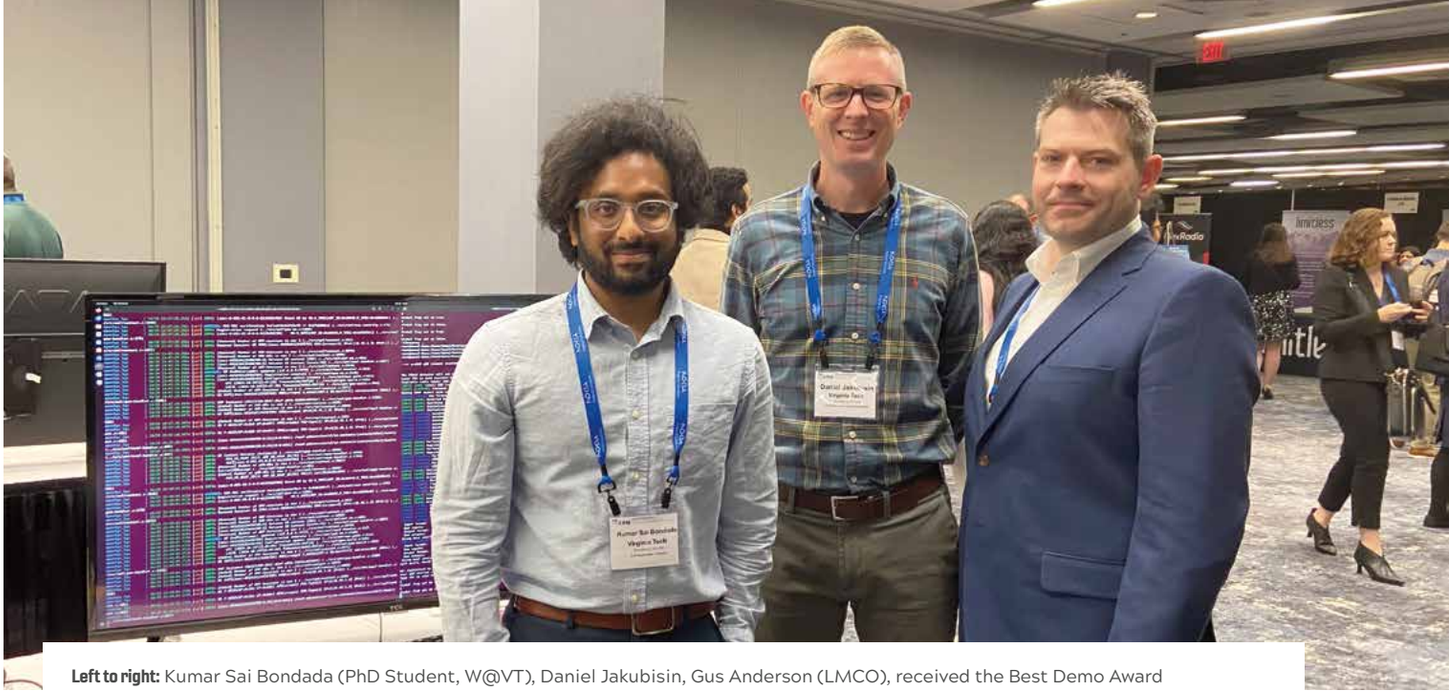
A. Mehrizi-Sani, J. Reed and C.-C. Liu

Book Chapter - *Military Microgrids With Renewable Energy and 5G Communication*
In the book, Microgrids and Virtual Power Plants by F. Shahnia and J. Guerrero, Eds. Springer, Nov. 2024, pp. 519–538

Xiaoting Jia and S. Jiang

Book Chapter - *Novel Functional Fibers for Neural Interfacing* | In the book Optical and Electronic Fibers: Emerging Applications and Technological Innovations, by L. Wei., Wiley-VCH GmbH., Ch.8, pp. 179-196, 2024





Left to right: Kumar Sai Bondada (PhD Student, W@VT), Daniel Jakubisin, Gus Anderson (LMCO), received the Best Demo Award at IEEE MILCO, 2024.

Paper Reviews & Awards

N. Jai, Y. Shi, L. A. DaSilva, Y. T. Hou, and W. Lou | Received the Dr. Vanu Bose Best Paper Award for *"Out-of-Band Interference Management to Protect Radio Astronomy"* at IEEE Military Communications Conference (MILCOM), Washington, DC, October 28 - November 1, 2024

Students, **Kumar Bondada and Connor McPeak**
Faculty members, **Daniel Jakubisin, Jeffery Reed and Nishith Tripathi** | Received Best Demo Award at IEEE MILCOM, 2024

Rose Qingyang Hu | Safeguarding Next-Generation Multiple Access Using Physical Layer Security Techniques: A Tutorial", Proceedings of the IEEE, in collaborations with researchers with Korea, UK, Canada and China

Ali Mehrizi-Sani | Contributed to *"Next G Alliance Report: Evolution of Sustainability Indicators for Data Centers and Next Generation Core Networks,"* published by the NextG Alliance, September 2024

Contributed to UNIFI Consortium's Specifications for Grid-Forming Inverter-Based Resources—Version 2, March 2024

Jeff Reed | Panel member, SpectrumX NSF Center Annual Review, November 12-14, 2024

Editorial Roles in Scholarly Journals

Nagender Aneja | Associate Editor of Engineering, ASEAN Journal on Science and Technology for Development

Harpreet S. Dhillon | Executive Editorial Committee, IEEE Transactions on Wireless Communications | Senior Editor, IEEE Wireless Communications Letters

Christina DiMarino | Associate Editor, IEEE Transactions on Power Electronics | Guest Associate Editor, IEEE Transactions on Power Electronics Special Section on Advancing Power Electronics Reliability | Guest Associate Editor, IEEE Journal of Emerging and Selected Topics in Power Electronics Special Issue on High Power Density Power Converters Achieved by Device and Components Integration

Rose Qingyang Hu | Editor-in-Chief, IEEE Communications Magazine | Associate Editor, IEEE Transactions on Vehicular Technology | Associate Editor, IEEE Transactions on Wireless Communications | Associate Editor, IEEE Wireless Communications

Tom Hou | Associate Editor, ACM Transactions on Sensor Networks | Editor-at-Large, IEEE Transactions on Network Science and Engineering

Xiaoting Jia | Editorial board member, Advanced Fiber Materials; | Guest editor, Frontiers in Bioengineering and Biotechnology

Mary Lanzerotti | Associate Editor, IEEE Transactions on Aerospace and Electronic Systems

Ali Mehrizi-Sani | Senior Editor, IEEE Transactions on Energy Conversion | Associate Editor, IEEE Power Engineering Letters | Associate Editor, IET Generation, Transmission & Distribution | Editorial Board Member, Elsevier Smart Power & Energy Security

T.-C. Poon | Specialty Chief Editor, Frontiers in Photonics | Editor, Applied Sciences | Feature Editor, Applied Optics | Special Issue Editor, Photonics | Deputy Editor-in-Chief, Advanced Devices & Instrumentation (a Science Partner Journal)

Jeff Reed | Editorial board Wiley/IEEE Press

Walid Saad | Term as Editor-in-Chief for the IEEE Transactions on Machine Learning in Communications and Networking was extended for 2 more years

Wayne Scales | Associate Editor of Radiation Effects and Defects in Solids

Angelos Stavrou | Associate Editor, IEEE Transactions on Computers | Associate Editor, IEEE Security & Privacy Magazine | Associate Editor, IEEE Internet Computing

Jeffrey Walling | Associate Editor, IEEE Transactions on Circuits and Systems - I | Senior Area Editor, IEEE Transactions on Circuits and Systems - I

Haining Wang | Associate Editor, ACM Transactions on Privacy and Security

Cindy Yang Yi | Associate Editor, IEEE Transactions on Circuits and Systems for Artificial Intelligence | Associate Editor, ACM Transactions on Design Automation of Electronic Systems | Associate Editor, IEEE Transactions on Very Large Scale Integration (VLSI)

Wei Zhou | Associate Editor, npj Biosensing (Springer Nature) | Associate Editor, IEEE Photonics Technology Letters (IEEE Photonics Society)

Exceptional National & International Services

Luiz DaSilva | Serves on the board of the International Cybersecurity Center of Excellence (INCS-CoE), a consortium led by universities in the US, UK, and Japan

Angelos Stavrou | IEEE Blockchain Initiative Representative for Reliability Society

Scott Midkiff | ABET Program Evaluator and Member-at-Large of the IEEE Committee on Engineering Accreditation Activities

Saifur Rahman | IEEE Past-President and Member of the IEEE Board of Directors, 2024 | Chair, IEEE Strategy and Alignment Committee, 2024

Rose Qingyang Hu | Editor-in-Chief, IEEE Communications Magazine | Director of Educational Services Board, IEEE Communications Society | Board of Governors, IEEE Communications Society | Board of Director, American Society of Engineering Education (ASEE) Engineering Research Council (ERC) | Chair, ASEE ERC Curtis W. McGraw Research Award Committee | Vice-Chair, IEEE GLOBECOM / ICC Management & Strategy (GIMS) Standing Committee

Wayne Scales | Elected to Serve on the Trustee Board of the University Space Research Association, Serves on the National Academies of Science, Engineering, and Medicine Committee on Space and Solar Physics, Serve on Advisory Board of the High Frequency Active Auroral Research Program Facility (HAARP)

Mary Lanzerotti | Member of the International Advisory Board for 2025 International Nonlinear Dynamics Conference. She previously was a Member of the International Advisory Board for 2023 International Nonlinear Dynamics Conference

Christina DiMarino | Elected to serve a second term as Chair of the IEEE Power Electronics Society (PELS) Technical Committee on Power Components, Integration and Power ICs

Paul Ampadu | Selected to join the National Science Foundation as Program Director for the Technology, Innovation and Partnerships (NSF TIP) directorate beginning January 2025

Tom Martin | Currently serving as a program director at the National Science Foundation in the Computer & Information Science & Engineering directorate, starting in January 2023. He co-leads the NSF-NIH Smart Health interagency program, while also contributing to the Human-Centered Computing, Strengthening American Infrastructure, Personalized Engineering Learning, Accelerating Computer-Enabled Scientific Discovery, and Graduate Research Fellowship programs

Scott Dunning | Serving on the ABET Board of Delegates representing the American Society for Engineering Education | Appointed to serve on the ABET Global Council for the next two years. The Global Council is responsible for international mutual recognition agreements (MRAs) for educational programs outside of the U.S.

Ali Mehrizi-Sani | Steering Committee Member of the International Symposium on Microgrids | Council Member, International Conference on Intelligent Systems Applications to Power Systems (ISAP)

Xiaoting Jia | Selected to serve as the Sensors, MEMS and Bioelectronics (SMB) Subcommittee Chair for the 70th Annual IEEE International Electron Devices (IEDM) Meeting in 2024. She previously served as a subcommittee member for IEDM from 2022-2023

Jeff Reed | Invited attendee at the 2024 US/European Cybersecurity Workshop, May 21-23, 2024, in Leuven, Belgium

Workers connect updated gas lines in the Whittemore clean room. Photo by Ben Murphy.

Collaborating for the Future

ECE has launched a new University-wide faculty user committee for the VT Micro/Nanofabrication Cleanroom and Laboratory Facility. The committee will guide the facility's future development and help address its current operational challenges. There are 17 faculty members from diverse disciplines:

Electrical and Computer Engineering
Mantu Hudait
Linbo Shao
Xiaoting Jia
Wei Zhou

Mechanical Engineering
Jiangtao Cheng (*Vice Chair*)
Zhenhua Tian

Materials Science and Engineering
Rebecca Cai
Tina Rost

Industry and Systems Engineering
Blake Johnson

Biological Science Engineering
Wujin Sun

Physics
Jean Heremans (*Chair*)
Vinh Nguyen
Satoru Emori

Chemistry
Feng Lin
Lina Quan

School of Animal Sciences
Azahar Ali

Food Science and Technology
Yifan Chen

Strategic Initiatives

New Equipment Acquisition

We are prioritizing the acquisition of a new physical vapor deposition (PVD) tool for thin film deposition, crucial for fabricating micro-/nano-devices and sensors.

Collaboration & Revenue Generation

We are committed to fostering research collaborations among internal and external users through initiatives like a joint NCFL-Micro/NanoFab@VT annual user meeting (in collaboration with NCFL director, Matt Hull) and by facilitating large-scale proposals aligned with the CHIP Act, Healthcare, Energy, Materials, and Quantum initiatives. We are also developing close partnerships with federal research labs, industry, and international collaborators to expand the facility's external user base and increase revenue.

Read more about the work we've done to expand and rebuild our cleanroom: **bit.ly/ECENanoFab**

Patents Issued | 2024/2023

Charge Balanced Power Schottky Barrier Diodes

Patent # 12,176,442
Issued December 24, 2024
Inventors Ming Xiao, Yuhao Zhang

Digital Surface-Enhanced Raman Spectroscopy Sensing Platform

Patent # 12,140,547
Issued November 12, 2024
Inventors Wei Zhou

Surface-Enhanced Raman Spectroscopy Membranes and Textiles, Methods of Making, and Uses Thereof

Patent # 12,140,548
Issued November 12, 2024
Inventors Wei Zhou

Electronic Transformer for Current Sharing and Load-Independent Voltage Gain

Patent # 12,132,408
Issued October 29, 2024
Inventors Dong Dong

High-Density Single-Turn Inductor

Patent # 12,119,161
Issued October 15, 2024
Inventors Dushan Boroyevich, Rolando Burgos

Hybrid Modulation Controlled DC-to-AC Converters

Patent # 12,034,376
Issued July 9, 2024
Inventors Jih-Sheng Lai

Magnetic Integration of Matrix Transformer With Controllable Leakage Inductance

Patent # 12,009,146
Issued June 11, 2024
Inventors Fred C. Lee, Qiang Li

Series/Series Resonant Topology for Wireless Power Transfer

Patent # 12,003,114
Issued June 4, 2024
Inventors Dushan Boroyevich, Rolando Burgos

Hybrid Multi-Level Inverter

Patent # 11,990,849
Issued May 21, 2024
Inventors Jih-Sheng Lai

Compact Inductor Employing Redistributed Magnetic Flux

Patent # 11,972,896
Issued April 30, 2024
Inventors Khai D.T. Ngo

Induction Cooking System

Patent # 11,968,765
Issued April 23, 2024
Inventors Jih-Sheng Lai

Sealed Interface Power Module Housing

Patent # 11,956,914
Issued April 9, 2024
Inventors Dushan Boroyevich, Rolando Burgos, Christinia DiMarino

Methods and Systems for Distributed Temperature and Pressure Sensing Comprising a Polymer Fiber

Patent # 11,947,163
Issued April 2, 2024
Inventors Xiaoting Jia, Anbo Wang

High Current DC-DC Converter with Integrated Matrix Transformer and Multiphase Current Doubler Rectifier

Patent # 11,894,778
Issued February 6, 2024
Inventors Fred C. Lee, Qiang Li

Intelligent Distribution of Data for Robotic and Autonomous Systems

Patent # 11,880,188
Issued January 23, 2024
Inventors Ryan Williams

Integrated Parallel Matrix Transformer and Inductor

Patent # 11,848,140
Issued December 19, 2023
Inventors Fred C. Lee, Qiang Li

Faculty Fellows

Eric Burger Elected AAAS Fellow

Research director, research professor of NextG security

Affiliations: Commonwealth Cyber Initiative, electrical and computer engineering, School of Public and International Affairs, computer science, Virginia Tech National Security Institute, Wireless@VirginiaTech

AAAS Citation: For distinguished contributions to communication policy, including accessibility for those with hearing loss, and contributions to communication for public safety in emergency location, emergency connectivity, and suicide prevention intervention.

An entrepreneur and technology leader, Burger is helping guide the research direction of the Commonwealth Cyber Initiative, an unprecedented statewide cybersecurity consortium of 40-plus Virginia universities and colleges. Burger is the former chief technology officer of the Federal Communications Commission and was named a 2023 fellow of the National Academy of Inventors. He is also technical director of the NextG Alliance, an initiative dedicated to advancing North American wireless technology leadership.

Read about the other AAAS fellows here: **bit.ly/AAASFellowECE**

CCI Fellowship: Wenjie Xiong

In modern computing devices, performance is king — often at the expense of security.

In general, hardware and software designs prioritize speed and efficiency. Commonwealth Cyber Initiative Faculty Fellow Wenjie Xiong is investigating ways to ensure that manufacturers don't cut corners when it comes to protecting data.

Xiong's research goals dovetail with the Commonwealth Cyber Initiative's mission to promote cybersecurity in Virginia. The initiative's faculty fellow program supports Virginia Tech departments in their efforts to recruit talented cybersecurity researchers like Xiong, who joined the Bradley Department of Electrical and Computer Engineering in January 2022.

While Xiong's work addresses security gaps throughout computing design, she focuses on hardware.

Read her Q&A here: **bit.ly/ECEWenjie**

Lingjia Liu and Yi Shi, Wireless Experts, Elected Fellows of the Institute of Electricaland Electronics Engineers

Two Virginia Tech wireless communications researchers – Lingjia Liu and Yi Shi, Ph.D. '07 – have each been elevated to the status of fellow as part of the Institute of Electrical and Electronics Engineers (IEEE)'s 2025 class. This honor highlights their excellence in solving the real-world challenges of wireless security, incorporating machine learning, and building the future of 6G.

To be named a fellow, IEEE members must demonstrate significant contributions to their field, show evidence of technical accomplishments and realization of significant impact to society, and a record of service to professional engineering societies, among other criteria.

Fewer than 0.1 percent of voting members in the institute are selected annually for this highest career milestone of IEEE.

"Virginia Tech and Commonwealth Cyber Initiative (CCI) researchers are leading advances in wireless communications that impact people around the globe," said Luiz DaSilva, CCI executive director and the Bradley Professor of Cybersecurity. "Contributions by Lingjia Liu and Yi Shi are changing how we interact with our smart devices and more by making them faster, more reliable, and secure. Being named an IEEE Fellow is a well-deserved career milestone."

Liu is the director of Wireless@Virginia Tech and an inaugural Innovation Campus faculty member. He's being elevated to fellow for his work on multi-cell multi-user, multiple-input, multiple-output (MIMO) and for intelligent spectrum access.

MIMO is a key technology for 4G, 5G, and in the future, 6G. Liu, professor and Bradley Senior Faculty Fellow in the Bradley Department of Electrical and Computer Engineering (ECE), is also collaborating with colleagues from MIT and Duke University on combining online real-time machine learning and MIMO to enable truly intelligent spectrum access for "6G and Beyond."

Yi Shi, Ph.D. '07 is a researcher for CCI, a research associate professor, by courtesy, in ECE, and affiliate faculty in the Intelligent Systems Division of the Virginia Tech National Security Institute. Shi was elevated to IEEE fellow for his contributions to wireless network performance optimization and wireless security.

Shi's work enhances the security of personal data and boosts network reliability, and has helped advance mobile communications from 3G to 5G and NextG. He has also worked on everyday wireless technology.

Read the full story here: **bit.ly/IEEEFellowVT**

Faculty Fellows & Professorships

Arthur Ball

Bradley Faculty Fellow of Education

At Virginia Tech, Arthur Ball has contributed extensively to curriculum development. As the course content committee chair for a National Science Foundation Revolutionizing Engineering Departments grant, he led a group of seven faculty members — which later grew to 24 — to redesign the traditional course materials around threshold concepts and hands-on learning. As the result of this work, seven base courses in the college were replaced with eight new courses in 2019 and significant improvements were seen. Ball has revised several additional courses and created new lab components for all of them.

Harpreet S. Dhillon

W. Martin Johnson Professor

The professorship was established in 1983 through the gift of the late W. Martin Johnson to recognize teaching and research excellence in the College of Engineering. A member of the Virginia Tech faculty since 2014, Dhillon is internationally recognized for his work in wireless communications, particularly in analyzing large-scale wireless systems using stochastic geometry. He has written numerous publications, including three books, two edited volumes, and nearly 250 journal and conference papers. He recently served as the interim department head for ECE.

Alan Michaels

Northrop Grumman Senior Faculty Fellow

Alan Michaels has delivered creative research solutions to problems in secure digital communications and cryptography, accompanied by a distinguished record of patents and scholarship. He has received external grants worth more than $181 million and has served as principal investigator of joint academic-industry teams, including the ongoing Northrop Grumman-Virginia Tech efforts for Intelligence Advanced Research Projects Activity. His work has led to 45 issued U.S. patents with seven more pending. He was elected as a fellow of the National Academy of Inventors in 2021.

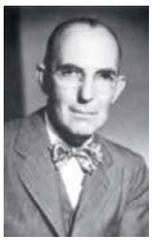
Leyla Nazhandali

Bradley Faculty Fellow of Education

Nazhandali pioneered the department's use of undergraduate teaching assistants and has made transformational changes to courses including Introduction to Computer Architecture (ECE 2500) and Introduction to Embedded Systems (ECE 2564). In the latter course, she introduced a new structure, new sequenced homework assignments, and a new website that contains relevant review materials for students as well as step-by-step tutorials and other materials.

Read their stories at: **bit.ly/ECEFellows**

Bradley & Webber Fellows 2024-2025



Harry Lynde Bradley

The Bradley Endowment

The late Mrs. Marion Bradley Via established an endowment for ECE in honor of her late father, Harry Lynde Bradley, who was a pioneer in the electric motor control industry and cofounder of the Allen-Bradley Company of Milwaukee, which is now part of Rockwell Automation. In recognition, the department is called The Bradley Department of Electrical and Computer Engineering. The endowment funds scholarships, fellowships, and professorships in an ongoing effort to improve our ECE programs.

William B. Webber

William Webber Undergraduate Scholarship

William B. Webber (EE '34) established a fund to encourage women engineers. Webber's career took him to Westinghouse, the U.S. Signal Corps, then to a booming company co-founded by an army buddy— Tektronix Inc. Today, the William B. Webber Fellowship is awarded to high-achieving women pursuing a graduate degree in ECE.

To date, more than 220 undergraduate and graduate students have full scholarships by the endowment as Bradley Scholars and Bradley Fellows. These scholarships and fellowships are among the most competitive in the country and are awarded to the best students who study with the department.

William Chong

BSEE '23 Rose-Hulman Institute of Technology

Chong's current research focuses on developing high-step ratio DC-DC converters.

Alexander DeRieux

BSEE '16, BSCS '16, and MSEE '22 Virginia Tech

DeRieux is developing quantum algorithms and machine-learning architectures to advance classical artificial intelligence paradigms.

Chris Conti

MSEE '26 Virginia Tech

Conti is studying the behavior of electromagnetic fields/waves in the upper atmosphere.

Davis Earley

BSEE '20 Auburn University
MSEE '22 Virginia Tech

Earley is researching observational methods to improve air quality measurements using Differential Optical Absorption Spectroscopy.

Joseph Esser

BSEE '26 Virginia Tech

Esser is working on implementing machine learning algorithms in hardware to improve radar performance.

Tyler McGrew

BSEE '21 Miami University

McGrew is modeling and developing techniques to reduce electromagnetic noise in high-frequency power converters.

Nicholas Goradio

BSEE '23 Virginia Tech
BS Math '23 Virginia Tech

Goradio is researching stochastic analyses for communications systems. Specifically focusing on Statistical Signal Processing.

Irina Mukhametzhanova

Ph.D. '29 Virginia Tech

Mukhametzhanova is studying topics related to computer architecture and VLSI design.

William Hall

BSEE '21, MSEE '26 Virginia Tech

Hall is studying magnetic design and modeling to improve the efficiency, size, and cost of power converters in electric vehicles and other clean energy sources.

Matthew Porter

BSEE '10 United States Naval Academy
MSEE '11 Naval Postgraduate School

Porter is researching the design, fabrication and characterization of novel wide- and ultra-wide bandgap semiconductor power devices, with a focus on vertical GaN and Ga^2O^3 device structures.

Caroline Larsen

BSEE '24, MSEE '25 Virginia Tech

Larsen is researching protection and cybersecurity techniques for inverter-dominated power systems.

Austin Roberts

MSEE '26 Virginia Tech

Roberts is developing a software-defined underwater acoustic modem to support development of covert and reliable underwater acoustic communications through advanced signal processing techniques.

Olivia Leonard

BSEE '25 Virginia Tech

Leonard is developing machine learning methods to control frequency allocation in radar sensor networks.

Veronica Romanek

BS '23 University of Scranton

Romanek is working with ECE Space@ VT's SuperDARN group to investigate the dynamics of space weather events and their effects on the ionosphere.

continued >

Sam Shebert

MSEE '22 Virginia Tech
BSEE '20 SUNY Oswego

Shebert is developing signal classifiers that fuse classical signal processing with recent advances in machine learning.

Ben Updike

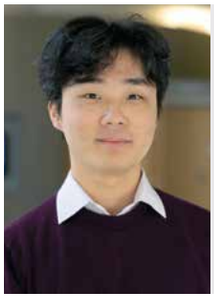
BSEE '24, MSEE '25 Virginia Tech

Updike is working on designing an efficient envelope tracking radio frequency power amplifier.

Anson Trapani

BSEE '24, MSEE '25 Virginia Tech

Anson is working on exploiting the piezoelectric properties of Lead Zirconate Titanate-based accelerometers to serve as a physical unclonable function.



Raymond Zhao

BSEE '23 Rose-Hulman Institute of Technology

Zhao is developing a deep neural network for the ORAN testing platform to reduce computational loads in maintaining wireless networks.

Not pictured:

Jack Chandler | Ph.D. '28, Virginia Tech
Chandler is working on the application of confidential computing to privacy-preserving machine learning, ORAM, and disaggregated memory systems.

Tad Didio

Jaysen Dildy | MSEE '26, Virginia Tech
Dildy is working on packaging solutions for next-generation high performance GPUs used in cloud computing and artificial intelligence applications.

Zachary Schmidt

Bradley Scholars

Julia Burant

Electrical Engineering

Julia is a dedicated learner and an analytical thinker with a keen eye for detail. She is enthusiastic about contributing to the altruistic endeavors of the ECE field, with plans to specialize in Controls, Robotics, and Autonomy.

Nicholas Burant

Electrical Engineering

As a junior at Virginia Tech, Burant is pursuing an Electrical Engineering degree with a major in Energy & Power Electronics Systems and a secondary focus area in Micro/Nanosystems. He has a strong interest in the world-changing capabilities within the field of electrical and computer engineering.

Andrew Merdes

Computer Engineering

Merdes is in his senior year at Virginia Tech. He enjoys various clubs on campus, including Board Game Club, Tennis, and Pickleball. His most memorable experience at Virginia Tech so far was visiting the FRITH lab and seeing all the tools and machines students can use.

Charlie Merdes

Computer Engineering

Charlie is an undergraduate student who loves the thrill of finding a solution to a complex problem. He is interested in studying Computer Engineering and is intrigued by the boundless potential that Artificial Intelligence holds in the near future.

Bradley Alumni

2024

Brady Alexander / F
MSEE '24, BSEE '23

Madeline Badger / F
MSCPE '24, BSCPE '23

Samuel Brown / F
MSEE '25, BSEE '23

Alex Downey / F
MSCPE '24, BSCPE '23

Samantha Frietchen / F
MSEE '24, BSEE '23

James Mislay / S
BSCPE '24

Robbie Platt / F
MSCPE '24, BSCPE '23

Gwyneth Steel / F
MSCPE '24, BSCPE '23

Joseph G. Thomas / F
Ph.D. EE '24, MSEE '20, BSEE '18

2023

Benjamin Biggs / F
MSEE '20, Ph.D. '23

Rebecca DeSipio / F
MSCS '23

Richard Gibbons / F
MSEE '23, BSEE '21

Danielle Lester / F
BSEE '21, MSEE '23

Alec Yip / F
MSEE '23, BSEE '22

2022

Eric Danson / F
BSCPE'22

Nathan Moeliono / S
BSCPE '22

Maymoonah Toubeh / F
MSCPE '18, Ph.D. '22

2021

Mark Cairnie / F
MSEE'21

Virginia Li / F
BSEE '13, Ph.D. '21

Megan Moore / F
MSEE '21, BSEE '19

2020

Shane Coyle / F
MSEE '20

2019

Jonathan Bunting / F
MSCPE '19

Michael Emanuel / F
BSEE '18, MSEE '19

Bryse Flowers / F
BS '14, MS '19

Christopher Goodkind / S
BSCS '19

Jonathan Graf / S
BSCPE '02, MSCPE '04, Ph.D. '19

Paul Kennedy / F
BSEE '17, MSEE '19

Hannah Mohr / F
MSEE '19

2018

Jacques Delport / F
Ph.D. EE '18

Christina DiMarino / F
MSEE '14, Ph.D. EE '18

Sean Douglass / F
MSCPE '18

Janay Frazier / F
MSEE '18

Elizabeth Hutz / S
BSCPE '18

Jason Ziglar / F
Ph.D. '18

2016

Colin Burgin / F
BSEE '16

Michael Cogswell / F
BSMATH '13, BSCS '13, MSCPE '16

Michael Fraser / F
MSEE '12, Ph.D. '16

Kristen Hines / F
MSCPE '16

Walker Sensabaugh / F
BSCPE '16

Richard Tillman / F
BSEE '12, MSEE '14, Ph.D. '16

2015

Paul U. David / F
MSEE '15

William C. Headley / F
BSEE '06, MSEE '09, Ph.D. '15

Christopher Jelesnianski / F
MSCPE '15

Javier Schloemann / F
Ph.D. '15

Amy M. Ridenour / F
MSEE '15

2014

Lucy Del Barga / F
(was Lucy Fanelli)
MSEE '14

Michael Hopkins / F
Ph.D. '14

Callie Johnston / S
BSCPE '14

Nicholas Kaminski / F
BSEE/CPE '10, MSEE '12, Ph.D. '14

Nathan Kees / F
BSEE '08, MSEE '14

2013

Thurman Shaver Deyerle IV / F
BSEE '10, MSEE '13

Kevin D. Jones / F
BSEE '09, MSEE '11, Ph.D. '13

Parrish Ralston / F
BSEE '06, MSEE '08, Ph.D. '13

David Uliana / F
BSCPE '11, MSCPE '13

Ben York / F
MSEE '10, Ph.D. '13

Phillip Andrew Zellner / F
BSEE '07, MSEE '12, Ph.D. '13

2012

Brittany Clore / S
BSCPE '10, MSCPE '12

Thomas Alan Cooper / S
BSEE '10, MSEE '12

Ryan Irwin / F
Ph.D. '12

David Reusch / F
BSEE '04, MSEE '06, Ph.D. '12

Ethan Swint / F
Ph.D. '12

2011

Amy Malady / F
BSEE '09, MSEE '11

David Mazur / S/F
BSEE '11

Benton Thompson / F
MSEE '11

Jerry Towler / S
BSEE '08, MSEE '11

2010

Ricky Castles / S
BSCPE '03, MSCPE '06, Ph.D. '10

David L. Kleppinger, Jr. / S
BSCPE '04, MSCPE '08, Ph.D. '10

Evan Lally / F
BSEE '03, MSEE '06, Ph.D. '10

Jacob R. Simmons / S
BSCPE '08, MSEE '10

2009

Benjamin Alan Beasley / S
BSEE '09

Matthew Carter / F
BSEE '09

Ross Clay / S
BSCPE '09

Daniel Friend / F
Ph.D. '09

Daniel Hager / S
BSCPE '08, MSCPE '09

Zachary La Celle / S
BSCPE '09

Matt Welch / S
BSEE '09

2008

Mark Baldwin / F
BSEE '93, MSEE '05, Ph.D. '08

David Casteel / S
BSCPE '08

Stephen Douglas Craven / F
Ph.D. '08

R. Matthew Gardner, Sr. / F
BSEE '03, MSEE '05, Ph.D. '08

Mark Alan Lehne / F
Ph.D. '08

Rebecca Kay Shelton / F
MSEE '08

Neil Steiner / F
MSEE '02, Ph.D. '08

2007

Aric Blumer / F
Ph.D. '07

Nathan Harter/ F
MSEE '07

Edward Andrew Jones / S
BSEE '07

Brian Joseph McGiverin / S
BSCPE '96, MSIT '07

Linh My Pham / S
BSCPE '07, BSPHYS '07

Gray Roberson / F
Ph.D. '07

Thomas Rondeau / S/F
BSEE '03, MSEE '06, Ph.D. '07

Adam Keith Shank / S
BSCPE '07

Juan Suris / F
Ph.D. '07

Richard Zimmermann / S
BSCPE '07

2006

Christopher R. Anderson / S/F
BSEE '99, MSEE '02, Ph.D. '06

Daniel Dae Cho / S
BSEE '06

Jeffrey R. Clark / F
MSEE '03, Ph.D. '06

Jamie N. Riggins / S/F
BSEE '04, MSEE '06

Daniel J. Tebben / F
Ph.D. '06

2005

Nathaniel August / F
BSCPE '98, MSEE '01, Ph.D. '05

Brian M. Donlan / F
MSEE '05

David Craig Schroder / S
BSEE '05

Ian Schworer / F
BSCPE '03, MSEE '05

Michael Gordon Vondrak / S
BSCPE '05

2004

Matthew R. Anderson / S
BSCPE '04

Mark B. Bucciero / F
BSCPE '01, MSCPE '04

Ryan Fong / S/F
BSCPE '01, MSCPE '04

Daniel J. Hibbard / F
BSEE '02, MSEE '04

Ellery L. Horton / S
BSCPE '04

Charles Lepple / F
BSEE '00, MSEE '04

Annie Martin / F
BSEE '04

Stephanie Martin / S
BSEE '04

Christopher A. Maxey / S
BSCPE '02, MSEE '04

Abigail Harrison Osborne / S
BSCPE '04

Christian Rieser / F
BSEE, MSEE '01, Ph.D. '04

Alexander James Taylor / F
BSEE '02, MSEE '04

Rose Trepkowski / F
BSEE '04, MSEE '04

Michael Lee Webber / F
BSEE '02, MSEE '04

2003

Cass Dalton / S
BSCPE '03

Brian Gold / S
BSEE '01, MSCPE '03

Timothy Gredler / S
BSCPE '03

Adam P. Hahn / S
BSCPE '03

Alexander Hanisch / S
BSCPE '03, BS MATH '03

James E. Hicks / F
MSEE '00, Ph.D. '03

Hugh E. Hockett / S
BSCPE '03

Spencer Hoke / S
BSCPE '03

Andrew S. Hollingsworth / S
BSCPE '03

Ryan Hurrell / S
BSEE '03

Dimosthenis Katsis / S
BSEE '95, MSEE '97, Ph.D. '03

Patrick McDougle / S
BSEE '03

David R. McKinstry / F
MSEE '03

Michael Mera / S
BSEE '03

Stephen Nash / S
BSCPE '03

Pablo Max Robert / F
MSEE '98, Ph.D. '03

Amy Rose / S
BSCPE '03

Roger Skidmore / F
BSCPE '95, MSEE '97, Ph.D. '03

Douglas Sterk / F
BSEE '00, MSEE '03

Samuel S. Stone / S
BSCPE '03

Kristin Weary / S
BSEE '03

Paul C. Weinwurm / F
BSEE '03

2002

William D. Barnhart / S/F
BSEE '00, MSEE '02

Kevin B. Cooley / S
BSEE '02

Christopher Griger / S
BSCPE '02

Keith Cristopher Huie / F
MSEE '02

Basil Thomas Kalb / S
BSEE '98, MSEE '02

Michael F. Mattern / S
BSEE '02

James W. McLamara / F
BSEE '02

Vin Menon / S
BSCPE '02, BSISE '02

Carl E. Minton / F
BSEE '97, MSEE '02

Troy Nergaard / F
MSEE '02

Kashan Ali Shaikh / S
BSCPE '02

Raymond Ashley Sharp / S
BSEE '02

Seema Sud / F
Ph.D. '02

Jason S.K. Wienke / S
BSEE '02

William Worek / S
BSCPE '99, MSCPE '02

2001

Sarah S. Airey / S
BSCPE '01

Brian Berg / F
BSEE '90, MSEE '91, Ph.D. '01

Carey Buxton / F
Ph.D. '01

Eric D. Caswell / F
Ph.D. '01

Kevin Flanagan / S
BSCPE '00, MSCPE '01

Matt Helton / S
BSEE '01

Ben Henty / F
MSEE '01

Erik Hia / F
BSCPE '99, MSCPE '01

Daniel A. Johnson / F
BSEE '98, MSEE '01

Adam Steven Kania / S
BSEE '01

Janie A. Hodges Longfellow / S
BSCPE '01

Daniel L. Lough / S
BSCPE '94, MSEE '97, Ph.D. '01

Richard Steven Richmond / F
MSEE '01

Jonathan Scalera / F
MSCPE '01

Amanda Martin Staley / S/F
BSEE '99, MSEE '01

Christian Twaddle / S
BSCPE '01

Jason Yoho / S
MSEE '98, Ph.D. '01

2000

Bryan Browe / F
BSEE '97, MSEE '00

Carrie Aust Cox / F
MSEE '00

Bradley A. Davis / F
BSEE '86, MSEE '88, Ph.D. '00

Scott Davis / S
BSCPE '00

Gregory D. Durgin / F
BSEE '96, MSEE '98, Ph.D. '00

Jason E. Lewis / S/F
BSEE '99, MSEE '00

Garrett Mears / S
BSCPE '00

Joseph Allen Payne, Jr. / S
BSEE '00

William B. Puckett / F
MSEE '00

Yaron Rachlin / S
BSEE '00

1999

Richard Ertel / F
Ph.D. '99

Jason Hess / F
BSEE '97, MSEE '99

J. Eric Nuckols / F
BSEE '97, MSEE '99

Neal Patwari / S
BSEE '97, MSEE '99

Jeffrey T. Scruggs / F
BSEE '97, MSEE '99

Jeff Smidler / S
BSEE '99

Matthew C. Valenti / F
BSEE '92, Ph.D. '99

1998

Robert Adams / F
MSEE '95, Ph.D. '98

Matthew Carson / S
BSEE '98

Brian Flanagan / S/F
BSEE '97, MSEE '98

Jayda Blair Freibert / S
BSEE '98

Eric J. Mayfield / S
BSEE '97, MSEE '98

John Morton / F
MSEE '98

Paul Nguyen / S/F
BSEE '98

1997

Ray Bittner / S
BSCPE '91, MSEE '93, Ph.D. '97

Thomas H. Drayer / F
BSEE '87, MSEE '91, Ph.D. '97

Bradley H. Gale / S
BSEE '97

Paul A. Kline / F
Ph.D. '97

Jeff Laster / F
BSEE '91, MSEE '94, Ph.D. '97

Matthew A. Yaconis / S
BSEE '97

1996

Shawn Addington / F
BSEE '90, MSEE '92, Ph.D. '96

R. Michael Buehrer / F
Ph.D. '96

Todd B. Fleming / F
BSCPE '94, MSEE '96

William Kuhn / F
BSEE '79, Ph.D. '96

Jennifer Hastings Steele / S
BSEE '96

1995

William Ashley Eanes / S
BSEE '95

Daniel J. Gillespie / S
BSCPE '95

David Kapp / F
MSEE '93, Ph.D. '95

Joseph C. Liberti / F
BSEE '89, MSEE '91, Ph.D. '95

Cheryl Duty Martin / S
BSEE '95

Kai Xu / S
BSEE '95

1994

JoAnn Adams / S
BSEE '94

Kirsten Ann Rasmussen Brown / S
BSEE '94

Charles Bunting / S
MSEE '92, Ph.D. '94

Scott Cappiello / S
BSCPE '94

Zion Lo / S
BSEE '94

Michael Newkirk / F
BSEE '88, MSEE '90, Ph.D. '94

Thomas Rose / S
BSEE '94

1993

John Todd Hutson / S
BSEE '93

John McHenry / F
BSEE '88, MSEE '90, Ph.D. '93

Graham David Stead / S
BSCPE '93

Scott Stern / S
BSEE '93

Wesley T. Wade / S
BSEE '93

1991

Phillip A. Danner / S
BSCPE '91

Bradley Duncan / F
Ph.D. '91

Dwayne Allen Hawbaker / F
BSEE '89, MSEE '91

Steven Schulz / F
MSEE '91

Anne Palmore Stublen / S
BSEE '91

David L. Tarnoff / F
BSEE '87, MSEE '91

Gregory A. Zvonar / S/F
BSEE '90, MSEE '91

1989

Steven Edward Bucca / F
BSEE '87, MSEE '89

Unspecified

Stephen P. Bachhuber / F
BSEE

Keith McKenzie

Nicole Ogden / F

Ian Roessle / F
Ph.D. CPE

Ph.D.'s Awarded

2023-2024

Tolga Atalay

Design of Secure Scalable Frameworks for Next Generation Cellular Networks

Committee Chair | Angelos Stavrou

Anders Buvarp

Robust Wireless Communications with Applications to Reconfigurable Intelligent Surfaces

Committee Chair | Lamine M. Mili

Yuliang Cao

Topology and Control Investigation of Soft-Switching DC-DC Converters for DC Transformer (DCX) Applications

Committee Chair | Dong Dong

Amrita Chakraborty

Impact of Thermal Effects and Other Material Properties on the Performance and Electro-Thermal Reliability of Resistive Random Access Memory Arrays

Committee Chair | Mariusz Kriysztof Orlowski

Michael Clavel

Tensile-Strained Ge/III-V Heterostructures for Low-Power Nanoelectronic Devices

Committee Chair | Mantu K. Hudait

Shane Coyle

Conductivity Modulation of Magnetosphere-Ionosphere Coupling

Committee Chair | Joseph Benjamin Baker
Co-Chair | C. Robert Clauer

Alireza Famili

Precise Geolocation for Drones, Metaverse Users, and Beyond: Exploring Ranging Techniques Spanning 40 KHz to 400 GHz

Committee Chair | Haining Wang
Co-Chair | Angelos Stavrou

Aditya Garg

Advancing Nanoplasmonics-Enabled Regenerative Spatiotemporal Pathogen Monitoring at the Bio-Interface

Committee Chair | Wei Zhou
Co-Chair | Peter J. Vikesland

Andre Vinicius Gomes Santos Goncalves

Wireless Network Dimensioning and Provisioning for Ultra-Reliable Communication: Modeling and Analysis

Committee Chair | Luiz Antonio Pereira da Silva
Co-Chair | Jacek Kibilda

Yunfei Guo

Vision-Based Force Planning and Voice-Based Human Machine Interface of an Assistive Robotic Exoskeleton Glove for Brachial Plexus Injuries

Committee Chair | Pinhas Ben-Tzvi

William Howard

Distributed Online Learning in Cognitive Radar Networks

Committee Chair | Richard M. Buehrer

Mohannad Ismail

Effective and Practical Defenses Against Memory Corruption and Transient Execution Attacks with Hardware Security Features

Committee Chair | Chang Woo Min
Co-Chair | Wenjie Xiong

Akshay Jain

Integrated Optimal Dispatch, Restoration and Control for Microgrids

Committee Chair | Chen-Ching Liu

Feng Jin

PCB-Based High-Power DC-DC Converters with Integrated Magnetics for Battery Charger

Committee Chair | Qiang Li

Jongwoon Kim

Multifunctional Polymer Fiber Probes for Biomedical Application

Committee Chair | Xiaoting Jia

Qian Li

Designing Power Converter-Based Energy Management Systems with a Hierarchical Optimization Method

Committee Chair | Dushan Boroyevich

Zheqing Li

High-Frequency Power Conversion for Medium Voltage Power Electronics Interfaces

Committee Chair | Qiang Li

Qing Lin

DQ-Frame Small-Signal Stability Analysis of AC Systems with Single-Phase and Three-Phase Converters

Committee Chair | Rolando Burgos

Guannan Liu

Investigating Security Threats of Resource Mismanagement in Networked Systems

Committee Chair | Haining Wang

Jian Liu

Hybrid Modular Multilevel Converter Family and Modular DC Circuit Breaker for Medium-Voltage DC (MVDC) Applications

Committee Chair | Dong Dong

Shiya Liu

Energy-Efficient Neuromorphic Computing for Resource-Constrained Internet of Things Devices

Committee Chair | Yang Yi

Xin Lou

Single-Stage 48 V/1 V Voltage Regulator for High-Performance Microprocessors

Committee Chair | Qiang Li

Yingzhou Lu

Machine Learning Enabled Bioinformatics Tools for Analysis of Biologically Diverse Samples

Committee Chair | Yue J. Wang

Yunwei Ma

Junction Based Gallium Nitride Power Devices

Committee Chair | Yuhao Zhang

Md Jubayer Al Mahmod

The Art of SRAM Security: Tactics for Remanence-Based Attack and Strategies for Defense

Committee Chair | Matthew Hicks

Xuelong Mi

Brain Signal Quantification and Functional Unit Analysis in Fluorescent Imaging Data by Unsupervised Learning

Committee Chair | Guoqiang Yu

Ardavan Mohammadhassani

Protection and Cybersecurity in Inverter-Based Microgrids

Committee Chair | Ali Mehrizi-Sani

Christopher Morency

Collision Avoidance Using a Low-Cost Forward-Looking Sonar for Small AUVs

Committee Chair | Daniel J. Stilwell

Taiwo Oyedare

A Comprehensive Analysis of Deep Learning for Interference Suppression, Sample and Model Complexity in Wireless Systems

Committee Chair | Jeffrey H. Reed
Co-Chair | Daniel Jakubisin

Gagandeep Panwar

Utilization-Adaptive Memory Architectures

Committee Chair | Ali Butt
Co-Chair | Xun Jian

Chensen Qi

Optimization of Distribution Systems: Transactive Energy and Resilience Enhancement

Committee Chair | Chen-Ching Liu

Lakshmi Ravi

Insulation-Constrained Design of Power Electronics Converters and DC Circuit Breakersn

Committee Chair | Rolando Burgos
Co-Chair | Dong Dong

Nitasha Sahani

AI-Based Defense Against Cyberattacks in Cyber-Physical Distribution Systems

Committee Chair | Chen-Ching Liu

Ashrarul Haq Sifat

A Safety-Performance Framework for Computational Awareness in Autonomous Robots

Committee Chair | Ryan K. Williams

Boyan Wang

Design, Fabrication, Characterization, and Packaging of Gallium Oxide Power Diodes

Committee Chair | Yuhao Zhang

Lauren Wong

Foundations of Radio Frequency Transfer Learning

Committee Chair | Alan J Michaels
Co-Chair | Jia-Bin Huang

Somayeh Yarahmadi

Electromechanical Wave Propagation Analysis

Committee Chair | Lamine M. Mili

Ruizhe Zhang

Robustness of Gallium Nitride Power Devices

Committee Chair | Yuhao Zhang

Yujing Zhang

Multifunctional Multimaterial Fibers for Sensing and Modulation in Wearable and Biomedical Applications

Committee Chair | Xiaoting Jia

Zichen Zhang

Field-Grading in Medium-Voltage Power Modules Using a Nonlinear Resistive Polymer Nanocomposite Coating

Committee Chair | Guo Quan Lu

Xingchen Zhao

Power Density Optimization of SiC-Based DC-AC Converter for High-Speed Electric Machine in More/All-Electric Aircraft

Committee Chair | Dong Dong

Ruoxi Zhu

Intrusion Detection and Recovery of a Cyber-Power System

Committee Chair | Chen-Ching Liu

Community Connections

WITH A COMMUNITY OF 10,000 ALUMNI STRONG, AND NUMEROUS EVENTS THROUGHOUT THE YEAR, THERE'S ALWAYS AN OPPORTUNITY TO CONNECT WITH YOUR FELLOW ALUMS AND OUR DEPARTMENT!

2024 Academy of Distinguished Alumni

Whether in research and development, leadership, or service, ECE alumni are changing the world. To recognize their contributions, ECE has inducted several of our alumni into the department's Academy of Distinguished Alumni.

The department has four award categories to recognize different forms of alumni excellence in each class of academy inductees:

- The Career Achievement Award in recognition of significant contributions to the field over the course of a career.
- The Extraordinary Impact Award in recognition of extraordinary accomplishments that improve people's lives.
- The Exemplary Giving Award for outstanding philanthropic service to ECE.
- The Meritorious Service Awards for outstanding volunteer service to ECE.

CAREER ACHIEVEMENT

Letutia (Tish) A. Long, BSEE 1982

Tish is the Chairman of the Board of the Intelligence and National Security Alliance, and currently sits on the boards of T-Mobile, Parsons, COPT and Noblis. She served as the fifth Director of the National Geospatial-Intelligence Agency (NGA), and was the first woman to lead a major US intelligence agency. She previously served as the Deputy Director of the Defense Intelligence Agency and the Deputy Director of Naval Intelligence. Tish earned a Bachelor of Science in Electrical Engineering from Virginia Tech, a Master of Science in Engineering from The Catholic University of America, and she was awarded an honorary Doctorate of Strategic Intelligence by the National Intelligence University.

MERITORIOUS SERVICE

Rene J. (RJ) Balanga, BSEE 1996

RJ serves as the Deputy Director at the Spectrum Policy and Planning Division at NASA Headquarters. He joined NASA in November 2015, and also leads various NASA strategic initiatives focused on spectrum professional education, engagement, and outreach initiatives. His professional experience includes over 28 years of spectrum management knowledge and policy analysis, with 23 years of federal government service. RJ holds his degree in Electrical Engineering from Virginia Tech and also served on our very own Advisory Board.

EXTRAORDINARY IMPACT

Laura J. Bottomley, BSEE 1984 & MSEE 1985

Laura is the Founding Director of Engineering Education and Senior Advisor to Women and Minority Engineering Program at NC State. She has worked at Texas Instruments and Bell Laboratories and has received the Presidential Award for Excellence in Mathematics, Science and Engineering Mentoring. She was named a fellow of the Institute of Electrical and Electronics Engineers and was elected to the YWCA Academy of Women. Laura received her bachelor's and master's degrees in electrical engineering from Virginia Tech. She received her Ph.D. in electrical engineering from NC State. She serves on the IEEE Education Society Board of Directors.

Left to right: Maja Lehnus, Laura Bottomley, RJ Balanga, and Carl Minton.

EXTRAORDINARY IMPACT

Maja M. Lehnus, BSEE 1984

Maja served 40 years with the Central Intelligence Agency, in numerous capacities. She currently serves on the board of managers of the National Technology and Engineering Solutions of Sandia; Lawrence Livermore National Laboratory's Global Security External Review Committee; the Armed Forces Communications and Electronic Association Intelligence Committee; and the Studies in Intelligence Editorial Board. She has her bachelor's in electrical engineering from Virginia Tech, and her master's in electrical engineering from Johns Hopkins University.

EXEMPLARY GIVING

Carl E. Minton, BSEE 1997

For generous contributions supporting the Electrical and Computer Engineering Department. Carl is a software engineer at Arion Systems. He volunteers in numerous capacities for the Virginia Science Olympiad, which puts on team-based STEM competitions for middle and high school students and is a member of the Community Foundation for Northern Virginia's Mental Health Community Investment Fund grant review committee. Carl has his bachelor's and his master's in electrical engineering from Virginia Tech, and a master's in statistical science from George Mason University.

EXEMPLARY GIVING

Doyle C. Counts, BSEE 1953

For generous contributions supporting the Electrical and Computer Engineering Department. Doyle is currently retired after spending 40 years as a design engineer with Hughes Aircraft Company in Los Angeles. He enjoys continuing to read technical books - the very books that got him excited about electrical engineering - attending train shows, exploring the United States and visiting museums. He received his bachelor's in electrical engineering from Virginia Tech in 1953.

Alumni Spotlights

Ray Hensberger '06

Hensberger considered multiple factors when choosing where he would go to college: proximity to his home in the Baltimore-Washington area; quality of the engineering program; and the physical location of the campus – was it in a city, or in a rural area? But there was one thing that made Virginia Tech his number one choice: the Hokie Spirit.

Ajay Jagtiani '88

Jagtiani always knew he'd head to law school after graduating with an electrical engineering degree from Virginia Tech. He just didn't think it would be in patent law.

"I originally planned for communications law," Jagtiani said. "I was going to be hanging out in Geneva, working on a standards committee in electrical engineering and crafting the law around standards for electrical devices."

Jeannette Mills '88

Mills, invested in electricity and community utilities since she was a little girl, received her B.S. in electrical engineering from Virginia Tech in 1988, and her MBA from Loyola University Maryland in 2006. After a quarter-century with Baltimore Gas & Electric (BGE), her hometown electrical company, Mills '88 traveled more than 500 miles to become the executive vice president and chief external relations officer at the Tennessee Valley Authority, where she manages relationships with 153 local power companies to distribute energy to 10 million people.

Zach Rattner '11

In 2005, a 15-year-old Rattner opened the recent issue of Time Magazine to read the cover article, "How Apple Does It," the sixth cover feature of the innovative tech giant.

"I had that image stuck in my head, this visual memory about wanting to be the guy who does the drawings," Rattner said. "I didn't care about being a rock star person holding it. I wanted to be the guy who draws it on graph paper."

Read their full profiles at: **bit.ly/ECEAlum24**

Getting Tech-y With It

During the fall and spring, we hold weekly our colloquium series is held once a week in the DC area for faculty, students, and guests. Speakers include academics, captains of the industry, technologists, venture capitalists, defense companies and even our very own ECE alumni. Each talk has a question-and-answer portion, so come prepared!

Scan to Watch Colloquium Talks
Or visit: bit.ly/ECETechTalks

INVENTOR. ENGINEER. HOKIE.

Since the turn of the millennium, Steven Bathiche ’97 has led the Microsoft Applied Sciences Research Group in creating new technology, like inventing the Surface series, or building new artificial intelligence (AI) tools for staple Windows software and the Office apps.

And it all began with a simple flier in Whittemore Hall.

As an electrical engineering student at Virginia Tech, Bathiche was happily studying robotics, psychology, and biology when, in 1994, he walked past a bulletin board advertisement for a scholarship funded by Microsoft. After chatting with mentors like Raymond Dessy, a Virginia Tech chemistry professor at the time, Bathiche applied and started the first of three internships for the technology company.

After adding one master’s degree in bioengineering from the University of Washington, Bathiche officially joined Microsoft in 1999 as a director of research. Over the next two and a half decades, Bathiche and his multi-disciplinary team worked together to create beneficial technologies, like the very first Surface device in 2007, which started out as a tabletop computer with cameras to track hand interaction.

We sat down with the 2022 Academy of Engineering Excellence inductee via a Microsoft Teams meeting (of course) to chat technology, teamwork, and Virginia Tech.

You’ve been at Microsoft for more than two decades. In that time, what have you learned from them about developing technology?

Microsoft taught me patience and persistence in regards to creating new things. Timing is oftentimes more important than the actual invention. It’s not good enough just to be smart and invent something new. There’s an art to building a solution and a product, and you have to put those components together. It’s great for me because I’ve always enjoyed the arts and the sciences. At Virginia Tech, I was able to pursue both; at the University of Washington, I was able to pursue both. In life, I try to pursue both. By having those two disciplines together, and seeing the impact of art on science and engineering, I’ve seen how an interdisciplinary approach can make the difference between a somewhat mediocre product versus an invention that is useful and impactful for many people.

Microsoft is proactive about responsibility when creating products or solutions. But when dealing with the rapid timeline of technology generation, does that hesitancy impact how you do your work?

One thing Microsoft is excited to do is to help businesses and people improve efficiency, by helping with those tasks that are hassles – we call them hassle maps. We make it much easier to get them accomplished, and also much more accurately.

As far as safety, we’re very cautious. We have a system in place for safety and responsibility in all sorts of areas to make sure our products achieve the right security status. We won’t release products that could cause harm. We even say internally that we are much more careful to ensure that what we put out is safe to use.

If something is not responsible and safe, it’s not just that it’s not responsible or safe, but people won’t use it, or people will be worried about it. Privacy, security, responsibility, and safety are the main gates before any of this technology really makes it out into the world, and it won’t if it doesn’t clear those gates.

Read the full interview at: **bit.ly/ECESteven**

Story by Niki Hazuda

ECE Faculty

A. Lynn Abbott
Professor
Illinois '90

William "Joe" Adams
Collegiate Associate Professor
US Army War College '08

Masoud Agah
Virginia Microelectronics Consortium (VMEC) Professor
Michigan '05

Paul K. Ampadu
Professor
Cornell '04

Nagender Aneja
Collegiate Associate Professor
J.C. Bose University of Science and Technology '19

Scott M. Bailey
Professor
Colorado '95

Joseph B. Baker
Professor
Michigan '01

Arthur Ball
Collegiate Assistant Professor
Virginia Tech '09

William T. Baumann
Associate Professor
Johns Hopkins '85

Almuatazbellah Boker
Collegiate Assistant Professor
Michigan State '13

Jordan Budhu
Assistant Professor
UCLA '18

R. Michael Buehrer
Professor
Virginia Tech '96

Rolando P. Burgos
Professor
Concepción '02

Virgilio A. Centeno
Professor
Virginia Tech '95

Thidapat (Tam) Chantem
Associate Professor
Notre Dame '11

Daniel Connors
Collegiate Associate Professor
Illinois Urbana-Champaign '88

Kristie L. Cooper
Collegiate Associate Professor
Virgina Tech '99

Luiz A. DaSilva
Bradley Professor of Cybersecurity & Executive Director of the Commonwealth Cyber Initiative
Kansas '98

Harpreet S. Dhillon
Professor & Elizabeth & James E. Turner Jr. '56 Faculty Fellow
UT Austin '13

Christina DiMarino
Assistant Professor
Virginia Tech '18

Dong Dong
Assistant Professor
Virginia Tech '12

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Collegiate Professor & Associate Department Head
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Associate Professor
Ohio State '00

Christiana Chamon Garcia
Assistant Professor
Texas A&M University '21

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Associate Professor
Iowa State '11

Kendall E. Giles
Collegiate Assistant Professor
Johns Hopkins '07

Dong S. Ha
Professor
Iowa '86

Sook Shin Ha
Collegiate Assistant Professor
Virginia Tech '12

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Bradley Distinguished Professor of ECE
NYU Tandon '98

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Professor
Illinois '97

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Indian Institute of Technology '99

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Assistant Professor
Berkley '18

Xiaoting Jia
Associate Professor
MIT '11

Ming Jin
Assistant Professor
Berkeley '17

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Virginia Tech '05

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James S. Tucker Professor
Tennessee '89

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Cornell '97

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Roanoke Electric Steel Professor Emeritus
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Collegiate Associate Professor
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Associate Professor
Washington '08

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Clayton Ayre Professor
Dalian '90

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Professor
Michigan '03

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Grant A. Dove Professor
Maryland '95

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Southern California '14

Christopher L. Wyatt
Associate Professor
Wake Forest School of Medicine '02

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Assistant Professor
Yale '20

Yong Xu
Professor
Caltech '01

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Professor
Maryland '97

Yaling Yang
Professor
Illinois '06

Yang (Cindy) Yi
Professor
Texas A&M '09

Haibo Zeng
Associate Professor
Berkeley '08

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Hugh P. and Ethel C. Kelly Professor
Virginia Tech '98

Wei Zhou
Associate Professor
Northwestern '12

Liyan Zhu
Assistant Professor
University of Tennessee, Knoxville '22

Yizheng Zhu
Associate Professor
Virginia Tech '07

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University Distinguished Research Professor

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Justin N. Carstens
Research Assistant Professor

Jyothi Chintalapalli
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Gregory D. Earle
Research Professor

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Sara Hashemi
Postdoctoral Associate

Yi-Hsun Hsieh
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Jun Ji
Postdoctoral Associate

Stephen Krauss
Research Associate

Avinash Kumar
Postdoctoral Associate

Bharat Simha Reddy Kunduri
Research Assistant Professor

Fred C. Lee
University Distinguished Research Professor

Chen-Ching Liu
Research Professor

Fariborz Lohrabi Pour
Postdoctoral Associate

Zinoy Manappadan
Postdoctoral Associate

Zinoy Manappadan
Postdoctoral Associate

Christopher Morency
Senior Research Associate

Swarn Priya
Postdoctoral Associate

Karim Said
Research Scientist

Rashed Shelim
Postdoctoral Associate

Xueling Shi
Research Scientist

Basavesh Ammanaghatta Shivakumar
Postdoctoral Associate

Ali Shokri
Postdoctoral Associate

Christo Thomas
Postdoctoral Associate

Brentha Thurairajah
Research Assistant Professor

Nishith Tripathi
Research Associate Professor

Yizhi Wang
Postdoctoral Associate

Charles Watson
Research Associate

Zhonghua Xu
Research Assistant Professor

Ruotong Yu
Postdoctoral Associate

Meet Our New Faculty

CHRISTIANA GARCIA | ASSISTANT PROFESSOR

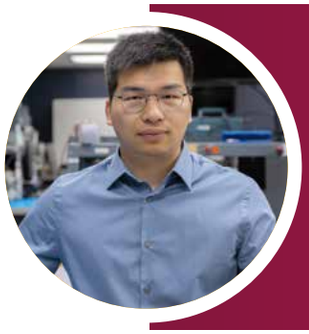
Ph.D. Electrical Engineering, Texas A&M University | M.S. Electrical Engineering, Texas A&M University
B.S. Electrical Engineering, University of Houston

Research Interests

Cyber-physical systems, noise-based security, decentralized identity, security in artificial intelligence, engineering education, human-computer interaction, accessibility in engineering and kinesiology, exercise science.

What impact do you hope to have here at Virginia Tech?

I hope to revolutionize my area of research. I want people to look at me and think, "she changed the way the world looks at physical security" and students to think "that was my professor; I learned XYZ from her" and "she is the one who got me interested in cybersecurity." I also like to think that people will see me as "the one who took a chance on me," like my PhD advisor did for me.



LIYAN ZHU | ASSISTANT PROFESSOR

Ph.D. Electrical Engineering, University of Tennessee-Knoxville | M.S. Electrical Engineering, University of Tennessee-Knoxville

Research Interests

My research focuses on power electronics for renewable energy, space applications, and transportation electrification.

What inspires you about engineering?

Engineering is about creating what doesn't yet exist. As a child, I built my own toys; now, I have the chance to create meaningful innovations that benefit society. Equally important, I can help create clear pathways for the next generation of engineers, ensuring they have the tools and opportunities to make their own mark on the world.

NAGENDER ANEJA | COLLEGIATE ASSOCIATE PROFESSOR

Ph.D. Computer Engineering, J.C. Bose University of Science and Technology, YMCA | M.E. Computer Technology and Applications, Delhi College of Engineering

Research Interests

Applied machine learning, particularly in medical imaging and cybersecurity. I aim to develop models that use LLMs for clinical decision support and medical question answering, and bridge the gap between technology and medicine by creating an intelligent system that can be used by clinicians and patients easily as a web application.

Why Virginia Tech?

Of course, Virginia Tech is one of the top-ranked universities with outstanding people and infrastructure. My primary reason for joining Virginia Tech is its commitment to research, including teaching. I felt the importance of both research and teaching during my initial interactions before joining. Further, the motto, Ut Prosim (That I May Serve), says everything about the potential opportunities available at VT.

MARK LIMES | ASSOCIATE PROFESSOR

Ph.D. Physics, University of Utah | M.S. Physics, University of Utah | B.S. Mathematics, Bowling Green State University

Research Interests

I am a quantum sensing expert specializing in sensitive alkali and hyperpolarized noble-gas measurements for DC-GHz magnetometry and inertial sensing. I'm building up a quantum sensing laboratory and portable sensing capabilities at the Virginia Tech National Security Institute (VTNSI). Initial research interests include methodology studies of accuracy and stability in alkali sensors, that will be transferred to small, robust, portable sensor packages for end-user deployment.

What inspires you about engineering?

I think that engineering done well is the act of building something that has useful applications. As an experimental physicist, I have, in the past, taken on science for the sake of science, but I think it is important to step back and ask, 'how can people use this?' In my opinion, this is the domain of engineering: trying to solve technical problems (design, building, testing), to provide something of value to other people. What inspires me then, is to use my expertise in atomic physics to provide unique solutions to real-world problems or capability gaps that people in the medical and military communities may have.

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MITRE

Dave Bostedo
Space Products Engineering Director
BAE Systems

Anil Chinthakindi
Director, FE Automotive Quality
Micron

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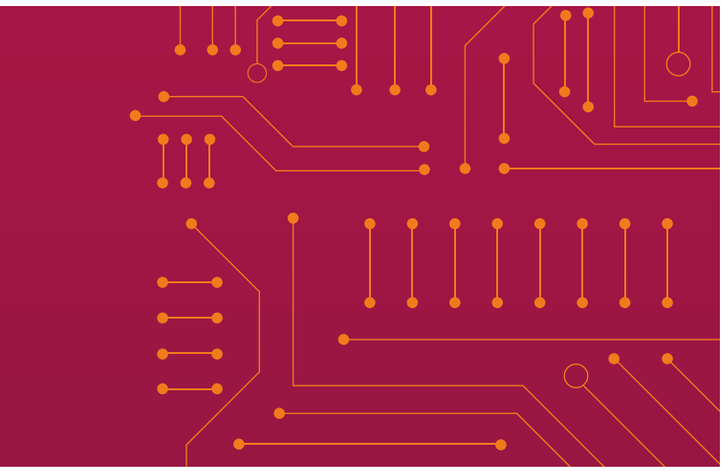

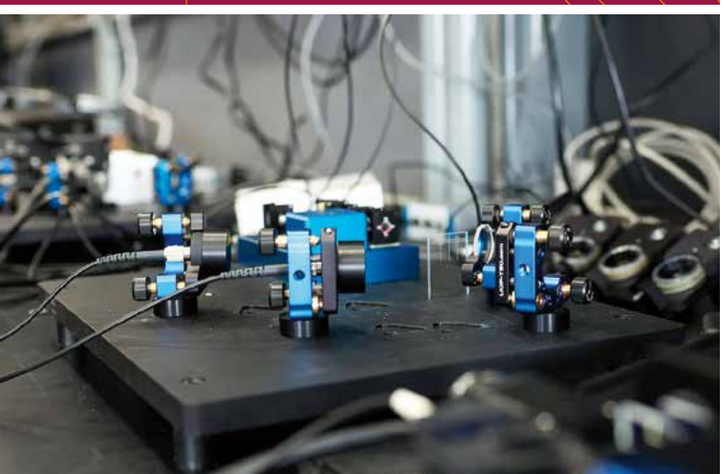


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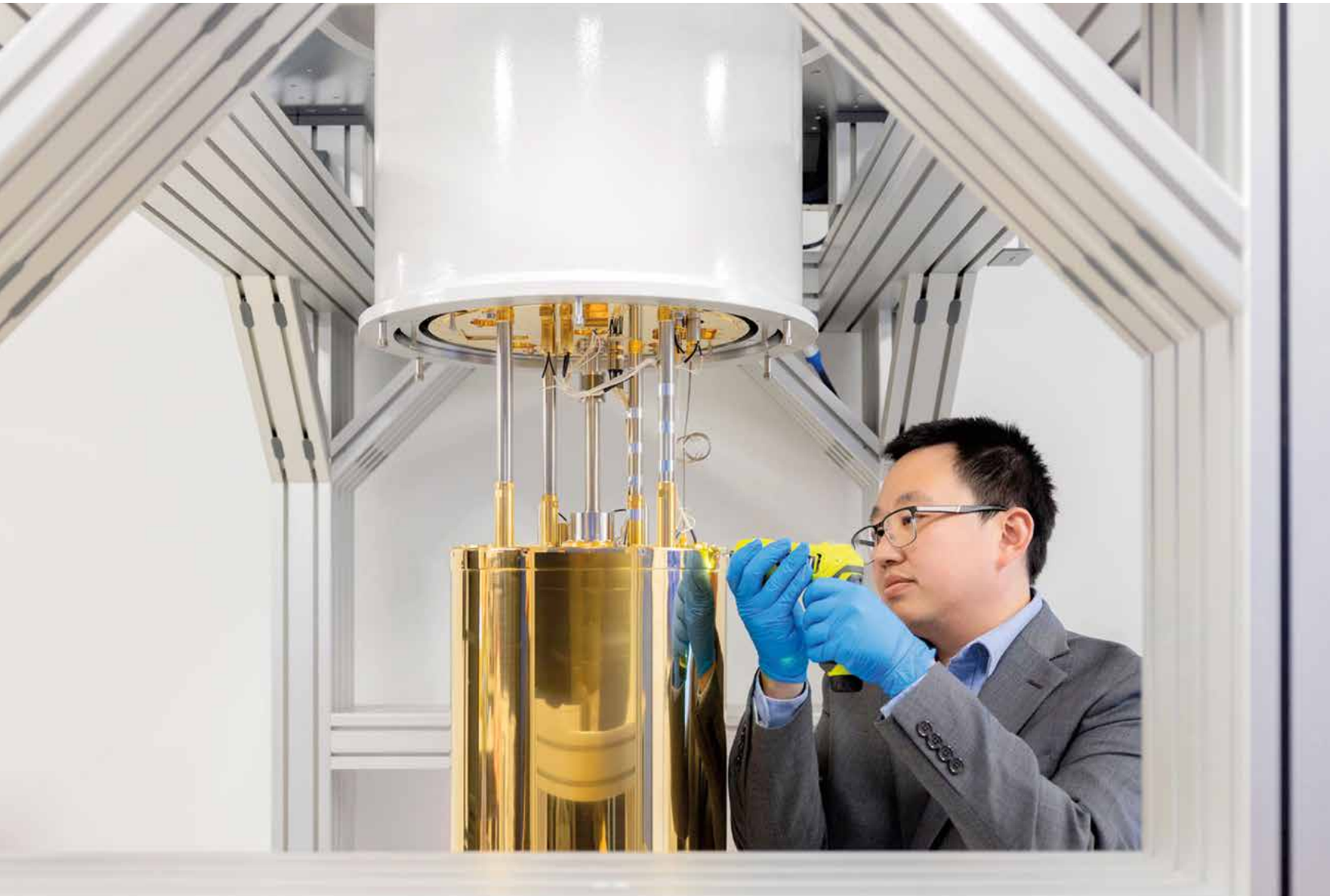

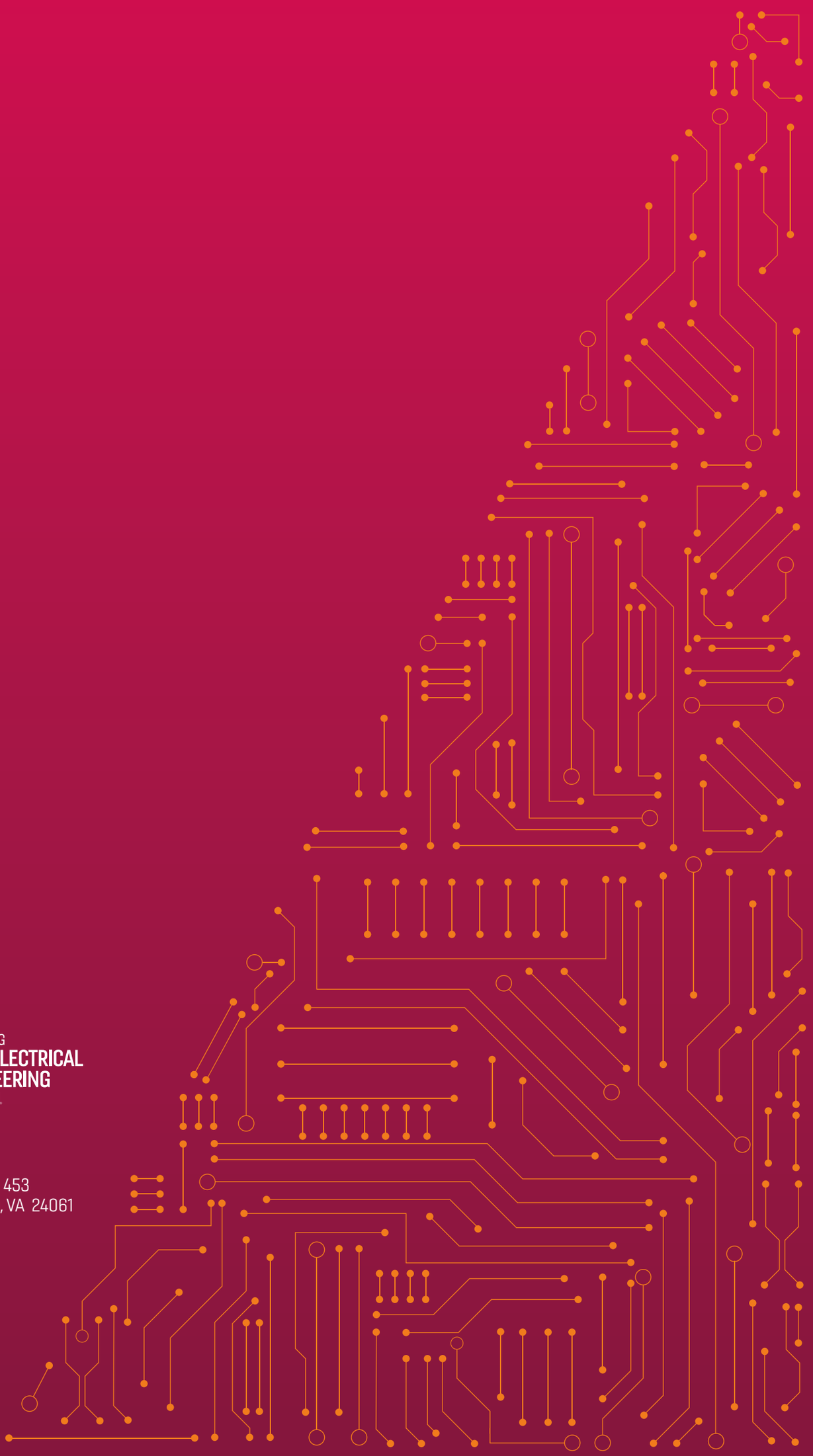

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