NC STATE Engineering

MAGAZINE FALL / WINTER 2022

UP IN THE AIR

NC State will help enable the future of drones

COLLEGE PREPARES TO MARK 100th ANNIVERSARY IN 2023

When the North Carolina College of Agriculture and Mechanic Arts opened its doors in fall 1889, the first student enrolled majored in mechanic arts. Also known as engineering.

In 1893, when the first graduating class completed their studies, 14 of the 19 new alumni received that same degree.

Engineering has always been at the heart of what is now known as North Carolina State University, one of a network of land-grant schools stretching from sea to shining sea that was created by the Morrill Acts of 1862 and 1890 "to teach such branches of learning as are related to agriculture and the mechanic arts." But it took another 30 years after that initial graduating class for NC State to establish a School of Engineering.

Today's College of Engineering will mark its 100th anniversary on May 28, 2023. The College is planning a yearlong celebration of NC State Engineering's century of achievements in 2023.

"The 100th anniversary will be an opportunity to all members of our community — students, faculty, staff, alumni and friends — to feel a sense of pride in what we have accomplished and our aspirations for the future," said **Griffin Lamb**, the College's assistant dean for development and college relations and executive director of the NC State Engineering Foundation. "You will see us celebrate our community in Day of Giving and other College-wide events throughout 2023, including a unique event in the spring."

Wallace C. Riddick was the School of Engineering's first dean. He joined the faculty in 1892 as a professor of mechanics and applied mathematics. When he became the first dean of the School of Engineering in 1923, he had already served as president of the entire college and as the football coach. He served as dean until his retirement in 1937.

The school consisted of the electrical engineering, civil engineering, physics, textile engineering and mechanical engineering departments. The departments that would eventually become materials science and engineering were established in 1924. Industrial engineering followed in 1930 and aeronautical engineering in 1940. In 1950, NC State established the nation's first nuclear engineering program and three years later, the world's first nuclear reactor at an academic institution went into operation on campus.

Today, the College has more than 11,000 students and is recognized as one of the preeminent public colleges of engineering in the United States. With funding through the North Carolina General Assembly's Engineering North Carolina's Future initiative, the College is embarking on a major expansion over the next few years that will add 4,000 students and 130 new faculty members.

We'll look forward to seeing what the coming generations of Wolfpack engineers and computer scientists will achieve over the next century.

Check our website, **engr.ncsu.edu**, for details on how the College will mark this important milestone in 2023. ■

MacDonald Gibson named head of Department of Civil, Construction, and Environmental Engineering

Jackie MacDonald Gibson started as the new head of the Department of Civil, Construction, and Environmental Engineering (CCEE) at NC State on Aug. 15, 2022.

MacDonald Gibson is a former professor and chair of the Department of Environmental and Occupational Health at Indiana University, Bloomington. She succeeds **Morton Barlaz**, Distinguished University Professor, who led CCEE for 12 years.

MacDonald Gibson served for 12 years on the faculty of the Department of Environmental Sciences and Engineering in the Gillings School of Public Health at the University of North Carolina at Chapel Hill. Her professional experience includes eight years in engineer and senior engineer positions with RAND Corporation in Washington, D.C., and Pittsburgh, Pennsylvania, and nine years in various research and management positions with the Water Science and Technology Board of the National Research Council in Washington, D.C.

Her research is conducted at the intersection of infrastructure, human health and the environment and has been funded by the National Science Foundation, Environmental Protection Agency, Department of Defense, the Department of Housing and Urban Development, NC Department of Transportation, the Robert Wood Johnson Foundation and various other funding organizations.

MacDonald Gibson received her B.S. in mathematics from Bryn Mawr College, her M.S. in environmental science in civil engineering from the University of Illinois at Urbana-Champaign, and a dual Ph.D. degree in civil and environmental engineering and engineering and public policy from Carnegie Mellon University. ■

The beginning of each academic year always feels like a fresh start and brings with it a great deal of excitement. This year, we have welcomed our largest class of new engineering and computer science students ever and have enjoyed a number of fall gatherings, including football games and Red & White Week. This new semester seems to have a bit of extra buzz because, after two consecutive years of starting an academic year with some level of disruption as the University tried to work its way cautiously through COVID-19, the normalcy on campus makes it feel as if we are truly back to a pre-pandemic world.

This will also be my final fall semester as dean of the College of Engineering. In August, Provost Warwick Arden shared with our University community the news that I have decided to step down from my position at the end of the 2022-23 academic year to return to the faculty.

While there are a number of personal reasons that have motivated this decision, the reality is that I never would have imagined when I arrived in 2006 that I would still be serving in this role 16 years later. It has indeed been the honor and privilege of a lifetime to have been able to serve and lead the College of Engineering at NC State for such an extended period of time.

I am proud to say that, thanks to the work of our faculty, staff, students and alumni, our College has never been stronger. The College has made significant advancements in its national reputation and its research enterprise. We have now moved eight of our nine departments to Centennial Campus, affording us the kind of top-flight facilities and collaborative environment that would be the envy of any of our peer institutions.

All that has been done while we have simultaneously made progress on recruiting more faculty members and students from groups that have been historically underrepresented in STEM fields and have worked diligently to make this an academic environment that is open and welcoming to all.

This work sets the College up perfectly for our next step — a significant growth phase spurred by investments by the North Carolina General Assembly in response to growing demand for an even larger STEM workforce to support the state's booming economy. The Engineering North Carolina's Future initiative will allow us to add **4,000 students** and **130 new faculty members** in the coming years and will make a significant and needed investment in our facilities.

I think that you will see my optimism about the College's future come to life in the pages of this magazine and hope that you will enjoy learning more about our research efforts in cancer treatment and unmanned aerial vehicles, our new Engineering Education program and the wide-ranging achievements of our alumni.

Thank you for the steadfast support that you have shown me since I arrived in Raleigh. I'm looking forward to a great academic year and to seeing what the future holds for this outstanding College and hope that I will be able to interact with many of you in the coming months.

Louis A. Martin-Vega, Ph.D., NAE
Dean

NC STATE
Engineering

MAGAZINE
VOL. XIVII, ISSUE II

OFFICE OF THE DEAN
College of Engineering
Campus Box 7901, NC State University
Raleigh, NC 27695-7901
919.515.2311
www.engr.ncsu.edu

NC STATE ENGINEERING FOUNDATION, INC.
919.515.7458
www.engr.ncsu.edu/alumni-and-giving/ncsef

UPDATE YOUR RECORD
Send address corrections to
alumnianddonor_records@ncsu.edu
or call **919.515.7458**, toll free **866.316.4057**.

NC STATE ENGINEERING ALUMNI MAGAZINE
is produced by the NC State Engineering Foundation, Inc. and Engineering Communications. No state funds are used. 70,000 copies of this document were printed at a cost of $61,250 on partially recycled paper.

FEATURES

ON THE COVER

In the near future, drones will fly around Centennial Campus as researchers study fifth-generation wireless communication. More on **page 16**.

Q&A

QUESTIONS FOR **PHIL MINTZ**

Phil Mintz is the executive director of NC State University Industry Expansion Solutions (IES) and director of the North Carolina Manufacturing Extension Partnership. He has a B.S. in engineering operations from NC State and an M.S. in industrial engineering from North Carolina Agricultural and Technical State University.

Please tell us a little bit about Industry Expansion Solutions (IES).

IES was established by the state legislature in 1955 as the industrial extension service of the College of Engineering. IES has an outreach team of regional managers and specialized product delivery specialists who serve in all regions of North Carolina. Our team helps small and mid-size manufacturers, educational and research institutions, health care facilities, defense contractors, the energy industry and the public sector apply innovative technologies to improve product design, enhance operational processes, facilitate industry-specific management systems and increase health, safety and environmental knowledge.

What happens when a company partners with IES?

Through the IES network of regional managers, we visit production and service facilities and engage with leaders to capture information about their challenges and needs. Our team provides an independent assessment of company needs and works with business leaders on a plan to address any discoveries and come up with recommendations for improvement. The company can then move forward on its own, or IES can assist by helping develop a technical service or providing a customized fee-based training or project opportunity. Because we are a state agency and also have some federal support, we are able to establish a staff of highly qualified and experienced experts and through them provide a substantial amount of no-cost effort.

How has IES evolved over the years?

IES is now much more involved in ensuring public awareness of the contribution the manufacturing industry makes to North Carolina's well-being. IES administers a recurring federal award, the North Carolina Manufacturing Extension Partnership, which organizes multiple state agencies and nonprofits to ensure all manufacturers regardless of size have access to programs and services for opportunities for continued growth. The unit has also evolved to support non-manufacturing industries such as healthcare.

How is IES responding to North Carolina's economic and population growth?

Manufacturing continues to have special growth needs, and we are working on programs that provide some help through implementing Industry 4.0-related solutions such as automation and robotics, additive manufacturing and sensor technology to help companies optimize operations. We are also sensitive to the balancing of urban- and rural-based business needs. We monitor this effort closely and are always excited to see successful projects in the rural parts of the state.

What is a recent success story?

Every now and then, IES connects with a new company that is so prepared for growth that we can hardly keep up with their desire to apply what we share. We met Geoff Foster, the owner of Core Technology Molding Corporation in Greensboro, NC, shortly before the pandemic, and began supporting the company with a comprehensive assessment. We completed a training and coaching plan with leadership that resulted in their achievement of multiple industry-specific quality management certifications, which helped the company see sustained rapid growth even through the pandemic. Core Technology Molding is now a global supplier of plastic injection molded products and provides critical parts to a highly diversified group of customers including automotive, aerospace and medical devices. ■

STEPS Center takes on phosphorus sustainability

IN THE FIRST YEAR SINCE the Science and Technologies for Phosphorus Sustainability (STEPS) Center launched, 20 research projects are in progress — all working toward the goal of reducing dependence on phosphorus mining and the amount of phosphates lost to water and soil.

A National Science Foundation (NSF) Science and Technology Center (STC), STEPS is funded by a $25 million, five-year cooperative agreement that is renewable for an additional five years. Researchers at NC State and other institutions in the physical, social, life and economic sciences are working across the center's four themes: materials scale, human-technology scale, regional and global scale, and convergence science education and convergence informatics.

As of April, STEPS has a new headquarters in the recently opened Plant Sciences Building (PSB) on Centennial Campus. PSB provides space for social and networking activities, including presentations, as well as offices and labs.

"STEPS is a highly interdisciplinary center located in a building that is designed to integrate highly interdisciplinary research," said Jacob Jones, Kobe Steel Distinguished Professor of Materials Science and Engineering and director of STEPS. "Our approach to solving problems through interdisciplinary work is synergistic and therefore being in the PSB is a great opportunity for STEPS."

BUILDING UP RESEARCH FROM THE ATOMIC SCALE

Elizabeth Trubchaninov, a Ph.D. student in the Department of Materials Science and Engineering (MSE) and president of the STEPS Student Leadership Council, is using different analytical systems, such as energy dispersive X-ray spectroscopy and X-ray photoelectron spectroscopy, to identify the presence of phosphorus in soil, water and wastewater samples to pinpoint at the atomic level where phosphorus is captured.

Comparing model samples from the lab and samples from the field, her contributions in method development will provide future researchers with a more complete understanding of the different characteristics of the element by standardizing techniques of how much information can be rendered from a particular sample.

"I hope my work can translate over to methods that allow for phosphorus recapture or recycling," Trubchaninov said. "My work might take time, but if it's not through my direct work, I hope someone else who steps up can look at my work and relate it to their project so that they can help the phosphorus problem."

One important focus is capturing phosphorus that has run off into

bodies of water where it can stimulate the growth of algal blooms that can lead to the formation of dead zones. Darrell Harry, a Ph.D. student in MSE, is working on a project centered on phosphorus capture and recovery through the use of metal cation-containing materials.

Harry systematically immerses oxidized, powder forms of metal cation-containing materials like aluminum, iron(III) and lanthanum in phosphate solutions in different experimental conditions. Afterwards, he characterizes the liquid and solid materials using a spectrophotometer to measure how much phosphate is captured in these materials.

"We're trying to understand how this process of capture can help inform us on the potential effects materials like these can have in the long term so that we can develop safe, sustainable and high-performing capture materials, and how we can use that to inform our future research decisions," Harry said.

Harry will be expanding his research to study the release of phosphates from the metal cation-containing material while continuing to analyze their capture potential.

A GLOBAL, INCLUSIVE APPROACH

Phosphorus is an essential element. Decreasing dependence on it is not easy, as global food systems rely on phosphorus fertilizers. STEPS has ambitious numbers to meet: reducing human dependency on mined phosphates by 25 percent and reducing the loss of phosphorus to water and soil sources by 25 percent within 25 years.

"If we continue to use it unsustainably with the world's growing population, we're going to continue to degrade our environment," Jones said. "It's in humanity's best interest to start controlling the problem and that involves engineering."

While some researchers are coming up with new technologies to capture and reuse phosphorus from the environment or to develop next-generation fertilizers, others are identifying how these will be scaled up locally, regionally and globally while accounting for socioeconomic and environmental factors. STEPS is using a convergence research informatics approach to provide data-driven guidance as researchers navigate their approaches and experiments around phosphorus sustainability.

It takes a diverse team to tackle this challenge, and not just in terms of different disciplines. Since the center's inception, Jones and his colleagues have made progress toward diversifying participation through strategic recruitment and the promotion of opportunities to individuals of traditionally underrepresented groups in engineering.

Within five years, the center's goal is for 50 percent of participants to be members of underrepresented minority or racial groups, in both research projects and in pre-college programs. After one year, 25 percent of STEPS participants are from underrepresented groups, 50 percent are women and 7 percent self-identify with a disability.

As an NSF STC, the center has participating institutions around the U.S., which is critical for conducting research relevant to different ecosystems with different concerns. For example, in south Florida, researchers are looking at the flow of phosphorus through the region's aquatic ecosystem while researchers in Arizona are studying the capture and recycling of phosphorus through urban systems.

NC State serves as the lead institution, and partners include Appalachian State University; Arizona State University; Clemson University; the Joint School of Nanoscience and Engineering between North Carolina Agricultural and Technical State University and the University of North Carolina at Greensboro; Marquette University; RTI International; the University of Florida; and University of Illinois at Urbana-Champaign. ■

> "If we continue to use it unsustainably ... we're going to continue to degrade our environment. It's in humanity's best interest to start controlling the problem and that involves engineering."
>
> **JACOB JONES**

College appoints assistant dean for diversity, equity and inclusion

"LET'S NOT TALK ABOUT IT, let's be about it," is one of Angelitha Daniel's favorite quotes.

The creation of an assistant dean for diversity, equity and inclusion position within the College of Engineering (COE) is an example of that kind of tangible movement toward change, Daniel said. She is the first person to hold the new position and began her work on Aug. 1, 2022.

As assistant dean, Daniel will provide leadership for College-wide efforts to better ensure a supportive, equitable and inclusive work, teaching and learning environment for the College's students, faculty members and staff members.

"It's important for people to feel that they belong in a space," she said. "They want to be comfortable and able to thrive."

Daniel received her B.S. degree in materials science and engineering from the University of Pittsburgh in 1998 and served as coordinator of minority recruitment in its Swanson School of Engineering for five years. She joined NC State in 2003 as the assistant director of Minority Engineering Programs (MEP) in the COE's Office of Academic Affairs. Daniel was promoted to interim MEP director in 2011 and then permanent director in 2013. In July 2020, she began work as a special advisor to the dean for diversity, equity and inclusion initiatives.

"For more than 19 years, Angie's efforts and leadership have been instrumental in the design and implementation of numerous programs and initiatives that have played a critical role in the recruitment, retention and success of our underrepresented minority (URM) students," said Louis Martin-Vega, dean of the College of Engineering.

Known nationally as a champion of student, faculty and staff equity and inclusion, her work includes presentations and publications at the American Society for Engineering Education, Women in Engineering Proactive Network, the National Academy of Engineering and other related forums.

This includes providing leadership of the COE Broadening Participation and Inclusion (BPI) Committee, the design and development of a COE Diversity Strategic Plan and various other related endeavors.

As a member of the COE Executive Committee, her work will be complementary to, and in collaboration with, ongoing DEI efforts and committees in the COE's departments and units. She will also be the College's principal interface with NC State's Office of Institutional Equity and Diversity and other University entities within the diversity, equity and inclusion space.

As Daniel steps into her new role, Javon Adams has been appointed as the interim director of the Women and Minority Engineering Programs. Adams holds bachelor's, master's and doctoral degrees in civil engineering from NC State and has worked previously for the College as coordinator of engineering transfer advising and diversity research. ■

Long-duration hypersonic research facility will be first in Southeast

A hypersonic tunnel being built by Department of Mechanical and Aerospace Engineering (MAE) students will help develop the next generation of high-speed vehicles that will lead to fundamental changes in travel and transportation.

Venkateswaran Narayanaswamy, associate professor in MAE, is leading the design and construction of the tunnel, which will be capable of speeds up to Mach 6 — six times the speed of sound — and can run for up to 10 seconds, simulating high-speed flight conditions long enough to see how materials and flight controls behave during realistic flight situations. It will be a collaborative facility for research, industry and K-12 outreach, and it is expected to be complete by early spring 2023.

High-speed platforms have immense and immediate potential in national security and revolutionizing the space economy. Since this facility will be the only one in the Southeast, Narayanaswamy is optimistic that it will draw students and increase North Carolina's footprint on the development of high-speed technologies.

Important applications include potential breakthroughs in aerothermodynamics, such as using friction to optimize turn trajectories and decrease fuel consumption of aircraft, as well as improved materials, including those used to make bomb shelters and spacecraft.

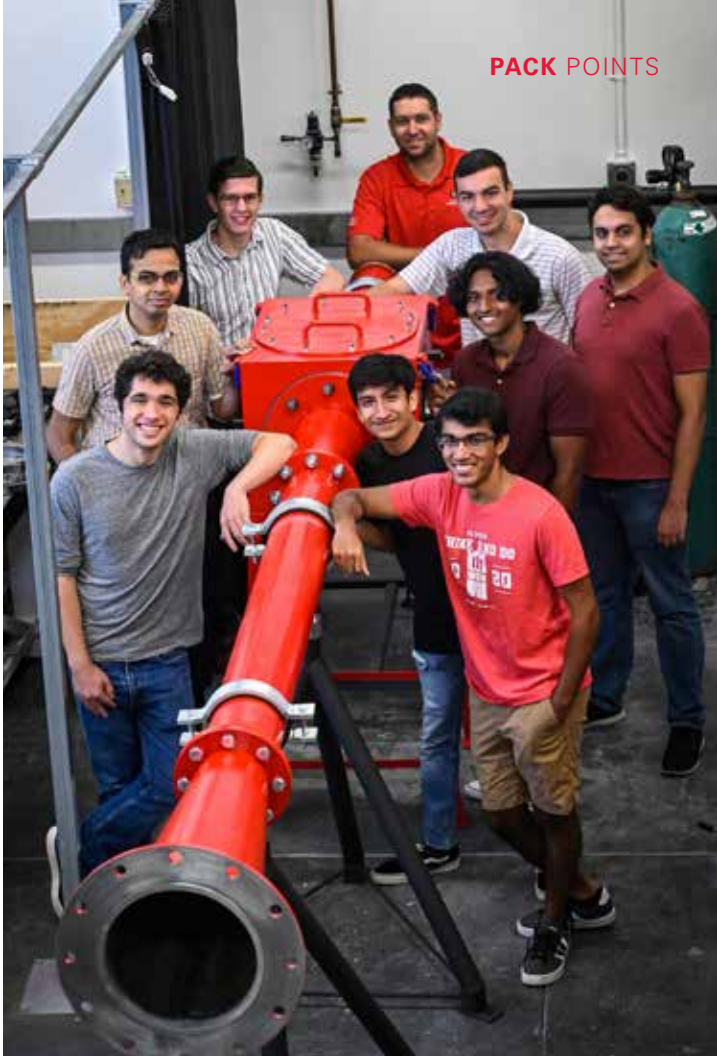
"(Our facility) will provide real conditions to see how the aerostructures and control surfaces behave while providing long enough duration to allow for the developments to happen," Narayanaswamy said. "The facility is also big enough that we can test articles that are of relevance for future technologies. So, we have this very unique intersection."

In the MAE West Annex, where the department's supersonic tunnel is housed on NC State's West Campus, students are gaining valuable experience by first building a subscale model to test for the right airflow at the right speed, explained Shaan Stephen, a senior aerospace engineering student.

Ethan Johnson, current master's student in aerospace engineering, worked on initial efforts to determine their operational needs for the facility, including compressible flows, high-temperature flows and wind tunnel design. "But perhaps one of the most unique and biggest takeaways has been designing for manufacturing," he said.

The students and Narayanaswamy work closely with on-campus facilities including the Center for Additive Manufacturing and Logistics and professionals in NC State's machine shops.

"I've learned that you need to find the people who are experts at that one specific thing and get all the information you need from them," said Jerod Schwandt, a graduate student in aerospace engineering.



FROM LEFT, LIAM STUMBAR, VENKATESWARAN NARAYANASWAMY, CHASE JENQUIN, JAMES WALZ, JW MASON, JEROD SCHWANDT, ASHWIN SIVAYOGAN, VICTOR IBARRA MENDOZA AND SHAAN STEPHEN WITH THE SUBSCALE MODEL OF THE HYPERSONIC TUNNEL.

NC State's hypersonics research dates back to the 1980s, explained Srinath Ekkad, MAE department head. Narayanaswamy and Jack Edwards, Angel Family Professor, have developed a team with renewed interest in the field. Narayanaswamy received a $775,000 grant from the Defense University Research Instrumentation Program in the Department of Defense in 2022, and his team has additional support from the College of Engineering.

"This capability will put us on the elite list of universities that work on hypersonics research," Ekkad said. ■

COE alumnus honored for supercomputing innovations

JIM FISCHER, electrical engineering '74, was a key player in several groundbreaking initiatives during his 40-year career at the NASA Goddard Space Flight Center, including managing the team that designed and built a revolutionary cluster computing prototype — the foundational architecture for most of the world's top 500 supercomputers and today's cloud computing.

Known as the Beowulf Computing Cluster, the project was inducted into the Space Technology Hall of Fame in April 2022, in Colorado Springs, Colorado. Fischer accepted the honor with Thomas Sterling, the "father of Beowulf" and professor at Indiana University.

The Beowulf cluster relies on commodity computer hardware, Ethernet and open source Linux software to minimize cost. Beowulf systems are the basis for supercomputers that process immense amounts of data and run models that lead to scientific breakthroughs across many fields.

"The usefulness of this system was so obvious that there was just a natural inclination to double it, and double it again, to see what you could do," Fischer said. "Whenever I hear about science advancement enabled by high-end computing, in biological sciences, geosciences, environmental sciences or mathematical and physical sciences, I see Beowulf as part of that work."

The 'tortoise'

From Concord, NC, Fischer first connected with NASA in 1971 for his co-op internship during his sophomore year at NC State. He joined NASA Goddard full-time in 1974 after graduation. He remains grateful to John Hamme, director of NC State's Cooperative Education Program, who placed him with NASA.

At NASA, Fischer thrived on taking difficult tasks and seeing them to completion. In his first 10 years as an electrical engineer at Goddard, he was one of the seven-person team that developed the Massively Parallel Processor (MPP). By 1983, he gave up his technical work and became the team manager because no one else wanted to lead.

"In the tortoise and the hare story, I'm the tortoise," he said. "I'm methodical, not competitive."

The MPP exceeded the capabilities of other supercomputers at the time and drew the attention of scientists across the U.S. In 1985, Fischer prepared the MPP for remote operational use by dozens of scientific teams who applied it to numerical simulations of complex physical and biological processes, generation of interactive visual displays, satellite image analysis and knowledge-based systems.

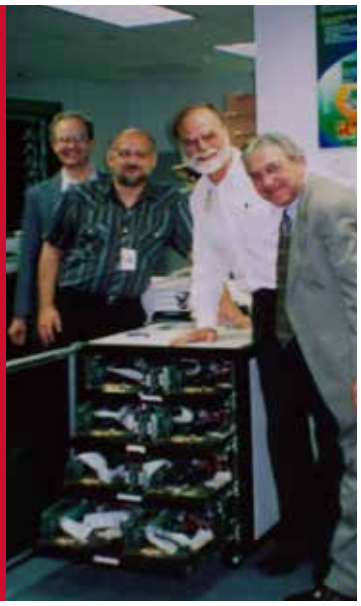
"The MPP went from being a curiosity to being seen as a solution," Fischer said. It is now on display under the wing of the Space Shuttle at the Steven F. Udvar-Hazy Center, part of the National Air and Space Museum.

The Beowulf revolution

Fischer's success with the MPP laid the groundwork for his leadership of the Beowulf project. By 1992, he was managing the Earth and Space Sciences (ESS) Project, which funded Grand Challenge Investigator Teams to adapt their important scientific applications — in Earth, space and planetary science as well as astrophysics — to run on high-end parallel computing testbeds.

The Goddard team he assembled included computer scientists,

> "Whenever I hear about science advancement enabled by high-end computing... I see Beowulf as part of that work."
>
> **JIM FISCHER**



FISCHER, LEFT, WITH THE FIRST BEOWULF AT NASA GODDARD SPACE FLIGHT CENTER IN 1994.

FISCHER, THIRD FROM RIGHT, AT THE 2022 SPACE TECHNOLOGY HALL OF FAME INDUCTION CEREMONY WITH T. E. ZELIBOR, REAR ADMIRAL, U.S. NAVY (RET.), CEO SPACE FOUNDATION; SID MAIR, PRESIDENT AND CEO, PENGUIN COMPUTING; PHILIP POKORNY, CTO, PENGUIN COMPUTING; STERLING; AND ROBERT D. CABANA, NASA ASSOCIATE ADMINISTRATOR.

modelers and Thomas Sterling as system evaluator. Fischer set a goal to develop a workstation that sustained one gigaflop at a cost of $50,000 to complement the large parallel computers they were using — and Sterling came up with a novel solution, which became Beowulf.

"When Thomas brought the idea to me in 1993, I could see immediately that each system would have the lowest possible cost because all the hardware was commodity, and the software was open source Linux," Fischer said. "The low cost would allow multiple systems, then impossible. Having lots of similar systems would enable many software developers."

Over the next four years, Fischer removed obstacles and brought visibility to the work. The Goddard team augmented Linux to support parallel execution, tested it with existing applications, and then told the world how to build a Beowulf. Soon ESS Investigator Teams were building their own Beowulf clusters and using them for scientific research.

Within just a few years, Beowulf became widely adopted and dramatically reduced the cost of high-end computing.

A lasting impact

Between 1992 and 2005, Fischer's ESS Project team funded, guided and supported several dozen Grand Challenge Investigator Teams to migrate their applications to high-end parallel computers. One that has had a lasting impact is the Earth System Modeling Framework (ESMF).

ESMF is an integrated model framework coupling previously incompatible atmospheric, ocean, land surface and sea ice components on a global scale. In 1999, at least seven government agencies and academic institutions had 10 different modeling systems with components that couldn't be interchanged. To remedy that, the National Center for Atmospheric Research (NCAR) collaborated with the Massachusetts Institute of Technology and NASA Goddard to develop ESMF.

Today, most of the climate and weather modeling systems in the U.S. use ESMF, including NASA's Goddard Earth Observing System models, NCAR's Community Earth System Model, NOAA's Unified Forecast System and Navy models, to name a few. ESMF continues to evolve in response to the changing computational environment and new model requirements.

During Fischer's career, NASA's operational supercomputing capacity has increased more than eight orders of magnitude, most recently with evolved Beowulf systems.

"Computation has become the third pillar of science, a new method of discovery," Fischer said. "The best discoveries are yet to come." ■

ISE alumna returns to women's basketball program

ALUMNA Ashley Williams left the NC State women's basketball program on a high note. Her senior year, the team made it to the second round of the NCAA tournament for the first time in 10 years. She returns as an assistant coach to a team that has won three consecutive Atlantic Coast Conference tournament championships.

Williams graduated from the Edward P. Fitts Department of Industrial and Systems Engineering (ISE) in 2017, following a family tradition of attending NC State.

"I never really looked at anywhere else seriously," she said. "I knew if I was given an opportunity to do both here, play basketball and come to school, that was going to win out."

While an engineering course load and the responsibilities of being a Division I athlete are both heavy, she found that they complement one another in that they both encourage creative thinking and problem solving.

"That was something that was cool about ISE, you had to take classes in disciplines that weren't your own," she said.

After four years, she left with close bonds with her teammates and the coaching staff.

"Senior day will always be something that sticks with me," Williams said. "I went through senior day with three other teammates of mine who I went through all four years with, which was really special. I got to live with them, and they're all still close teammates and friends of mine to this day.

"That day was great. We played North Carolina at home, beat them pretty good in (William Neal Reynolds Coliseum), and that was a lot of fun."

During her junior year, she realized she was interested in coaching, so she pursued a master's degree in athletic administration from Indiana University, during which she was a graduate manager for two years before starting her coaching career, first as an assistant coach at Furman University, and then back at Indiana University.

While there, the team made progress on the national level, reaching two regional semifinal rounds — the Sweet 16 — giving Williams experience that she brings to the Wolfpack.

Williams admires Teri Moren, the head coach of the Indiana University women's basketball team, and the staff. "One thing that they left me with is if you work really hard, and you also surround yourself with really good people and do right by those people, you'd be surprised where it can take you," she said.

Williams is now working for Wes Moore, who was in his first year as head coach of the team when she was a freshman.

"He's maybe mellowed a little bit," she said. "Just don't tell him I said that."

Upon her return to NC State, she went to work immediately with a team that is energized for the season.

"We're approaching our summer workouts like we're chasing the Final Four," she said. "They're hungry." ■

Here comes the solar-powered car

SINCE 2016, SOLARPACK has pushed the boundaries of what is possible for a sustainably powered car. Thanks to those years of work and innovative thinking, the team put together a record-breaking car for this year's Formula Sun Grand Prix (FSGP).

At FSGP, teams compete to see whose solar car can complete the most laps around the 2.5-mile track over three days of competition. There is also a spot on the podium for the team that completes the fastest lap of the day. This year, SolarPack took that spot with a 3-minute, 1-second lap.

Not only did the team complete the fastest lap in this year's competition, they broke the record for the entire history of the competition, which has been running since 2000 as part of the American Solar Challenge.

This year's success was built on their effort in the 2021 competition. That year, the team got to compete on the track in FSGP for the first time after passing days of safety and performance tests.

"This made the event a success and anything that happened after that point was icing on the cake," said alumnus Benjamin Nichols, the team's technical director. "Due to lasting issues that we had seen in scrutineering, we were only able to complete five laps that year, but as I said already, just being on the track was a success for us."

Running on the high of that performance, the team returned to the garage this year to continue improving their build.

They have a unique car. Rather than starting from scratch, they bought a 2001 Volkswagen Golf GTI that they have since extensively refurbished. One of the students' goals is not just to build a solar car that can go far or fast, but to also show how this is a viable option for the future of the automotive industry.

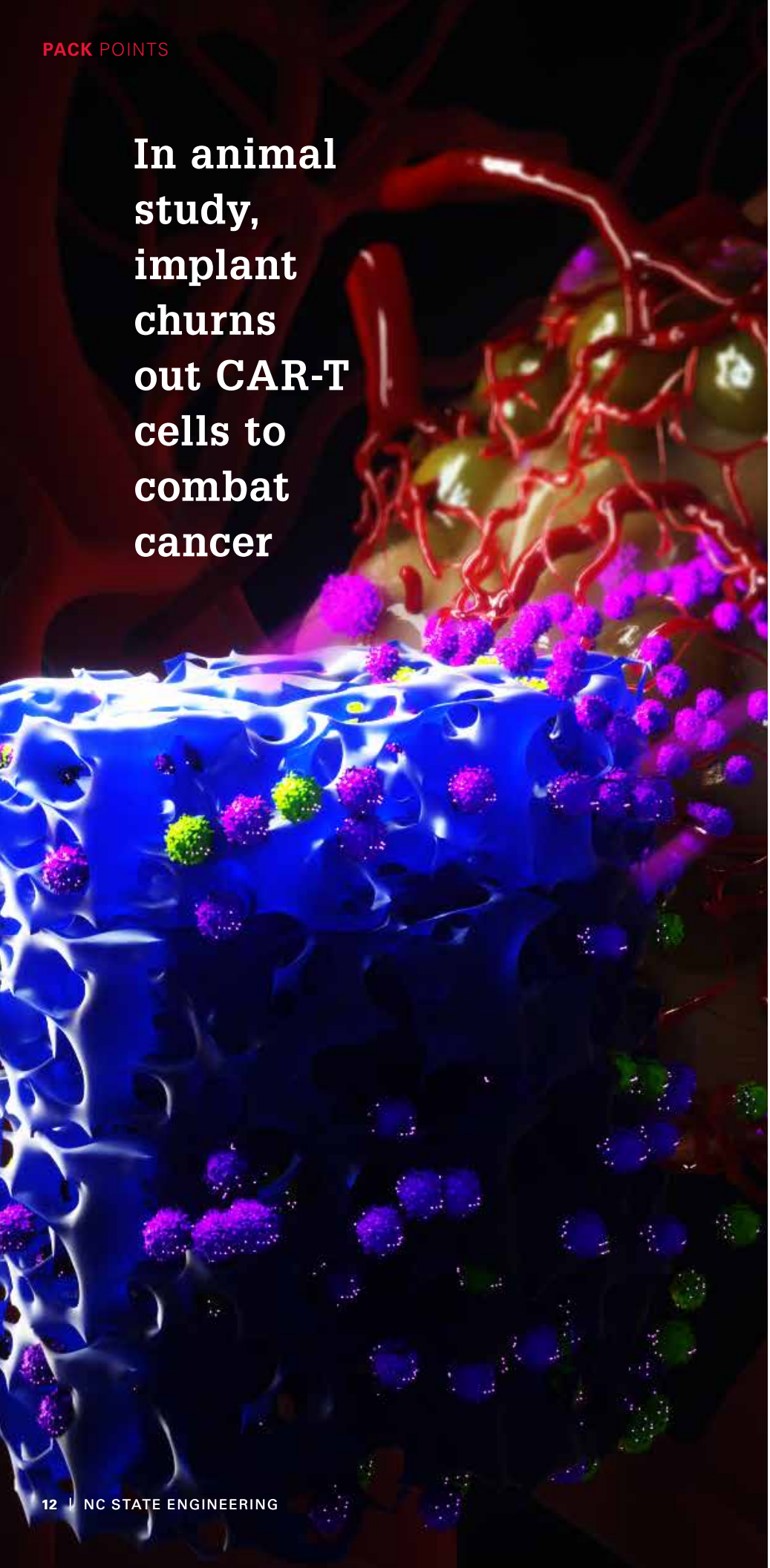
Over the last school year, they had a list of changes they wanted to make. The most important of these was replacing the battery pack, which weighed 700 pounds. To do so, they fundraised to build a totally new battery pack. Once they had the funds, they individually tested 1,800 lithium ion cells to narrow down to the 1,300 they needed for the car. This brought the weight down by 450 pounds.

"We also wanted to incorporate some more quality-of-life components into the car like power steering and electronic power braking to make it more practical since that is the goal we hold the highest on this vehicle," Nichols said.

With these changes in place, the team traveled to Topeka, Kansas, to make history. Now they are already looking forward to the future.

"The team has worked through so many challenges and we have shown that we can do so much with so little," Nichols said. "Just imagine what we could do with the right amount of support. In the future we would like to compete in the American Solar Challenge, which FSGP is a qualifying event for." ■

In animal study, implant churns out CAR-T cells to combat cancer



RESEARCHERS FROM NC STATE University and the University of North Carolina at Chapel Hill have developed an implantable biotechnology that produces and releases CAR-T cells for attacking cancerous tumors. In a proof-of-concept study involving lymphoma in mice, the researchers found that treatment with the implants was faster and more effective than conventional CAR-T cell cancer treatment.

T cells are part of the immune system, tasked with identifying and destroying cells in the body that have become infected with an invading pathogen. CAR-T cells are T cells that have been engineered to identify cancer cells and destroy them. CAR-T cells are already in clinical use for treating lymphomas, and there are many clinical trials under way focused on using CAR-T cell treatments against other forms of cancer.

"A major drawback to CAR-T cell treatment is that it is tremendously expensive — hundreds of thousands of dollars per dose," said Yevgeny Brudno, corresponding author of the study and assistant professor in the UNC/NC State Joint Department of Biomedical Engineering (BME).

"Due to its cost, many people are shut out from this treatment. One reason for the high cost is that the manufacturing process is complex, time-consuming and has to be tailored to each cancer patient individually," Brudno said.

"Reducing the manufacturing time is even more critical for patients with rapidly progressing disease," said Pritha Agarwalla, lead author of the study and an assistant research professor in BME.

To tackle this challenge, the researchers created a biotechnology called Multifunctional Alginate Scaffolds for T cell Engineering

and Release (MASTER). The work was done in partnership with Gianpietro Dotti, professor in the Department of Microbiology and Immunology and co-leader of the Immunology Program at the Lineberger Cancer Center at UNC; and Frances Ligler, a professor of biomedical engineering at Texas A&M University.

To understand how MASTER works, you have to understand how CAR-T cells are produced. Clinicians first isolate T cells from patients and transport them to a clean manufacturing facility. At this facility, researchers "activate" T cells with antibodies over several days, preparing them for reprogramming. Once T cells are activated, researchers use viruses to introduce the CAR gene, reprogramming the T cells into CAR-T cells that target cancer cells. Researchers then add factors to stimulate the CAR-T cells to proliferate, expanding their number. Finally, after these manipulations are complete, the cells are brought back to the hospital and infused into the patient's bloodstream.

"Our MASTER technology takes the cumbersome and time-consuming activation, reprogramming and expansion steps and performs them inside the patient," Agarwalla said. "This transforms the multi-week process into a single-day procedure."

MASTER is a biocompatible, sponge-like material with the look and feel of a mini marshmallow. To begin treatment, researchers isolate T cells from the patient and mix these naïve, or non-activated, T cells with the engineered virus. Researchers pour this mixture on top of the MASTER, which absorbs it. MASTER is decorated with the antibodies that activate the T cells, so the cell activation process begins almost immediately. Meanwhile, MASTER is surgically implanted into the patient.

After implantation, the cellular activation process continues. As the T cells become activated, they begin responding to the modified viruses, which reprogram them into CAR-T cells.

The MASTER material is also impregnated with factors called interleukins that foster cell proliferation. After implantation, these interleukins begin to leach out, promoting rapid proliferation of the CAR-T cells.

"Engineering the material so that it is dry and absorbs this combination of T cells and virus is critically important," Brudno said. "If you try to do this by applying T cells and virus to a wet MASTER, it just doesn't work."

The researchers worked with mice that had lymphoma. One group was treated with CAR-T cells that were created and delivered using MASTER. A second group was treated with CAR-T cells that were created conventionally and delivered intravenously. These two groups were compared to a control group receiving non-engineered T cells.

"Our technology performed very well," Brudno said. "It would take at least two weeks to create CAR-T cells from naïve T cells for clinical use. We were able to introduce the MASTER into a mouse within hours of isolating naïve T cells."

In addition, since cells are implanted within hours of isolation, the minimal manipulation creates healthier cells that exhibit fewer markers associated with poor anti-cancer performance in CAR-T cells. The MASTER technique results in cells that are less differentiated, which translates to better sustainability in the body and more anti-cancer potency. The cells display fewer markers of T cell exhaustion, which is defined by poor T cell function.

"The end result is that the mice that received CAR-T cell treatment via MASTER were far better at fighting off tumors than mice that received conventional CAR-T cell treatment," Agarwalla said.

The improvement in anti-cancer efficacy was especially pronounced over the long term, when mice were faced with a recurrence of lymphoma.

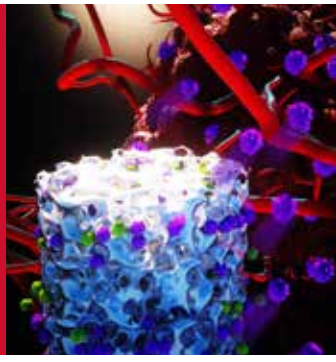
"The MASTER technology was very promising in liquid tumors, such as lymphomas, but we are especially eager to see how MASTER performs against solid tumors — including pancreatic cancer and brain tumors," Brudno said.

"We're working with an industry partner to commercialize the technology, but there's still a lot of work to be done before it becomes clinically available. Further work to establish the safety and robustness of this technology in animal models will be necessary before we can begin exploring clinical trials involving human patients."

While it's impossible to estimate what the cost of MASTER treatment might be if it is eventually approved for clinical use, Brudno said he's optimistic that it would be substantially less expensive than existing CAR-T treatment options. ■

"Our MASTER technology takes the cumbersome and time-consuming activation, reprogramming and expansion steps and performs them inside the patient."

PRITHA AGARWALLA



TOP, LEFT TO RIGHT, ASHLY CABAS, FRANCIS DE LOS REYES III, IQBAL HUSAIN, MICHAEL KUDENOV, JAMES LESTER III, LEDA LUNARDI, VEENA MISRA, SPYRIDON PAVLIDIS, RICHARD SPONTAK, WENYUAN TANG AND STEVEN S. WELTON.

Three receive **NSF CAREER Awards**

Three faculty members from the NC State College of Engineering (COE) received Faculty Early Career Development (CAREER) Awards from the National Science Foundation (NSF). The NSF CAREER Award is one of the most prestigious awards in support of junior faculty members who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations.

They are among five COE faculty members to receive CAREER awards this year, and 25 have received the award over the last five years.

Ashly Cabas, assistant professor in the Department of Civil, Construction, and Environmental Engineering (CCEE), will receive $566,155 over five years for her project, "Multiscale Probabilistic Characterization of Seismic Site Response in Highly Uncertain Environments."

Spyridon Pavlidis, assistant professor in the Department of Electrical and Computer Engineering (ECE), will receive $500,000 over five years for his project "Engineering Ultra-Wide Bandgap III-Nitride Devices for Highly Efficient and Robust Electronics."

FACULTY HIGHLIGHTS

Wenyuan Tang, assistant professor in ECE, will receive $500,000 over five years for his project, "Pricing Non-convexities Toward Transparency in Electricity Markets."

Husain, Kudenov receive 2022 **Alcoa Foundation Awards**

Iqbal Husain, ABB Distinguished Professor in ECE and director of the Future Renewable Electric Energy Delivery and Management (FREEDM) Systems Center, received the 2022 Alcoa Foundation Distinguished Engineering Research Award. The award recognizes a senior faculty member for research achievements made over a period of at least five years at NC State. An internationally renowned researcher, his work centers on decarbonization to address environmental concerns and global energy supply challenges.

Michael Kudenov, associate professor in ECE, received the 2022 Alcoa Foundation Engineering Research Achievement Award. The award recognizes young faculty members for significant research contributions during the preceding three years. Kudenov's research is focused on developing novel imaging systems, interferometers, detectors and anisotropic materials related to polarization and spectral sensing, for wavelengths spanning ultraviolet through the thermal infrared. He has helped establish interdisciplinary research collaborations at NC State.

Lunardi, Welton receive 2022 **Blessis Outstanding Undergraduate Advisor Awards**

Leda Lunardi, professor in ECE, and Steven S. Welton, teaching professor in CCEE, were awarded the 2022 Blessis Outstanding Undergraduate Advisor Awards from the College. The award recognizes recipients' outstanding commitment to ensuring students are academically and personally supported by routinely giving their time and effort to advising, counseling and mentoring individual students and student groups. It is also a tribute to George H. Blessis, a faculty member whose interest in undergraduate education and advising serves as an example today.

Three COE faculty members among **Holladay Medal winners**

Three faculty members in the College were honored with the Alexander Quarles Holladay Medal for Excellence, the highest honor bestowed by NC State and the University's Board of Trustees.

James Lester III, Distinguished University Professor in the Department of Computer Science, is the director of the Center for Educational Informatics at NC State. His research centers on transforming education with artificial intelligence.

Veena Misra, MC Dean Distinguished University Professor in ECE, is director of NC State's Advanced Self-Powered Systems of Integrated Sensors and Technologies (ASSIST) Center. She has built a community of faculty members across universities and created a rich, interdisciplinary experience for student researchers while advancing technologies behind wearable and implantable health monitoring devices.

Richard Spontak is a Distinguished Professor in the Department of Chemical and Biomolecular Engineering. His primary research interests relate to the phase behavior and morphology / property development of nanostructured polymers, polymer nanocomposites and coatings, electron microscopy and stimuli-responsive soft materials.

De los Reyes receives NC State **Alumni Distinguished Undergraduate Professor Award**

Francis de los Reyes III, Glenn E. and Phyllis J. Futrell Distinguished Professor #2 in CCEE, received the Alumni Distinguished Undergraduate Professor Award, a prestigious honor that recognizes excellence in undergraduate education.

For more than two decades, de los Reyes has been praised for his approaches to course delivery in water system process design and mentoring, illustrating his dedication to student learning, outcomes and overall success.

De los Reyes previously received several accolades including the Water Environment Federation Gordon M. Fair Distinguished Engineering Educator Award and the NC State Outstanding Teacher Award. ■

UP IN THE AIR

NC State will help 5G and unmanned drones reach their full potential

CATCHING A GLIMPSE of an unmanned aerial vehicle (UAV) in flight is still a novelty for most people. Researchers working with UAVs, more commonly known as drones, envision a future in which you'll see them everywhere, performing a variety of tasks that make our lives easier and doing so safely.

A sneak peek of that future will be available around the NC State campus and surrounding communities in the coming years. National Science Foundation (NSF) funding is helping faculty members in the College's Departments of Electrical and Computer Engineering (ECE) and Computer Science (CSC) build experimental testbeds using new fifth generation (5G) wireless communication technology to allow the research that will enable the future of drones.

> "I was happy to spend my time at NC State ... I had a chance to see how an American university works and how they put students first ... I felt like I was part of the Pack."
>
> **MATTEO DRAGO**

As the power of our wireless networks has grown, from 2G to 3G and then 4G technology, the possible applications for drones have as well. They have tremendous potential for a wide variety of uses, from monitoring the grazing patterns of cattle to providing on-time deliveries or assisting with traffic control. They can also carry a wireless node, providing connectivity to a rural area, battlefield or disaster zone. In order to do that safely and efficiently, wireless communication had to improve. The vehicles must be able to communicate with each other and must be detectable around airports and other sensitive areas.

"At some point, 4G will not be able to support that safely," said Ismail Guvenc, professor in ECE and principal investigator (PI) of the Aerial Experimentation and Research Platform for Experimental Wireless (AERPAW) led by NC State. "5G will be able to do that."

AERPAW was established in 2019 with a $24 million grant from NSF's Platforms for Advanced Wireless Research (PAWR) Project Office. PAWR, in coordination with Northeastern University, broadband development nonprofit US Ignite and a consortium of leading companies, is funding four city-scale research testbeds across the country to enable U.S. research in areas of wireless devices and networks and to train the nation's domestic workforce. AERPAW is the only one of the four that is studying 5G and autonomous drones together.

NC State's local partners in the effort are the Town of Cary and City of Raleigh, the NC Department of Transportation, the Renaissance Computing Institute at the University of North Carolina at Chapel Hill and the nonprofit Wireless Research Center. Purdue University, the University of South Carolina and Mississippi State University are also involved in the effort, as is a consortium of dozens of industry partners.

AERPAW offers researchers from around the globe a chance to conduct their experiments in a real-world environment, whether they visit North Carolina or not.

Vasilii Semkin, a senior research scientist at VTT Technical Research Centre of Finland who used the AERPAW testbed to determine whether the drone-detecting radar that he and his colleagues developed would return accurate readings in the field, visited NC State earlier this year.

"I'm passionate about drones," Semkin said. "There are more and more emerging applications for them. It's literally endless."

Drones and dairy

Drive south of NC State's Centennial Campus along Lake Wheeler Road and you will find hundreds of acres of open farmland that supports university research in poultry, dairy, cover crops, aquaculture and more. Now, you can add drone research to the list.

AERPAW's testbed on the Lake Wheeler Road Field Laboratory is one of the two planned testbed sites; the other will be on Centennial. This testbed allows

experimenters a chance to work in a rural environment, while the expansion in the Centennial site is expected to enable drone experiments in urban scenarios in the future.

Testing drones on Centennial is nothing new, thanks to a research effort started 15 years ago called the NC State Centennial Wireless Mesh Project, or CentMesh. Some of the same faculty members who are now leading AERPAW, including co-PIs Professor **Mihail Sichitiu** of ECE and CSC Professor **Rudra Dutta**, established CentMesh. **Brian Floyd**, ECE Alton and Mildred Lancaster Professor, is also an AERPAW co-PI, as is **Thomas Zajkowski**, flight operation manager with NC State's Institute for Transportation Research and Education.

CentMesh built a permanent outdoor wireless mesh facility on Centennial using rooftop and pole-mounted nodes, along with mobile nodes on pushcarts and on drones. The AERPAW network that extended some of the existing CentMesh infrastructure is completely user-programmable and can be used for research, outreach and education activities.

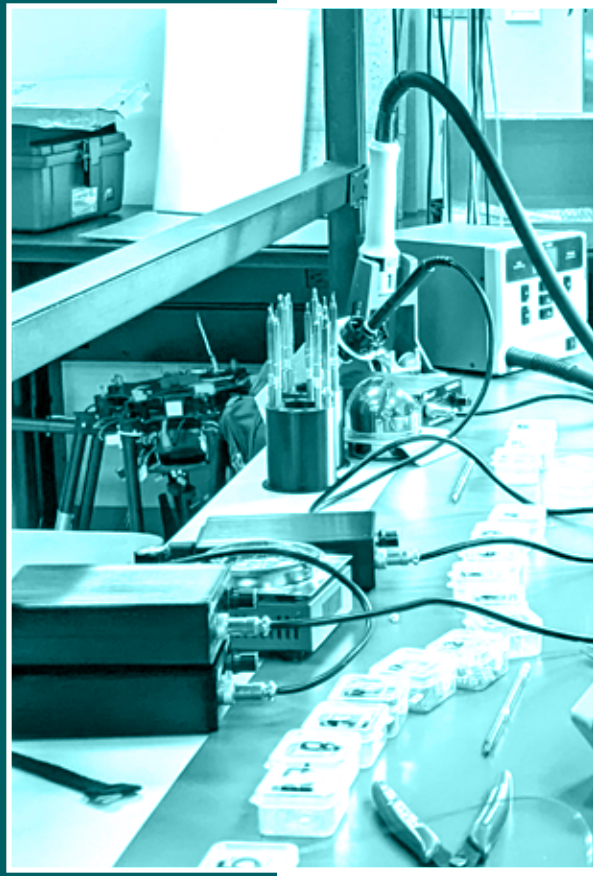
The fact that NC State researchers had built and maintained CentMesh helped make a strong case for landing one of the four PAWR projects, Sichitiu said. So, too, did the fact that NC State was willing to invest in the necessary infrastructure.

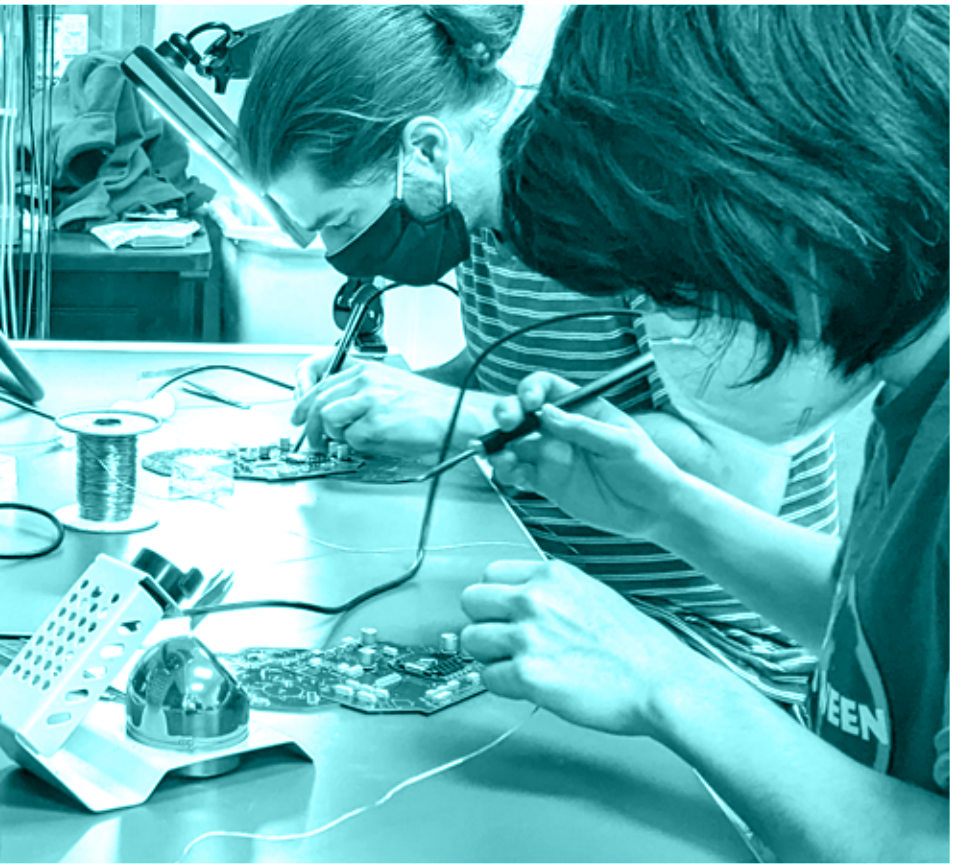
The AERPAW testbeds offer users both fixed and mobile nodes to interact with. Those mobile nodes can be on drones, but also on a ground-based rover and even a helium balloon, which can stay airborne much longer than a drone.

Users are asked to conduct their experiments in a virtual environment first, in a digital twin of the real environment where the testbed experiments are to be carried out. Faculty members and students who are part of the AERPAW operations team will then run the software developed in the virtual environment in the real-world testbed and collect the data, and finally, share the data with the experimenters. This two-step process allows the AERPAW team to ensure that testbed operations always stay compliant with relevant FCC and FAA regulations. Based on the outcome from the testbed experiment, researchers may choose to refine their experiments in the virtual environment.

AERPAW faculty members and students build their own drones using ECE's Troxler MakerSpace. While commercially produced drones could be outfitted with the hardware and software needed to work for the testbed, Sichitiu said that building their own offers much-needed flexibility, including the programmed repeatability of experiments that is critical to science.

"It's a first-of-its-kind facility," Dutta said of AERPAW. The Department of Defense maintains drone testbeds, but they aren't available to academic researchers. Of those that are available for public use, none before AERPAW have offered outside experimenters the opportunity to work with programmable drones.





Part of the Pack

After initial NSF funding, the hope is that AERPAW will continue with other sources of support and will make NC State, and by extension the Research Triangle region of North Carolina, a hotbed for drone research, development and commercialization that will draw collaborators from around the globe.

For Matteo Drago, visiting NC State was worth the long flight. Drago, a third-year Ph.D. student supervised by Professor Michele Zorzi from the SIGNET Research Group at Italy's University of Padova, arrived at NC State in November 2021. As his work studying the next generation of mobile networks progressed, Drago felt that working with a testbed could be the missing piece in his understanding of how a network functions.

"I was happy to spend my time at NC State for six months," he said. "I had a chance to see how an American university works and how they put students first. I thought the facilities were astonishing.

"I felt like I was part of the Pack." ■

TRACKING COVID-19

CCEE researchers use wastewater testing to identify trends

> "We are trying to understand how the level of infection is shifting inside of a community from one variant to another by testing the wastewater instead of each individual."
>
> **TANVIR PASHA**

As the COVID-19 pandemic continues, researchers are taking a look at our waste — specifically regional wastewater — to get a better view of outbreaks and trends to help ensure local communities have the information they need when making public health decisions.

"Wastewater surveillance is helpful in looking for trends that can provide insight about what might be going on at the population level," said Angela Harris, assistant professor in the Department of Civil, Construction, and Environmental Engineering (CCEE).

With support from the North Carolina Department of Health and Human Services (DHHS), the Centers for Disease Control (CDC) and Wake County Public Health, NC State researchers have been testing wastewater to identify trends in COVID-19 outbreaks across Wake County.

This research is led by Harris, with assistance provided early on by Nadine Kotlarz, postdoctoral researcher at NC State's Center for Human Health and the Environment, and Francis de los Reyes, CCEE Glenn E. and Phyllis J. Futrell Distinguished Professor #2.

A shift to community testing

SARS-CoV-2, the virus that causes COVID-19, is shed in feces, making wastewater surveillance an optimal tool for public health officials to monitor outbreaks, moving testing from an individual to community level.

"We are trying to understand how the level of infection is shifting inside of a community from one variant to another by testing the wastewater instead of each individual," said Tanvir Pasha, a CCEE Ph.D. student and researcher working under Harris.

In April 2020, NC State and other universities, including Rice University, Howard University and the University of Southern California, began testing wastewater within their respective cities to compare communities across different environmental contexts. This research was funded by a one-year, $200,000 National Science Foundation Rapid Response Research (RAPID) grant.

NC State's research continued with funding from the North Carolina Policy Collaboratory and North Carolina DHHS, and is now a part of the CDC's National Wastewater Surveillance Program.

"That was a really important role that universities played in supporting state-level public health efforts," Harris said. "The data we collect feeds into the state program, which feeds into that national database that the CDC is operating and maintaining."

Zeroing in on SARS-CoV-2

Harris' lab gathers wastewater at six sites across Cary and Raleigh, NC, with these facilities serving more than 800,000 people. Two 24-hour composite samples are collected weekly from each location.

Using membrane filtration with a vacuum pump, Harris concentrates 40 milliliters of wastewater using filter paper with a pore size 60 times smaller than a particle of dust. Virus particles are even smaller. But to concentrate the COVID-19 virus particles, they must stick to the filter paper. Harris treats the sample with a magnesium chloride solution that causes the COVID-19 virus particles to stick.

SARS-CoV-2 is an RNA virus, and Harris and her team perform nucleic acid extraction on the filter paper, which allows for molecular detection of the virus using digital droplet polymerase chain reaction (ddPCR). Specifically, they target the N1 and N2 genes of the virus that in combination prove its presence in a sample.

"The idea with an environmental sample is that you want to remove all the compounds that are in wastewater that can impact you doing molecular work," Harris said. "You just want the nucleic acid."

This process involves a digital droplet PCR with primers that consist of short sequences of RNA that identify unique genomic sequences. The sample is broken up into thousands of droplets that signal the detection of the virus through a luminescent molecular tag.

Based on the number of positive droplets, researchers are able to estimate the total quantity of SARS-CoV-2 particles in a sample and compare concentrations in previous specimens to further categorize them within percentiles that range from very low (0-19.9 percent) to very high (80-100 percent) within wastewater.

The testing method is sensitive enough that low concentrations of SARS-CoV-2 can be detected, and when compared to reported cases, the data correlates accurately. Additionally, this form of testing provides results more quickly than individual testing.

Harris' lab and the CDC program are not able to accurately identify how many people are infected with COVID-19 as variables including weather and behavioral patterns in water usage can influence the concentration of particles within a sample.

Future implications of wastewater surveillance

Harris hopes to expand research to other enteric, or intestinal, pathogens such as rotavirus and norovirus or bacterial pathogens like campylobacter and salmonella.

She also thinks that wastewater can be helpful in understanding disease trend dynamics related to variables such as climate change and mass behavioral changes.

"We can gain insight and predict ahead of time what [public health] messaging would be useful or give hospitals a heads up on when they can expect more patients," Harris said.

Working with the CDC and the North Carolina DHHS, researchers have also improved at making the data and trends easier to understand.

"When looking at some of the published data, you might not feel comfortable making an individual decision based on this information right now because it's hard to make sense of it," Harris said. "I think working with the CDC and the North Carolina DHHS has put a lot more thought into these data visualizations and how to make it accessible to the public." ■

ESPORTS FOR THE PACK

One of the largest collegiate esports arenas in the U.S. will be built at NC State with funding from the North Carolina General Assembly.

In 2021 and 2022, NC State received $12 million from the North Carolina General Assembly to build an on-campus esports arena and $4 million to develop a mobile arena truck that brings esports competitions and activities to other parts of the state. Beyond esports competitions, NC State wants to develop a space that supports research, education and economic development. A pilot space will open in the James B. Hunt Jr. Library by the end of 2022, and the new arena is expected to be completed in 2024.

WHAT ARE ESPORTS?

Esports are video games played in a competitive online environment, sometimes with players facing off in person with a live audience. These events are commentated and broadcasted, and they can draw millions of online spectators on streaming sites Twitch and YouTube. Viewership and participation have grown in recent years, and North Carolina has hosted several large tournaments. Some of the most popular games include Counter-Strike: Global Offensive, Fortnite and League of Legends.

AN ARENA TO SERVE *EVERYONE*

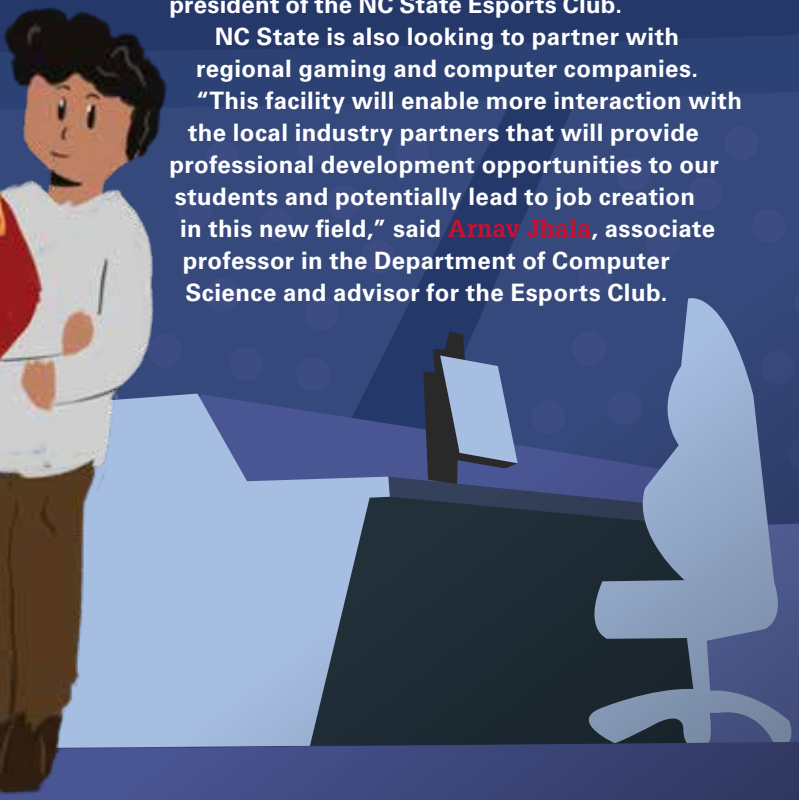
The arena will offer opportunities not only for student players, but for students who are interested in a broad range of fields, including game design, broadcasting and event management. **Marc Hoit**, vice chancellor for information technology, envisions the space functioning in the future as one of NC State's CORE Labs, a shared facility for students and faculty members. "If you want to rent time in it, host a competition, it's available," he said. "You can ... do the things that you need in order to pursue your research, your education."

Keys for Success:

University and industry partnerships

Student clubs have provided feedback on what they need to set up cohesive, successful tournaments, or specialized equipment they want. "It's the little things that we think of," said Avi Sukhramani, senior marketing major and president of the NC State Esports Club.

NC State is also looking to partner with regional gaming and computer companies. "This facility will enable more interaction with the local industry partners that will provide professional development opportunities to our students and potentially lead to job creation in this new field," said Arnav Jhala, associate professor in the Department of Computer Science and advisor for the Esports Club.



Student education and inclusion

One of NC State's main goals for the facility is to develop curriculum for existing gaming-related courses in the College of Design, College of Engineering (COE) and College of Humanities and Social Sciences (CHASS), as well as courses in areas like media broadcasting, business, event management and human-centered streaming data analytics.

Other major priorities for the facility are diversity, inclusivity and sustainability. "Creating a formal community and expert players and spectators also creates opportunities for social sciences research on community dynamics and questions of diversity and inclusion within gaming communities," Jhala said.

Research opportunities

The space will help with leveraging research funding, especially for interdisciplinary projects. Jhala explained that faculty members in COE and CHASS have interests in similar questions — such as improving our understanding of high-performance user interaction with computer systems — but approach them through different perspectives.

Technology and equipment

The arena will need computer setups, movable desks, big screens, proper lighting, a soundstage and video production capabilities, to name a few requirements.

ESPORTS AT NC STATE

NC State's Esports Club started in 2018, when several esports groups on campus joined together. The club now has 200 active members and more than 1,700 subscribers on the communications platform Discord. Teams have experienced success at the collegiate level.

The club also aims to provide a space for people not playing at a high level. They are focused on bringing in groups who have been traditionally marginalized in esports, which have been predominantly played by white and Asian men. There are three women on the club's board. "The community aspect is always something I'm trying to push forward," Sukhramani said. ■

10 years of wearable device breakthroughs

As the ASSIST Center graduates from National Science Foundation funding, researchers look to a self-sustaining future and advancements in implantable devices

ASSIST HAS DEVELOPED A HYBRID BIOPHOTONIC/ELECTROCHEMICAL PLATFORM THAT CAN SIMULTANEOUSLY MEASURE HEART RATE, OXYGENATION, LACTATE, CORTISOL AND PH. THE GOAL IS TO HAVE MULTIMODAL SENSING OF AS MANY PARAMETERS AS POSSIBLE. CORRELATION OF MULTIPLE BIOMARKERS CAN PROVIDE INSIGHT INTO CARDIOVASCULAR HEALTH, STRESS, METABOLIC HEALTH AND MORE.

A PARTICIPANT FROM ASSIST'S YOUNG SCHOLARS PROGRAM PRACTICES SOLDERING AN ELECTRONIC COMPONENT OF HIS TEAM'S WEARABLE DEVICE.

TEN YEARS SINCE ITS FOUNDING, the Advanced Self-Powered Systems of Integrated Sensors and Technologies (ASSIST) Center led by NC State has made groundbreaking advances in wearable health monitoring devices.

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

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

ASSIST is the third National Science Foundation (NSF)-funded Engineering Research Center (ERC) led by NC State, which is one of only two institutions to lead two ERCs at the same time. The Future Renewable Electric Energy Delivery and Management (FREEDM) Systems Center graduated from NSF funding in 2018.

ERCs are funded for 10 years by the NSF and are reviewed annually. NC State led ASSIST with collaboration from researchers at Florida International University, Pennsylvania State University and the universities of Virginia, Michigan, North Carolina, Notre Dame and Utah.

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

"Now that we're in self-sufficiency, we can look into other avenues that can be useful," Misra said. "Getting into implantable devices, or wearables and implantables working together, is an interesting concept. Faculty (members) are also looking at other applications of our technology in agriculture, internet of things and veterinary medicine."

10 startups

Over 120 Ph.D./master's graduates

$8,189,322 annual research funding

32 full patents filed
82 inventions
657 papers/conference proceedings

19 industry partners

Changing health monitoring

ASSIST's primary research initiative is the development of flexible, self-powering and wearable devices that will help monitor a range of health indicators. In the last 10 years, researchers have made several generations of health and environmental trackers (HET) that are used for monitoring asthma, diet and wound healing. Some of these are just a few years away from use by patients and physicians.

HET Gen 1, which monitors users' health and environment to predict and prevent asthma attacks, is the center's most mature platform. Users wear a wristband that detects pulse, activity levels, ozone exposure and volatile organic compounds (VOC), as well as a chest patch that monitors heart rate, heart rate variability and cough. These have helped researchers find a correlation between ozone exposure and physiological effects in individuals with asthma compared to those who do not have asthma.

ASSIST's second-generation HET is a modular and flexible platform that can be integrated into biochemical sensors to monitor lactate, glucose and uric acid.

ASSIST researchers have made industry-changing breakthroughs in flexible devices, especially in its state-of-the-art thermoelectric generators (TEGs). These harvest energy from the temperature difference between the body and surrounding air to power ASSIST's sensors. Through an NSF Partnerships for Innovation grant, ASSIST is focused on manufacturing these TEGs for broader use.

Over the last decade, ASSIST has been highly entrepreneurial, and its technologies have led to 10 startups. The center has also closely partnered with several companies, including Murata, a biotechnology company. Murata funded research on liquid metal patterning done by Michael Dickey, Camille and Henry Dreyfus Professor in the Department of Chemical and Biomolecular Engineering.

Murata's involvement with ASSIST began in 2014. Over the years, Murata deepened its involvement with the center — from evaluating ASSIST technologies, to providing perspective and direction as a member of the Industry Advisory Board, to working directly with students and sponsoring research.

"The Murata and ASSIST relationship took time to incubate and find the correct research and project topic alignment," said Mark Waugh, senior manager, corporate technology and innovation. "The last five years of the relationship continued to grow with activities including sponsored research, white papers, conference papers, ECE senior design projects and webinars."

Through this partnership, ASSIST received access to Murata's technology and materials expertise, guidance on market readiness and mentoring from an established industry leader. Murata has benefitted through connections to a tremendous talent pool, including students who have gone on to work for the company, and to leading faculty members, in addition to access to cutting-edge research and intellectual property and spin-off entities.

ASSIST'S SELF-POWERED ELECTROCARDIOGRAM MONITORING PLATFORM IS MADE OF SCREEN-PRINTED DRY ELECTRODES ON A STRETCHABLE ARMBAND. ASSIST IS WORKING TOWARD IT BEING SELF-POWERED BY BODY HEAT AND/OR SOLAR SOURCES.

A FLEXIBLE ZERO-POWER SWEAT EXTRACTION PATCH THAT ALLOWS MONITORING OF BIOCHEMICAL MARKERS IN SWEAT WITHOUT THE PATIENT NEEDING TO ACTIVELY BE SWEATING OR EXERCISING.

A WOUND MONITORING BANDAGE THAT DETECTS URIC ACID AND PH LEVELS IN WOUND EXUDATE TO HELP MEDICAL PROFESSIONALS MONITOR THE PROGRESSION OF HEALING IN CHRONIC WOUNDS.

From wearable to implantable

One of ASSIST's new priorities is the development of implantable health monitoring devices. As of September 2022, Alper Bozkurt, professor in ECE, is the new deputy director of the ASSIST Center. He succeeds Mehmet Ozturk, who had served in the role since 2015 and is also an ECE professor. Bozkurt will be leading the center's transition to implantable devices, which is a natural step from ASSIST's work on sensors, circuits, communications and energy storage and transfer in wearable devices.

"It is important to note that we have a very strong College of Veterinary Medicine and medical schools in the area, in addition to ASSIST's strength in novel biomedical instrumentation," Bozkurt said. "This brings supply and demand together where a number of implantables applications emerge for animal and human medicine spaces."

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

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

Ideas for and from everyone

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

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

One of its most successful K-12 programs is the Wearable Device Challenge. Teachers who participate in the NSF Research Experiences for Teachers at the ASSIST Center task their students with designing and building a wearable device.

"They do some really unique things," Veety said. These unique things include a glove that helps alleviate arthritis, a posture detection device and a gait rehabilitation device worn on a sock.

These are all ideas in the same vein as what ASSIST faculty members are developing and researching — and the students devising them might be among the people continuing ASSIST's foundational research as the center looks to the next 10 years and beyond. ■

STUDENTS IN EED 590: TEACHING UNDERGRADUATE ENGINEERS, WORK ON A CLASSIC ENGINEERING EDUCATION PROBLEM: BUILDING A TOWER WITH SPAGHETTI THAT CAN SUPPORT A MARSHMALLOW.

A better engineering education

This fall, NC State becomes the first university in the United States to start an engineering education program offered jointly by an engineering college and an education college, and the first to ground its program in diversity, equity and inclusion (DEI).

NC State's College of Engineering (COE) and College of Education (CED) have a long relationship, and the two colleges have been working for six years to develop the Engineering Education program. Faculty members started teaching courses in 2019. There are now five courses available, and they are listed as EED in the course catalogue.

About 60 students have taken EED courses so far, and several will receive their certificates this year. The master's degree program is on its way to approval, and eventually there will be a Ph.D. program. The courses are geared toward engineers who want to teach at the college level full time as faculty members in engineering disciplines or as engineering education faculty members. In addition, the program is designed to prepare community college instructors to teach engineering courses that will transfer to a four-year university, and even engineers who work in industry and have training or sales responsibilities.

NC State is not the first to develop an engineering education program, and faculty members looked to Purdue University, Virginia Tech and other schools as models when developing curriculum.

"This is the first one where it's actually 50/50. People ask why would that be, and I'd ask the opposite question," said **Aaron Clark**, director of the Department of STEM Education in CED and one of the program's leaders. "Why would it not be? The two words — engineering education — both of them are disciplines, you can become an engineer, you can become an educator."

From COE, **Laura Bottomley**, director of Women in Engineering, The Engineering Place and Engineering Education, has led the initiative, along with faculty members in the Office of Academic Affairs. **Tameshia Ballard Baldwin**, teaching assistant professor in COE, helped develop the program's curriculum, and **Jerome Lavelle**, associate dean of academic affairs, supported the initiative. **Kanton Reynolds**, director of undergraduate programs and associate teaching professor in the Edward P. Fitts Department of Industrial and Systems Engineering, and **Veronica Cateté**, assistant professor in the Department of Computer Science (CSC), have also developed and taught several of the program's courses.

The NC State College of Engineering and College of Education teamed up to develop a unique engineering education curriculum

In CED, along with Clark, **Tamecia Jones**, assistant professor of STEM education, brought her expertise to the curriculum development. **Joy Gaston Gayles**, senior advisor for advancing diversity, equity and inclusion and professor of higher education in CED, helped finalize the DEI component of the program.

"As we increase the number of engineering students we produce, we want to also increase the diversity of those engineering students," Bottomley said. "The people who come out of our Engineering Education program will be prepared to teach diverse students in a way that no one ever has been before."

'MORE TO ENGINEERING'

NC State has long been a leader in engineering education, and the program builds off previous successes. The CSC department, for example, has one of the top computer science education programs in the U.S., and in 2020, was ranked first in the world for computer science education research. The new program will work closely with CSC education students and faculty members.

The program will help fill a need for highly qualified engineering faculty members across disciplines, which will be especially vital as more technology companies come to the area and North Carolina aims to increase its STEM workforce. NC State's student body is growing by 4,000 through funding from the Engineering North Carolina's Future initiative, which means the College will need more engineering and computer science faculty members. With the growth, the College will also be looking to further increase diversity in its student body and faculty.

Baldwin, who was on the team that developed the curriculum, said that with both CED and COE coming together, the future faculty members coming from NC State will be well-prepared educators. Through the EED courses, students will learn how to create student learning assessments, develop lesson plans, implement current trends and more.

They will also be equipped to help make engineering — both in school and in the workforce — more equitable and inclusive of everyone.

"Developing an engineering education program with a DEI-focused underpinning will lead to graduates who not only have the required technical and pedagogical foundation, but also a knowledge and appreciation of DEI and its impact across the engineering education enterprise," she said. "With the increased focus on DEI efforts across COE and the University in the past several years, in particular, this program is very timely in its objectives and approach."

Amy Isvik, a fifth-year computer science Ph.D. student, has taken all of the EED classes available and earned the EED certificate. Her research focus is in computer science education, with an emphasis on improving access to computing. One of the most important things she's learned during the EED courses is figuring out what questions she needs to be asking as she develops lessons to ensure they are effective for all students.

After graduation, Isvik hopes to work in STEM outreach, specifically in expanding informal STEM education opportunities to students.

"There is more to engineering than just having outstanding research labs," she said. "We also need to be able to deliver quality instruction to our students, nurture their passions and interests and ensure an equitable environment for learning."

K-12 engineering camps return to in-person activities

SUMMER ON CAMPUS

AT 9 A.M. ON A JULY WEDNESDAY, more than 70 middle school students filed into a classroom, waiting to be assigned the real-world problem they'd be solving that day. Clustered together, campers tackled complex problems like how to construct a moving boat or how to stop a viral outbreak. Using cardboard, aluminum foil, balloons and more, these campers were trying to solve some of the fundamental challenges in engineering.

These students were just a few of nearly 1,000 rising kindergarteners through 12th-graders who participated in one of the 26 American Camp Association Accredited summer camps at the College of Engineering. Summer camps are run annually by The Engineering Place in the Office of Academic Affairs, as well as by several other departments in the College.

After two years of virtual camps, children and parents were excited for the return of in-person activities.

"While the virtual camps went well these past two years, nothing takes the place of in-person, hands-on work," said Susan D'Amico, coordinator of engineering K-12 outreach extension for The Engineering Place. "We're replicating the work that engineers do out in industry with different angles of interest that children can connect with."

Since 1999, The Engineering Place has invited students to investigate and solve engineering-related challenges each day during residential and day camps.

"It's exciting for the campers to return to our campus where they can solve fun challenges together throughout the week as they learn about engineering and engineering careers," said Leah Bug, assistant director of The Engineering Place. "We like to show campers that engineering isn't scary, but really fun and it's something they can do."

Activities encouraged students to learn about the engineering habits of mind — systems thinking, creativity, optimism, collaboration, persistence and conscientiousness.

"These engineering habits of mind are a mindset engineers utilize in solving the world's problems, but it also translates well for campers in everyday life, both at home and school," Bug said.

Departments host camps for high schoolers

The Engineering Place collaborated with engineering departments to host 16 residential camps for rising high school juniors and seniors. Camps were available in biological and agricultural engineering; biomedical engineering; chemical and biomolecular engineering; civil, construction and environmental engineering; electrical and computer engineering; industrial and systems engineering; materials science and engineering; mechanical and aerospace engineering; and paper science and engineering.

The UNC/NC State Joint Department of Biomedical Engineering (BME) hosted a week-long camp, "The Human Machine," which introduced 20 rising high school juniors and seniors to challenges in the field.

Students brainstormed, prototyped and pitched innovative ideas to counselors, family and peers. Final projects included self-sterilizing syringes, shopping carts able to hook onto wheelchairs and motorized vehicles, and exoskeleton arms that reduce astronauts' muscle mass loss.

To expand who would be able to participate in the camp, Aryssa Simpson, a third-year biomedical engineering Ph.D. student and a camp lead, secured five seats as scholarship positions for students from underrepresented communities. These scholarships were provided by a corporate donor.

"I didn't have a lot of opportunities to expose myself to engineering growing up," she said. "Last year's camp didn't have much diversity and that became a main motivator to try to expand access."

With assistance from the North Carolina Mathematics and Science Education Network Pre-College Program, Simpson connected with five local high school students.

Simpson sees the summer camp as a chance to give future college students the confidence to pursue a degree in science while addressing the hesitations around medicine that exist in underrepresented communities.

"There's a natural hesitancy in minority communities regarding medicine, and many minority students don't allow themselves to investigate their interests in science because they don't feel smart enough," she said. "This is a great opportunity for students to see what the world could provide for them."

Through the Department of Nuclear Engineering's (NE) three-week Young Investigators' Summer Program, 18 rising high school juniors and seniors explored nuclear engineering's global impact.

"We're introducing students in a more holistic way to various elements of nuclear science and technology," said Lisa Marshall, director of outreach, retention & engagement and director of the Young Investigators' Summer Program. "They see some aspects of nuclear engineering in high school physics and chemistry courses, but there's not enough time to explore their interests."

During lectures, graduate students and faculty members presented on topics including reactors, power plants and nuclear engineering's role in health and environmental sciences. Lab projects in radiation detection and light sensitive monitors for NC State's PULSTAR reactor and plasma facilities allowed students to operationalize their classroom instruction. Students got to see concepts in action during field trips to the University of North Carolina at Chapel Hill's Biomedical Research Imaging Center and to the Framatome Technical Training Center, an advanced training center located in Lynchburg, Virginia, focused on nuclear site maintenance.

These experiences showed students how interconnected the field is with daily life, and how they might be able to contribute.

"I'm interested in learning more about energy, like nuclear batteries and generators," said a student from Raleigh, NC. "I want to figure out solutions that help the world."

While familiarizing students with the world of nuclear engineering, the program also helps them acclimate to a university environment.

"Exposing students to a very exciting and integral field while helping them navigate 'university life' before they get here is my favorite part," Marshall said. "Seeing some of these students in the future on campus, you can tell they walk with a bit more confidence." ■

‘The right thing to do’: MAE alumnus gives back to WMEP

DALE HOPKINS

Dale Hopkins, mechanical engineering ’84, didn’t take the most traditional path through college.

With an interest in engineering, Hopkins, who is from Gastonia, NC, started at NC State in the fall of 1973. Two years later, he left school due to poor grades.

“My father, as I like to say it, revoked my scholarship on academic grounds,” he laughed.

Hopkins got a job with the City of Raleigh in the utilities department at a wastewater treatment plant, where he stayed for seven years.

“I got to be on the operations and maintenance staff, and I learned a lot from the blue-collar guys who had been working on pumps and electrical systems, everything that goes into a water plant,” he said. “I got all of my certifications there and had gone as far as I could go without a degree.”

Hopkins decided to return to college in 1982. By then, he knew he wanted to be a mechanical engineer, but the program wouldn’t accept him due to his grades. He didn’t let that stop him, getting his advisor to sign

off on his mechanical engineering courses and taking 18 credit hours every semester and six credit hours every summer session. By his last semester, he went back to the person who told him he couldn't get in and showed him his transcript, with all As and Bs in the upper-level mechanical engineering courses.

"I said, 'The kid who flunked out all those years ago is not the same man standing in front of you today,'" Hopkins said. He was accepted into the program his last semester and graduated with a degree in mechanical engineering.

After graduation, he started doing clerical work writing assembly instructions for circuit boards, which he quickly realized was not his interest. Despite an initial resistance to sales, in 1985 Hopkins ended up working as an HVAC equipment sales representative at LDR Technologies, eventually leading the HVAC digital control division until 2017. His engineering degree helped with understanding fully the thermodynamics and physics behind the equipment he was selling. A career learner, Hopkins took on more of the business side of the company.

"I think the biggest thing you get out of an education is the ability to teach yourself," he said.

Now retired and working as a consultant, Hopkins has made it a point to give back to NC State, especially wanting to help students who are traditionally underrepresented in engineering.

"There's a part of me that supports the underdogs, and I do not like to see injustices," he said. "You're supposed to leave a place better than you found it … There's an old adage that everybody in America has equal opportunity — well everybody has an opportunity, but it's certainly not equal."

With that in mind, Hopkins decided to make an annual gift to the Women and Minority Engineering Programs (WMEP). He has also established a planned gift to provide scholarships, with preference given to first-generation college students and those who need financial support.

Angelitha Daniel, assistant dean for diversity, equity and inclusion and former director of the Minority Engineering Programs (MEP), and Laura Bottomley, director of Women in Engineering, The Engineering Place and Engineering Education, said that gifts like the one from Hopkins are critical to the success of WMEP.

"Without the support from alumni like Dale Hopkins, we would not be able to recruit, engage and launch our students into their professional careers," Daniel said. "Mr. Hopkins' support is a game changer in terms of our holistic support of women and historically underrepresented students in the College of Engineering."

WMEP is one of the College's most important student programs. It provides support for current NC State students, as well as for K-12 students, teachers and parents interested in engineering. Bottomley got the WIE Program off the ground in 1997, marking its 25th anniversary this year. The WIE Program later joined forces with MEP to become WMEP.

Thanks to the program's efforts, the College has made important strides in creating more inclusive and diverse student and faculty bodies. This year, the incoming student class is 33 percent women. NC State is one of the few engineering schools to reach that metric, and Bottomley aims to eventually reach an even split.

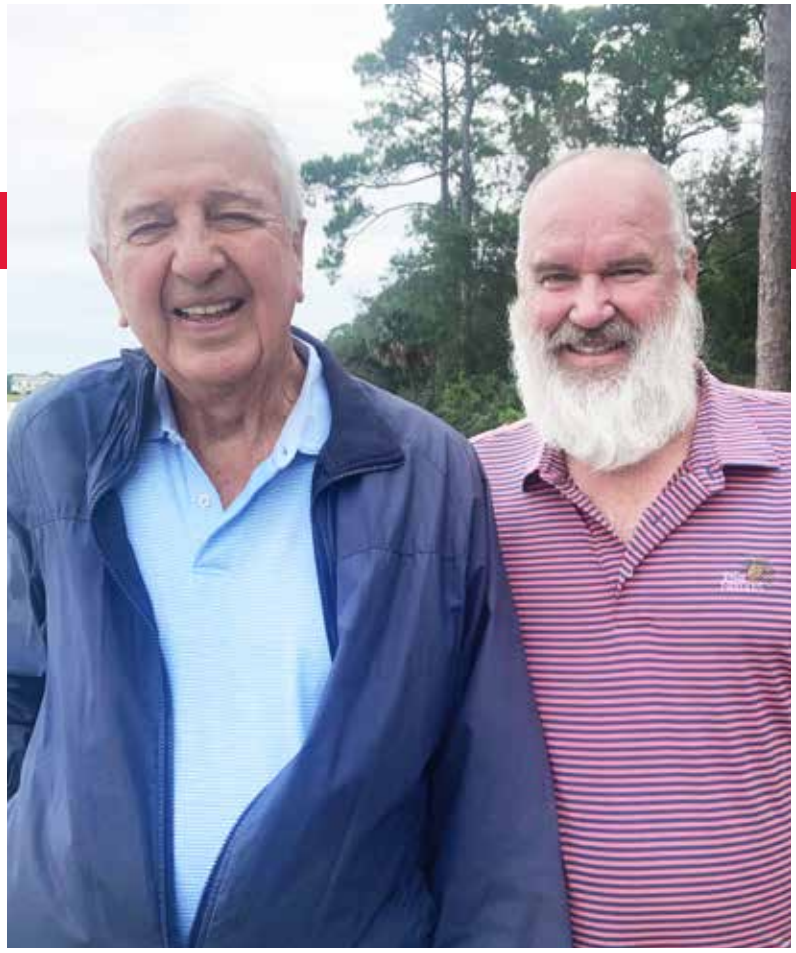
The Engineering Place, NC State's K-20 engineering education program, is focused on outreach to students through school visits and on-campus programs, including summer camps. It has reached more than 1 million students, parents and teachers. The Engineering Place's goal is to help all students realize their engineering abilities and interests. Outreach to younger students is a key part of helping to ensure a diverse, inclusive engineering field.

For Hopkins, when he started at NC State, it was easier to get into the engineering program, but harder to stay and keep going through the courses. Now, the script has flipped. Getting in is more competitive than ever, but WMEP and other programs at the College have helped retain students. WMEP aims to meet students where they are, setting them up for success in their rigorous programs and for when they enter the workforce.

"The reason I did it through the College of Engineering and without any other academic qualifications is that … if you're good enough to get accepted, then you're good enough," he said. ■

"Mr. Hopkins' support is a game changer in terms of our holistic support of women and historically under-represented students in the College."

ANGELITHA DANIEL



BILL GARWOOD, LEFT, WITH JEFF GARWOOD.

A **one-of-a-kind** pair

William R. (Bill) Garwood, chemical engineering '60, and Jeffrey R. (Jeff) Garwood, chemical engineering '84, have more in common than a typical father-son pair.

They both went to NC State University, both graduated from the Department of Chemical and Biomolecular Engineering (CBE), both were named a College of Engineering Distinguished Alumnus and both had fulfilling careers that took them outside of the United States. They also have a deep respect and admiration for each other.

In 2006, they endowed the Garwood Family Scholarship, which supports CBE students who need financial aid.

"When you begin to really assess how your life evolved, and what were the things that got you to have accelerators or changes in direction — there's no question that education in both of our experiences has been one of those," Jeff said.

Bill was born and raised in Cooleemee, NC. With a natural inclination toward math and science, he enrolled at NC State in 1956 as an engineering student. He was one of just two engineering students on the football team, where he was backup quarterback for Roman Gabriel, who played for 15 years in the National Football League.

"I would come out about 3:30 after a lab or something, and my coach would yell 'Here comes our engineer,'" Bill said. "They'd been practicing for hours already."

Bill moved to Tennessee after graduation for a job at Eastman Chemical Company and spent more than 39 years there. His last two years, he worked in Europe, where he oversaw Eastman's expansion and the construction of three plants in England and Spain. He retired as president of Tennessee Eastman Division in 1997.

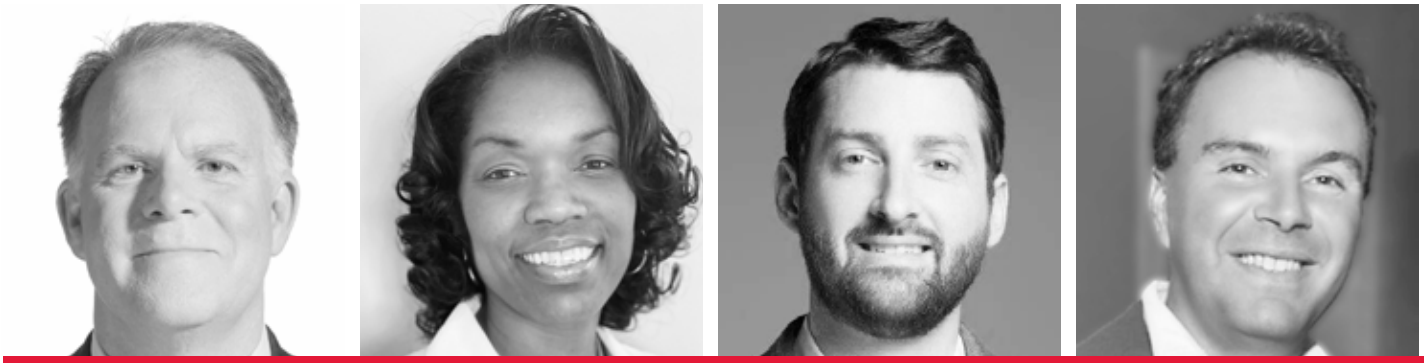
Despite the family connection to NC State, Jeff wasn't dead set on joining the Wolfpack and applied to several schools with strong chemical engineering programs. When he toured NC State with his father, they made a stop in Riddick Hall. There was one advisor, J. Frank Seely, professor emeritus until 1991, who recognized Bill and pulled out his file.

"It was a very special moment," Jeff said. "That's when I decided to go to NC State."

After he graduated, Jeff took a different approach to his career, moving 18 times in 27 years and visiting about 100 countries, mostly through work. He spent the majority of his career at General Electric (GE), where he ran three of its global businesses and retired as president and CEO of GE Water and Process Technologies in 2009. That same year, he founded Liberation Capital, a Charlotte, NC-based global equity firm that provides project finance for clean technology infrastructure.

Both Garwoods have come back to NC State to talk to CBE students, who they advise to try new things — something that benefitted both of them.

"I've had a great advisor in my father and being able to bounce ideas off of him," Jeff said. "Stories, or careers, or experiences, are made if you are willing to make a turn." ■



Inspiring Engineers event series promotes NC State engineering excellence

FROM LEFT TO RIGHT, GIL WEST, STEFFANIE EASTER, BEN BURGESS AND TONY BLEVINS.

The College of Engineering (COE) has been the starting point for thousands of careers. Through the Inspiring Engineers event series, the College invites alumni to share their journeys and accomplishments to encourage new generations of engineers.

In its first year, the series has hosted four impressive NC State engineering alumni who talk with COE leaders about their accomplishments and what they've overcome. The conversations are held on Zoom and are open to all COE alumni and students.

"Our hope is to share with alumni and students just how wide the College's impact expands across disciplines, professions and experiences," said Hannah Kunkel, assistant director of development, alumni engagement and stewardship at the NC State Engineering Foundation. "Every person's story has the ability to inspire someone else and our goal is to continue to share as many stories as we can."

The 2021-22 Inspiring Engineers speakers were:

Gil West,

mechanical engineering '84

West, chief operating officer at Cruise, kicked off the series on Nov. 18, 2021, with a talk on his extensive history in aviation. Beginning his career as an engineer at Boeing, West went on to turn Delta Air Lines into one of the most profitable airlines after the company nearly went bankrupt. Now at Cruise, he has returned to the ground to chart a path for driverless autonomous vehicles.

Steffanie Easter,

chemical engineering '85

Easter, vice president of strategy and planning for the defense and civilian sector at Science Applications International Corporation, spoke on Feb. 23 about her time with the Department of Defense with Griffin Lamb, assistant dean for development and college relations and executive director of the NC State Engineering Foundation. Easter worked in multiple leadership positions, such as the assistant secretary of the Army for Acquisition, Logistics and Technology, and as the executive director for the F-35 Joint Strike Fighter program.

Ben Burgess,

construction engineering and management '06

Burgess, president and CEO of Burgess Civil, LLC, joined Helene Lollis, chemical engineering '87 and president and CEO of Pathbuilders, on May 23 to talk about how being fired from his first job gave him the motivation to start his own civil contracting firm. Now after seven years, his company, based in Tampa, Florida, makes more than $40 million in annual revenue.

Tony Blevins,

industrial and systems engineering '89

Blevins, former vice president of procurement at Apple, Inc., spoke on Aug. 30 with Dean Louis Martin-Vega about his role in overseeing the production of iPods, iPhones, iPads and Apple Watches. Before joining Apple, Blevins worked for IBM in the areas of engineering, finance, production control and procurement and was the program director of IBM's development lab in Greenock, Scotland.

Stay tuned for additional Inspiring Engineers events during the upcoming year. Have a story you want to tell? Share it at **go.ncsu.edu/inspiringengineers**. ■

"The more you help people in your early days, it's a little bit like your deposit in a bank, which you can count on later."

RADHIKA VENKATRAMAN

Taking a seat **at the table**

RADHIKA VENKATRAMAN AT HER GRADUATION.

Radhika Venkatraman has always been willing to raise her hand to take on challenging opportunities — and to share what she has learned from her experiences with other female engineers.

Venkatraman, who graduated from NC State with master's degrees in computer-aided engineering and computer science in 1995 and 1996, has more than 20 years of experience in leadership roles in telecommunications and finance. While there have been times when she has found herself as one of a few women in the room, she has been able to navigate her career through building networks, learning to be comfortable with being uncomfortable and asking for a seat at the table.

"It's okay to be uncomfortable seeking out new things and attempting new things because if you don't take a chance at all, others are not going to take a chance on you," she said.

CREATING A NETWORK

Growing up in Mumbai, India, Venkatraman didn't know she wanted to be an engineer, but she had an early interest in science, math and puzzles. She is the first engineer in her family.

After graduating from the Indian Institute of Technology (IIT) Bombay with a degree in civil engineering, she wanted to continue her education

in graduate school. She knew others from her school had gone to NC State, and that it had a strong engineering program, so she applied. Her first year, she lived with a friend who she knew from IIT.

Her degree in computer-aided engineering branched off her civil engineering degree. Realizing that she needed to strengthen her coding skills, she took a few computer science courses, enjoyed them and decided to take on a second master's degree.

At NC State, in addition to finding her stride in her program, Venkatraman found a strong community. She made many lasting friendships, and most importantly, met her husband, Ayushman Gupta. He graduated from NC State with a master's degree in geotechnical and geoenvironmental engineering in 1995. The couple lived near each other and met through mutual friends.

"Our time at NC State — and I also got married while I was still at NC State — I think those are some of the best memories," she said.

Around the same time that she graduated from NC State, President Bill Clinton signed the Telecommunications Act of 1996, and people with computer science degrees and coding experience were in high demand. She took a job with Verizon and spent 20 years in telecommunications, becoming the company's senior vice president and chief information officer of network and technology, before moving on to the finance sector. In 2017, she took a managing director position at Credit Suisse. Currently, she serves on a number of boards while deciding on her next leadership role.

In the early days of her career, she worked hard to build relationships with everyone around her to help create a network and find mentors who would speak to the quality of her work. She also volunteered to take on projects that others wouldn't, and she became known as a go-to person around the office, arriving early to get to know her coworkers better.

"The more you help people in your early days, it's a little bit like your deposit in a bank, which you can count on later," she said. "I think building strong connections and networks with other people helped me navigate."

As she got to know people better and became better known by her coworkers, she received more opportunities to grow and learn about the business, and moved on to higher roles and more responsibilities.

RADHIKA VENKATRAMAN DURING GRADUATE SCHOOL IN THE MID-1990s.

'NEVER SETTLE, KEEP GOING'

While advancing in her own career, Venkatraman has continued to look out for the people coming up behind her. She made a visit to NC State on Sept. 24 to take part in the celebration of the Women in Engineering Program's 25th anniversary. Speaking with Anna Knight, director of development at the NC State Engineering Foundation, in a fireside-chat-style conversation about women empowerment, Venkatraman shared some of her experience and what she's learned with the next generation of engineers.

Some of her advice to current students and young alumni includes having a broad perspective and recognizing how an engineer's role fits in with an organization's larger mission; seeking out what they want and feel that they have earned; and to always be looking forward to the next thing.

"I think they just should not be settling for anything," she said. "I always tell people, 'Never settle, keep going.'"

Beyond her mentorship, Venkatraman has also given back to NC State engineers through a scholarship. She and Gupta created a scholarship endowment fund for the Women and Minority Engineering Programs, which will support students from underrepresented backgrounds who want to pursue engineering. She said that both she and her husband were fortunate to receive a premium education in India without having to pay a lot in tuition, and thanks to graduate fellowships, they were able to do the same at NC State.

"I feel like a lot of times it is about the opportunity, right? I mean, there are many, many very talented people who do not always have the means and affordability to pursue whatever their dream might be, or whatever might be their calling," she said. "We have also been very fortunate to be able to do well, so it is our way to do something small for others who come after us." ■

NC STATE Engineering

ANNUAL GIVING

ENGINEERING FOUNDATION

Annual gifts to the College of Engineering keep us moving forward, especially as we grow our student body and faculty to meet North Carolina's increasing needs for engineers and computer scientists.

If you have already made your 2022 gift to the College of Engineering, please accept our sincere thanks. If you have questions or would like to learn more about your giving options, contact Angela Martin at 919.513.1714 or anstalli@ncsu.edu.

WAYS TO GIVE

- Make your gift online at **go.ncsu.edu/engineering-giving**
- Use the return envelope included in this magazine to pay by check
- Make a gift over the phone by calling **919.515.7458**

GIVE BACK TO YOUR DEPARTMENT

Alumni can give back directly to their department with a gift to its department enhancement fund. These funds help our 12 engineering departments meet immediate needs and plan for future research and educational endeavors, including scholarships.

SUPPORT THE ENGINEERING LEADERSHIP FUND

Gifts made to the Engineering Leadership Fund are used at the discretion of the dean and support College-level initiatives.

> "People would ask what I'd do with the money, and I'd say I was saving for college."
>
> **KENNETH A. STEVENS**

Working hard to **give back**

Growing up in Durham, NC, Kenneth A. Stevens, industrial engineering '72, developed a strong work ethic from an early age.

His mother, Amelia Stevens, encouraged him to do well in school. His father, Boone Stevens, showed him the value of working hard to provide for his family through long hours — up to 80 per week — running his service station.

"When it came to work ethic, he gave his three children a wonderful role model," Stevens said. "He had to do it to survive, and he did it with a smile on his face most of the time."

Stevens carried his parents' guidance with him as he became the first in his family to attend college. A lifetime of hard work put him in a position to give back, and he established a planned gift for NC State to support engineering students. Preference is given to students who are studying industrial and systems engineering, are Caldwell Fellows and are from Durham County or Guilford County.

"Someone who has aspiration to improve themselves through education, I would like to have it so that someone can do that either more affordably or maybe even for free if they're able to buckle down … and do the work," he said.

While at Northern High School in Durham, where Stevens took math and science courses with teachers who helped him feel prepared for college, he worked at the local A&P grocery store starting at $1.26 an hour, a penny over minimum wage.

"People would ask what I'd do with the money, and I'd say I was saving for college," he said.

His Sunday school teacher Melvin Christy, an NC State chemical engineering alumnus, asked Stevens about his goals, which led him to his interest in industrial engineering and how it combined business and technical skills.

At NC State, Stevens became editor of *The Southern Engineer*, the magazine of the Engineers' Council of the College of Engineering; vice regent of Theta Tau, the engineering professional fraternity; and president of NC State's chapter of Circle K International — all while continuing to work at A&P.

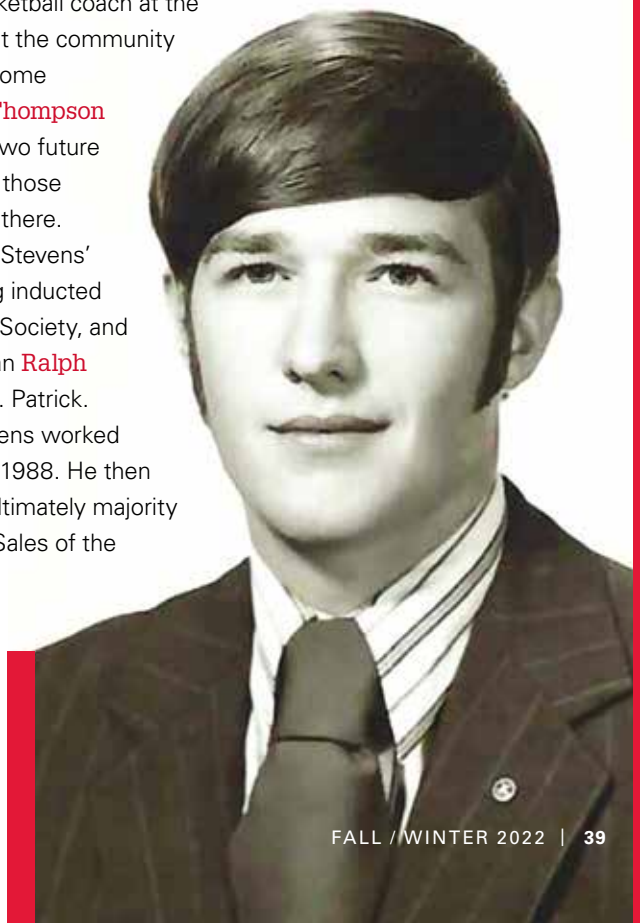
He spent a lot of time in southeastern Raleigh, NC, where he did after-school tutoring and sports, creek cleanups and other community service. NC State's Circle K chapter won best in the world his junior and senior years. His senior year, Circle K asked Norm Sloan, the NC State basketball coach at the time, if players could visit the community recreation center to do some basketball drills. David Thompson and Tommy Burleson, two future NBA stars, were among those who spent an afternoon there.

Special honors during Stevens' senior year include being inducted into the Blue Key Honor Society, and being recognized by Dean Ralph Fadum as a Knight of St. Patrick.

After graduation, Stevens worked for Trane Company until 1988. He then became president and ultimately majority owner of Heat Transfer Sales of the Carolinas until 2007. In retirement, he has continued to give back to NC State and his community in Greensboro, NC. ■

ABOVE, STEVENS WITH CALDWELL FELLOWS LUKE CAPLICE AND ADAM MCINTOSH.

BELOW, STEVENS DURING HIS SENIOR YEAR.



"We want students to look at the Foundation board and see themselves or at least people who look like them."

SUZANNE GORDON

SUZANNE GORDON

GAYLE LANIER

From the board NCSEF Board of Directors

GET INVOLVED

To learn more about board service for the College of Engineering or to nominate someone, contact Griffin Lamb at grlamb@ncsu.edu.

In 1921, Lucille Thomson became the first woman to enroll at NC State, taking classes in electrical engineering. It's debated whether or not she graduated in 1923. Twenty years after Thomson's enrollment, Katharine Stinson became the first confirmed woman to receive an NC State engineering degree, a B.S. in mechanical engineering, aeronautical option, in 1941.

Over the last century, NC State Engineering's demographics have changed, with more women and people from diverse racial backgrounds enrolling in the College, joining the faculty and taking on leadership roles. The two most recent incoming engineering classes are each about 33 percent women, which is a new milestone, and the College of Engineering's Women in Engineering Program celebrated its 25th anniversary in 2022. This year also marks the 50th anniversary of Title IX, which helped women and girls advance in a number of areas, including science, technology, engineering and mathematics (STEM) fields.

The NC State Engineering Foundation (NCSEF) Board of Directors has followed suit, taking deliberate steps to invite more women and minorities to serve on the board. Today, nine of the 28 members of the NCSEF board are women, and women chair four of its seven committees. Like everyone who serves on the NCSEF board, these women are highly accomplished in their careers and dedicated to helping NC State be the best it can be.

"I'm very proud of the board," said Board President Deborah Young, the board's first Black president and one of its first female members. "We were willing to be different and to include others."

'DIVERSITY OF THOUGHT'

NCSEF was established in 1944 to aid and promote, by financial assistance and otherwise, engineering education and research at NC State. Today it is led by Young and Vice President Scott Stabler, B.S. mechanical engineering '82. The board works with the dean and the advancement team to help advise the College's growth and outreach, through efforts that include developing Centennial Campus, starting the Young Alumni Advisory Board and most recently, supporting the completion of Fitts-Woolard Hall.

In 1994, Beverly McKim, B.S. civil engineering '80, was the first woman to join the NCSEF board, where she helped guide the College through a period of growth and the early stages of Centennial Campus. She served through 1998.

McKim never felt out of place as the only woman on the board, and she had been encouraged to pursue engineering from a young age. "All of the board


BEVERLY MCKIM


BARBARA MULKEY


DEBORAH YOUNG

takes action to grow women leadership

members were very welcoming," she said. "It was an inclusive environment, and I felt like a part of the team."

Several more women joined in the late 1990s: Gayle Lanier, B.S. industrial engineering '82; Barbara Mulkey, B.S civil engineering '77 and MCE in structural engineering '84; and Young, B.S. civil engineering '77.

"I was very used to being 'the only woman in the meeting,' the 'first woman in this position,' etc., because of the field I had chosen," Mulkey said. "What I recall of that experience was that when I spoke, I was listened to; however, I found myself battling inside with feeling like I probably didn't have as much experience and thus insights to offer, as it seemed that almost everyone in the room was a good bit older than I was."

During their tenure, the board improved its philanthropy strategies, established scholarships and implemented eight-year term limits, with the option for members to return. The last accomplishment was particularly important to diversifying and growing the board.

"By establishing these term limits, we were able to begin to change the face of the board — still get the same input, but have diversity of thought, diversity of background, and more women to participate on the board," Lanier said.

In 2018, Suzanne Gordon, B.S. computer science and mathematics '75, became the first female president of the board. She joined in 2010, after serving on the NC State Board of Trustees, which was also making efforts to bring on more women.

"We want students to look at the Foundation board and see themselves or at least people who look like them," she said. "So, when you bring in diversity, you bring in different ideas and perspectives, that leads to better problem solving and promotes creativity."

During her first term on the board, Young worked with Lanier to lead the way in establishing term limits and new guidelines for inviting potential board members. Young, chair of the Nominations, Orientation and Recognition Committee; Alvin Sumter, vice chair and B.S. industrial and systems engineering '87; and their team evaluated the members' demographics — when they graduated, their discipline, ethnicity, residence and more — and developed a system to attract and recruit more diverse candidates.

Now, the board is more reflective of NC State Engineering's growing and more diverse student body, which is important as the board supports the College.

"We are more diverse in our thinking," Young said. "We don't have the same people, same professions. When you have that diversity, it really helps you become more inclusive." ■

Engineering Foundation welcomes two new employees

The NC State Engineering Foundation welcomed Josh Bowman and Lucas Carpenter this fall as the College's newest engineering advancement team staff members.

"We are excited to welcome Josh and Lucas to our team," said Griffin Lamb, assistant dean for development and college relations and executive director of the NC State Engineering Foundation. "Their skills and talents will help our team reach our fundraising goals for scholarships, professorships and more in support of the College of Engineering and its exceptional students, faculty members and research."

JOSH BOWMAN AND FAMILY.

JOSH BOWMAN

Bowman joined the College's advancement team in October 2022 as a senior director of development, bringing more than a decade of experience working within higher education fundraising. He is the major gifts contact for the Department of Chemical and Biomolecular Engineering.

For more than 14 years, Bowman has raised millions of dollars for post-secondary, arts, environmental and hunger-relief organizations before transitioning into consulting. Bowman went on to serve as fundraising director for the Canadian Association of Physicians for the Environment and then managed the call center for the Better Planet Project campaign by the University of Guelph. He continued to work within higher education at the University of Waterloo as a senior development officer and then as the associate director of development at Toronto Metropolitan University. Bowman continues to be involved within the fundraising community, having written for publications including *Charity Info*, *101 Fundraising*, *Forbes*, *Huffington Post* and the *Journal of Education Advancement & Marketing*.

LUCAS CARPENTER AND FAMILY.

LUCAS CARPENTER

Carpenter joined the College's advancement team in August 2022 as a senior director of development. He is the major gifts contact for the Department of Mechanical and Aerospace Engineering.

Carpenter's journey with NC State began when he enrolled as a student in 2007. In addition to earning his B.S. in sports management in 2011, he was a four-year letter winner and captain of the men's soccer team. Following graduation, he earned his M.S. in sport business from New York University. For the past seven years, Carpenter has worked for the Wolfpack Club, beginning as a field representative until being promoted to associate director of major gifts. Through this position, he has raised more than $5 million in philanthropic gifts by leading the major gifts team in pipeline and donor strategy while also implementing a sport-specific giving program. ■

YOUNG ALUMNI
BOARD ADDS 10 NEW MEMBERS

Ten College of Engineering (COE) graduates joined the 2022-23 Young Alumni Advisory Board (YAAB), bringing the group to 30 members.

Formed in 2018 by the NC State Engineering Foundation, YAAB aims to encourage support from the growing population of COE young alumni. The College defines "young alumni" as students who are 0-15 years post-graduation from their last degree earned. Currently, 39.5 percent, or 27,706, of graduates are young alumni.

New members are excited to give back to the College by volunteering and connecting with current students.

"Recognizing the value that NC State and the [COE] provides not only to our profession but to our community, I have always wanted to give back to my alma mater," said Charlie Townsend, civil engineering '15 and MBA '21. The Townsend family has a deep connection to NC State Engineering. His mother, Pamela Townsend, who has bachelor's and master's degrees in civil engineering from NC State, serves on the Engineering Foundation's Board of Directors. She was named a Distinguished Engineering Alumna in 2016.

"I joined YAAB to renew my connection with COE, to build new relationships with young alumni board members, and to help fellow Wolfpack engineers find ways to stay connected with NC State as young alumni," said Tyler Ellington, mechanical engineering '15, '19.

Members of YAAB are drawn from various engineering disciplines, with new board members representing seven different departments.

While young engineers, they have all made significant strides in their careers. Rachel Kennedy, industrial and systems engineering '17, has worked her way up from leadership development programs to leadership roles, while Christopher Bailey, mechanical engineering '16, now manages million-dollar contracts with large government agencies. ■

New members include

CHRISTOPHER BAILEY, mechanical engineering '16, project engineer at Leonardo DRS.

MEREDITH BIECHELE, mechanical engineering '18, advanced R&D product engineer at John Deere.

PATRICK CARROLL, electrical and computer engineering '12, camera architect at Apple Inc.

DARSHAN "DASH" DIVAKARAN, geospatial information science and technology '16, senior manager for Strategic Innovation and Partnerships for AFWERX.

TYLER ELLINGTON, mechanical engineering '15, '19, electromechanical systems engineer III at LORD Corporation.

CONOR KENNEDY, civil engineering '17, project manager at Brasfield and Gorrie.

RACHEL KENNEDY, industrial and systems engineering '17, quality manager at Xylem Inc.

ZAC LENTZ, biological engineering '13 and biological and agricultural engineering '18, civil engineer at LaBella Associates.

MICHAEL SANDERSON, chemical engineering '17, manufacturing automation engineer at Pfizer.

CHARLIE TOWNSEND, civil engineering '15 and MBA '21, project manager at VHB.


CHRISTOPHER BAILEY


MEREDITH BIECHELE


PATRICK CARROLL


DARSHAN DIVAKARAN


TYLER ELLINGTON


CONOR KENNEDY


RACHEL KENNEDY


ZAC LENTZ

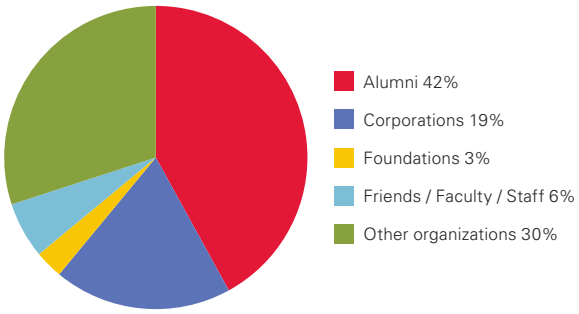

MICHAEL SANDERSON


CHARLIE TOWNSEND

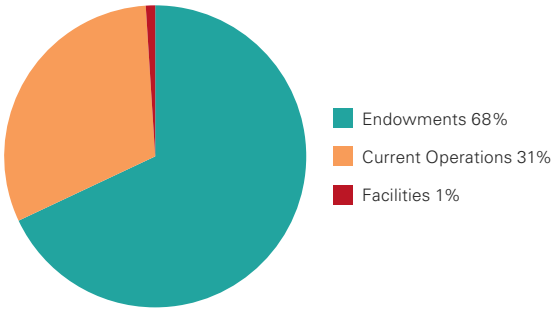
Foundation **Year in Review**

The NC State Engineering Foundation, Inc., established in 1944, is the fundraising arm of the College of Engineering. For more information on the Foundation, including financial statements, audits and tax identification number, please visit ***foundationsaccounting.ofa.ncsu.edu/foundations/nc-state-engineering-foundation-inc.***

GIFTS AND NEW COMMITMENTS BY GIFT SOURCE, FISCAL YEAR 2021-22



GIFTS AND NEW COMMITMENTS BY GIFT USE, FISCAL YEAR 2021-22



The **NC State Engineering Foundation, Inc.** led a successful fundraising year for the College of Engineering following the close of the Think and Do the Extraordinary Campaign in December 2021.

Fundraising totals to the College were **$22,965,010** during the 2021-22 budget year. The College has invested in projects like Day of Giving, raising **$1.5 million** from **1,443** gifts in March. These donations are critical to the growth and development of the College's programs — including the Women and Minority Engineering Programs — that round out and enhance students' experiences while at NC State.

Endowments to the College generally fall into one of three categories: scholarships, named professorships and fellowships. There are now **61** permanently endowed named professorships and more than **$78 million** in total endowed scholarships. Total endowment support for the College is **$230.1 million** as of June 30, 2022, including directly owned assets as well as endowments held outside of the Engineering Foundation.

The annual giving program raised a total of **$583,184.01** for the College of Engineering Leadership Fund. The Dean's Circle, the College's leadership annual giving society, has **510** members.

Two new staff members joined the College's advancement team in 2022 *(more on page 42)*, and the team has plans to add more members in the future. ■

NC STATE ENGINEERING FOUNDATION, INC.

Board of Directors

Deborah B. Young, *President*, CE '77
Scott Stabler, *Vice President*, MAE '82
Bruce Baldwin, ME '92
Bhavana Bartholf, IMSEI '00
Marcus Belvin, CSC '01
Michael Broaders
Robert (Bob) Brooks, EO '69
Linda Butler, NE '86
Wes Covell, EE '84
Mike Creed, CE '73, '84
Casey Dean, EE '67
David Dove, AE '69
Steffanie Easter, CHE '85
Basil Hassan, AE '88, '90, '93
Rashida Hodge, ISE '02, '03
Zachary Horton, ISE '23
Seneca Jacobs, CE '99
Rob Loftis, EE '02
Helene Lollis, CHE '87
Samuel (Sam) McCachern, CE '85
Tiffany Chin Moore, IE '01
Deval Parikh, CHE '94, EC '95
V. Nelson Peeler, Jr., EE '88
Andrew Pita, EE '08, '10
Jennifer Rhatigan, ME '87
Jim Stewart, ME '70
Pam Townsend, CE '84, '87
Hannibal (Hans) Warren, Jr., CE '84
David Whitley, EE '92
Mark Wyatt, CSC '80

College Advancement Staff

Griffin Lamb
Assistant Dean for Development and College Relations • Executive Director of the NC State Engineering Foundation, Inc.
grlamb@ncsu.edu • 919.515.9956

Michael Auchter
Director of Development / Major gift contact for the Department of Civil, Construction, and Environmental Engineering
mrauchte@ncsu.edu • 919.515.6243

Josh Bowman
Senior Director of Development / Major gift contact for the Department of Chemical and Biomolecular Engineering
jcbowma7@ncsu.edu • 984.234.8519

Carissa S. Burroughs
Lead Event and Alumni Relations Coordinator
csburrou@ncsu.edu • 919.515.9975

Lucas Carpenter
Senior Director of Development / Major gift contact for the Department of Mechanical and Aerospace Engineering
lbcarpen@ncsu.edu • 919.616.5098

Allison Gorrell
Business Services Coordinator • argorrel@ncsu.edu • 919.515.9974

Anna Knight
Director of Development / Major gift contact for the Department of Electrical and Computer Engineering and the Department of Nuclear Engineering • anna_knight@ncsu.edu • 919.513.7604

Hannah Kunkel
Assistant Director of Development, Alumni Engagement and Stewardship • heallen3@ncsu.edu • 919.515.7458

Savannah Lammers
Assistant Director, Leadership Annual Giving for the College of Engineering • slammer@ncsu.edu • 919.515.0522

Angela S. Martin
Associate Director of Annual Giving and Prospect Development Contact for the Dean's Circle and Annual Giving
anstalli@ncsu.edu • 919.513.1714

Vanessa May
Administrative Support Associate
vsmay@ncsu.edu • 919.515.7458

Sara Seltzer
Director of Development / Major gift contact for the Department of Computer Science and the Department of Materials Science and Engineering • skseltze@ncsu.edu • 919.515.3973

Wanda Urbanska
Director of Development / Major gift contact for the Edward P. Fitts Department of Industrial and Systems Engineering
wmurbans@ncsu.edu • 919.515.9976

Department Representatives

Russ O'Dell
Department of Chemical and Biomolecular Engineering
russ_odell@ncsu.edu • 919.513.2071

Laura Schranz
UNC / NC State Joint Department of Biomedical Engineering
lschran@ncsu.edu • 919.513.7937

Kenneth M. Tate
Department of Computer Science
tate@csc.ncsu.edu • 919.513.4292

ALUMNA ABBY LAMPE MAKES HISTORY AS **THE WORLD CHAMPION OF CHEESE ROLLING**

In North Carolina, NC State students and alumni recognize the name Lampe from a street on main campus or as the last name of a former engineering dean. Around the world, the name is now known for an unusual event: the Cooper's Hill Cheese-Rolling and Wake.

Alumna Abby Lampe, the great-grandaughter of former dean J. Harold Lampe, is believed to be the first American woman to ever win this event. After graduating with her degree in industrial and systems engineering in May 2022, she celebrated with a summer in Europe. She traveled widely around the continent, visiting Portugal, Greece, Sweden, Scotland, France and England. Like many people her age, she was excited to see Billie Eilish and Harry Styles in concert while in Europe, but the cheese rolling was a major priority for her.

For those unfamiliar, cheese rolling involves chasing a round of cheese down a steep hill either by running, rolling or falling after it. Lampe learned about the competition through social media and YouTube videos.

"I wanted to compete in this event because I think it's really funny, very interesting and unique," Lampe said. "It's like no other sporting event."

When the morning of the competition dawned, she was ready in an NC State sweatshirt.

"I was confident, and I was so ready to get down to the bottom of the hill," she said. "I don't think I was fearful at all. I really wanted to win by any means necessary, so if that meant breaking something, if that meant spraining something to get down to the bottom of the hill first, I was going to do it."

When the race started and Lampe began rolling, she was disoriented. While she felt unsure of where she was on the hill, she had one concern: her teeth.

"I had braces from my freshman year to my senior year of high school, so I wanted to avoid any additional time with the orthodontist," she said. "I love my orthodontist, but I did not want to have any more dental work done."

Although she did not know the location of her competitors, she had taken quite a lead in coming down the hill. Despite someone's last-minute attempt to pass her, she was the first to the bottom.

After the race, Lampe stood covered in mud, her collegiate sweatshirt a little worse for the wear.

"It was everything I could ever dream for," she said. ■

NC STATE Engineering

Campus Box 7901
Raleigh, NC 27695-7901
www.engr.ncsu.edu

@ncstateengr
@NCStateEngr
NC State Engineering
NC State College of Engineering

You're inspiring

Share your story with the College of Engineering for the Inspiring Engineers series.

The Inspiring Engineers series shares diverse stories, career paths and experiences that were all in some way shaped by NC State Engineering.

All of us have a story to tell, and you can share yours by filling out the Inspiring Engineers form at go.ncsu.edu/inspiringengineers or using the QR code.

Your accomplishments make the College stronger, and we are proud of our alumni who are making a difference in their communities. Your stories inspire our current students and future engineers, who are already making an impact on campus and beyond.

We're also looking forward to introducing you to a few of NC State Engineering's inspiring stories through regular speaking events on Zoom.

For questions about the event, contact Hannah Kunkel at heallen3@ncsu.edu.