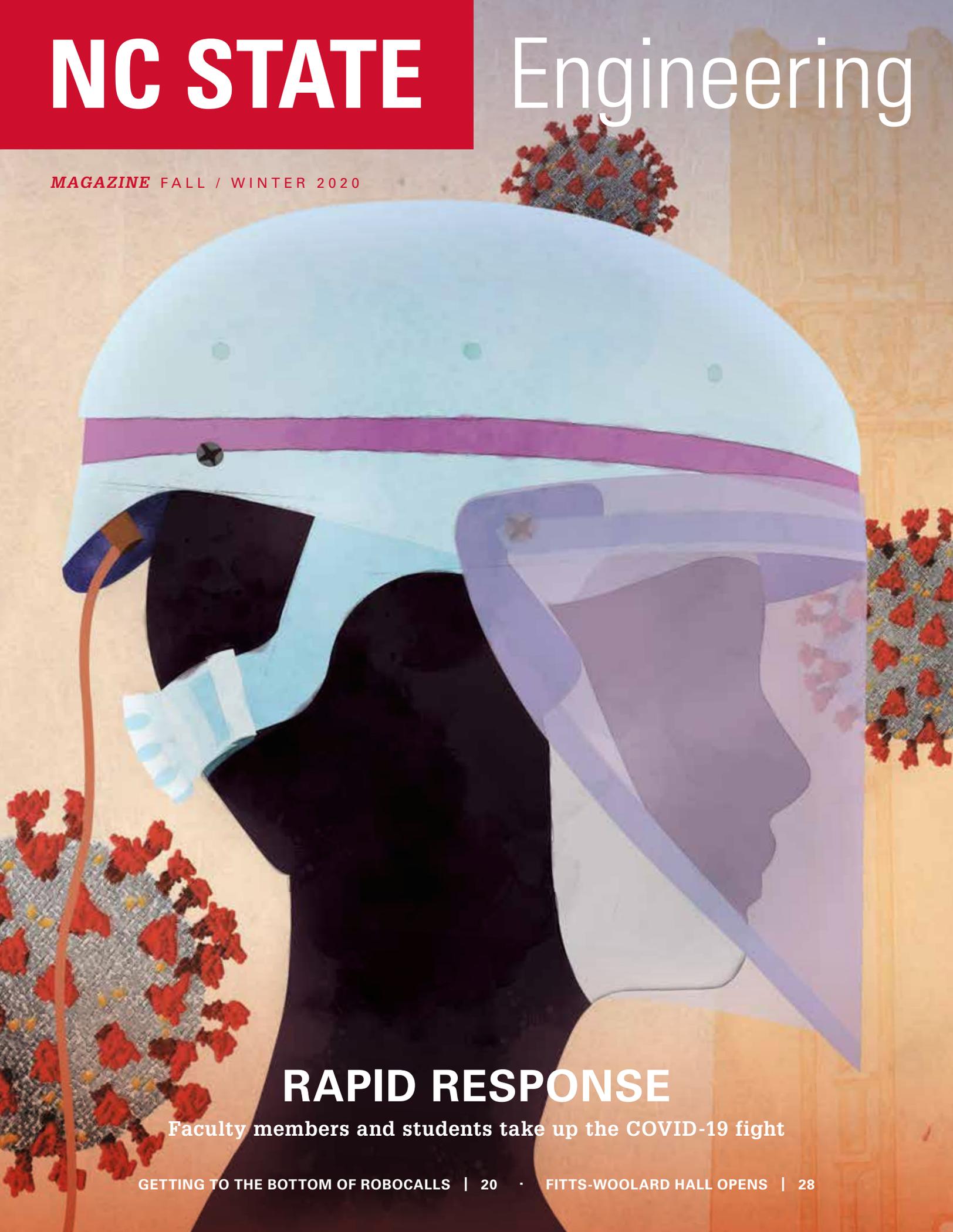


MAGAZINE FALL / WINTER 2020



RAPID RESPONSE

Faculty members and students take up the COVID-19 fight

ASHEVILLE'S MINERALS RESEARCH LABORATORY REMAINS ROCK SOLID



The College of Engineering's footprint in North Carolina extends far beyond NC State's Raleigh campus, with site-based undergraduate programs with partner institutions from the mountains to the sea and an industrial extension program that operates in all 100 counties.

In Asheville, the College has helped further North Carolina's mining and mineral industry for nearly 75 years.

The Minerals Research Laboratory (MRL) was established in Asheville in 1946 as a joint venture between the state of North Carolina and the

Tennessee Valley Authority (TVA). TVA eventually discontinued its support of the laboratory, and in 1954 the operation was transferred to the then-School of Engineering. The MRL is still a part of the College of Engineering; since 2004 it has been part of Industry Expansion Solutions, the College's extension service.

Over the years, engineers and geologists employed by the lab have worked to examine and evaluate mineral samples for commercial potential. That includes helping to

identify viable ore deposits across the state that have led to North Carolina's rise to prominence as a world leader in industrial mineral production. Part of the MRL's mission includes research into how mining waste products can be reused to mitigate environmental impacts.

In this archive photo, taken in April 1960, an employee of the lab oversees a spiral concentration process, in which minerals are separated according to density and particle size.

The lab's most prominent feature is a pilot plant, the only one of its kind in the United States. The facility allows engineers to determine the cost and specifications of assembling and running a full-scale plant to exploit a particular mineral resource.

It's a vital tool for a mineral industry with more than 700 active permitted mines in the state, annual sales in excess of \$800 million and an employee base of 100,000 people. North Carolina is the only producer of andalusite and pyrophyllite, and a major producer of common clay, feldspar, mica and phosphate rock. The state also produces construction and industrial sand/gravel and crushed stone, according to the U.S. Geological Survey.

Over decades, the MRL has shifted from being largely state funded to today providing the majority of its research efforts through contractual agreements with client corporations.

In 2008, the lab began a partnership with nearby UNC-Asheville to offer a mineral processing curriculum, part of which is delivered at the MRL's facility on Coxe Avenue in Asheville's South Slope neighborhood. The laboratory also offers free educational materials, such as rock kits and posters, to schools that request them.

The lab has been led since 2012 by Dr. Robert Mensah-Biney, who has more than 35 years of experience in mineral and chemical industry research and development. ■



RASHIDA HODGE

Alumna named to *Fortune* 40 under 40

The College of Engineering has known that **Rashida Hodge** is a rising star. Now, the rest of the country is catching on. Hodge, an alumna of the Edward P. Fitts Department of Industrial and Systems Engineering (ISE) and executive at IBM, was recently named to *Fortune* magazine's 40 Under 40 Technology list.

Hodge has held several leadership positions at IBM over a nearly-18-year career, and is now a vice president overseeing integration of AI and Cloud for key clients in North America.

Hodge earned B.S. and M.S. degrees in industrial engineering from NC State and an executive MBA from Duke University's Fuqua School of Business. She is motivated to further the mission of the university that helped launch her career and inspire young female and African-American engineers.

She has established the Real Hope for NextGen Engineers scholarship in the College and has donated to help fund the construction of Fitts-Woolard Hall, the newest engineering building on Centennial Campus. The native of the U.S. Virgin Islands named a foyer in the new building in honor of her mother, Karen Hodge.

Hodge, who is the one of the youngest alumni to endow a scholarship for the College, said in an earlier story in *NC State Engineering* magazine that, "I wanted to show women engineers and African-American engineers that they have the skill set to have that earning potential to make that kind of contribution."

Hodge is a member of the NC State Engineering Foundation Board of Directors and the ISE Advisory Board.

She also sits on the boards of Misty Robotics and Girls, Inc. and is a founding partner of How Women Invest, a venture firm that invests in female-led companies. ■

FROM THE DEAN

NC STATE Engineering

Welcome to the fall
2020 issue of *NC
State Engineering*
magazine.

Much has happened since I shared my thoughts with you in late March in our spring issue. Then, all of us on campus were hopeful that we would return to a normal fall semester, with first-year students finding their way around and our classrooms and laboratories humming with the kinds of interactions that are such a core part of what makes an academic setting so wonderful.

Unfortunately, and despite the best efforts of our University leadership and community, we continue to find our beautiful campus lacking the in-person activity we all would have desired to have seen by this time. NC State spent the summer preparing for a safe reopening of classrooms and dormitories in August, but after two weeks and a significant amount of COVID-19 spread among the student body, Chancellor Randy Woodson made the difficult, albeit necessary, decision to move undergraduate classes online and have most students who were living on campus leave.

The good news, however, is that despite these difficult circumstances, our COE faculty and staff have risen to the challenge and have been able to provide our students with the educational and research continuity needed to assure their academic progression and success. Our faculty continues to excel at online teaching and most of our research laboratories are operational. The University has also announced plans to bring more students back for in-person instruction during the spring semester if possible.

We received more good news in July, when our College and University took possession of Fitts-Woolard Hall. The opening of our newest state-of-the-art engineering building represents a major milestone toward unifying the College on Centennial Campus. As you read more about the new building in these pages, please consider helping us close the \$12M fundraising gap we still have for this vital project.

The last few months have also seen a nationwide reckoning regarding the social and systemic inequities that members of our African-American and minority communities continue to face on a daily basis in our nation. The killings of George Floyd, Breonna Taylor and others have sparked protests and much-needed conversations and actions around this topic. These events have inspired us to work even harder to ensure that your College is a place that is welcoming to all and we will be sharing some of our efforts to enhance diversity, equity and inclusion in this issue as well.

Finally, it is important to note that the unprecedented challenges created by the COVID-19 pandemic and our social inequities have also brought out the very best in our faculty, staff and students. I have never been prouder of their dedication and commitment nor have I ever been prouder to be a part of NC State and the College of Engineering. I am confident that the research, teaching and service work that is at the core of our mission, which continues, albeit in a different way, will return at full steam once we know that it is safe for our campus community to reopen.

Take care, stay safe and thank you all for your continued support especially during these difficult times. I look forward to seeing you again on campus as soon as possible and encourage you to stay in touch with us until then.

Sincerely,

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

DEAN

Dr. Louis A. Martin-Vega

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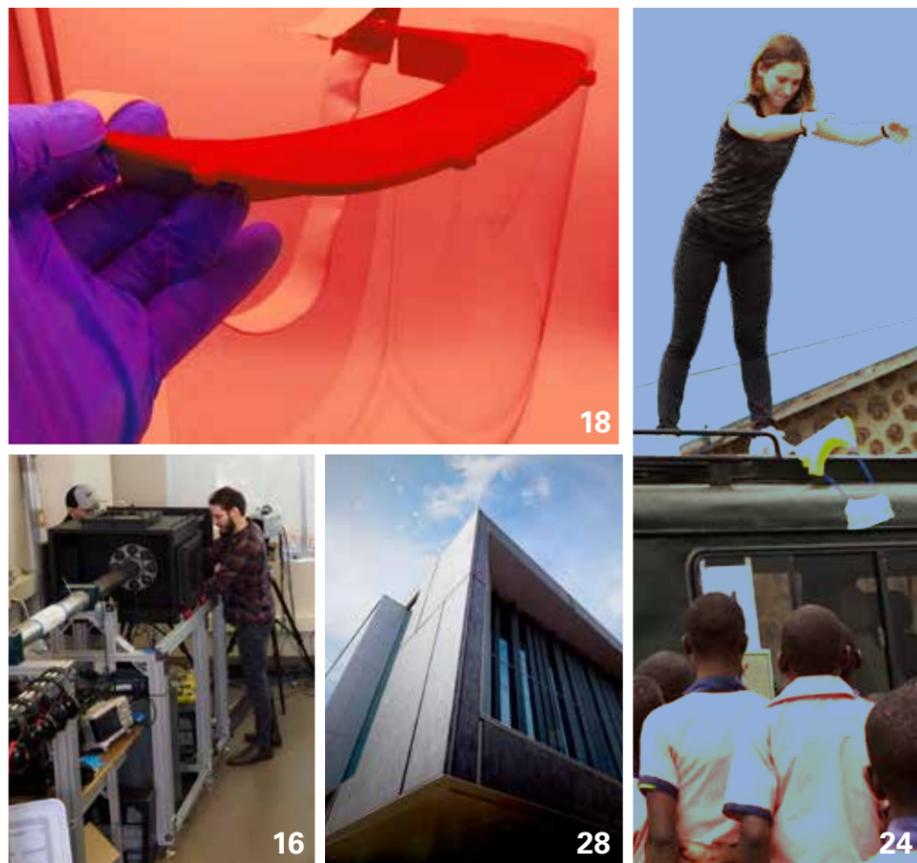
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Researchers in the Department of Computer Science monitored thousands of phone lines to find out who is behind robocalls and begin work on how to stop them.

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Students from the College spent their spring break in Rwanda, bringing STEM education to rural primary schools and making connections with the people.

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Fitts-Woolard Hall, the newest engineering building on Centennial Campus, opened this summer. Take a look inside and learn about available naming opportunities that allow alumni to leave a long-term legacy for the College.



ON THE COVER

Faculty members and students in the College are producing protective equipment and hand sanitizer and beginning research that will help navigate the long-term fight against COVID-19. Read more on page 18.

Q&A

QUESTIONS FOR **DR. JAMES LESTER**

Dr. James Lester is a Distinguished University Professor in the Department of Computer Science and director of NC State's Center for Educational Informatics (CEI). This year's pandemic has increased demand for the kind of educational technology tools that are CEI's specialty.

Tell us a little bit about CEI.

CEI creates innovative next-generation learning technologies. With a focus on technologies that leverage artificial intelligence, we design, develop and field learning software for a wide variety of student populations ranging from elementary school to college. Much of this work centers on intelligent learning software for K-12 STEM education. Our faculty conducts research on intelligent game-based learning environments, multimodal learning analytics, intelligent tutoring systems, collaborative learning environments and natural language technologies for education.

Does CEI work beyond the boundaries of K-12?

We also conduct research on learning technologies to support training for the defense and first-responder communities, as well as healthcare. For example, we're working on a project for the U.S. Army Futures Command to investigate technologies to support team training, including using natural language processing to assess team communication and performance. We're also working with the Washington, D.C. Metro to investigate virtual reality-based training environments with intelligent user interfaces to support firefighters. In healthcare, with the support of the National Science Foundation and the National Institutes of Health, we're partnering with the UC San Francisco medical school to

create health behavior change environments for adolescents.

This COVID-19 pandemic has shone a spotlight on virtual learning tools like never before. What do they do well?

Traditional educational software can work for some students in some subject matters to some degree. For example, there are some success stories for introductory literacy and math — but certainly not across the board.

And what parts of learning in a classroom can they not provide?

Traditional educational software doesn't "understand" students. As a result it isn't able to engage in the kind of give-and-take that teachers do or that outstanding tutors can in one-on-one learning. It doesn't know what motivates particular learners, and it doesn't know how to provide problem-solving advice or emotional support that is tailored to individual students, particularly for underperforming students in adverse circumstances, like we're seeing today.

How can parents help?

Parents' in-depth involvement in their children's education has always been a major contributor to successful learning outcomes, and the pandemic is highlighting its importance. We see a future in which AI-augmented learning technologies not only help students learn, but help parents help their children learn.

Have any of the technologies developed by CEI researchers been utilized by educators during the pandemic?

CEI currently is conducting a host of federally supported projects on AI-augmented learning technologies for K-12 education. None of these projects were originally centered on home use — they were all for classrooms and museums. For example, we're working on cognitive assistants for teachers, but now we need these cognitive assistants to support teachers whose students are working remotely. With COVID-19 developments, we've pivoted and are excited to pilot these technologies in home use. Stay tuned! ■





College of Engineering enhances its commitment to diversity, equity and inclusion

JUST AS MUCH AS the COVID-19 pandemic, protests over the killings of George Floyd, Breonna Taylor and other African Americans at the hands of police officers and the national reckoning over issues of race that have followed have been the story of 2020.

Leaders across the University and within the College of Engineering spoke out in late May, after Floyd’s death on May 25 in Minneapolis, Minn., led to protests around the country, including in downtown Raleigh, NC, just a couple of miles from the NC State campus.

Chancellor **Randy Woodson**, in a statement, condemned acts of racism, discrimination and violence and reaffirmed the University’s “responsibility to educate ourselves and those who pass through our doors to overcome ignorance, unite against intolerance, model inclusivity and advance the dignity and power of diversity.”

In a “personal statement” distributed in early June, Engineering Dean **Dr. Louis Martin-Vega** urged the entire College of Engineering community to “make it our highest priority

“I urge every person in our College ... to make it our highest priority to work as hard as we can to better understand the unfair realities and bias that are part of the daily life and experiences of our black and underrepresented minority brothers and sisters.”

DEAN LOUIS MARTIN-VEGA

to work as hard as we can to better understand the unfair realities and bias that are part of the daily life and experiences of our black and underrepresented minority brothers and sisters.”

Martin-Vega called on the College’s department and unit heads to “commit themselves in even greater and more purposeful ways

to the sustained recruitment and retention of a much more diverse faculty and staff.” He asked the College’s leadership to “not just communicate more ... but to listen more to their underrepresented and particularly African-American faculty and staff.”

NEXT STEPS AT NC STATE

Over the summer, the University assembled an interdisciplinary team to evaluate NC State’s policies, examine every opportunity to strengthen them against racism

and discriminatory behavior, and modify them, where allowed by law, to bolster its commitment to diversity, equity and inclusion. Other steps included increasing NC State’s focus on fundraising for scholarships and programs that support the recruitment, access, success and well-being of students of color; providing support to NC State’s cultural centers; and enriching other campus programs that enhance the educational experience for students from underrepresented groups.

Beginning with the 2020-21 fiscal year, the University has incorporated diversity, equity and inclusion learning development requirements in all University staff work plans.

In June, the NC State Board of Trustees voted unanimously to remove the name Daniels Hall from one of the oldest engineering buildings on campus. The building had been named for Josephus Daniels, a Raleigh newspaper editor who, though a supporter of NC State, had strong ties to white supremacy and played a leading role in the 1898 Wilmington coup, also known as the Wilmington massacre.

Updates on NC State’s efforts can be found in the Diversity Portal at www.ncsu.edu/diversity.

COLLEGE COMMITMENTS

The College has long been committed to providing an open, inclusive research and learning environment that is welcoming to all.

Since taking over as dean in 2006, Martin-Vega has been committed to building a more diverse student population as well as recruiting more women and minority faculty and staff members and elevating them to leadership positions within the College and within research centers led by its departments. While these efforts have resulted in significant



TOP, LEFT TO RIGHT, ANGELITHA DANIEL, DR. DOUGLAS REEVES. BOTTOM, LEFT TO RIGHT, DR. JOEL DUCOSTE, DR. CHRISTINE GRANT.

increases in the number of women faculty members and students and greater diversity in our staff population, the College continues to work hard to increase the number of African-American and other underrepresented minority faculty members and students in its quest to assure that the College will achieve its potential as a premier college of engineering. Examples of efforts with these objectives in mind include:

- Led by **Angelitha Daniel**, the College's Minority Engineering Programs (MEP) work to ensure a diverse engineering student body by providing community building and engagement, academic support and professional development through several activities to ensure an inclusive environment for students. MEP programs include an overnight recruiting weekend for admitted students in the spring and a Summer Transition Program that gives incoming first-year students a leg up on their academics and a chance to form bonds with others in the program. Throughout their undergrad years, students in MEP have access to a supportive community on campus and resources to help them be successful.

"We have the responsibility to educate ourselves and those who pass through our doors to overcome ignorance, unite against intolerance, model inclusivity and advance the dignity and power of diversity."

CHANCELLOR RANDY WOODSON

- In addition to her leadership of the MEP program, Angelitha Daniel has also been named a special advisor to the dean for faculty and student diversity, equity and inclusion. Her advisory role also includes leading the development of a new Diversity and Inclusion Strategic Plan for the College of Engineering. In June, she invited Dr. Valeria Sinclair Chapman, a professor of political science and African-American studies and director of the Center for Research on Diversity and Inclusion at Purdue University, to lead an equity and inclusion training for the College's executive committee.

- **Dr. Christine Grant**, associate dean for faculty advancement, and her office have been critical in creating a more welcoming and supportive environment for the recruitment and retention of our women and underrepresented minority faculty members. Her leadership of the promotion and tenure process in the College together with the development and implementation of multiple initiatives for faculty development has resulted in a culture of inclusion that has enhanced the success of our entire faculty.

- **Dr. Doug Reeves**, associate dean for graduate programs, and his office have also developed, implemented and received external funding for a number of initiatives for the recruitment and retention of minority Ph.D. students. These efforts are also centered on creating a more inclusive and supportive environment for incoming graduate students as well as providing the financial support necessary for their success. A recent award to **Dr. Joel Ducoste** as the PI of an NSF Bridge to the Doctorate grant

is currently supporting 10 new underrepresented minority Ph.D. students in COE plus five more in the College of Sciences and is now a centerpiece of these efforts.

- In 2019, the College was one of 74 colleges of engineering to receive a Bronze Award for the inaugural American Society for Engineering Education (ASEE) Diversity Recognition Program. This was the highest award category made available by ASEE during its inaugural year and required: signing and executing the ASEE Deans Diversity Pledge; having infrastructure to support diverse populations; having at least one K-12 or community college pipeline activity; implementing at least one additional program or initiative from a list of proven practices; and having a Diversity and Inclusion Plan that includes measurable goals designed to improve diversity. The College was also marked as an exemplar honoree by ASEE making it only one of 29 recipients in the inaugural group to receive this additional distinction.

Going forward, the College is committed to furthering its efforts at creating a just, open educational environment and contributing to broader change in our city, state and nation.

"While our country has made progress in providing greater opportunities for African Americans and other underrepresented minorities, it is abundantly clear that we have not made nearly as much progress as many of us would like to believe," Martin-Vega said in his June statement. "My hope is, however, that the events of this time will compel and commit us and our country to such needed change." ■

Tech sector job interviews assess anxiety, not software skills

A NEW STUDY from NC State's Department of Computer Science and Microsoft finds that the technical interviews currently used in hiring for many software engineering positions test whether a job candidate has performance anxiety rather than whether the candidate is competent at coding. The interviews may also be used to exclude groups or favor specific job candidates.

"Technical interviews are feared and hated in the industry, and it turns out that these interview techniques may also be hurting the industry's ability to find and hire skilled software engineers," says **Dr. Chris Parnin**, an assistant professor of computer science and co-author of a paper on the work. "Our study suggests that a lot of well-qualified job candidates are being eliminated because they're not used to working on a whiteboard in front of an audience."

Technical interviews in the software engineering sector generally take the form of giving a

job candidate a problem to solve, then requiring the candidate to write out a solution in code on a whiteboard — explaining each step of the process to an interviewer.

Previous research found that many developers in the software engineering community felt the technical interview process was deeply flawed. So, the researchers decided to run a study aimed at assessing the effect of the interview process on aspiring software engineers.

For this study, researchers conducted technical interviews of 48 computer science undergraduates and graduate students. Half of the study participants were given a conventional technical interview, with an interviewer looking on. The other half of the participants were asked to solve their problem on a whiteboard in a private room. The private interviews did not require study participants to explain their solutions aloud, and had no interviewers looking over their shoulders.

Researchers measured each study participant's interview performance by assessing the accuracy and efficiency of each solution. In other words, they wanted to know whether the code they wrote would work, and the amount of computing resources needed to run it.

"People who took the traditional interview performed half as well as people that were able to interview in private," Parnin says. "In short, the findings suggest that companies are missing out on really good programmers because those programmers aren't good at writing on a whiteboard and explaining their work out loud while coding."

The researchers also note that the current format of technical interviews may also be used to exclude certain job candidates.

The study was co-authored by **Shivani Shirolkar**, a Ph.D. student at NC State who worked on the project while an undergraduate; and by **Dr. Titus Barik**, a researcher at Microsoft and former computer science Ph.D. student at NC State. ■



"Our study suggests that a lot of well-qualified job candidates are being eliminated because they're not used to working on a whiteboard in front of an audience."

DR. CHRIS PARNIN

NC State Day of Giving focuses on student impact

NC STATE HELD its second annual Day of Giving — a 24-hour fundraising campaign to maximize support for the University — on Sept. 16, 2020, and the College of Engineering’s alumni and friends showed the strength that is the Wolfpack.

After being rescheduled from March due to the COVID-19 pandemic, the theme of the fall event, “Stronger as a Pack,” put emphasis on increasing need-based scholarships, emergency needs of students related to coronavirus and promoting efforts to create a more inclusive university experience.

The College of Engineering raised \$1,243,338 from 934 gifts and was the number one college at the University for gifts received.

Additionally, the College was recognized for receiving the most out-of-state gifts for the second year in a row.

“This year’s Day of Giving brought our alumni and friends together in a time of unique need. The kinds of funds raised on Day of Giving have an immediate impact on our students and nine academic departments,” said **Griffin Lamb**, executive director of the NC State Engineering Foundation, Inc. “There is no doubt in my mind that we are stronger as a pack, and I hope our students feel the support of those alumni who have gone before them.”

Three academic departments within the College worked to raise additional funds by meeting

challenge gifts set by alumni and friends.

In honor of Chancellor Randy Woodson and to celebrate the second annual Day of Giving, alumnus **Tony Brown** '83 donated \$10,000 to the Department of Computer Science when the Computer Science Enhancement Fund received 50 gifts.

When the Department of Civil, Construction, and Environmental Engineering (CCEE) received 100 gifts, the CCEE Industry Advisory Board donated an additional \$11,500 to the Civil, Construction, and Environmental Engineering Enhancement Fund.

The ISE Advisory Board matched gifts to the ISE Enhancement Fund dollar for dollar, up to \$10,000, to advance the work of the Edward P. Fitts Department of Industrial and Systems Engineering.

All three challenges were met by the departments.

On the day, the College competed in the Red Division Leaderboard against five other colleges and programs. With use of the #GivingPack hashtag on social media, the NC State Engineering community kept conversation going and helped the College win several giving challenges, including the Show us your Pack Pets challenge — where followers were asked to post a photo of their pet in Wolfpack gear — winning the College an additional \$3,000.

At the end of the day, the University received 8,230 gifts totaling \$23,223,425 — an increase of nearly \$10 million from 2019’s event. Donors from all 50 states participated in the event. ■

Managing data flow to boost cyber-physical system performance



RESEARCHERS IN NC STATE’s Department of Electrical and Computer Engineering (ECE) have developed a suite of algorithms to improve the performance of cyber-physical systems — from autonomous vehicles to smart power grids — by balancing each component’s need for data with how fast that data can be sent and received.

“Cyber-physical systems integrate sensors, devices and communications tools, allowing all of the elements of a system to share information and coordinate their activities in order to accomplish goals,” says **Dr. Aranya Chakraborty**, co-author of a paper on the new algorithms and a professor of electrical and computer engineering at NC State. “These systems have tremendous potential — the National Science Foundation refers to them as ‘enabling a smart and connected world’ — but these systems also pose challenges.

“Specifically, the physical agents

in a system — the devices — need a lot of communication links in order to function effectively. This leads to large volumes of data flowing through the communication network, which causes routing and queuing delays. These delays can cause long waiting times for the agents to take action, thereby degrading the quality of the system. In other words, there’s so much data, being passed through so many links, that a system may not be able to accomplish its established goals — the lag time is just too long.”

This creates a dilemma. Reducing communication can hurt the quality of the system’s performance, because each element of the system will be operating with less information. On the other hand, reducing communication means that each element of the system would be able to get that information more quickly.

“So, it’s all a trade-off,” Chakraborty says. “The right balance needs to be struck between

all three variables — namely, the right amount of communication sparsity, the optimal delay and the best achievable performance of the agents. Striking this fine balance to carry out the mission in the best possible way while also ensuring safe and stable operation of every agent is not easy. This is where our algorithms come in.”

Chakraborty and ECE graduate student **Nandini Negi** developed three algorithms that, taken together, reduce the overall number of data requests from each node in a system, but ensure that each node receives enough information, quickly enough, to achieve system goals.

“There is no one-size-fits-all solution that will apply to every cyber-physical system,” Negi says. “But our algorithms allow users to identify the optimal communications solution for any system.”

Negi is first author of the paper. The work was funded in part by the National Science Foundation. ■

NC STATE

Thank you for making Day of Giving extraordinary for the College of Engineering!

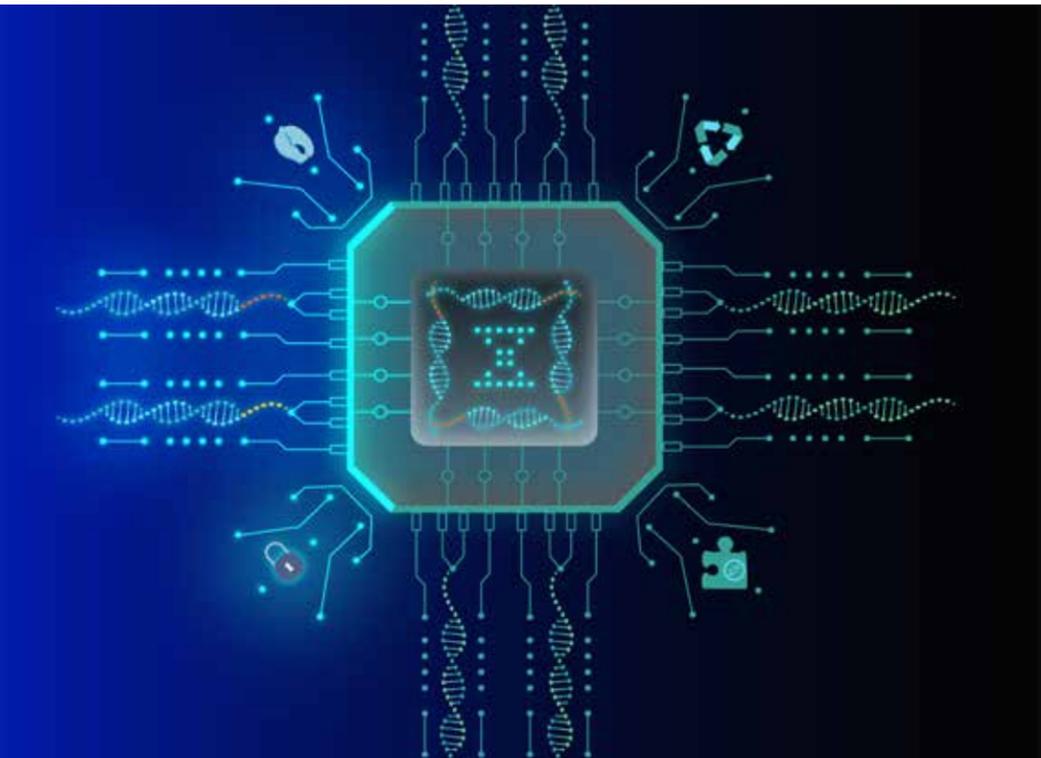
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\$440,000
largest single gift

924
gifts made by alumni

#1 College
in gifts received for 2nd year in a row

New approach to DNA data storage makes system more dynamic, scalable



RESEARCHERS IN THE COLLEGE

have developed a fundamentally new approach to DNA data storage systems, giving users the ability to read or modify data files without destroying them and making the systems easier to scale up for practical use.

"Most of the existing DNA data storage systems rely on polymerase chain reaction (PCR) to access stored files, which is very efficient at copying information but presents some significant challenges," says **Dr. Albert Keung**, co-corresponding author of a paper on the work and an assistant professor in the Department of Chemical and Biomolecular

Engineering. "We've developed a system called Dynamic Operations and Reusable Information Storage, or DORIS, that doesn't rely on PCR. That has helped us address some of the key obstacles facing practical implementation of DNA data storage technologies."

DNA data storage systems have the potential to hold orders of magnitude more information than existing systems of comparable size. However, existing technologies have struggled to address a range of concerns related to practical implementation.

Current systems rely on sequences of DNA called primer-binding sequences that are added to

the ends of DNA strands that store information. In short, the primer-binding sequence of DNA serves as a file name. When you want a given file, you retrieve the strands of DNA bearing that sequence.

Many of the practical barriers to DNA data storage technologies revolve around the use of PCR to retrieve stored data. Systems that rely on PCR have to drastically raise and lower the temperature of the stored genetic material in order to rip the double-stranded DNA apart and reveal the primer-binding sequence. This results in all of the DNA — the primer-binding sequences and the data-storage sequences — swimming free in a kind of genetic soup. Existing technologies can then sort through the soup to find, retrieve and copy the relevant DNA using PCR. The temperature swings are problematic for developing practical technologies, and the PCR technique itself gradually consumes — or uses up — the original version of the file that is being retrieved.

DORIS takes a different approach. Instead of using double-stranded DNA as a primer-binding sequence, DORIS uses an "overhang" that consists of a single-strand of DNA — like a tail that streams behind the double-stranded DNA that actually stores data. While traditional techniques required temperature fluctuations to rip open the DNA in order to find the relevant primer-binding sequences, using a single-stranded overhang means that DORIS can find the appropriate primer-binding sequences without disturbing the double-stranded DNA.

Kevin Lin and **Kevin Volkel**, both Ph.D. students at NC State, are first author and co-author, respectively, of the paper. ■



Study finds dedicated clinics can reduce impact of a flu pandemic

A NEW STUDY concludes that opening clinics dedicated specifically to treating influenza can limit the number of people infected and help to "flatten the curve," or reduce the peak prevalence rate. While the work focused on influenza, the findings are relevant for policymakers seeking ways to reduce impacts of the ongoing COVID-19 pandemic.

"Dedicated clinics would have less of an impact than interventions such as vaccination, but at the statewide level, we're talking about cutting the overall number of infections by six figures," says **Dr. Julie Swann**, corresponding author of a paper on the work. Swann is the department head and A. Doug Allison Distinguished Professor in the Edward P. Fitts Department of Industrial and Systems Engineering.

"And while our work here focused on the H1N1 strain of influenza, the findings are useful as we grapple with how best to respond to COVID-19," Swann says. "COVID-19 is more infectious than H1N1, and has a higher

mortality rate. So, I would expect the effect of using dedicated clinics to be larger for COVID-19."

Swann and her collaborators were inspired to do the study by the fact that some hospitals opened dedicated H1N1 clinics during the H1N1 influenza pandemic in 2009-10. These clinics focused exclusively on treating patients who were exhibiting symptoms of H1N1. There was some question at the time as to whether these clinics were a good use of limited resources. It was also unclear as to whether the clinics may have had unintended consequences, such as spreading H1N1 to patients who showed up at the dedicated clinic with flu-like symptoms, but didn't actually have the disease.

For this study, Swann and her collaborators at Purdue University, Georgia Tech and Emory University used a simulation model to address questions related to the ultimate impact of dedicated clinics during an H1N1 pandemic.

The researchers found that opening dedicated clinics reduced

disease spread and hospitalizations, particularly when open during the periods of peak prevalence — when the most people are sick. Specifically, the researchers found that if dedicated clinics were open for the entire duration of the pandemic, the clinics would have reduced the overall number of infections by 0.4 - 1.5 percent; reduced peak prevalence (or "flattened the curve") by 0.07 - 0.32 percent; and reduced hospitalizations by 0.02 - 0.09 percent.

"For a state that has a population of 10 million, the difference in the baseline clinic case would be about 100,000 cases, with about 6,000 hospitalizations averted," Swann says. "In other words, dedicated clinics certainly don't make things worse, and can make things at least a little better. And these are benefits that come on top of any benefits we'd see from other, behavioral changes — such as wearing masks — which may be more difficult to implement." ■

Summer K-12 engineering camps go virtual

WHEN COVID-19 ELIMINATED the 2020 in-person summer engineering camps held annually on the NC State campus, The Engineering Place (TEP) team quickly jumped into action and adapted the face-to-face summer engineering camps into online virtual camps, ensuring K-12 students did not miss out on summer engineering camp learning experiences.

The Engineering Place is the K-12 Engineering Outreach program for the College of Engineering. Collaborating with engineering faculty and staff members and utilizing the expertise within the program, TEP develops hands-on engineering challenges and programs that incorporate science, technology, engineering and mathematics (STEM) discipline areas, including language arts and social studies. Engineering is the hook that can engage students in becoming interested and excited for STEM learning.

TEP summer camps are accredited by the American Camp Association and are the only camps held on a UNC System campus to hold that distinction.

"We focus on the E in STEM, since engineering is often overlooked in the K-12 classroom, especially in grades K-8," said TEP Assistant Director **Dr. Leah Bug**.

Engineering challenges were designed to accommodate an online format and materials assembled into kits for shipment. Coordinator of Engineering K-12 Outreach Extension and Camp Director **Susan D'Amico** stated, "You can't

just passively watch something to experience engineering camp, you must do it," and so the idea of shipping kits was born.

In all, more than 580 engineering kits were sent to registered campers, allowing them to experience engineering by doing: designing and creating solutions to engineering challenges.

A total of 40 virtual camps were offered this summer. 10 9th - 12th grade camps, 12 6th - 8th grade, eight 3rd - 5th grade and 10 K-2nd grade camps were held. K-8th grade camps were theme based, ranging from High Tech Farming to NASA Artemis to the Moon and Mars. The most popular camps were Island Survival and Amusement Park. High school students participated in day-long camps during the week in materials science and engineering, electrical engineering, computer science engineering, biomedical engineering, and industrial and systems engineering.

SUPPORTING PARENTS AND CHILDREN

To facilitate parents' and students' adaptation to their new summer plans, The Engineering Place provided classroom teachers, engineering undergraduates and TEP professional staff members as instructors and counselors throughout each week of camp. Camps were designed for minimal parent involvement, allowing the students to work through the engineering design process with their fellow campers and camp instructors. However, just in case



parents did want to help, a Parent and Camper Digital Handbook was provided, "so parents and guardians have some ideas of how to best help their child," Bug said. The goal was for parents to remain as hands off as possible, replicating a typical face-to-face summer camp setting, ensuring the campers were still the ones completing the projects.

Parents were very appreciative to have a learning experience for their children during the summer when most everything else was shut down.

"Our daughter has thoroughly enjoyed the NC State camps and we are beginning to see that interest in her to make and build things which is great," said one parent in an anonymous survey. "We appreciate this initiative from NC State and you all, during these times."

INCREASING INTEREST FROM UNDERREPRESENTED STUDENTS

Alumni of the College's Women and Minority Engineering Programs and NC State faculty and staff engineers provided a unique opportunity in the rising 3rd - 5th and 6th - 8th grade camps as guest engineers, sharing how they became interested in engineering and how they currently use their engineering degree and listening to student presentations. Demonstrating the diverse composition of engineering professions and allowing participants to talk with a diverse group of engineers was a highlight for many campers. "Increasing diversity in engineering careers is a high priority at The Engineering Place, and our

programming is designed to engage underrepresented populations to help them see themselves as an engineer," stated TEP Director **Dr. Laura Bottomley**. "These engineers provided a unique experience for the campers as only NC State can."

FUTURE K-12 ONLINE PROGRAMMING

Bug and D'Amico are both looking forward to what this successful type of programming can mean for the future of TEP summer camp offerings, even planning for virtual engineering learning past COVID-19.

"We are quite proud of how we were able to pivot from face-to-face to virtual camp offerings this year, as not many programs were able to do so," stated Bug.

In fact, TEP partnered with the Puerto Rico Science Technology and Research Trust group in providing a TEP engineering camp to more than 55 students in July. The camp, conducted in Spanish, focused on food stability through the Engineering Applied to Agriculture Camp. As D'Amico stated, "We can see every summer, having the options of our day camps, our residential camps and a virtual camp, reaching kids throughout the state, out of state, and internationally... who would like to be a part of our engineering programming, but just can't physically get here."

Learn more at www.engr.ncsu.edu/theengineeringplace.

ENGINEERING CAREER FAIR DOES, TOO

The first virtual NC State Engineering Career Fair was held on Sept. 15 and 16.

Using virtual event vendor Career Fair Plus, the Career Fair team was able to match 148 participating companies with 5,016 job and internship seekers.

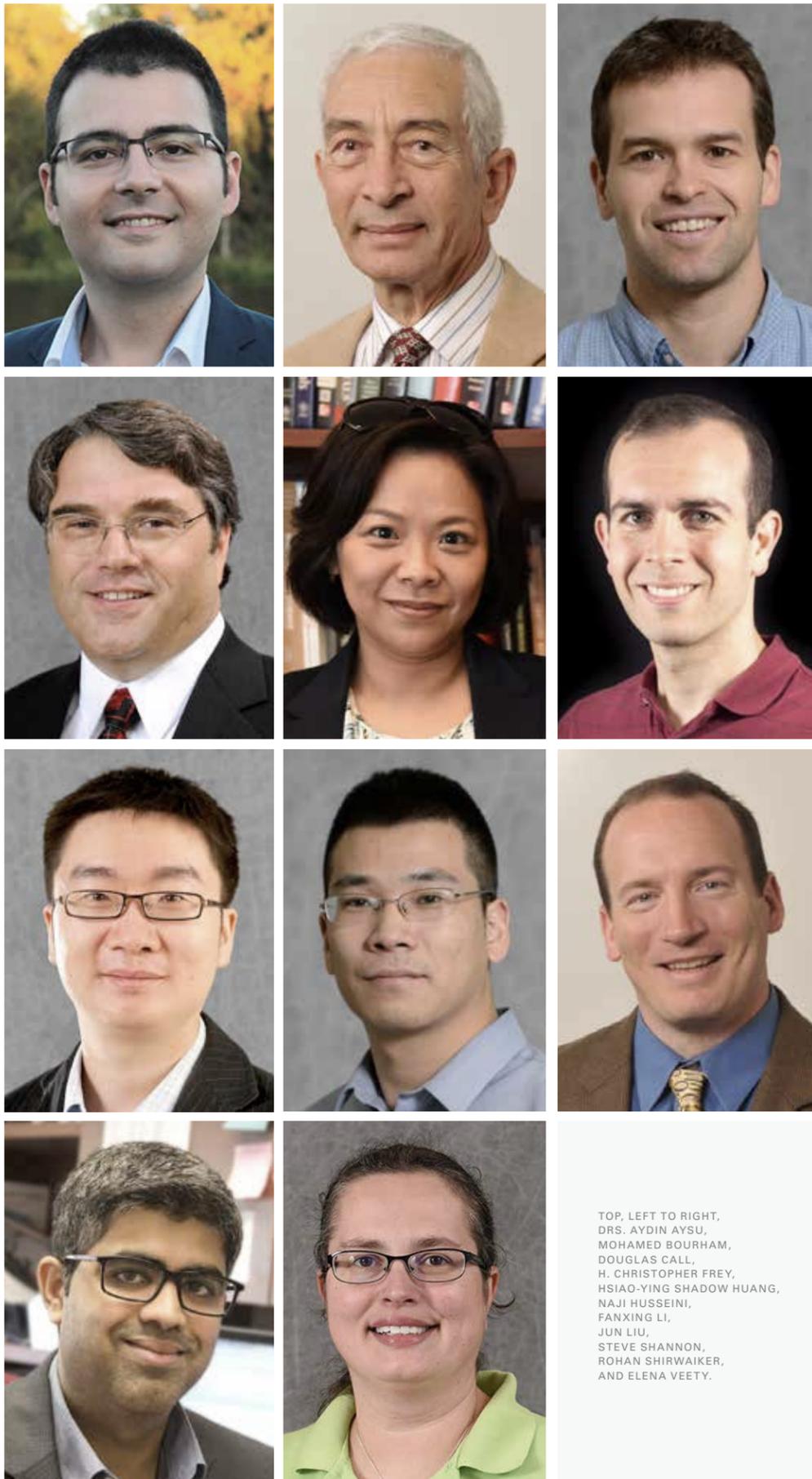
Students were able to upload their resumé and sign up for 10-minute virtual appointments with recruiters that were designed to mimic the walk-up experience at an in-person event. There were more than 11,000 appointments over two days.

The spring career fair will also be held virtually, on Feb. 2, 2021. Learn more at www.engr.ncsu.edu/careerfair.

For more information on how to support The Engineering Place, contact Bug at lbug@ncsu.edu or 919.515.2110.

Direct donations to TEP summer camps can be made at go.ncsu.edu/summerprograms.

FACULTY HIGHLIGHTS



TOP, LEFT TO RIGHT, DR. AYDIN AYSU, MOHAMED BOURHAM, DOUGLAS CALL, H. CHRISTOPHER FREY, HSIAO-YING SHADOW HUANG, NAJI HUSSEINI, FANXING LI, JUN LIU, STEVE SHANNON, ROHAN SHIRWAIKER, AND ELENA VEETY.

Shirwaiker, Veety receive Blesis Awards

Drs. Rohan Shirwaiker and **Elena Veety** have been announced as the winners of the George H. Blesis Outstanding Undergraduate Advisor Award.

The award recognizes faculty members who consistently and willingly give their time and effort to advising, counseling and mentoring students and assisting student groups. It is also a continuing memorial to George H. Blesis, a faculty member whose interest in undergraduate education and advising serves as an example today.

Shirwaiker, an associate professor in the Edward P. Fitts Department of Industrial and Systems Engineering, has served as a faculty member at NC State since 2011.

Veety, a teaching assistant professor in the Department of Electrical and Computer Engineering (ECE) and operations and education director for the National Science Foundation ASSIST Center, joined the NC State faculty in 2012. ■

Three receive NSF Career awards

Three faculty members in the College have been chosen to receive 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.

NSF will provide \$500,000 in funding over five years to **Dr. Douglas Call**, assistant professor in the Department of Civil, Construction, and Environmental Engineering (CCEE), to support his project, "Leveraging the multifunctional redox properties of pyrogenic materials to enable biological transformations of aqueous organic contaminants."

NSF will provide \$518,775 in funding over five years to **Dr. Jun Liu**, assistant professor in the Department of Mechanical and Aerospace Engineering (MAE), to support his project, "Pushing the Lower Limit of Thermal Conductivity in Layered Materials." ■

NSF will provide \$438,000 in funding over five years to **Dr. Aydin Aysu**, assistant professor in ECE, to support his project, "Physical Side-Channels Beyond Cryptography: Transforming the Side-Channel Framework for Deep Learning." ■

Frey, Li receive Alcoa Foundation Awards

Dr. H. Christopher Frey, Glenn E. Futrell Distinguished University Professor in CCEE, and **Dr. Fanxing Li**, associate professor in the Department of Chemical and Biomolecular Engineering (CBE), have been named the 2020 Alcoa Foundation Awards recipients.

Frey received the Alcoa Foundation Distinguished Engineering Research Award, made to a senior faculty member for research achievements over a period of at least five years at NC State. Li was awarded the Alcoa Foundation Engineering Research Achievement Award, which recognizes young faculty members who have accomplished outstanding research achievements during the preceding three years.

Frey has developed a nationally and internationally recognized program of research in air pollution control, air quality, uncertainty analysis and human exposure to air pollutants.

As an early-career researcher, Li has demonstrated strong leadership with exceptional creativity in the fields of chemical reaction engineering and particle technology. ■

Bourham receives Holladay Medal for Excellence

Dr. Mohamed Bourham, Alumni Distinguished Graduate Professor of Nuclear Engineering, was one of three faculty members selected to receive the Alexander Quarles Holladay Medal for Excellence, the highest honor bestowed by NC State and the University's Board of Trustees.

Bourham has served NC State for nearly 27 years, and has developed and modified numerous courses providing state-of-the-art education materials to undergraduate and graduate students. He currently serves as the director

of the College of Engineering's master's in engineering program, is a member of Sigma Xi, was awarded the university-level Outstanding Teacher Award in 2019 and is a member of the Academy of Outstanding Teachers, among many other memberships and honors. ■

Three receive Outstanding Teacher Award

Three faculty members in the College were named recipients of the Outstanding Teacher Award for 2019-20.

Dr. Hsiao-Ying Shadow Huang is an associate professor in MAE; **Dr. Naji Hussein** is a teaching assistant professor in the UNC / NC State Joint Department of Biomedical Engineering; and **Dr. Steve Shannon** is a professor in the Department of Nuclear Engineering.

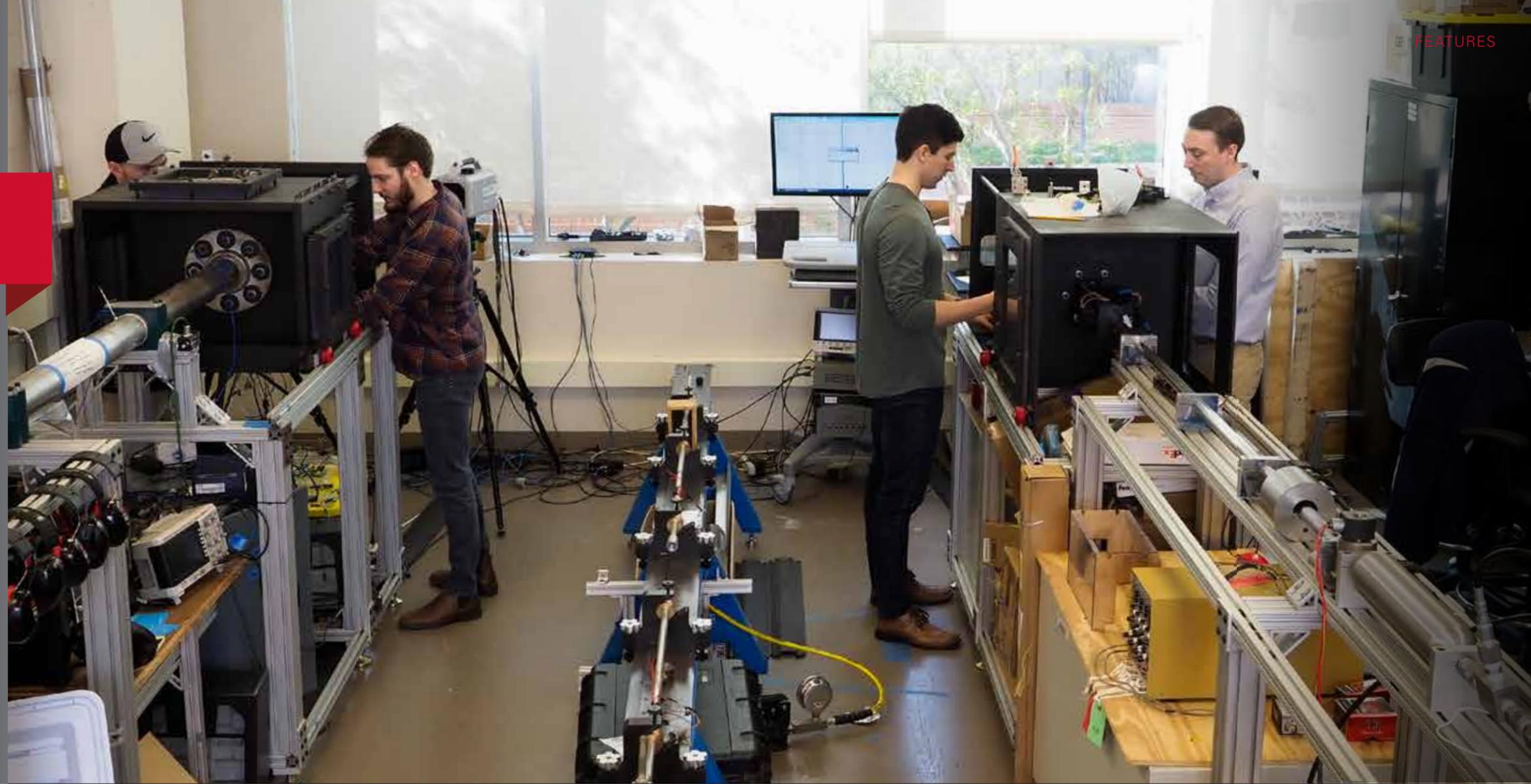
The award recognizes excellence in teaching at all levels and is a prerequisite for being considered for the Board of Governors Award for Excellence in Teaching and the Alumni Distinguished Professor Award. ■

IN OUR LABS

THESE ARE THE SPACES THAT ENABLE
GROUNDBREAKING RESEARCH

Ballistic Loading and Structural Testing Lab

DEPARTMENT OF MECHANICAL
AND AEROSPACE ENGINEERING



LOUD BOOMS sometimes heard on the ground floor of Engineering Building III on NC State's Centennial Campus signal successful experiments in the Ballistic Loading and Structural Testing (BLAST) Laboratory. The lab is led by [Dr. Mark Pankow](#), an associate professor in the Department of Mechanical and Aerospace Engineering. Not factoring in a complex setup, an actual experiment lasts less than a hundredth of a second from start to finish. Pankow's lab investigates how different materials fail in response to a wide variety of extreme loading environments. He suggests Silly Putty as an example.

"If you pull on it slowly, there's no telling how far it will stretch. But if you pull on it quickly it snaps right in half."

The longtime stretchy child's toy is an elegant example of ductile-to-brittle failure transition, in which the material properties change as a function of loading rate.

PANKOW'S LAB has worked on projects sponsored by U.S. Army Research Laboratory, the National Science Foundation, Boeing and others. Research involves both applying impact to materials and modeling the outcome, to learn how that material reacts and if it has failed. All of the equipment in the lab simulates real-world events such as high-speed projectiles, impact from falling objects and bomb blasts. The experiments have one thing in common — they are designed to exert an extreme amount of force in a very short time frame. For example, the shock tube generates a pressure wave traveling at Mach 4 and exerts a force as high as 2,500 psi by sending a high-speed pressure load down a long tube into a containment chamber not much larger than a microwave oven. It simulates the power of a bomb blast or improvised explosive device (IED). The results are captured using multiple high-speed cameras and an array of sensors.

MODERN AIRCRAFT rely heavily on composites; the BLAST Lab team identified a need to understand how those materials perform when struck by lightning. The group developed a new way to simulate a lightning strike, applying both the heat and pressure caused by a bolt to study how they cause damage, both separately and in combination. Protection systems are another important area of research for the lab. A project sponsored by an athletic apparel company focuses on protecting athletes from head injuries, by ensuring that their protection gear does not degrade on a hot day. Through the Department of Defense, the lab also works to develop techniques for evaluating the extent of injury. With a better understanding of how Kevlar in soft-body armor deforms during impact, the research findings from the BLAST Lab will inform the next generation of armor design that would mitigate impacts and reduce injuries.

THE TEAM'S work also takes them on adventures far outside the lab, most notably to perform experiments on what was once called the "Vomit Comet" operated by a company called Zero-G in Sanford, Fla. A project funded by NC Space Grant and NASA requires routine flight-testing for different types of deployable structures in a zero-gravity environment. Taking advantage of the high strength-to-weight ratio of composites, the research team developed a material to be used in the deployment of a satellite boom in space. The resulting structure can be easily unwound and deployed, then rewound, similar to a tape measure. Unlike a tape measure, though, it is rigid enough to remain stiff when deployed. Later this year, the team will travel to Florida again to continue flight testing the structures in a zero-gravity environment. ■



RAPID RESPONSE

The College of Engineering has taken up the fight against COVID-19

On a Thursday morning in late May, the machine shop in Engineering Building III on NC State's Centennial Campus is quiet for the first time in a long time.

Soon after the COVID-19 crisis began in the United States in early spring, a team of NC State Engineering faculty members and students undertook an effort to quickly design and produce personal protective equipment (PPE) for frontline healthcare workers in local hospitals and doctor's offices. Soon, a group of about a dozen graduate students were working 10 to 12 hours a day in the shop, part of the Department

of Mechanical and Aerospace Engineering (MAE), as the crisis deepened and healthcare systems worried about a lack of PPE. In the Edward P. Fitts Department of Industrial and Systems Engineering (ISE), students manned 3D printers 24 hours a day to produce face shields.

As spring turned into summer, MAE began transitioning the work to a local company, but not before providing a life-saving boost for healthcare providers scrambling for the equipment they needed to keep them safe so that they could continue saving lives.

Dr. Landon Grace, an assistant professor in MAE, and **Dr. Ola Harrysson**, Edward P. Fitts Distinguished Professor in ISE, led the efforts in the two departments.

THE NEXT PROBLEM TO SOLVE

Grace gave all the credit for the work in MAE to the graduate students from his research team and others who have innovated and done the assembly line work to produce the PPE.

The team manufactured 16,000 plastic face shields that work with a Controlled Air Purifying Respirator (CAPR) system, which provides a wearer with protection from inhaling germs using safe air in an enclosed helmet. The four-piece product includes a plastic face shield (cut from plastic sheets using the department's laser cutter), a plastic film that provides a seal under the chin and two clips to attach to a CAPR helmet.

To seal the film to the faceshield, the team developed a two-piece system made up of a kitchen griddle and a homemade hand-held sealer that is heated and used to fuse the two pieces together.

The ISE team in the department's Center for Additive Manufacturing and Logistics (CAMAL) produced 1,273 face shields and 1,384 "ear savers" (pieces that take the pressure of elastics attached to face masks off of a wearer's ears).

Most of the sets went to North Carolina healthcare systems, but some units have been shipped as far away as New York, Chicago and California.

"It was amazing to get the support from the NC State engineering team," said Dr. Francis Castiller, medical director of Critical Care at UNC REX Hospital in Raleigh. "The early stages of the pandemic were very uncertain times. The engineering team listened to our needs and their response was impressive. They mobilized a team that designed and produced necessary protective equipment rapidly that essentially supported the entire UNC Health system. It is a reflection of the strong leadership and innovation of the department and how the engineering field can successfully collaborate with healthcare."

CLEANER ON CAMPUS

NC State's Golden Leaf Biotechnology Training and Education Center (BTEC), part of the College of Engineering, partnered with

Novozymes to ensure that the University has an adequate supply of hand sanitizer to handle a safe return to campus.

BTEC identified an early opportunity to use its idle production capacity to produce the sanitizer using a formula made available by the World Health Organization. But the key ingredient ethanol — a type of alcohol used in automobile and truck fuels — was hard to come by.

Novozymes, the world's largest industrial biotechnology company with North American headquarters in North Carolina, was able to supply surplus ethanol made available during the early days of the pandemic in the United States because fewer drivers were on the roads.

After receiving FDA approval, BTEC began producing hand sanitizer in mid-May and bottling it in one-gallon containers at its facility on Centennial Campus. Along with assistance from Novozymes, BTEC received contributions from the Kenan Institute for Engineering, Technology and Science (KIETS) and the University and by fall had produced more than 1,100 gallons for the campus community.

BTEC is also partnering with KIETS to provide sanitizer for the North Carolina Museum of Natural Sciences.

WHAT'S NEXT

Several research projects are under way in the College that offer promising solutions as the global effort against COVID-19 continues. They include:

A multidisciplinary team led by **Drs. Francis de los Reyes, III** and **Angela Harris** in the Department of Civil, Construction, and Environmental Engineering is examining whether tracking the spread of COVID-19 by sampling municipal wastewater might be an effective tool for containing the spread of the disease. The researchers have begun testing in Raleigh, NC; Houston, Texas; Washington, D.C.; and Los Angeles, Calif. The work has been funded by the National Science Foundation (NSF) and the North Carolina Policy Collaboratory.

Drs. Osman Ozaltin, Julie Ivy and **Maria Mayorga**, faculty members in ISE, received NSF funding for a project that will study how U.S. hospital systems handled a surge in critically ill, infectious patients and adjusted their operations. By examining data from two major hospital systems in Oregon and Washington, D.C. / Maryland, the team hopes to develop important decision support for hospitals that can improve response to future pandemics and mass casualty disasters. ■

WHO'S CALLING?

COMPUTER SCIENCE RESEARCHERS GET TO THE BOTTOM OF **ROBOCALLS**

Automated or semi-automated phone calls, also known as robocalls, are a major security concern for phone users in the United States. While most robocalls are an annoyance, some of these calls are specifically designed to target the vulnerable segments of our society.

Dr. Bradley Reaves was first inspired to research robocalling after a visit to his grandparents over Christmas break when he was a graduate student.

"Their phone was ringing constantly with robocalls. It was disrupting their lives," shared Reaves, assistant professor in the Department of Computer Science (CSC). "I realized that this has made an essential service basically unusable, and something needed to be done."

Reaves took this inspiration and wrote his dissertation on how to build a better Caller ID system that can't be spoofed so that unwanted calls get through. His work on robocalls is being continued with a team of graduate students in CSC with support from the National Science Foundation.

In their newest paper, "Who's Calling? Characterizing Robocalls through Audio and Metadata Analysis," the group found a lack of empirical grounding to understand the scale of the robocalling landscape. They sought to provide the first longitudinal analysis of the robocalling problem in the U.S. while also providing powerful new tools and perspectives for researchers, phone service providers and the general public.

The study centered around answering three questions. Is the problem of robocalls getting worse? Is it even safe to answer the phone? Who is calling and how do they operate?

Over the span of 11 months, the researchers worked with communications company Bandwidth, Inc. to collect data from unsolicited phone calls made to over 66,000 unlisted phone numbers, resulting in 1.48 million phone calls in total.



LEARN MORE

Reaves discusses his research as part of NC State's Audio Abstract podcast series

news.ncsu.edu/podcast/podcast-robocalls



FROM LEFT TO RIGHT, DR. BRADLEY REAVES AND SATHVIK PRASAD.

"The sheer number of unsolicited phone calls indicates that robocalling is a huge problem in the United States. Our findings highlight the need for an effective solution to combat robocalls and protect phone users," shared **Sathvik Prasad**, a doctoral student in CSC.

Using audio processing techniques, the researchers grouped similar call audio recordings into broader campaigns to uncover robocalling campaigns operating in the wild.

It was discovered that nearly 62 percent of the unsolicited calls received by the researchers' numbers included practically no audio at all. Which, according to Prasad, was surprisingly high.

"Only a little more than half of the remaining 38 percent contained enough audio data to allow for us to conduct a robust assessment.

"But what was exciting was that we were able to identify calls that were identical or nearly identical, allowing us to group calls into clusters that were clearly all affiliated with a single campaign," Reaves says.

They also identified long-running fraudulent phone campaigns designed to defraud senior citizens and recent immigrants in the United States.

"The audio processing techniques allowed us to reliably uncover fraudulent robocalling campaigns. Our language-agnostic techniques helped us identify two distinct robocalling campaigns operating in Mandarin. We also uncovered two Social Security fraud campaigns that attempt to defraud their victims," Prasad said.

Robocalls are used to deceive callers by frequently changing their caller ID. The researchers found that some robocalls used sophisticated spoofing techniques to ensure that the incoming call appears to originate from a neighbor in your region. Prasad said that this is done by spoofing the caller ID to match the first six digits of your phone number.

The team found that there was no evidence that answering an unsolicited call increases the number of unsolicited calls received. Additionally, they found that they can reliably isolate individual call campaigns, which in the process revealed two distinct Social Security scams while also empirically demonstrating the majority of campaigns rarely reuse phone numbers.

Prasad said that by using the tools and techniques presented in their paper, they can equip the service providers to systematically identify fraudulent

robocalling campaigns and surgically target the source of these operations.

Looking to the future, Reaves and Prasad agree that this research will be continued.

"The COVID pandemic has triggered robocalls that pitch fake COVID tests. This is just one of many examples where fraudulent robocallers change their tactics and exploit recent events in our society to target victims. We still have so much more to understand about robocalls and how they operate," Prasad said.

"This first paper is just the beginning," Reaves said. **"The robocall problem isn't going away, and we won't stop until the robocalls do, too."**

The group's paper was presented Aug. 12 at USENIX Security Symposium, where it received the first place Internet Defense Prize from Facebook and a distinguished paper award. The paper was co-authored by **Elijah Bouma-Sims**, an undergraduate at NC State, and by **Athishay Kiran Mylappan**, a former graduate student at NC State. ■



A SCHOLARSHIP FOR SERVICE

SALAM IBRAHIM is scheduled to graduate in 2021 with a degree in industrial engineering.

Favorite class at NC State? ISE 520 introduces methods used to improve the performance of health care delivery systems with emphasis on patient care cost, access and quality. I particularly enjoy learning about healthcare policy and the fundamentals of scheduling, staffing and productivity in health systems.

Favorite Park experience so far? My favorite experience has been applying for a Park Enrichment Grant to study renewable energy in Iceland. I spent my time there taking classes on geothermal energy and hydropower systems. As a group, we also visited one of the largest geothermal plants in the world, hiked the Icelandic highlands and explored the effects of climate change on glaciers.

What types of service activities have you participated in through the program? My sophomore year I went on an Alternative Service Break trip to Alaska. I loved it so much that I led a trip to Rutherfordton, NC, where we teamed up with a volunteer group called the Women Roofers who repair and replace roofs for those in need.

PARK SCHOLARSHIPS AT A GLANCE



Named for the late Roy H. Park, a 1931 NC State alumnus, the charitable Park

Foundation has committed nearly \$145 million to support the Park Scholarships program since launching it with an initial grant in 1996.



Recipients have access to enrichment activities including

leadership training, grants for undergraduate research and study abroad and access to a large, successful alumni network.

THE PARK SCHOLARSHIPS PROGRAM IS MARKING 25 YEARS

NC State's Park Scholarships program welcomed its 25th class to campus this fall. Of the **41** students in the class of 2024, **20** announced plans to study in the College of Engineering. In most years, more Park Scholars study in COE than any other college.

SHANNON PINNELL is scheduled to graduate in 2022 with a bachelor's degree in electrical engineering and a minor in biological sciences.

Who is your mentor in the Park program? I have been with my current mentor, Dr. Alyson Wilson (associate vice chancellor for national security and special research initiatives), for the past two years — she has been a key part of my time at NC State and in guiding me through research, graduate school applications, funding applications, balancing extracurriculars and life in general.

Tell us about the air-quality monitoring startup that you are involved with. The current standard of air quality monitoring is placing one \$100,000 air quality monitor in an area the size of Raleigh. This method is inaccessible to the majority of community organizations due to the high cost but also only provides data from one location, making it difficult

to understand how plumes are moving or where sources may be. Scivir is using modified long-range technology to create a network that does not need power or satellite internet access, is cost-accessible and can take many measurements over a small area to see trends.



What have you learned about leadership through the program? The Park Scholarships program has significantly shaped my view of leadership. Hearing the viewpoints and experiences of public leaders, especially those who work in tech, has helped me understand that leadership is not a set of actions or a checklist but more a mindset.

TERRELL RUSSELL graduated in 2001 with B.S. degrees in computer engineering and in information technology and service organizations. He earned a master's degree in computer networking in 2003.

What have you been up to since graduation? After seven years at NC State, and a "student sabbatical" starting my own company and figuring out the next steps, I spent another seven years getting a Ph.D. in information and library science at UNC-Chapel Hill. After graduation, I took a job with the Renaissance Computing Institute working on iRODS, an open source data management platform, and am now the chief technologist.

What has receiving a Park Scholarship done for your life and career? I was in the first class of Park Scholars in fall 1996 and had an amazing opportunity to shape what the scholarship program has become today. Knowing we were building something we hoped would last a very long time and having an impact on the University and beyond gave me a sense of purpose.



CALVIN PHELPS graduated in 2009 with a degree in aerospace engineering.

What have you been up to since graduation? Directly after graduation I went to Cornell University, obtaining my master's degree in mechanical engineering with a minor in engineering management. Since grad school I've worked for Pratt & Whitney in design, test and production for jet engine components and am now supporting maintenance, repair and overhaul operations for our fleets in Asia.

How did being a Park Scholar enhance your NC State experience? Being a Park Scholar gave me an invaluable community of both students and faculty members while I was at NC State, with the learning labs in particular (both as an attendee and mentor) serving as important capstones for my time there.



ENGINEERING LEND'S A HELPING HAND



Undergraduates introduce engineering to Rwandan students during Alternative Spring Break trip



NC State engineering and business major **Tyler Brading** climbed on top of a jeep to test out the results of the morning parachute drop activity for students in the Nkumba primary school. Teams of the young students had designed and created small parachutes holding weights. To test the parachutes, Brading dropped one after the other off the jeep surrounded by laughing students below.

In March, Brading with other NC State students and faculty and staff members had traveled to the Musanze district of Rwanda. They were there to hold four days of science, technology, engineering and mathematics (STEM) workshops in five rural primary schools as part of an NC State Alternative Service Break (ASB) trip.

The Rwandan schools welcomed the STEM workshops. Despite a legacy of poverty and genocide in their country's tragic past, the hardworking and resilient people of Rwanda have built a strong tourism industry with ambition for more. Citing the importance of STEM education to the future of Rwanda, the country's government has directed that it be taught in their schools.

ABOVE, ASB GROUP AND FRIENDS.

LEFT, TYLER BRADING TESTS PARACHUTES BY DROPPING THEM FROM THE TOP OF A JEEP AT NKUMBA PRIMARY SCHOOL.



The experience meant a great deal to the NC State engineering students:

Chemical engineering major **Josh Jimison** said, *"This ASB trip opened my eyes to life outside North Carolina. Everyone I met in Rwanda was incredibly kind, and they were open to sharing their story and culture. From discovering new foods to learning amazing dances, the students and people we encountered were generous to teach us about life in Rwanda. Rwanda is known for being the land of a thousand hills, but all I noticed were a thousand smiles from everyone we met."*

Chemistry and psychology major **Bryce Royal** said, *"I found there were instances throughout my time in Rwanda where I had to check my own energy and privilege in a way to make sure that it was appropriate for an environment I myself was not familiar with. It was a gentle reminder that the world does not revolve around me and only my experiences. I am thankful for these moments and the impact it had on me."*



FAR LEFT, FROM LEFT TO RIGHT, ALICE KUBWIMANA (FAR LEFT), ERIC MUPENZI (FAR RIGHT) AND KEPLER UNIVERSITY STUDENTS WERE INVALUABLE TO THE ASB GROUP.

LEFT, DANIEL BUN SHOWS PICTURES FROM A TABLET TO STUDENTS AT NKUMBA PRIMARY SCHOOL.

The College of Engineering's Women and Minority Engineering Programs (WMEP) started STEM education trips to Rwanda in 2018.

Dr. Laura Bottomley, director of WMEP, explained why international travel is important to their engineering students. Engineering is really a global endeavor, she explained. If you are going to engage in global endeavors, you have to have gotten out of North Carolina and understand both the differences and similarities of people in other places.

The 2020 trip was WMEP's third student trip to Rwanda. **Angelitha Daniel**, director of Minority Engineering Programs, **Kim Pender**, WMEP program coordinator, and Bottomley have conducted all of the trips.

STUDENT-LED TRIP

WMEP chose to partner with non-profit organization Mothering Across Continents (MAC) for the 2020 trip.

Bottomley said that they were trying to build a sustainability model that would allow them to go back each year and work with the same people so that they could have more of an impact in the schools. They thought MAC could help make that happen.

MAC provided key resources for the 2020 trip. Eric Mupenzi, education coordinator for MAC, and Alice Kubwimana, acting country director for MAC, served as liaisons between the NC State group and the primary schools.

"Without the assistance and input of Alice and Eric, we would never have been able to translate our understanding of engineering to a place where students who live without electricity and running water can not only appreciate it, but engage in solving problems that are meaningful to them," Bottomley said.

MAC also selected the schools, provided Kepler University students to serve as interpreters and purchased tablets for distribution to the primary schools. NC State students loaded

activities onto the tablets and showed teachers how to use them.

NC State student leaders **Tashana Flewwellin** (senior, textile engineering and political science) and **Jeremy Petersen** (B.S. in electrical engineering, May 2020) organized the 2020 trip and managed it in Rwanda.

During the planning phase, they worked closely with Pender. She helped them with logistics, including finances, but the student leaders organized everything from transportation, accommodations, assignments and supplies to outings for the engineering students during their free time in Rwanda.

Dr. Kanton Reynolds, teaching associate professor and director of undergraduate programs in the Edward P. Fitts Department of Industrial and Systems Engineering, went on the trip and praised the student leaders. "There was never a point when I thought I would have to jump in and take control. Our trip leaders, Jeremy and Tashana, did a fantastic job."

IN THE SCHOOLS

On the first day of the workshops, small NC State teams dispersed to primary schools: Mwiko, Kinoni, Karugunda, Nkumba and Birwa. Most of the teams worked with P6 students who were 11 to 12 years old.

During the workshops, the teams introduced the Rwandan students and their teachers to engineering and the engineering design process through team-building exercises, reading activities in English and simple hands-on activities to teach basic physical principles. By the end of the week, the Rwandan students embraced the engineering design process: ask, imagine, plan, create and improve.

Although English is taught in the schools, communication problems, especially with regard to the readings, presented an unexpected challenge on the first day.

The NC State teams adapted.

After that first day, teachers and Kepler students helped paraphrase stories and directions in Kinyarwanda, the native language.

Bottomley also realized that many of the books they had chosen were difficult for the Rwandan students to relate to.

"I purchased some stories that originated at least in eastern Africa... We talked to the students about the countries these stories originated in, and they were able to understand and relate to them," she said.

Daniel said, "The first day was very challenging. Then it was

difficult to leave. You just think about how quickly you adapt and make things work."

The rest of the week went well.

Materials science and engineering major **Mack Vinson** said, "I was really stressed after the first day because of the language barrier, but the next day I woke up and said, 'We can do this.' By the end of the week, students were asking questions relevant to the engineering process."

On the last day, the Rwandan students and their teachers honored the NC State teams with celebrations, including traditional dances.

WMEP plans to take another group of NC State students back to the same schools when the pandemic allows.

Bottomley said, "The establishment of a program like this, ensuring it really is a two-way street, takes time and a lot of work. I'm 100-percent confident that we got more out of this trip than they did this time, and I want to persist until it is at least mutual." ■

"If you are going to engage in global endeavors, you have to... understand both the differences and similarities of people in other places."

DR. LAURA BOTTOMLEY

With construction complete, Fitts-Woolard Hall is going through a phased opening

The College of Engineering took beneficial occupancy of Fitts-Woolard Hall on July 24, 2020. Coming in at approximately 225,000 gross square feet, NC State's newest engineering building provides the crucial next step in uniting the College on Centennial Campus.

The Department of Civil, Construction, and Environmental Engineering (CCEE) and the Edward P. Fitts Department of Industrial and Systems Engineering (ISE) began moving into spaces on August 3. The dean's administration began moving into its offices on the fourth floor on August 31.

During the first two weeks of the fall semester, before the University's decision to move undergraduate classes to full-time online instruction, classrooms on the second floor were being utilized — including the Angel Family Foundation Auditorium (Room 2336).

Multiple laboratories located throughout the building are up and running — including the Multifunctional Composites Lab (Room 1322) led by CCEE's **Dr. Jason Patrick**. The research group works toward advancing modern fiber-reinforced composites, which are both strong and lightweight compared to conventional structural materials like steel and concrete.



fwh
FITT'S-WOOLARD HALL



home new



Cornerstone Society

The Cornerstone Society provides an opportunity for you to name a space of your choosing in Fitts-Woolard Hall or in an existing engineering building on Centennial Campus. Naming opportunities begin at \$100,000. As a member of this exclusive society, you will:

Have your name permanently associated with the space of your choosing

Have your gift recognized in a central location in Fitts-Woolard Hall along with a special recognition biography and photo.

Receive regular insider updates on the research and education in Fitts-Woolard Hall

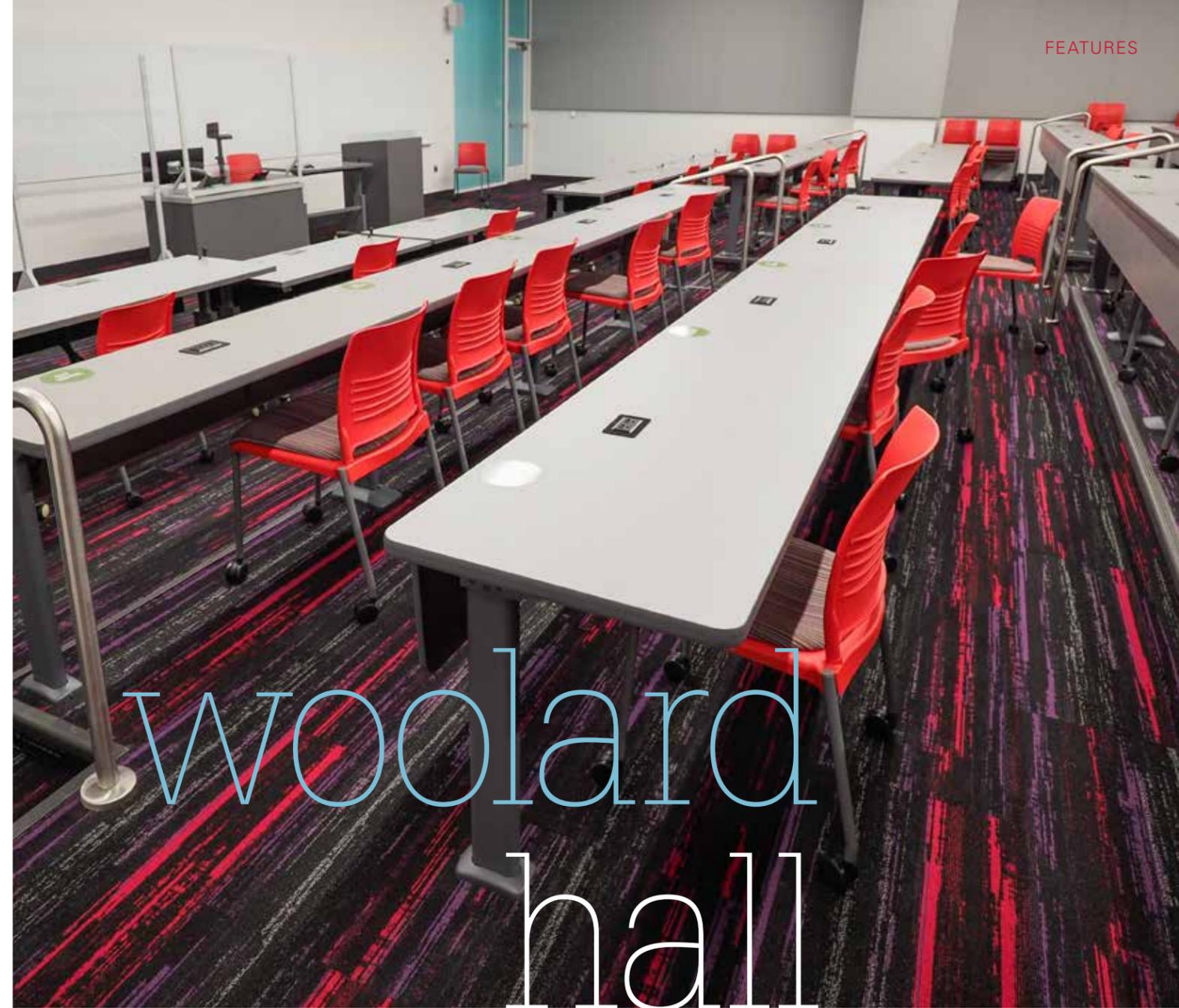
Be invited to exclusive events, including the dedication of the new building (spring date TBD).

If you are interested in learning more about fundraising efforts or named spaces in Fitts-Woolard Hall, please contact Erica Fuller with the NC State Engineering Foundation, Inc. at ecacinder@ncsu.edu or 919.515.9958.

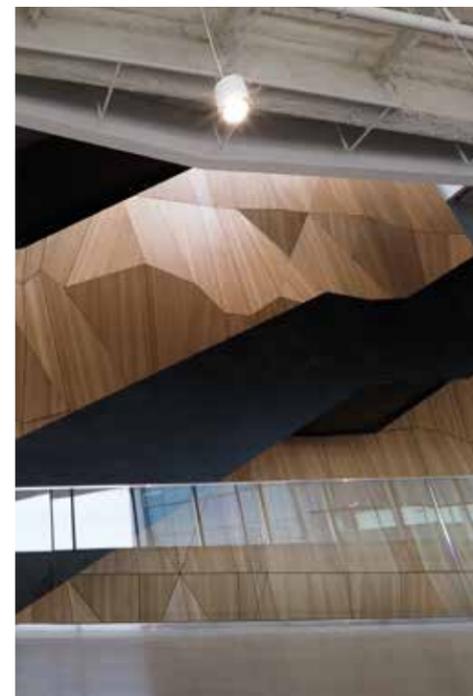
The \$154 million project received \$75 million from the voters of North Carolina through a 2016 bond referendum. The NC Legislature provided an additional \$2 million in design funding and the University is providing \$17 million for support infrastructure. The College pledged to contribute \$60 million through private philanthropy and currently has commitments of over \$48 million, thanks to the generosity of more than 300 alumni donors and a lead gift of \$25 million from industrial engineering alumni Edward P. Fitts and Edgar S. Woolard.

The College still needs the support of its alumni and friends to close the remaining fundraising gap to avoid taking on debt that would impact the opportunities that can be made available to our students. ■

fitts woolard hall



Fitts-Woolard Hall represents a new public-private model for funding construction, a first for a campus building in the University of North Carolina System.



NAMING OPPORTUNITIES

EXTERIOR	04 / 10	STILL AVAILABLE
LABORATORIES	35 / 42	STILL AVAILABLE
CLASSROOMS	06 / 09	STILL AVAILABLE
CONFERENCE/MEETING ROOMS	12 / 15	STILL AVAILABLE
FACULTY OFFICES	00 / 08	STILL AVAILABLE
COMMON / MULTI-PURPOSE SPACES	11 / 23	STILL AVAILABLE

68 of the 107 naming opportunities in Fitts-Woolard Hall are still available.



TOM MIRALIA (NE '84)



EDWARD WEISIGER, JR. (IE '82)

Fitts-Woolard Hall effort is powered by alumni giving

“The engineering students I went to school with were sharp and they've gone on to do a lot of great things. That's something we can be very proud of.”

TOM MIRALIA

Fitts-Woolard Hall, the College's newest building on NC State's Centennial Campus, started as a dream.

After the 2008 recession, plans to build a fourth engineering building on Centennial were put on hold. To help move the vital project forward, the College of Engineering committed to raising \$60 million in private funding to help support the project. It represented a paradigm shift in how infrastructure is funded in the UNC System.

The new home of the Department of Civil, Construction, and Environmental Engineering; the Edward P. Fitts Department of Industrial and Systems Engineering; and the dean's administrative offices opened this summer.

But the work isn't over yet.

Thanks to the support of more than 300 alumni donors, the College has raised \$48.2 million toward its goal. Though the building is done, the fundraising effort continues.

Meet two engineering alumni who have made support of the project a priority and learn why they decided to give.

TOM MIRALIA

Tom Miralia's late father, Rock, was an Indiana University graduate and engineer who co-founded the Charlotte-based Distribution Technology, Inc. in 1969.

Miralia was raised in the family business and today leads the warehousing and transportation firm. But he followed a different path at first.

As a high school senior in Charlotte, NC, Miralia liked physics, hard science and technology. Coming to Raleigh was a natural fit.

“When I got my NC State admittance, I replied pretty quickly,” he said.

Miralia chose nuclear engineering, despite the fact that his freshman year at NC State coincided with the accident at Three Mile Island Nuclear Generating Station in 1979. It was a tough time for the industry, but Miralia enjoyed the rigorous coursework and the department's faculty and he stuck with it.

He was involved with the student chapter of the American Nuclear Society and with Delta Sigma Phi fraternity.

After graduation in 1984, he worked for Duke Energy at the McGuire Nuclear Power Station near Charlotte, NC, as an associate engineer in the reactor group, involved in project procedure development and testing in support of power plant operations. After four years, Miralia decided that he was ready to try working with the family business. He served as systems engineer, supervisor, general manager and vice president in support of company operations while earning an MBA from Charlotte's Queens College. Today, he is the company's president and CEO.

Miralia has kept in touch with the University as a member of the alumni association and through interactions with NC State students who come to Distribution Technology through internship programs. He and his wife, Laura, have two children currently enrolled.

The couple saw support of Fitts-Woolard Hall as a great way to give back to the University and College. He also sees it as an investment; he expects to recruit some of the students who benefit from his contribution and study in the new building.

Miralia said that the NC State students who come to his company always arrive well prepared. He sees it as a legacy that dates back to his own time at NC State and a benefit to the state of North Carolina.

“The engineering students I went to school with were sharp and they've gone on to do a lot of great things,” he said. “That's something we can be very proud of.”

EDWARD WEISIGER, JR.

The Weisiger family has a long history at NC State. Though not an alumnus, Leslie M. Weisiger, who bought Charlotte's Carolina Tractor and Equipment Co. (now CTE) in 1930, was a longtime supporter of the University and a civil engineer. The Weisiger-Brown Athletics Building, home of much of the Wolfpack athletics administration, bears his name.

His son, Ed Weisiger, Sr., earned a degree in mechanical engineering from NC State and succeeded his father as head of the company. So, Ed Weisiger, Jr., president and CEO since 1991, had a lot of familiarity with NC State; he grew up attending Wolfpack football games and staying on campus for youth basketball camps. The choice to study engineering, though, was another matter. The decision came naturally.

“There was a history of engineering in our family,” Weisiger, Jr. said. “By genes or DNA or something else, I had some ability in math and science, so that leaning was very natural.” Weisiger graduated with a bachelor's degree in industrial engineering in 1982. He also took several mechanical engineering classes, so many that

he nearly finished with a dual major. After graduation from NC State, he earned an MBA from the Harvard University Graduate School of Business.

NC State offered him a rich education that taught problem solving within a business context. During his time on campus, Weisiger participated in ROTC, fraternity life and intramural and club sports.

“I was doing a number of things that made it a broad experience that I really relish,” he said. “It allowed me to interact with a broad cross section of people that I normally wouldn't.”

Weisiger has kept NC State close to his heart through the years. He has served as a board member for the NC State Engineering Foundation and the Wolfpack Club and currently serves on the University's Board of Trustees.

He established the Edward I. Weisiger Professorship in the area of construction engineering and management and he and his father endowed the Carolina Tractor and Equipment Co. Endowed Scholarship to aid students from Western North Carolina enrolled in mechanical or civil engineering.

When it came to supporting the fundraising efforts for Fitts-Woolard Hall, Weisiger said that he and his wife, Betsy Fleming, saw an opportunity to support his home department as it moves to a much-needed new home and to help further the College's continued move to Centennial Campus. ■

“(NC State) allowed me to interact with a broad cross section of people that I normally wouldn't.”

EDWARD WEISIGER, JR.



Engineering a more inclusive campus

The applause was unexpected.

As vice president for IBM's Chief Data Office, senior state executive for IBM in North Carolina and senior location executive for Research Triangle Park, **Timothy Humphrey** is accustomed to public speaking. And as an involved alumnus, he has stood in front of an audience of NC State students numerous times to share his expertise.

But at the fall 2019 welcome address for the College of Engineering, when Humphrey reached the part of his talk where he mentioned being inducted to the College's Electrical and Computer Engineering (ECE) Hall of Fame, the first-year students caught him off guard.

"Normally when I say that, I just keep going, but this time, everybody started clapping. It was really touching — a very, very proud moment," he said.

A proud moment on an already meaningful day

— Humphrey felt like he was going back in time. "I was imagining if I was in their shoes," he said. "I've benefited from great advice through the years. So to be able to give that back to 1,700 engineering freshmen, it was powerful."

Volunteering his time through such talks is just one way Humphrey, a 1996 ECE graduate, chooses to give back to NC State. He participates in panel discussions about careers and delivered the College of Engineering's fall 2019 Welcome address.

He sums up his passion for higher education succinctly: "Great institutions teach you how to learn." And Humphrey is a model for constant learning, having gained experience in fields like artificial intelligence, software development testing, battery technology and analytics.

But before he leveraged his education into a successful career, before his hall of fame induction,

before he entered the College of Engineering after being encouraged toward that career path by a guidance counselor — before all that, as a high school student in Fayetteville, NC, Humphrey already saw himself at NC State.

The summer before his junior year, he had the opportunity to attend a camp run by Wilson College of Textiles. The week at camp sold him on NC State — in fact, he liked it so much, he considered majoring in textiles before his lifelong fascination with electricity brought him back to engineering.

Humphrey was able to fund his NC State education through a combination of work and partial scholarships — one of which was the Minority Engineering Scholarship.

"I think the work they do at the College of Engineering to encourage minorities to pursue careers in engineering is amazing. Working with middle and high school students, then working with the students in the engineering program is game-changing," he said. "I always say that getting a job in a STEM field is, for some people, generational wealth. It really can change generations."

Humphrey's experiences, as well as his desire to give back and create additional opportunities for students with backgrounds similar to his, helped motivate his recent decision to create the Timothy L. Humphrey Women and Minority Engineering Initiatives Award. The endowment will support the work of Women and Minority Engineering Programs (WMEP) at the College of Engineering.

Through summer programs, recruitment weekends, workshops and roundtables, WMEP assists in recruiting, retaining and mentoring students traditionally underrepresented at the College of Engineering. The program is run by **Dr. Laura Bottomley** and **Angelitha Daniel**.

"Tim's support allows us to continue exposing students of all ages to the field of engineering. It is also important to create a campus culture that allows all students to thrive. Having a partner like Tim is crucial to us reaching our program goals in terms of enabling a dynamic and inclusive student body that can solve the most pressing problems of our society," Daniel and Bottomley said in a shared statement.

Diversity is one of the pillars he focuses on in his work at IBM, a company he describes as having a long-standing history of firsts when it comes to inclusion. "I like to do anything I can to move the ball forward," he said. "So that's an additional motivating factor around

focusing on diversity at NC State."

On a recent campus visit, Humphrey spent time with the Office of Institutional Equity and Diversity and learned more about what the office's programs deliver to students. "It really hit home for me," he said. "Meeting some current students and seeing them take advantage of OIED's resources made me say this group could really use some help."

He decided to establish an additional endowment, the Timothy L. Humphrey Inclusion, Equity and Diversity Award to support OIED's campus community centers.

"Tim's personal story of his time at NC State motivates us to work hard every day to enhance our university's climate of belonging and inclusion, and to enrich everyone's cultural competence. That's part of what we see as setting NC State apart. His financial backing of our programs shows that, as an alum and a business person, he recognizes how the work of OIED supports student success for all students. Tim's investment is so meaningful, and we hope it inspires others," said Sheri Schwab, vice provost for institutional equity and diversity.

"When you want to be proud of your university, your university should model the world, the society, your region. Diversity and inclusion programming helps the school look like its surroundings," Humphrey said. "And creating a diverse institution takes time and programming, which requires investing."

Humphrey's two endowments will further the extraordinary opportunities NC State can offer to students by fostering a more inclusive campus.

"Thinking and doing the extraordinary to me means creating something you would have never imagined possible in the past," he said. ■

"When you want to be proud of your university, your university should model the world, the society, your region. Diversity and inclusion programming helps the school look like its surroundings."

TIMOTHY HUMPHREY

Meet the DEAN'S CIRCLE



FROM LEFT TO RIGHT, SAM BURGISS (EE '66, '68, '71), LAURA GEARY (ISE '17), KAREN (ACC '88) AND STEVE WELTON (CE '88 '92)

Now more than ever, NC State students need your support.

The Dean's Circle, the College's leadership annual giving program recognizing all unrestricted gifts of \$1,000 or more, is focused on providing competitive recruiting undergraduate and graduate scholarships and fellowship awards.

Ensuring that our most deserving students are able to obtain all of the benefits that come with an NC State engineering education is a solid investment that pays off for the state, our nation and the world. Alumni who know the impact that their degree has had on their lives can create a legacy by supporting the next generation of NC State engineers.

Meet some Dean's Circle donors, and learn why they give.

SAM BURGISS came to NC State in 1964 to study electrical engineering. He decided to stay awhile.

As a boy in Yadkinville, NC, Burgiss took an early interest in electronics and worked in a television repair shop in high school. He settled on NC State because it was an excellent school and affordable for North Carolina residents.

Burgiss paid for his education through summer jobs and teaching positions, and was just focused on earning his bachelor's degree. But a faculty member encouraged him to stay on and earn his master's. Soon enough, he was encouraged to earn a Ph.D. So, he did.

After graduation, Burgiss was employed by a couple of different companies before moving to Knoxville, Tenn., to work on one of the first PET scanners. He then joined the University of Tennessee (UT) Medical Center and was appointed to a faculty position with

the University of Tennessee Graduate School of Medicine, doing research on healthcare technology and establishing the university's telemedicine program.

"It was very interesting and rewarding to have something to do with both of these technologies," he said.

Burgiss and his wife, Janet, had two boys, both engineers themselves. He retired in 2005 but still does consulting work with UT.

He remembers all of the assistance and opportunities that were provided by faculty members and is appreciative of the fulfilling career that was made possible by his NC State education.

Burgiss is motivated to support the College of Engineering so that he can help make that same opportunity a reality for the next generation.

"I like to try and help a student to be focused on education, rather than finances."

LAURA GEARY grew up in a rural farming community in Maryland. The daughter of a single mother, Geary is the first person in her family to earn a four-year degree.

Geary finished her bachelor's degree from the Edward P. Fitts Department of Industrial and Systems Engineering (ISE) in 2017 and jumped in to giving back to the College of Engineering early on.

"My degree means so much to me," Geary said. "I don't want to take it for granted, ever."

As a teenager, Geary spent time in the Research Triangle area visiting a cousin attending Duke University. She wanted to come to North Carolina for college and knew her future was in a STEM field. When she set her sights on engineering NC State, and its ties to agriculture, felt like home.

She came to Raleigh not knowing anyone, but quickly fell into friendships playing volleyball on Tucker Beach and participating in club tennis and table tennis. She matriculated into ISE as a sophomore, attracted by the diverse opportunities that a degree offers.

Since graduation, she has held positions with GE Industrial Solutions, ABB, Inc. and now Intel. In each role, she's utilized the ISE education to manage leaner supply chains and streamline logistics of sales operations. Her reward, Geary says, is to work with great people and to make their work life more enjoyable with the improvements she is able to produce.

Geary was one of the first volunteers and leaders of

the NC State Engineering Foundation's (NCSEF) Young Alumni Advisory Board, tasked with helping young professionals connect and give back to the College at an early age. Geary was the board's first events chair, helping plan gatherings where alumni can make connections with each other and find out what their alma mater is doing today.

"Giving back not only financially but spending time with people who love NC State as much as I do is incredibly enjoyable," she said.

KAREN AND STEVE WELTON met in a freshman English class in NC State's Tompkins Hall in fall 1984. After a couple of decades raising a family and running a business together, they're back on campus.

Steve, who earned bachelor's and master's degrees in civil engineering, is a senior lecturer in the Department of Civil, Construction, and Environmental Engineering (CCEE). Karen, who earned her bachelor's degree in accounting, is an executive assistant in the Edward P. Fitts Department of Industrial and Systems Engineering (ISE).

After graduation, Steve worked as a structural engineer for a couple of firms before starting a company of his own serving the Virginia Tidewater region. Karen, who had been with a couple of different companies, was soon running the office and handling payroll, accounting and marketing.

In 2014, Steve had an opportunity to try his hand at teaching the senior design course in structures in CCEE. He's still teaching senior design, plus several other classes, and serves as faculty advisor for a few student groups. Karen also works closely with students coordinating travel and the department's presence at national conferences.

Supporting the College, and the students they love spending time with and mentoring, is a natural.

"We have longstanding connections with this place," Steve said. "We are both very grateful for the experiences we've had. We're very honored to be in this position to be stewards."

The Weltons will find themselves in the same building this fall as CCEE and ISE move into their new home in Fitts-Woolard Hall on Centennial Campus.

"We were very lucky to be able to come back here and both have jobs that we really love," Karen said.

"And we get to move into a new building." ■

PLANNED GIVING

Have you included the **NC State Engineering Foundation, Inc.** in your will, trust or other estate plans?

It's a great way to make sure the opportunity that meant so much to you is there for future generations.

GIFT IN A WILL OR TRUST

Create your personal legacy by including the NC State Engineering Foundation, Inc. in your will or trust.

CHARITABLE GIFT ANNUITY

Provide fixed income for yourself or a loved one.

CHARITABLE REMAINDER TRUST

Create life income for you and your spouse.

RETIREMENT PLAN BENEFICIARY

Name the Foundation to receive part or all of your IRA, 401(K) or 403(B).

If you have already included the NC State Engineering Foundation, Inc. in your estate plans please let us know. Call Erica Fuller at 919.515.9958 to discuss any of these charitable options or visit www.engr.ncsu.edu/alumni-and-giving/ways-to-give for more information.



Couple's gift supports students in Engineering, Education

CATHY (ED '79) AND RON (CE '78) HAIRR

Ron Hairr can remember taking out student loans in the 1970s to fund his way through the civil engineering program at NC State.

During the second half of his time at NC State, he was married, working 24-40 hours a week and going to school.

"Between working, studying, sleeping and going to school, it was a hard road to go down," Hairr, a 1978 graduate in civil engineering, recalled.

His wife, Cathy Faircloth Hairr, graduated in 1979 from the College of Education and spent her career as a teacher. She'd seen students who had the grades to go to college, but didn't have the finances.

"It became apparent to us that money makes all the difference in the world when it comes to getting a college education," Ron Hairr said. "We wanted to be able to help other deserving people not have to work so hard to get an education."

The couple established a gift in their estate to be shared equally between the College of Education and College of Engineering. Their gift will provide full cost of attendance scholarships every year for two students in need.

"I read so much about the student loans today, and so many cases where they can't pay them off," Hairr said. "I wanted to provide help that didn't need to be paid back."

He also credits Cathy, as the educator in the family, with sharing her appreciation for the importance of education, along with the impact of his own professors at NC State who helped him see the importance of supporting higher education as well.

Hairr was accepted to NC State during his junior year of high school and could have graduated high school early, but says with a laugh that his parents

weren't ready to send him up to Raleigh at 17 years old.

He enrolled in 1970 and by his second year, settled on mechanical and aerospace engineering. But at the end of that year, as the Vietnam War was winding down, his professors were instead encouraging students to pursue other avenues in engineering. The end of the war meant firms making planes, rockets and other wartime materials were laying off thousands of engineers rather than hiring them.

Hairr took the next 18 months away from NC State to think about where he would go next in engineering. A professor suggested civil engineering, and Hairr realized it was the right fit — allowing him to pursue a similar avenue in building infrastructure such as airports, ports and highways.

"I decided to go that route and I just fell in love with civil engineering," he said.

He returned to NC State to finish his degree, followed by a long, successful career within both engineering firms and as a consultant before retiring about six years ago.

The Hairrs requested the two scholarships go to North Carolina residents, and that those selected show promise in the fields of math education and engineering, with a focus on civil and environmental engineering. Hairr said they want to support students that show financial need as well.

"We firmly believe in reaching down and grabbing an arm and saying, let me help pull you up," he said. ■

MAKING A BEQUEST

A bequest is one of the easiest gifts to make. With the help of an attorney, you can include language in your will or trust specifying a gift to be made to family, friends or the NC State Engineering Foundation, Inc., as part of your estate plan, or you can make a bequest using a beneficiary designation form.

- Bequest dollar total in the **Think and Do the Extraordinary Campaign** as of July 31, 2020: **\$65,017,241**, which makes up 28.9 percent of the College's campaign total of \$224,823,117.
- During the Campaign, there have been **110 new bequests documented from 99 donors.**

NC STATE Engineering



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Alumna builds off scholarship support by starting one of her own

ELIZABETH (CHE '06)
AND CANDY NANCE

“I wanted to give students the safe space to fail, but know that there’s always someone in your corner.”

ELIZABETH NANCE

The story behind **Elizabeth Nance's** scholarship endowment to the College of Engineering begins and ends with her maternal grandmother.

In between is Nance's own story of feeling as if she wasn't as qualified as her peers while pursuing her engineering degree. Yet, in spite of that feeling, the support of faculty and staff members kept her in the program and led to the receipt of her own scholarship that she says was essential to her success.

Nance enrolled at NC State in 2003 determined to pay her own way as she pursued a degree in chemical engineering.

As she progressed, it became evident that her work commitments were impacting her study time. The intervention of her professor and mentor, **Dr. Lisa Bullard**, teaching professor and director of undergraduate studies, changed Nance's trajectory.

“She was instrumental in prioritizing and helping me,” Nance said. “She found a scholarship opportunity that would take some of the pressure off.”

Nance was the first recipient of the first scholarship created by **Frank and Doris Culberson** to support the College of Engineering.

Several family members had gone through the engineering program, but it was a family health issue that really drove Nance's decision to pursue engineering. Both her grandmother and uncle had been diagnosed with an at-the-time poorly understood neurodegenerative disorder.

“It was clearly hereditary,” Nance said. “But science and medicine didn't have information or solutions then to provide treatment.”

She saw engineering as a useful, problem-solving approach to tackle challenges.

As she pursued her degree, however, Nance said she struggled with imposter syndrome — feeling as if she wasn't cut out to be a chemical engineer.

“Even though I struggled a lot in the program, I still remember distinctly the community, and feeling invested in by the faculty, the graduate students and the teaching

assistants,” she said.

In fact, Bullard's role was so critical in her life that Nance's career path was motivated, in part, to “re-create Lisa Bullard at another university,” she said.

“I wanted to give students the safe space to fail, but know that there's always someone in your corner,” she said. “She would support me and give me perspective — when she saw me approaching a point where it was a risk for me, where I could potentially drop out of that major, she provided the space to be able to have those conversations.”

Nance earned her Ph.D. from Johns Hopkins and did a post-doc in critical care medicine. That work confirmed her passion for working with students and creating active learning environments. Today, she is the Clare Boothe Luce Assistant Professor of Chemical Engineering and Associate Chair of Undergraduate Studies at the University of Washington.

Nance came from a tight-knit family that spent every Sunday together at her grandparent's house.

NC State was a prominent part of Nance's life from an early age. Her uncle **Roger Nussman** and cousin **Chad Nussman** both earned degrees in chemical engineering at NC State. Additional family members earned degrees from the University as well.

Nance's mother was a nurse and father, a minister — putting the family income at that line where they barely qualified for financial aid when Nance was accepted to NC State, she said.

“That wasn't easy on my mom and dad — they took out loans and did what they had to,” she said. “I felt the need to financially help support our family, as did my brothers, but it wasn't something my parents asked us to do.”

She knew from the time she received the Culbersons' scholarship that she would want to pay it forward one day.

That's exactly what she's done. When her grandmother passed away in 2015 — largely from complications from the neurological disease she had — Nance knew she wanted to do something in her grandmother's memory.

When her family heard about the idea, they wanted to be a part of it as well. The Edna Loretta Nussman scholarship, named for Nance's grandmother, was endowed through the generosity of Nance, Tommy Nussman, Nance's uncle and Chad's father, and Candy Nussman Nance, Nance's mother.

Nance said she's stayed in close contact with many NC State faculty members over the years. In discussing a gift to the College, it was clear that student support was at the top of their list.

What's more, she could personally speak to the ways in which financial support changed her life.

“I wrote letters to Frank and Doris at Christmas,” she said. “I wanted to keep them updated because it was so impactful to me at that age — I didn't always feel like I had the skills to be an engineer, and when somebody invests in you, that's a message.”

Frank Culberson noted that he didn't have a lot of money growing up, and wasn't sure if he'd be able to attend college. Scholarship support was essential to his success in college, he said. It's part of why he supports the University today, and it is his hope that other recipients of support will do the same.

“Those that get scholarships, I would believe a significant number of them would give back to school,” he said. “We just need to keep pushing these students to think about the University, and to think about including support for the University in their budget.” ■

Engineering Foundation welcomes new development officer



ANNA KNIGHT

Anna Knight joined the NC State Engineering Foundation in July 2020 as a director of development working with the Department of Electrical and Computer Engineering and the Department of Nuclear Engineering.

Most recently, Knight was an associate director of development at the Whiting School of Engineering at Johns Hopkins University in Baltimore, Md.

This is Knight's second "tour" at NC State; she served previously as an assistant director of development in the College of Humanities and Social Sciences. She earned her master's in public administration in 2014 from NC State and is happy to be a Wolfpack alumna. ■

SPOTLIGHT

YOUNG ALUMNI



From the board

Learn more about the work of the NC State Engineering Foundation, Inc. Board of Directors

ABOVE, FROM LEFT TO RIGHT: RALPH EDWARDS, HELENE LOLLIS, NELSON PEELER, LEAH PURSELL, PAMELA TOWNSEND, DR. GREGORY WASHINGTON, AND DEBORAH YOUNG.

The NC State Engineering Foundation, Inc. was established in 1944 to aid and promote, by financial assistance and otherwise, engineering education and research at NC State. A board of directors made up of alumni and friends of the College of Engineering work with the Foundation staff and the dean of engineering to set the foundation's agenda. The board is led by President **Nelson Peeler, Jr.** and Vice-President **Deborah Young.**

The Foundation's College Relations Committee has undergone a renaming and shift in its focus. Now called the College and Alumni Engagement Committee, it will focus on supporting the work of the Foundation in respect to events, alumni communications and other activities designed to raise awareness of the Foundation and the way it supports the College.

That support may include developing alumni engagement plans, mentoring the Young Alumni Advisory Board (YAAB) or other organizations working with current students and serving as a sounding board for college-wide alumni marketing initiatives.

The committee — led by chair **Ralph Edwards, Jr.**, and vice-chair **Helene Lollis** — will shift its focus to engaging current alumni, with the YAAB now involved with outreach to current students. The committee also hopes to build on successful events held in Atlanta, Charlotte and Virginia.

THE FOUNDATION'S ADVOCACY COMMITTEE hosted a virtual panel discussion on May 22 to give alumni an opportunity to learn more about how the COVID-19 pandemic was impacting the University and College. **Pamela Townsend**, chair of the committee, served as moderator.

The discussion offered insights into how the College is operating during the crisis, efforts to help produce personal protective equipment and offer assistance with relevant expertise, and impacts on students.

The panel included remarks from **Dean Louis Martin-Vega** and **Dr. Paul Dayton**, William R. Kenan, Jr. Distinguished Professor and interim chair of the UNC / NC State Joint Department of Biomedical Engineering; **Dr. Landon Grace**, assistant professor in the Department of Mechanical and Aerospace Engineering (MAE); **Dr. Julie Swann**, A. Doug Allison Distinguished Professor and head of the Edward P. Fitts Department of Industrial and Systems Engineering; and **Leah Pursell**, the student representative on the Foundation board and a junior studying in MAE.

AN NC STATE ENGINEERING alumna and member of the Foundation board took office over the summer as the eighth president of George Mason University in Fairfax, Va.

Dr. Gregory Washington earned bachelor's, master's and Ph.D. degrees in mechanical engineering from NC State and has been a Foundation board member since 2013. Before joining George Mason, Washington served as a professor of mechanical and aerospace engineering and the dean of the Henry Samueli School of Engineering at the University of California, Irvine.

Washington is George Mason's first African-American president. At UC, Irvine, he was the first African-American dean of engineering at any of the University of California campuses. ■



HOMETOWN

Raleigh, NC

GRADUATION YEAR

2012

DEGREE

B.S. Computer Engineering, NC State
 B.S. Electrical Engineering, NC State
 MBA University of Maryland, 2017

CURRENT JOB TITLE

Diversity Recruiting Business Partner at Apple

JASMINE JARVIS

From attending football games with her Wolfpack alum father to growing up in Raleigh, NC, **Jasmine Jarvis** was exposed to NC State at an early age. What drew her to attending the University came from an unexpected internship project in high school.

"I reached out to Tara Britt in the ECE (Electrical and Computer Engineering) department, who was the external relations manager at the time, on a long shot and she took a chance on me by facilitating my participation in the department's autonomous vehicle camp and lab research work," shared Jarvis. "Having that initial exposure to the engineering discipline fundamentals and the department as well as the ability to participate in research presentations on campus with the support from the College so early on — it made selecting NC State an easy decision."

While studying at NC State, Jarvis had the opportunity to intern and work year-round as a tech student intern at SAS Institute and an IT analyst intern with Cisco Systems. Upon graduation she began her career in Washington, D.C. at IBM as a technical consultant.

"Through my time in the College, I learned that I loved people, team projects and collaboration. So, for me, consulting brought together the building blocks I had learned in undergrad with my ability to communicate well and pull together a team to solve problems." Jarvis held various consulting roles in IBM and pivoted into leading the company's diversity and inclusion initiatives within her role as a talent acquisition partner, until leaving to be a corporate recruiter with

Apple in 2018. Now, as a diversity recruiting business partner, she works with R&D and non-R&D recruiting leaders and teams to define and execute diversity strategies to make a direct positive impact at Apple.

Outside of her work she started her own podcast, *TECHnically Female*, devoted to empowering women of all ages who are interested in pursuing STEM fields. According to Jarvis, the mission of the podcast is to provide useful advice to inspire women to slay in a male-shaped society, to motivate females to pursue STEM courses and pathways and to create a community of like-minded STEMInists and tech-girl bosses.

TECHnically Female (@technicallyfemale) began as a motivational Instagram account idea two years ago and has evolved into a podcast. As of the end of August, it had over 1,000 listens in just two months and she has solidified episode guests for 'WISE Women Wednesday' through October.

"I think people are enjoying it because we have authentic conversations that do not shy away from the 'taboo topics' as well as discuss the difficulties and the perseverance it takes to be a woman in STEM. The *TECHnically Female* podcast is helping mentor and guide the tribe towards an empowered STEM journey."

To learn more about the *TECHnically Female* podcast, you can check it out on Apple podcasts, Spotify and Anchor, or reach out directly to technicallyfemale@gmail.com. ■

MEET THE CLASS OF 2020

Here's what to know about spring 2020 graduates who completed an undergraduate degree

Of the **1,537** new alumni who completed undergraduate degrees, **362** were women.

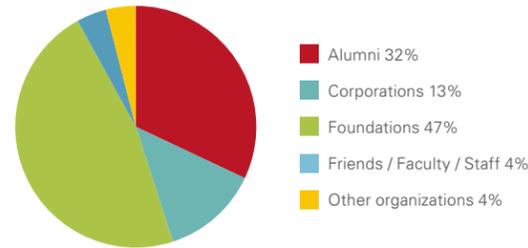
Of those surveyed during the spring, **47** percent had already accepted a full-time position and **23** percent planned to attend graduate or professional school within a year.

The three most common industries for those new employees were engineering, computer software / hardware and manufacturing.

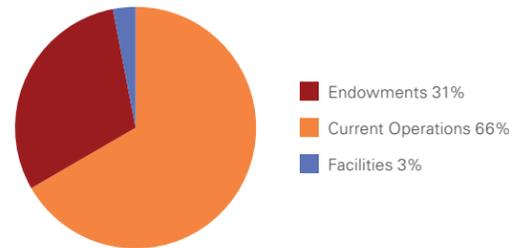
Of those who had already accepted a full-time position, the median starting salary was **\$71,250**.

Foundation Year in Review

GIFTS AND NEW COMMITMENTS BY GIFT SOURCE, FISCAL YEAR 2019-20



GIFTS AND NEW COMMITMENTS BY GIFT USE, FISCAL YEAR 2019-20



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 ofa.ncsu.edu/foundations/nc-state-engineering-foundation-inc.

The **NC State Engineering Foundation, Inc.** maintained fundraising momentum this fiscal year in light of unprecedented challenges with one-third of the year spent working remotely and creatively meeting donors and alumni through virtual formats. Fundraising totals to the College were **\$43,098,073**. As of June 30, 2020, the College had raised **\$228,218,548** toward our comprehensive campaign

goal of \$230M. We have confidence that we will reach \$230M by December 31, 2020, but are still hard at work on several key sub-goals, including completing fundraising for Fitts-Woolard Hall. Endowments to the College generally fall into one of three categories: scholarships, named professorships and fellowships. There are now **313** permanently endowed scholarships in the College and **56** permanently endowed named professorships. Total endowment support for the College is **\$139.7 million** as of March 30, 2020, including directly owned assets as well as endowments held outside of the Engineering Foundation. The annual giving program for the COE raised a total of **\$1.25 million** for the College of Engineering Leadership Fund and the nine academic department enhancement funds. The Dean's Circle, the College's leadership annual giving society, had a total of **456** members, which includes **148** new members this fiscal year.

The Young Alumni Advisory Board remains a focus for the College, and currently has **26** young professionals representing various engineering disciplines from NC State classes 2005 or later. The board is modeled after the Foundation board and has four working committees focused on College priorities from development to college relations and engagement with current students. ■

NC STATE ENGINEERING FOUNDATION, INC.

Board of Directors

- V. Nelson Peeler, Jr., President, EE '88
- Bruce Baldwin, ME '92
- Ashley Barnes, IE '95
- Suzanne Beckstoffer, CE '82
- Michael Broaders
- Robert (Bob) Brooks, EO '69
- Linda Butler, NE '86
- Calvin Carter, Jr., MSE '77, '80, '83
- W. H. Clark, Jr., IE '56
- Wes Covell, EE '84
- Mike Creed, CE '73, '84
- Casey Dean, EE '67
- Heather Denny, CE '95
- David Dove, AE '69
- Ralph Edwards, IE '61
- John Freeman, MSE '57
- Suzanne Gordon, CSC '75, MA '75, ST '80
- Len Habas, EE '66
- Rashida Hodge, ISE '02, '03
- Seneca Jacobs, CE '99
- Rob Loftis, EE '02
- Helene Lollis, CHE '87
- Samuel (Sam) McCachern, CE '85
- Mark Norcross, FMM '65
- Chi Nguyen, AE '92
- Leah Pursell, ME '21
- Scott Stabler, MAE '82
- Carl Stutts, Jr., CHE '68
- Alvin Sumter, ISE '87
- Pam Townsend, CE '84, '87
- Hannibal (Hans) Warren, Jr., CE '84
- Greg Washington, ME '89, '91, '94
- David Whitley, EE '92
- Robert (Bob) Womack, MAE '59
- Mark Wyatt, CSC '80
- Deborah B. Young, CE '77

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A PLACE FOR INVENTORS

Alexander Graham Bell. Thomas Alva Edison. Henry Ford. Steve Jobs. The National Inventors Hall of Fame (NIHF) honors the best of American ingenuity. The 603 inventors who have been inducted since the organization's founding in 1973 represent the brightest minds in the nation's history and advancements that have truly changed the world. NC State, and the College of Engineering, are very well represented. Four current NC State faculty members are NIHF inductees, three in the College of Engineering:

DR. JAYANT BALIGA
Progress Energy Distinguished Professor in the Department of Electrical and Computer Engineering (inducted in 2016)
Baliga's insulated gate bipolar transistor is a semiconductor power switch used in household appliances, cars and heavy equipment that has been credited with reducing electricity consumption by 40 percent.

DR. DONALD BITZER
Distinguished University Research Professor in the Department of Computer Science (inducted in 2013)

Bitzer and two collaborators at the University of Illinois at Urbana-Champaign created the first plasma display panel.

DR. SYLVIA BLANKENSHIP
Professor emerita and retired senior associate dean in the College of Agriculture and Life Science and its Department of Horticultural Science (inducted in 2020)

Blankenship and biochemist Dr. Edward Sisler identified 1-methylcyclopropene, a novel compound now used globally to extend the storage life of fruits, vegetables and cut floral products by mitigating the effects of ethylene. Sisler, who passed away in 2016 after a career on the NC State faculty, was also inducted into NIHF in 2020.

DR. FRANCES LIGLER
Ross Lampe Distinguished Professor in the UNC / NC State Joint Department of Biomedical Engineering (inducted in 2017)
A biosensor is a device using biological molecules to detect a chemical or biological target. Ligler developed a new chemistry for attaching biomolecules on sensor surfaces that maintained their functionality far better than prior approaches and then integrated emerging technologies from a variety of fields to make optical

biosensors smaller, more versatile and more automated.



FROM LEFT, DRS. JAYANT BALIGA, DONALD BITZER, SYLVIA BLANKENSHIP, AND FRANCES LIGLER.

When it comes to active or living emerita faculty members who are NIHF inductees, **NC State ranks second in the world.** Massachusetts Institute of Technology (MIT) leads the way with seven members and NC State and Stanford are tied for second with four apiece. ■

Frances Ligler is part of a very distinguished group of women inventors in engineering. She is **one of just six women who have been inducted into NIHF and elected to both the National Academy of Engineering and the National Academy of Inventors**, another organization that celebrates American inventors in academia and the non-profit work sector.

The NIHF has inducted 603 people from the inventors of more than 10.7 million patents. Forty-five of these inductees are women. Of those 45 women, 22 are living. Of the 22 who are living, eight are either active or emerita faculty members at universities, and two are members of the NC State Wolfpack.

Leaders Needed

Donors who support the College's Fitts-Woolard Hall project receive recognition and exclusive benefits as part of their important gift. Along with recognition in this iconic new engineering building, members will receive regular insider updates on the construction and will be invited to exclusive events, including hard hat tours of the space and the building dedication.



Cornerstone Society

For gifts beginning at \$100,000

Your name will be permanently associated with the space of your choosing, and your gift will be recognized in a central location in Fitts-Woolard Hall along with a special recognition biography and photo.



Dean's Oval Club

For gifts of \$50,000 to \$99,999

You will receive permanent recognition with a donor profile in a central location in Fitts-Woolard Hall.



Dean's Young Alumni Oval Club

For gifts of \$25,000 over five years by young alumni up to 15 years after graduation

You will receive permanent recognition with a donor profile in a central location in Fitts-Woolard Hall.

To learn more about how you can support Fitts-Woolard Hall and about membership in these groups, contact Erica Fuller with the NC State Engineering Foundation, Inc. at eacinder@ncsu.edu or 919.515.9958.

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NC State Engineering



NC State College of Engineering

