

Annual Report 2019-2020
College of Engineering
North Carolina State University

Overview

NC State's College of Engineering is the flagship engineering school in the state of North Carolina and is recognized as one of the leading public colleges of engineering in the United States. Through its threefold mission of engineering research, education and extension, the College continues to have a major impact on the state by providing its students with a very high-quality education that affords them significant career opportunities. The College is also a major driver of the North Carolina economy through its research and innovation and the creation of a job-ready workforce as well as new industries and products that are the source of new job creation statewide.

The College's goal is "to become and be perceived as the leading public college of engineering in the United States and one of the preeminent colleges of engineering in the world." This goal closely aligns with the University's goal, stated in its strategic plan, of emerging as a preeminent technological research university. It is our belief that NC State will not be a world-class university without a world-class college of engineering as a leader.

The College's primary focus continues to be the recruitment and retention of outstanding faculty and students and creating for them an inclusive environment that is welcoming to all and that allows them the opportunity to pursue interdisciplinary work on the vexing problems that face mankind. Our students benefit from continued investments in programs that add breadth to their engineering classwork through opportunities in research, entrepreneurship, the humanities and study abroad. For faculty members, investments in research infrastructure and a focus on areas that align with funding priorities have afforded the opportunity to compete for and earn the leadership of major government-funded research projects.

With more than 10,500 students, COE ranks in the top 20 nationally in the number of annual engineering bachelor's, master's and Ph.D. degrees awarded. At the same time, the College is recognized nationally for the high quality of its programs. COE climbed again in the *US News & World Report* rankings of the top graduate engineering programs, to 24th nationally and 11th among public institutions. This represents the College's highest ranking in more than a decade. The College has ranked in the top 10 nationally in research expenditures two years in a row, according to data from the American Society for Engineering Education.

As construction of Fitts-Woolard wraps up this summer, COE prepares to take another large step toward unification on Centennial Campus. Thanks to more than 360 generous alumni and friend donors, the College has made a significant contribution to the cost of construction of this new facility, raising \$48.5 million of its \$60 million private philanthropy

commitment.

Changes in the Service Environment

The College saw a very successful year turned upside down in late winter 2020 as an outbreak of the COVID-19 respiratory illness shuttered campus. COE mounted a successful response and is preparing for the fall 2020 semester under drastically different conditions than those we faced just a year ago.

Thanks in large part to experience and infrastructure in place because of the award-winning Engineering Online program, COE faculty members were able to transition to virtual instruction and finish the semester strong. Faculty and staff members and students across the College took up an effort to create tens of thousands of mask components for frontline healthcare workers and a design for an emergency ventilator and our Biotechnology Training and Education Center (BTEC) was soon making enough hand sanitizer to supply the entire campus. Going forward, COE research projects are determining whether outbreaks of the disease can be spotted in our municipal wastewater, modeling the best ways to respond to the pandemic and helping create a better patient test.

Dr. Julie Swann, head of the Fitts Department of Industrial and Systems Engineering, has become a national leader and media source on the pandemic. Nuclear engineering alumna Dr. Linda Butler, vice president of medical affairs and chief medical officer for Raleigh's UNC REX Healthcare, is a prime example of an NC State engineering graduate serving on the frontlines of the crisis.

Major Initiatives

The COE engineering enhancement fee continues to play a critical role in supporting significant enhancements to the undergraduate and graduate student experience. This includes upgrades of research laboratory space and acquisition of research equipment for undergraduate and graduate research efforts as well as much-needed funding for support of graduate research assistants. The College has also been able to provide enhanced opportunities for undergraduates to engage in a wider range of activities such as our Research Experiences for Undergraduates (REU) program, our NAE Grand Challenges Scholars program, Entrepreneurship programs, newly developed North Carolina Rural Works! Internship and Federal Government Internship programs, Immersive Study Abroad programs, and others that are providing our students with both the breadth and depth consistent with a high-quality 21st-century engineering education. At the graduate level, the fee is supporting student travel to professional meetings, career services, speaking and writing support, mentored teaching experiences, RA/TA experiences and others.

Plans for the creation of a Joint College of Engineering/College of Education Ph.D. program in Engineering Education have taken a slightly different route from original plans. The

Colleges of Engineering and Education have submitted paperwork to first establish an M.S. in Engineering Education with a focus on preparing community college instructors. The plan now is that when the first class is enrolled, hopefully in fall 2021, COE and the College of Education will proceed with the Ph.D. as well. The classes in support of the M.S. are already being taught and are applicable to any engineering student with the intention of teaching in higher education in some fashion. This M.S. degree will serve our state and nation well, as there is not currently any other institution in the U.S. that offers a comparable degree. The classes will be offered both in person and online, so that the entire degree can be completed via distance education.

The College is growing the breadth of its international programs, with approval for two new Exchange Program partners in high-quality engineering programs in Switzerland and Columbia. Associate Dean Dr. Doug Reeves also made trips to South Korea and China to meet with potential future partners. The College has created a part-time position to help with these efforts.

Diversity

COE has long placed a priority on creating a welcoming environment for all. Some progress has been made, especially in increasing undergraduate enrollment of women students and hiring of women faculty. Attracting and retaining both students and faculty members from historically underrepresented groups in engineering is an ongoing priority and the national conversations that have come out of the killing of George Floyd have inspired College leadership to focus even more on these recruiting and retention efforts.

The College has made excellent progress in recruiting female students. Our fall 2019 first-year engineering class was 30.5 percent female, which set the College well above the national average. The class is 13 percent underrepresented minority, up from 10 percent. At the graduate level, 9.5 percent of domestic students enrolled were members of historically underrepresented groups. African-American student enrollment was 4.3 percent (up from 3.6 percent the previous year) and Hispanic enrollment was 5.2 percent (up from 4.9 percent the previous year).

Since 2006, the College has essentially tripled the number of women faculty members and doubled the number of faculty members from underrepresented groups.

In summer 2019, the College was recognized in the initial cohort of 74 institutions into the ASEE Diversity Recognition Program. The NC State College of Engineering was further recognized as one of 28 engineering colleges across the U.S. with “exemplary program” status. The *Dean’s Pledge* affirms a commitment by the engineering dean to improving measures of success, including increases in diversity in enrollments, retention and graduation rates of engineering and engineering technology students, and increases in the diversity of faculty and in engineers in workforce, over the next decade.

Future plans include the creation of an assistant dean for diversity, equity and inclusion position to provide College-wide leadership in this critical area. The position would report directly to the dean and sit on the College's Executive Committee.

Instructional Program Advances

- COE Academic Affairs and Industry Expansion Solutions (IES) continue to be two of the main drivers behind the University's *Rural Works!* Program, which provides students with summer internships in underserved regions around the state. In summer 2019, the College supported 19 students in these experiences, and were on goal to support nearly 50 in summer 2020. Issues with response to the COVID-19 pandemic affected the ultimate placement numbers, which matched the 19 placements from last year.
- The College supports faculty and staff efforts to impact and enhance engineering education across the P-20 spectrum. Examples include:
 - Continued support for P-12 outreach activities in NSF ERC proposals
 - Internal support for The Engineering Place, home of the COE P-12 engineering outreach activities
 - Support for more than 40 engineering summer camps at NC State for elementary, middle and high school students and satellite camps in Rocky Mount, Hickory, Havelock and Charlotte
 - Teaching classes for graduate students, such as "Teaching Undergraduate Engineers," which have been taken by about 70 students so far.
 - Dr. Tameshia Ballard-Baldwin, assistant professor and director of engineering education in COE and in the College of Education, is leading a team that received a National Science Foundation grant to further STEM education within the Edgecombe County Public Schools.

Research

COE continues to invest significantly in efforts to grow its research program by building the infrastructure that undergirds it and by aligning project proposals with funding agency priorities that lead to impactful societal change. The College's research program is recognized as one of the most innovative and productive in the country.

After being in the top 10 nationally in research expenditures two years in a row, the College increased its research expenditures to more than \$206 million in 19-20, a jump of more than 4 percent. COE also recorded an increase of more than 3 percent in F&A over last year. As of June 2020, COE new awards exceeded \$120M.

Significant research developments during 19-20 include three new industry members in the IBM Quantum Hub Site Portal, an NSF MRI Equipment Grant, two GRIP 4 PSI awards and a critical eight-year renewal for the NSF ASSIST Center. Novo Nordisk Foundation allocated \$18M for Aim Bio, a biopharmaceutical manufacturing research and training effort involving Technical University of Denmark in Copenhagen and led by BTEC. The College will lead an NSF AERPAW project for 5G wireless research. A grant from the NIEHS Superfund Research Program will build on research in the Department of Civil, Construction, and Environmental Engineering (CCEE) on the human health effects of per- and polyfluoroalkyl substances.

At the same time, our faculty members are involved in proposals for even more very significant nationally competitive research projects, including NSF ERC grants and pre-proposals, and proposals for an NSF Science and Technology Center proposal, a Materials Research Center and a Mid-Scale Infrastructure Center.

Seven new companies were formed based on COE research 19-20 and 10 in 18-19; this represents 45 percent of the University total for those two years.

Other research highlights include:

- Total research expenditures for the year were estimated in mid-July to be \$206,544,973, an increase of more than 4 percent over 2018-19.
- New research awards for 2019-20 were \$124,455,054, an increase of more than 2 percent as compared to 2018-19.
- The College saw increases in excess of four percent in research expenditures and more than three percent in F&A generated in 2019-20 compared to 2018-2019.
- One faculty member received a National Science Presidential Early Career Award for Scientists and Engineers (PECASE Award) and five faculty members received National Science Foundation CAREER Awards.
- Dr. Hsiao-Ying Shadow Huang, associate professor in the Department of Mechanical and Aerospace Engineering (MAE), received an NSF 2019 Presidential Early Career Award for Scientists and Engineers (PECASE). This is the highest honor bestowed by the U.S. government on scientists and engineers beginning their independent careers.
- Dr. Douglas Call, assistant professor in the Department of Civil, Construction and Environmental Engineering (CCEE), received a five-year, \$500,000 CAREER award in support of his project, "Leveraging the multifunctional redox properties of pyrogenic materials to enable biological transformations of aqueous organic contaminants."

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

- Dr. Aydin Aysu, assistant professor in the Department of Electrical and Computer Engineering (ECE), received \$438,000 in NSF CAREER funding over five years to support his project, "Physical Side-Channels Beyond Cryptography: Transforming the Side-Channel Framework for Deep Learning."

- Dr. Qingshan Wei, assistant professor in the Department of Chemical and Biomolecular Engineering (CBE), received \$500,000 in NSF CAREER funding over five years to support his project, "Smartphone-Based CRISPR Biosensor for Point-of-Care HIV Viral Load Testing."

- Dr. Milad Abolhasani, assistant professor in the Department of Chemical and Biomolecular Engineering (CBE), received \$558,779 in NSF CAREER funding over five years to support his project, "Intelligent Synthesis of Colloidal Nanocrystals Enabled by Microreaction Engineering in Flow."

Extension and Outreach

The Engineering Place for K-20 Outreach: The Engineering Place (TEP) continues to impact engineering education and increase student interest in engineering through extensive programming offerings throughout the state, nationally and internationally. The various Engineering Place programs, including Engineering on the Road, Family STEM nights, summer camps, campus visits by schools and individuals, the Solar House, the Resource Room and others served more than 12,000 students and provided more than 550 programming hours across North Carolina and nationwide this year. This number reflects many spring programs cancelled due to weather issues and COVID-19. COVID-19 programming impact is creating a unique opportunity to continue supporting COE through online programming development for both students and teachers. In addition, TEP partnered with Women and Minority Engineering Programs (WMEP) to offer engineering outreach to six schools in Rwanda totaling nearly 600 students. A second trip to five more schools in Rwanda was cancelled due to COVID-19.

Week-long K-12 day and residential engineering camps in Raleigh continued to be a huge success, with nearly 1,000 campers participating on the NC State campus. Accreditation with the American Camp Association (ACA) was achieved, making our camp the only camp on campus to receive this acclaim in the UNC System.

A large focus is placed on encouraging the participation of underrepresented minority groups. We prioritize these groups through collaborations with partner organizations such as Wake and Johnston County Indian Education Programs, Emily K Center in Durham, and Raleigh non-profit organizations supporting homeless children such as

Families Together, Salvation Army's Project CATCH, Passage Home's REACH program and Haven House Services.

Staff worked with schools in Wake and Gaston counties on incorporating engineering into school curriculum, providing student programs for more than 400 students and teacher workshops to more than 200 teachers on integrated STEM. Presentations at several different teacher conferences promote the teaching of engineering in the K-12 classroom and highlights the resources available to North Carolina teachers.

Industry Expansion Solutions (IES): As the statewide extension service of the college, Industry Expansion Solutions (IES) partners with North Carolina industry to catalyze the transfer of knowledge and technology in support of economic development. IES supplies North Carolina businesses with the tools and services they need to help increase productivity, efficiency, quality and profit.

Over the past year, IES has added capabilities and expertise in additive manufacturing through infrastructure, training and partnerships. In addition, cybersecurity remains a top priority as 3D printing and additive manufacturing, along with increasing network access and interaction, become more commonplace throughout the Department of Defense (DoD) and other sectors. IES has introduced a new suite of solutions designed to help organizations address complex leadership and organizational development challenges like enhancing or transforming organizational culture, developing a talent strategy or succession plan to support business continuity and growth, cultivating company leadership or optimizing organizational performance.

In spring 2020, however, the national challenges for manufacturing related to the novel coronavirus required a shift in our strategies in order to respond directly to the immediate needs of helping companies address the shortage of Personal Protective Equipment (PPE). IES played a key role as part of a Governor's Task Force for Repurposing Manufacturing (TFERM) in order to create new capacity in critical healthcare items.

Biotechnology Training and Education Center (BTEC): BTEC continues to be focused on its primary mission of providing educational opportunities to develop skilled professionals for the biomanufacturing industry. Undergraduate and graduate enrollment in BTEC classes was strong in 2019-2020, with an all-time high of 893 students. Efforts to more closely connect with academic advisors in departments that feed students into BTEC's academic program continue to pay off. Further, BTEC continues to boast a 98-percent placement rate for its students within six months of graduation. Demand for open-enrollment and custom courses for professionals, offered as part of BTEC's Professional Development Program, was extremely strong until mid-March, when the BTEC facility essentially shut down in response to the COVID-19 pandemic, halting our ability to offer short courses. Enrollment and revenues in our Professional Development program suffered significantly as a result in what otherwise would have been a banner year for this program.

BTEC also continues to seek opportunities to provide contract services to industry and academia and to undertake research projects. Our Bioprocess and Analytical Services program completed 15 projects for industry clients, down from 18 last fiscal year. The decline was due to the shutdown of BTEC labs in mid-March in response to the pandemic. Likewise, revenues from this program are down from the last fiscal year. BTEC was a lead or partner in nine projects funded by the National Institute for Innovation in Biopharmaceutical Manufacturing (NIIMBL) that were active throughout this fiscal year. BTEC led projects in the areas of gene therapy vector production, viral vector characterization and single-use technologies. These topics are all critically important to modern biopharmaceutical manufacturing, and the work will enable BTEC to expand its course offerings and to work even more closely with the industry on solving process and analytical challenges.

Faculty

COE hired 18 new tenured or tenure-track faculty members in 19-20, making an investment of \$7.8 million, which was in addition to the Provost's support for these hires. COE also hired 45 non-tenure track teaching and research faculty members in 19-20, all of whom also play a critical role in the educational and research mission of our College.

Our associate dean for faculty advancement and her team continue to lead faculty professional development initiatives connecting COE faculty members with each other and faculty members in other NC State colleges (e.g., CNR, Textiles). Investments include an interdisciplinary two-day COE DC Research Clinic connecting 25-35 faculty members annually with federal funding agencies in Washington DC, workshops on faculty skills development and enhancements in the joint 4-day COE/COS new faculty orientation workshop.

Initiatives focused on Mid-Career and Teaching Track faculty members such as the Mid-Career Faculty Pivot awards continue to provide seed-funding resources for COE faculty members to explore new areas in research, teaching and extension, including invited talks and other international collaborations. Mid-career faculty members have now become eligible for the Faculty Research and Professional Development Awards (FRPD). Teaching Track faculty members also received career development funds and they have been included in the DC Research Clinic. Programs are designed to improve faculty well-being and create faculty communities of practice by engaging faculty at all ranks.

Faculty Highlights

- Dr. Mohamed Bourham, Alumni Distinguished Graduate Professor in the Department of Nuclear Engineering (NE), received the 2020 Alexander Quarles Holladay Medal for Excellence. This award is the highest honor bestowed by NC State and the University's Board of Trustees.

-Dr. Michael Dickey, Alcoa Professor in the Department of Chemical and Biomolecular Engineering (CBE), was presented with the inaugural Outstanding Research Mentor Award from the Office of Undergraduate Research. Future recipients, honored annually at the Spring Symposium, will be presented with the Michael Dickey Outstanding Research Mentor Award.

- Dr. Hsiao-Ying Shadow Huang, associate professor in the Department of Mechanical and Aerospace Engineering (MAE); Dr. Naji Hussein, teaching assistant professor in the UNC/NC State Joint Department of Biomedical Engineering (BME); and Dr. Steve Shannon, professor in the Department of Nuclear Engineering (NE), received the College's Outstanding Teacher Award.

- Dr. Michael Dickey, Alcoa Professor and University Faculty Scholar in CBE, received an Outstanding Research Award from the Office of Research and Innovation.

- Drs. Rohan Shirwaiker, associate professor in the Edward P. Fitts Department of Industrial and System Engineering (ISE), and Elena Veety, teaching assistant professor in the ASSIST NSF ERC and Department of Electrical and Computer Engineering (ECE), received the College's George H. Blesis Outstanding Undergraduate Advisor Award.

- Dr. H. Christopher Frey, Glenn E. Futrell Distinguished University Professor in the Department of Civil, Construction and Environmental Engineering (CCEE), and Dr. Fanxing Li, associate professor in the Department of Chemical and Biomolecular Engineering (CBE), received the 2020 Alcoa Foundation Awards.

- Dr. Douglas Irving, associate professor in the Department of Materials Science and Engineering (MSE); and Dr. Gary Roberson, professor and extension specialist in the Department of Biological and Agricultural Engineering, received the Alumni Distinguished Undergraduate Professor Award.

- Dr. Alper Bozkurt, professor in ECE; Dr. Ashley Brown, assistant professor in BME; Dr. Erik Santiso, assistant professor in CBE, Dr. Brian Floyd, professor in ECE, Dr. Tiegang Fang, professor in MAE; and Dr. Emiel DenHartog, associate professor in the Department of Textile Engineering, Chemistry and Science (TECS), were named 2019-20 University Faculty Scholars.

- Dr. Christine S. Grant, associate dean of faculty advancement and professor in CBE, received the 2019 William W. Grimes Award for Excellence in Chemical Engineering from the AIChE Minority Affairs Committee and the 2019 Dr. Joseph N. Cannon Award for Excellence in Chemical Engineering from the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers.

- Drs. Fuh-Gwo Yuan, Samuel P. Langley Distinguished Professor in MAE, and Mo Gabr, Distinguished Professor in CCEE, received Alumni Association Graduate Professor Awards.
- Dr. Laura Bottomley, director of The Engineering Place and the College's Women in Engineering program, was named Tech Educator of the Year during the NC TECH Association's annual NC TECH Awards program.
- Dr. Jan Genzer, S. Frank and Doris Culberson Distinguished Professor in CBE, was named the 35th recipient of the R.J. Reynolds Tobacco Company Award for Excellence in Teaching, Research and Extension.
- Angelitha Daniel, director of Minority Engineering Programs (MEP), received the STEM Educator of the Year Award from STEM RTP at its annual STEMmy Awards ceremony.
- Six faculty members received Named Distinguished Professorships, Distinguished Professorships or Named Professorships
- Dr. Fred Kish was named the M.C. Dean, Inc. Distinguished Professor in ECE
- Dr. Mervyn Kowalsky was named the Christopher W. Clark Distinguished Professor in CCEE
- Dr. Helen Huang was named the Jackson Family Distinguished Professor in BME
- Dr. Xiangwu Zhang was named the Samuel S. Walker Distinguished Professor in TECS
- Dr. Elizabeth Dickey was named a Distinguished Professor in MSE.
- Dr. Binil Starly was named the James T. Ryan Professor in ISE
- Three faculty members were named Fellows of their professional organizations
- Dr. Jacob Jones, professor in MSE and director of the Research Triangle Nanotechnology Network and the Analytical Instrumentation Facility, was named an IEEE Fellow.
- Dr. Carol Hall, Camille Dreyfus Distinguished University Professor in CBE, was named a Fellow of the American Association for the Advancement of Science.
- Dr. Julie Swann, head of ISE and A. Doug Allison Distinguished Professor, was named a Fellow of the Institute of Industrial and Systems Engineering.

Students

Undergraduate enrollment Undergraduate enrollment for fall 2019 was 6,924 (1,448 new first year, 304 new transfer, 92 first year, 1,020 sophomores, 1,524 juniors, and 2,536 seniors). This represents a 9-percent enrollment increase over 10 years. Enrollment of women increased to 1,790 (25.9 percent). Enrollment of minority students was 755 (10.9 percent) in fall 2019. Minority enrollment included 236 African Americans, 392 Hispanic students, 20 Native Americans and 107 minority students of more than one race.

Graduate student enrollment Graduate student enrollment for fall 2019 was 3,401 (2,049 master's and 1,352 doctoral). That figure represents a 31-percent increase in graduate enrollment over ten years. International students made up 60 percent of that enrollment; women students accounted for 26 percent of enrollment.

Undergraduate degrees awarded The number of bachelor's degrees awarded during 2019-20 was 1,629, compared to 1,699 for the 2018-19 year.

Graduate degrees awarded The number of graduate degrees awarded during 2019-20 was 1,242 (1,018 master's degrees and 224 doctoral degrees). That compares to 1,203 total graduate degrees awarded in 2018-19 (1,008 master's degrees and 195 doctoral degrees).

Undergraduate recruiting During fall 2019, Engineering Academic Affairs hosted four on-campus recruiting events for prospective fall 2020 applicants. Beyond the University's Open House, the College hosted three fall recruiting visitation days, two of which were specifically targeted toward women and underrepresented minorities in engineering. Additionally, COE hosted and paid visits to a number of NC community colleges, high schools and partner institutions to speak directly to prospective first-year and transfer students.

During spring 2020, Engineering Academic Affairs offered 17 yield events for students accepted for fall 2020 (four on campus, in-person and 13 live, virtual). One such event was offered specifically for women and highlighted the Women in Science and Engineering (WISE) and the Women in Engineering (WIE) programs. Two others focused on minority freshmen students and highlighted both the MEP and WIE. These events were designed to increase enrollment of women and underrepresented students and make the opportunities and community support aspects for these populations.

Included in the College's spring yield events were 15 Experience NC State visitations (two on campus, in-person and 13 live, virtual) offered at the University level for accepted freshmen. Each on-campus College event included information sessions, student panels made up of Engineering Ambassadors, parents' sessions and tours of Centennial Campus. Each virtual College event featured information sessions, student panels and separate Q&A sessions for students and families.

Graduate student recruiting The College continues to increase the resources available to

graduate students, with growth in the number of fellowships and stipend total, the number of assistantships and stipend total and the amount of travel funding.

The College's continued support of a graduate recruiter position that serves the diversity needs of the NSF FREEDM and ASSIST ERCs is a valuable tool for recruiting and retaining graduate students from underrepresented groups. Additionally, Dr. Joel Ducoste works part time as the College's assistant dean for graduate student advancement and leads a successful NSF-sponsored Bridging to the Doctorate Program. The program is in its first year and is funding 14 (10 in COE, 4 in COS) outstanding Ph.D. students from underrepresented groups for two years.

Dr. Brandon McConnell has significantly improved recruiting of active duty military and veteran students into our graduate programs. COE is now the number one college at NC State in terms of the number of such students, by a wide margin.

Incoming graduate enrollment in fall 2019 increased year over year by more than 9 percent. The College's sustained efforts to grow at the Ph.D. level continued to pay dividends, with new enrollment at the doctoral level setting an all-time record for the College, at 254 (up more than 18 percent over the prior year).

Distance Engineering Education Programs

The College offers a broad and diverse set of distance engineering education courses and degree programs for students in North Carolina, across the United States and in other countries. Sixteen online master's degree programs in engineering and computer science, an undergraduate Computer Program Certificate program, three 2+2 undergraduate site-based programs and two four-year site-based degree programs are part of the distance education programs administered by the College. Several new graduate certificates are now available. Both the Mechatronics Engineering program in Asheville and the Mechanical Systems Engineering program are ABET-accredited as distance programs and have had an increase in enrollments and in graduation rates.

US News & World Report ranked both the Graduate and Computer Science online programs in the Top Ten Best Online Programs in 2020. Engineering Online continues to deliver quality educational programs for working professionals and scientists who, because of time, family or work responsibilities or geographic constraints, cannot attend classes on campus. One hundred and thirty-four students graduated from an online master's degree program and 49 students graduated from the site-based BSE programs.

Women and Minority Engineering Programs at NC State are known as a national leader in recruitment, retention, graduation and placement of outstanding engineers. Our College is one of the few in the nation where programs for women are combined with those for underrepresented students in engineering. Accounting for intersectional identities has been a positive factor toward program efficacy.

Programs such as the Tools Workshop in the fall and Taste of Engineering in the spring remain signature programs for WMEP during the school year. During the summer, two bridge programs were hosted for students. The Summer Transition Program for minority students remains a six-week program to bring new students to campus during the second summer session before their freshman year to help them make a smooth transition from high school to college. For the summer of 2019, STP was offered in partnership with a University bridge program known as Summer Start.

ESCAPE to Engineering is a one-week experience for accepted female students before their first year. Offered either just before or just after Orientation, ESCAPE is designed to provide social capital, engineering experiences and expertise with the campus that will help the women feel as if they are coming home when they arrive for fall semester. Approximately 50 young women participate in ESCAPE each year.

Additional WMEP initiatives are specially designed to recruit and retain talented minority engineering students. The Overnight Minority Recruitment Weekend was cancelled due to the global pandemic, so online group sessions were held for accepted students. In these sessions, conducted through Zoom, we connected with more than 120 students in May.

Engineering Career Fair

The NC State Engineering Career Fair continues to be one of the largest career fairs of its kind in the country, drawing top companies in sectors that include energy, healthcare, transportation, computer networking and software development.

During the two-day fall event, 327 companies registered to attend. There were 6,550 job, internship and co-op seekers in attendance (of those, 1,042 were from outside NC State). During the single-day spring event, 187 companies participated and 2,524 job, internship and co-op seekers attended (of those, 532 were from outside of NC State).

Fundraising

The NC State Engineering Foundation 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, due in part to a substantial non-governmental grant from Novo Nordisk. As of June 30, 2020, the College has 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. These gifts represent part of our "pipeline" for major gifts and an important part of the College's overall advancement plan.

Under new leadership by Griffin Lamb, assistant dean for development, the College and Foundation continue to garner strong support from alumni volunteers serving on the Foundation Board of Directors and across the nine academic departments. Deborah B. Young ('77 CE) was elected vice president of the board and is the first African American to serve in a leadership position on the board. Debbie has worked tirelessly in recent years to implement a more rigorous nomination process to the board, resulting in added layers of diversity to board membership. As chair of the Strategic Planning Committee, Debbie is working closely with the Dean and Griffin Lamb to incorporate diversity and inclusion goals into the College's comprehensive alumni engagement and fundraising strategy. A committee of the board was restructured as the Alumni and College Engagement Committee to more strategically engage a broader base of alumni with the College and facilitate stronger connections between department-level advancement activity and college-wide strategy.

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.

With an eye to the future, the dean and the assistant dean are modeling fundraising staff growth scenarios with vice chancellor Sisco and AVC Broschart. These conversations are raising healthy questions about how to merge cultures and processes. The anticipated outcome of these conversations is a MOU between the two units outlining a shared understanding of how to manage fundraisers for optimal performance alongside a financial investment in front-line staff salary from university advancement.

Student Emergency Fund College of Engineering alumni and faculty/staff contributed a total of \$120,345.39 to the Student Emergency Fund this fiscal year. This total includes gifts from almost 500 alumni and fueled by the Associate Dean's Challenge, led by Dr. Jerome Lavelle, 65 COE faculty/staff donors. Of the more than 2,000 student applications for support from the Student Emergency Fund, 34.4 percent were engineering students.

Administration

- Michael Walker became the new assistant dean for finance and business management in October. He joined the College from the Graduate School at NC State and succeeds Virginia Teachey, who accepted the position of vice chancellor for finance at UNC Pembroke.
- Shannon Williams took over as assistant dean for personnel and administration. She succeeds Connie Reno, who retired from the University.
- Dr. Paul Dayton was named as the interim chair of the Joint UNC/NC State Department of Biomedical Engineering as the department searches for a permanent replacement for Dr. Nancy Allbritton, who left the department to become dean of engineering at the University of Washington.
- Brent Lancaster became the College's director of communication on a permanent basis in September after serving as the interim director. He succeeds Jennifer Cox, who retired from the University.

Recommendations and Concerns for the Future

The College and University find themselves in a completely different world than we faced just six months ago. The last four months have included unprecedented challenges for our faculty, students and staff and while it's hard to know what lies ahead, COE will continue on with our steadfast commitment to student success and excellence in engineering research and education regardless of the circumstances. Providing on-campus instruction and conducting research in a safe manner will be a challenge. The ongoing pandemic in North Carolina will affect budgets and place tremendous pressure on our ability to attract international graduate students.

Beyond the challenges of COVID-19, a few other concerns stand out. While the COE has continued its steady growth in several categories, no one is standing still. Colleges of engineering across the country are making substantial commitments to faculty hiring and facilities construction. State leaders recognize the value of engineering education for their students and their communities and economies.

COE's 2013 Strategic Plan called for increasing the number of T/TT faculty in the College to 400 by the year 2020. COE is now at 320 T/TT faculty or basically 80 below the COE Strategic Plan. In addition, all of the 10 projected faculty hires in 2020-21 are replacement hires. Our revised hiring plan for the next four years reflects 41 total hires of which only seven are projected to be new hires. If this is what indeed happens, it would mean that COE would still have less than 330 T/TT faculty members in 2024 or more than 70 short of the 2020 COE Strategic Plan goal. This is our primary concern since this is well below the faculty size needed to maintain the growth in enrollment and research productivity that has been driving COE forward and which has provided significant returns to NC State.

Strategic investments, by our College and the University, in faculty hiring, physical infrastructure and growing Ph.D. enrollment have turned COE into a research powerhouse. With over \$200 million in research expenditures the College has ranked among the top 10 nationally in research expenditures for two year in row. In 19-20, we also saw the largest

Ph.D. enrollment in the College's history and the largest incoming Ph.D. student class in the College's history. These investments, especially in new faculty members and infrastructure, have also provided substantial growth and improvement for our teaching and extension programs, programs that pay significant dividends and returns to NC State and our state as a whole. They must continue, not only for COE and NC State to reach its full potential, but to continue to provide significant benefits to the state of North Carolina.

Finally, closing the funding gap on Fitts-Woolard continues to be a top priority and concern. While we are hopeful that potential construction cost savings could help reduce what is still an \$11.5M gap, the idea that the College may have to consider borrowing to meet its \$60 million fundraising goal under the heightened budget uncertainty created by the COVID-19 situation is a major concern. Taking on additional debt, especially at this moment in time, may simply not be feasible without severely impacting all our programs and our research and educational mission.

