

Annual Report 2022-2023
College of Engineering
North Carolina State University

Overview

NC State's College of Engineering (COE) is the flagship engineering school in the state of North Carolina and one of the leading public colleges of engineering in the United States. 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. NC State Engineering is a major driver of the North Carolina economy through its research and innovation. The COE also plays an integral role in building a highly skilled workforce for North Carolina, thus supporting existing industry as well as assisting and spearheading the development of new businesses, products and services that have led to significant investment and job creation in our state.

The College, in keeping with goals set forth in its most recent Strategic Plan, works to provide a premier educational experience for its students and a world-class environment for its faculty members that allows them to thrive and become global leaders in discovery, learning and innovation. Of equal, if not greater, importance is that the College be able to carry this out within a culture that promotes diversity, equity and inclusion (DEI) throughout so that all of our students and faculty members can thrive and prosper in their endeavors. Our vision and long-term goal, which is to be the leading public college of engineering in the country and one of the preeminent colleges of engineering in the world, can only be achieved if we are true to the last commitment.

Underlying this mission and vision is a sustained effort to engage and invest in vital areas of research growth and educational needs. It involves, first and foremost, making strategic investments in faculty and infrastructure in areas of significant societal need and impact that also provide the greatest potential for attracting external funding and best serve the needs of our country and state. At the core of the COE's mission and vision is enhancing student success through the integration of research and education, recruiting and retaining outstanding faculty members and students and providing opportunities for interdisciplinary research at both graduate and undergraduate levels.

With more than 11,000 students, the COE consistently ranks in the top 15 nationally in the number of annual engineering and computer science bachelor's, master's and Ph.D. graduates. The College is also recognized nationally for the high quality of its undergraduate and graduate programs. In the most recent *U.S. News & World Report* rankings of the top graduate engineering programs in the country, NC State's COE was ranked 25th overall and 12th among public institutions, an improvement over the previous year. The College has been in or near the top 10 nationally in research expenditures for several years, according to data from the American Society for Engineering Education (ASEE). In particular, federal research expenditures have grown significantly over the last decade.

Changes in the Service Environment

Announcements made over the last two years by Apple, Google, Fujifilm Diosynth, Pratt-Whitney, Vin Fast, Microsoft, Wolfspeed and numerous other major companies to locate new or expand existing facilities in North Carolina have highlighted the critical need and urgency to grow and expand COE engineering and computer science programs in order to meet the human resource, workforce and technical demands of these new investments in North Carolina. Together with the need for enrollment growth is the importance of increasing COE faculty size, not just to support the COE strategic plan, but more importantly NC State's goals and aspirations to be a premier university and a major engine of growth for the economic development of North Carolina. With this in mind, we have been pleased to see that the North Carolina legislature has both heard and acted upon these needs with investments that are aimed at catalyzing significant growth in COE enrollment and concurrent significant growth in faculty size.

Engineering North Carolina's Future as funded by the NC legislature represents an initial investment of \$20 million to push forward what would eventually be an increase of 4,000 engineering and computer science students at NC State together with an increase of over 175 additional faculty and staff members. This investment also includes \$30 million in capital funding for initial additional space needs for this student, faculty and staff growth. Even when significant additional recurring and capital funding will be needed to achieve these enrollment and faculty and staff growth goals over a six-to-eight-year horizon, this legislative action has kick-started a number of actions and initiatives, both within COE and across the University, that have already played a significant role in both the scope and the scale of activities carried out by COE in 2022-2023.

At the same time, this year the University/College confronted a mental health crisis we were unprepared to face. The deaths of 14 students, seven of which were death by suicides, forced both the University and the COE to focus on the issue. The Office for DEI led COE efforts to support the mental health and well-being of our students, staff and faculty. Several initiatives and programs were implemented to address the crisis. With the support of Director of Engineering Education Laura Bottomley, the College was able to provide training facilitated by a national suicide prevention expert. Also, working with campus partners the COE created space and opportunity for the community to relax, connect with each other and engage in self-care at the first-ever Last Day of Class Fest. More than 1,000 students and staff and faculty members attended the event. As a result, the event will be offered, in some capacity, during future semesters.

Major Research Initiatives and Highlights

Over the last ten years, NC State has been recognized as one of the nation's leaders in the increase of federal research expenditures per year, rising more than 70 percent in that period. The COE represents half of that growth. In fact, the COE federal research expenditures grew 105 percent in the ten-year period — one of the top two in the country, and far above the national average growth of 35 percent in engineering. This has been driven by the COE's success in

starting and sustaining large federal research centers and institutes. This is also reflected in the large increase in doctoral graduates in the COE, which is now in the top 10 in the United States.

Significant investments have also been made to match and cost-share research efforts to attract large research grants. As a result, several new large national research projects have been awarded, such as the National Science Foundation (NSF) Science and Technology Center on phosphorous sustainability (STEPS) and the NSF AI Learning Institute. The Hub Site Portal for the IBM Quantum Computing in North America now has four new and sustained industry members and two new faculty members in this area will be joining NC State in fall 2023. A Power America critical eight-year performance renewal was conducted with high likelihood of continued federal support. The \$18 million award from the Novo Nordisk Foundation (NNF) for Aim Bio, a bio pharma manufacturing research and training effort led by the Biomanufacturing Training and Education Center (BTEC), underwent a critical third-year review by NNF and was recommended for continued funded through year five. Faculty members in the UNC/NC State Joint Department of Biomedical Engineering (BME) were also awarded a new \$4.6 million rehabilitation engineering center award. These new grants and renewals alone generate in excess of \$20 million in annual research expenditures, translating into almost \$8 million in annual F&A revenue for NC State.

Two NSF Engineering Research Center full proposals were invited for submission as full proposals by NSF. The COE has also been a driver of the two prestigious National Institutes of Health T32 training grants to be awarded to NC State. The COE is also a university leader in the Army Futures Command areas of wearable sensors, additive manufacturing and power electronics. The FREEDM Center was also awarded a large grant for development of new fast charging electronics. In addition, COE is collaborating with Wolfspeed on its \$5 billion manufacturing plant in Chatham County.

Other research highlights include:

- Total research expenditures for the year were estimated in mid-June to be \$208,490,938.
- New research awards for 2022-23 were estimated at \$113,257,807.
- Based on estimates, the College saw an increase of 12 percent in research expenditures year over year, while F&A generated increased by 7 percent over 2021-22.
- Thirty-three (33) faculty members have received research awards of over \$1 million this year and nine above \$2 million.

New Initiatives

The COE Academic Affairs and Industry Expansion Solutions (IES) offices continued strong advocacy and support of the RuralWorks! internship program. Summer 2023 was the largest ever with a total of 91 students working in 31 counties in North Carolina and working at 57 companies. This is a 49-percent increase from summer 2022. For summer 2022, around 60 summer internships had been arranged, growing from 45 in 2021 and 19 in 2019. The lower number in 2019 was due to Covid and many were virtual that summer. Of this year's 91 students, 82 are located in Tier 1 & 2 counties and nine are located in Tier 3 counties.

The Engineering Education program, which represents a strategic partnership between the College of Engineering and the College of Education, continued to make progress. Co-directed by faculty members in both colleges, a total of five classes now exist under the EED prefix and are being taught in fall, spring and summer. The certificate is expected to be approved this summer, hopefully for a fall 2023 implementation. The M.S. in engineering education is on track for a soft start in spring 2024.

The College is developing significant faculty participation in the Kern Engineering Entrepreneurial network (KEEN). Anna Howard and Joel Ducoste have developed materials and other presentation opportunities to educate faculty members about the entrepreneurial mindset promoted by KEEN.

Diversity, Equity and Inclusion

The College continues its focus on creating an inclusive and welcoming college culture for all. The inaugural assistant dean for DEI worked to hire staff to assist in meeting the goals of the newly established office. Last year's report noted that the unit completed a climate survey of all undergraduate and graduate students. The findings were disseminated to department heads and the College will now move to create action plans based on the survey findings.

We continue to have great success with recruiting and hiring female faculty members. For the 2023-24 year, the COE hired 35 new tenured/tenured-track and professional-track faculty members. Almost a third of these hires are women. The 35 hires include 26 tenured/tenure-track (T/TT) faculty members and nine professional faculty members. Of the 26 T/TT hires, three are Black/African American, three are Hispanic and one is Hispanic/American Indian or Alaskan Native/White. Of these seven diverse hires, three are female. Of the nine professional faculty members hired, four are female, which includes one Black/African American and one Hispanic. Of the five males, one is Black/African American and one is Hispanic.

A noteworthy highlight is that the dean's leadership team is 30 percent women. On June 30, 2023, the interim associate dean for graduate programs will step down. With the appointment of Kara Peters to this position together with the appointment of Veena Misra to be interim head of ECE, the percentage of the leadership team who are women will be 39 percent.

While the College has made significant progress with hiring women, increasing the number of diverse faculty members remains a high priority. We continue to focus on hiring and retaining historically underrepresented faculty and staff members, realizing that the opportunity for staff members to advance and equitable pay are hurdles to overcome. The assistant dean for DEI and the associate dean of faculty advancement continue collaborating on strategies to locate and recruit diverse faculty members.

The College continues to make excellent progress in recruiting female undergraduate students. Our fall 2022 first-year engineering class was 28.6 percent female, and fall 2023 is anticipated to be 33.3 percent female, which sets the College well above the national average of 19 percent. Our fall 2022 first-year engineering class was 15.82 percent underrepresented minorities (URM);

for fall 2023, the percentage is expected to be 17.6 percent. This year, we yielded 39.5 percent of the URM students admitted for fall 2023.

The Broadening Participation and Inclusion (BPI) Steering Committee, chaired by the assistant dean for DEI, completed the draft of the Diversity Strategic Plan. The draft is currently under review.

Educational Program Advances

The Engineering Enhancement fee has allowed the COE to continue to scale our Research Experiences for Undergraduates (REU) and Grand Challenges Scholars program, strongly encourage high impact experiences, such as work, international, research, service and entrepreneurship activities, as well as add a number of new special initiatives that are enhancing the quality of the undergraduate experience in the COE and improving retention.

First-year students join the College as part of the Engineering First-Year Program. This program is designed to: support first-year students in their transition from high school to college, give them the opportunity to explore the 16 on-campus degrees offered by the College and encourage their professional development.

The College strongly encourages high impact experiences, many of which are provided through its Engineer Your Experience, or EYE, program. These include opportunities for students to attend conferences, compete in national and international student design competitions and participate in immersive study-abroad experiences. The total number of students impacted by EYE Program programming for 2022-2023 is 1,042 students representing a 19-percent increase from 876 students in 2021-2022. A total of 135 group/individual requests were approved by the EYE Program for 2022-23 and this impacted 734 students. The number of requests went from 61 in 2021-22 to 135 in 2022-23, clearly showing the student demand for these programs.

International immersion experiences have continued with ongoing partnerships with the GREEN Program and alternative service break trips with the NC State Leadership & Civic Engagement Office. For fall 2022, there were 21 students with the Nepal program, which is focused on Ethics of Sustainable Development. The GREEN Program did not run any online programs in spring 2023. We continue to collaborate with the Student Leadership & Engagement Office and the Alternative Service Break (ASB) programs. For spring 2023, 13 students participated in ASB trips compared to 10 students in spring 2022. The 2023 locations for undergraduate engineering students included: Alaska, Dominican Republic and Orlando.

Extension and Outreach

The Engineering Place for K-20 Outreach (TEP):

The Engineering Place (TEP) program, the College's K-20 education and resource headquarters, is a national leader in engineering and engineering education outreach, continuing to introduce, inspire and increase K-20 students' knowledge and interest about engineering, design thinking, engineering habits of mind and career possibilities with a focus on serving underserved,

underrepresented and under resourced populations, all while promoting engineering research at NC State. These programs assist in building the K-8 learning ecosystem necessary in order to recruit high-school students to the College with focused programming to increase underserved and underrepresented population participation. Undergraduate engineering students are provided with training and hands-on experiences in both leadership and best practices in teaching and communicating engineering concepts to younger students and the general public, strengthening their communication skills in preparation for engineering careers. Presentations at several different teacher conferences promoted the teaching of engineering in the K-12 classroom and highlighted the resources available to North Carolina teachers. TEP is always a requested presenter at several of these conferences.

The TEP team, along with the engineering ambassadors and summer camp graduate and undergraduate staff, continues to provide outstanding engineering programming for the state. We increased our impact in all areas this year due to a return to in-person programming with all programming, even with a decline in event numbers. Many of our programs supported large numbers of students (200+) as schools were allowed this year to attend in-person programs but planning and facilitating large groups of students is stressing the system and our personnel capacity. Until we can increase office staff, we must modify our programming next year to better reflect our staffing capabilities.

The Summer Engineering Camps returned to in-person camps this year. This is significant because after two years of virtual camps, an entire camp staff had to be trained in all the processes, both for residential and day camps, as there were no returning staffers to assist the new hires. A total of 25 week-long camps (10 weeks of K-10 day camps, 15 weeks 11-12 residential camps) with 862 campers (K-10 day: 515 campers, 11-12 residential: 347 campers).

Industry Expansion Solutions (IES):

IES, the College's extension service, saw a successful year working through three key goals: 1) advancing the university engineering and technology and extension mission, 2) maintaining strong departmental financial health and 3) expanding departmental collaboration across the College.

As to goal number one, IES quadrupled new client development direct engagements by regional extension specialists in 2022-23, co-hosted its largest NC Manufacturing Conference ever and is standing up a new NC Supply Chain Optimization Intelligence Network in support of a federal administration national priority led by the National Institute of Standards and Technology (NIST).

On goal two, another approved increase in the NIST Manufacturing Extension Partnership federal recurring award will bring total funding to be managed by IES to \$4 million in FY23-24. An additional \$1.5 million for IES is included in a recent Department of Energy proposal led by the NC Department of Commerce for supporting smart manufacturing technology implementations in smaller manufacturers throughout the state. IES fee-for-service receipts are

expected to show a 10-percent increase this year, though that has been offset by stronger inflationary characteristics in staff salaries and operating expenses.

On goal three, IES continued grant evaluation support with both new and existing collaborators within the College and expanded the co-op and internship opportunities offered to COE students. IES personnel also provide instruction support for a course in biomedical engineering, participate on COE committees focused on research and industry ties and are part of events including the twice-annual Engineering Career Fair.

Biomanufacturing Training and Education Center (BTEC):

BTEC continued to focus on its primary mission of providing educational opportunities to develop skilled professionals for the biomanufacturing industry. Undergraduate and graduate enrollment in BTEC classes was at an all-time high of 1,011 in 2022-2023. Further, BTEC continues to boast a nearly 100-percent placement rate for students enrolled in our academic programs, most of whom find outstanding opportunities in the local biopharmaceutical industry. BTEC's professional development (i.e., short course) program continued to attract professionals from North Carolina, throughout the U.S. and around the world and boasted a strong enrollment of 717 participants in 2022-2023. The last three years have seen particularly high enrollment largely driven by enhanced online course options.

BTEC also continued to provide contract services to industry and academia and to undertake projects with external stakeholders. The bioprocess and analytical services program executed 23 projects during the 2022-2023 fiscal year. BTEC was a lead or partner in three projects funded by the National Institute for Innovation in Biopharmaceutical Manufacturing (NIIMBL). One of these projects aims to design highly optimized processes for production of mRNA, a new and critically important vaccine modality. In addition, BTEC continued its efforts on the Accelerated Innovation in Manufacturing Biologics (AIM-Bio) program, in collaboration with the Technical University of Denmark (DTU) and funded by a grant from the Novo Nordisk Foundation (NNF). This program has seen much success in both research and development/delivery of new courses, all on topics of great import to biopharmaceutical manufacturing. The NNF officially announced that it will continue funding Phase II of the AIM-Bio program, which runs from January 1, 2023-December 31, 2024.

Faculty

The COE hired and employed 37 new faculty members who started in fall 2022 and spring 2023. Of these, 31 were tenured or tenure-track faculty members and six were professional faculty members. This includes one new department head, Jackie Gibson, who is now the third female department head in COE. COE has also hired an additional 35 faculty members who have accepted offers to start in 2023-2024. Of these, 26 are tenured or tenure-track and nine are professional faculty members. In order to make these hires, the COE has already invested or committed over \$14 million in addition to the provost's support for these hires.

Our associate dean for faculty advancement (EFA), Joel Ducoste, and his team continue to lead faculty professional development initiatives that not only support the COE faculty but also

faculty members in all colleges at NC State. In COE, our goal is to develop faculty members at all levels to be research and educational leaders who provide strong mentoring of our graduate students and peers.

Our faculty continues being recognized for its outstanding scholarship. In 2022-23, four of our faculty members were selected as University Faculty Scholars and seven of our faculty members were recipients of Goodnight Early Career Innovator Scholar awards. Our faculty members have also been recognized at the University level, having received the Alumni Association Distinguished Undergraduate Professorship, three Outstanding Teaching awards and an Outstanding Global Engagement award. One of our faculty members was a finalist for the Provost Award for Excellence in Teaching, which is the most prestigious award for exceptional teaching given to professional full-time faculty members from among NC State's 10 colleges. In addition to these internal prestigious recognitions, our faculty members were also acknowledged nationally with professional society awards and Fellow distinctions in their respective professional societies.

EFA strategically disseminates just-in-time resources to ensure faculty members continue to receive impactful career development opportunities, and work on support that influences the constituencies that faculty members serve in COE. A mix of in-person and virtual workshops were delivered during this academic year. These include our flagship New Faculty Orientation workshop (NFOW). NFOW is tailored to COE faculty members and provides a comprehensive view of tools and best practices needed to jumpstart the academic career. The workshop continues to be well received and participants' feedback points to the just-in-time advice provided for effective student learning pedagogy and best practices as well as the strong and useful advice provided by our faculty during the research sessions.

Faculty Highlights

- Richard Spontak, Distinguished Professor in the Department of Chemical and Biomolecular Engineering (CBE), received the R.J. Reynolds Tobacco Company Award for Excellence in Teaching, Research and Extension from the College of Engineering.

- Laura Bottomley, director of Engineering Education, received the Sharon Keillor Award from ASEE. The award recognizes and honors outstanding women engineering educators.

- Nathan Crook, assistant professor in CBE, received an NSF CAREER Award.

- Alper Bozkurt, professor in ECE, received NC State's Outstanding Global Engagement Award.

- Ismail Guvenc, professor in ECE, and Milad Albohasani, associate professor in CBE, received Alcoa Foundation Research Awards from the College of Engineering.

- Afsaneh Rabiei, professor in the Department of Mechanical and Aerospace Engineering (MAE), and Zlatko Sitar, Kobe Steel Distinguished Professor in the Department of Materials Science and Engineering (MSE), were each named as a senior member of the National Academy of Inventors.

- Ge Yang, associate professor in the Department of Nuclear Engineering (NE), attained senior membership within the Institute of Electrical and Electronics Engineers.
- Ashok Gopalarathnam, professor in MAE, received an Alumni Distinguished Undergraduate Professor Award.
- Tiffany Barnes, Distinguished Professor in the Department of Computer Science (CSC), received the Harrold and Notkin Research and Graduate Mentoring Award from the National Center for Women & Information Technology.
- Katharina Stapelmann, associate professor in NE, received the Early Career Award for Plasma Medicine from the International Society of Plasma Medicine.
- Lisa Marshall, director of outreach, retention, and engagement and an assistant extension professor and advisor in NE, was named as vice president and president-elect of the American Nuclear Society.
- Michael Dickey, Camille and Henry Dreyfus Professor in CBE, was honored with one of the University's Alumni Association Distinguished Graduate Professorship Awards.
- Ola Harrysson, Edward P. Fitts Distinguished Professor in the Department of Industrial and Systems Engineering (ISE), and Maria Mayorga, professor in ISE, were selected as NC State Alumni Association Outstanding Research Faculty members and were inducted into the Research Leadership Academy.
- Rachana Gupta, teaching professor in ECE; Julie Ivy, professor in ISE; and Robert Kelly, Alcoa Professor in CBE, all received the George H. Blessis Outstanding Undergraduate Advisor Award from the College of Engineering.
- Lina Battestilli, associate teaching professor in CSC; Jeremiah Johnson, associate professor in the Department of Civil, Construction and Environmental Engineering (CCEE); and Jun Liu, associate professor in MAE, received Outstanding Teacher Awards from NC State.
- Maria Avramova, professor in NE, was recognized with the Outstanding Global Engagement Award.
- Distinguished University Professor Morton Barlaz of CCEE won the American Academy of Environmental Engineers and Scientists Gordon Maskew Fair Award.
- Phil Westmoreland, professor in CBE, received the 2023 F. J. and Dorothy Van Antwerpen Award for Service to the American Institute of Chemical Engineers.

- David Johnston, Edward I. Weisiger Distinguished Professor Emeritus in CCEE, was elected honorary member of the American Concrete Institute (ACI) in recognition of his contribution to the work of ACI and the concrete industry.

- Rada Chirkova, professor in CSC, was named a distinguished member of the Association for Computing Machinery.

- Eight faculty members were named as Professors of Distinction

- Veronica Augustyn was named a Jake and Jennifer Hooks Distinguished Scholar in MSE.

- Kevin Han was named an Edward I. Weisiger Distinguished Scholar in CCEE.

- Julie Ivy was named an Edgar S. Woolard Distinguished Professor in ISE.

- James Lester in CSC was named a Goodnight Distinguished University Professor in Artificial Intelligence and Machine Learning.

- Louis Martin-Vega was named a Distinguished University Professor in ISE.

- Veena Misra was named an M.C. Dean, Inc. Distinguished University Professor in ECE.

- Sinee Simon was named a Distinguished Professor in CBE.

- Munindar Singh was named a SAS Institute Distinguished Professor in CSC.

- Twelve faculty members were named Fellows of professional organizations.

- Sinee Simon, department head and professor in CBE, was named a Fellow in the American Association for the Advancement of Science.

- Christine Grant, professor in CBE and inaugural associate dean of faculty advancement for the College of Engineering, was named a Fellow of ASEE.

- Julie Ivy, professor in ISE, was named a Fellow of the Institute of Industrial and Systems Engineers.

- Srinath Ekkad, head of MAE, was named as a Fellow of the Royal Aeronautical Society.

- Maria Avramova, professor in NE, was named as a Fellow of the American Nuclear Society.

- Ashley C. Brown, associate professor in BME, has been named to the American Institute for Medical and Biological Engineering College of Fellows.

- Katherine Saul, associate professor in MAE, was named as a Fellow in the American Society of Biomechanics.
- Rudi Seracino, professor in CCEE, was named as a Fellow of the American Concrete Institute.
- Joseph Tracy, professor in MSE, has been inducted as a Fellow of the Royal Society of Chemistry.
- Helen Huang, Jackson Family Distinguished Professor in BME, was named an Institute of Electrical and Electronics Engineers Fellow.
- Donald Bitzer, Distinguished University Research Professor in CSC, was named a 2022 Fellow by the Computer History Museum.
- Katherine Saul, professor in MAE, was selected by the Kern Entrepreneurial Engineering Network as an Engineering Unleashed Fellow.

Students

Undergraduate recruiting and student success:

Undergraduate enrollment and student success continues to be very strong in the College. The demand for enrollment continues to grow with over 11,000 applications for slots in fall 2023. First-year, first-time cohorts have grown from 1,571 in fall 2021, to an anticipated 1,800 students in fall 2023, an increase of 229 additional slots over two years. Transfer student numbers continue to be strong through our community college, four-year 2+2 and dual-degree partnerships. In spring 2023, 70 new transfer students enrolled in engineering from these sources. In fall 2023, we expect approximately 263 new transfer students.

Retention and graduation rates continue to improve. Data for the last available year shows first year retention at 95 percent, and four-year and six-year graduation rates at 58.4 percent and 87 percent, respectively. The net result is that first year, and external transfer, student profiles have increased in quality both in terms of academic achievement and promise. This very high-quality student body combined with strategic programs and investments has resulted in higher retention and overall success across all our COE undergraduate programs.

Graduate student recruiting and student success:

Academic year 2022-23 COE graduate program enrollment reached an all-time high, growing beyond academic year 2021-22, which in itself was a year of remarkable recovery from the global pandemic. Applications and admissions this year were below the 2021-22 cycle as expected due to the record number of deferrals at that time but were strong due to aggressive recruiting by our directors of graduate programs and the strong reputation of the COE at NC State. Prior to the pandemic, the COE was at an all-time high total graduate enrollment of 3,302 in fall 2019, growing from 3,249 and 3,260 in F17 and F18, respectively. Then the pandemic occurred, bringing F20 total enrollments to 2,797, a drop of 505 graduate students, due

primarily to a drop in new enrollments from 1,182 in F19 to 584 in F20 (with the majority decrease being master's students). Fall 2021 showed a remarkable recovery, with 1,288 new enrollments giving a total F21 enrollment of 3,141. Fall 2022 enrollment reached a COE record of 3,686, 384 students more than the previous record in F19. This surpassed the COE's engineering expansion commitment to increase COE graduate student enrollment by 150 students. The investment of legislatively allocated one-time funds to recruit 43 new doctoral students in F22 played a large role in reaching this record graduate student enrollment.

Graduate student applications, recommendations and admission decisions for F23 continue to be strong. As of June 9, 2023, there have been 5,900 applications (-1272 from the same time last year which included ~700 deferrals), 3,186 recommendations (-169 from last year) and 1,437 admissions (-70 from last year). On this same June 9th date, total F23 enrollments are at 2,720 (+189 from the same time last year). This data shows what is believed to be a national trend where highly qualified graduate students are applying to a smaller number of graduate programs. However, due to their high qualifications this results in a similar number of recommendations and admits.

Both African American and Hispanic graduate student enrollments have remained stubbornly small compared to overall COE graduate student enrollment over the past 10 years. In fall 2023, 68 African American students (30 doctoral, 36 master's, two certificate) and 87 Hispanic students (27 doctoral, 58 master's, two certificates) were enrolled in COE graduate programs. Both these enrollments, though small, are the highest in the past 10 years and correspond to a 19 percent increase for African American students and a 70 percent increase for Hispanic students in the period from F19 (i.e., pre-pandemic) to F22. Although these are positive trends, more work needs to be done to further increase URM student enrollments in the COE. Fall 2022 Engineering Online enrollments decreased slightly to 500 from 523 in fall 2021, but increased over the F19 DE enrollment of 431, a 16-percent increase.

Distance Engineering Education Programs:

The College offers a broad and diverse set of distance engineering education courses and degree programs for individuals in North Carolina, across the United States and in other countries. One new online degree program, the Master of Engineering Education, was added this year to the list of graduate program offerings, bringing a total of 19 online master's degree programs. One hundred and sixty-seven students graduated from the online graduate programs, with the largest number of graduates in MAE, followed by graduates completing their degree programs in CBE, CCEE and CSC. The remaining degree programs have at least three students who completed his/her degree program.

The College also offers online graduate certificate programs and an undergraduate computer programming certificate program. In partnership with sister institutions in Asheville and Wilmington and Craven Community College in Havelock, the College has three 2+2 undergraduate site-based programs and two four-year site-based degree programs. Both the Mechatronics Engineering program in Asheville and the Mechanical Systems Engineering

program again achieved ABET-accredited distance programs. A total of 21 students graduated in the BSE program in Asheville and 11 students in Havelock.

Women and Minority Engineering Programs:

Women and Minority Engineering Programs (WMEP) at NC State continues to be known as a national leader in recruitment, retention, graduation and job placement of outstanding engineers and computer scientists.

WMEP hosted three VIP recruitment receptions: one for students attending the North Carolina School of Science and Mathematics (NCSSM), one for women and one for Black males. These receptions were well attended and allowed participants to learn about the engineering departments and the support offered for women and historically underrepresented groups.

For the 2022-23 year, the COE continued the momentum toward a fully inclusive and diverse student body. In the summer of 2022, WMEP again held its bridge program for 100 newly admitted engineering students. Again, the Summer Exploration Experience (SEE) Program was highly successful, with industry partners supporting their week-long activities. In the fall, the COE celebrated 25 years of the Women in Engineering Program with a day of activities for K-12 in the morning and university students in the afternoon. A luncheon for industry, campus and alum partners was held. In the upcoming year, the COE will celebrate 40 years of the Minority Engineering Programs. In support of the engineering expansion, an additional coordinator for the WMEP program, now led by Javon Adams as the interim director, was hired.

Engineering Career Fair:

In fall 2022, the Engineering Career Fair was held in person at the McKimmon Center on day one and virtually on day two. At the in-person event, 174 companies attended, with 2,911 NC State students and 335 non-NC State students.

Partnering with Career Fair Plus on the second day of the fall 2022 event, the College was able to host participation from 109 employers who scheduled 3,853 virtual meetings.

During the single-day spring 2023 in-person fair in February, there were 170 participating employers, with 1,948 NC State attendees and 284 attendees from outside of NC State. To accommodate waitlisted companies for the in-person event, the Career Development Center hosted a virtual event called Meet the Engineering Employer – 22 companies attended who scheduled 828 virtual meetings. The ECF team is planning to be fully in person for a two-day event in September 2023 with a one day in-person event planned for the spring 2024 semester.

Fundraising and Development

Regarding advancement and fundraising, COE was proud to celebrate last year surpassing its \$230 million Think and Do campaign goal with a final result of \$276 million as of December 31, 2021. Given the achievement of this significant milestone, this year could be described as a year of building and planning. The team addressed significant staff shortages and is now currently fully staffed. This is a strong position on which to grow, and the College's advancement team

appreciates the provost's support for the addition of incremental front-line fundraising positions.

An important building block programmatically this year has been the College's 100th anniversary. The advancement team, in collaboration with College communications and academic affairs, led the effort to mark the occasion with increased external activities. These included dean-featured events in Atlanta, Charlotte, Greensboro, Wilmington and Raleigh during the spring semester and a signature 100th anniversary event on May 3, 2023. The year-long celebration of COE's 100th anniversary also provides an opportunity to implement fall 2023 events that will also introduce incoming Dean Pfaendtner to the alumni and donor community within the context of celebration and a forward-looking message. Other important building blocks include expanded annual giving and alumni relations/engagement capacity under new initiatives led by central University Advancement. Members of our staff have been invited to participate in workgroups and conversations that enable short-term coordination and long-term planning. The College has been able to take advantage of campus-wide advancement growth to expand capacity where the College does not have staff.

As of June 12th, the College has raised \$20,268,106 in FY23. Highlights include a \$2.8 million planned gift for CSC on Day of Giving, contributing to a Day of Giving College total of \$6.6 million. Upon realization at a future date, this substantial planned gift will establish a distinguished professorship, scholarship and a department discretionary fund, all directly benefitting computer science. Not evident in overall dollar totals is the number of newly identified major gift conversations at \$50,000+. As of June 12, the COE Advancement team is actively managing 51 open gift conversations and has identified 155 potential major gift prospects for future cultivation, not counting prospective engineering donors identified from campus colleagues. This "pipeline" of future major gifts was a key area of focus this year in the long-term planning for the University's next campaign, of which COE is expected to be a significant contributor.

Administration

- Dean Louis Martin-Vega announced that he would step down as dean of the COE at the end of the 2022-23 academic year. Jim Pfaendtner of the University of Washington was named as his replacement, with a start date of Aug. 1, 2023.
- Dan Stancil announced his intention to step down as head of ECE at the end of the 2022-23 academic year and continue as a faculty member. Veena Misra was named interim head of the department.
- Liz Moore was named as the College's director of facilities. She replaces Steve Sharp, who left NC State.
- Maria Mayorga, professor in ISE, was named head of the Operations Research program after serving in the role on an interim basis.
- Richard Gould announced his retirement from his role as associate dean for graduate programs. Kara Peters, professor in MAE, has been named to the position on an interim basis.
- John Gilligan announced his intention to step down from his role as executive associate dean of the College effective Sept. 1, 2023.

- Garey Fox announced plans to step down from his role as head of the Department of Biological and Agricultural Engineering. Fox has been named dean of the NC State's College of Agriculture and Life Sciences, effective Aug. 1, 2023. Professor Lingjuan Lang-Wi has been named as his replacement on an interim basis.

Recommendations and Concerns for the Future

Engineering North Carolina's Future represents a generational opportunity to magnify the impact of NC State University on the state of North Carolina. The goal is to increase the enrollment in the engineering and computer science disciplines by 40 percent over an eight–10-year period. The new, talented graduates will support the explosive economic growth of the state in the high-tech areas exemplified by Apple, Google, Fujifilm, VinFast, Toyota Battery, Novozymes and others.

About 30 percent of the time of COE leadership has been dedicated to planning and implementing the student, faculty and staff growth projected to occur as part of the engineering expansion. A task force has been assembled and meets on a regular basis with representatives from the provost's office to address the growth issues. Some of the guiding principles for the growth have been that 2/3 of the enrollment increase would be undergraduate students and 1/3 graduate students. Also, not all departments would grow at the same percentages. Given the current focus of industry growth and expansion, we anticipate CSC, ECE, MAE and CBE seeing the largest growth in that order.

In order to maintain and increase research productivity concurrent with such a significant enrollment growth, tenured/tenure track (T/TT) faculty members will be needed to accommodate the graduate student and research roles at a ratio of about 10 to one, graduate students to faculty members. Teaching faculty members will be needed to accommodate the larger number of service courses, especially in computer science. Staff will be needed in many support roles such as advising, financial, HR, contracts and grants, IT, etc.

A critical need for the engineering growth will be the additional teaching, research and office space required to hire the nearly 200 more faculty and staff members. As an example, the new Fitts-Woolard Hall accommodates approximately 67 T/TT faculty members, whereas the engineering expansion anticipates an additional 100 T/TT faculty members. The Smith Group has been engaged by the University Architect's Office to conduct a space needs study of current and projected space for the COE. The COE has grown in enrollment by nearly 20 percent over the last decade, but space has only increased by 4 percent (including Fitts-Woolard Hall). Likewise, research output has increased by nearly 100 percent with only modest increases in faculty size.