

Annual Report 2017-2018 College of Engineering North Carolina State University

Overview

As the flagship engineering college in North Carolina, NC State's College of Engineering (COE) is the largest in the state, with more than 10,000 students, and the 9th largest in the nation. The College is the most highly ranked engineering college in the state. The most recent *US News and World Report* graduate rankings place NC State Engineering at 24th overall and 12th among public engineering colleges—the highest ranking of the COE in decades. The College is also among an elite group of engineering colleges with more than \$200 million in annual research expenditures. According to American Society for Engineering Education (ASEE) data for 2017, the COE is ranked 10th in the nation in research expenditures. To be so large and so highly ranked is a tremendous achievement for the College and NC State University.

This achievement is driven by our long-term goal of “becoming and being perceived as the leading public college of engineering in the U.S. and one of the preeminent colleges of engineering in the world.” We also believe this is a necessary condition for NC State to achieve its vision of emerging as a preeminent technological research university as stated in the University's strategic plan.

The COE is committed to providing our students a premier educational experience that integrates essential engineering fundamentals with a broader understanding of behavior, policy, entrepreneurship and global perspectives. This includes enhancing student success through the integration of research and education and adopting new academic initiatives, such as the National Academy of Engineering (NAE) Grand Challenges Scholars Program, which commits the COE to the development of opportunities that provide our students with a broad range of creative learning experiences. These efforts are consistent with the University's strategic plan and complement the development and implementation of its academic mission.

Essential to the success of the COE and its students and faculty is a sustained effort to engage and invest in vital areas of research growth, as well as educational need. This involves, first and foremost, making strategic investments in faculty and infrastructure in areas that support world-class research and teaching and attract and retain the highest caliber faculty who are global leaders in discovery, learning and innovation. Hiring the best faculty and supporting their research activities are necessary components for the COE to achieve its goal of global preeminence and provides the greatest potential for attracting external funding that best serves the needs of our state and nation.

Changes in the Service Environment

The Board of Governors' approval of the COE engineering enhancement fee has played a critical role in allowing the College to provide 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 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 21st century engineering education. At the graduate level this support has expanded student travel to professional meetings, provided career services, speaking and writing support, mentored research and teaching experiences and others. In addition, the premium tuition program in three masters programs has been fully implemented. Staff positions have also been created in the career development and advising areas. Since overall student enrollments at all levels continue to increase, these new investments are critical in assuring that this increase in "quantity" is not happening at the expense of the "quality" of the student experience and ultimately the success of our students.

Over the last five years, these measures along with assistance from the Provost have allowed the College to increase the number of tenured and tenure-track faculty and continue to improve its facilities and infrastructure. This has resulted in significant increases in research productivity and growth in graduate enrollment. The College hired 15 new tenured/tenure-track faculty in 2017-18, representing a net increase of 3 tenured/tenure-track faculty over the 2016-17 totals.

As reflected in the campus 2020 enrollment plan, the COE is committed to expanding its number of doctoral students by 50 percent over the fall 2011 headcount. In order to achieve this goal while maintaining the College's admirable Ph.D. time-to-degree statistics, it will be necessary to continue to increase the number of faculty members available to mentor these doctoral students while also increasing the financial resources available to support the students. Studies have shown that the two greatest impediments to Ph.D. completion are lack of financial support and poor advising.

Major Initiatives

Significant matching and cost-share investments made by the College, the Provost, and the VC for Research allowed COE to compete successfully for a number of major national research grants in 2017-18. These new awards include an National Science Foundation (NSF) Research Triangle

Nanotechnology Network award, an NSF Research Traineeship (NRT) and two NSF Major Research Instrumentation (MRI) awards, two Department of Defense (DOD) Multi-University Research Initiative awards, and one Department of Energy (DOE) ARPA-E Meitner Center award. Continued investments also resulted in successful renewals of our DOE CASL Center, a critical sixth year renewal for the NSF ASSIST Engineering Research Center (ERC), a critical third year performance renewal for PowerAmerica under new DOE management and continuation funding for our National Security Agency (NSA) Science of Security Label for another five years. These renewals alone generate in excess of \$24 million in annual research expenditures translating into almost \$12 million in annual F&A revenue for NC State.

This last year also provided COE with a landmark moment in its major infrastructure initiative. In April 2018, the College held a groundbreaking ceremony for its newest engineering building under construction on Centennial Campus. The ceremony also celebrated the naming of the building as Fitts-Woolard Hall. The naming was made possible with an historic \$25 million joint gift from alumni Ed Fitts (IE '61) and Ed Woolard (IE '56). This is the largest gift in support of a building in the history of the university. As of June 2018, the College has raised all but \$14 million of the \$60 million in private funding needed to complete Fitts-Woolard Hall.

Diversity

The College is committed to supporting a diverse faculty, staff and student body that is welcoming to all individuals. Efforts within the College to increase diversity continue to be successful.

In 2017-18, the COE added six additional female tenured/tenure-track faculty members, bringing the total to 63 female faculty members. The College hired its second female department head, Dr. Julie Swann, who leads the Fitts Department of Industrial and Systems Engineering. The COE also has 19 African-American and 13 Hispanic faculty members. Since 2006, the College has essentially tripled the total number of women and doubled the number of underrepresented faculty members. While the College has made good progress, we still have farther to go to achieve a level of diversity in our faculty that would mark us as a leader in this regard among our peer engineering colleges.

The College has made excellent progress in recruiting female students. Our 2017 first-year engineering class was 27.9 percent female, which set the College well above the national average. The enrollment of female students for the fall 2018 first-year class is expected to be 27.7 percent. We hope to realize similar successes in recruiting underrepresented minorities in the near future.

Instructional Program Advances

- Research experiences for COE undergraduates continue to be a high priority in the

College, as is the Engineering Entrepreneurship Program. Funds made available from the engineering enhancement fee have allowed the College to increase the offerings available for students.

- A new Federal Government student internship program was started by the Dean's Office. The goal of the program, implemented in conjunction with the College of Engineering at the University of Arkansas, is to serve as a nationwide pilot for immersing engineering students in congressional and federal offices and attracting engineering students into public service careers. More than 60 students applied for the 4 internships provided by NC State.
- COE Academic Affairs Office together with the COE Industry Expansion Solutions Office (IES), implemented a new pilot North Carolina Rural Internship Program to facilitate student internships in underserved areas of our State through partnerships with industries, government and service organizations in these communities. Eight students participated in this pilot program.
- The College has also been actively engaged in efforts to better define and provide a career path for non-tenure-track faculty, particularly non-tenure-track teaching faculty, as a way of enhancing quality and commitment to teaching. These efforts have received national attention and are being disseminated through presentations at national engineering education forums.
- 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 16 engineering summer camps at NC State for elementary, middle and high school students and satellite camps in Rocky Mount, Hickory, Havelock and Charlotte, and
 - Second year activities of an NSF Research Experience for Teachers (RET) grant, PIs Drs. Lavelle and Bottomley.
- Our faculty and staff also continue to play an important role in the development and implementation of the NC State-Wake County Early Career High School on our campus, including their role in curriculum development based on the concepts of the NAE Grand Challenges.

Research

Our aspirations, mission and strategic investments have enabled a culture that has produced some spectacular successes that have enhanced, in a very significant way, the reputation of COE and NC State as a premier technological research university. These successes include successful graduation of our NSF FREEDM ERC after receiving 10 years of support from NSF, continued support by NSF of our ASSIST Nanosystems ERC, continuation funding for our Science of Security Lablet by the NSA for five years under a new contract, a major role in the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL) Center and various other new initiatives and renewals as stated in a previous section of this report.

An immediate result is that we are seeing increases in excess of 7% and 6% respectively in research expenditures and F&A generated in comparison to last year. This is a remarkable accomplishment that reflects first and foremost the outstanding productivity and quality of COE faculty and the significant return on the investments that have been made for their recruitment, retention and infrastructure support. Other highlights include:

- New annual research awards through June 2018 are estimated at \$93,671,240.
- COE research expenditures for 2017-18 are estimated to come in at \$212.5 million.
- The National Science Foundation Future Renewable Electric Energy Distribution and Management (FREEDM) Systems Center celebrated 10 years and its “graduation” from the NSF Engineering Research Center program. FREEDM will continue to operate as a research center with industry partners, grants and an endowment from Duke Energy.
- Three faculty members received National Science Foundation CAREER Awards.
 - Dr. Fernando Garcia Menendez, assistant professor in the Department of Civil, Construction, and Environmental Engineering, received an NSF Faculty Early Career Development (CAREER) Award. The five-year, \$500,000 award supports his research project, “Modeling and Educational Framework to Support Air Quality Management in a Smoky Atmosphere.”
 - Dr. Landon Grace, assistant professor in the Department of Mechanical and Aerospace Engineering, received an NSF Faculty Early Career Development Award. The five-year, \$500,000 award support his research project, “Exploiting the Dynamic Dielectric Behavior of Water to Understand and Predict Polymer Composite Damage Progression.”
 - Dr. Kathryn Stolee, assistant professor in the Department of Computer Science, received an NSF Faculty Early Career Development Award. The 5-year, \$500,000 award supports her research project, “On the Foundations of Semantic Code Search.”

- Dr Jason Patrick, assistant professor in the Department of Civil, Construction, and Environmental Engineering, received a prestigious Young Investigator Research Program (YIP) award from the Air Force Office of Scientific Research (AFOSR) for his proposal entitled “Integrated Self-healing and Self-sensing using Optical Waveguides in Microvascular Fiber-Composites”.
- Dr. James LeBeau, assistant professor in the Department of Materials Science and Engineering and associate director of the Analytical Instrumentation Facility, was awarded a \$2 million Transmission Electron Microscope (TEM) from the NSF Major Research Instrumentation (MRI) program.

Extension and Outreach

The Engineering Place for K-20 Outreach

The bridge programs for female and minority students and K-12 summer camps programs and in the Research Experiences for K-12 teachers (RET) programs are resulting in increasing numbers of female engineering students enrolling in the College, due to the strength of COE’s collaboration and outreach to K-12 students and teachers.

The various Engineering Place programs, including Engineering on the Road, Family STEM nights, summer camps, campus visits, the Solar House and others served more than 15,000 students in North Carolina and nationwide this year. Staff worked with schools in New Hanover and Wake Counties on incorporating engineering into school curriculum; provided teacher workshops to several hundred teachers on integrated STEM; and again presented at the National Science and Engineering Festival, which hosted 600,000 people, doing an activity on wearable electronics. Engineering camps continue to be a great success and have grown across the state, with partner camps in Hickory, Charlotte, Wilson, Pembroke, Lumberton, Spindale, Havelock, Roxboro and Morganton. The week long K-12 day and residential camps hosted about 1,800 campers. The Engineering Place had twice as many applicants as slots for day camps for grades 3-10 and three times the applicants for 11th and 12th grade overnight camps. Work with New Hanover County schools has resulted in the production of a new curriculum integrating engineering with language arts, math, social studies and science, which will be useful to other schools and systems around the state.

Industry Expansion Solutions (IES)

Industry Expansion Solutions (IES) has served as the administrator for the North Carolina Manufacturing Extension Partnership (NCMEP) Center since 1955, operating under the College of Engineering. NCMEP is the official representative of the MEP National Network™ and NIST MEP in North Carolina. The MEP National Network is a unique public-private partnership that delivers

comprehensive, proven solutions to U.S. manufacturers, fueling growth and advancing U.S. manufacturing.

IES, through NCMEP, continues to help state manufacturers with important networking opportunities through programs like Manufactured in North Carolina (MNC), the premiere searchable supply chain directory for North Carolina manufacturers, and the membership-based mfgNC CONNECTIONS educational and networking program. In 2017, IES partnered with Business North Carolina to host the third mfgCON Conference, delivering two days of keynotes, presentations and breakout sessions, attracting more than 400 attendees in Winston Salem, NC.

In 2017-18, IES delivered 350 industry fee-for service projects and 104 open enrollment courses and workshops for a total of 33,933 contact hours, serving 1,553 students. Additionally, clients of IES or IES' NCMEP partners returned surveys to NIST's third-party survey company, reporting results they attributed to work done by NCMEP affiliates, including the NC Community College System, NCWorks Customized Training; the Economic Development Partnership of NC; the Polymers Center of Excellence; the Manufacturing Solutions Center; and NC A&T State University. Over the past five years, manufacturers reported \$2.8B total impact for manufacturing in NC, including 13,563 jobs retained; \$584 million in retained sales, \$288 million in cost savings, 6772 jobs created, \$321 million in increased sales and \$1.6 billion in investments.

Biotechnology Training and Education Center (BTEC)

The undergraduate and graduate enrollment in BTEC classes remains strong at over 700 students. Enrollment in open-enrollment and custom courses for industry was at an all-time high. The custom course program served both returning and new clients seeking to fill knowledge gaps and learn the latest biomanufacturing trends. The number of bioprocess and analytical services projects completed for industry and academic clients remained strong. Revenues from our professional development program and bioprocess and analytical services, including both testing and services agreement and contracts and grants, continue to be high.

This year BTEC is a lead or partner on five projects funded by the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL). The projects are expected to begin execution early next fiscal year. BTEC will lead projects in the area of bioprocess automation and gene therapy vector production. Both topics are critically important to modern biomanufacturing, 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. BTEC will take a supporting role as a partner on three other NIIMBL projects, all of which have close ties to organizations in NC. To accommodate this work, office space in the facility was converted to a laboratory that will house NIIMBL project work. State funds earmarked for NIIMBL projects were used to support that project along with the

procurement of a number of new pieces of equipment, which has led to a significant enhancement of BTEC's laboratory capabilities. BTEC is also in the process of hiring additional personnel to staff these projects. The NIIMBL-related activities this year put BTEC in a position to become a key player in applied process research and development for years to come.

Faculty

The COE's 2013 Strategic Plan called for increasing the number of T/TT faculty in the College to 400 by the year 2020. The COE is now at 310 T/TT faculty. We are also projecting 17 faculty hires in 2018-19. Together with 7 retirements/faculty resignations this will bring us to 320 T/TT faculty. Our revised hiring plan for the next four years reflects 41 total hires of which 11 are projected to be new hires. If this is what indeed happens, it would mean that the COE would level out at about 330 T/TT faculty in 2023.

The COE currently leads three Faculty Cluster initiatives (Sustainable Energy Systems and Policy; Carbon Electronics; and Global Water, Sanitation and Hygiene) and is invested in ten others (Data-Driven Science, Digital Transformation of Education, Emerging Plant Disease and Global Food Security, Forensic Sciences, Geospatial Analytics, Microbiomes and Complex Microbial Communities, Precision Medicine, Synthetic and Systems Biology, Translational Regenerative Medicine, and Visual Narrative). Each cluster will require investments in startup commitments (half of the startup commitments would come from COE funds) as well as additional space lease commitments.

Our Faculty Advancement team continues to lead faculty professional development initiatives connecting COE faculty with each other and faculty in other NC State colleges (e.g., CNR, Textiles). New investments include a two-day COE DC Research Clinic connecting faculty with federal funding agencies in Washington DC, new workshops on faculty skills development, and enhancements in the joint 4-day COE/COS new faculty orientation workshop. Programs are designed to improve faculty well-being and create faculty communities of practice by engaging faculty at all ranks. Faculty Advancement also works in partnership with college and campus leadership in the diversification and retention of COE faculty.

The College mourned the loss of Dr. Nino A. Masnari, distinguished professor of electrical and computer engineering and dean emeritus of the College of Engineering, who passed away on May 19, 2018.

Faculty Highlights

- Ruben Carbonell, Frank Hawkins Kenan Distinguished Professor of Chemical Engineering, received the O. Max Gardner Award from the University of North Carolina System, for his contributions in engineering, health care, education and public policy.
- The 2018 Alcoa Foundation Engineering Research Awards were presented to Dr. Min Chi, assistant professor in the Department of Computer Science, and Dr. Jason Haugh, professor in the Department of Chemical and Biomolecular Engineering, at the spring faculty meeting of the College of Engineering.
- Dr. Donald L. Bitzer, Distinguished University Research Professor of Computer Science, has been named a Fellow of the National Academy of Inventors.
- Dr. Joseph DeSimone, the William R. Kenan, Jr. Distinguished Professor of Chemical Engineering, has been named one of five recipients of the 22nd Heinz Award in the Technology, the Economy and Employment category by the Heinz Family Foundation.
- Dr. Louis A. Martin-Vega, Dean of the College of Engineering, completed a 4 year term as Vice-Chair of the National Science Foundation's Committee for Equal Opportunities in Science and Engineering (CEOSE) and completed a three-year term on the American Society for Engineering Education Board leadership, having service as president-elect, president, and this past year as immediate past president.
- Dr. Daniel D. Stancil, Alcoa Distinguished Professor and Department Head of Electrical and Computer Engineering, was named president of the Electrical and Computer Engineering Department Heads Association.
- Dr. Orlin Velez, INVISTA Professor in the Department of Chemical and Biomolecular Engineering, was the thirty-third recipient of the R.J. Reynolds Tobacco Company Award for Excellence in Teaching, Research and Extension.
- Dr. Kostadin Ivanov, Professor and Head of the Department of Nuclear Engineering, and Dr. Richard Spontak, Distinguished Professor of Chemical and Biomolecular Engineering, received the Outstanding Global Engagement Award from NC State.
- Four professors received Named Professorships
 - Dr. Michael Dickey was named the Alcoa Professor in the Department of Chemical and Biomolecular Engineering.

- Dr. Srinath Ekkad was named the R.J. Reynolds Professor in the Department of Mechanical and Aerospace Engineering
- Dr. Detlef Knappe was named the S. James Ellen, Jr. Distinguished Professor in the Department of Civil, Construction, and Environmental Engineering.
- Dr. Gregory Parsons was named the Celanese Acetate Professor in the Department of Chemical and Biomolecular Engineering.
- Three professors received Distinguished Professorships
 - Dr. Mohammed Gabr has been named Distinguished Professor in the Department of Civil, Construction, and Environmental Engineering.
 - Dr. Nagui Roupail was named Distinguished University Professor in the Department of Civil, Construction, and Environmental Engineering.
 - Dr. Laurie Williams was named a Distinguished Professor in the Department of Computer Science.
- Four professors were named Fellows of their professional organizations
 - Dr. Jerome Lavelle, associate dean of academic affairs, was named to the American Society for Engineering Education (ASEE) Academy of Fellows.
 - Dr. Yan Solihin, professor in the Department of Electrical and Computer Engineering at North Carolina State University, has been elected as a Fellow of the Institute of Electrical and Electronics Engineers (IEEE).
 - Dr. Victor Veliadis, professor in the Department of Electrical and Computer Engineering and deputy executive director and chief technology officer (CTO) for PowerAmerica, was elected as a Fellow of IEEE.
 - Dr. Laurie Williams, professor and interim head of the Department of Computer Science, was elected as a Fellow of IEEE.

Students

Our students are the COE's reason for existence and our main focus. Each year, we recruit the highest-quality students possible and work to bring all students successfully through to graduation.

Undergraduate enrollment The fall 2017 undergraduate enrollment was 6,731 (1,429 first year students, 129 freshman, 1,219 sophomores, 1,591 juniors, and 2,363 seniors). Enrollment of women increased to 1,576 (23.4 percent). Enrollment of minority students was 665 (9.9 percent) in fall 2017, which is an increase of 63 over the previous year. Fall 2017 minority enrollment included

242 African Americans, 317 Hispanic students, 14 Native Americans and 92 minority students of more than one race.

Graduate student enrollment Graduate student enrollment for fall 2017 was 3,359 (2,095 master's and 1,264 doctoral). International students made up 63 percent (2,110 students) of the enrollment; 25 percent (828) of the students were women. Minority enrollment was 7 percent (249) of all students or 20 percent of domestic students (1,249 students).

Growth in student enrollment Our current total enrollment of 10,044 (undergraduate plus graduate) represents a 33 percent increase from the total COE enrollment of ten years ago.

Undergraduate degrees awarded The number of bachelor's degrees awarded for 2017-18 was 1,552 compared to 1,508 for the 2016-17 year.

Graduate degrees awarded The number of graduate degrees awarded during 2017-18 was 1,209 (1,027 master's degrees and 182 doctoral degrees). In 2016-17 there were 1,172 (991 master's degrees and 181 doctoral degrees) graduate degrees awarded.

Undergraduate recruiting During fall 2017, Engineering Academic Affairs hosted four on-campus recruiting events for prospective fall 2018 applicants. Beyond the University's Open House, the College hosted three fall recruiting visitation days, one of which was specifically targeted toward women and underrepresented minorities in engineering. Additionally, site visits were made to a number of NC Community Colleges and a handful of partner institutions to speak directly to prospective transfer students.

During spring 2018, Engineering Academic Affairs offered eight yield events for students accepted for fall 2018. One such event was offered specifically for women and highlighted the Women in Science and Engineering (WISE) and the Women in Engineering (WIE) programs. Another program focused on minority freshmen students and highlighted both the Minority Engineering Program (MEP) and WIE. Both events were designed to increase enrollment of women and underrepresented students and make the opportunities and community support aspects for these populations more visible to prospective students. Included in the College's spring yield events were five Experience NC State visitations offered by the university for accepted freshmen. Each College event included information sessions, student panels made up of Engineering Ambassadors, parents' sessions and tours of Centennial Campus. Additionally, the Engineering Open House in March 2018 drew approximately 4,000 people including admitted and prospective high school, middle school and community college students plus parents.

Graduate student recruiting. Master's applications for the five years ending in 2016-17 increased by 27 percent. Interest remains strong, despite the fact that most masters' students are self-supporting. Doctoral applications during this same period decreased by 12 percent, which represents a challenge to our ability to grow at the doctoral level. COE master's and doctoral applications for the 2016-17 year represented 54 percent and 39 percent of the university total, respectively.

In the last five years, expenditures on graduate student recruiting and educational enhancements from all sources, including the engineering enhancement fee and the Provost's office, have approximately doubled. For the 2018-2019 academic year, the College awarded over \$700,000 in fellowship funding provided by the Provost, plus GSSP costs.

In addition, we had eight graduate students continuing their the U.S. Department of Energy Nuclear Energy University Program (NEUP) fellowship awards. Other funding sources include NSF Graduate Fellowships and occasional funding from other graduate scholarship sources such as the GEM Consortium and others.

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. 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.

Approximately 750 working professionals were enrolled in graduate classes as matriculated or non-degree students, the majority of whom are located in North Carolina and the surrounding states. The College offered 301 graduate and undergraduate online courses during 2017-18 and 60 courses during the 10-week summer term. *US News & World Report* ranked both the Graduate and Computer Science online programs programs in the Top Ten Best Online Programs in 2018.

Women and Minority Engineering Programs

Women in Engineering (WIE) Program

NC State continued to be feted nationally, as a leading graduator of female engineers. Fifty-five incoming female students attended the ESCAPE to Engineering bridge program. The functions of

University Orientation are incorporated into programs as well as field trips to statewide industries, social activities and success-based activities. This camp is funded by donations from John Deere and Praxair.

The WIE and MEP program staff continue to work in conjunction with Academic Affairs staff on recruitment and retention issues for women. The combined WMEP staff worked together on many efforts that are intersectional between gender and ethnicity, which will benefit our students greatly. Programs included Dinner Dialogues for students within departments; the Tools Workshop, where students can learn how to solder, use power tools, pipette and other skills needs in today's engineering laboratories; Taste of Engineering; and programs with John Deere, Caterpillar, Duke Energy, Praxair, Glaxo-Smith-Kline and other industry partners.

In spring 2018 a new combined program took place that has now become a student-led alternative spring break. Twenty-nine students and staff traveled to Rwanda. We visited a women's center and learned about life in the capital city, particularly for women. We also visited a rural community and helped lay bricks on a new house for a local Episcopal pastor. We also spent some time learning about the Rwanda genocide, including touring the National Genocide museum and traveling on a safari, both with guides who are genocide survivors. This trip involved many students who had never been out of the country before and was life changing.

Minority Engineering Programs (MEP)

The Minority Engineering Programs offer a variety of specially designed initiatives aimed at recruiting and retaining talented minority engineering students. The Overnight Minority Recruitment Weekend, geared toward high school seniors who have been admitted to the College, hosted 24 admitted minority students (15 females and 9 males) along with approximately 50 family members/guests in spring 2018, with 24 (15 females and 9 males) NC State minority engineering students serving as hosts/volunteers. Of the 24 participants, 18 paid enrollment deposits at NC State University (75 percent), and 8 of the 24 (33.3 percent) are participating in the 2018 Summer Transition Program.

The Summer Transition Program (STP) brings 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. In summer 2017, 21 students (6 females, 15 males) participated in STP, and 9 of those (42.86%) 2017 were recognized at the Freshman Honors Convocation (FHC) in spring 2018, and one was recognized for having a perfect 4.00 GPA. The 2017 STP cohort had a GPA of 2.938 in fall 2017 and a GPA of 2.865 in spring 2018, with a 2.974 cumulative GPA; four participants made the Dean's List each semester.

The Minority Summer Research Program (MSRP), a six-week program designed to provide high-impact research experiences for undergraduate minority students, hosted five students (4 females, 1 male) in summer 2017. Three of the participants were recognized at the Freshman Honors Convocation, and one was recognized for a perfect 4.00 GPA. The 2017 MSRP cohort had a semester and cumulative GPA of 3.223 for the fall 2017, with two on the Dean's List, and a semester GPA of 3.356 and cumulative GPA of 3.388 for spring 2018; with two on the Dean's List.

In the 2017-18 academic year, four sections of E144 – Academic and Professional Preparation I, were available to the approximately 140 incoming minority engineering freshmen and transfers. The fall course had 119 students enrolled. The spring course, E145 – Academic and Professional Preparation II, had 23 students enrolled. E144 and E145 aim to help minority engineering students become better acclimated to our campus and the College.

Engineering Career Fair

The Engineering Career Fair continues to be one of the largest and highest quality events of its kind in the country with more than 500 companies attending the two-day fall event and the one-day spring event in 2017-18. Demand for engineering and computer science students continues to be very strong.

Dinners with the Dean

Sponsored by COE and implemented by the Engineering Student Council, the once a semester "Dinner with the Dean" series continues to provide the Dean with the opportunity to interact with representative sets of undergraduate students in an informal forum. These interactions provide considerable insight into student needs and perceptions as to how well the COE is providing them with a student experience that is contributing to their success.

Fundraising

The College held a groundbreaking ceremony and celebrated the naming of its newest building, Fitts-Woolard Hall. The naming was made possible with an historic \$25 million joint gift from alumni Ed Fitts (IE '61) and Ed Woolard (IE '56). This is the largest gift in support of a building in the history of the university. As of May 2018, the College has raised all but \$14 million of the \$60 million in private funding needed to complete this building.

Fueled by strong support for Fitts-Woodlard Hall, the NC State Engineering Foundation had another record-setting fundraising year with giving totals to the College at \$39,287,344. Fiscal Year 2018 ended on June 30, 2018. Endowments to the College generally fall into one of three categories: scholarships, named Professorships and fellowships. There are now 301 permanently endowed scholarships in the College and 52 permanently endowed named professorships. Total endowments

benefiting the College are \$3,300,815 with total economic support from all fundraising sources being \$10,794,968.

The annual giving program for the COE raised a total of \$1,539,977 for the College of Engineering Leadership Fund and all nine department enhancement funds. This represents a 3 percent increase from the previous year. The Dean's Circle, the leadership annual giving society, grew by 33 members, bringing our total membership to 487 alumni and friend donors, representing a 7 percent increase from the previous year. These gifts often represent our "pipeline" for major gifts and an important part of the College's overall advancement plan. In addition, Kyle Kremer joined the Engineering Foundation staff in March as the director of development and major gift contact for the Department of Materials Science and Engineering.

The Think and Do the Extraordinary Campaign began 2013 and concludes in 2021. The College of Engineering's goal is \$230 million and thus far has raised \$161 million.

Administration

- Dr. Donald Brenner, Kobe Steel Distinguished Professor has been named head of the Department of Materials Science and Engineering. Brenner has served as interim head since fall 2017.
- Dr. Javon Adams has been named the coordinator of transfer student academic advising in the College of Engineering's Office of Academic Affairs.
- Jennifer Cox, Director of Communication, stepped down from her role as director of communication, effective July 2018. Brent Lancaster was appointed interim director.
- Dr. Joel Ducoste, professor of civil, construction, and environmental engineering, joined the Graduate Programs office on a part-time basis to assist with graduate recruiting and graduate student advancement.
- Dr. Srinath Ekkad was named the new head of the Department of Mechanical and Aerospace Engineering effective September 2017.
- Phil Mintz was appointed executive director of Industry Expansion Solutions (IES) effective July 2017.
- Dr. Julie Swann was named the A. Doug Allison Distinguished Professor and Head of the Fitts Department of Industrial and Systems Engineering effective August 2017.

Recommendations and Concerns for the Future

As the COE continues to move up in most every category—research expenditures, quality of students and faculty, graduation rate of undergraduates, quality of programs, and *US News* rankings—our peer institutions continue to improve as well. So while we celebrate the many accomplishments outlined in this report, we are mindful that “*no one is standing still*” and that we must continue to work hard toward our goal of becoming a preeminent college of engineering.

In particular, other states continue to make significant commitments to our peer colleges of engineering and aspirational peers to grow faculty size and improve existing or build new infrastructure. These investments are strategic to increase the recruitment and retention of top faculty and students but also to garner attention from top industry and business. The investments in new infrastructure among engineering colleges emphasizes the importance of our efforts to complete Fitts-Woolard Hall and continue to move toward completing the move of the COE to Centennial Campus.

Funding for recruiting top faculty and retaining our excellent faculty is critical to the success of the COE and NC State. As other states and private universities make significant investments in engineering education the competition for the best faculty increases. Our ability to attract and retain outstanding faculty has been the cornerstone of our success over the last decade, but we are now being challenged more than ever to retain our most outstanding performers. This challenge is exacerbated by the stagnation in faculty salaries that we have experienced, especially over the last 5-6 years, to the point where faculty compensation is arguably 15-20 percent below that of our competitors. The need for a targeted effort to bring salaries up to a competitive level, together with available retention funding, will need to go hand in hand if we are to maintain the reputation and research achievements that we have worked so hard to attain.

A growing concern is our ability to attract outstanding international graduate students. This presents problems for the future of the college as it continues to grow as a research powerhouse. Efforts to improve the recruitment of graduate students, and international graduate students in particular, are being made, but as we are all aware, outside factors are influencing the success of our efforts. While we cannot control outside impacts, we can influence our competitive standing among international graduate student candidates through enhancements in our graduate stipends.

The potential for a continued increase in undergraduate enrollment would also present a challenge to the College. Although we have increased our T/TT faculty to 310, accompanying increases in undergraduate enrollment still place us among the highest student-faculty ratio among engineering

colleges. Reducing the student-faculty ratio, or at the very least assuring that it does not increase, is a priority that is necessary for the College to maintain, and improve, its rankings and research productivity as well as being important in the retention and recruitment of top faculty and in maintaining of the quality of education our students receive.

Our recent successes in fundraising for Fitts-Woolard Hall give us much to celebrate, but with \$14 million more to raise toward the construction of the building and the additional fundraising goals of the Think and Do the Extraordinary campaign, we are working closely with University Advancement to assure that we reach both goals. If we fail to meet the fundraising goal for Fitts-Woolard Hall, we will have to explore other options for financing its completion. Our alumni have been very supportive of our fundraising and are becoming more aware that while our state legislature continues to provide support, we can no longer rely on the state for all of the capital funds necessary to support a growing engineering college. We continue to rely on assistance from the university administration and the central development office.

In summary, our college is moving up in almost every category, but continued investments must be made to maintain our upward trajectory. The groundbreaking and construction of Fitts-Woolard Hall has our faculty, staff, students and alumni excited about the future of the College of Engineering at NC State. We will continue to strive to provide the best education as well as conduct the highest quality research for the betterment of the people of North Carolina and our nation.