

Annual Report 2016-2017 College of Engineering North Carolina State University

Overview

NC State's College of Engineering (COE) is the flagship engineering college in North Carolina. With more than 10,000 students, it is the largest engineering college in the state and the 9th largest in the nation. The College is also highly ranked among its peer institutions with the most recent *US News & World Report* graduate rankings placing NC State Engineering at 25th overall and 13th among public engineering colleges — the highest ranking of the COE in decades. 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.

This goal underscores the COE's commitment to providing a premier educational experience for our students and a world-class environment for our faculty that makes them global leaders in discovery, learning and innovation. Underlying this mission is a sustained effort to engage and invest in vital areas of research growth and educational need. It involves, first and foremost, making strategic investments in faculty and infrastructure in areas that provide the greatest potential for attracting external funding and best serve the needs of our state and nation.

We are also committed to providing our students an educational experience that builds upon essential engineering fundamentals to develop their broader understanding of behavior, policy, entrepreneurship and global perspective. This includes enhancing student success through the integration of research and education and adopting new academic initiatives, such as the NAE Grand Challenge Scholars program, which commits the COE to the development of opportunities that provide our students with a broad range of creative learning experiences. We believe that these efforts are consistent with the University's strategic plan and complement the development and implementation of its academic mission.

Changes in the Service Environment

Board of Governors' approval of the second scheduled increase in the COE engineering enhancement fee has allowed 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.

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 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.

Over the last four years, with assistance from the Provost, the College has been able 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 24 new tenured/tenure-track faculty members in 2016-17 representing a net increase of 12 tenured/tenure-track faculty.

Major Initiatives

The citizens of North Carolina voted to pass the Connect NC bond referendum in May 2015. This bond provides \$75 million in support of the construction of the Engineering Oval Building, which will be located on Centennial Campus and house the Department of Civil, Construction, and Environmental Engineering, the Edward P. Fitts Department of Industrial and Systems Engineering and COE administration. The \$75 million from the bond along with \$2 million in appropriated planning funds represents half of the \$154 million total budget that is being raised using a public-private funding model. The COE, especially through its development offices, continues to work to generate private funding to help finance the Engineering Oval Building and has raised more than \$24 million toward the \$60 million needed from private donors.

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 2016-17, the COE added seven additional female tenured/tenure-track faculty members, bringing the total to 57 female faculty members. Three of the new women faculty members are Hispanic, bringing the total Hispanic faculty members to 13. The COE also has 19 African-American 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 2015 first-year engineering class was 25 percent female, which set the College well above the national average. The enrollment of female students for the fall 2016 first-year class was 29 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.
- The UNC/NC State Joint Department of Biomedical Engineering is requesting approval for a new professional science master's degree program: "BME Translational Innovation" (BME-Train).
- All engineering programs hosted ABET site team evaluators as part of the process to reaffirm program-level ABET accreditation. The visit occurred in September 2016 and took place over three days. Final communication from ABET related to the evaluations is due in early Fall 2017.
- The College has also been actively engaged in efforts to better define and provide a career path for non-tenure-track faculty, and particularly non-tenure-track teaching faculty, as a way of enhancing quality and commitment to teaching.
- Improved College support for graduate education includes a 41 percent increase (in one year) in RA and TA funds (exclusive of start-up packages), travel support for students to attend conferences, professional development activities, speaking and writing support, and significantly increased funding for international research experiences for COE students. Part of this funding was also made possible by the engineering enhancement fee.
- 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 the NSF ERC proposals

- Internal support for The Engineering Place, home of the COE P-12 engineering outreach activities, and
 - 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 a NSF RET (Research Experience for Teachers) 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 around the concepts of the NAE Grand Challenges.
 - The newly combined undergraduate program in biomedical engineering, joint with UNC-CH, went through the ABET accreditation process.

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 continued support by the National Science Foundation of our two Engineering Research Centers (FREEDM and ASSIST) and recognition as the Southeast hub for the new NNMI in Smart Manufacturing, sponsored by the US Department of Energy. Other highlights include:

- Annual research awards through June 2017 are estimated at **\$130,000,000**, or **more than three times** the \$40 million in annual research awards generated by COE eight years ago.
- COE research expenditures for 2016-17 are estimated to come in at **\$198.4 million**.
- COE also generated an estimated **\$17,953,406 in F&A** in 2016-17.
- The COE is part of the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL), a new Manufacturing USA initiative led by the University of Delaware and supported by a five-year, \$70 million grant from the U.S. Department of Commerce and focused on advancing U.S. leadership in the biopharmaceutical sector. Dr. Ruben Carbonell will serve as the chief technology officer.

- The Center for Additive Manufacturing and Logistics (CAMAL), PowerAmerica and NIIMBL have applied for official Board of Governor status.
- Dr. James Lester in our Department of Computer Science is leading several significant NSF-funded efforts in game-based STEM education.
 - \$2.5 million grant for “ENGAGE: A Game-Based Curricular Strategy for Infusing Computational Thinking into Middle School Science” with Dr. Eric Wiebe and Dr. Bradford Mott,
 - \$1.5 million grant for “PRIME: Engaging STEM Undergraduate Students in Computer Science with Intelligent Tutoring Systems” with Dr. Eric Wiebe and Dr. Bradford Mott, and
 - \$857,421 grant for “REFLECT: Improving Science Problem Solving with Adaptive Game-Based Reflection Tools” with Dr. Roger Azevedo
- Dr. Laurie Williams, Interim Head of our Department of Computer Science, continues to lead as PI of our DoD sponsored Science of Security Lablet, a \$2.5M annual effort and one of only three sponsored nationally by the National Security Agency (NSA).
- Drs. Nam Dinh, Abhinav Gupta, Igor Bolotnov, John Baugh, and Maria Avramova received a \$3.5 million grant from the U.S. Department of Energy in support of their research “Development and Application of a Data-Driven Methodology for Validation of Risk Informed Safety Margin Characterization Models.”
- Drs. Brendan O’Connor, Joseph DeCarolis, Harold Ade, Heike Sederoff, and Carole Saravitz received a \$2.7 million grant for “INFEWS/T3: Solar-Powered Integrated Greenhouse (SPRING) Systems Using Wavelength Selective Photovoltaics for Complete Solar Utilization.”
- Five young faculty members received National Science Foundation CAREER awards.
 - Dr. Veronica Augustyn, assistant professor of materials science and engineering, for her research proposal, “Understanding Ion Transport in Solvated Layered Oxides for Electrochemical Energy Storage.”
 - Dr. Min Chi, assistant professor of computer science, for her research proposal, “Improving Adaptive Decision Making in Interactive Learning Environments.”
 - Dr. Ramon Collazo, assistant professor of materials science and engineering, for his research proposal, “Engineering point defect formation in UWBG-based optoelectronic devices.”
 - Dr. Stefano Menegatti, assistant professor of chemical and biomolecular engineering, for his research proposal, “Light- and temperature- controlled peptide ligands for purifying blood factors and orphan enzyme drugs.”

- Dr. Rohan Shirwaiker, assistant professor of industrial and systems engineering, for his research proposal, “Ultrasound-Assisted Biofabrication Of Biomimetic Soft Tissue Constructs With Aligned Fiber Organization.”

Extension and Outreach

The Engineering Place for K-20 Outreach

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 17,000 students in North Carolina and nationwide this year. Staff worked with schools in eight states on incorporating engineering into school curriculum, provided teacher workshops to several hundred teachers on integrated STEM and went to the National Science and Engineering Festival, which hosted 600,000 people. Engineering camps continue to be a great success and have grown across the state, with partner camps in Hickory, Charlotte, Wilson, Havelock, and Morganton. The camps had 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. For the second year, visually impaired and blind students came to campus from across the US for **the nation's only engineering camp for VIB students.**

Industry Expansion Solutions (IES)

IES has served as the North Carolina Manufacturing Extension Partnership (NCMEP) Center since 1995, operating under the College of Engineering. The North Carolina affiliate for MEP became available through a full-and-open competition held in fall 2014, the first time since 1995. IES submitted a comprehensive proposal and won a new five-year award that began in 2015.

IES, through NCMEP, continues to help state manufacturers with important networking. Some examples include Manufactured in North Carolina (MNC), which is the premiere searchable supply chain directory for North Carolina manufacturers, designed to showcase the capabilities and innovations of NC companies to domestic and global B2B markets and the membership-based mfgNC CONNECTIONS – North Carolina Manufacturing Extension Partnership.

While much of IES’ attention has been focused on small to medium-sized manufacturers, it also serves businesses in other sectors and government agencies across the state; economic benefits to those entities — new efficiencies or new employment in hospitals, schools or service companies — are not included in MEP survey results.

In 2015-16, IES delivered 387 industry service projects for fees and 108 short courses, workshops and conferences. Additionally, clients of IES or IES’ NCMEP affiliates in 63 North Carolina counties returned surveys to NIST’s third-party survey company, reporting results they

attributed to work done by NCMEP affiliates. Manufacturers reported \$864.3 million in economic impact from NCMEP activities and the creation of and/or retention of 4,081 jobs. IES is now led by Mr. Phil Mintz, who was named Executive Director during this last year.

Biotechnology Training and Education Center (BTEC)

The Golden LEAF Biomanufacturing Training and Education Center (BTEC) offers a wide array of courses to NC State students. Enrollment in BTEC undergraduate and graduate programs remains strong, with 842 seats filled during the fall and spring semesters. BTEC is also a critical player in extension and economic development, particularly in providing human resources needed to grow and enhance the biomanufacturing sector in North Carolina. Its efforts, which include the involvement of the NC Community College System, are supported by bio-related industries in the state. During this fiscal year, BTEC received more than \$1.37 million in revenues from non-state sources. Outside monies came from contracts and grants (\$914,000), BTEC's industry training program (\$328,000) and bioprocess and analytical service projects (\$131,000) via testing services agreements.

The BTEC model has been highly successful and has encouraged the development of similar biomanufacturing training centers in the United States, Europe and Asia. BTEC continues its efforts to establish partnerships with universities, companies and trade organizations to generate new research and development programs. The center is seeking funding opportunities to expand its staff and facilities to enable the center to provide a more extensive array of services to NC State students, incumbent workers, large biomanufacturers and start-up companies. The new NIMBL NNMI is also expected to provide resources that will enhance the future development of BTEC efforts.

Faculty

The College of Engineering Faculty Advancement Unit connects more than 300 faculty at all ranks with the tools needed to excel at all levels of their careers. Associate Dean for Faculty Advancement and Professor Dr. Christine Grant emphasizes building community by establishing a culture of faculty care and faculty-to-faculty peer relationships that cross departments. The unit uses traditional resources, as well as innovative techniques, to encourage outstanding research, teaching and professional development via transformational faculty development programs, directly impacting the research productivity, teaching effectiveness and the extension mission. The mission is to assist the recruiting, promotion and retention of excellent faculty across the College; actively engage faculty, administrators and staff across departments; and celebrate faculty success, achievement and promotion.

Strategic visits to federal agencies (e.g., NSF, Sandia Laboratories, EPA and AFOSR) empower faculty to stimulate new funding opportunities and broaden current research development. The programs have resulted in new grants, invitations to serve on panels, new collaborations and myriad opportunities for graduate students. An added outcome of group travel has been the enhancement of cross-departmental camaraderie, community and collaboration and the formation of new cohorts.

Some of the most relevant COE Faculty Advancement programs for tenure track early career faculty consisted of the new faculty orientation workshop (NFOW); NSF CAREER workshop; Retention, Promotion, Tenure roundtables; and NSF introductory funding agency trips. The COE Teaching Professors Learning Community creates a community to share ideas about teaching and learning and best practices and to learn from invited speakers and maintain connections and deepening pedagogical knowledge.

The Faculty Advancement Unit leads and actively participates in college, university and national initiatives to broaden participation of women and underrepresented minorities on engineering faculties. COE faculty serve as mentors and coaches in cross-campus Building Future Faculty and NSF ADVANCE programming at NC State, working at the national level to connect with diverse faculty members and networks to raise the visibility of NC State to diverse candidates. Below are selected faculty highlights from 2016-17.

- Two faculty members were elected to the National Academy of Engineering: Dr. Jagdish Narayan in materials science and engineering and Dr. Paul Turinsky in nuclear engineering bringing the count of NAE members in COE to 17.
- Dr. Fran Ligler, biomedical engineering, was elected to the National Inventors Hall of Fame.
- Twenty-four new tenured/tenure-track faculty and three new non-tenure track faculty joined the COE and affiliated departments in 2016-17.
- Hires include six associate professors and 18 assistant professors.
- The total new faculty hired by COE since 2007-08 is 193, with 169 of these being tenure/tenure-track faculty and 24 non-tenure-track faculty. This represents a net increase of approximately 80 tenure/tenure track and 15 non-tenure-track faculty over the last decade. This increase has been critical since it has allowed us to absorb the 25% increase in student enrollment over that same period without adversely affecting the quality of the student experience.
- Our Department of Computer Science was recognized as the leader in the number of women tenure/tenure track faculty among peer research extensive computer science programs nationwide.

- Five professors received endowed professorships:
 - Dr. Jan Genzer was named S. Frank and Doris Culberson Distinguished Professor in Chemical and Biomolecular Engineering
 - Dr. Ola Harrysson was named the Edward P. Fitts, Jr. Distinguished Professor in Industrial and Systems Engineering
 - Dr. Russell King was named the Henry A. Foscue Distinguished Professor in Industrial and Systems Engineering
 - Dr. David Kropaczek was named Duke Energy Distinguished Professor in Nuclear Engineering
 - Dr. Korukonda Murty was named Progress Energy Distinguished Professor in Nuclear Engineering
- Four professors were named Distinguished Professors:
 - Dr. Yousry Asmy was named a Distinguished Professor in the Department of Nuclear Engineering
 - Dr. John Gilligan was named a Distinguished University Professor in the Department of Nuclear Engineering
 - Dr. D. F. Ollis was named a Distinguished University Professor in the Department of Chemical and Biomolecular Engineering
 - Dr. Richard Spontak was named a Distinguished Professor in the Department of Chemical and Biomolecular Engineering

Students

Our students are 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 2016 undergraduate enrollment was 6,188 (1,367 first-year students, 1,190 sophomores, 1,468 juniors, and 2,053 seniors). Enrollment of women increased to 1,353 (21.9 percent). Enrollment of minority students was 603 (9.7 percent) in fall 2016, which is an increase of 11 over the previous year. Fall 2016 minority enrollment included 224 African Americans, 265 Hispanic students, 20 Native Americans and 94 minority students of more than one race.

Graduate student enrollment. Graduate student enrollment for fall 2016 was 3,161 (2,009 master's and 1,152 doctoral). International students made up 62 percent (1,963 students) of the enrollment; 21.2 percent (671) of the students were women. Minority enrollment was 9.8 percent of domestic students (117 students).

Growth in student enrollment. Our current total enrollment (undergraduate plus graduate) represents a 25% increase from the total COE enrollment of ten years ago.

Undergraduate degrees awarded. The number of bachelor's degrees awarded for 2016-17 was 1,483 compared to 1,373 for the 2015-16 year.

Graduate degrees awarded. The number of graduate degrees awarded during 2016-17 was 1,174 (996 master's degrees and 178 doctoral degrees). In 2015-16 there were 1,134 (966 master's degrees and 168 doctoral degrees).

Undergraduate recruiting. During fall 2016, Engineering Academic Affairs hosted five recruiting events for prospective fall 2017 applicants. Beyond the University's Open House, the College hosted four fall recruiting visitation days, one of which was specifically targeted toward women and other underrepresented minorities in engineering. Additionally, site visits were made to a number of North Carolina Community Colleges and a handful of partner institutions to speak directly to prospective transfer students.

During spring 2017, Engineering Academic Affairs offered six yield events for students accepted for fall 2017. One such event was offered specifically for women and minority freshmen students and highlighted the Women in Science and Engineering (WISE) program as well as the Minority Engineering Programs (MEP) and the Women in Engineering (WIE) program. The event was designed to not only increase enrollment of women and underrepresented students, but also to make the opportunities and community support aspects for these populations more visible to prospective students. Included in the College's spring yield events were four 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 2017 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 2015-2016 increased by 52 percent. Interest remains strong, despite the fact that most masters' students are self-supporting. Doctoral applications during this same period decreased by 14 percent, which represents a challenge to our ability to grow at the doctoral level. COE master's and doctoral applications for the 2015-16 year **represented 56 percent and 40 percent of the university total**, respectively.

From 2013-14 to 2017-18, expenditures on graduate student recruiting and educational enhancements from all sources, including the engineering enhancement fee and the Provost's office, have increased by 80 percent, to \$1.56 million. Additionally in 2017-18, the Provost is providing \$770,000 in recruiting funds for doctoral fellowships, which did not exist in 2013-14. During this same period, the Associate Dean of Graduate Programs position has been created,

as well as the Manager for Graduate Diversity position, and an assistant to the Director of Graduate Programs. The College and Provost jointly are investing in graduate programs and graduate recruiting at unprecedented levels.

In addition, the U.S. Department of Energy Nuclear Energy University Program awarded three national fellowships to our graduate students. This is more than any other university received. Other funding sources include National Science Foundation (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 233 graduate and undergraduate online courses during the fall and spring semesters and 53 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 2017.

Women in Engineering (WIE) program

The WIE program continued to be feted nationally, as the percentage of women in our first-year class rose **above 29 percent** for the first time. The national average remains at 18 percent. Fifty incoming female students attended the ESCAPE to Engineering bridge program. The functions of University Orientation are incorporated into programming as well as field trips to statewide industries, social activities and success-based activities. This camp is funded by donations from John Deere, Praxair and ABB.

The WIE program staff continues to work in conjunction with Academic Affairs staff on recruitment and retention issues for women. WIE and MEP staff worked together on many efforts that are addressing intersectionality between gender and ethnicity, which will benefit our students

greatly. Programs included Dinner Dialogs for students within departments, the Tools Workshop (where students can learn how to solder, use power tools, pipette and other skills needed in today's engineering laboratories), Taste of Engineering and programs with John Deere, Caterpillar, Duke Energy, Praxair, Glaxo-Smith-Kline and other industry partners.

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 is geared toward high school seniors who have been admitted to the College. Twenty-nine admitted minority students (12 females and 17 males) along with approximately 60 family members/guests participated in the 2016-17 event. Of the 29 admitted minority students who participated, 18 paid enrollment deposits at NC State University (62 percent) and 10 of the 29 (34.5 percent) are participating in the 2017 Summer Transition Program. Twenty-five (10 females and 15 males) NC State minority engineering students served as hosts/volunteers.

The Summer Transition Program (STP) is a major minority engineering student recruiting program that brings new students to campus during the second summer session before fall of their freshman year to assist them in making a smooth transition from high school to college by offering courses in mathematics, chemistry, study skills and the College's computing environment. In summer 2016, 21 students participated (12 African-American, 2 Native American, 5 Hispanic/Latino and 2 multi-racial students). This year, 14 of the 21 (66.67 percent) 2016 STP participants were recognized at the Freshman Honors Convocation (FHC). Four of the 2016 STP participants were recognized for having a perfect 4.00 grade point average (GPA). The 2016 STP cohort had a cumulative GPA of 3.239 for the fall 2016 semester; nine participants made the Semester Dean's List. The 2016 STP finished the spring 2017 semester with 2.899 cumulative GPA; eight participants made the Dean's List. The 2016 STP cohort finished the 2016-17 academic year with 3.033 cumulative GPA.

In the 2016-17 academic year, four sections of E144 – Academic and Professional Preparation I, were available to the 131 incoming minority engineering freshmen. The fall course had 109 students enrolled. The spring course, E145 – Academic and Professional Preparation II, had 34 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 in the country with 514 companies attending the two-day fall event and the one-day spring event in 2016-17.

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 COE is providing them with a student experience that is contributing to their success.

Engineering Entrepreneurs Program (EEP)

The Engineering Entrepreneurs Program (EEP) senior design sequence served 135 students this year. Twenty-one student teams completed the formal EEP sequence, and 383 students participated in the COM eClinic embedded in HQ Raleigh.

EEP acts as a replacement for a student's traditional senior design project. Students opt out of their department-specific senior project and into the EEP, which is a two-semester sequence. In EEP, students divide into multidisciplinary three-person or four-person teams and participate in the creation and development of a complete startup company. The foundation of the program starts with a blank sheet of paper. A team is able to conceive of any physical product (of sufficient engineering content) that they wish to develop. After running multiple ideas through a vetting process (in conjunction with EEP faculty and their Plexus mentors) to select their project for the semester, teams complete a variety of tasks including: customer development, market analysis, competition analysis, prototype planning, business plan development, financial modeling, prototype development (two phases) and investor presentations. Students write a variety of papers (including a formal business plan) and give multiple public presentations along the way. At the end of the process, students own a complete startup company that they may choose to advance if they so desire.

Alumni of the EEP have continued to garner success with their start-ups. Most notably, Rythcor from the 2016-17 cohort has raised nearly \$30,000 by winning grant and business plan competitions. The Kast team is also moving forward under an Entrepreneurship Initiative (EI) fellowship for graduating seniors. Tayyab Hussain and Moaad Benkaraache of the 2015-16 cohort are current ThinkHouse fellows. Undercover Colors, founded by four graduates of the Department of Materials Science and Engineering in the 2014-15 cohort, has raised \$2 million in funding and is continuing to develop its groundbreaking technology in the Centennial Campus Incubator. NicoTrax, a smoking cessation platform company launched from the Garage by EEP graduates, has recently released its first “smart” cigarette lighter and is actively developing therapeutic and tracking software.

Fundraising

Fueled by strong and early support for Engineering Oval, the NC State Engineering Foundation had another record-setting fundraising year with giving totals to the College at \$30,468,121. Fiscal Year 2016 ended on June 30, 2016. This is the fifth consecutive year with an increase in gift commitments.

The Campaign for Engineering Oval launched this past year with Leadership Gifts recorded at \$15,275,000 (Goal is \$60 million). Dean Martin-Vega and his wife Maggie also made an initial commitment during this past year to create the Deans EB Oval Club providing a giving level for EB Oval that would attract a broader base of alumni support.

Endowments to the College generally fall into one of two categories: scholarships and named professorships. There are now 292 permanently endowed scholarships in the College and 44 permanently endowed named professorships. Endowment gifts were off slightly this year at \$7,094,856 (Compared to \$9.2 million in FY '15).

The annual giving program for the College of Engineering raised a total of \$1,483,151 for the College of Engineering Leadership Fund and all nine department enhancement funds. This represents a 19 percent increase from the previous year. The Dean's Circle, the College's leadership annual giving society, grew by 76 members, bringing our total membership to 421 alumni and friend donors, representing a 22 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.

Administration

- Dean Louis A. Martin-Vega concluded a very successful year as president of the American Society for Engineering Education (ASEE). The ASEE has more than 12,000 members and is the largest professional society devoted to engineering education. He also continues as Chair of the Engineering Directorate's Advisory Committee and Vice-Chair of the Committee for Equal Opportunities in Science and Engineering (CEOSE) both at the National Science Foundation.
- Dr. John Gilligan, executive associate dean of the College of Engineering and Distinguished University Professor of Nuclear Engineering, was awarded the 2017 ANS Arthur Holly Compton Award by the Education, Training & Workforce Development Division.
- The 2016 Paul Zia Distinguished Lecture Series in Civil Engineering and Construction

featured John Proskovec and Walter Baomy, who spoke on “Protecting New Orleans-Gulf West Closure Complex.” More than 500 people attended the event.

- The Engineering Place hosted the annual North Carolina Future City competition, in which some 2,500 K-12 students from across the state participated.
- The College hosts an annual social event for the FIRST Robotics regional competition participants. Approximately 600 high school students attended the spring 2016 event.

Recommendations and Concerns for the Future

Our persistent efforts to attract and retain the highest quality faculty combined with our success in highly competitive national programs such as DOD and DOE and the NSF ERC programs and others have continued to move us forward in almost every major “data” category in the latest *US News & World Report* graduate engineering rankings. While it is always gratifying to see that we are moving in the right direction, our peer institutions are also making strides to improve, so we are aware that maintaining and improving upon this ranking will continue to be a significant challenge.

As was the case last year, the biggest challenge nationally is that no one is standing still and many of our peers and aspirational peers are receiving significant commitments to grow even more their faculty size and engineering infrastructure. New colleges of engineering building projects abound across the national landscape making our efforts to complete EB Oval even more pressing. These investments by our peers and aspirational peers increase competition for top faculty members and create the need for available funds to retain our current top faculty. This pressure has continued to increase during this last year and will only continue to increase as other institutions move forward with expansion plans.

Another major challenge will be dealing with increases in undergraduate enrollment going forward. Our previous plan had been to maintain, or possibly reduce, our undergraduate enrollment; however, we understand that the immediate financial realities facing NC State, has necessitated the rise in enrollment. Our concern lies in mitigating the adverse impact that this will have on what is already a strained student-faculty ratio for a research college of engineering. What we certainly want to avoid is stagnation or reduction in research productivity since the inverse relationship between these two metrics is well known and documented and in fact is already impacting some of our peer colleges of engineering that have seen enrollment increases. We would like our main focus to continue to be growth in our graduate enrollment, particularly our Ph.D. enrollment, which is critical to supporting our research efforts, enhancing the rankings and reputation of COE and furthering the achievement of NC State’s strategic plan.

The College also faces the challenge of raising private sector capital support for moving the rest of the College to Centennial Campus. The solicitation of private sector capital funding for the construction of EB Oval represents a shift in the way university academic buildings are funded and built and involves exploring all possible funding options for future capital investments for academic space. It also represents a significant shift in the mindset of many of our alumni who have heretofore seen support for capital funding to be a responsibility of the state rather than the private sector. While the support of the administration for the public/private capital funding model that we are now implementing for EB Oval is very much appreciated, we will need even more assistance from the administration and central development if we are to move forward in a significant way on this option.

In synopsis, the support that COE has received in the past from the Legislature and the University has been crucial in assuring that we did not lose ground among our peers nationwide. Prior support from the Legislature and the Connect NC bond for partial funding of EB Oval represented very significant steps forward in our quest to be among the premier colleges of engineering in the nation. The steps that have been taken during this last year through the approval of the second increase in the engineering enhancement fee have also been critical since without this support, quite frankly, it would have difficult to imagine a viable growth path forward. The College is grateful for this support; especially in light of the budget reductions and challenges we have had to face together. The support of our administration for all of our efforts means a great deal to all of us in the College and we will always try to assure that the these investments will continue to yield the positive returns for COE and NC State that they have in the past. While changes in the federal and state landscape present us with many new challenges, our goal will be to seek out the opportunities that also arise from these changes so that we can continue to forge a brighter future for our students, our state and our nation.