

North Carolina State University
College of Engineering
Campus Box 7901
Raleigh, NC 27695-7901



COLLEGE OF ENGINEERING

Strategic Plan

www.engr.ncsu.edu



"SURVEY SQUAD"
1918

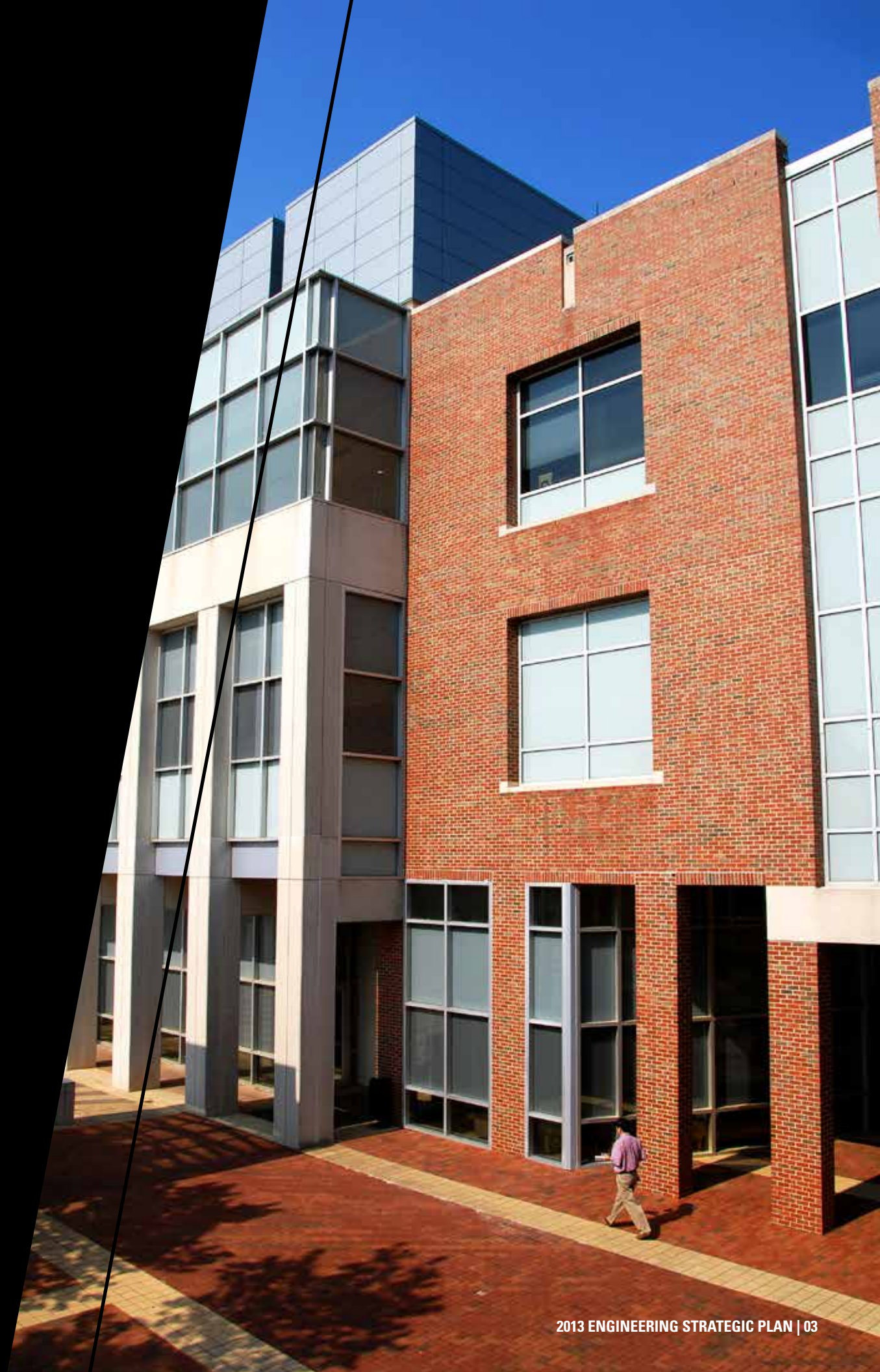
INTRODUCTION

From the moment NC State University was founded in 1887, its engineering educational, research and extension programs have been cornerstones of the state’s economic development efforts. These programs, representing the "mechanic arts" roots of our university, have grown and evolved into one of the nation’s best and largest engineering schools and contribute significantly to the academic powerhouse that NC State is today. They have also played a critical role in our institution's ability to meet the needs of the people of North Carolina and make significant contributions to the economic growth of our State and the Research Triangle region.

The development of this new strategic plan is rooted in a document produced by the College of Engineering in 1996 that included a vision and mission statement along with nine (9) strategic goals and a set of statements articulating a detailed vision for the future of the College. In August 2008, the Executive Committee of the College held a two-day workshop retreat in Boone, NC, to assess the 1996 plan and develop a new plan that would carry the College forward over the next decade. This led to revised vision and mission statements, a new set of statements reflecting the core values and guiding principles of the College, and a new statement expressing the envisioned future of the College through an ambitious long-term goal and plans to achieve it. The retreat also endorsed a comprehensive strategic vision for the College in terms of critical interdisciplinary thrust areas, a vision that has guided investments in new faculty and infrastructure since that time. These thrust areas fit well with the University's strategic plan for the future.

The development of this new 2013 strategic plan draws from both plans, particularly the 2008 version. The plan development process also involved benchmarking with strategic planning efforts in selected peer and aspirational colleges of engineering such as Purdue, Texas A&M, Cornell and Ohio State. It is framed by the new NC State strategic plan and also takes into account the UNC system strategic plan to address critical North Carolina needs. The process involved the College Executive Committee members, who engaged their constituencies to review the plan and provide feedback on the proposed strategies and actions. As part of the process the decision was made to frame these strategies and actions in the context of the five goals of the University’s Pathway to the Future strategic plan.

MISSION, VISION AND CORE VALUES



MISSION

The mission articulated in the 2008 plan was to lead discovery, learning and innovation by creating and disseminating knowledge, empowering significant advances in technology, and driving economic development for the welfare of the state, the nation and the world. Our new mission statement expands on this to align better with the University's strategic plan and now reads as follows:

The mission of the College is to provide a premier educational experience for our students and a world-class environment for our faculty that supports and prepares them for addressing the engineering and computer science challenges and opportunities that exist and await them in the 21st century. We want our students and faculty to be global leaders in discovery, learning and innovation across the broad, exciting and diverse world of engineering and computer science. In so doing, it is our expectation that our faculty and students will convert ideas to reality, provide solutions to societal needs and enhance the economic development and quality of life of the citizens of North Carolina, our nation and humankind.

VISION

The vision articulated for the College in the 2008 plan was to become and be perceived as the leading public college of engineering in the country and one of the preeminent colleges of engineering in the world. This continues to be the vision and long-term goal for the 2013 plan. The College will achieve the national and international recognition of this envisioned future through the following:

Image: The College will attain a global reputation for excellence and professional leadership. We will be a world-class leader, solving critical problems facing our planet and making research and educational contributions on a global scale. We will be an international model for best practices in research, education and outreach. The quality of our students and faculty will be an essential asset to our state and nation.

Research: We will be pioneers in identifying and solving problems that improve human, ecological and environmental conditions on a global scale. We will develop interdisciplinary centers and a funding base to address global grand challenges and reward faculty for their entrepreneurship and scholarship. We will lead the expansion of the world's knowledge base through discoveries and recognized scholarly publication and information exchange.

Education/Alumni/Outreach/Students: We will provide relevant, world-class education for students to enable their professional and personal success, instill institutional pride, promote social responsibility and encourage lifelong involvement and investment in the College. We will be internationally recognized for our scholarship in engineering education, K-12 outreach, quality and diversity of students and distance education programs. Our alumni will be known as leaders of industry, society and academe.

Economic Development: We will be a global leader in facilitating intellectual property and technology transfer, involving faculty, staff, students, industry and government to assist existing companies and encourage the success of start-up companies in North Carolina and beyond. Through our location on Centennial Campus, we will be a leader in developing innovative ways of partnering with industry and government to enhance economic well-being and ensure North Carolina's global competitiveness and future prosperity.

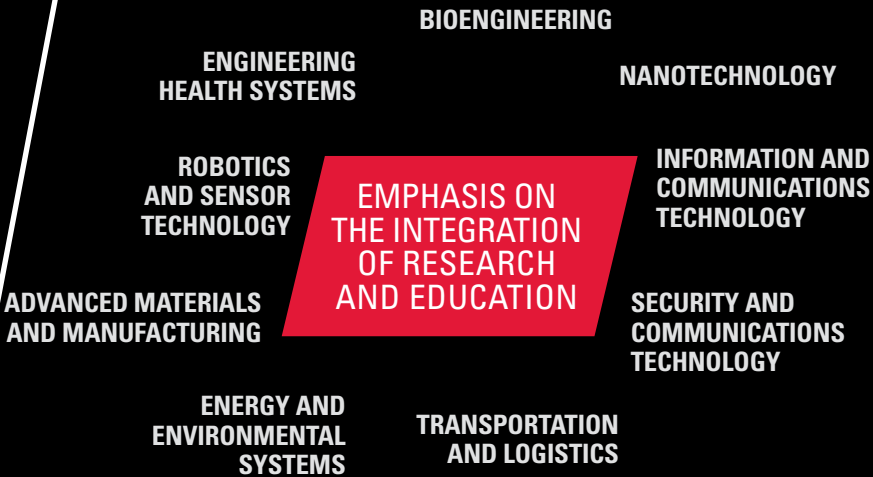
Collaborations/Partnerships: The College will be an international model for fostering new and improved collaborations and partnerships with industry, alumni, professional associations, government and public sector organizations, and leading international educational institutions. We will lead our respective professions nationally and globally and increase our endowments to a level commensurate with our goals.

Infrastructure/Culture/Staff/Faculty: We will develop world-class facilities for interdisciplinary research and education. Endowments for scholarships and professorships will attract and retain the best and brightest students and faculty. The College will attract a diverse set of students, staff and faculty into a nurturing environment that rewards excellence and embraces innovation in an entrepreneurial culture. We will have a global virtual presence and infrastructure.

Underlying this vision is a sustained effort to engage and invest in vital areas of research growth and educational need. This strategic vision is highlighted in the graphic on page 5 and describes the strategic investments in faculty and infrastructure in interdisciplinary

thrust areas that provide the greatest potential for attracting external funding and best serve the needs of our nation and state. The common thread running through this vision is a commitment to enhancing student success through the integration of research and education, the recruitment and retention of outstanding faculty and students, and the provision of opportunities for interdisciplinary research at both graduate and undergraduate levels. This vision also includes the creation of new academic programs with cutting-edge interdisciplinary focus and systems orientation, industrially relevant and internationally oriented internship and immersion experiences, and sustained investment in the people and infrastructure required for the success of these programs.

COE STRATEGIC VISION



CORE VALUES

The College fully supports the NC State Values as expressed in the 2011-2020 University Strategic Plan. The following statements, which align strongly with the NC State Values, are the set of core values and guiding principles articulated in the College's 2008 plan and which continue to be endorsed by the College in this 2013 update.

Honesty, integrity and insistence on ethical behavior

We believe that when we hold ourselves, our students and our collaborators accountable for our actions and words, and insist on ethical behavior, we get closer to the truth, make better discoveries, and remain credible, relevant and respected in all our endeavors.

Providing equal educational opportunities for all

We believe that education is an equalizing agent that facilitates individual and collective growth and economic opportunity.

A focus on students in all our activities

We believe that a student empowered with a quality education has confidence, is able to take risks, and ultimately has the ability to make the world a better place.

Leadership and positive worldwide impacts in all of our programs

We believe that when we make a difference, our people are inspired, our college remains relevant, and we build a positive worldwide image of the University, the region and North Carolina as a whole.

The pursuit of excellence in scholarship, leadership and service

We believe that the pursuit of excellence sets an example for our students, peers, collaborators, partners and supporters, inspiring them to succeed, and creates an atmosphere that encourages all people to reach their full potential.

Discovery and lifetime learning

We believe that by empowering students to be independent and to pose questions, address issues and find innovative solutions to problems, they have the necessary tools to succeed and are encouraged to continue to pursue learning throughout their lives.

Free, open and respectful exchange of ideas

We believe that by creating a climate that respects the dignity of all individuals, we allow and encourage everyone to participate in solutions resulting in more robust discovery, richer innovation and better quality.



LONG-TERM GOAL

To become and be perceived as the leading public college of engineering in the country and one of the preeminent colleges of engineering in the world.



CONTEXT

This long-term goal aligns directly with the NC State vision of emerging as a preeminent technological research university. We also feel that it is a necessary condition for the achievement of the University's vision over the next decade.

STRENGTHS TO BUILD UPON

National reputation: During the last five years the College has risen from 34th overall and 18th among public colleges of engineering in the nation to 29th overall and 16th among public institutions in the 2013 US News and World Report graduate engineering rankings. The College's undergraduate program is ranked 28th overall, 16th among public institutions in the 2012 US News ranking of Best Undergraduate Engineering Programs. The College has two departments ranked in the top 10 among their peers nationwide with most of the departments ranked in the top 10-15% of their peers nationwide. The Engineering Online program is one of the largest in the country and the top-ranked distance education engineering master's degree program for military and veterans in the most recent US News rankings of online programs.

International reputation: Of equal, if not greater importance is the College's global ranking of 29th worldwide in the 2012 Academic Ranking of World Universities in Engineering and Computer Science. Since six of the top 30 are non-US engineering colleges, this corresponds to a ranking of 23rd among US colleges of engineering.

Enrollment Growth: Undergraduate enrollment now exceeds 6,000 students with substantial increases both in numbers and incoming quality of this student population. Total enrollment has grown from 7,500 to more than 9,000 students over the last five years, making the College one of the largest colleges of engineering in the country.

Research Growth: Research expenditures have grown 50%, from less than \$100M per year to more than \$150M per year between FY06 – FY12, placing the College among the top 10 in the country in this measure of research activity.

Faculty Investment: Underpinning this growth has been a significant investment in faculty recruitment and retention including the hiring of more than 100 new faculty into the College over the last five years and a net growth of 45 tenure/tenure track faculty. Many of our faculty are world-class leaders in their fields whose many national and international awards provide clear testimony to the very high quality, relevance and impact of their scholarly and industrial contributions. The College is now home to 12 National Academy of Engineering members, 2 recipients of the National

Medal of Technology and Innovation, 1 Emmy Award winner, more than 55 NSF Career Awardees since 2000 and numerous Fellows of their respective professional societies.

Administrative Leadership: The outstanding quality and leadership of our department heads, center directors, and unit heads, many of whom are also leading researchers and/or prominent national and international leaders in their professional communities, is a major strength that has also played a pivotal role in the growth and development of the College.

National Centers: The College has received two NSF Engineering Research Center awards in the last five years. The creation of FREEDM and ASSIST is a singular achievement, making the College and NC State the only college of engineering and university, respectively, in the country to lead two NSF ERCs. Coupled with the establishment of CASL, a DOE nuclear reactor design, modeling and innovation hub, the NSA Lablet effort housed in computer science and our significant role in the leadership of the Triangle MRSEC, the College is now home to or a major partner in a number of highly competitive national centers that place it in a category of excellence that rivals its aspirational peers nationally and globally. College faculty have also contributed significantly to the establishment of the Eastman Chemical Center of Excellence on Centennial Campus and to ongoing activities for additional centers in national security and critical infrastructure.

Impact on the Economic Growth and Development of North Carolina: The 54,000-plus alumni of the College have made a significant impact on the transformation of our state from its agricultural roots to the diversified and highly technological economy that exists in North Carolina today. First and foremost has been the impact of our alumni on job creation and development where the existence of a world-class College of Engineering provided them with the opportunity to excel in their professional endeavors and become the primary workforce fueling the technological development of the RTP region and the state. Reports show that well over 20% of all jobs, and a much greater percentage of the higher paying jobs in North Carolina, are in occupations either directly related to engineering and computer science or highly associated occupations. The employment of engineers and computer scientists extends into every sector of the economy, whether it be healthcare, agriculture, biopharmaceuticals, construction, information technology, manufacturing, aerospace, the military and many others. Of equal importance has been their impact on the creation of new jobs in North Carolina through the numerous successful companies they have started in our state. As the flagship college of engineering in the state, it is crucial that the College continue to enhance its status as a world-class engineering school to assure the continued economic development and growth of North Carolina.



THE WAY FORWARD

A major objective of this plan is to continue to focus on faculty recruitment and retention in NC State's areas of emphasis and the College's interdisciplinary thrust areas. In conjunction with this is the need to invest in the necessary infrastructure required to sustain this faculty growth. We are looking to do this in alignment with the five goals of the NC State strategic plan developed in 2010. The process we followed used these five goals as our framework, with discussion and feedback focusing primarily on the College's strategies and actions that would be embedded within these goals.



GOAL 1: ENHANCE STUDENT SUCCESS THROUGH EDUCATIONAL INNOVATION

Strategies and Actions

Recruit and retain the top undergraduate students to address the needs of North Carolina and our nation

- Actions:
- › Build a "team spirit" mentality by creating a mindset in students that celebrates and emphasizes the critical role of engineering in today's society
 - › Increase scholarships
 - › Centralize advising model including creation of Director of Student Engagement and Academic Success position
 - › Enlarge and expand summer camp program
 - › Enhance math preparation of engineering students
 - › Improve retention and graduation rates by providing selected upper level undergraduate courses through distance education
 - › Work with industry to expand "first year" internship opportunities

Recruit and retain more students from underrepresented groups as well as non-traditional students

- Actions:
- › Expand BioMed-Connect Alliance (Purpose Scholars model)
 - › Double the resources for recruiting scholarships
 - › Expand Community College and 3+2 pathways
 - › Set clear goals college-wide and add staff accordingly

Maintain and enhance educational quality through innovative curricula and programs

- Actions:
- › Promote more student clinical and internship experiences
 - › Revamp core curriculum including enhancement of first year design
 - › Develop new courses and formats (e.g., flipped classroom)
 - › Create a center for Education Informatics
 - › Expand use of online capabilities

Educate students to be critical thinkers, problem solvers and lifelong learners

- Actions:
- › Develop undergraduate student retreats
 - › Increase internship/co-op and REU opportunities
 - › Promote multidisciplinary student organizations or clubs for undergraduates
 - › Formalize and expand NAE Grand Challenges Scholars Program

Recruit, mentor and retain the nation's best graduate student engineering population to create innovation and meet the increasing needs of high-tech industry in North Carolina and across the nation

- Actions:
- › Organize recruiting efforts at COE level
 - › Significantly increase PhD enrollment in COE
 - › Create 50 additional full ride PhD level fellowships over the next 3 years
 - › Create 400 additional GSSP slots
 - › Add space for 400 additional student offices/labs
 - › Provide more assistance with recruiting top graduate students
 - › Provide additional funds and flexibility for graduate student support
 - › Promote graduate fellowships in capital campaign
 - › Develop hybrid online PhD programs

Grow portfolio of "first in kind" professional master's degree offerings

- Actions:
- › Develop more programs along the lines of Electric Power Systems Engineering, Biomanufacturing, Nanoengineering and Supply Chain Engineering and Management
 - › Create MS in Prosthetics and Orthotics
 - › Identify "revenue generating", "tuition premium" programs with direct return to COE and departments

Integrate entrepreneurship and research more fully into the curriculum to increase the number of engineers who start and support companies

- Actions:
- › Help "scale up" and leverage EEP model
 - › Integrate more into senior project/design
 - › Include from first year on
 - › Increase COE REU program

Enlist North Carolina industry to become "educational partners" in enhancing student success through increased internship opportunities and direct student engagement

- Actions:
- › Develop and implement an industry-focused "Partners in Engineering Education" campaign
 - › Leverage dean and department head interactions with industry to promote this concept
 - › Develop goals and measures of success



ACCOMPLISHMENTS

The College offers 18 bachelor's, 21 master's, and 13 doctoral degrees.

The College produces more engineers to support the North Carolina economy than all other state universities combined.

More than 1,000 students have passed through the Engineering Entrepreneurs Program since its inception in 1993, many of whom have gone on to start companies in North Carolina.

Online Master of Engineering degree programs support our military as well as location-bound adult students working for North Carolina companies. Engineering Online ranked #1 for active military and veterans in recent *US News & World Report* rankings.

The College was first in the nation to offer master's degree programs in electric power systems engineering and biomanufacturing.

Each year, the College hosts more than 1,000 elementary, middle and high school students at more than 30 summer camps held in Raleigh, Rocky Mount and Hickory.

The College has received four Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM).

Leverage growth of distance education along with increasing use of technology and MOOC approaches to increase educational opportunities for industry, military and government personnel

Actions:

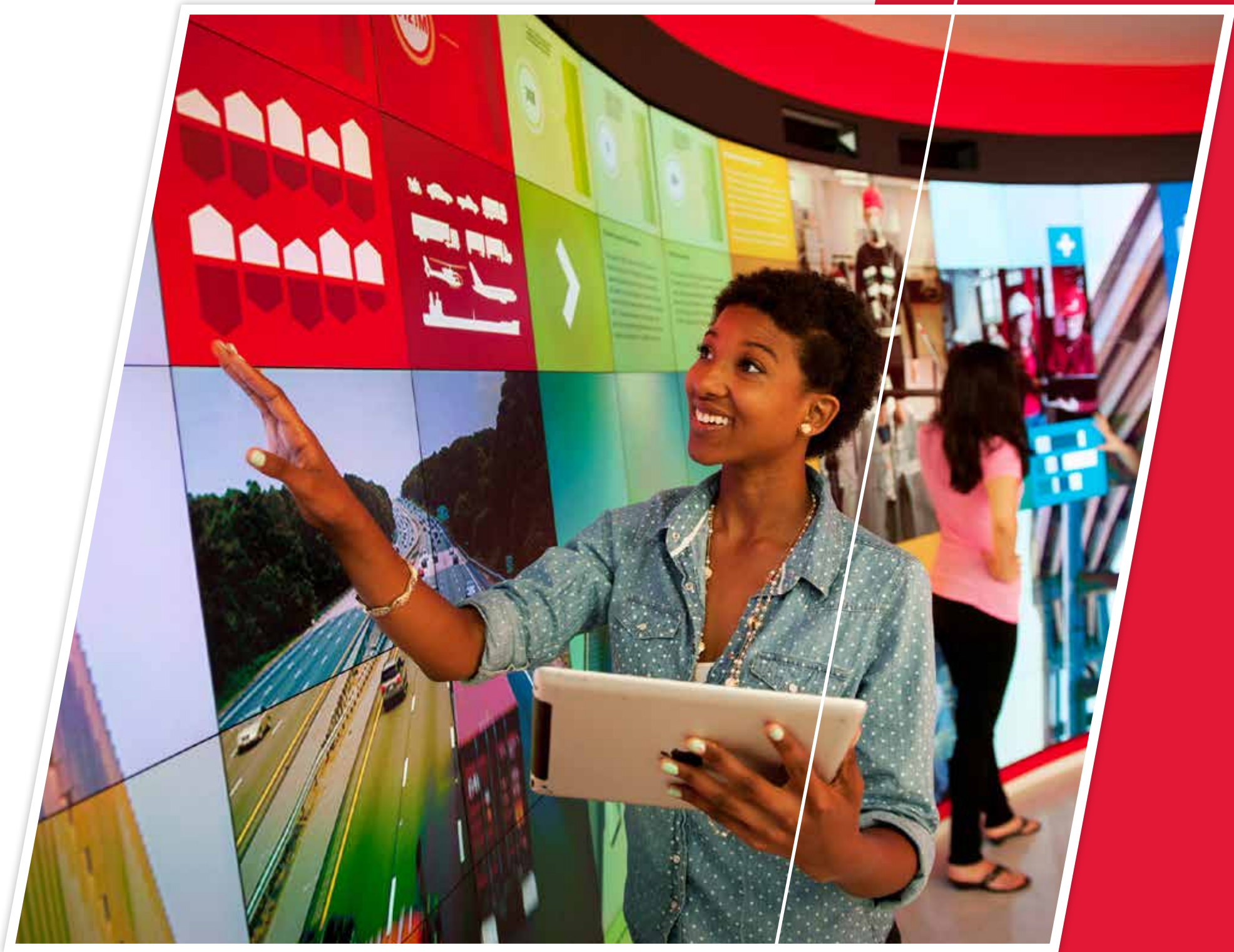
- › Prototype “MOOC” MS online professional offerings
- › Expand footprint of COE statewide to more industry, military and government locations

Enhance faculty “innovation and training” in teaching

Actions:

- › Enhance faculty innovation in classroom; format and content delivery
- › Improve understanding of how our students “think”
- › Integrate NSF Curriculum reform

These strategies align directly with a number of the University strategies under Goal 1 and particularly support the focus that needs to be maintained on improving undergraduate retention and graduation rates. The actions reflect efforts in the College such as new, high impact first year experiences, greater investments in undergraduate research and entrepreneurship experiences, our NAE Grand Challenge Scholars Program and an innovative effort to build a unified mental framework to be shared by all students across the College celebrating the profession of engineering and its many amazing accomplishments. They also reflect the reality associated with the implications of a significant growth in the number of PhD students in the College as a necessary condition for it to move towards its long term goal. While less explicit, various strategies will move us more aggressively into proactive advising models, articulation agreements for community college and other undergraduate transfer students, and greater efforts to attract more out of state and international students, all of which are important elements of Goal 1 of the NC State strategic plan.



GOAL 2: ENHANCE SCHOLARSHIP AND RESEARCH BY INVESTING IN FACULTY AND INFRASTRUCTURE

Strategies and Actions

Increase T/TT faculty in COE to 400 by the year 2020

- Actions:
- › Recruit 125 new T/TT faculty in COE by 2020
 - › Recruit 50 world-class leading scholars in COE interdisciplinary thrust areas over the next three years
 - › Target faculty who are Fellows in professional societies or on the path to NAE and NAS membership as well as the "best and brightest rising-star young faculty"
 - › Enhance COE involvement in future cluster hire opportunities
 - › Identify space and equipment needs and capabilities required
 - › Increase administrative support staff in accordance with increase in faculty

Update and promote COE strategic vision and thrust areas

- Actions:
- › Consider adding/modifying strategic vision areas (e.g., National Security) and pursuing center-level activities in these areas
 - › Hold a series of COE "brainstorming retreats" so as to skate to "where the puck is going" rather than "to where it is"

Foster and enhance cross-disciplinary and cross-campus research programs

- Actions:
- › Increase staff support to help write complex proposals
 - › Enhance COE participation in cluster hiring process

Significantly grow endowment targeted at named professorships and related faculty hiring

- Actions:
- › Increase COE endowment from \$100M to \$150M by 2015
 - › Double endowment by 2020

Create, celebrate and maintain a diverse set of faculty

- Actions:
- › Continue to enhance COE culture toward this end
 - › Define clear goals and measures of progress in recruitment, promotion and retention

Provide COE faculty with best equipment and laboratories to compete internationally and support industry

- Actions:
- › Develop centralized mechanical testing facility

- › Enhance centralized nanoscience testing and analysis facility
- › Design specialized buildings for specialized central facilities
- › Create COE online Research Symposium

Develop and implement a strategic plan for completing the move of COE to Centennial Campus

- Actions:
- › Engage alumni in "public/private partnership" dialogue to change alumni culture
 - › Use COE Foundation Board as vanguard
 - › Enhance COE communications infrastructure to make the case to legislature and political bodies

Improve and enhance mentorship of junior faculty

- Actions:
- › Identify COE "best practices" and encourage college-wide effort
 - › Expand career and professional development options for new faculty
 - › Develop mutually beneficial Faculty Sage program for junior and senior faculty

Continue to enhance faculty development and support activities in the COE

- Actions:
- › Develop sustained support for Visit An Agency Day, National Lab Visits and other high-impact activities
 - › Develop sustained support for COE faculty development unit

Position COE to be preferred destination for academic and policy leaders

- Actions:
- › Develop more COE sponsored and led high impact, state and nationally visible seminar and workshop events

Continue to improve strength, reputation and national ranking of COE and all its academic programs

- Actions:
- › Bring more professional conferences, meetings and peers to NC State and Centennial Campus
 - › Increase PR/Marketing efforts at department and COE levels

Goal 2 is the most critical goal for the College. Over the last six years, with assistance from the legislature, the College has been able to increase the number of tenured and tenure-track faculty, resulting in significant increases in research productivity and growth in graduate enrollment. The various University strategies expressed in this goal imply University operating and capital investments that will be critical to the continued recruitment and retention of leading scholars. They are also critical to the ability of the College to keep pace with, and hopefully move forward, among our peer colleges both nationally and worldwide.

As reflected in the campus 2020 enrollment plan, the College is being asked to expand its number of doctoral students by 50% over the fall 2011 headcount. In order to achieve this goal and also maintain the College's admirable PhD time-to-degree statistics it will be necessary to increase the number of faculty available to mentor these doctoral students while also increasing the financial and space resources available to support the students. Studies have shown that the two greatest impediments to PhD completion rates are lack of financial support and weak advising.



ACCOMPLISHMENTS

COE research brings over \$200M directly into the North Carolina economy per year. Indirect impact is significantly higher.

More than 55 COE faculty have received prestigious NSF Career awards since 2000.

Over the past decade COE innovation has spawned 30 start-up companies in North Carolina.

Two COE faculty members and one alumnus hold National Medals of Technology.

COE has more members of the National Academy of Engineering than all other NC universities combined.

The College is the only engineering college in the nation currently leading two NSF Engineering Research Centers.

Centennial Campus brings together companies, government and University researchers and students for innovation and complements Research Triangle Park.

The College is 14th in the nation in research expenditures.

GOAL 3: ENHANCE INTERDISCIPLINARY SCHOLARSHIP TO ADDRESS THE GRAND CHALLENGES OF SOCIETY

Strategies and Actions

Invest in efforts that cross departmental and program boundaries

- Actions:
- › Increase COE interdisciplinary capstone design and related projects
 - › Increase multi-college interdisciplinary design projects
 - › Increase interdisciplinary multi-college professional MS degree programs
 - › Develop more inter-department, inter-college sabbatical leaves
 - › Create or make current PhD programs more interdisciplinary
 - › Promote NAE Grand Challenges as a core interdisciplinary framework
 - › Facilitate more interdisciplinary efforts at Dean level

Continue to promote faculty collaborations for large national-center-level grants that address NAE and societal Grand Challenges

- Actions:
- › Develop Large Project Management training for faculty
 - › Continue to drive Nano, Bio, IT themes combined with NAE Grand Challenges themes
 - › Pursue more partnership opportunities in future national Engineering Research Center efforts
 - › Include large center theme as "module" in faculty development programs
 - › Create college-level PDU equivalent
 - › Create partnerships with University PDU

Increase faculty involvement in key interdisciplinary clusters and joint positions with industry and government partners

- Actions:
- › Enhance participation in Chancellor's Faculty Excellence Initiative
 - › Continue to play leading role in attracting industrial and government research centers to NC State
 - › Facilitate joint faculty appointment mechanisms
 - › Embed "interdisciplinary culture" in promotion and tenure process

Discover new technologies to advance the human condition and meet Grand Challenges

- Actions:
- › Expand the world's knowledge base through discoveries and recognized scholarly publication and information exchange
 - › Be pioneers in identifying and solving problems that improve the human condition on a global scale
 - › Think "big", both in terms of impact and relevance in accordance with guidelines provided by NAE Grand Challenges framework as well as national and state imperatives

Since the College alone contains 9 academic departments and 17 ABET-accredited engineering degree programs, part of its effort to enhance interdisciplinary scholarship began "at home" by investing in efforts that cross departmental and program boundaries. Examples of these efforts include the success of center-level research and educational programs such as FREEDM, ASSIST and CASL, the increase in joint faculty appointments across departments and growth in interdisciplinary capstone design and related projects. While it has been encouraging to see these efforts extended beyond the College (ex: joint COE and COD capstone design, joint NC State/UNC-CH Biomedical Engineering department), what *The Pathway to the Future* strategic plan points us to are both the opportunities and needs to expand these efforts even more for the benefit of our faculty, students and University. The NAE Grand Challenges, which have also been embedded more in the strategic thought process of the College, provide a platform that aligns well with this goal.

Many of the areas of societal need that the College has emphasized in its strategic plan align significantly with the four problem-based areas of research emphasis in Goal 3 of *The Pathway to the Future*: Enhance Interdisciplinary Scholarship to Address the Grand Challenges of Society. This has led to joint academic programs as well as numerous ongoing research, educational and outreach collaborations with practically every college at NC State. Examples of major efforts include collaboration with the College of Textiles in a center-level proposal in nano-textiles (SAFE), with the PCOM in the development of a

new academic program in supply chain engineering and management and the creation with CHASS of a new University-wide seminar series in Engineering and Public Policy. Other significant and continuing collaborations include pioneering work in the rapid prototyping of prosthetic devices for animals between faculty in our College and the College of Veterinary Medicine, collaboration with the College of Education (CED) in a number of proposals related to K-12 education, collaboration with PAMS in nanotechnology and high performance computing and joint efforts with CALS and CNR in many biofuels-related areas.

The growth of multi-college capstone design projects or similar activities represent a great opportunity for interdisciplinary growth for students and faculty. The expansion of the Engineering Entrepreneurs Program (EEP) to include students from the College and four other colleges, the collaboration between our computer science department and the College of Design in joint undergraduate senior projects and Digital Games Research Initiative, the joint honors programs with CHASS (e.g., Benjamin Franklin Scholars Program), and our joint Biomedical Engineering department with the College of Medicine at UNC-CH are all great examples, platforms and opportunities for interdisciplinary growth.

ACCOMPLISHMENTS

Engineers and computer scientists at NC State work together with researchers from other colleges as well as other universities to address the grand challenges facing society. Recent developments include

- An injectable "smart sponge" that can provide controlled drug delivery of insulin in diabetic patients
- NSF ASSIST Engineering Research Center's self-powered devices that help people monitor their health and understand how the surrounding environment affects it
- NSF FREEDM Systems Engineering Research Center's efficient solid-state transformers designed for flexibility and high power levels for the new smart grid, touted by MIT's *Technology Review* as one of the world's top 10 most important emerging technologies
- A new technique to identify the proteins secreted by a cell for precise data collection, which is critical in fields ranging from zoology to cancer research
- Mathematical and computer models to predict how plants will respond to various stresses, ensuring the human population has enough to eat

The Chancellor's Faculty Excellence Initiative has also served as an excellent catalyst to bring together faculty from across colleges to create and assemble teams of research scholars to work on complex problems that have many interdisciplinary aspects. This has resulted in new opportunities particularly between our faculty in computer science and faculty in PAMS in the area of data analytics, between our faculty in industrial engineering and biomedical engineering and faculty in CVM in regenerative medicine, and between our faculty in computer science and faculty in the CED in digital transformation of education. We also anticipate even greater collaboration and opportunities with the College of Education in the area of Engineering Education reflecting faculty investments that both our colleges have made in this area. The funding of a second NSF ERC in health-based nanosystems (ASSIST), the continued funding by NSF of the FREEDM ERC, and a number of new DoD funded opportunities in areas of security and analytics that are on the horizon also provide opportunities for interdisciplinary growth among our departments and colleges.

Many of our younger faculty, as a result of their own interdisciplinary graduate research and post-doc or industry experience, are more naturally inclined to interact with faculty in other departments and colleges than would have been the case even just five years ago. With this in mind, the College has made it an important priority to nurture this interaction through its faculty development efforts. The result has been either the creation or expansion of a number of interdisciplinary efforts that now span various colleges. When this is added to the major center level research efforts and other collaborations described above it leads to a bright picture and promise for even greater growth in interdisciplinary efforts in the future.



Goal 3

Goal 3

GOAL 4: ENHANCE ORGANIZATIONAL EXCELLENCE BY CREATING A CULTURE OF CONSTANT IMPROVEMENT

Strategies and Actions

Educate and apply “continuous improvement” methodologies to create more efficient administrative infrastructure and research planning

- Actions:
- › Build on proven practices such as CSC accreditation document, ABET process and other
 - › Annual review of progress made on COE strategic plan
 - › Update COE strategic plan every five years

Continuous Quality Improvement of Processes

- Actions:
- › Have Finance and Personnel Office lead this process
 - › Develop COE assessment of effectiveness of BOCs

Consolidation of IT staff and supporting financial resources

- Actions:
- › ITECS-led Administrative IT Equipment Life Cycle Plan

Recruit and retain high quality administrative and facility support staff

- Actions:
- › Provide greater staff “salary” flexibility
 - › Enhance efforts to balance staff workload
 - › Enhance staff training opportunities

Diversify funding sources through more creative public/private partnerships and related development efforts

- Actions:
- › Focus on partnerships for completing move to Centennial

Improve the national reputation of COE faculty and programs

- Actions:
- › Communications-led update of web and printed materials

Encourage benchmarking for all departments and units to establish best practices for organizational performance

- Actions:
- › Participate with CC partners group and gain feedback

Increase diversity of faculty and staff

- Actions:
- › Develop goals, benchmarks and action plan to achieve this outcome
 - › Include explicitly in administrative expectations and faculty and staff training efforts

Enhance COE-wide communication

- Actions:
- › Create a COE equivalent of the University-wide Administrative Leadership Meetings (ALM)

Enhance support for COE PhD student and faculty development programs

- Actions:
- › Enhance programs to develop PhD students
 - › Enhance Faculty Development initiatives
 - › Enhance Teaching Professors Learning Community

While the College agrees wholeheartedly with the importance of this goal, its explicit inclusion as a major category in The Pathway to the Future motivates even greater recognition and inclusion of these efforts in the College strategic plan. The intent will be to enhance current COE investments in areas such as faculty development and staff training and consider additional, more explicit ways to embed a culture of continuous improvement in all College activities. This is particularly important and challenging in a financial environment that has severely limited mechanisms to appropriately reward faculty and staff. University efforts aimed at enhancing staff and faculty trust and satisfaction are even more critical in this environment. An important message for the College is our need to enhance our efforts to diversify funding sources through more creative private/public partnership efforts and development efforts.



ACCOMPLISHMENTS

Every dollar invested in the College of Engineering by the state returns \$5 in grants, tuition and other support.

The College accepts transfers from all 57 NC community colleges and all 12 state universities without engineering programs to make wise use of state support.

The College partners with UNC Asheville to provide a Mechatronics degree program and UNC Wilmington to provide an engineering 2+2 degree program.

The College is a leader in ABET curriculum development and program development.

The NC State Engineering Foundation raised more than \$17.3M in pledges and gifts in 2012-13.

GOAL 5: ENHANCE LOCAL AND GLOBAL ENGAGEMENT THROUGH FOCUSED STRATEGIC PARTNERSHIPS

Strategies and Actions

Increase industrial and government partnerships to enhance academic and economic development

- Actions:
- › Include “liaison programs” in faculty development
 - › Emulate CSC ePartners program in other departments
 - › Expand GE partnership for worldwide graduate education
 - › Select/develop collaborations in key areas that have international government sponsors

Use senior projects and senior design to assist North Carolina companies of all sizes to expand design capability and productivity

Extend development of Bachelor of Science in Engineering programs statewide

- Actions:
- › Use Havelock and Asheville models to expand footprint at other UNC campuses and locations

Encourage and foster entrepreneurship and economic development activities among students and faculty

- Actions:
- › Scale and expand Engineering Entrepreneurs Program
 - › Scale and expand industrial internship opportunities for students and faculty
 - › Facilitate intellectual property and technology transfer involving faculty and students to assist existing companies and encourage the success of start-up companies in North Carolina and beyond

Expand collaboration and outreach to K-12 students and teachers

- Actions:
- › Build from strong base in Academic Affairs
 - › Expand Early Career STEM High School Model
 - › Leverage better Virtual Computing Laboratory model

Increase impact of COE on key North Carolina industry sectors

- Actions:
- › Better leverage Industrial Extension Service (IES), Solar Center and Ergonomics Center efforts
 - › Increase impact of IES and Solar Center to deliver short courses and technical assistance to North Carolina companies
 - › Integrate IES and Solar Center with department outreach activities as appropriate
 - › Support growth/expansion of BTEC

Expand international engagement in research and graduate education

- Actions:
- › Continue/grow Transatlantic Partnership for Excellence in Engineering (TEE) program and implement Vest Scholars program
 - › Proactive and selective expansion of our international footprint (BRIC countries, key universities overseas such as MS Nanoengineering with universities in India and Latin America)
 - › Expand online international classes (e.g., construction class)
 - › Reduce administrative requirements to award joint degrees with international institutions
 - › Develop certificate programs with international partners
 - › Develop multi-language COE and departmental websites
 - › Establish College-level global/international unit

Enhance relationships with alumni

- Actions:
- › Benchmark, track and leverage alumni global engagement activities
 - › Include alumni liaison for national lab and company visits (e.g., Oak Ridge, Sandia and Los Alamos)

The College has taken important steps forward to facilitate global engagement for its undergraduates through its NAE Grand Challenge Scholars Certificate Program and its international student exchange and immersion programs in China and Brazil. Nonetheless, this goal provides even more encouragement to try to scale up COE global involvement for the benefit of our students and faculty. Significant efforts to expand international engagement in research and graduate education have been made through the College’s participation in the University Global Partnership Network (UGPN), the Vest UK Scholars program and the EU-funded Transatlantic Partnership for Excellence in Engineering (TEE). The College submitted eight proposals to the UPGN directed toward connecting research faculty at NC State, the University of Surrey and the University of Sao Paulo. These proposals all provide for faculty and student exchanges and study visits. The TEE program provides full funding for mobilities involving doctoral students, post-docs and faculty between five North American universities (including NC State) and six premier European universities. These are important programs, not only to provide expanded student experiences, but also to enhance international research collaborations among our faculty.

Goal 5

ACCOMPLISHMENTS

- COE has performed research partnerships with 250 companies over the last decade.
- The Industrial Extension Service has assisted 200 North Carolina companies over the past decade resulting in over \$1B in savings.
- Through senior design projects our students have assisted 140 North Carolina companies to develop products and systems solutions to retain jobs and remain competitive.
- COE is in the top 10 for industry research funding in the US.
- COE research and outreach centers have engaged with 200 companies over the last decade.
- College faculty hold leadership roles in significant national research centers, including two NSF Engineering Research Centers, CASL, an NSA Labet, and the Triangle MRSEC.



LOOKING AHEAD

The key priorities of the College of Engineering are related to Goal 1 — Enhance Student Success through Educational innovation — and Goal 2 — Enhancement of Scholarship by Investing in Faculty and Infrastructure. While all the goals of the NC State and COE strategic plans are important, these intertwined goals are the foundation upon which our shared missions and visions most depend.

Over the last six years, with assistance from the legislature, the College has been able to increase both the number and quality of its tenured and tenure-track faculty and the quality of its infrastructure, resulting in significant increases in research productivity and enrollment. This progress also underpins the College's growth in national and international reputation and the significant impact the College has had on job creation and economic development in North Carolina over this same period. The reality, however, is that "no one is standing still". While we are appreciative of the support we have received, the significant investments being made in faculty and infrastructure at a number of peer institutions make it unlikely that the College will be able to maintain its stature as one of the nation's top engineering schools unless it can continue to increase faculty size, research productivity and PhD enrollment.

The most critical concern is the College's ability to recruit and retain outstanding faculty. Contributing to this challenge are a lack of resources and related constraints, along with the inability to provide the appropriate infrastructure. For example, the investment and commitments toward faculty retention during 2012-13 were unprecedented and unforeseen. Continued stagnation in faculty salaries will place significant pressure on the College's recruitment and retention abilities. The competition for faculty, both new and established, is especially difficult given the financial rebound enjoyed by many of the top private engineering schools and the ambitious growth plans of some of our major public peers.

On the infrastructure side, there is a tremendous need to "move the needle" on capital funding for the completion of the move of the College to Centennial Campus. This remains the College's top strategic priority. In addition to adversely affecting faculty recruitment and retention, it also increases pressure on the College to find other ways to meet research growth infrastructure needs, which entail significant renovation and related capital expenses. As our student enrollment continues to grow, especially at the graduate level, we need to have appropriate classroom and laboratory space. Without the completion of Engineering Buildings IV and V, the College cannot maintain its current level of excellence.

The long-term goal of the College is to become and be perceived as one of the preeminent engineering schools in the nation and world. This goal is critical to the achievement of the long-term vision of NC State as articulated in The Pathway to the Future. Achievement of this goal will require investments in faculty and infrastructure over the next five years at least equivalent to those made over the last five years in order to sustain and enhance the progress made by the College since 2008. North Carolina and its citizens have received significant economic benefits from the growth and development of the College of Engineering at NC State. It is difficult to conceive that our state will continue to progress and achieve its economic potential unless we assure that a preeminent world-class college of engineering exists at NC State.

