

College of Engineering Strategic Plan

PREAMBLE

The mission of the College of Engineering is to play a leading role in solving society's most challenging problems through (1) the discovery and application of new knowledge and technologies, (2) the education and development of future leaders who can innovate and implement needed solutions, and (3) the formation of knowledge-based partnerships with colleagues throughout the world.

The College of Engineering is committed to excellence in teaching and scholarship and to the creation of a vibrant intellectual culture at the University of Delaware. As one of the premier engineering programs in the country, we plan to further extend our national and international reputation for excellence through the creation of five new initiatives as outlined below.

1. MULTIDISCIPLINARY RESEARCH AND EDUCATION INITIATIVE

To meet the changing needs of today's world, the College of Engineering will create, enhance, and expand multidisciplinary research and education.

Such efforts are more necessary than ever to solve the complex problems facing humankind and our planet. By promoting an appreciation for a broad range of technical fields, we can expand technological and scientific applications beyond the boundaries of traditional disciplines. New areas of multidisciplinary research and education will experience targeted growth through the establishment of a critical mass of faculty, funding, and infrastructure.

To this end, we will

- **Establish multidisciplinary research centers.** A powerful metric of success in multidisciplinary research initiatives is the establishment of large-scale research centers such as NSF ERCs, STCs, MRSECs, etc. Targeted areas of research include, but are not limited to, bioengineering, sustainable engineering, financial engineering, energy, nanoscience, multifunctional materials, and multiscale engineering. Cluster hires should be made to facilitate growth in such areas. The pursuit of large-scale multidisciplinary grants is a multi-year process that would be greatly aided by a well-developed grant-writing center and more permanent educational outreach personnel within the College. In addition, successful multiuser research infrastructure within the College, such as the electron microscopy center and clean room, needs to grow to meet the significant demands of new research initiatives. Also, new multiuser research facilities, such as a nanoscale characterization and fabrication center, are essential for the establishment and growth of large multidisciplinary research initiatives. Both virtual and physical centers are critical for future COE research success.
- **Create joint faculty appointments.** Successful multidisciplinary initiatives require the formation of faculty teams spanning departments both within the College of Engineering and across colleges. In addition to establishing joint appointments for

existing faculty, new faculty positions should require appointments to at least two departments. Promotion and tenure criteria should be modified to encourage and reward participation in multidisciplinary research efforts.

- **Seek funding for seed grants.** Seed grants are essential for promoting the development of new multidisciplinary research efforts with the potential to lead to large-scale research grants. Establishing support for such efforts, from internal institutional resources as well as research foundations, should be an important thrust of fundraising efforts by the College.
- **Promote training grants.** In addition to establishing a critical mass of multidisciplinary faculty, the College must commit to the intellectual and career development of graduate students. We should promote the growth of multidisciplinary training programs, such as IGERTs, NIH training grants, and foundation-driven programs.
- **Educate leaders.** The college will educate the next generation of technology leaders, as well as teach UD's non-engineers about the critical interaction between technology and society. We will provide students with the broad-based education needed to produce holistic solutions that consider technical, economic, and societal issues. We will also provide students with increased opportunities to hone their leadership skills both through project-based learning and strengthened student organizations.
- **Establish new undergraduate degrees.** To train students for careers in multidisciplinary fields, the College should develop new undergraduate degree programs and even full-scale departments in areas such as bioengineering.
- **Expand undergraduate research opportunities.** The University of Delaware has a nationally recognized Undergraduate Research Program, and undergraduate research is a hallmark of the College. We need to build on successes in this area through the NSF REU program. This will require us to develop better resources for providing ethics education and for establishing success metrics to enable program evaluation. We should leverage the Undergraduate Research Program to encourage more students to do multidisciplinary research here on campus by building upon and expanding UD's Science & Engineering Scholars Program. We should also develop a better-integrated research internship program, whereby students can work at companies over the summer and during winter session.

2. GLOBAL INITIATIVE

To prosper in a global economy, we will pursue more global opportunities for our students and faculty.

We are in a global world that is changing rapidly, and times of change are times of opportunity. The prominent universities will be those that shine on the world's stage. Since this is a relatively new phenomenon, the winners in this contest are yet to be decided. The College of Engineering can lead the effort in establishing strong international ties. A number of engineering faculty already have relationships with high-profile foreign institutions, which could provide a starting point for cooperative ventures. The motivation would be to strengthen

areas of weakness in our research infrastructure and to recruit students to our areas of strength. Both sides would benefit through recruitment of students who would otherwise go elsewhere. The cooperation can start with individuals and rapidly grow to College and finally University-wide associations.

To this end, we will

- **Form alliances with internationally renowned universities around the world.** We need to expand on existing collaborative relationships established by our faculty with academic institutions in other countries, as well as capitalize on existing resources at the University for establishing and facilitating such arrangements. For example, the Vice Provost for Academic Affairs and International Programs is responsible for overseeing strategic global partnerships and initiatives, and the College should take advantage of this resource in forging new international cooperative relationships.
- **Create new opportunities for our students to study abroad.** The University of Delaware is nationally ranked for its study abroad programs, and the College has recently offered engineering study abroad opportunities in Greece, Australia, and Turkey. However, we need to make this option more feasible for engineering students by offering programs that incorporate both required undergraduate courses and technical electives. We also need to create study abroad opportunities for our graduate students. In addition, we need to continue and to expand support for our Engineers without Borders program.
- **Encourage research partnerships between our faculty and those abroad.** Such partnerships should involve not only faculty but graduate students as well. We should also encourage our faculty to take part in such programs as NSF's Materials World Network, which promotes cooperative activity in materials research between US investigators and their counterparts abroad.

3. INITIATIVE FOR INNOVATION AND PARTNERSHIP

To compete in the technological world, we will promote engineering innovation and entrepreneurship with a clear transition path to societal impact on a local, national and global scale.

Engineering innovation stems from the translation of research discoveries and ideas to the development of new technologies in the form of devices, products and processes. Innovative technologies often have a dramatic impact on the way in which we live, work and play. While universities typically emphasize patenting and licensing of their intellectual property, an alternative path of innovation is through entrepreneurship in the form of startups and small businesses. The latter are especially important for fostering the development of the newest, and often most radical, of emerging innovations. These may lack an immediate or obvious customer, often require more time for development before they are ready for the marketplace, and perhaps even call for the creation of entirely new markets. One result of innovative and entrepreneurial activity is the growth of the regional economy through the creation of new enterprises that recruit and retain top engineering talent. But such activities also contribute

broadly to the intellectual vibrancy of the University and provide a clear beacon broadcasting the University's leadership in our technological society. Thus, an environment that encourages, fosters, and recognizes innovation and entrepreneurship also enables the recruitment of top graduate students and faculty, generates excitement in the community and among the general public, and brings recognition for faculty, students, and alumni. As enterprises and partnerships spun off from the University community grow, they create new demand for the educational and professional training of a top engineering college and professional degree programs.

To this end, we will

- **Promote translation to practice.** Engineering must be transformative and practical if it is to have an impact on the world. Translational research, which takes ideas from the lab and implements them in society, is our aim. Centers that focus on translational research—whether they do work relevant to NSF, NIH, DOE, or other funding agencies—need to be established and supported. Establishing university-industry partnerships is a key element of our strategy.
- **Foster entrepreneurship.** Technology development beyond the initial discovery stage is often at odds with the educational mission of a graduate institution, in which students focus on learning the skills necessary to generate new knowledge. We will work with the Delaware Economic Development Office to leverage state resources to focus new technological development. We will also provide opportunities to incubate new technologies by developing facilities and generating seed funds.
- **Create new models for research and education in engineering.** The critical technological challenges the nation faces in the 21st century require not only a skilled workforce trained in science and engineering fundamentals, but also one that is adept in all facets of the research and development enterprise, including understanding how scientific discovery is integrated into new technologies and recognizing the opportunities and constraints imposed by policy and capital markets. We will establish collaborations with the business and policy programs University-wide to enhance student exposure to these broad issues. Concurrently, we will partner with the business school to support entrepreneurial activity by providing their students with the opportunity to create business plans, conduct market research, and assess new and emerging innovations.
- **Promote national interests such as energy diversity, sustainability, national security, and economic competitiveness through university-industry-government partnerships.** Taking our innovative engineering research and using it to support national interests is critical. We already have considerable research that is supported by such partnerships, and will continue to form new teams and establish new partnerships with industry and government to conduct research in areas of national need.

4. INITIATIVE FOR GRADUATE EDUCATION

A premier graduate education is required for a world-class college; our plan is to enhance the current standards of excellence in graduate education.

The quality of the scholarly work produced at a university is central to establishing the stature of that institution, and such scholarly work results primarily from the efforts of pre- and post-doctoral researchers working in concert with faculty; the subsequent accomplishments of these individuals also contribute significantly to the stature of the institution. The College of Engineering has a history of scholarly productivity and a solid foundation for enhancing its national reputation. Enhancing the current standards of excellence will be pivotal in raising the profile and stature of the College, as well as in expanding the scope of educational opportunities for students from traditional and non-traditional backgrounds.

To this end, we will

- **Place greatest emphasis on the Ph.D. degree.** The Ph.D. is the highest degree awarded by the University and thereby is critical to establishing a level of scholarly research consistent with UD's goal of enhancing its stature as a leading national institution. Our doctoral students will receive extensive professional development opportunities that will enable them to become the future leaders in academia, industry, and government. An emphasis on the Ph.D. will aid in recruiting and retaining first-rate graduate students and in maximizing research productivity.
- **Improve graduate recruitment by expanding graduate fellowship opportunities.** Recruiting outstanding graduate students depends on the availability of flexible, diverse research programs, including traditional discipline-based programs as well as multidisciplinary efforts. Critical to such efforts is the need for student support to facilitate intellectual breadth, especially in the first year or two of graduate study. Fellowship funds should be developed for this purpose from sources including endowment funds to support all full-time first-year graduate students and federal training programs such as NSF IGERT and NIH training grants.
- **Leverage successful master's programs in attracting students into non-traditional and enhanced graduate offerings.** While Ph.D. programs are central to institutional stature, other degree programs can aid in recruiting, enhance opportunities for students, and provide outreach options that are valuable to both students and the College. Such programs include 4+1 BS/MS degrees, professional master's programs, and PhD/MBA programs. We will also foster life-long learning opportunities as another avenue to strengthen our industry-university relationship.

5. INITIATIVE FOR DIVERSITY

The College will create and sustain a multifaceted culture of diversity that embraces intellectual, cultural, racial, and gender diversity; a culture that values a diverse faculty, staff, and student body is one that will ultimately produce better engineers and better engineering.

We are committed to providing an environment within which all members of our community, including students, faculty, and staff, can be productive members of an increasingly interconnected world. To do this, we must recognize the changing world in which they must function as well as the inherent value of a College that reflects the diversity of society. We are also committed to creating a culture that supports critical thinking, free inquiry, and respect for diverse views and values. The College has the opportunity to launch this initiative for diversity from a well-established foundation, including the NSF Advance Program for Institutional Transformation, the RISE program, the Delaware EPSCoR program, the NSF Research Education for Teachers (RET) program, the NSF AMP Bridges to the Doctorate (BTD) Program and the Women in Science and Engineering program.

To this end, we will

- **Establish strategic partnerships with colleges and universities that serve students from historically underrepresented backgrounds in the engineering disciplines.** It is critical that we provide opportunities for students and faculty at such institutions to become engaged at UD, particularly involving research experiences. The creation of sabbatical opportunities at UD for faculty is one such example.
- **Create programs that enable students at non-PhD granting institutions to engage in undergraduate and master's-level research.** The goal here is to provide a bridge to graduate education at Delaware, building upon our NSF-sponsored BTD program.
- **Foster outreach activities that encourage interest in engineering and science among all K-12 students.** This includes those at schools serving socioeconomically disadvantaged backgrounds.
- **Hire, mentor and promote a diverse faculty and staff.** We will enhance mentorship for all junior faculty from all backgrounds to help them succeed, and will promote ongoing training and advancement for our support staff.
- **Engage in the aggressive recruitment of top undergraduate and graduate students from underrepresented and international populations.** To retain such students, we will reinforce a culture that is welcoming to women as well as men, international students as well as domestic, and students from all creeds, races, religions, and cultures.
- **Create a vibrant intellectual life that encourages diversity of ideas.** Respectful argumentation lies at the foundation of good science and engineering practice.

SUMMARY

This strategic plan is broad in scope and ambitious in nature, yet not outside our reach. Achieving our goals will require modifications in the way we do research, radical changes in our education programs, and hard work on the part of our faculty and staff. We will also need to develop a clear and unique brand for our college.

It is anticipated that the College will also need to make changes in its organization, evaluate the allocation of college resources, initiate a robust development and public relations campaign, and establish new, non-traditional facilities to enable innovative multidisciplinary research.

Given the initiatives we have proposed and the leadership we will provide, we will need more faculty and space to accomplish these goals. We envision an increase in the size of the College by 50%, both in the size of the student body and the faculty and staff. That would make the college of engineering approximately 15% of the University of Delaware. Of course, an increase in the size of the student body and the faculty and staff will require a concomitant increase in space.

Taken together, these five initiatives will position the College of Engineering to lead the University of Delaware on its Path to Prominence.

To prepare for a future that turns these initiatives into realities, we will create a robust business plan that allows us to prepare for the growth necessary to accomplish our goals, identify the funding opportunities to support our initiatives, and build the intellectual commitment to sustain our objectives.

ANNUAL PLAN FOR 2009-2010

The following actions steps will be worked on during the 2009-10 academic year. These steps should move us towards achieving one or more of our five initiatives as indicated in parentheses. Each year the success of the action steps will be evaluated. Following the action steps is a set of metrics that will be used to evaluate the achievement of the overall strategic plan.

Action Steps for 2009-10

Multidisciplinary Research and Education Initiative

- Recruit computer science to the college
- Recruit outstanding faculty through traditional and cluster searches
- Recruit high quality undergraduate students
- Train future leaders by providing robust learning experiences to students at all levels
- Apply for and win major research centers
- Increase multidisciplinary research activities
- Create core research facilities
- Strengthen interactions with the Lerner College of Business and Economics
- Establish a new undergraduate program in biomedical engineering and an interdisciplinary bioengineering graduate program

Global Initiative

- Establish a global activities committee to coordinate international programs

Initiative for Innovation and Partnership

- Establish research and educational partnerships with Aberdeen Proving Grounds

Graduate Education Initiative

- Recruit high quality graduate students
- Develop new professional degree programs and 4+1 BS/MS programs

Initiative for Diversity

- Improve faculty diversity and develop a critical mass of women faculty
- Grow and improve the diversity of the undergraduate population through a defined enrollment management plan

Operations

- Develop and implement a long-range space plan
- Prepare for ABET
- Expand development efforts to ensure that we have the resources needed to reach our goals
- Develop a clear brand for the college and improve communications and marketing
- Implement a business model and organizational structure that will enable the college to grow and excel

METRICS USED TO EVALUATE PROGRESS TOWARDS ACHIEVING THE STRATEGIC PLAN

The following set of metrics will be used to evaluate the achievement of the strategic plan.

Overall

- Ranking in US News and World Report
- Faculty (number of faculty, publications per faculty, funding per faculty, students per faculty, faculty awards, NAE members, NSF Career winners, Named professors)
- Size of college relative to the rest of campus

Multidisciplinary Research and Education Initiative

- Undergraduate program (enrollment, student quality, retention, degrees, research, awards)
- Research program (proposal submissions and awards, total research dollars awarded, major research centers, interdisciplinary research awards)

Global Initiative

- UG study abroad
- Cooperative agreements with foreign schools

Initiative for Innovation and Partnership

- Enrollment in professional programs
- SBIR and STTR awards

Graduate Education Initiative

- Graduate program (total enrollment, student quality, degrees, awards, enrollment in 4+1 programs, students becoming faculty members)

Initiative for Diversity

- Faculty, staff, and student diversity
- UG programs (RISE, WIE, ...)
- Grad programs (WIE, ...),
- Cooperative programs with institutions that have diverse populations

Operations

- Development (development staff size, prospect list, donors, annual donations, total endowment, alumni awards, alumni events)
- Space (new buildings, total space, core facilities)
- Communications (web site hits, national media coverage and references to UD work, number of PR items distributed, PR staff size)
- Budget (revenue vs. expenses (college and units), charged graduate tuition, charged faculty salary, income from professional programs, percentage of research on campus, number of credit hours taught total and per faculty, undergraduate retention)
- Centralization (faculty and staff satisfaction surveys, productivity and efficiency measures, staff cost per faculty member)

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