College of Engineering Strategic Plan

Vision Statement for the College of Engineering

The mission of the College of Engineering is to advance the discovery and application of new knowledge in engineering and science and to educate and develop leaders of our technology-driven society.

The vision of the College is to be a focal point for science and technology development and education within the University and the State, with an impact extending to regional, national, and global dimensions. Within the context of the University as a state-supported, student-centered research university, the aims of the College are to provide outstanding programs of undergraduate, graduate, and continuing education; to be a research leader advancing the frontiers of engineering and science through increasingly multidisciplinary initiatives; and to serve the citizenry and industry as an agent of technological, economic, and educational innovation and advancement.

The College plans to achieve this vision through the pursuit of six distinct goals, each of which encompasses specific objectives, strategies, and action items. These goals are listed here and are described in more detail in subsequent sections:

1. The College of Engineering will lead the University of Delaware to become a nationally prominent research university.

2. The College of Engineering will advance multidisciplinary research and education at both the graduate and undergraduate levels.

3. The College of Engineering will promote excellence in undergraduate education that will enable the development of leaders for our technology-driven society.

4. The College of Engineering will increase the number and quality of graduate students, with a focus on US students.

5. The College of Engineering will improve its visibility and impact with alumni, citizenry, legislature, industry, and the science and engineering community.

6. The College of Engineering will foster diversity of College faculty, staff, and students.
Goal 1: The College of Engineering will lead the University of Delaware to become a nationally prominent research university.

Research in the College of Engineering has seen unprecedented growth in recent years: over the past decade, research funding has increased by 125% and the number of faculty has grown by 18%. Along with the growth in research dollars has come a rise in national rankings. These trends must continue if the College is to promote further enhancement of its own reputation as well as to lead the University of Delaware in becoming a nationally prominent research institution. With this in mind, we offer the following specific actions:

1. **Cultivate and enhance the growth of research funding**—For the research funding to continue to grow at a target rate of 10–15% per year and thus to double within 5-7 years, there is a need to build infrastructure and support under the direction of the Dean and Department Chairs. Successful completion of this growth will require the appointment of an Associate Dean for Research to oversee the continuing development of an expanded College research infrastructure, to lead and develop the College professional technical staff, and to serve as a facilitator and resource person for research funding opportunities.

2. **Continue growth of College faculty**—The College added one new department this past decade. As this department grows and the College develops other new initiatives, the number of faculty members in the College must continue to increase at a reasonable rate. By the year 2005, we plan to have 110 faculty lines, with 100 filled.

3. **Retain and hire outstanding College faculty**—It is important to attract high-quality candidates to the University, as well as to retain the excellent faculty we already have. To invigorate and stimulate the intellectual environment in the College, a three-pronged approach will be pursued. First, the College will target the hiring of senior faculty with research reputations and funding portfolios that equal or exceed those of current UD faculty. This should be done through the creation of five new endowed professorships. Second, retention of existing faculty members will be emphasized. A more competitive bonus and/or merit system should be established though the Offices of the Dean and Human Resources for the retention of our top-ranked faculty members. Third, the College will offer attractive start-up packages and competitive salaries in order to continue the great success it has recently had in recruiting high-quality young faculty members.

4. **Increase inter-college research activities**—To promote multidisciplinary research activities, the College will develop plans that support inter-college research. The current PIRSE initiative that returns some of the overhead expenses to investigators is an excellent example.

5. **Encourage the development of innovative research centers**—The research centers and programs in the College foster collaborative, cutting-edge research that transcends traditional departmental boundaries. We need to cultivate existing centers, identify promising research areas, and promote the activities necessary to win competitions for new center grants. To procure center grants, the College will provide resources to faculty with outstanding ideas. Such resources include release time from teaching for the development of large, center proposals and providing technical writing support.
Goal 2: The College of Engineering will advance multidisciplinary research and education at both the graduate and undergraduate levels.

The College of Engineering will lead the University in establishing multidisciplinary research centers of excellence with the mission of seeking and strengthening the capability of engineering to contribute to and solve multidisciplinary problems. This will be accomplished by supporting programs and activities that foster innovation, creativity, and excellence in fundamental research, engineering education, and knowledge application and by promoting the increasing synergy between multiple technical fields. Expected outcomes include successful pursuit of multidisciplinary block grants, integration of relevant research programs within the college into the activities of the Delaware Biotechnology Institute, and the establishment of new cross-college research centers. Strategies and tactics include the following:

1. **Evaluate and invest in targeted research areas, opportunities to launch new centers, and degree programs**—Previously new research centers in the college have been formed on an ad-hoc basis in response to faculty interest or to perceived funding opportunities. While it is essential that faculty scholarship remain at the core of college initiatives, it is important to engage in continuing strategic planning at the department, college, and university levels to identify fields of research and education in which we can play a leading role. Successful pursuit of funding of multidisciplinary initiatives will require establishment of a continuing record of collaborative research and interdisciplinary educational programs.

2. **Assemble and fund faculty teams to pursue multidisciplinary block grants**—A crucial component of intellectual leadership is the identification of new fields of scholarly endeavor, rather than reaction to the visions of others. Success in launching new multidisciplinary initiatives will depend on the establishment of faculty teams with the necessary commitment of talent, energy, and resources to build programs that will be competitive externally. Successful pursuit of large multidisciplinary grants is typically a multi-year process, and will require sustained efforts to establish a growing record of success in collaborative research and education.

3. **Create and fill senior faculty positions with joint appointments that cross department and college boundaries**—Increasing emphasis on multidisciplinary research and education will require individuals capable of providing intellectual and administrative leadership. The augmentation of the existing talent in the college with strategic hires of senior faculty who have a breadth of research vision that extends beyond traditional disciplinary boundaries represents a particularly effective way to stimulate new multidisciplinary initiatives.

4. **Establish a program of prestigious College-wide, multidisciplinary seminars**—While we focus, rightfully, on increasing the intellectual exposure of our students, it is important to recognize that faculty, too, need continuing exposure to emerging fields of intellectual endeavor, lest they stagnate. To that end, a college-wide seminar program will be established to provide opportunities for faculty and students to learn from leaders whose activities represent models of multidisciplinary scholarship applied to relevant problems of broad interest in the college.

5. **Build on the University's reputation and programs for undergraduate research**—The University of Delaware has received significant recognition from NSF and elsewhere for its
incorporation of research experiences into undergraduate education. We have an excellent opportunity to build upon this reputation, and particularly to recruit the undergraduate and graduate students who will be integral members of multidisciplinary research teams, by broad and consistent efforts across the college. As one example, Research Experiences for Undergraduates (REU) summer programs will be pursued in all departments.
Goal 3: The College of Engineering will promote excellence in undergraduate education that will enable the development of leaders for our technology-driven society.

The College of Engineering is committed to producing world-class engineers that will provide technological leadership for the state, the region, and the nation. To achieve this goal, we strive to attract the very best and brightest students and to provide these students with a challenging engineering education that will be stimulating and will allow them to realize their potential. Our curricula will reflect the needs of the engineering community and exploit the latest in educational technology. We will provide our students with the necessary experiences to become innovative thinkers, leaders, and entrepreneurs. We believe that by continuing to be at the forefront of engineering education, the College will be able to improve its national ranking.

1. **Revise engineering curricula in preparation for the ABET EC2000**—To provide the educational experiences needed for students to excel in the modern engineering climate, we will evaluate and revise our existing curricula. The nature of engineering today is changing rapidly. Adapting to these changes—and continuing to educate world-class engineers—requires continued adaptation of our engineering curricula. As we revamp our curricula, we will capitalize on the flexibility and opportunities provided by the new ABET EC2000 criteria to promote engineering to capable students with a broad range of academic and career goals. External committees will be formed to provide input to the development of new curricula. We will carry out a thorough curriculum evaluation in each department and establish College-wide curriculum goals in concert with University-wide curriculum revision. In terms of evaluation, College-wide coordination of evaluation mechanisms will be implemented. A College committee will lead this effort as well as educate faculty in the methods of outcome-based assessment. Through the implementation of curriculum revisions and evaluation procedures, we will prepare ourselves for future accreditation under ABET EC2000. Revised curricula should be in place by Fall 2001.

2. **Increase the quality of incoming students**—As we strive to produce the highest quality engineering graduates, we must also work to improve the quality of our incoming students. This can be done by building on the many strengths of the University and the College. In addition, we will identify and evaluate opportunities for the establishment of new degree programs and new degree combinations, especially BS/MS combinations across departments. The quality of incoming students will also rise as the number of applications and the number of merit-based scholarships increase. An increase in quality should be evident through improvements in SAT scores, PGIs, honors program participation, and other appropriate metrics.

3. **Increase and broaden undergraduate enrollment**—While one of the strengths of the College in terms of undergraduate education is the modest student/faculty ratio, some increase in overall enrollment should follow increases in faculty size (maintaining the current student/faculty ratio). One way of broadening the undergraduate enrollment is to establish courses for freshmen and sophomores accessible to non-majors, consistent with ongoing UD curriculum revisions.

4. **Provide ample undergraduate research experiences**—The University’s strength in promoting undergraduate research is well embedded in the College, and we are committed to expanding opportunities for undergraduate research. The increase in multidisciplinary
research should provide increased opportunities while allowing engineering students to work in teams with students from other colleges. We will expose undergraduate students to the fruits of multidisciplinary initiatives in the College and seek to develop NSF REUs within the College.

5. **Mentor students and provide experiences for future career paths**—If we want to produce students who will excel in their career development, we must increase faculty mentoring of undergraduate students with respect to research, career development, professional opportunities, and responsibilities. We will educate students about graduate and professional school. We will expand opportunities for experience-based learning, both intramural research/design, etc. and extramural co-op programs and internships. These activities can have major benefits not only for the students involved, but also for recruiting, improved interaction with industry, and increased impact on the engineering community.

6. **Utilize state-of-the-art information technology**—If we want to compete for the very best students and graduate the highest quality engineers, we need to stay at the forefront of information technology (IT). We need to foster innovative teaching techniques that utilize IT and provide our students and faculty with the latest facilities (computer classrooms and user rooms) and software. We will develop departmental and College recommendations regarding computing hardware and software needs and utilization by each student and make these recommendations available to incoming students. The cost of computer equipment should be factored into financial aid packages.
Goal 4: The College of Engineering will increase the number and quality of graduate students with a focus on US students.

One consequence of the continuing growth of technology as a driver of our economy is an expanding societal need for highly trained engineers and scientists. The challenges these individuals face will be considerable. They will not only need to be experts in a field upon graduation but also be equipped with the tools that will enable them to adapt to a rapidly changing marketplace. This requirement for breadth and depth of training means that more students will need graduate education during their careers. In keeping with UD’s commitment to education, the College plans to fulfill this need for engineering and science professionals by increasing both the number and quality of graduate students. The number of graduate students should steadily increase from the current 420 to 600. This increase is consistent with the anticipated growth in faculty and research activity as well as the economic need for engineers. The College will undertake a concerted effort to increase the quality of these students while the student population grows. A major effort will be made to recruit domestic students who are eligible for NIH and NSF fellowships that add to the financial base of the College as well as contributing to the prestige of the institution.

1. **Attract highly qualified graduate students**—It will be easier to attract top academic students if offers for graduate fellowships are independent of specific funding sources. The College will institute a plan to provide fellowships to the top students applying to each department. All Ph.D. students offered financial support will be guaranteed continued support for four years as long as they are making adequate academic progress. These fellowships should help in attracting outstanding students to Delaware.

2. **Improve recruiting efforts**—Since engineering is a broad-based and multidisciplinary endeavor, students can be recruited from non-traditional departments. Specifically, additional domestic students will be recruited from math/science departments and from liberal arts colleges. Furthermore, feeder programs will be identified and cultivated through the establishment of faculty interaction with colleagues at the target schools. Increasing the recruiting base will allow the College to grow while maintaining and even increasing the quality of the students. To aid recruiting efforts, the Dean’s office will institute a program to facilitate departmental recruiting of graduate students.

3. **Establish new degree programs**—New inter-departmental and inter-college BS/MS degrees will be implemented. This will fulfill industrial needs for employees with a breadth of knowledge. Additionally, it will enable the College to attract and retain students who might otherwise opt for different careers.
Goal 5: The College of Engineering will improve its visibility and impact with alumni, citizenry, legislature, industry, and the science and engineering community

With the national and global competition for students and for resources, it will become increasingly important to expand existing efforts and to explore new avenues to enhance the visibility of the College. This effort should be focused on a broad range of groups that have a vested interest in the success of the College such as alumni, citizens, and members of the legislature. In addition, it will be necessary to raise the awareness and the impact among potential supporters in industry and government and further raise the reputation of the College for excellence within the science and engineering community.

The primary aim of these activities will be to attract higher quality students at both the undergraduate and graduate levels and to improve the College’s ability to attract and retain outstanding faculty. To this end, each department will establish and utilize an external advisory board and increase the involvement and active participation of their alumni. Faculty and chairs will aggressively pursue nominations of their colleagues to receive national awards for their achievements. An increased awareness of the academic excellence in the College on the national level will lead to a rise in the national and international prominence of our program.

To achieve our goal of increasing the awareness and impact of the College, several focus activities will be pursued. These activities focus on students and faculty initiatives to improve the pool of potential applicants and reward and recognize outstanding achievement. The Engineering Outreach Program will be expanded to enhance the College’s reputation in the community. A coordinated public relations effort will be established, taking advantage of personal contacts, traditional media, and the Internet to highlight the opportunities and areas of excellence that the College has to offer.

1. **Promote academic careers among students**—It is anticipated that an increase in engineering faculty who graduated from Delaware and teach at other institutions will directly enhance the visibility of the College. The College will increase its efforts to raise awareness among undergraduates about the opportunities and advantages of pursuing graduate studies. In addition, the engineering departments will further focus on exposing their top graduate students to future teaching and academic career opportunities.

2. **Promote faculty professional development and visibility**—The reputation of the faculty is central to the future success of the College and plays a major role in attracting high-quality graduate students. To this end, attention will be placed on further expanding the leadership role of UD engineering faculty in national professional organizations. In addition, the College and the departments will aggressively nominate UD engineering faculty for national and international awards. Incentives for the preparation of textbooks and other educational media with broad extramural impact and visibility will be created.

3. **Build on the success of the Outreach Program**—The Engineering Outreach Program has provided a very successful mechanism to improve community involvement. The College will build on this successful program by expanding and completing the menu of MS degree programs available through Outreach. The recent success with short courses under the Outreach Program highlights opportunities for expansion to provide additional short courses
to local and national industries. Furthermore, the College will coordinate Outreach activities with the new ABET mandates for continuing education awareness and activities.

4. **Establish focused PR activities within the College**—The engineering departments have already been using their own PR materials to promote the strengths of their programs for both faculty and students. A focused PR campaign will be established within the College to strongly leverage the individual strengths of the various departments and research centers. To this end, new media such as web sites and a College-wide CD-ROM need to be balanced with increased publicity in print and electronic media. Journalists will be regularly invited to campus for briefings on recent accomplishments of UD engineering faculty. Special information packages will be prepared and regularly mailed to deans and chairs at other institutions to further the exposure of the Delaware program. In addition, direct contact will be established with key legislators to highlight the benefits of the UD engineering program to the local and regional economy.
Goal 6: The College of Engineering will foster diversity of College faculty, staff, and students.

The College is committed to fostering an environment in which all people are welcome and able to learn. To accomplish this, it is important that the faculty, staff, and students of the College reflect the diversity of our society and that those who have traditionally been underrepresented in engineering fields find new opportunities there. To that end, we will carry out the following actions.

1. **Increase the number of female and minority faculty members in the College**—At present, the fraction of female and minority faculty members in the College is well below the representation of these groups among the undergraduate student population of the College. The learning experience of these and of all students will be enhanced by interaction with a more diverse and representative faculty. Significant efforts in both recruiting and retention of female and minority faculty members are needed. Accordingly, the College will establish a target of one-third of new faculty hires to be female and/or minorities. A key to success in meeting this target will be the implementation of active programs to identify outstanding faculty candidates from among these groups and to introduce them to the College and the University. It is essential that resources be made available for the recruitment of such individuals. A second essential component of diversifying the College faculty is the retention of outstanding faculty. A formal mentoring program for new faculty will be established in each department of the College.

2. **Increase the number of female and minority graduate students in the College**—To bring greater diversity to the leadership of our profession, especially in academia, it is essential that this diversity be reflected among the holders of advanced degrees from our institution. Thus, efforts are needed to increase the representation of female and minority group members among the graduate student population, and to ensure that members of these groups find attractive opportunities for advanced study. The College will build on the networking opportunities provided by the RISE Program to enhance its success in recruiting a diverse graduate student population. A second important component is an increased effort to recruit female and minority graduate students in conjunction with recruiting initiatives directed toward non-traditional degree programs and institutions, e.g., science majors from liberal arts colleges. The College will seek both external and internal resources to improve its recruiting efforts and to enhance the fellowship support and educational opportunities that it can offer to female and minority graduate students.

3. **Maintain the size and strength of the RISE Program for recruitment and retention of undergraduate students from underrepresented groups**—The RISE Program has had an impressive impact in helping to attract minority students to undergraduate degree programs of the College and in providing the academic support and other programs to ensure the success of these students. It is vitally important that the strength of the RISE Program be maintained, that the keys to its continuing success be recognized and fostered, and that resources be available to make full use of the program’s potential in recruitment and retention of a diverse student population in the College.
Appendix: Assessment of College Strength and Resource Needs

In FY99, the College of Engineering had a faculty size of 86.5 FTEs and research expenditures of $22.7 M. Over the preceding five years the College experienced an average annual growth rate of 14.8% per year, approximately doubling its research expenditures from FY94 to FY99. This growth represents a combination of research productivity growth (per capita research expenditures increased at an average annual rate of 10.3%) and faculty growth (from 70 to 86.5 = 4.3%/annum). One of the underlying objectives of the strategic planning exercise was to develop a plan to ensure sustained growth of the College’s research base, effecting another approximate doubling in five to seven years. The growth of the faculty size projected in Goal 1 anticipates that approximately 2/3 of the growth rate of research expenditures will again come from increased per capita funding generation and 1/3 from increased faculty size.

The University’s budget decentralization process has resulted in a substantial revenue stream to the College from indirect cost return. This represents a marvelous opportunity for the College to make coherent investments to facilitate the growth envisioned above and to achieve the specific goals articulated in this strategic plan. It is imperative that the planning exercise initiated here be an ongoing process, with continuing assessment of strategic opportunities and of the level of success in meeting previously defined goals.

The goals and strategies described in this document are an outline of the opportunities as we see them today, as well as of needs for improvement in the College. Among the latter, we wish to emphasize issues of faculty retention, graduate student recruiting, and faculty and graduate student diversity. We recommend that these issues be the subjects of continuing strategic assessment and initiatives in the College. As examples of the vulnerability of the College in these areas, we note the following:

- Per capita research expenditures of faculty members who left the University in FY98 and 99 were more than twice the College average. It is not surprising that it is our best faculty who are most attractive to other institutions, but it is much more costly to hire and to develop outstanding faculty than to retain them. We must break the reputation of UD as a “farm team” for other institutions.

- The competition among universities for high quality graduate students, especially American students, continues to grow. While the College of Engineering has succeeded in increasing its number of full-time graduate students by approximately 50% since 1995, the percentage of these who are from the United States has fallen from nearly 50% to less than 40% currently.

- In the history of the College, only one female hired as an Assistant Professor has ever progressed along the tenure track to the rank of Professor. Two of the College’s six female faculty members resigned within the past two years. Likewise, the number of minority faculty members in the college presently stands at six. Thus we are not starting from a position of strength as we seek to improve faculty diversity.

The realization of the growth and improvement of the College envisioned in this Strategic Plan will require ongoing attention to other issues not fully developed here. For example, the laboratory and office space currently available per research-active faculty member in the College
is approximately 2000 square feet. To maintain this level as the faculty size increases, new construction will be required. For example, if the number of research-active faculty increases to 100 (out of 110 total), in addition to the expansion of DuPont Hall and the renovations of Spencer and Evans already planned, a new building with approximately the research space of the current Colburn Laboratory would be needed. It is not too soon to begin to plan such a building if occupancy is to occur within the decade.

Finally, the College has reached its present level with relatively little emphasis on centralized facilities for support of research or for research computing. In the face of an evermore competitive funding environment and increasing emphasis on multidisciplinary, collaborative research, it is not clear that past practice provides the best model for the future. Specific examples of infrastructure support needed to sustain the development of the College include centralized analytical and materials characterization facilities, research computing availability (especially for pre-competitive, exploratory research), and electronics design and repair, among others. Each of these will require addition or commitment of professional technical staff members to supervise and maintain these assets as service or user facilities. Such issues should be considered within the broader context of how best to invest the College’s overhead return revenues to advance the quality, stature, and impact of the College.