Strategic Planning

Towards

A 2025 Vision for NCE Excellence

Sunil Saigal, Dean
Newark College of Engineering
February 2010

njit.edu

THE EDGE IN KNOWLEDGE
January 26, 2010

Dr. Sunil Saigal, Dean
Newark College of Engineering
New Jersey Institute of Technology
University Heights
Newark, New Jersey 07102

Dear Sunil:

Thank you for sharing with me the strategic planning document for NCE. A strong case is made for a bold initiative that has the potential to transform the College. You and your colleagues in NCE will have the full support of the Administration in such a pursuit, a pursuit in concert with the University’s Strategic Priorities to focus on a limited number of academic and research thrusts, student and faculty recruiting and retention, securing financial support, and improving the quality of life for the university community.

The approach adopted should provide a genuine sense of excitement among NCE faculty, staff, students and alumni. Few could argue that enhancing NCE’s prominence among national colleges of engineering will not benefit everyone concerned. Many before us and others here today have positioned NCE well to reach for that next level of achievement. Your goal is a “stretch goal,” but worth the effort. Engaging in a purposeful process over the next 15 years will provide a shared vision and direction toward excellence that will permeate all of NCE, enhancing your ability to recruit students and faculty and garner support from external constituencies.

It is said that these are difficult economic times. Perhaps they are different economic times through which those who navigate wisely will emerge the leaders. The key to success is to align effort collectively toward reaching a common goal, which the plan facilitates. NCE will be challenged in this endeavor, but I believe it will accept the challenge and be rewarded richly for it.

As you work with faculty and various constituencies to gain commitment for such an important undertaking, please know that NJIT truly values NCE as its largest college. NJIT’s stature among universities is largely dependent on NCE’s place among colleges of engineering. We will all share the work of advancing NCE into the top ranks of its peers as we work to advance the stature of the University. Achieving the University’s vision of a preeminent science and technology research university known for innovation, entrepreneurship, and engagement is in large part dependent on the standing and accomplishment of NCE.

Sincerely,

Robert A. Altenkirch
President

cc: Don Sebastian, Interim Provost
February 5, 2010

Sunil Saigal, PhD, P.E.
Newark College of Engineering
New Jersey Institute of Technology
University Heights
Newark, NJ 07102

Dear Sunil:

As the Chair of the NCE Board of Visitors, I want to thank you for your vision and effort to produce such a bold strategic initiative. We as a board have been intimately involved in its process and are in full support of its goals and challenges.

Our charge as a board will be to enhance partnerships with the faculty, students, administration, and the public and professional community to insure the success of the plan. Achieving this goal will be evident in enhanced academic stature and greater student success.

This is an important time in our tenure on the board. We have an opportunity with the implementation of the plan to move NCE into a new era.

It is time that NCE as a 80 year old institution builds on its foundation and identity to lead NJIT in the future to academic excellence.

Sincerely,

Lawrence A. Raia, P.E.
Chair
NCE Board of Visitors
EXECUTIVE SUMMARY

The Newark College of Engineering (NCE) is embarking on the development of a five year Strategic Plan for the College. The Strategic Plan will be developed through committees established to develop goals, strategies and objectives for various areas in which the College seeks preeminence. A key long range guiding principle informing the work of the committees is that NCE reach the top-25 status in a number of US News and World Report (USNWR) categories by the year 2025. The College leadership and faculty must share this vision and commit to the development of tactics that will make it a reality.

A. GOAL AND TIMELINE

(a) The Newark College of Engineering (NCE) has been in existence for 128 years. NCE currently has 115 tenured and tenure track faculty and is not among the top 50 colleges of engineering in USNWR rankings. This is a respectable number of faculty for a mid-size college of engineering. We have departments or programs in all of the core disciplines of engineering (viz. Civil, Mechanical, Chemical, Biomedical, Industrial, Electrical and Computer Engineering) as well as in Engineering Technology. We have strived to be a research university for over three decades now with significant investments made into transitioning to a research based college. Our facilities, though starting to present challenges as we grow, are better than adequate and reasonable investments have been made in the past to keep them upgraded and current. Given our current strengths, we are in a good position to move into the top ranks among the colleges of engineering. Some of the categories used by USNWR in ranking colleges are based on surveys of peers and recruiters. Others, however, are based on faculty achievements, student selectivity and other similar objective measures. We will target these categories in achieving a prestigious ranking for NCE.

Recommend: NCE undertake, as a long range guiding principle, the significant improvement of its national standing to reach top-25 status in selected categories.
(b) The national rankings for colleges, including colleges of engineering, are published each year by *US News and World Report*. The appropriateness of these rankings, as well as the criteria used for ranking, have been the subject of debate for many years now. Regardless, these rankings are popular, are seen and used by a wide cross section of students and their parents, and have become the *de facto* gold standard for comparing colleges and universities. No single set of metrics has universal support in determining the quality of a college. The metrics used by USNWR have the advantage that they form the basis of the most popular published rankings and, therefore, are important for attracting top students that may have chosen to go elsewhere. The metrics are shown in Appendix A.

**Recommend:** NCE adopt the metrics used by USNWR in developing a plan to achieve excellence and to improve its national standing.

(c) Accomplishing the top-25 status with the criteria used by any ranking including USNWR rankings depends strongly on the quality and commitment of the faculty in the College. A large number of faculty members in NCE are reaching potential retirement. Many of the USNWR metrics, such as research expenditure per faculty, percentage of National Academy of Engineering (NAE) faculty, etc., cannot be achieved without adequate number of faculty. In order to manage the transition without losing ground, new faculty should be hired in parallel with the retirement wave. New, cutting-edge research areas have come to the fore in the last decade. Junior faculty members hired in various institutions in the last 5-10 years have contributed significantly to these directions. The number of junior faculty hired in NCE in the last 5-10 years is low compared to the numbers for other research intensive universities. The recruitment of junior faculty will help to strengthen our presence in these frontier areas.

In order to make progress towards the adopted USNWR metrics, *it will be necessary to recruit promising new faculty into NCE*. Given the economic climate, this faculty recruiting activity will not begin until Fall 2010. Investing in a faculty member and
mentoring them into becoming productive faculty takes at least five years. Another 5-10 years are needed for these faculty members to gain prominence in their field. Thus, approximately 15 years are needed before faculty performance in terms of gains in USNWR ranking will begin to be fully realized. If a strong faculty recruitment effort occurs over a period of 5 years, it will take us 15 years to show significant gains and for us to have a solid place in top ranks. This supports the need for a long range plan with measurable short term milestones.

**Recommend:** NCE adopt a 15-year timeline for the long range guiding principle of achieving top-25 status in selected categories.

### B. FACULTY AND FOCUS

(i) Faculty: The number of faculty in each department must be adequate to: (a) cover the undergraduate as well as graduate course offerings, and (b) allow a department to carve a place for itself in selected "signature" areas of research. Not all departments in NCE have the number of faculty to make the latter possible. Additional faculty need to be recruited in these departments to maintain class size and quality while allowing adequate time to develop rich research programs. Other departments that do have the required number of faculty members will not be able to compete with top-ranked departments due to faculty issues mentioned above. New faculty with strong research credentials need to be recruited in these departments also in order for the departments to be competitive in the USNWR metrics. A preliminary analysis of faculty strengths in each department indicates that 60 new faculty members will enable NCE to reach its long term goal.

**Recommend:** NCE recruit a total of 60 faculty members in strategically selected 'signature' areas over the next five years.
Focus: Accounting for the current faculty strength of about 115 plus the target faculty strength in the future, NCE is a small to moderate size college of engineering. Colleges of Engineering like Purdue, Michigan, North Carolina State and others boast a faculty of 350+. In its quest to be in the top-25 ranks, NCE will inevitably compete with larger colleges of engineering. It cannot afford to offer as many courses and specializations as large schools do, nor can it dilute its research focus by engaging in a large number of research areas. In contrast, smaller colleges of engineering have competed well historically by focusing and truly excelling in a small number of areas. It is critical that NCE adopt this same proven strategy and focus all its energies and investments in strengthening small number of “signature” areas selected.

The National Academy of Engineering recently described 14 areas of interest to humankind as Grand Challenges for Engineering (Appendix B.1). The next three decades will see engineering academia focus on these Grand Challenges. Reputations will be made by those who leave a significant impact in one or more Grand Challenge topics. NJIT, at the university level, is currently engaged in its Strategic Planning process. This process describes six areas as “thematic” (Appendix B.2) – ones in which NJIT will focus its investments. Thematic areas that NJIT will pursue overlap those outlined by NAE in the Grand Challenges. NCE must ensure that the signature areas that it selects belong in that overlap. Furthermore, thematic areas at NJIT evolve and new areas are selected every five years. Given that we will be focused on a 15-year overall goal, the signature areas must be flexible and have the potential of being areas of interest to humankind over an extended period of time.

**Recommend:** NCE focus on a select number of overall signature areas. These areas should be flexible and have the potential of generating interest over an extended period of time. The individual departments, in turn, should have two to three focus areas of their own that are consistent with the signature areas of NCE.
C. RESEARCH

The decision to be a research based university was made by NJIT several decades ago. We are classified as a Ph.D. granting research university, and metrics that correspond to this class of universities are applied by USNWR for our assessment and ranking. NCE must, therefore, perform consistent with these metrics, which tend to be weighted heavier towards research accomplishments. Since research is now considered central to the adequate education of an engineering student even at the undergraduate level, any strategic plan developed for NCE should take a careful look at our research culture and our performance and standing in research relative to our peers as well as top ranked colleges in the US.

The parameters that assess the research standing of a college are: (a) Student to Faculty Ratio (doctoral students per faculty and masters students per faculty), (b) Doctoral Degrees Awarded, (c) Total Research Expenditures, and (d) Average Research Expenditure per Faculty. At this time, our scores are behind in these areas compared to our peer colleges and most certainly compared to those in the top ranks (See Appendix C). A serious plan to rectify this situation needs to be formulated by NCE faculty.

Moving forward in research will require the right investments and incentives. Significant additional resources are not available in the foreseeable future other than those that may result from increases in enrollments in NCE. While a growth in enrollment produces additional revenues, it also places additional demands on the college. Supporting NCE to become a leader in research will primarily derive from the adjustment of present resources and future investments.

Detractors from research often claim that building research excellence takes away from the education mission of the College. Done right, a research environment improves the quality of education and helps in attracting top students. The research infrastructure that we build will complement our education mission. Inquiry based learning, facilitated by involving students at all levels in research, has been shown to be highly effective in
helping students learn how to learn. Data are also available that clearly show that graduate reputation drives undergraduate reputation in US engineering colleges. Accordingly, the research infrastructure that we will build will complement our education mission.

Recommend: NCE faculty and administration make an unfailing commitment to creation and dissemination of new knowledge via research at all levels to achieve our long-term goal.

D. STRATEGIC PRIORITIES

In order to excel in the metrics of USNWR for ranking of engineering colleges, NCE plans to target seven areas. These include:

1. Undergraduate and Master’s Studies. Impacts (a) Peer Assessment, (b) Recruiter Assessment, and (c) Student Selectivity.

2. Graduate Research and Doctoral Studies. Impacts (a) Peer Assessment, (b) Doctoral Degrees Awarded, (c) Total Research Expenditures, and (d) Average Research Expenditures per Faculty.

3. NCE Culture and Environment. Impacts (a) Percent of faculty in NAE, (b) Doctoral Degrees Awarded, (c) Total Research Expenditures, and (d) Average Research Expenditures per Faculty.

4. Space and Infrastructure. Impacts 1 and 2.

5. External Visibility. Impacts (a) Peer Assessment, and (b) Recruiter Assessment.
6. Alumni and Corporate Relations. Impacts (a) Recruiter Assessment, (b) Total Research Expenditures, and (c) Average Research Expenditures per Faculty


Recommend: NCE develop clear goals, strategies, objectives, metrics and benchmarks in each of the seven areas and closely monitor progress in these areas throughout the Strategic Planning period.
F. STRATEGIC PRIORITIES: STRATEGIC OBJECTIVES and TACTICS

A preliminary list of Strategic Objectives under each of the Strategic Priorities is given below. The final list of Strategic Goals will be developed by faculty groups. For each of the goals, the faculty will also help develop tactics for their achievement as well as metrics to determine progress over time.

1. Strategic Priority: Undergraduate and Master’s Studies
   NCE’s traditional strength has been its undergraduate programs that have helped produce world class engineers. We must continue to build while strengthening our undergraduate programs. In recent years, the Masters degree has come to be viewed as the entry level degree into the profession. This view is strongly supported by NCE. Our Masters programs should build on our undergraduate programs to produce world leaders in engineering. The following Strategic Objectives are recommended in this regard:

   (i) Enhance college wide curricula.

   (ii) Enhance freshman matriculation and retention.

   (iii) Promote inquiry based learning.

   (iv) Align master’s degree programs towards industry needs and professional preparation.

2. Strategic Priority: Graduate Research and Doctoral Studies
   The graduate reputation of a college drives its undergraduate reputation. The future success of our graduate and research programs will establish NCE as a leader in engineering education. In order to make an impact, NCE will need to increase the number of doctoral students as well as the quality of research undertaken by its students and faculty. We will also need to be engaged in
research topics that are of current relevance. The following Strategic Objectives are recommended in this regard:

(i) Create clusters of research strength in signature areas.

(ii) Increase pool of graduate students applying for doctoral studies.

(iii) Increase number of graduate students working towards doctoral degrees.

(iv) Increase research funding and graduate student support.

3. **Strategic Priority: NCE Culture and Environment**

The driving force behind any initiative in NCE is its faculty and staff. For the accomplishment of its goals and objectives, this Strategic Plan relies heavily on the quality of faculty and its involvement. The following Strategic Objectives are recommended in this regard:

(i) Facilitate the improvement of faculty/staff quality and productivity.

(ii) Recruit, retain and renew world-class faculty.

(iii) Provide efficient administrative support to faculty, staff and students.

4. **Strategic Priority: Space and Infrastructure**

NCE has decided on a highly ambitious agenda of creating a world class college that excels at the integration of life sciences and engineering in all departments. Life Sciences require extensive space and infrastructure. Additionally, our undergraduate laboratories are getting old and increased enrollments will further
strain these resources. We must pay serious attention to the issues of space and infrastructure, primarily when growing new programs. State-of-the-art physical environment and facilities are key to promoting exceptional productivity and creative collaborations. The following Strategic Objectives are recommended in this regard:

(i) Expand and enhance undergraduate laboratories.

(ii) Enhance current research laboratories and invest in new laboratories for new faculty with research focus.

(iii) Create office space for graduate students, postdoctoral fellows and researchers.

5. **Strategic Priority: External Visibility**

The actions and initiatives listed in this plan will inevitably lead to significant improvement in quality and bring accolades to NCE. While it is of critical importance to continue refining and building such activities, it is also critical to widely promote NCE’s successes through an integrated marketing and communications plan. The following Strategic Objectives are recommended in this regard:

(i) Enhance communication, marketing and media relations.

(ii) Promote NCE’s excellence in engineering as well as accomplishments of its faculty and students.

6. **Strategic Priority: Alumni and Corporate Relations**

NCE has a strong record of placement of its students. While most top companies recruit on campus, many do not. NCE also does not fare strongly on the Recruiter
Assessment Score in the USNWR rankings. Specific Strategic Objectives need to be developed to enhance academic corporate relations.

7. **Strategic Priority: Development Efforts**

NCE does not derive full benefit from its alumni network. For some time, the main activity of NCE’s development efforts has been the annual event “Salute to Engineering Excellence”. The realization of the goals, priorities, and objectives of the current strategic plan will require support from the alumni and corporate sector as well as additional sources of revenue. The following Strategic Objectives are recommended in this regard:

(i) Substantially expand NCE’s Development Office.
QUALITY ASSESSMENT (weighted by .40)

**Peer Assessment Score (.25)** - In the Fall of 2008, engineering school deans and deans of graduate studies at engineering schools were asked to rate programs on a scale from marginal (1) to outstanding (5). Those individuals who did not know enough about a school to evaluate it fairly were asked to mark "don't know". A school's score is the average of all the respondents who rated it. Responses of "don't know" counted neither for nor against a school. About 55 percent of those surveyed responded.

**Recruiter Assessment Score (.15)** - In the Fall of 2008, corporate recruiters and company contacts who hire from previously ranked programs were asked to rate programs on a scale from marginal (1) to outstanding (5). Those individuals who did not know enough about a school to evaluate it fairly were asked to mark "don't know." A school's score is the average of all the respondents who rated it. Responses of "don't know" counted neither for nor against a school. About 28 percent of those surveyed responded. For the purpose of calculating this year's rankings, the two most recent years' recruiters' survey results were averaged and were weighted by .15.

STUDENT SELECTIVITY (weighted by .10)

**Mean GRE Quantitative Scores (.0675)** - The mean quantitative score of the Graduate Record Examination for master's and doctoral students entering in the Fall of 2008.

**Acceptance Rate (.0325)** - The proportion of applicants to the master's and doctoral programs who were offered admission for Fall 2008.
FACULTY RESOURCES (weighted by .25)

Student to Faculty Ratio - The ratio of full-time doctoral students to full-time tenured or tenure-track faculty (.075) and full-time master's students to full-time tenured or tenure-track faculty (.0375) in the Fall of 2008.

Percent of Faculty in the National Academy of Engineering (.075) - The proportion of full-time tenured or tenure-track faculty who were members of the National Academy of Engineering in the Fall of 2008.

Doctoral Degrees Awarded (.0625) - The total number of doctoral degrees granted in the 2008 school year.

RESEARCH ACTIVITY (weighted by .25)

Total Research Expenditures (.15) - The total externally funded engineering research expenditures. These expenditures refer to separately funded research, public and private, conducted by the school and are averaged over the 2007 and 2008 fiscal years. The definition for research expenditures is set by the American Society for Engineering Education.

Average Research Expenditures Per Faculty Member (.10) - The average amount of externally funded engineering research expenditures per full-time faculty member averaged over the 2007 and 2008 fiscal years.

Overall Rank - Data were standardized about their means, and standardized scores were weighted, totaled, and rescaled so that the top-scoring school received 100; others received their percentage of the top score.

Specialty Rankings - These rankings are based solely on assessments by department heads in each specialty area. Department heads in their specialty area rated the other
schools that offered a doctoral degree in the specialty on a 5-point scale. Those schools with the highest average scores appear here. Names of department heads and the names of their respective engineering schools that grant a doctoral degree in that specific area came from the American Society for Engineering Education.

Specialty rankings were out of 55 schools with aerospace/aeronautical/astronautical engineering; 89 schools with bioengineering/biomedical engineering; 125 with chemical engineering; 143 with civil engineering; 142 with computer engineering; 170 with electrical/electronic/communications engineering; 94 with environmental/environmental health engineering; 73 with industrial manufacturing engineering; 90 with materials engineering; 164 with mechanical engineering; 25 with nuclear engineering; 26 with petroleum engineering.
APPENDIX B

B. 1 NAE Grand Challenges in Engineering

1. Make solar energy economical.
2. Provide energy from fusion.
3. Develop carbon sequestration methods.
4. Manage the nitrogen cycle.
5. Provide access to clean water.
6. Restore and improve urban infrastructure.
7. Advance health informatics.
8. Engineer better medicines.
12. Enhance virtual reality.
14. Engineer the tools of scientific discovery.

Ref: http://www.engineeringchallenges.org/cms/challenges.aspx

B. 2 NJIT 2010-2015 Thematic Areas

1. Applied Life Science and Engineering
2. Alternative Energy
3. Sustainable Systems
4. Healthcare Systems
5. Digital ‘Everyware’
6. Design Professions

## APPENDIX C

### NJIT COMPARISON WITH TOP RESEARCH UNIVERSITIES

<table>
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<tr>
<th>Rank</th>
<th>University</th>
<th>OS</th>
<th>Peer</th>
<th>Recr</th>
<th>GRE</th>
<th>Acc (%)</th>
<th>Stu / Fac</th>
<th>Rsch</th>
<th>Rsch / fac</th>
<th>Grad</th>
<th>Ph.D.</th>
<th>NAE (%)</th>
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<td>MIT</td>
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<td>5.0</td>
<td>4.8</td>
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<td>4.5</td>
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<td>5.7</td>
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<td>1,774</td>
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<td>1,327</td>
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*OS = Overall Score
*Peer = Assessment Score
*Recr = Recruiter Assessment Score
*GRE = '08 Average Quantitative GRE Score
*Acc (%) = '08 Acceptance Rate
*Stu/Fac = '08 Ph.D Student/Faculty Ratio
*Rsch = 2008 Engineering School Research Expenditures (in millions)
*Rsch/Fac = Research Expenditures per Faculty (in thousands)
*Grad = Total Graduate Engineering Enrollment
*Ph.D. = Ph.D.'s granted 2007/08
*NAE (%) = Faculty Membership in National Academy of Engineering