

**University of Houston
Cullen College of Engineering**

**Strategic Plan
2008 – 2013**

A. Introduction

Throughout its 67-year history, the University of Houston's Cullen College of Engineering has grown at an expected and commendable rate. Research expenditures have risen, the quality of the student body has improved, and college-wide academic and outreach programs have evolved.

The Cullen College of Engineering, however, has been challenged to take a leadership role in the university's endeavor to become a Top Tier research institution. Therefore, the college has redeveloped its Strategic Plan, based on input from college leadership, faculty, staff and alumni, to provide calculated measures and targeted initiatives as a means of propelling the college from its current position to nationally-recognized status.

To meet this challenge, the Cullen College will raise its expectations substantially— more rigorous academic curricula will be developed, annual research expenditures will be doubled (if not tripled), and the college will successfully raise external funding for construction of a new building and renovation of existing space. In addition, we will seek more support for professorships, graduate student fellowships and undergraduate student scholarships.

The college is also preparing to play a more significant role in the economic development of the region by forming partnerships to advance research in areas of national need, including energy, biomedical engineering (BME), nanotechnology, infrastructure and the environment. The college will also advance its educational offerings by launching expanded programs in petroleum and biomedical engineering, as well as provide online graduate courses and specialized certificate programs.

The Cullen College will leverage its progress by aggressively marketing its academic and research programs to prospective faculty and students. The hallmark of the college will be contingent upon recruiting the best and brightest to its programs.

The following Strategic Plan presents the college's mission, vision and strategic initiatives to meet these goals. It focuses on several key elements that are essential for the continued advancement of the Cullen College among the ranks of the best engineering programs, and places an emphasis on the importance of quality and excellence in all aspects of the college.

Within the plan, there are numerous references and specific action steps in which the emphasis on excellence is highlighted. Moreover, the plan recognizes the importance of education, research and outreach, and focuses on strengthening the college in these areas through an integrated approach.

Strategic Initiative 1 calls for recruiting and retaining high quality personnel, including faculty, students and staff.

Strategic Initiative 2 delineates the development of programs directed toward educating a high quality technology workforce for the state, region and nation.

Strategic Initiative 3 outlines our plans for building an outstanding, comprehensive research program that would help propel forward the economy of the state, region and nation through the creation of new knowledge. This initiative requests the establishment of a number of major cross-disciplinary research programs directed at establishing the Cullen College as a significant contributor in these areas on a national scale. These programs include: Energy, alternatives and renewable, as well as fossil fuels; Biomedical Engineering; Nanotechnology; and Sustainability, the infrastructure and environment.

Strategic Initiative 4 prescribes a significant enhancement of the college's physical infrastructure to support the ambitious goals of Initiatives 1, 2 and 3.

Strategic Initiative 5 advocates that the Cullen College be an organization of relevance and impact in facilitating the economic development of the region.

Strategic Initiative 6 focuses on the college's outreach programs, including industrial partnerships, entrepreneurship programs and other new activities that will strengthen the Cullen College's role and effectiveness in technology transfer and economic development.

Finally, *Strategic Initiative 7* delineates external relations activities directed toward increasing philanthropic support to generate the resources required for the Cullen College to realize its educational and research goals. This will require significant improvement of college efforts to communicate its accomplishments to enhance its visibility and image.

B. Vision and Mission

The Cullen College of Engineering envisions its principal long-term goal to be the establishment of educational, research, and outreach programs of outstanding quality, as well as sufficient breadth and size, to fulfill the below-stated mission. Through a successful implementation of this Strategic Plan, we intend to become a key player in fueling the economic engine of the region, state, and nation by meeting the technical work force needs, advancing the state of knowledge through basic and applied research, and facilitating technology transfer through proactive establishment of partnerships with industry and government laboratories. By staying focused on the plan and achieving its goals, we aspire to be an internationally-recognized, top-ranked college of choice for student and faculty scholars that provides exceptional education and innovative research. Our success will be measured by educating future leaders and providing engineering solutions for the region, the nation and the global community

The mission of the Cullen College of Engineering at the University of Houston is to serve the Greater Houston community, Texas and the nation by educating engineers to assume leadership positions in the identification and solution of the complex technical challenges of society, to advance the state of knowledge through pioneering research and scholarly work, to facilitate the transfer of new technology to Texas and U.S. industries, to play a key role in economic development for the Greater Houston region and the State of Texas, and to benefit the public sector through service to the university, community, industry, government and the engineering profession.

C. Strategic Initiatives

The Cullen College of Engineering enjoys a proud history of serving the workforce and technological needs of the Greater Houston region. The Cullen College is prepared to aggressively move forward to achieve higher levels of excellence with the intent of becoming one of the best public engineering schools in the nation. To help us focus our attention and energy, to create a sense of direction for the college community, and to accelerate our progress toward achieving the highest levels of excellence, this Strategic Plan includes seven “strategic initiatives” that collectively describe the framework for action within the Cullen College in the next five years (2008-2013). These initiatives are outlined below.

Strategic Initiative 1: Recruit and retain high quality faculty, staff, graduate and undergraduate students

Strategic Initiative 2: Provide innovative undergraduate and graduate degree programs, as well as specialized certificate programs

Strategic Initiative 3: Conduct pioneering research in areas of national and regional need

Strategic Initiative 4: Build quality infrastructure that includes “state of the art” education and research facilities and services

Strategic Initiative 5: Become a strategic partner in the economic development of the region

Strategic Initiative 6: Expand the college's outreach and service programs through continuing and extended education, industrial partnerships, entrepreneurships, and technology transfer

Strategic Initiative 7: Establish an effective external relations operation to significantly increase philanthropic support to realize the education and research goals of the Cullen College

These initiatives are intended to impact all major aspects of the college, and are directed at promoting excellence across the college and increasing the visibility and influence of our programs, both regionally and nationally. Decisions on allocation of resources (human, fiscal and capital) must be carefully weighed to ensure a successful implementation of the Strategic Plan. Further, the success of this plan is heavily dependent on the engagement of the entire college community in helping advance these goals and implement the action steps outlined below.

Strategic Initiative 1: Recruit and Retain high quality faculty, staff, graduate and undergraduate students

- Create an innovative “Honors” curriculum for undergraduates to provide a highly competitive and challenging engineering-based option. Integrating with the strategic initiative of the university to enhance undergraduate research, such an honors curriculum in the CCOE will help complement the Industrial Scholars Intern Program, a successful program to recruit and retain the best undergraduate students.
- Provide a challenging yet collegial work environment for faculty and staff.
- Engage in “cutting-edge”, funded and publishable research in modern facilities.
- Be ranked in the top 50 Engineering Colleges by USNWR.

Strategic Initiative 2: Provide innovative undergraduate and graduate degree programs

- Continuously upgrade curricula to keep with the times, including new undergraduate program in Petroleum Engineering and graduate program in Biomedical Engineering. Development of online and distance education programs, initially at the graduate level, will help the CCOE serve an important and increasing group of highly proficient students.
- Provide experiential learning opportunities for undergraduates to stimulate innovation and open-ended problem solving
- Provide extensive undergraduate research opportunities
- Provide rigorous graduate courses that prepare students for pioneering research

- Provide research programs with quality and breadth on technical problems of national interest
- Provide specialized certificate programs that foster our continued interactions with industry and the community.

Strategic Initiative 3: Conduct pioneering research in areas of national and regional need

- Enhance research activities in the four strategic research clusters through hiring and multi-PI research initiatives that cut across academic disciplines
 - Nano-Materials: Build on the existing major strengths in soft and hard materials with impact on research developments in energy, biomedical, sustainability and information technologies.
 - Energy and Natural Resources: Grow in alternative and renewable energy, and advanced fossil fuel technologies.
 - Biomedical Sciences & Engineering: Aggressively grow biomedical and biomolecular engineering research in emerging BME program and in other disciplines.
 - Sustainability: Enhance the research focus on the environment, the infrastructure and sustainable engineering with broad regional, national and global impact.
- Develop at least one nationally-recognized, federally-funded research center in the next three years

Strategic Initiative 4: Build quality infrastructure that includes “state of the art” education and research facilities and services

- Conduct a college-wide space audit to assess the quality and utilization of space in the college, and develop a long-term facilities plan.
- Replace the “Y” building with a building complex dedicated to serving the needs of both undergraduate and graduate students.
- Engage both our industrial and alumni partners to provide resources for improving the quality of engineering student life at UH
- Develop and maintain an innovative laboratory experiences for our students.
- Renovate space in the existing engineering buildings to raise the educational and research impact.
- Develop a technical support infrastructure commensurate with our high quality research and education aspirations.

Strategic Initiative 5: Become a strategic partner in the economic development of the region

- Increase interactions with industry within the greater Houston region by applying our strengths in
 - Energy – alternate energy paradigms including wind, solar, biofuels, fuel cell technologies and advanced hydrocarbon (oil & gas) recovery methods.
 - Materials – nano-structured, electronic, polymeric, catalytic, biological
 - Environment – water and air quality, clean diesel technologies, air quality modeling

- BME – sensing, neuro-engineering, imaging, bioanalytical, biomolecular engineering, drug delivery
- Urban Infrastructure including hurricane, storm water and disaster preparedness and response.
- K-12 partnerships to increase the student pipeline in engineering.

Strategic Initiative 6: Expand the college's outreach and service programs in continuing and extended education, industrial partnerships, entrepreneurships, and technology transfer

- Improve access through “online” graduate degree programs as well as strategic undergraduate offerings
- Offer certificate programs that through partnerships with the management school, law school (health & energy law in particular) and regional medical schools
- Encourage faculty and student entrepreneurship activities and aggressively pursue collaborative research programs with industry, as well as programs that lead to technology transfer and economic development of the region
- Collaborate with Community Colleges to create seamless transfer opportunities for undergraduate students
- Place students in highly sought industries through our Career Center

Strategic Initiative 7: Establish an effective external relations operation to significantly increase philanthropic support to realize the education and research goals of the Cullen College

- Establish an Engineering Advancement Office, directly reporting to the Dean, to oversee and coordinate all development, alumni relations, corporate and foundation relations and communications activities of the college
- Strengthen the college’s development staff and infrastructure to significantly increase funding for the college’s strategic initiatives
- Develop programs for strengthening existing ties and establishing new relationships with corporations and individuals
- Engage the Cullen College of Engineering Leadership Board as an intellectual and practical resource to achieve the goals and aspirations of the college, emphasizing their leadership role in development
- Design and initiate a comprehensive campaign to fund the aspirations of the strategic plan
 - Set goal of securing at least \$15 million in philanthropic support per year by 2013
 - Increase emphasis on individual major gifts (\$100,000 plus) development efforts through the identification, cultivation and solicitation of prospects
 - Implement a strategy to increase the alumni giving rate to 20% of all engineering alumni
 - Raise \$30 million to fund the design and construction of the new engineering building

D. Leveraging Our Strengths

Successful implementation of this plan requires that there be broad and enthusiastic support for its spirit and goals by the Cullen College students, alumni, faculty and staff, administrators and external constituencies. Moreover, it is equally essential that we leverage our strengths in quality educational programs, research and scholarship, and engineering education outreach throughout the implementation process.

Strength: Quality Education with a Personal Touch

The College's motto is emphasized by personal interactions with prospective students prior to and throughout the application and enrollment process. The recruitment process incorporates an aggressive recruiting strategy that is strongly aligned with our Honors College to increase the numbers of high quality undergraduates, and our graduate efforts are based on partnering with universities in the U.S. and selected international venues to identify outstanding students.

Once enrolled, we will provide students with

- an abundance of professional development activities through our Career Center
- academic excellence workshops that enhance student learning
- robust student organizations
- well-equipped laboratories and computer facilities.

Strength: Research and Scholarship

The College's research strengths, as measured in research expenditures, journal publications and PhD graduates lie in Materials, Energy, Bioengineering, and Sustainability (environment and infrastructure). Our faculty hiring plan will be focused in these areas.

- Expectations
 - Annual research expenditures: Expectations are for at least \$350K per faculty member
 - MS and PhD Graduates: Expectations are that MS and PhD graduates will approach 2.0 and 1.0 per FTE faculty member per year, respectively, within these areas at steady state
- Challenges
 - Start-up packages: Start-up funds needed are on the order of \$400K to \$700K per faculty member
 - Space: Lab space associated with SERC and our Space Utilization Plan will have to strongly correlate with faculty hires

Strength: Engineering Education Outreach

To respond to the needs of the State of Texas and the nation for more engineering graduates and to provide a highly capable technical workforce, the Cullen College of Engineering at the University of Houston has robust, externally-funded programs that are designed to:

- recruit a new generation of engineering students
- retain present engineering students in greater numbers
- encourage existing engineering students to consider graduate education opportunities

E. Action Items

This section of our plan cites specific action items for the realization of plan implementation. These action items address specific issues related to educational programs, research, faculty mentoring, communications, development and staffing.

Action Item: Educational Programs

- Develop Honors Undergraduate Curriculum within the Cullen College
 - Sub-committee to be formed and handed charge to devise lower division curriculum and upper-division synergistic curriculum, subject to ABET criteria
 - Draft curriculum and course loads to be determined by November 15th 2008
 - Implementation in Spring 2009 to raise quality and integrate with University emphasis on undergraduate research.
- Integrated BS/MS program needs to be expanded
 - Identification of programs and curricular needs that will be best candidates.
 - Begin at least 2 additional BS/MS accelerated programs by Fall 2009
- Internet Delivery of Degree Program Debuts in 2009 with Petroleum Engineering
 - Develop at least one similar MS program in each department
 - Expand certificate and short course delivery throughout the college
- Delivery of courses in Research Methodology and Research Ethics for campus-wide use: Dovetails QEP and SACS
- Expand International Programs at both the graduate and undergraduate levels

Action Item: Research

- Provide Incentives for IDC generating research
 - IDC return to be structured different and to be worked on by a committee during Fall 2008, in line with the overall changes in the university-wide IDC distribution
 - Seed programs within college towards development of national research centers.
- Identification of Major Research Thrust Growth Areas
 - Significant Issue: Start-up funds and compatible research space.
 - Research Opportunities and Multi-PI efforts encouraged through programs such as the seed program.
 - Research Faculty growth in strategic areas.
- Development of National Center (3-year timeframe)
 - Wind and Alternate Energy Program
 - Diesel/Engines Testing and Research, and Air Quality Modeling
 - Infrastructure (water, hurricane, environment)

- Nanomaterials
- Biomedical Research
 - Development of Partnership with Medical Center
 - Strong growth of BME Department in targeted research areas
 - Complementary growth of Biomedical and Biomolecular research in other academic departments
- SERC and Core Facilities
 - Clean Room: Operational Fall 2008; Materials Characterization Core: Summer 2009
 - BME: 2nd Floor of SERC
 - Molecules: 5th Floor
 - Bio-Safety Laboratories
 - Neuro-Cognitive Research

Action Item: Faculty Mentoring

- Junior Faculty
 - Provide orientation to Research Environment; Core Facilities; Grants Process
 - Assist faculty in Career Award and Other Junior Award applications
 - Meet twice annually with College Mentoring Group
 - Have annual meetings with Dean in small groups
- All Faculty
 - Establish college-wide Awards Committee
 - Identify and pursue college-wide research opportunities: Agency Updates and Seminars
 - Have targeted College-Wide Seminars
 - Integrate Student-Symposia across College
 - Have annual meetings with Dean in small groups

Action Item: Communications

- In the process of reorganizing and clearly defining duties and responsibilities of associate deans
- Examine our support infrastructure (academic, development, technical) to optimize resources
- Welcome opportunity to attend faculty meetings
- Have monthly meetings with faculty groups for the purpose of exchanging ideas
- Promote open door policy in Dean's Office
- Have monthly e-communicate from Dean's Office
- College-wide website improvements and changed focus of college magazines

Action Item: Development

- Establish a tradition of Alumni Luncheons (timelines; alumni list, etc) for all departments
- Donor visits to College and labs (open house dates for attracting graduate students also)
 - Showcase labs in thrust areas
 - Involve student and faculty ambassadors in visits
- Identify and cultivate strategic partners for individual departments and thrust areas
- Establish new development team dedicated to the Cullen College

- Replace Y-Building

Action Item: Staffing

- Clarify reporting of staff duties in College
- Identify of staff resources across college
- Identify potential synergies throughout College
 - Machine shops; Electrical shops; Computing assistance
- Create a new staff position to assist faculty in grant preparation and grant writing

Appendix I

5 Year Strategic Growth Plan

As part of our strategic plan, the Cullen College of Engineering has identified the following thematic areas for future growth and development of the six academic departments and the college overall:

- Biomedical Engineering
- Energy
- Materials
- Sustainability (Environmental and Infrastructure)

The growth of the academic departments will be targeted to align with the College-wide and University-wide targeted growth opportunities. The growth plan specifically includes a combination of targeted senior hires along with well-aligned growth of faculty at all ranks. Specifically, three of the academic departments are poised for leadership change or new leadership (Civil & Environmental Engineering, Chemical & Biomolecular Engineering and Biomedical Engineering) in the short term, and the targeting of academic leadership for those departments will be aligned with these strategic growth initiatives. Additionally, efforts are underway to attempt to “acquire” a national center by hiring a faculty member who has established a national “NSF” funded center at a different university.

Over the next five years, it is estimated that the Cullen College of Engineering will hire 30 new faculty members to new faculty lines and will replace ~ 20 faculty members across the different academic programs. Of these, two strategic growth areas are in biomedical engineering and petroleum engineering. It is anticipated that the academic department of Biomedical Engineering will grow from the current strength of 2 faculty members to 12 in five years. On the other hand, Petroleum Engineering will grow to be a program with 6 faculty members of over the next five years.

On average each faculty member will require an average startup package of 500k and research space of ~ 1500 sq ft. The total startup commitment for the college would be to the tune of \$ 25 - 30M and additional research space of ~ 75,000 sq ft (25,000 sq ft for BME in SERC) will become necessary over the next five years. The College will need to leverage four to five Endowed Chairs (at \$2 million level) to recruit and retain star candidates and roughly six to eight Professorships (at the \$0.5 – 1 million level) for junior and mid-career faculty.

Core facilities for appropriate energy, biomedical, materials and infrastructure are also envisaged and will require a total of ~\$ 8M investment over five years. These will have impact

on not just the research undertaken in the Cullen College of Engineering, but also at the rest of the University and the collaborating institutions in the greater Houston area.

It is projected that in five years, with the full hiring, the Cullen College of Engineering would have annual research expenditures of \$ 25M, and in seven years sustained research expenditures of \$32M. The graduate population will significantly increase, with additional Masters-level enrollment increasing by 250 (headcount) and Doctoral-level enrollment by 150 in five to seven years. The undergraduate headcount would nominally increase to ~ 3000 students from the current level of ~ 2000.

I.1 Energy Cluster in CCOE

Vision

Develop a strong interdisciplinary team to address critical research and educational needs in the areas of energy engineering, including petroleum engineering, alternate energy solutions (such as wind energy, fuel cells, hydrogen and biofuels), and systems approach for energy storage, energy transport and sustainable development, including efficient construction.

Opportunities and Uniqueness

Houston has held a pre-eminent position as the global energy leader with ~ 50% of the area economy impacted by the energy industry. Several super-majors and numerous mid-major oil and gas companies along with oil service companies are headquartered in the Houston area. Significant workforce requirements and reduction of in-house R&D require strong interactions between industry and academia. In addition to interest in optimizing oil & gas exploration and production, many companies are also significantly interested in alternate energy methods. Texas is now the largest producer of wind energy in the US; with the potential for off-shore wind, the potential is significantly higher. We are uniquely situated: UG and doctoral Petroleum Engineering (PE) at UH is nascent (although a strong global MS level program exists) and can be tailored to the changing and paradigm shift in oil & gas exploration & production. We will become the national leader with the wind testing facility to be set up in Corpus Christi.

Current Status and Strengths

An undergraduate PE program is being established. The Provost has approved three faculty hires in the area of PE. We have no doctoral degree program as yet. A nascent wind energy program with large blade testing facility is being developed (CCOE in lead). The college's Diesel Engine Testing Center and strategic partnership with Ford provide the basis for leading efforts in conservation and minimizing environmental impact. Previously held MRSEC in oxide materials forms the basis for a strong effort in fuel cells. Superconductivity research and the maturation of the sciences enable engineering to be at the forefront of the energy transportation integration.

Materials for deep water oil pipeline insulations, and for use in LEED buildings are being developed. Engineering centers include: IIOR; Well Logging; CEAC; Diesel Testing; CIGMAT.

Strategy for Growth

We expect to grow the energy cluster efforts in the CCOE via (i) development of a doctoral program in Petroleum Engineering; (ii) hires in the area of (a) Petroleum Engineering (Drilling/completion; Flow Assurance; Reservoir Characterization; Intelligent Wells; Shale/Heavy Oil & Tight gas; Thermal EOR; Nanotechnologies); (b) Alternate energy strategies (wind, off-shore, hydrogen, fuel cells, biofuels); (c) Energy transport; (d) Energy Storage; (e) Sustainability; (f) Engines and Environment; and (g) Energy efficient construction; and (iii) development of integrated Masters-level programs that focus on (a) Energy Economics/Energy Management and (b) Integrated Reservoir Characterization with Geosciences; and (c) development of novel delivery mechanisms for Masters courses. Partnerships with local industry, along with State-supported initiatives that build on state supported wind and engine testing program, provide platforms for shared resource development and management. While 6 to 8 positions will directly be tied to the Integrated Petroleum Engineering program, an additional 4 to 6 positions in the other areas to build on existing core-strengths are required to develop a critical mass.

I.2 Materials Science and Engineering Cluster in CCOE

Vision

To develop a *transdisciplinary* and strong materials science and engineering cluster with emphasis on applications of nanomaterials in electronics, wireless technology, advanced lighting, and structures including aerospace; biomedical science and engineering; alternate energy and energy storage and transportation and sustainable environment.

Opportunities and Uniqueness

Materials science and engineering has been a transdisciplinary strength at the University of Houston. Significant opportunities for the application of materials, especially nanomaterials in technological applications ranging from electronic materials, magnetic storage, advanced lighting, drug delivery systems, construction and repair materials and sustainable environment, are being considered at the federal, state and industrial level and are a natural extension of the large investments in nano-science over the last decade. The unique combination of the energy and chemical focus of the industry in the Houston area, along with NASA and the expanding medical research arena in Houston, with the unique strengths of UH provides a natural platform for the expansion and growth of critical mass in this area.

Current Status and Strengths

We have leading efforts in the CCOE across the various engineering disciplines in materials. Some of the highlights include (a) the nanoelectronics and nanomagnetics group (2 NIRTs funded & 2 centers); (b) the nanomaterials for aerospace group (NASA-URETI program); (c) advanced multifunctional polymeric materials (NIRT); (d) Off-shore technologies (CEAC) and wind energy testing center; (e) Center for Innovative Grouting Materials Technology (CIGMAT). Combined with strong Mechanical, Chemical, Civil and Environmental Engineering departments with strength in materials, mechanics, and catalysis – along with the strength in materials across campus (TcSUH, CAM and the past MRSEC on oxide materials) – as well as the recent hires in the CCOE (Donnelly, Litvinov, Brankovic, Ruchhoeft, Sharma, Larin, Selvamanickam, Liu, Lim, Strasser & Doxastakis) and the development of the clean room and other core facilities at UH, puts the CCOE at a unique position to grow this cluster effort.

Strategy for Growth

To develop a national center such as MRSEC or ERC in the area of materials, we are requesting that the CCOE be allowed to hire 9 faculty in the areas of (a) Nanoelectronics; (b) Nanomagnetics; (c) Nanofluidics; (d) Off shore materials; (e) Computational Catalysis; (f) Multifunctional Materials; (g) Materials for Energy; (h) Construction and Repair Materials; (i) Sustainable Environment; and (j) Biomedical Applications. Additionally, development of the

clean room and the ancillary characterization facilities, including high resolution electron microscopy, focused ion beam and x-ray scattering, are crucial elements that are critical for the success of the materials cluster.

I.3 Biomedical Sciences and Engineering Cluster in CCOE

Vision

Develop a strong doctoral-granting biomedical engineering competence at the University of Houston that can partner with scientific, translational and clinical collaborators in the Texas Medical Center and developing Health Science Center and Medical Schools at the University of Houston.

Opportunities and Uniqueness

Biomedical research and especially that dealing with the translation element is one of the new frontiers of engineering. Relying on the core of strength in the physical, chemical and biological sciences along with strengths in existing engineering programs, UH is positioned ideally to lead the efforts in BME. We have a unique opportunity to create a research program in BME that has close ties to the scientific and engineering community at UH and the scientific, translational and clinical expertise of possible partners at TMC.

Current Status and Strengths

An undergraduate program has been established. There are two research-active, full-time faculty in the BME program. A doctoral degree program is being established. Strengths include a strong neuro-engineering program, bioanalytics research and biomolecular engineering. Within the University, the formation of IBIS and strong thrusts in biomedical sciences will foster synergistic growth. The Methodist Hospital is a strong partner in TMC, and the Alliance for NanoHealth is a healthy partner for growth. One substantial advantage is the existence of a clean room facility (silicon emphasis) along with strong animal care facilities and gene sequencer at the University.

Strategy for Growth

A cluster hire that promotes the Biomedical Engineering portfolio is suggested. Areas for growth include: (a) Bioanalytics; (b) Bioimaging; (c) Biodevices and biosensors; (d) Neuro-engineering; (e) Gene & Tissue engineering; (f) Proteomics and Protein Therapies. In the CCOE, we expect over the next three years to hire 12 faculty members to build on core competencies that already exist and create new ones. Primary targets include: (a) Department Chair of the Biomedical Engineering Department; (b) Two additional senior hires + 9 Assistant or Associate Professors.

I.4 Environmental & Infrastructure (Sustainability) Cluster in CCOE

Vision

Grow and enhance the research focus on the environment, infrastructure, and sustainable engineering and thereby gain pre-eminence both locally and nationally.

Opportunities and Uniqueness

Houston is the fourth largest metropolitan area with ~ 30% of the petrochemical industry focused here. The Greater Houston area has a population of ~5 million, which is expected to double in the next 20 years, and is home to the world's largest medical center and the second busiest port in the country. In addition to complex air quality related problems, protection and sharing of water resources and protection from natural disasters such as hurricanes and flooding are paramount to the economic well-being of the nation. Nationally, the aging of water, wastewater, highways and oil & gas pipelines and transportation logistics during natural disasters have attracted significant interest.

Along the Gulf Coast, outside of Florida and Louisiana, no national research centers focusing on disaster mitigation, flood modeling and sustainable development exist. UH is uniquely positioned to partner with local industry, local authorities and with other academic institutions to develop a strategy to address these current limitations.

Current Status and Strengths

Education and research in environmental and infrastructure engineering have been primarily housed in the Department of Civil and Environmental Engineering. Significant expertise lies in the areas of water quality and treatment, flood modeling, structural materials, repair materials and non-destructive testing, air quality modeling, high performance computing aided facial and threat modeling, diesel engine testing for NO_x/SO_x reduction, and characterization and apportionment of airborne particulate matter. In particular, the faculty is nationally recognized for developing advanced water purification techniques such as membrane filtration and ion exchange as well as in soil and groundwater remediation. Existing centers within the CCOE include: (a) Center for Innovative Grouting Materials and Technology (CIGMAT); (b) Severe Storm Prediction, Education and Evacuation from Disaster (SSPEED); (c) The Diesel Testing Center; (d) Southwest Public Safety Technology Center (SWTC) and (e) Texas Hurricane Center for Innovative Technology (THC-IT). On-going research in NSM in Geosciences, Computer Science, and Mathematics, with modeling for air quality issues and environmental and face recognition technologies, complement the efforts in CCOE.

Strategy for Growth

Growth in Environmental, Infrastructure and Sustainability engineering is crucial for the growth of the CCOE. Clearly significant strengths in terms of the academic program and the various centers are an ideal springboard. The growth strategy is two-fold: (a) Developments and upgrades to the existing research infrastructure; and (b) Growth of faculty in critical areas to grow beyond critical mass. Specific areas of growth include (a) advanced water and wastewater purification methods and sustainable infrastructure, (b) environmental impacts of alternative fuels and manufactured nanomaterials, (c) flood sensing and modeling, (d) air-quality modeling and mitigation especially related to airborne particulate matter, (e) water quality improvement and modeling, (f) hurricane-resistant materials and structure, and (g) diesel testing and modeling NOx reductions.