College of Engineering and Computer Science Strategic Plan

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September 15, 2010

Content

I. INTRODUCTION

The College of Engineering and Computer Science at the University of Central Florida was founded in 1969 as the College of Engineering. In 1999 it became the College on Engineering and Computer Science (CECS) as a result of the merger of the School of Computer Science with the College of Engineering. Due to severe budget cuts in 2009 the University decided to eliminate the Engineering Technology Department in the college at the end of the Spring 2011 semester. This strategic plan is therefore primarily focused on the four departments that will constitute the college as of the Fall semester of 2011. These departments are:

- Electrical Engineering and Computer Science: EECS
- Mechanical, Materials, and Aerospace Engineering: MMAE
- Civil, Environmental and Construction Engineering: CECE, and
- Industrial Engineering and Management Systems: IEMS.

In the Fall semester of 2010, the college consisted of 110 tenure and tenure-track faculty and enrolled 5,886 undergraduate and 1,292 graduate students. In addition to these faculty members the teaching mission of the college is supported by 13 lecturers and visiting faculty as well as 46 adjuncts. Research expenditures in FY09 amounted to $20M.

Our ability as a college to be competitive in the State of Florida and nationally will depend heavily on how well we plan to move forward. During the Fall semester of 2009, Dr. Marwan A. Simaan, dean of the college, asked each of the four departments to perform a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis as a part of the college strategic planning process. The four SWOT analyses were then combined into one common college-wide SWOT diagram which is summarized below:

	Positive	**Negative**
Internal	**Internal Strengths** • Strong and dedicated faculty and staff • Strong ties with Local government and industry • Synergies across disciplines • Strong Funding in select areas • Strong undergrad programs throughout the college	**Internal Weaknesses** • Insufficient Resource (faculty positions, raises) • Lack of Quality Laboratories • Inability to attract top students • Inability to attract and retain top faculty • Low level of peer reviewed funding across • UCF/College reputation is not as good as we'd like
External	**External Opportunities** • Supportive local industry • Leverage Industry funding to attract federal funding • Emerging education/research areas: 1) Bioengineering 2) Energy 2) Systems Engineering 3) Infrastructure (water, transportation) 4) Smart materials, sensors	**External Threats** • Florida's budget • Competition from FL universities (UF) • K-12 education in Florida • Emerging satellite campuses in central Florida • On line course delivery • Uncertainties in local economy and companies (eg. KSC)

This resulting college SWOT was discussed and vetted at length by the college Planning and Budgeting Committee (PBC). This committee consists of the college leadership (Associate Deans and Chairs) and elected faculty members representing the three professorial ranks, and an elected member of the staff. The college SWOT was also presented by Dean Simaan to the entire faculty at the Spring college-wide faculty meeting held on March 26, 2010 and also presented to the College Advisory Board at its Spring meeting held on April 24, 2010. All of the college constituents (PBC, Faculty, Staff, Advisory Board, etc.) who were apprised of this SWOT analysis felt that it accurately represented our current internal strengths and weaknesses, and external opportunities and threats. As a result, our college SWOT became an important input in the derivation of the strategic initiatives that our college feels it needs to pursue in order for it to have a sustainable competitive advantage among colleges of Engineering and Computer Science in Florida and nationally.

II. STRATEGIC PLANNING BACKGROUND

In developing our strategic plan, it was important to examine the context within which our college has operated in the years prior to 2009. At the beginning of 2009, with the appointment of Dr. Simaan as Interim Dean, the college confronted many issues and challenges. Among these are:

- A need to reconstitute and engage the Advisory Board for the college and to meaningfully increase its involvement with the local industry
- A need for a vision, mission and a strategic plan for the college
- A need to meaningfully connect to our alumni
- A small faculty size for the size of the student body in the college
- A lack of two important engineering departments: Biomedical and Chemical
- A lack of facilities and space to accommodate growth in research in the MMAE and CECE departments
- A need to pay attention to three of the four departments that have not received significant attention or resources prior to 2009
- A need to evolve the administrative structure of the college to meet the challenges of a research-oriented college
- A heavy reliance on adjunct faculty in some departments (especially CECE)
- A very small college endowment

At the same time, the college enjoyed considerable strength and opportunities. Among these are:

- Strong support from the University Central Administration (President and Provost)
- Strong support from local industry and alumni
- A new College of Medicine at UCF with increased potential for collaboration
- Very dedicated and loyal faculty and staff who are committed to the College
- A substantial number of NSF Career Awards (mostly in EECS and MMAE)
- Ability to attract the largest number of the National Merit Scholars that attend UCF
- Proximity to NASA/Kennedy Space Center, Siemens, Disney, Harris Corporation, Florida High Tech Corridor, etc.
- Beautiful campus in a very vibrant city

III. VISION AND MISSION

Our college is able to attract students who are remarkably bright and talented. They come to our college to learn and become the technological leaders of tomorrow. Our Engineering and Computer Science faculty are some of the best and brightest that one can find anywhere. They share with our students the excitement of discovery and creative research as they teach the problem solving and leadership skills that prepare our students to be productive members of society.

Our Vision is to be recognized as one of the premier Colleges of Engineering and Computer Science locally, nationally and internationally. While we are aware of the need to maintain our fundamental capabilities, we will pursue new opportunities in teaching, research and outreach by leveraging UCF's strengths in innovative partnerships, effective interdisciplinary research, and a commitment to excellence, inclusiveness, and diversity.

Our Mission is to provide high-quality, broad-based education and experience-based learning in engineering and computer science; to create knowledge through pioneering scholarship and impactful research; to enrich our student development and leadership skills; and to address pressing local, state, national, and international issues in support of the global community.

Our vision recognizes the fact that we will be challenged in the next five years to improve in all aspects mentioned in our mission.

IV. STRATEGIC INITIATIVES AND PRIORITIES

Our college strives constantly to provide our students with the best possible education in a stimulating research-oriented and intellectually diverse environment. We make every effort to provide high-quality and innovative undergraduate and graduate curricula that prepare our students to be effective, contributing members of a technological society and life-long learners. We are committed to strengthening our partnerships with industry, engaging our alumni and friends, and serving the state of Florida and beyond. The following interdisciplinary initiatives represent our highest priorities in our desire to accomplish our mission and realize our vision. The first two initiatives will support our desire to strengthen the departmental structure of our college and its research enterprise. The next three initiatives will build on our educational strengths, and the last two will complement UCF's outreach, diversity and inclusion activities.

INITIATIVE 1: Create a Department of Biomedical Engineering in CECS

Biomedical Engineering (BME) is a unique mix of engineering, medicine and science. The American Society of Engineering Education (ASEE) recently reported that in the U.S. and Canada, BME B.S. degrees increased by 192% over the past eight years. A recent report from the US Department of Labor indicates that the BME job market nationwide is expected to grow by 72% from 2010-18. The U.S. Bureau of Labor statistics occupational handbook indicates that "biomedical engineers are expected to have employment growth much faster than the average for all other occupations."

As far as our college is concerned BME is an interdisciplinary discipline that impacts all of our existing four departments and remains important not only for the college but also for the entire university. At present, because of the lack of a BME program at UCF, many undergraduate students either go to UF for such a degree (UF has just started a BME department) or leave the state for competitor institutions, such as Georgia Tech, UNC, Duke, and Vanderbilt. At UCF we propose to initiate an effort that will culminate in a BME department within 5 years. This new department will allow for an increase in admissions to our CECS and should result in an increased retention of students in the college. The new department will be a bridge between the College of Engineering and Computer Science and the College of Medicine.

BME research is a key element is our efforts to become recognized as a premier research oriented college in the nation. We will start by building on our current strength in BME which is focused on bio-imaging, bio-informatics, cardiovascular modeling, robotic surgery, nanomaterial-based bio sensors, biomechanics and healthcare delivery systems. BME is also important in the partnerships and synergy that it will create between our College and the Sanford-Burnham Medical Research Institute. In addition, it is crucial for the growing biotechnology industry in the Orlando and Central Florida region. According to a recent article in the Orlando Business Journal, "Florida pulled in $100M for medical research in 2009 through the American Recovery and Reinvestment Act. More than half of that funding, or $66M, was split between South Florida and the Gainesville area. Only 3%, or $3M, came to the Central Florida area". Biomedical Engineering at UCF will be the crucial missing element if this is to change and will be instrumental in increasing the research funding in the college by opening the door to NIH as a potential source of funding.

To accomplish this initiative, the college needs allocation of additional resources. We anticipate that we need to add 3 new faculty positions (some at the senior level) including star-up funds each year for the next 5 years. Space for the new department needs to be allocated outside the current engineering I, II and III buildings. The outcome will be a new BME Department in 2015 with increased student enrollment, research funding and national visibility.

INITIATIVE 2: Focus on Four Selected Interdisciplinary Research Areas

In addition to research in Biomedical Engineering as mentioned in initiative 1 (above), our college will focus on the following four interdisciplinary research areas:

2.A: Energy Sustainability: The State of Florida and especially the Central Florida area is a hub for research activities in the area of renewable and sustainable energy. Energy sustainability is an area that impacts the EECS, MMAE and IEMS departments. Current research in the college is focused on photovoltaic, power electronics, power devices, solar energy at the Florida Solar Energy Center (FSEC), the smart grid, combustion and heat transfer, turbo-machineries, steam turbines and generators, energy systems modeling. The presence of Siemens Energy next door to our campus and the Florida Center for Advanced Aero Propulsion (FCAAP) presents a great opportunity for us to become one of the leading universities in the area for turbines and combustion engineering. This research focus will involve collaboration and a true partnership between MMAE, EECS, IEMS and FSEC as well as FCAAP.

2.B: Infrastructure Sustainability: Infrastructure sustainability has been identified as a strategic initiative for the CECE department. The health monitoring and security of our nation's civil infrastructure (roads, bridges, water distribution systems, the power grid, the internet, etc.) is an area of national importance that everyone in the college needs to be involved in and can contribute to. The management and fusion of data coming from smart sensors placed throughout an infrastructure will provide research and opportunities for faculty in all four departments. Considerable expertise already exists in EECS in communication and computer networks, network security, distributed systems, wireless & cellular networks, wireless data, networking & resource management, and mobile computing. In CECE, the Health Monitoring and Condition Evaluation of Constructed Facilities activity, the Stormwater Management Academy, and the Coastal Hydroscience Analysis, Modeling and Predictive Simulation (CHAMPS) Laboratory are currently the lead activities in the area of infrastructure sustainability. UCF has the potential to become the leading Florida University in the area of Infrastructure Sustainability. This research focus will involve collaboration among all departments in the College and partnership with the state in monitoring many of its civil infrastructures.

2.C: Smart Materials and Sensors: Smart Materials is an area where the college has already considerable activity and strength in MMAE, EECS, the Advanced Materials and Processing Center (AMPAC) and the NanoScience Technology Center (NSTC). Current research exists in composite materials and structures such as polymer/ceramic/metal matrix composites, multifunctional nanocomposites, smart composites, processing and characterization, non-destructive evaluation, aerospace, space and energy applications. Additional research exists in cross-scale transducers such as nanomaterial-based bio and chemical sensors, microfluidic components, micro/nano scale process development, microactuators, biomimetic smart surfaces, and micro-electro-mechanical systems (MEMS). The college currently has excellent faculty who are contributing to teaching and research in these areas. In addition, smart materials and sensors are important building blocks of biomedical devices, civil infrastructures and energy systems. Thus, a strengthening of our research in this area will have a positive impact on our initiative in biomedical engineering, and research focus in energy and infrastructure sustainability. This initiative will involve collaboration among all departments in the College, AMPAC and NSTC.

2.D: Systems Engineering: Systems Engineering is an interdisciplinary field that deals with the design, modeling and simulation, optimization, control and operation of complex systems whether natural or engineered. Examples of such systems include energy systems, biomedical systems, robotic systems, healthcare systems, cyber-physical systems, complex uncertain and auto-reconfigurable systems to mention a few. Clearly, this area impacts all of our disciplines and has the potential of unifying the previous four research areas under one umbrella. This initiative will involve collaboration among all departments in the College with the Institute for Simulation and Training (IST). Emphasis of our research in this area will largely be in "Modeling and Simulation" - an area where considerable research activity and strength already exists in and around the UCF campus.

To accomplish this important interdisciplinary initiative, the college needs allocation of four new faculty positions per year; one for each research area, for the next 5 years. The outcome will be national prominence and increased research funding in these four interdisciplinary focus areas by 2015. The potential for increased funding for the college will largely be from sources such as

NSF, DoE, DoD and many of the large corporations in the Central Florida area such as Lockheed Martin, Harris Corporation, Disney and Progress Energy.

INITIATIVE 3: Grow the Size & Quality of the Graduate Program

While our undergraduate program is currently the 13th largest in enrollment in the nation, our graduate program is the 42nd. To put things in perspective in Fall 2009 the College of Engineering at the University of Florida enrolled 5071 undergraduate and 2773 graduate students while our College enrolled 5164 undergraduate but only 1203 graduate students. In order for us to achieve international eminence in key research areas and become competitive as a research college, our graduate enrollment needs to grow to around 2000 by 2015. This can only be supported if our faculty size and funded research also grow simultaneously. Our desired targets are for our tenured and tenure-track faculty size to grow from its current 110 to 175 by 2015 supporting all of the initiatives in this strategic plan. At the same time, we plan to reduce our heavy dependence on part-time instructors and adjuncts. This growth in faculty size and graduate enrollment coupled with emphasis on research initiatives 1 and 2 described above are essential if we hope to improve the national ranking of our college. Furthermore, the growth in faculty size will be strategically oriented by hiring faculty that will strengthen our research initiatives 1 and 2.

To accomplish this initiative, the college needs allocation and additional resources for 6 new faculty positions in addition to those listed under initiatives 1 & 2. These positions will support the growth and quality of our graduate programs and is anticipated to result in an increase in our research expenditures from $20M to $30M by 2015.

INITIATIVE 4: Sustain the Size and Quality of the Undergraduate Program

Our Engineering and Computer Science undergraduate programs are the bread and butter for the entire college. The size and quality of these programs needs to be sustained at all costs. While all of our programs are currently accredited, we need to continuously prepare for the next ABET visit which will occur in 2014. At present the college offers a minor in bioengineering to students in MMAE and EECS. It is our plan that as our research in BME grows (initiative 1) this minor will evolve into a Department of BME by 2015. This department will not only attract new students, hence providing a new source of revenue, it will also provide a pre-med pipeline of students to the College of Medicine.

The new ***Engineering Leadership and Innovation Institute*** (ELI^2) that has been recently inaugurated with the enthusiastic support of our Advisory Board will focus on all aspects of engineering leadership and innovation to help a much larger segment of our students (undergraduate and graduate) develop the skills they need to advance their careers by enhancing their ability to communicate effectively, to work in teams, and to bring innovation in their approach to solving real world engineering problems. The main mission of this institute is to prepare our students to be leaders in their profession.

To accomplish this initiative, the college needs allocation of $100,000 of funds per year to support the ELI^2 for the next 5 years. The outcome is that the ELI^2 will be recognized locally and nationally as a leader in the area of engineering leadership by 2015. This initiative will involve collaboration between Our College, the College of Business and partnership with many of the local industries such as Siemens, Progress Energy, Harris and Disney. The faculty hires through initiatives 1, 2 and 3 as described above will also contribute to a much needed lowering of the undergraduate student to faculty ratio.

INITIATIVE 5: Increase the College Endowment

Our College endowment is currently around $7M. This is significantly smaller than the endowments at some of the smallest colleges of engineering in the country. This small endowment limits our ability to recruit and retain top faculty and students. Our goal is to work with the UCF Foundation and create partnerships with local industries to increase the effectiveness of our fundraising efforts from our alumni as well as from our friends and industry/corporate supporters. The Advisory Board will be instrumental in helping us achieve this goal. Our goal is to increase the endowment to $25M in 5 years. No additional university resources are needed for this initiative. It will be funded internally from CECS funds.

INITIATIVE 6: Become More Inclusive and Diverse

Our College needs to increase its focus on recruitment and retention of students from underrepresented groups. While we are consistently ranked among the top ten Engineering Schools in the nation for Hispanics, we need to increase the representation of African American and Women in our student body and faculty. We will achieve this goal by capitalizing on UCF's strong diversity initiatives and supporting UCF's Office of Diversity Initiatives in its efforts to position UCF as a Center of Excellence in domestic diversity. This initiative will necessitate reorganizing our CECS Outreach Office into two offices. One office will focus on Outreach and Educational Partnerships and the other on Diversity and Inclusion. No additional resources are needed for this initiative. It will be funded internally from CECS funds.

INITIATIVE 7: Provide an International Dimension to the Students Education

As the world economy becomes more global, the likelihood that our graduating students will end up in a job that will take them overseas temporarily or even permanently has increased tremendously in recent years. It is our responsibility to make sure that our students are given an opportunity to get an international experience prior to graduation. This need was reinforced by members of our Advisory Board many of whom work for global companies that continuously relocate engineers in various parts of the world. We need to take the necessary steps and initiatives in our college to partner with international colleges of engineering so that our students have an opportunity to visit, intern, and/or collaborate with their international counterparts. We will need to create an office within our college to find and facilitate international opportunities

and internships for our students. No additional resources are needed for this initiative. It will be funded internally from CECS funds.

V. SUMMARY

In summary, the seven strategic initiatives outlined in this plan will be the main instruments that will guide our growth in the next five years and possibly beyond. Implementation of this ambitious plan will strategically help the college accomplish its mission and realize its vision. In total, the investment by the university will amount to 13 faculty positions per year for 5 years (plus the required space and start-up funds) and $100K per year to support the Engineering Leadership and Innovation Institute as summarized in the table below. This investment will bring our faculty size to 175 in 2015 (**we will still be 100 less than the UF engineering faculty size in 2010**). It is hoped that a large portion of this investment will be generated through enrollment growth, differential tuition and additional support from university resources. This plan will ultimately have the largest possible positive impact on our national ranking by increasing the potential of positioning us in the company of the top 50 Colleges of Engineering & Computer Science in the nation (or the top 25 colleges of Engineering & Computer Sciences at public universities) by 2015 and beyond.

	Faculty and Resources Needed							Target Faculty Size
INITIATIVE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	
Yr 2011	3	4	6	$100K	-	-	-	123
Yr 2012	3	4	6	$100K	-	-	-	136
Yr 2013	3	4	6	$100K	-	-	-	149
Yr 2014	3	4	6	$100K	-	-	-	162
Yr 2015	3	4	6	$100K	-	-	-	175