Introduction

As I look back on my nine year tenure as dean, I am both proud and pleased to note the progress we have made on so many fronts. By all quantifiable metrics, the SOE is in a better position today than at any time in its past. Much of this progress, of course, cannot be attributed solely (or even in large part) to me, but rather to the extraordinarily talented individuals, both faculty and staff, who make up the SOE and to the leadership and support provided by Tufts central administration in this period. Below, I have tried to identify some of the highlights of the past five years. Although we have started to reap the fruits of the investments made in faculty, staff, and physical infrastructure in the past 7-8 years, I believe that we have not yet reached our potential. Indeed, there is much opportunity for further growth and much left to do to nurture our talent. I continue to be both excited and challenged by my position as Dean and am grateful for the opportunity to be a part of the Tufts community.

Faculty Recruitment, Development, and Retention

Over the past five years, the SOE has recruited 21 new tenure-track faculty members across all of its six departments (see Figure 1), focusing primarily on strengthening its three strategic areas: Engineering for Human Health, Engineering for Sustainability, and Engineering the Human-Technology Interface (see attached revised SOE vision/mission statement). This faculty hiring process has also contributed substantially to the ethnic and gender diversity of the faculty. In AY03-04, the School of Engineering had 54 tenure-track/tenured faculty members (with 4 unfilled positions), of whom 8 were women and 9 were ethnic minorities. By AY12-13, the size of the T/TT faculty has increased to 79, of whom 18 are women and 17 are ethnic minorities. Of these 79 T/TT faculty members, 43 have been recruited during my tenure as dean. The number of endowed professorships has also grown significantly in this period, increasing from 1 to 8 (with one other committed). In addition, our educational model has evolved in the past few years to include an important educational role for non-tenure track Professors of the Practice (POP), who are providing leadership in our engineering design curricula and a direct connection to industry and engineering practice. In AY03-04, there were no POPs in the SOE. Today, the POPs (part- and full-time) number 15. Some of these individuals now form a core faculty for the Tufts Gordon Institute.

Faculty retention in the SOE is also a point of pride. Of all T/TT faculty hired from AY90-91 through AY04-05 (faculty cohorts for which all tenure reviews are complete), we have retained 64% -- notably, 64% (16 out of 25) of the men and 65% (11 out of 17) of the women. (The overall retention rate for these cohorts in AS&E is 53%.)

Over the past few years, a number of programs have been instituted to support faculty development and graduate student teaching assistant training. These programs include joint TA training programs with A&S; workshops offered through CELT; a formal SOE T/TT faculty mentoring program, and faculty workshops organized by our Center for STEM Diversity (for classroom climate, mentoring) and by the SOE Assoc Dean for Research (proposal writing, research administration, library resources). In this same period, we have created faculty development funds to provide discretionary resources to support faculty scholarship (allocations represent 5% of average ICR). About four years ago, the SOE also spearheaded the change in Tufts’ administrative/financial policies that has resulted in the benefitting of faculty summer
salary. Substantial efforts are now underway, in conjunction with A&S leadership, to address many of the Work/life Balance Task Force recommendations.

**Student Recruitment and Retention**

Undergraduate admission outcomes for the SOE improved greatly over the past six admission cycles (see Figures 2a, b), benefitting from the development of new promotional materials and new a new messaging/recruitment plan that aligns closely with the School’s new academic mission and strategic areas. The SOE has received record applicant pools for six consecutive years, resulting in a 54 percent increase in applications, with the AY2012-13 admission cycle the most selective on record (a 21.4% acceptance rate for engineers [AS&E had an overall acceptance rate of 21.35%]). Accompanying these wins in application volume and selectivity have been increases in the SAT composite score for enrolled engineers, which climbed from 1414 for the Class of 2010 to 1447 for the Class of 2016. The mean SAT-M score for the Class of ’16 was 750, representing a nearly 20-point increase over this period. The Class of ’16 also has a record number of female engineers – 36%, double the national average and 8-10 percentage points higher than the previous few years. An enhanced communications plan, now in its second generation, a joint effort with the Office of Admissions, has led to a significantly expanded web presence and functionality and a new engineering publication and has provided more targeted messaging. Over the past six years, this plan has directly impacted the types of students who visit, apply and ultimately enroll. Expanded “Engineering Open House” programs for prospective applicants in the fall, as well as a Women in Engineering program, have been critical elements of SOE’s recent admissions success.

At the undergraduate level, the School of Engineering continues to have a remarkable average net student attrition rate of zero (the average engineering school in the US is reported to lose more than forty percent of its entering class). Our success is, in part, due to the highly personalized nature of our undergraduate advising system (designed and administered by Associate Dean Kim Knox), which is taken extremely seriously by our faculty and students alike, and the close integration of engineering students with those in A&S. The strong connection between the SOE and A&S, and the ability for engineering students to take courses of interest to them outside of engineering also keeps our students motivated and excited about their education and the intellectual freedom they have here.

The SOE has experienced a sea change in its graduate programs (see Figure 3), both in number and quality of applicants, which we believe derives directly from the school’s successful faculty hiring and the reputation and achievement of those faculty members. For example, the number of PhD applications rose from 242 in 2007 to 586 in 2012. Our entering PhD cohort in 2012 was 49, with a 33% yield on fellowships. Consistent with the growing PhD enrollment, we continue to see a sharp upward trend in the number of doctoral degrees granted, with 31 doctoral degrees awarded in 2012, an increase of approximately 50% over the previous year. In the past three years, Tufts Gordon Institute completed a planned expansion of its MS in Engineering Management (MSEM) program, with enrollment growing by 80 percent over AY08-09. Master degree applications and enrollment in SOE departments have also risen sharply in the past couple of years, likely due to the introduction of new certificate and interdisciplinary programs and to the current economic climate.

The Bridge to Engineering Success at Tufts (BEST) program, a summer bridge program for incoming engineering students from under-resourced high schools, was developed and piloted
In summer 2010 to increase recruitment and to address gaps in academic preparation for students from some underrepresented groups (Black, Hispanic, and first generation college-bound students). This program was created under the direction of Travis Brown, Director of the SOE’s Center for STEM Diversity (CSD) and funded by resources from the SOE Dean’s discretionary fund, undergraduate admissions, and the AS&E diversity fund. The launch of the BEST program essentially doubled the SOE freshman underrepresented minority enrollment and is a promising first step in improving undergraduate diversity. The data from the first two BEST student cohorts suggest that these students are performing at a high level, with more than half (10/19) achieving the Dean’s list at least once in their first two years and all but one still enrolled in the SOE. Last year the SOE secured a generous donation from a Tufts alumnus which will support the direct costs of the BEST program over the next five years. Last year the SOE assumed leadership, through the CSD, for the direction of the Computer Science Engineering Math Scholars (CSEMS) program. Under NSF sponsorship, CSEMS ran for nine years and successfully helped retain first generation students with large financial need. This program is now continuing with CSD oversight, with a similar programming model but under a new name—Promoting Retention in Science and Engineering (PRISE).

Over the past three years, we have also made excellent strides in enhancing our visibility to prospective graduate students from underrepresented groups, again through the CSD. Travis Brown has worked with Yvette Dalton-McCoy, associate director of graduate diversity programs, on outreach to retention programs at local colleges and universities, particularly focusing on STEM retention programs. Students in those programs are invited to campus every other year for our Prospective Graduate Student day-long recruiting event. We have also taken advantage of our membership in the National GEM Consortium, and applications from GEM students have more than tripled in the last three years. Utilization of fee-waivers (offered to students in pipeline programs) has more than doubled in the last three years as well. Other CSD programming has been instrumental in the development of study groups in some of the large undergraduate science courses, for supporting new underrepresented student societies, and for stimulating faculty discussions on classroom climate and graduate student mentoring (see http://stemdiversity.tufts.edu/).

**Staff Recruitment, Development, and Retention**

In 2005, a new administrative and fiscal structure was developed for AS&E, and after its implementation in FY07, the SOE dean assumed discretionary control of financial resources within the SOE, including graduate tuition and research revenues. Over the subsequent six years, the SOE administrative structure has been augmented to support its mission; positions have been created to handle budgetary (CFO), advancement (Senior Director, three Associate Directors, in Development and CFR), career services (Associate Director), IT (CS/ECE Systems Administrator), research (Research Administrator, Assoc Dean), alumni relations, curriculum development (Assoc Dean, Special Projects Coordinator), recruitment and retention (Center for STEM Diversity - Program Director, Program Assistant) and communications (Communications Manager) functions for the school. Some of these positions reside in the appropriate central administrative units, while others are housed in Anderson Hall, associated with the Office of the Dean. We have also added some departmental staff and technician positions, primarily to support our growing research enterprise.

In July 2010, the Tufts University Excellence at Work initiative administered a survey to all engineering staff to gauge their level of satisfaction with the SOE on a broad range of work-
related topics. A summary of these results was shared with the staff in November 2011 and a staff SOE Action Planning Committee (APC) was then established to develop recommendations that would improve the working environment at the SOE from a staff perspective. For the most part, staff expressed positive feelings about working at the school and satisfaction with their individual roles and work/life balance. Some of the staff’s concerns were associated with improving the physical work space, increasing staffing levels, reducing red tape, and increasing efficiency. Improving communication was an overarching theme, both at the school and university levels. We have been able to address some communications weaknesses, putting in place several enhanced internal communications strategies (e.g., disseminating minutes to all administrative staff from the Department Chairs Group meetings, holding semiannual all-school staff meetings and regular staff meetings at the departmental level). We have also recently initiated a partnership with Tufts HR and Hirsh/Hills Associates to complete an assessment of the SOE administrative organization, with an eye towards improving its structure and operation.

**Interdisciplinary Research and Graduate Education**

The SOE’s goal is to educate engineers who are committed to the innovative and ethical application of technology in solving societal problems. Consistent with this mission, our strategic areas of emphasis for interdisciplinary education and research have been selected for their potential impact on the well-being and sustainability of society. The SOE has experienced tremendous growth in research activity in the past five years (see Figure 4). Since FY04, research expenditures have increased by almost 400%, with current levels approaching $16M, and the SOE has led the University in the past four years in intellectual property disclosures (Figure 5). Establishment of our first SOE research administrator position and development of pre-award data bases and proposal submission interfaces, through the efforts of Eric Miller, our previous Associate Dean for Research, are supporting faculty research efforts. A number of new cross-disciplinary research and graduate education initiatives have also been fostered over this period. Educational initiatives include: NSF IGERT Awards in ‘Water and Diplomacy’ and ‘Soft-Material Robotics’, new MSE and PhD programs in Biomedical Engineering, a cross-school MSE program in Bioengineering, and a joint PhD program in Computer Science and Cognitive Science. A perusal of the School’s annual reports or the SOE website will provide a view of the breadth of exciting research projects that are being undertaken by SOE faculty members (see [http://engineering.tufts.edu/about/news/index.htm](http://engineering.tufts.edu/about/news/index.htm)). Supported by the efforts of its new communication’s manager, Julia Keller, and liaison with Tufts external relations offices, media references to SOE faculty and student activities have increased six-fold since 2009 (see Figure 6).

In new faculty hiring, we have actively sought to recruit faculty who are collaborative by nature and are working across disciplinary boundaries in their research. This strategy has led to numerous fruitful collaborations. As an example, over the past two years 58% of the Tufts Collaborates! Provosts’ grants were awarded to teams that included SOE faculty members. We have also sought to align policies and provide incentives to support interdisciplinary faculty recruitment and interdisciplinary research and education. Examples of such policies include: a requirement that faculty search committees have one member from outside the department; use of cluster hiring (recruiting candidates across a number of departments, using a single search committee) (e.g., in sustainable energy); permission for faculty members with courtesy appointments in SOE departments to advise SOE PhD students; Dean’s seed funding grants for research that involve faculty from two departments or disciplines; establishment of faculty development funds for SOE project co-PIs in other Schools, equivalent to 5% of the average ICR associated with that faculty member’s effort on a collaborative research project; support of faculty release time in A&S departments to assist in development of cross-disciplinary courses;
and providing discretionary funds to Centers (e.g., the CEEO) in an amount equivalent to 5% of the ICR on participating faculty grants (5% is also provided to the faculty member’s home department, so that both the disciplinary and interdisciplinary units benefit equally for a faculty member’s research contributions).

Of particular pride is the establishment of new interdisciplinary research spaces. The Advanced Technology Laboratory housed in leased space at 200 Boston Avenue has fostered some very exciting collaborations among engineering departments and colleagues in biology, medicine, and dentistry, that are now bearing fruit. Last year, building on this model, we opened two new interdisciplinary lab spaces, creating new collaborative environments to advance research in our strategic areas. The Interdisciplinary Laboratory for Computation came online in our newly leased and renovated space at 196 Boston Avenue. This 10,000 square-foot space is a collaborative environment for CS, ECE, and CEE researchers working in such areas as visualization, human-computer interaction, signal processing, statistics, and machine learning. In the spring, we opened the doors to the NSF-sponsored Environmental Sustainability Laboratory in Anderson Hall. This 6,000 square-foot lab space serves as a model for interdisciplinary research in biology and environmental engineering. Conceptualization and development of these spaces was enabled by the leadership of Executive Associate Dean Scott Sahagian.

**Undergraduate Curriculum**

In 2005, the Curriculum Task Force (CTF) was created and charged with strategically reviewing the undergraduate curriculum in the School of Engineering, proposing changes consistent with the school’s vision for educating engineering leaders, and developing an implementation plan for these changes. Led for much of its life by Associate Dean Edgers, the CTF includes members of: the SOE faculty, associated A&S department faculty, the SOE Board of Advisors, who provide employer perspective, and undergraduate engineering students. A particular focus of the CTF has been to revise our curricula and educational approaches to stress interdisciplinary, team-oriented, and project-based learning; to strengthen curricular components associated with professional practice; and to provide students the opportunity to hone leadership skills. Seed funding for these efforts has been provided through the generosity of one of the SOE Board of Advisors’ members. Some of the curriculum changes and refinements initiated by the CTF include the development of cross-school courses in computing and fundamentals of biological systems, as well as a new calculus course with applications, developed in collaboration with colleagues in the Mathematics Department. The CTF also undertook an examination and extensive revision of our undergraduate minor in engineering management. Modeled on the TGI MSEM curriculum, this newly revamped minor was piloted in 2009 under the leadership of TGI Director Rob Hannemann and emphasizes four specific areas: leadership skills, communications skills, business fluency and the innovation process. Its primary faculty is comprised of POPs affiliated with TGI.

In addition to the CTF activities described above, over the past three years, working groups consisting of SOE faculty, students, alumni, and external advisors have been engaged in brainstorming and discussion sessions to identify strengths and weaknesses in the current SOE undergraduate experience and to develop plans for addressing identified shortcomings. One outgrowth of this effort is the piloting, this fall, of a series of new first year (EN) elective courses. Supported by seed funding from the dean, these courses are theme-based and incorporate identified ethics, team project, engineering practice, and leadership elements. Over the semester, EN course faculty members are meeting in a seminar format to exchange ideas and
instructional methods. We are also piloting a new interdisciplinary capstone design course this year and hope to expand this model to more of our students.

In the past few years, in addition to the development of our first major program in biomedical engineering (engineering for human health) we have also established two interdisciplinary minors that resonate with our human/technology interface strategic theme: music engineering (joint with the A&S department of music) and engineering education (joint with the A&S department of education). The past few years have also witnessed a large increase in enrollment (primarily from A&S students) in our entrepreneurial leadership studies (ELS) and computer science minors. Since the inception of The ELS minor in 2002, under the leadership of the previous Director, Pamela Goldberg, and with its core support provided by the SOE, the program has grown from an offering of a few courses annually to a thriving academic minor with 12 course sections per semester. Approximately 500 students are now enrolled in the program annually, with 50 seniors completing the minor. A new Director, James Barlow, has recently been hired to help continue and strengthen our curricular and extracurricular activities in this entrepreneurship/innovation space.

**Infrastructure**

Inadequate infrastructure to support research and doctoral education was among the challenges identified in the SOE's 2005 strategic planning process. To begin to address this deficiency, we have expanded our staff support in financial and research administration, communications, and development. We have also renovated existing laboratories for new faculty hires, consolidated and upgraded teaching laboratories and classroom IT support, and renovated graduate student and departmental office space. Since 2006, over $6.0 million dollars (see Figure 7), most of it derived from indirect cost recovery and federal grant support, has been invested in such capital improvements. Securing new space, however, represents a particularly thorny challenge. Benchmarking conducted as part of the University Master Planning process in 2006 revealed that the SOE would need to more than double its footprint to reach the per faculty average of peer institutions. Thus, to meet critical space needs associated with our new faculty hires and expanding research enterprise, we have turned to alternative approaches. Over the past seven years, we have been extremely fortunate to secure quality leased space at 200/196 Boston Avenue. In 2003, the School occupied approximately 86,000 square feet of office and laboratory space. Today, primarily through its leased space inventory, the School occupies over 137,000 square feet. We are currently working with the Office of the Vice President for Facilities and Planning to develop a space master space plan for the SOE to ensure that it continues to provide high-quality academic and research facilities. With the completion of the Steve Tisch Sports and Fitness Center, the athletics department has vacated its space in Halligan Hall, allowing us to plan for Halligan’s renewal/renovation. In addition, we are exploring new leasing opportunities for new faculty hires and expansion of collaborative research opportunities.

The SOE Advancement organization is quite young; it was founded in late 2005, with the creation of a single dedicated position, that of Senior Director of Development. Since that time, it has grown to encompass a dedicated staff position in CFR, and two associate director positions. After a lengthy search for a new Senior Director in 2009-10, we were fortunate to recruit Cynthia LuBien to the position. Engineering achievement, excluding exceptional gifts, was flat over the 1999-2003 time period, and showed some expansion in the next eight years, coinciding with the creation of our Advancement organization, a new administration, and the Beyond Boundaries campaign (2003-2011). Major gifts over the past five years have supported the creation of new
fellowships, scholarships, and endowed professorships, as well as seed funding for interdisciplinary research and prizes and curriculum development. Details of these gifts can be found in the SOE’s annual reports. Under the new SOE Advancement leadership, we are now on a clear path to improving our donor base and foundation for future fundraising. In the past fiscal year, annual fund contributions exceeded our goal by 12%, with donor visits up 22% and donors up 2% (new donors up 7%) in a period where all other Tufts Schools experienced a drop in donors.

Communication activities at the School of Engineering have grown significantly since the creation of its Communications Manager position in 2005. By establishing and strengthening our relationships across the university, we have been able to create award-winning materials with the graduate and undergraduate admissions offices. Our current communications efforts encompass: production of undergraduate and graduate student recruitment marketing materials, development of departmental newsletters and collateral e-communications to enhance connection with our alumni, in collaboration with the Alumni Relations Office; and development of a high-quality annual report, in collaboration with the Development Office. This collaboration model is integral to Tufts School of Engineering’s continued success; through this support, we have been able to expand SOE communication efforts beyond what would be possible with an office of one.

A new Associate Director of Employer Outreach and Engineering Career Services, Robin Kahan, was hired in 2006 with SOE funds and since that time career consults for engineering students have more than doubled from 432 in 2006 to 949 in 2011. Outreach to employers and alumni has increased the number of engineering firms participating in all aspects of recruiting; interviews, resume collections, networking events, and career fairs including a Science, Technology and Engineering Job and Internship Fair. Due to the support provided by Career Services and its strong ties to industry, 80% of graduating engineers have had at least one internship during their Tufts experience and almost half the class has completed more than one.

Accreditation

Last fall the SOE underwent a site visit for formal reaccreditation of seven of our degree programs and first time accreditation of our BSBME degree. These accreditation visits occur on a seven year cycle. The outcome of this visit was that all programs were accredited to September 30, 2018, with Biomedical Engineering accredited retroactively to 2010. The final report noted a number of institutional strengths, particularly highlighting student quality, faculty-student interaction, and the opportunities for undergraduate research as unique and distinguishable; and praising the School’s growth (hiring of well qualified faculty, increased enrollment, enhanced quality of engineering programs, improved administrative and business processes). This successful ABET/CAC accreditation visit was facilitated by the processes the SOE has put in place to provide oversight for the undergraduate academic programs, under the leadership of former Associate Dean, Lew Edgers. The school’s assessment and improvement system encompasses the integrated operations of a number of elements, including a number of processes for assessing and evaluating the extent to which student outcomes (what students are expected to know and be able to do by the time of graduation) and program educational objectives (what graduates are expected to attain within a few years of graduation) are being met. SOE committees involved with assessment include the Committee on Outcomes and Objectives Assessment (OAC) (established in 2008), the SOE Curriculum Committee (SOECC), and the Curriculum Task Force (CTF) (established in 2004).
Figure 1. Faculty Size Evolution in the SOE

Figure 2a. SOE Undergraduate Application History
Figure 2b. SOE Matriculated Student SAT History

Figure 3. SOE Graduate Degrees Awarded
Figure 4. SOE Research Expenditures

Figure 5. Tufts University Invention Disclosures
Year by Year Coverage for Engineering

Figure 6. Media Coverage History for the SOE

Figure 7. SOE Space and Facilities Investments
School of Engineering Academic Vision (revised April 2011)

A Unique Learning Environment

The Tufts University School of Engineering offers a rigorous engineering education in a unique environment that blends the intellectual and technological resources of a world-class research university with the strengths of a top-ranked liberal arts college. Our size and educational philosophy support a distinctive sense of community, a diversity of perspectives, and a student-centric learning environment. Engineering curricula across a wide spectrum of majors emphasize project-based learning, the nurturing of leadership skills, and cultivation of creativity through innovative design. Close partnerships with Tufts’ cadre of excellent undergraduate, graduate, and professional Schools, coupled with a long tradition of collaboration, provide a strong platform for interdisciplinary education and scholarship. Proximity to a thriving Boston metropolitan area facilitates close relationships with local industry and research labs, student internship and employment opportunities, and the committed engagement of seasoned practitioners in the School professoriate.

Mission

To educate engineers committed to the innovative and ethical application of science and technology in addressing the most pressing societal needs.

To develop and nurture twenty-first century leadership qualities, perspectives, and skills in our students, faculty, and alumni.

To develop and disseminate transformational new knowledge and technologies that further the well-being and sustainability of society.

To provide national leadership in enhancing the role and visibility of the engineering profession in the education of our youth and the development and implementation of public policy.

Strategic Areas

The SOE focuses on building core strength and visibility in select cross-cutting strategic areas. The following criteria were considered in the selection of these areas: provide opportunity for significant societal impact; build on SOE faculty expertise and leadership; leverage opportunities for multi-disciplinary engagement across the SOE; link to faculty strengths in Arts and Sciences and the Tufts professional schools (medicine, dental medicine, law and diplomacy, nutrition, veterinary medicine); and resonate with university priorities. Based upon these considerations, the School strives for pre-eminence in its research and educational programs in three strategic areas:

Engineering for Human Health - areas of particular SOE faculty strength and cross-school collaboration include: biomedical imaging, regenerative medicine, bioinformatics, waterborne disease, and metabolic engineering

Engineering for Sustainability - faculty strengths and collaborations encompass water and diplomacy, water quality, climate change mitigation, environmental remediation, smart structures, alternative energy, and smart grids

Engineering the Human/Technology Interface - faculty strengths include development and dissemination of educational technologies, robotics and cognition, sensors, human factors engineering, visualization