



School of  
Engineering

Strategic Planning Framework

2013

*to*

2023

**Tufts School of Engineering  
Strategic Planning Framework  
2013-2023  
January 2014**

**INTRODUCTION**

It is now widely acknowledged that advances in science and engineering are central to the economic health and competitiveness of our nation. In 2005, the U.S. Congress authorized the National Academies to conduct a study of America's competitiveness in the evolving global community. The product of this study, a report entitled *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* (1), argued that as much as 85% of the measured growth in U.S. income per capita in the first half of the twentieth century, even before the information technology revolution, can be attributed to technological change. While only four percent of the nation's work force is composed of scientists and engineers, data indicate that this group disproportionately creates jobs for the other 96 percent (2). One of the major conclusions of the *Gathering Storm* report is that the primary driver of the future economy and associated creation of jobs in the U.S. will be innovation, largely derived from advances in science and engineering. Even following the 2008 financial crisis, when overall U.S. unemployment exceeded 10 percent, unemployment peaked at 5.5 percent in the STEM (science, technology, engineering, and mathematics) fields (3).

In addition to driving and sustaining economic growth, engineering skills are critical to addressing the increasingly technical problems facing society. The engineering profession has both a responsibility and an opportunity to provide leadership in addressing these 21st-century problems — developing a sustainable energy supply and distribution system, providing clean water and an adequate food supply for an ever-increasing population, and revitalizing the industrial base of the United States, among many others. More than at any time in the past, business leaders need engineering knowledge and basic STEM competencies to succeed in their careers. Indeed, Spencer Stuart's multi-year study of S&P 500 companies found that over 20% were headed by executives with undergraduate degrees in engineering, consistently the most common undergraduate major among this select cohort of business people (4).

Unfortunately, the past century witnessed the demise of the large industry research laboratories, such as AT&T Bell Labs, whose emphasis on applications-based, long-term, research produced some of the most groundbreaking inventions of the 20th Century. Furthermore, today, we are witnessing escalating federal deficits, shrinking federal support for basic research, and industry shifts away from R&D, as it emphasizes short-term profitability. Given these trends, it is clear that U.S. global competitiveness will become increasingly dependent on successful partnerships between industry and academia. As these partnerships develop, it is likely that the boundaries between academia and industry will become ever more permeable. Indeed, at many universities, the accepted role of the engineering faculty member is being enhanced to encompass that of inventor, innovator, and entrepreneur, while professional practitioners are bringing real world problems and experiences to the academic laboratories and classrooms.

With an appreciation for the realities and opportunities highlighted above, leading U.S. research universities, even those that traditionally emphasized a strong liberal arts education, such as Princeton, Harvard, Yale, Brown, and Dartmouth, are investing substantially in the establishment and growth of programs in engineering and the applied sciences. For example, Harvard University's Division of Engineering and Applied Sciences was transitioned to a School in 2007, while Brown University announced the establishment of its School of Engineering in 2010.

Against this backdrop, Tufts University School of Engineering, established as an independent School in 2001, is committed to the education of the next generation of technological leaders through the blending of the best elements of liberal arts and engineering curricula and to leadership in interdisciplinary research and innovation for the betterment of society.

## **TUFTS SCHOOL ENGINEERING**

### **BACKGROUND**

The Tufts School of Engineering (SOE) has a long and proud history, with engineering courses and degrees offered as part of the Tufts curriculum since 1865. By the official founding of the College of Engineering (COE) in 1898, enrollment in engineering had grown to more than 100 and BS degrees were offered in four disciplines: Civil, Electrical, Mechanical, and Chemical Engineering. Graduate programs were initiated in the 1961-62 academic year, with PhD programs first introduced in 1963. The Tufts Gordon Institute (TGI) was joined with the college in 1992. The addition of TGI augmented the curriculum by establishing a new Tufts Master of Science program in Engineering Management (MSEM). Through the year 2000, the COE remained administratively part of the 'School of Arts, Sciences, and Engineering,' with its graduate degrees administered through the Graduate School of Arts and Sciences. In 2001, the college was elevated to the status of a school, permitting it to grant its own graduate degrees and elevating its dean to a level equivalent to the other school deans. Today, the SOE has an undergraduate enrollment of more than 750 students and houses six departments (along with TGI), four rooted in the original disciplinary areas and two, Biomedical Engineering and Computer Science, established in 2002. At the undergraduate level, the school now offers 14 degree programs, eight of which are ABET/CAC accredited.

### **PROGRESS OVER THE PAST TEN YEARS**

By all quantifiable metrics, the SOE is in a better position today than at any time in its history. Strategic investments in SOE faculty, staff, and infrastructure over the past decade are now bearing fruit, and the quality of its students and faculty has never been higher. Academic year (AY) 2012-13 marked the School's most selective and successful undergraduate admissions cycle, with applications increasing by 15% over the previous year (by more than 75% since 2006). The incoming undergraduate class of 2017, with women making up a third of the student body, is broadly talented, with a remarkable mean composite SAT score of 2170 that reflects both quantitative as well as verbal excellence. The SOE is maintaining its enviable average net undergraduate attrition rate of zero (the average engineering

school in the US is reported to lose more than forty percent of its entering class), actually experiencing a net gain in enrollment in the past academic year due to students transferring from the School of Arts and Sciences (A&S). The launch of the Bridge to Engineering Success at Tufts (BEST) program in 2010, a summer program that serves incoming engineering students from under-resourced public high schools, has essentially doubled the underrepresented minority enrollment in the SOE and is a promising first step in improving our undergraduate diversity. At the graduate level, the SOE has experienced a sea change in its programs, both in number and quality of applicants, attributed to successful faculty hiring and a substantial increase in fellowship support and funded research. The number of PhD applications has doubled since 2008, with the entering PhD cohort increasing from 38 to 50. Consistent with this enrollment increase, there has been a sharp upward trend in the number of doctoral degrees granted; PhD degrees awarded in the School have increased more than five-fold in the past ten years. At the master's level, the Tufts Gordon Institute completed a planned expansion of its MS in Engineering Management (MSEM) program in 2012, with enrollment growing by 80 percent.

Over the past ten years the SOE faculty has grown in size, stature, and diversity. 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. In AY 13-14, the size of the T/TT faculty is 80, of whom 18 are women and 17 are ethnic minorities. The number of endowed professorships has also grown significantly in this period, increasing from 1 to 8. In addition, the educational model has evolved to include an important role for non-tenure track Professors of the Practice (POP), who are providing leadership in engineering design curricula and a direct connection to industry and engineering practice.

In tandem with its faculty growth, the SOE has experienced tremendous growth in its research activity. Since FY04, research expenditures have increased by almost 400%, with current levels approaching \$16M, and the SOE has led all University schools in intellectual property disclosures for five consecutive years. Consistent with its mission, three strategic areas of emphasis for interdisciplinary education and research were selected by the SOE for their potential impact on the well-being and sustainability of society: Engineering for Human Health, Engineering for Sustainability, and Engineering the Human-Technology Interface. Faculty members have been recruited in each of these strategic areas across all departments, with a preference for those who are collaborative by nature and are working across disciplinary boundaries in their research. This strategy has led to numerous fruitful faculty collaborations. A number of new cross-disciplinary research and graduate education initiatives have also been fostered over this period. Educational initiatives include: NSF Integrative Graduate Education and Research Traineeship Awards in 'Water and Diplomacy' and 'Soft-Material Robotics', new MSE and PhD programs in Biomedical Engineering, a cross-school MS program in Bioengineering, and a joint PhD program in Computer Science and Cognitive Science.

In 2005, the SOE Curriculum Task Force (CTF), with an open membership of faculty, alumni, and students, was created and charged with strategically reviewing the SOE undergraduate curriculum and proposing changes consistent with the school's vision for educating engineering leaders. The work of the CTF has emphasized revision of the SOE curricula and educational approaches to (1) stress interdisciplinary, team-oriented, and project-based learning; (2) strengthen curricular components associated with professional practice; and (3) provide students the opportunity to develop leadership skills. 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, a new calculus course with applications, and a new series of first year elective courses. The CTF also undertook an examination and extensive revision of our undergraduate minor in engineering management. Other significant developments in the School's undergraduate curriculum include the first major in biomedical engineering and two interdisciplinary minors: music engineering (joint with the A&S department of music) and engineering education (joint with the A&S department of education). This period 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, the program has grown from an offering of a few courses annually to a thriving academic minor, annually enrolling some 500 students with 50 seniors completing the minor.

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, the SOE has expanded its staff to support financial and research administration, communications, and development. It has 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 \$8.0 million dollars, most derived from indirect cost recovery, graduate tuition, and federal grant support, has been invested in these capital improvements. In 2003, the School occupied approximately 86,000 square feet of office and laboratory space. In 2013, primarily through its leased space inventory, the School now occupies over 137,000 square feet. Of particular significance is the establishment of new interdisciplinary research spaces, including the Advanced Technology Laboratory and the Interdisciplinary Laboratory for Computation, housed at 200/196 Boston Avenue and the National Science Foundation-sponsored Environmental Sustainability Laboratory in Anderson Hall. Working with the Office of the Vice President for Facilities and Planning, the school has completed a space master plan that examines both traditional campus space (classroom, office, and labs) and nontraditional leased space at Boston Avenue. The process included in-depth interviews with department chairs, assessment of current and projected enrollments in undergraduate and graduate programs, and evaluation of current research lab conditions for future use. Plans are underway for renovating existing space to house several SOE programs. The SOE will secure 7,000 square feet in the building at 574 Boston Avenue which will house an interdisciplinary cluster in 'Human Centered Engineering.' In addition, the Silk Technologies Center at 200 Boston Ave will be expanded from 6,000 to 10,000 square feet.

The SOE Advancement organization was founded in late 2005, with the creation of a single dedicated position, and has since grown to encompass four full time professionals. Major gifts over the past seven 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. Over the past ten years, the SOE has raised \$110 million for capital purposes and \$12.8 million through the annual fund (increasing from \$0.9 million in FY04 to \$1.5 million in FY13). With the maturation of its development operations, since FY06, donor and prospect visits have increased by 175% and qualification, cultivation, solicitation, and stewardship contacts have grown by 215%. Under its new Advancement leadership, the SOE is on a clear path to improve its donor base, providing a strong foundation for future fundraising.

The SOE's first communications manager position was created in 2005 to provide support for the development of news stories, as well as the production of student recruitment marketing materials and SOE newsletters, collateral e-communications, and annual reports. The current collaborative communications model, enlisting the support of the University Alumni Relations, Admissions, and Advancement Offices, has facilitated the expansion of SOE communication efforts beyond the current size of its office. In FY2012, there were more than 1700 positive stories (up from 240 in FY2009) in external news media that involved the SOE.

SOE infrastructure has also been enhanced to support the student experience. Since its founding in AY08-09, the Center for STEM Diversity (CSD) has helped support the recruitment and retention of underrepresented students, through such programs as BEST, science course study groups, and classroom climate seminars. Creation of a dedicated associate director staff position in 2006 has similarly improved student support and industry outreach in the Tufts University Career Center. By graduation, 80% of engineering students now have had at least one internship during their Tufts experience and almost half the class has completed a second.

### **CHALLENGES AND OPPORTUNITIES<sup>1</sup>**

Although the Tufts SOE can reflect with pride over its progress in the past ten years, it is clear that it has yet to achieve its full potential. The SOE's reputation among U.S. engineering schools – as measured by outlets such as the *U.S. News & World Report* rankings of engineering programs, for example - lags its current reality, which in turn hampers its ability to recruit exceptional graduate students and world-class faculty members. This issue is less acute at the undergraduate level. Although the SOE faculty has been extraordinarily successful in growing its externally funded research enterprise, inadequate facilities and infrastructure support, as well as lack of faculty critical mass, continues to hinder successful applications for large center grants and could create faculty retention issues. Furthermore, the rising costs of higher education and the national focus on rising tuition have called into question the sustainability of the SOE's model for need-based financial aid (shared with A&S), in which the majority of funds to support financial aid are derived from undergraduate tuition revenues rather than endowment resources. The creative use of digital and web-based learning technologies could offer tremendous opportunities for the improvement of the delivery, reach, and effectiveness of SOE educational programs, but, although a number of pilot digital learning projects have been undertaken, little effort has been directed to date to develop a comprehensive digital learning strategy for the School. In this time of flat tuition as well as uncertain and diminishing federal and state support for research, the SOE lags its peers in establishing industry research partnerships, despite the significant advantages offered by its Boston area location. In addition, although a leader among Tufts Schools in IP generation, the SOE has had minimal success to date in transferring this new technology to society, whether through start-up company development or technology licensing.

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<sup>1</sup>Based upon a SWOT assessment conducted at a January 10, 2013 retreat of SOE Department Chairs and Center Directors

Among the SOE's primary strengths is the quality of its people – its students, faculty, staff, and alumni. The presence of excellent students attracts excellent faculty and staff, whose presence, in turn, attracts ever more talented students, leading to the graduation of ever more successful alumni. However, as the U.S. demographics change and the world becomes ever 'flatter', to preserve this 'virtuous cycle', the SOE must recruit and retain the very best individuals, representative of society in all its diversity. Although substantial strides have been made in the recruitment of underrepresented students from ethnic minorities, the current U.S. K-12 pipeline is insufficient to support the recruitment and education of a culturally diverse student body at either the undergraduate or graduate levels. Furthermore, little financial aid is available for the enrollment of extraordinary international students, many of whom are citizens of developing nations in Africa and Southeast Asia. Although the SOE has made significant progress in developing our alumni communications in recent years, its alumni engagement, as measured by donors<sup>2</sup> and participation in continuing education programs, lags its peer private institutions and, perhaps more importantly, the talent and experience of SOE alumni remains a largely untapped resource. Finally, although Tufts is noted for its reputation as a global University, the SOE's approach to international collaborations to date has been more opportunistic than strategic; it has done little to advance research and education partnerships with the Fletcher School, to develop strategic partnerships with foreign institutions, or to increase opportunities for international student exchanges and Tufts student experiences abroad.

Building on its past and understanding its unique opportunities and challenges, the Tufts School of Engineering has revised its vision and mission statements (below) and is poised to capitalize on the investments made in the past decade.

## **VISION**

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,

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<sup>2</sup>A recent assessment (2012) found that Tufts School of Engineering's Productivity is 59% of that of some of its aspirational peer engineering schools (University of Pennsylvania and Columbia) and well short of that of aspirational peer schools with more mature advancement operations (Duke and Dartmouth). Here the Productivity metric is defined as average cash gifts from Individuals over the last 5 years divided by the average number of alumni over the same period. Current SOE alumni participation rate in fund raising is at 14%, consistent with the former peer pair average (15%), but quite modest in comparison with the 47% participation rate of the latter group.

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

Over the next ten years the SOE seeks to position itself to:

- Rank among the ‘top 30’ undergraduate engineering schools, consistent with Tufts’ overall ranking
- Be recognized as the school of choice for a liberal arts/engineering education
- Be recognized for its ‘top 20’ ranked graduate education/research programs associated with its three strategic interdisciplinary areas: Engineering for Human Health; Engineering for Sustainability; and Engineering the Human-Technology Interface

**OVERARCHING THEMES AND STRATEGIC GOALS**

In support of its mission, the SOE has identified a number of overarching themes, which serve as organizing principles for its strategic goals. Each theme and its associated goals are described briefly below.

**I. Educating technological leaders (enriching the student experience):**

Our mission is to produce graduates who have exceptional competence in their engineering specialties but who also have had exposure to and knowledge of other engineering, science, and liberal arts disciplines (so-called “T-shaped engineers” with both bread and depth of knowledge) and who understand the interconnection of technology and society – to produce graduates who are as well prepared for engineering practice as they are for engineering research. This mission applies to all of our educational programs – those for undergraduate and graduate students as well as continuing professionals. Through curricular and co-curricular elements, we seek to provide a solid foundation for our students to assume leadership roles in their professional careers and to produce graduates who are committed to the application of their knowledge and skills for the betterment of society. Brain-storming and discussion meetings among faculty, alumni, and students supported by our Curriculum Task Force have identified a list of areas relating to engineering leadership that need purposeful attention in the design and execution of our educational programs: (i) ability to communicate effectively; (ii) understanding of professional and ethical responsibility; (iii) understanding the impact of engineering

solutions in a global and societal context; (iv) functioning on multi-disciplinary and multi-cultural teams; (v) providing leadership to groups or individuals; and (vi) establishing a relevant connection between learning and the practice of the engineering discipline.

The following strategic goals are associated with this important theme:

- Increase the diversity of the SOE community – student, faculty, staff - across all dimensions – gender, socio-economic, ethnic, cultural
- Build opportunities to develop ‘21st century skills’<sup>3</sup> across the undergraduate and graduate curricula
- Provide more international experience opportunities – e.g., development of new Tufts study abroad programs, international research partnerships/student exchanges
- Improve academic and professional advising; expand use of alumni, professional, and peer-to-peer mentoring
- Expand opportunities for cross-disciplinary leadership and team experiences, both curricular and co-curricular
- Expand career development opportunities – e.g., internship opportunities, teaching assistant training, research integrity and professional ethics training
- Develop new on-campus, satellite, and distance or hybrid learning programs to engage alumni in continuing education

## II. Interdisciplinary education and research in strategic areas

Given its relatively small faculty size, the strategy of the SOE is to focus on building core strength and national 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 other 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 preeminence in its research and educational programs in three strategic areas:

*Engineering for Human Health* — faculty strengths and cross-school collaborations encompass biomedical imaging, regenerative medicine, bioinformatics, waterborne disease, epidemiology, and metabolic engineering

*Engineering for Sustainability* — faculty strengths and collaborations encompass water and diplomacy, water quality, climate change mitigation, environmental remediation, risk analysis, structural health, alternative energy, and smart grids

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<sup>3</sup> It is widely acknowledged that, with the development of computers and information technology, non-routine problem-solving and complex communication and social skills are becoming increasingly valuable in the workplace. These so-called “21st century skills” include the ability to solve complex problems, to think critically, to effectively communicate across cultures and perspectives, to work in collaboration with others, to adapt to rapidly changing environments and conditions, and to be able to acquire new skills and information (5).

*Engineering the Human/Technology Interface* — faculty strengths encompass development and dissemination of educational technologies, robotics and cognition, sensors, human factors engineering, human computer interaction, and visualization

Faculty recruitment over the past ten years has done much to build critical mass in each of these areas, and Tufts SOE faculty members have forged a number of cross-School and cross-University research partnerships that have led to a strong base of externally funded projects. Consistent with its mission, in the coming ten years, the SOE will build on these partnerships to develop high quality, high impact research and education programs associated with these strategic areas. Here faculty leadership is key to the establishment of particular thrusts within a strategic area. Targeted cluster hiring and the forging of strategic national and international partnerships will further strengthen faculty research teams. Associated educational programs are expected to define new fields at the intersections of disciplines. These programs will benefit SOE student at all levels, both undergraduate and graduate, as well as alumni.

Specific strategic goals associated with this theme include:

- Cluster hiring of faculty in strategic areas
- Establish/strengthen cross-disciplinary research centers – e.g., existing centers/institutes include the Center for Engineering Education and Outreach, Tufts Institute for the Environment, Silk Technologies – and secure substantial external funding to ensure their sustainability
- Form strategic international partnerships
- Create/strengthen interdisciplinary doctoral programs
- Expand opportunities for undergraduate research
- Develop undergraduate minors in interdisciplinary strategic areas
- Develop specialized (professional) certificate, master’s programs, continuing education seminars

### **III. Enhancing the role and visibility of the engineering profession in education and public policy**

The engineering profession has both a responsibility and an opportunity to provide leadership in solving the increasingly technical problems that face the country and the world. Addressing these 21st-century problems — developing a sustainable energy supply and distribution system, providing clean water and an adequate food supply for an ever-increasing population, redesigning the nation’s health care system, among many others — will require the concerted efforts of collaborative, interdisciplinary teams of highly trained individuals, providing expertise ranging from the sciences to the social sciences to the humanities and arts. To be effective, these teams must also work closely with government entities and the public at large. The SOE’s mission is to educate engineers capable of organizing and leading such interdisciplinary teams and to help foster a national climate that supports technical literacy and engineering engagement with society. To this end, the SOE seeks to advance the role of engineering in the development of a technically literate population, to increase the pool of those pursuing an engineering education, and to strengthen the voice and role of engineers in the development of public policy.

Specific strategic goals associated with this theme include:

- Enhance and sustain leadership in engineering education research and K-12 outreach

- Provide opportunities and reward community engagement for all SOE students, faculty, and staff. – Make community engagement a signature program requirement for all undergraduate and graduate students<sup>4</sup>
- Support the development of technological literacy in all Tufts students. – Assume leadership, in collaboration with the School of Arts and Sciences, in the development and delivery of courses designed to support technological literacy in all Tufts undergraduates
- Forge cross-University partnerships to promote rational discourse and research at the intersections of SOE strategic areas and public policy

#### **IV. Strengthening the innovation/entrepreneurial ecosystem**

Creativity and innovation are at the core of the engineering profession. The SOE is committed to fostering the creative and innovative talents of its community and to providing the infrastructure to support the creation, translation, and transfer of ideas and inventions to their beneficial use in society. The large student enrollment in Tufts ELS Program, alumni engagement in entrepreneurship events, and the SOE's leadership in University IP development provide strong evidence of the entrepreneurial nature of our students, faculty, and alumni. Much of the progress that has been made in this area over the past decade can be attributed to strong individual (faculty and staff) contributions and alumni support. In the coming decade, the SOE must take the lead in improving the climate and support for innovation and entrepreneurship at Tufts. Central to this part of its mission will be the expansion of curricular and co-curricular experiences at both the undergraduate and graduate levels, the development of designated space for creation, collaboration, and translation, the engagement of alumni as mentors, students, and investors, and the forging of strategic industry-university partnerships to promote applied research, technology transfer, and business development.

Specific strategic goals associated with this theme include:

- Establish a Center for Innovation and Entrepreneurship – this will encompass:
  - Curricular and co-curricular educational components (e.g., undergraduate minor, graduate certificate, internships, mentors, business plan and product design competitions)
  - Incubator/maker spaces
  - A core PoP faculty
- Develop and strengthen strategic industry-research partnerships
- Foster continued engagement of alumni and sustain community of engineering/technological entrepreneurs and innovators

#### **FACILITATING STRATEGIES**

For the Tufts SOE to move forward with the development and implementation of its strategic plan, it must build the capacity and resources required to achieve its goals. The SOE is currently among the smallest research-extensive schools of engineering in the country. While it enjoys an excellent student to faculty ratio, its present tenure-track faculty size is not sufficient to support strategic sub-disciplinary areas within each of its six departments nor to support the necessary graduate course offerings and faculty leadership to build strong cross-disciplinary research and education programs. Thus, to achieve

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<sup>4</sup> Highlighted text strengthens language, consistent with preliminary feedback from the SOE Board of Advisors

its vision, encompassing ambitious goals in education and research as well as societal impact, the School will need to grow its tenure track faculty cohort, in addition to expanding its core POP and research faculty (the latter at a rate commensurate with the growth in research activity). It will also need to add strategic staff positions to support expanded educational, research, and outreach activities. This increase in critical mass will also allow the school to be more adaptable to change and to support a (modest) expansion of its undergraduate student body, consistent with its student-centric education model, its growing applicant pool, and A&S student interest. Ongoing planning for new construction and renovation on the Medford campus will need to be supplemented by the development and execution of a comprehensive renovation and space allocation plan for the SOE's current and future space inventory.

High level facilitating strategies for achievement of the strategic goals identified above are listed below. Prioritization and development of specific implementation plans and metrics for each of the strategic goals will be the purview of SOE working groups over the coming academic year.

- Development and execution of a communications plan to support strategic goals
- Development and execution of a capital campaign to support strategic goals
- Examination and revision of AS&E budget model for undergraduate tuition and student services
- 25% increase in tenured/tenure-track faculty size (target 100 faculty)
- 50% increase in full and part-time POP positions to support TGI and the new Center for Innovation and Entrepreneurship
- 25% increase in undergraduate enrollment (target 1000 undergraduates), coupled with an increase in financial aid endowment to support this growth
- Infrastructure enhancement
  - Securing and enhancing space (renovation, new construction, leasing) to support above objectives
  - Addition of strategic staff positions: research, marketing/communications, assessment/data/financials, advising
  - Enhanced technology transfer/business development support

### **References**

(1) *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, National Academies Press, 2007.

(2) National Science Board, *Science and Engineering Indicators 2010*. Arlington, VA: National Science Foundation (NSB 10-01), Figure 3-3.

(3) *Emerging technology and its Broad Implications*, Norman R. Augustine, The President's Distinguished Lecture Series, Stevens Institute of Technology, October 24, 2012.

(4) Spencer Stuart: *CEO Study: A Statistical Snapshot of Leading CEOs, 2004*; *Leading CEOs: A Statistical Snapshot of S&P 500 Leaders, 2006*; *Route to the Top, 2008*.

(5) National Research Council, *Assessing 21st Century Skills: Summary of a Workshop*, ISBN978-0-309-21790-3, 2011.