Strategic Plan 2010–2020

ERIK JONSSON SCHOOL OF ENGINEERING & COMPUTER SCIENCE
THE UNIVERSITY OF TEXAS AT DALLAS

The Erik Jonsson School of Engineering & Computer Science aspires to be one of the top schools of engineering and computer science in the United States – and one of the great research engineering schools in the world.

Located in the heart of the Telecom Corridor in North Texas and coming off of a $300 million public-private initiative that greatly expanded its capabilities, the school is well positioned to achieve this goal, which is central to transforming UT Dallas into a Tier One research university.

This strategic plan is key to our efforts. Designed to help us realize our educational and research goals by 2020, the plan resulted from a spirited collaborative effort among our faculty. Its ultimate success, however, depends upon energetic support from a broad group of people, including industry leaders, elected officials and our generous financial supporters.

We invite you to familiarize yourself with our plan and join us on our journey.

Mark W. Spong, Dean
Lars Magnus Ericsson Chair
Excellence in Education Chair
May 2010

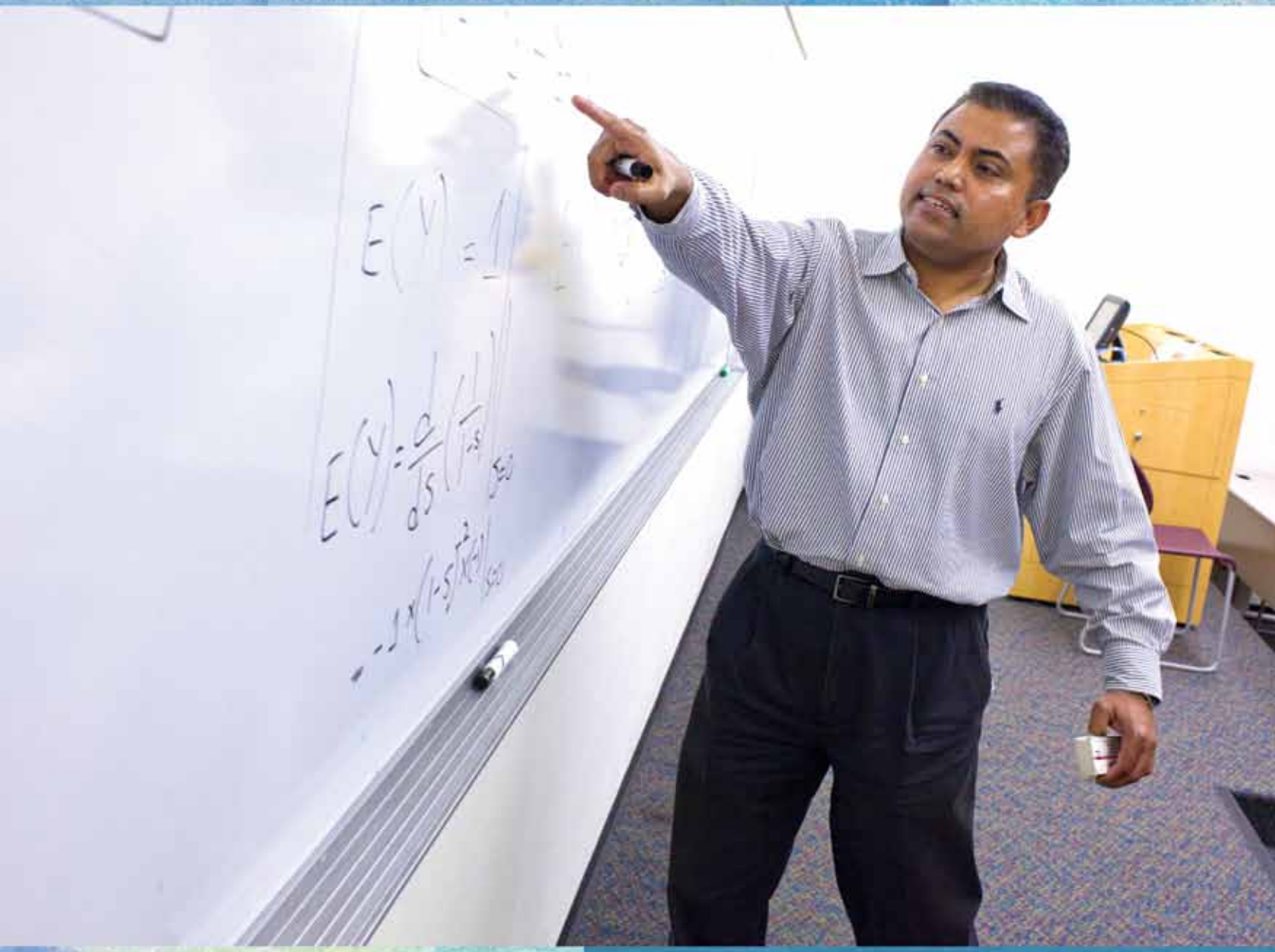
The six strategic imperatives on the following pages form the core of the Jonsson School's strategic plan. Our ultimate goal is to help UT Dallas become a Tier One research university, which will benefit the region in many ways:

- Partnerships between Tier One universities and businesses spur economic growth through technology commercialization, spin-off companies and job creation.
- Top-tier universities produce a highly skilled workforce, particularly in the sciences, engineering and professional fields crucial for economic success.
- The direct effects of money invested in university research multiply throughout the economy.
- A top-tier institution will enable the region to attract more scientists, engineers and scholars, further increasing the amount of research dollars infused into the economy.

STRATEGIC IMPERATIVE 1

Significantly increase the number of faculty, undergraduate students and graduate students through aggressive recruiting

- To join the ranks of top-tier engineering schools we must expand our scale of operations.
- We will add 70 to 80 tenure-track faculty positions by 2020, increasing our faculty to approximately 175.
- We will nearly double student enrollment to 5,000 by 2020.



Dr. M. Saquib, associate professor of electrical engineering

STRATEGIC IMPERATIVE 2

Add new departments and degree programs of strategic importance

- Actively foster the growth of the mechanical engineering and bioengineering departments.
- Develop a doctoral program in mechanical engineering.
- Develop doctoral and master's degree programs in systems engineering and management.
- Add undergraduate degree programs in biomedical engineering and systems engineering, and explore an undergraduate program in materials science and engineering.

Dr. Mario Rotea, head of the new Department of Mechanical Engineering

STRATEGIC IMPERATIVE 3

Foster excellence and impact in research

- Create new research centers and institutes in key areas such as analog design, sustainable energy, information security, healthcare technology, biomedical engineering, nanotechnology and cyber-physical systems.
- Double externally funded research to more than $60 million, double annual PhD production to more than 70 and further engage the Texas industrial community.
- Increase the number of endowed chairs and professorships to more than 40 in order to attract and retain top faculty.
- Significantly increase the number of graduate fellowships offered in order to attract the best graduate students.

Research under way in Dr. Robert Wallace's lab

STRATEGIC IMPERATIVE 4

Improve undergraduate and professional master's education

- Increase the number of top students applying to the Jonsson School by proactively recruiting the highest quality students throughout Texas and beyond.
- Strengthen our ties to community colleges throughout the state.
- Recruit students from selected international communities for the professional master's program.
- Significantly increase the amount of undergraduate scholarship support.
- Build a strong sense of community among our students – especially undergraduates – in order to improve retention.

We intend to nearly double Jonsson School enrollment by 2020

STRATEGIC IMPERATIVE 5

Expand the infrastructure and opportunities for excellence

- To accommodate planned increases in student and faculty populations, we must obtain an additional 335,000 square feet of research, academic and classroom space by 2020.
- We will enhance learning opportunities by developing additional remote instruction and learning capabilities to complement our curricula.

The Natural Science and Engineering Research Laboratory building opened in 2006

STRATEGIC IMPERATIVE 6

Enhance diversity and community relations

- Broaden our already strong ties to industry.
- Work proactively to develop and maintain lifelong connections with alumni.
- Reach out to K-12 schools and community colleges throughout Texas.
- Increase success in recruiting and retaining students from underrepresented groups by intensifying our recruitment efforts and strengthening our support structures for students from these groups.

Our students regularly work with children interested in science and engineering

Strategic Plan 2010-2020

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THE UNIVERSITY OF TEXAS AT DALLAS

Strategic Plan 2010-2020

ERIK JONSSON SCHOOL OF ENGINEERING & COMPUTER SCIENCE • THE UNIVERSITY OF TEXAS AT DALLAS

VISION FOR THE JONSSON SCHOOL

To become one of the top schools of engineering and computer science in the United States and one of the great research engineering schools of the world.

MISSION STATEMENT

The mission of the Erik Jonsson School of Engineering & Computer Science is to:

- Deliver state-of-the art, high-technology engineering educational programs for Dallas and Collin Counties, the DFW Metroplex, and the State of Texas.
- Instill in students the critical innovative and entrepreneurial skills needed for them to compete successfully in a global economy.
- Address problems of critical need to society through research aimed at the creation of new engineering knowledge and technology transfer.
- Develop partnerships with government and the private sector to apply new knowledge for economic growth and high-tech job creation in order to strengthen existing regional firms, promote the growth of new regional firms, and create new high-paying private sector jobs.
- Provide leadership and outreach to nurture tomorrow's leaders in science, mathematics, and high-technology education and business.

GOALS OF THE STRATEGIC PLAN

The goals of this strategic plan are designed to help the faculty and administration of the Jonsson School and the University to make the entrepreneurial decisions that are needed in order to realize the school's vision. This plan will also serve as a guide in allocating resources to carry out those decisions. Specific goals stated in the plan will enable us to measure our progress toward achieving our vision by the year 2020. In order to chart a feasible path from the current state of the Jonsson School to the long-term goals, the plan sets intermediate goals that can be achieved by the year 2015.

The Jonsson School already has a foundation for excellence in its faculty and students. The single greatest challenge facing the school is that we are too small, in numbers of faculty, students and graduates, and in terms of research expenditures, to be one of the nation's top schools of engineering and computer science. We must approximately double in both size and quality. This strategic plan outlines the steps we must take in order to grow with excellence.

The Jonsson School strategic plan calls for significant growth in carefully selected areas, such as Mechanical Engineering and Bioengineering, where substantial industrial and institutional support exists in the Dallas/Fort Worth Metroplex, and where large enrollments are likely. The intent is to broaden the base of excellence in the school by creating a critical mass of faculty and graduate students in selected new research areas, and to provide a modern undergraduate engineering education that will attract high-quality students to the new departments, while continuing to strengthen and improve existing programs.

STRATEGIC IMPERATIVES

The overarching goal of the Jonsson School for the next decade is to become one of the premier schools of engineering and computer science in the country. Achieving this goal will require significant increases in the numbers of faculty and degree programs, undergraduate and graduate enrollments, and research funding, as well as improvements in research quality and impact, infrastructure, and community outreach.

This strategic plan defines six mutually reinforcing strategic imperatives that, when fully acted upon, will achieve the vision for the school. These strategic imperatives are to:

1. Significantly increase the number of faculty, undergraduate students, and graduate students through aggressive recruiting.
2. Add new departments and degree programs of strategic importance.
3. Foster excellence and impact in research.
4. Improve undergraduate and professional master's education.
5. Expand the infrastructure and opportunities for excellence.
6. Enhance diversity and community relations.

Strategic Imperative 1:
Significantly increase the number of faculty, undergraduate students, and graduate students through aggressive recruiting

In fall 2009, the number of tenure-track faculty in the Jonsson School reached 100[1] and the total number of students was approximately 2,900. In order to be competitive with top-tier engineering schools we must significantly increase the number of faculty and students. We will add at least 70 tenure-track faculty positions in the school by 2020, together with suitable numbers of non-tenure-track teaching faculty and support staff. We will increase the total student population to over 5,000, while maintaining the current ratio of approximately 55–60% undergraduate and 40–45% graduate students.

Strategic Imperative 2:
Add new departments and degree programs of strategic importance

Growing top-tier Mechanical Engineering and Bioengineering Departments, while continuing to improve existing programs, is our top priority. We will create an MS degree program in Systems Engineering and Management in collaboration with the UT Dallas School of Management and develop a Department of Systems Engineering and Management in the Jonsson School, resulting in a School of Engineering and Computer Science with six departments. We will develop a PhD program in Mechanical Engineering as soon as possible. We will add undergraduate degree programs in Biomedical Engineering and Systems Engineering, and a doctoral program in Systems Engineering. We will study the feasibility of adding an undergraduate degree program in Materials Science and Engineering.

Strategic Imperative 3:
Foster excellence and impact in research

In order to increase the impact of our research, the Jonsson School must create new research centers and institutes in focal areas in which we can lead, such as analog design, sustainable energy, information security, healthcare technology, biomedical engineering, nanotechnology, and cyber-physical systems. The success of this initiative depends critically upon recruiting and retaining top-quality faculty and doctoral students, increasing our level of externally funded research, and engaging the Texas industrial community. In order to attract and retain top faculty we will increase the number of endowed chairs and professorships from the current level of eight to more than 40. To attract the best graduate students, we must significantly increase the number of graduate fellowships that we are able to offer. We must more than double our level of research expenditures over the next decade from the current level of approximately $30M/year to more than $60M. We must increase our PhD production from the current level of approximately 35/year to over 70/year. We must increase the number of faculty who are members of the National Academy of Engineering, both by aggressive recruiting and by promoting from within. Likewise, we must increase the number of faculty who are IEEE, ACM, ASME or AIAA fellows, or have won other prestigious awards.

Strategic Imperative 4:
Improve undergraduate and professional master's education

Our students and graduates define the Jonsson School to the broad community. At all levels, we must recruit the highest quality students over the entire Texas community and beyond and, for the professional master's program, in selected international communities, in order to increase the number of top students applying to the Jonsson School. A large pool of strong applicants will enable greater selectivity. We will build a strong sense of community, especially among our undergraduate students, in order to improve retention.

Strategic Imperative 5:
Expand the infrastructure and opportunities for excellence

In order to accommodate the planned increases in numbers of students and faculty, the Jonsson School must acquire 182,000 gross ft² of research, academic and classroom space by 2015, and a total of 335,000 gross ft² by 2020.[2] This goal is consistent with the University's building goals. We will also enhance learning opportunities by developing additional remote instruction and learning capabilities to complement our existing curricula.

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1 Includes full-time administrators with tenured faculty appointments.

2 This goal is based on the following parameters: 1,700 ft² of research laboratory, office, conference, TA and other space per new faculty member, 25 ft² of classroom space per new student, 25 ft² of teaching laboratory space per new student, 100 ft² of space per new staff member, and a ratio of net assignable square feet to gross square feet of approximately 0.6. The projected space need is more than 4,500 gross ft² per tenure-system faculty member. The university number of 4,000 gross ft² includes a preponderance of faculty outside of ECS who do not require research or teaching laboratory space.

Strategic Imperative 6:
Enhance diversity and community relations

Our location in Texas and the Dallas/Fort Worth Metroplex is our greatest asset. In order to become one of the top schools of engineering and computer science in the region, we must broaden our already strong ties to industry, develop and maintain lifelong connections with alumni, and reach out to K-12 schools and community colleges throughout Texas. One of the most important initiatives in improving the numbers and quality of our applicants and students is to increase our success in recruiting and retaining students from underrepresented groups. In order to accomplish this goal, we must intensify our recruitment efforts, especially for undergraduate and professional master's students from underrepresented groups, and strengthen our support structures for students from these groups.

IMPLEMENTATION PLAN

1. Significantly increase the number of faculty, undergraduate students, and graduate students through aggressive recruiting

In order to grow top-tier Mechanical Engineering and Bioengineering Departments, we must recruit a large number of senior faculty to anchor the core areas of these new departments. Funding for 35 new endowed chairs will be essential for the recruitment of faculty at the levels and with the quality that are consistent with our overall goal of becoming a top-tier school of engineering and computer science.

Support is also of paramount importance for increasing doctoral enrollment. In addition to the increases in extramural funding associated with new faculty hires, the Jonsson School must substantially increase the number of graduate fellowships. The school and the University should strive to meet the Project Emmitt target of a $25 million endowment for graduate fellowships.

Table 1 summarizes the Jonsson School 2020 goals for faculty and enrollment increases with respect to fall 2009 and shows the distribution of the new faculty hires across existing and future departments. The total enrollment increase projected in this table is 2,440 students at all levels. Appendix B presents projections of enrollment for 2015 and 2020.

Degree program	Current faculty (fall 2009)	Net growth in T/T faculty	Growth in bachelor's enrollment	Growth in master's enrollment	Growth in PhD enrollment
BMEN	1	10	150	100	40
CE	--	--	210	90	40
CS	45	5	100	150	25
EE	40	5	100	110	30
MECH	5	35	500	400	160
MSEN	9	6	--	50	25
SE	--	--	0	0	0
SYSM	0	9	80	50	20
TE	--	--	10	0	0
Totals for all programs	100	70	1,150	950	340

Table 1. Projected Jonsson School faculty and enrollment growth, 2010–2020. CE, SE, and TE faculty are included in EE and CS numbers.

2. Add new departments and degree programs of strategic importance

Currently the Jonsson School has three well-established departments, Computer Science, Electrical Engineering, and Materials Science and Engineering, and one new department, Mechanical Engineering. These departments support bachelor's, master's and PhD degree programs in Computer Engineering, Computer Science, Electrical Engineering, Software Engineering and Telecommunications Engineering; master's and PhD degree programs in Materials Science and Engineering; and bachelor's and master's degrees in Mechanical Engineering.

The Erik Jonsson School will create new departments and concentrations in areas where sustainable funding exists as a result of student demand or external research interest, and where signi;ficant industrial support exists in Texas. Revenues from tuition, designated fees, and state formula funding must be sufficient to support faculty and staff salaries. Therefore, this plan gives the highest priority to bachelor's and master's degree programs for which there is substantial student demand, and to PhD programs in which research funding is likely to be available to support doctoral students.

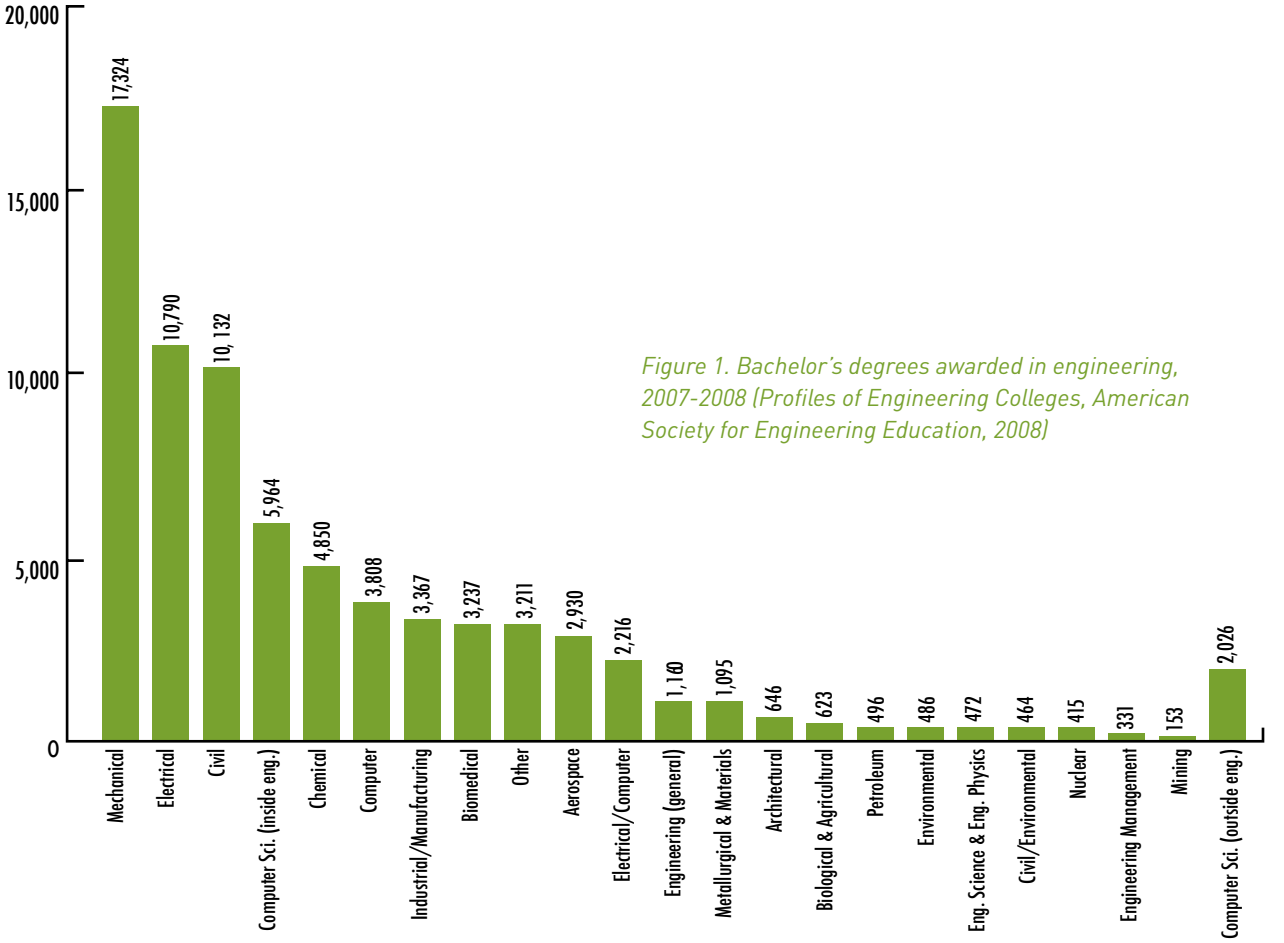

Figure 1. Bachelor's degrees awarded in engineering, 2007-2008 (Profiles of Engineering Colleges, American Society for Engineering Education, 2008)

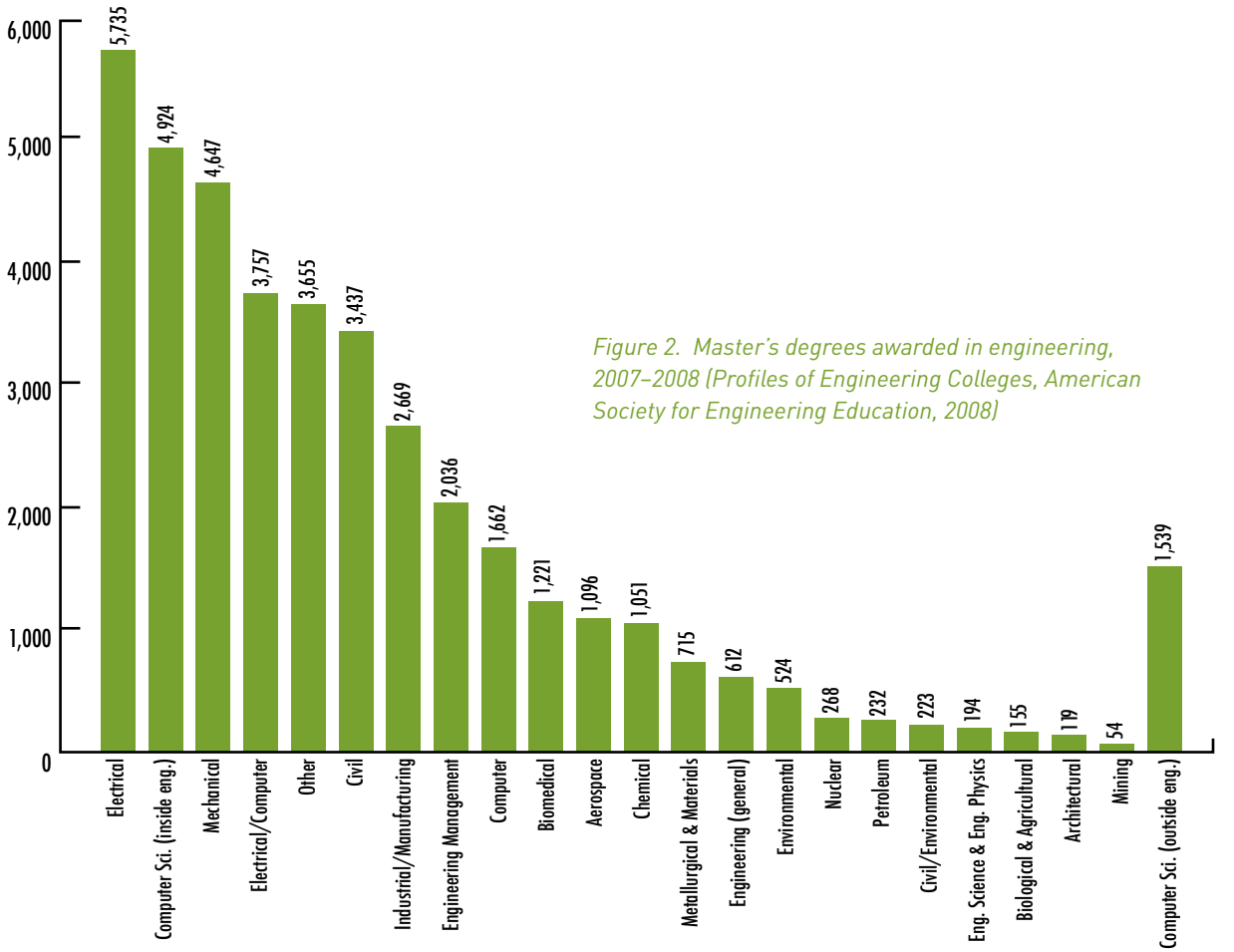

Figure 2. Master's degrees awarded in engineering, 2007–2008 (Profiles of Engineering Colleges, American Society for Engineering Education, 2008)

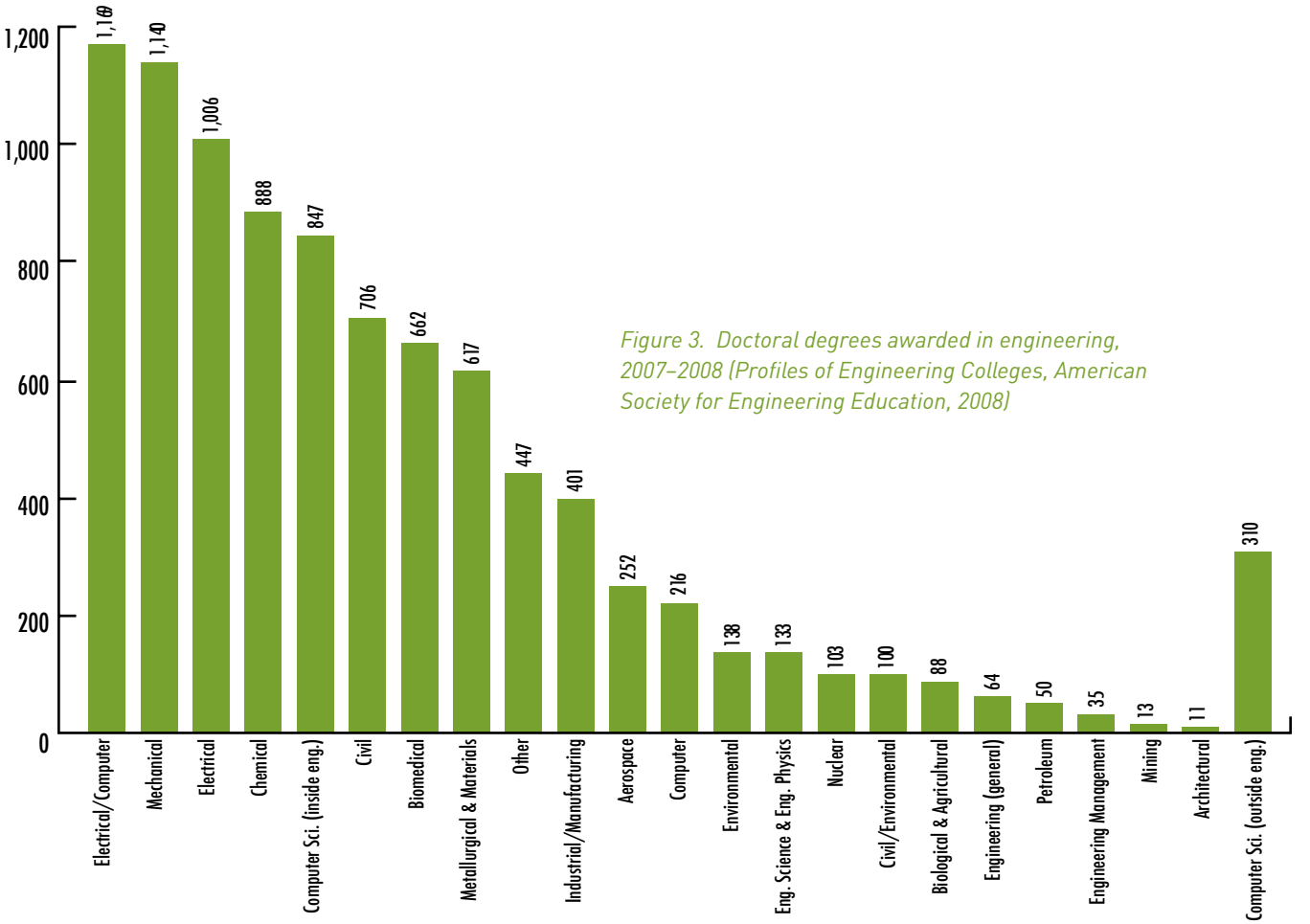

Figure 3. Doctoral degrees awarded in engineering, 2007–2008 (Profiles of Engineering Colleges, American Society for Engineering Education, 2008)

New departments and degree programs

From its inception in 1986, the Jonsson School's strategy for adding engineering departments has been to choose disciplines with high enrollment and local industrial support and, in those disciplines, to build excellence in a few fundamental but leading-edge research areas. From Figure 1, which charts the U.S. production of bachelor's degrees in engineering and computer science, 2007–2008,[3] one can see that after Computer Science, Electrical Engineering and Mechanical Engineering the high-enrollment engineering programs are Civil, Chemical, Industrial and Biomedical Engineering. Figure 2 (for master's programs) and Figure 3 (for doctoral programs) reinforce this conclusion. This strategic plan envisions the addition of full degree suites in Biomedical Engineering and Systems Engineering (the successor of Industrial Engineering). We will study the feasibility of adding a bachelor's program in Materials Science and Engineering. Thus, by 2020 we will have comprehensive education and research programs in all of the top disciplines except Civil Engineering and Chemical Engineering. We will explore the feasibility of adding the latter two disciplines late in the 2010-2020 timeframe, once our other new programs are sufficiently well established. The primary consideration for further development of new programs, such as Civil Engineering and Chemical Engineering, will be student demand and the needs and interests of Texas industry.

Goals for 2015:

The degree programs and departments that are now being organized, or that will be organized by 2015, are the following:

Computer Engineering. The bachelor's program in Computer Engineering, which the THECB authorized in 2006, is only now starting to grow strongly. At the same time as undergraduate enrollments in Computer Science and Electrical Engineering have declined, enrollment in Computer Engineering has increased sharply. Nationally, computer engineering is one of the most popular undergraduate engineering majors. Faculty hiring in computer engineering should keep pace with long-term enrollment growth. A conservative estimate of steady-state enrollments in our Computer Engineering degree program is 200 bachelor's students and 100 master's students. If enrollments in Computer Science and Electrical Engineering grow as projected, then 20 new faculty members,

3 "Profiles of Engineering Colleges", American Society for Engineering Education (2008).

distributed approximately equally between the departments of Computer Science and Electrical Engineering, will be needed to support the expected enrollment growth in Computer Engineering, Electrical Engineering and Computer Science.

Mechanical Engineering. Although the Mechanical Engineering Department is still in its infancy, undergraduate enrollment numbers already suggest that enough student demand exists to give Mechanical Engineering one of the largest undergraduate enrollments of the Jonsson School's engineering degree programs by 2020. The highest priority for the new Department of Mechanical Engineering is to obtain authorization for a Ph.D. program. Hiring goals through 2011 can be accomplished by attracting top faculty in core areas of mechanical engineering with ability and interest in synergistic efforts with the other departments in the Jonsson School. By 2020 the Jonsson School must have at least 40 faculty members whose home department is Mechanical Engineering in order to support expected student enrollment.

Bioengineering. The industrial demand for engineers who practice bioengineering and biomedical engineering in Texas is expanding rapidly because Texas is home to some of the nation's finest medical research facilities and healthcare providers. Student demand has made biomedical engineering the fastest-growing engineering specialty nationwide. The Jonsson School is responding to these developments by creating a Bioengineering Department to support the University's participation in the master's and PhD programs in Biomedical Engineering at The University of Texas Southwestern Medical Center and The University of Texas at Arlington. By 2015, the school should secure authorization for a baccalaureate program in Biomedical Engineering and should hire at least 10 new tenure-system faculty members in the Bioengineering Department.

Systems Engineering and Management. By 2015, the Jonsson School will create a Department of Systems Engineering and Management. A proposal for a master's degree in Systems Engineering and Management will be submitted to the THECB in 2010. The THECB has granted the University preliminary authorization for a doctoral program in Systems Engineering. To be successful, degree programs sponsored by this department will require substantial collaboration with the School of Management. A properly structured bachelor's program in the general area of systems engineering and management may attract a significant number of students. The Jonsson School should hire at least nine faculty members in this area by 2015 and should secure the active participation of an equal number of faculty in the School of Management in order to support the expected enrollment.

New degree suites and departments that are built on an undergraduate foundation, as the THECB expects for new degree proposals, must incorporate academic structures and processes that facilitate student-faculty engagement. An example is the project-oriented freshman experience course that has been developed in Mechanical Engineering.

Goals for 2020:

The creation of other concentrations, degree programs and departments by 2020 may facilitate achieving and exceeding the enrollment goals laid out elsewhere in the strategic plan. A workable strategic plan for an academic entity must take account of the different time horizons for the initiation and termination of concentrations, degree programs and departments. Departments in particular should be created conservatively, in the expectation that they will last for many decades. During the next five years, the Jonsson School must create a detailed plan for further broadening its degree options.

Degree programs that have the potential for large undergraduate enrollments include Chemical Engineering and Environmental and Civil Engineering. Both of these areas are currently served by other Texas universities that are in close proximity to supportive industrial communities. In order to build degree programs and departments beyond the areas envisioned by 2015, the Jonsson School must broaden its engagement of the community from the Dallas/Fort Worth Metroplex to the entire state of Texas.

The doctoral enrollment of 665 planned for 2020 will support an annual PhD graduation rate around three times as large as the recent average of 45 PhD graduates per year. A smaller doctoral enrollment of 450 to 500 would double the recent PhD graduation rate.

Doctoral enrollment will be limited by the amount of available support from graduate fellowships, endowed chairs, and research and teaching assistantships. In order for the planned growth in doctoral enrollment to take place, the Jonsson School must at least double its research expenditures. This growth in research expenditures must be supported by increased extramural research funding, as well as by graduate fellowships supported by the income stream from new endowments.

Large professional master's programs have been a mainstay of Computer Science and Electrical Engineering since the inception of the Jonsson School. Revenue from these programs is a major part of the support for these large departments. Because some professional master's courses contribute little to the PhD programs, it may be unwise to staff professional master's courses exclusively with tenure-system faculty. UTD's location in one of the major high-technology centers in the U.S. makes it possible to recruit experienced individuals as senior lecturers, some of whom have doctoral credentials and research experience that permit them to teach at the master's level.

The Jonsson School, as part of a public university in Texas, must increase the diversity of its faculty. Some improvement in diversity will occur as a result of the growth of the future Bioengineering Department. That development, however, will not relax the need for diversity in other departments.

Decisions with respect to departmental sizes and enrollment configurations should not be forced on the sole basis of achieving the highest possible enrollment for the school. Goals for departmental growth should instead be based on departmental strategic plans that project achievable enrollments and take account of the varying student and industrial demands for undergraduate and graduate programs in different fields. Departmental strategic plans must be submitted for school-wide review by Jan. 1, 2011.

Appendix C describes the plan for funding faculty growth.

Strengthen existing departments and degree programs

Hire outstanding faculty:

No institution or department can afford a status-quo approach to faculty excellence. The existing departments must pursue strategically focused faculty hiring based on sustainable student enrollment and research funding in areas that support the best interests of the Jonsson School.

Specifically, tenure-system faculty should be added in degree programs and concentrations in which the stable ratio of students to tenure-system faculty is above 35 and in a few strategically chosen research areas, which are described elsewhere in this planning document. In faculty hiring, the top priority should be to hire outstanding people. The second priority should be a good fit with the desired area.

Increase enrollment:

The Departments of Computer Science and Electrical Engineering have reached the size that can be sustained with current levels of enrollment. To increase faculty numbers, the existing departments must undertake broad, new, vigorous student recruitment efforts at all levels. The goals should be, first, to stabilize enrollment near 2009 levels, and, second, to increase enrollment significantly beyond 2009 levels. Plans for departmental student recruitment strategies should be in place by Jan. 1, 2011.

Materials Science and Engineering is a strategically vital part of the Jonsson School because of the disciplinary and human links that exist among the Mechanical Engineering, Electrical Engineering, Biomedical Engineering and Materials Science and Engineering Departments. The Department of Materials Science and Engineering will study the feasibility of adding a viable bachelor's degree program by 2015, and it will create a strategic plan for increasing graduate enrollment. Enrollment in the recently launched undergraduate minor in Nanotechnology may indicate the potential for the success of a full-fledged undergraduate major in Materials Science and Engineering.

3. Foster excellence and impact in research

One of the goals of this strategic plan is to position the Jonsson School among the top 40 engineering schools in the United States, based on U.S. News & World Report rankings. An even more important goal is to position the school among the top engineering schools in the U.S. based on the impact of our research.

The cornerstone of the Jonsson School's long-term research reputation consists of both the cumulative impact of our research efforts and the success of our doctoral graduates, especially in academic positions at top universities.

Obtain resources for doctoral productivity

Many of the quantitative metrics that enter into ranking engineering schools, such as those shown in Appendix A, relate to research funding and PhD production. Benchmarking of our aspirational peer engineering schools has shown convincingly that minimum average research expenditures of $250,000 to $300,000 per tenure-system faculty member, and minimum PhD production of 0.3 to 0.5 PhD graduates per year per tenure-system faculty member, are necessary conditions for being ranked as a top engineering school.

More importantly, funding is necessary to support highly capable PhD students. A graduate research group that is sufficiently large enough so that experienced students can help new students get started on their research projects produces significantly more results, and it probably has a greater impact per graduate student than a research operation in which doctoral students work alone. Considerations of research efficiency and impact lead to goals for doctoral student enrollment and funding.

To sustain a doctoral graduation rate of 0.5 or more per year per faculty member, an average of at least three to four doctoral students must be supported per faculty member, primarily through research expenditures. In graduate-only degree programs, faculty should be expected to sustain a doctoral graduation rate of 0.5 to 1.0 per year, requiring the support of at least three to five doctoral students per faculty member. Supporting three to four doctoral students requires average research expenditures of at least $180,000 to $240,000 per year in 2008 dollars plus operational and capital expenses. To support five doctoral students, expenditures of at least $300,000 per year in 2008 dollars are necessary. These estimates do not take into account the indirect support provided to the research program by teaching assistantships.

Extramural funding, graduate fellowships, and the income streams from endowed chairs should support research expenditures for graduate students. Support from endowed fellowships and faculty chairs is essential in order to broaden the Jonsson School's research portfolio beyond areas of interest to extramural sponsors.

Recruit excellent doctoral students

It is in doctoral recruitment that the greatest opportunities for improvement exist. Nothing affects a faculty member's research productivity and impact more than the quality of his or her doctoral students. In the past, the Jonsson School has provided very little support for faculty involvement in doctoral recruiting, and no support for doctoral recruiting at universities in Texas. While individual faculty members have successfully recruited PhD students in Texas and elsewhere, they have mostly done so with their own resources. By Jan. 1, 2011, the Jonsson School must develop a plan for allocating resources to doctoral recruitment and design a system to reward faculty for participating in school-based doctoral recruiting, not merely recruiting for their own research groups. Doctoral recruitment should be focused on universities in Texas and nearby states and excellent international universities.

Focus on areas of excellence

One of our most important goals to enhance our research impact between now and 2020 must be to seek funding for, and build, nationally prominent research centers. The school should plan to build on the order of 10 research centers and institutes, led by National Academy of Engineering members where possible. The research centers should engage faculty members in the process of building a top-tier engineering school by helping the faculty develop their individual and team research efforts.

The new research centers should organize our faculty around proposal initiatives in fields in which we can lead and have a substantial impact, such as:

- Sustainable energy
- Security
- Healthcare technology
- Nanotechnology
- Cyber-physical systems

The new research centers should also focus on important enabling technologies in which we can lead, such as analog design, control theory, and materials science and engineering.

Provide for faculty development and intellectual life

A few faculty know from their earliest days as assistant professors what is necessary to succeed, probably as a result of good mentoring by their dissertation supervisors. Most faculty, especially early in their careers, benefit from suggestions that help them set priorities. Tenured faculty who change research areas may also benefit from mentoring. At one time the Jonsson School had a voluntary mentoring program, but recent experience with tenure cases makes it clear there is room for improving the mentoring process in both of our existing large departments. By the spring of 2011, all departments must include in their strategic plans a process for mentoring faculty and for interfacing with the University-wide mentoring programs.

One factor that influences peer evaluators of engineering departments is the fraction of faculty who have won national awards for research excellence, such as election to IEEE, ACM, ASME or AIAA fellowship, or election to the National Academy of Engineering. By the spring of 2011, the Jonsson School will create a school-wide committee to review faculty for nomination for major professional awards.

To improve the success rate of Jonsson School faculty in proposals for extramural funding, the school and departmental administrations should encourage and facilitate internal review and editing of proposals prior to submission. Informal opportunities for information transfer, such as luncheons involving faculty who span several research areas, may be useful in meeting this goal.

One of the hallmarks of a top-tier department is the vitality of its intellectual life. Jonsson School departments will strongly encourage attendance at regularly scheduled colloquia and seminars by faculty and doctoral students.

Standardize the promotion and tenure process

As a two-department engineering school, the Jonsson School could afford to use the default UTD process for tenure review, which was designed without departments in mind. As a major engineering school with a half-dozen departments, the Jonsson School must refine the tenure review process to ensure that high and uniform standards exist across the school and that all tenure-track faculty are fully informed of these standards. To this end, the Jonsson School should institute, by fall 2011, school-wide review of promotion and tenure cases.

Strengthen faculty governance

In a research university, the faculty play a strong leadership role. Faculty leadership is not possible without robust faculty governance institutions. A strong governance structure that incorporates collaboration between the central administration and faculty is a hallmark of UT Dallas. In order to align faculty governance in the Jonsson School with University-wide expectations and policy

for faculty governance, each department must take the following steps by 2011:

a. Create and implement departmental bylaws. The bylaws must ensure adherence to University and school policies for faculty performance evaluation and in all other areas.
b. Create, and obtain departmental approval of, departmental strategic plans. These strategic plans should be compatible with and reinforce the strategic plans of the school and the University.

4. Improve undergraduate and professional master's education

Recruit more broadly

The Jonsson School must work with the University, and supplement University-wide practices when necessary, to ensure that our recruiting, application, admission, and retention processes are consistent with the school's top-tier ambitions.

In keeping with the objective of broadly engaging the Texas community, the Jonsson School must recruit students at all levels and in all regions of Texas. To increase the yield of top undergraduate and graduate students, faculty members must broadly participate in meeting with prospective students and encouraging top students to choose the Jonsson School. By 2011, all departments must provide appropriate rewards and incentives for faculty members to engage actively in student recruiting.

Developing a pipeline of students from other universities requires more than faculty visits to give talks and meet with students. The Jonsson School must develop a plan for including selected faculty at other universities, especially in Texas, in the school's research programs through sabbaticals and collaborations.

The Jonsson School serves many student constituencies: First-time freshmen, undergraduates who transfer from other universities and community colleges, professional master's students, part-time doctoral students, and full-time doctoral students. Each of these groups of students has its own demographics, expectations and needs. The school must devise strategies that are specifically crafted for each group in order to attract the best students to apply and enroll.

Transfer students

Because our first-time undergraduates' SAT scores are already the highest of any public university in Texas, it is unlikely that the Jonsson School and the University will be able to effect substantial improvements in the quality of incoming first-time freshmen. There is a widespread perception among the Jonsson School faculty, however, that there is room for improvement in the academic performance of transfer students. This perception is not rebutted by the statistic that the grade-point averages of transfer students who graduate is not statistically different from the grade-point averages of students who entered as first-time freshmen.

The University's current undergraduate scholarship programs are almost exclusively merit-based and focused on first-time freshmen. While this strategy has produced highly credentialed entering freshman classes, it has done nothing to improve academic performance and retention of the majority of Jonsson School undergraduates, who do not enter as first-time freshmen. Financial necessity forces as many as 40% of our undergraduate students to work for 20 or more hours per week, predisposing them to academic underachievement. The Jonsson School must find ways to provide financial aid for transfer students using a combination of need and merit as the criterion for making awards. To this end, the school must prepare, by 2011, a plan for attracting highly qualified transfer students from all over Texas, using financial aid as one incentive. Financial aid has proven its worth in improving the quality of our first-time freshmen. It is now time to use financial aid as a strategy in recruiting top-quality transfer students.

Professional master's students

In many engineering schools, master's programs are primarily intended to prepare students for doctoral programs and research careers.At urban universities such as UT Dallas, however, professional master's programs are important generators of funds that support academic programs in the engineering school and the university. The master's enrollment growth projected in Table 1 is important in order to support the planned increase in faculty numbers. Achieving the projected master's enrollment growth will require substantial recruitment efforts.

The recruitment of high-quality professional master's students requires a different approach from the recruitment of undergraduates. Many professional master's students are full-time employees of local companies. Others are international students who are attracted to the high-quality educational experiences that are available in the U.S. and the low cost of living in North Texas. Marketing the Jonsson School master's programs to international students should include, at a minimum, Web and print advertisements, and, if at all possible, the development of personal contacts at universities whose students we would like to recruit. A detailed marketing plan for international students will be prepared by 2011.

Initiatives that may make the master's programs of the Jonsson School attractive to able, ambitious engineers include packaging existing and new courses into concentrations and certificate programs that will give our graduates a competitive advantage in areas of high demand. We have begun this process by creating a master's concentration in RF and Microwaves and a Graduate Certificate in Infrared Technology. A graduate certificate program in Systems Engineering and Management began in spring 2010. Additional areas in which such opportunities exist should be identified as part of departmental strategic planning processes.

Foster excellent teaching

From the taxpayers' point of view, the foremost purpose of a university is education. The path to excellence in teaching begins with an understanding that education involves much more than presenting subject matter and testing student comprehension of the material presented. The Jonsson School must take concrete steps to encourage its faculty to take proactive steps to improve teaching, and to support them in doing so.

To a university's outside community as a whole, the most visible academic aspect is the ensemble of bachelor's programs. One of the historical reasons for UTD's lack of visibility in the Texas community is also one of its greatest strengths: the University's origins as a graduate research institute. Plans for the future must take into account the fact that a great engineering school provides great education to both undergraduate and graduate students.

Faculty engagement with students is a necessary condition for excellence in education. The Jonsson School has taken a step toward engaging the tenure-system faculty with the undergraduate programs by requiring that all tenure-system faculty teach at least one undergraduate course every academic year. Further concrete steps must be taken to engage the tenure-system faculty in the Jonsson School's existing departments with undergraduate students through a carefully crafted system of teaching workshops, financial incentives, internal teaching awards, and requirements. For example, the Jonsson School and its departments may wish to implement incentives for faculty to play active roles as advisors or mentors of student organizations.

Providing faculty with feedback on their teaching performance is potentially an effective way to improve teaching performance. The current system, in which teaching performance is evaluated solely on the basis of student surveys, is ineffective because students have not yet completed their education, and therefore they focus on the details of a single course, not necessarily on the most important details from an educational point of view. The Jonsson School must incorporate peer evaluation as an important component of evaluating faculty teaching performance. Peer evaluations of teaching should be coordinated through the elected departmental and school-wide performance evaluation committees, and through the Jonsson School Committee on Effective Teaching.

Foster undergraduate participation in research

In mature universities, the bachelor's programs are among the most important pipelines to the graduate programs. Concentrations should be created in the existing undergraduate programs to prepare students for graduate work in the graduate-only Departments of Bioengineering and Materials Science and Engineering.

As the quality of our undergraduate students has improved, so has the value that undergraduates can bring to the research projects of faculty and graduate students. Each undergraduate degree program should undertake initiatives to match interested undergraduates with faculty members, and assistance should be provided to faculty with NSF grants to take advantage of the ready availability of supplemental funding to support research experiences for undergraduates.

Retain our undergraduates

Retention of undergraduates who have enrolled as engineering or computer science majors is crucial to achieving our objectives for enrollment growth and improving the Jonsson School's position in national rankings. The University has addressed freshman retention with the Gateways to Excellence in Math and Science (GEMS) initiative.[4] However, the Jonsson School, in which two-thirds of our bachelor's graduates did not matriculate as first-time freshman, must take a broader view by including transfer students in our undergraduate retention goals. The Jonsson School must create a plan for academic evaluation and remediation of transfer students at the time of entry into the school.

The primary reasons why students leave engineering and computer science are poor academic performance in required courses and failure to identify with their chosen profession. The causes of poor performance include an inadequate academic background, a lack of effective study skills, and, above all, discouragement when success is not immediate. Performance improvements that have been proposed and tested in other engineering schools include increasing the time students spend in class and recitation sections, remediation in specific skill areas, and building a culture of success and group identity with other students in the same major.

As noted previously, approximately 40% of the undergraduates in the Jonsson School work outside the University for 20 hours or more per week in order to pay for their college education. Working half time or more at an outside job, even one that contributes to a student's engineering experience, has a significant adverse impact on the student's academic performance. Many of those students with substantial work commitments begin their education at community colleges in order to reduce the cost of their education. Undergraduate scholarship programs targeted at academically capable transfer students should be part of the Jonsson School's retention strategy.

By 2011, all departments with undergraduate degree programs should prepare detailed plans for increasing the amount of organized instructional time in required undergraduate courses without increasing the number of required semester credit hours. The departments must also create plans for online remediation in specific academic skills that incoming students frequently

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4 http://www.utdallas.edu/GEMS/

lack. Most importantly, the departments with undergraduate programs must design and implement student experiences to provide a smooth transition from the students' previous academic preparation to the environment of a top-tier engineering school.

Ensure success in meeting accreditation requirements

Accreditation is an absolute necessity for bachelor's programs in engineering, and it is highly desirable in Computer Science. The next ABET[5] accreditation visit for our currently accredited engineering and computer science programs will occur in fall 2011. In the best possible case, the next visit after that will occur in fall 2017. Constant preparation for accreditation scrutiny is essential because of the ABET and SACS requirements for continuous improvement.

The collection and analysis of assessment data requires a dedicated professional staff, adequately supported by professional and classified staff and student teaching assistants. The Jonsson School must maintain its commitment to success in meeting accreditation requirements by maintaining its staff support for assessment and adopting new processes that increase our efficiency in documenting continuous improvement.

A weakness that ABET visitors have consistently identified in the Jonsson School's undergraduate programs is a lack of breadth of faculty engagement in the processes of assessment and accreditation. To ensure broad faculty engagement, the school must undertake periodic broadly based faculty training on ABET criteria and processes. The last such training exercise was in 2003. All Jonsson School faculty should receive professional ABET training at least once every six years. In addition, incentives should be created to encourage full professors to become ABET evaluators.

Another consistently identified weakness is that Jonsson School programs collect more data than they can analyze. Current paper-based data collection methods must be replaced by electronic data collection by Jan. 1, 2011, in order to permit automated data analysis.

ABET requires an engaged industrial advisory board for each accredited degree program. The heads of the existing undergraduate degree programs have succeeded in creating strongly engaged industrial advisory boards. However, like an excellent faculty, a well-engaged industrial advisory board is always a work in progress. The school and departmental administrations should review the existing industrial advisory boards annually in order to replace members whose interests have evolved in other directions with new members who are eager to contribute.

5. Expand the infrastructure and opportunities for excellence

The minimal infrastructure resources required to build school-wide excellence in research are as follows:

Needed by 2015:

a. Office, research laboratory, TA and conference space @ 1,700 ft² per new faculty member for 40 new faculty: Add 68,000 assignable ft² by 2015.
b. Classroom space @ 25 ft² per student[6] for 915 new bachelor's and master's students: Add 22,875 assignable ft² by 2015.
c. Teaching laboratory space @ 25 ft² per student for 735 new bachelor's students: 18,375 assignable ft² by 2015.
d. Space requirement for 41 additional tenure-system faculty members and 1,420 additional students (headcount): 109,250 assignable ft² by 2015.
e. **New or renovated space providing 182,000 gross ft² must be provided by 2015** (assuming a ratio of assignable square feet to gross square feet of approximately 0.6). This is almost equivalent to the area of a new NSERL building without the clean-room facilities.

The projected space need is 4,550 gross ft² per tenure-system faculty member. The current university-wide average of 4,000 gross ft² per faculty member includes a large majority of faculty outside the Jonsson School who do not require teaching or research laboratories.

It is noteworthy that much of the projected growth in laboratory space must occur by 2015. The Mechanical Engineering and Bioengineering Departments cannot grow as projected in this plan without additional high-quality research and teaching laboratory space. Because of the near-term nature of this need, this space must be in renovated building areas, leased space or both. New buildings probably cannot be constructed in time to meet the near-term space requirements entailed by the projected growth in Mechanical Engineering and Bioengineering. Therefore, we must depend on leased, purchased or renovated space for new laboratory space for faculty research and undergraduate laboratories. The Jonsson School leadership will work with University administration to develop a transition plan to provide adequate office, classroom, and research and teaching laboratory space for the growth expected by 2015.

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5 http://www.abet.org/

6 David E. Daniel, "White Paper on Implementation of the UT Dallas Strategic Plan," p. 25 (Draft 2, 2007).

Total needed by 2020:

f. Office, research laboratory, TA and conference space @ 1,700 ft² per new faculty member for 70 new faculty: Add 119,000 assignable ft² by 2020.
g. Classroom space @ 25 ft² per student[7] for 2,110 new bachelor's and master's students: Add 52,250 assignable ft² by 2020.
h. Teaching laboratory space @ 25 ft² per student for 1,150 new bachelor's students: 28,750 assignable ft² by 2020.
i. Space requirement for 80 additional tenure-system faculty members and 2,440 additional students (headcount): 200,000 assignable ft² by 2020.
j. **New or renovated space providing 335,000 gross ft² must be provided by 2020** (assuming a ratio of assignable square feet to gross square feet of approximately 0.6). This is equivalent to the combined area of ECS North and South, with much more provision for laboratory facilities than in ECS South.
k. Staff requirements for 70 new tenure-system faculty at one staff for every four faculty: Add 17 new staff positions.
    i. Regularly provide professional training for new and current staff.
l. Increase the operating budgets of the existing departments to cover the expenses of additional instructional and staff requirements.

These goals are based on the increases in student enrollment and tenure-system faculty numbers projected in Table 1. Jonsson School administration and faculty will develop a space-utilization plan by 2011. For the most efficient use of space, planning should be school-wide, not department by department.

6. Enhance diversity and community relations

"Community," for the purpose of this imperative in the Jonsson School strategic plan, means the Texas community, including industry, K-12 schools, and state and local government. As a state university, the Jonsson School must have good relations with this broad community for industry support, legislative success, student recruitment and placement of our graduates in industry.

The foundation for strong community relations is the Jonsson School's reputation. Our bachelor's and master's graduates, our marketing and our outreach efforts are the major determinants of our reputation in the Texas community. The Jonsson School must be seen as an asset to the entire state of Texas and as one of the best destinations in Texas for engineering and computer science students.

Broaden relations with industry

To become one of the nation's top engineering schools, the Jonsson School must expand industry awareness of, and engagement with, its programs beyond the school's base in the Dallas/Fort Worth Metroplex. Engagement includes recruiting students at all levels, as well as marketing the school through industrial and community relations and undertaking collaborative relations with other Texas universities. To this end, the Jonsson School, in collaboration with its Industrial Advisory Board, must develop a comprehensive marketing plan by 2011. The marketing plan should show how the Jonsson School can take advantage of the geographical and demographical diversity of Texas to strengthen the school's industrial base and improve its recruiting effectiveness.

Build strong alumni relations

Strong relations with alumni are essential to improve the Jonsson School's position in national rankings, meet the expectations of our accreditation and continuous improvement processes, and increase the yield from annual giving and capital campaigns.

Good alumni relations begin on the day a student first enters the Jonsson School. Starting with redesigned freshman experience courses, each Jonsson School degree program must plan how to improve the experiences of its students. The goal here is not to win a popularity contest, but to provide each student with experiences that he or she will recognize as professionally essential after graduation.

Alumni relations are vital for assessment, SACS/ABET accreditation, and improvement of our rankings, as well as development. We have a long way to go in improving communications with our existing alumni. To this end, the Jonsson School will work with the UTD Vice President for Development and Alumni relations to create a strong Jonsson School alumni network.

Build excellence through development

Organizations frequently carry out fundraising to support immediate crucial needs, but development should support the objective of maximizing large gifts over the long term.

In both private and public engineering schools, endowment income provides excellence funding in the form of income from endowed chairs, graduate fellowship endowments and undergraduate scholarship endowments. The Jonsson School needs endowment income to help close the gap between the funding per student provided by the state and the funding needed for top-tier

7 David E. Daniel, *ibid*., p. 25.

education and research.

There are three ways to answer the question, "How large an endowment does the Jonsson School need?" The first is to refer to earlier local goals, such as those set for Project Emmitt. The second is to refer to the excellence funding per student that other universities in Texas receive from sources other than the legislature. The third is to compare revenue per student at UT Dallas with revenue per student at national peer (or aspirational peer) universities.

The Project Emmitt goal was $100 million in endowment funds for the Jonsson School. A way to measure the effectiveness of an endowment in promoting educational objectives is to consider the endowment per student, which indicates in very rough terms how much income is available per student. An endowment of $100 million would generate approximately $4 million per year, which in terms of the current undergraduate enrollment of roughly 2,000 students translates to an income stream of $2,000 per year per undergraduate student.

At the University of Texas at Austin, the Available University Fund provides approximately $3,000 per student per year in addition to state formula funding and designated tuition and fees. An income stream at this level would require a Jonsson School endowment of at least $150 million.

UT Dallas President David E. Daniel has estimated that our peer universities elsewhere in the nation have student revenue of approximately $18,000 per student per year. UTD revenue is closer to $12,000 per student per year. Raising UTD's revenue stream to this level would require an endowment of $300 million. Clearly, the endowment alone cannot be expected to address this entire funding gap. We must increase support from both private industry and external funding as well.

Going forward, the Jonsson School must develop a plan for endowment growth that matches enrollment growth over the long term. By 2011, the Dean should work with the Jonsson School Industrial Advisory Board to set an achievable goal for the endowment.

Increase student diversity

The future of the engineering profession in the United States depends upon the success of engineering schools in recruiting women and minorities to enroll in and complete engineering degree programs. Until now the Jonsson School has operated without a plan for recruitment of underrepresented groups. The result has been unplanned and little-understood enrollment changes. For example, from 2003 to 2008, the fraction of bachelor's degrees awarded to women by our Computer Science Department fell from 31.9% to 11.7% while the national average declined much less, from 17.9% to 11.4%. Also from 2003 to 2008, the fraction of Electrical Engineering bachelor's degrees that the Jonsson School awarded to women fell from 27.3% to 16.8%, while the national average declined from 14.8% to 12.1%. To reverse these sharp declines, and to build African-American and Hispanic enrollments, the departments and the school must take strong action.

By 2011, the school must devise an actionable plan for recruiting increased numbers of women and minority students, especially as first-time and transfer students in bachelor's programs. The school should work closely with the office of the Vice President for Diversity and Community Engagement to develop these plans.

Because many students from underrepresented groups enter the Jonsson School as transfers from community colleges, the school and the University must seek ways to increase financial aid for transfer students.

Efforts to build student diversity cannot stop at matriculation. Different underrepresented groups have different support needs. The existence of appropriate support structures may be an important consideration for students as they decide where to enroll. Support in addition to financial aid may include both student organizations and school or University structures. Planning for effective support of students from underrepresented groups should be undertaken as soon as possible in collaboration with the office of the Vice President for Diversity and Community Engagement.

Build faculty diversity

Many of our national diversity rankings are respectable in terms of absolute numbers, but less so in percentage terms. The Jonsson School must work with the office of the Vice President for Diversity and Community Engagement to recruit faculty members from underrepresented groups, with the goal of exceeding national percentage averages as tabulated by the American Society for Engineering Education.

APPENDICES

A. Benchmarking against selected engineering schools

B. Enrollment projections, 2010–2020

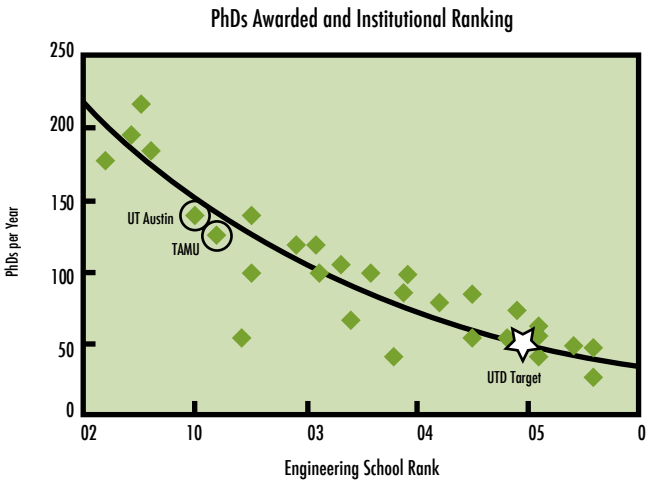
C. Funding faculty growth

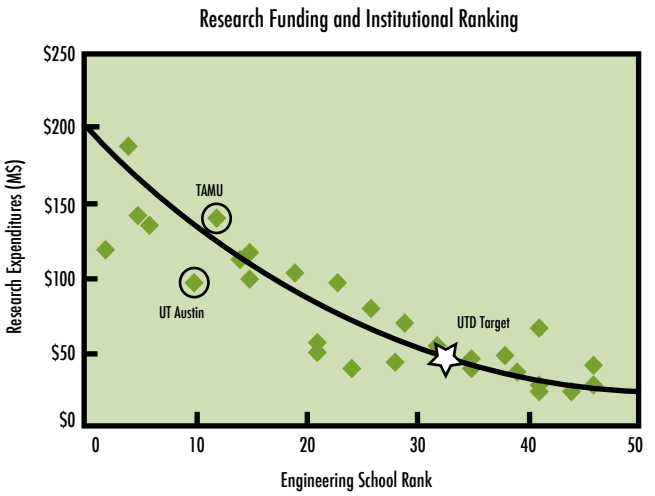
APENDIX A.

Benchmarking against selected public engineering schools (From presentations by C.R. Helms)

	Engineering Ranking	T/TT + Res. Faculty	PhDs	Research Expenditures	PhD/Fac	Res. Expenditures/Fac	ASEE Res. Expen. last year	ASEE Expen./Fac
Virginia	37	144	51	$54	0.35	$375	$51	$354
UC Irvine	37	155	89	$66	0.57	$426	$45	$290
Colorado	40	190	76	$57	0.40	$300	$59	$311
Iowa State	45	254	78	$65	0.31	$256	$59	$232
Delaware	47	96	69	$39	0.72	$406	$35	$365
Rutgers	47	131	66	$78	0.50	$595	No report	NA
Arizona State	50	227	100	$50	0.44	$220	$45	$198
Pittsburgh	50	138	52	$57	0.38	$413	$44	$319
Massachusetts	54	128	50	$42	0.39	$328	$20	$156
Michigan State	55	194	62	$27	0.32	$139	$24	$124
Colorado State	55	93	27	$50	0.29	$538	$50	$538
Average	47	159	65	$53	0.43	$363	$43	$289
UT Dallas	77	85	42	$23	0.49	$271	$19	$224
Recent UTD		90	54		0.60			

Sources: U.S. News & World Report, ASEE





APPENDIX B.

Enrollment projections

Table B1 summarizes fall 2009 enrollments in Jonsson School degree programs. Noteworthy features include a master's enrollment in Computer Science that is nearly equal to the bachelor's enrollment, a graduate-only program in Materials Science and Engineering, and very rapidly growing undergraduate enrollment in Mechanical Engineering. The student/faculty ratios for CS and EE were calculated by assuming that Computer Science faculty teach all software engineering majors and that CS and EE faculty share equally in teaching Computer Engineering and Telecommunications Engineering majors.

Degree program	BS	MS	PhD	Enrollment	Tenure-system faculty See note (c)	BS S/F ratio	MS S/F ratio	PhD S/F ratio
CE	191	59	11	261	See note (a)	See note (b)	See note (b)	See note (b)
CS	558	424	114	1,096	46	18.5	11.9	2.9
EE	559	288	150	997	37	18.1	9.1	4.3
MECH	135	6	0	141	5	27.0	1.6	0
MSEN	0	14	30	44	9	0.0	2	3.3
SE	184	76	8	252	See note (a)	See note (b)	See note (b)	See note (b)
TE	31	36	10	77	See note (a)	See note (b)	See note (b)	See note (b)
Totals	1,658	903	323	2,884	97	17.1	9.3	3.3

Table B1. Jonsson School enrollments in fall 2009. Only degree-seeking students are counted in the enrollments shown in this table.

NOTES: (a) Computer Engineering, Software Engineering and Telecommunications Engineering are interdisciplinary programs to which no tenure-system faculty are assigned. The CE and TE programs are supported jointly by EE and CS. SE is supported directly by CS. (b) Student/faculty ratios for EE and CS have been calculated by adding half of the CE enrollment to each of the EE and CS enrollments at the same level (e.g., EE enrollment for S/F ratio = EE major enrollment + 0.5 CE major enrollment). (c) In this and the following tables, the number of T/T EE faculty does not include emeritus faculty or full-time administrators with tenured faculty appointments.

The plan for 2015 laid out in Table B2 calls for significant enrollment increases in the doctoral programs in Electrical Engineering, Computer Science and Materials Science and Engineering, as well as rapid faculty hiring and enrollment growth in Mechanical Engineering and Biomedical Engineering. The enrollments projected in Computer Engineering are based on 2008-2009 enrollment and application trends.

The doctoral enrollments in Computer Engineering, Telecommunications Engineering and Software Engineering projected for 2015 are barely large enough to ensure the viability of these doctoral programs. The Texas Higher Education Coordinating Board is expected to require that doctoral programs produce an average of at least two graduates per year.

The plan for 2015 calls for the creation of two new departments, Bioengineering and Systems Engineering and Management. The Texas Higher Education Coordinating Board authorized doctoral and master's programs in Biomedical Engineering in fall 2009, and authorized the creation of a Department of Bioengineering in January 2010. UTD has the Coordinating Board's preliminary authorization for bachelor's and master's degree programs in all areas of engineering, and for the Ph.D. in Systems Engineering.

Degree program	BS	MS	PhD	Enrollment	Tenure-system faculty	BS S/F ratio	MS S/F ratio	PhD S/F ratio
BMEN	80	50	20	150	5	16.0	10.0	4.0
CE	400	75	20	495	See note (a)	See note (b)	See note (b)	See note (b)
CS	630	500	130	1,260	51	20.3	12.4	3.0
EE	610	345	165	1,120	42	19.8	9.5	4.3
MECH	400	250	100	750	25	16.0	10.0	4.0
MSEN	0	50	40	90	12	0.0	4.2	3.3
SE	185	75	10	270	See note (a)	See note (b)	See note (b)	See note (b)
SYSM	50	25	10	85	3	16.7	8.3	3.3
TE	45	35	10	90	See note (a)	See note (b)	See note (b)	See note (b)
Totals	2,395	1,405	505	4,305	138	17.4	10.2	3.7

Table B2. Projected Jonsson School enrollments of degree-seeking students in 2015.

NOTES: (a) CE, SE and TE are interdisciplinary programs to which no tenure-system faculty are assigned. The CE and TE programs are supported jointly by EE and CS. SE is supported directly by CS. (b) Student/faculty ratios for EE and CS have been calculated by adding half of the CE enrollment to each of the EE and CS enrollments at the same level (e.g., EE enrollment for S/F ratio = EE major enrollment + 0.5 CE major enrollment).

To provide instructional support for the enrollment of 5,330 students envisioned for 2020 and beyond, the Jonsson School must plan for 170 to 180 tenure-system faculty members, or an increase of more than 50% over the number of tenure-system faculty in 2009. Table B3 summarizes enrollment and faculty goals for 2020, under the assumption that no new departments are added beyond the ones called for by 2015.

The default student/faculty ratios for full-spectrum degree programs employed in Table B3 are 16 BS/faculty, 10 MS/faculty and 4 PhD/faculty. The ratios for CS and EE are based on historical experience instead of these target ratios.The PhD enrollment of 665 projected for 2020 would support an annual graduation rate of 120, more than four times the 2009 PhD graduation rate.

Degree program	BS	MS	PhD	Enrollment	Tenure-system faculty	BS S/F ratio	MS S/F ratio	PhD S/F ratio
BMEN	150	100	40	290	11	13.6	9.1	3.6
CE	400	150	50	600	See note (a)	See note (b)	See note (b)	See note (b)
CS	660	575	140	1,375	51	20.9	14.6	3.5
EE	660	400	180	1,240	42	21.0	11.7	5.0
MECH	640	405	160	1,205	40	16.0	10.1	4.0
MSEN	0	65	55	220	15	0.0	4.3	3.7
SE	185	75	10	270	See note (a)	See note (b)	See note (b)	See note (b)
SYSM	80	50	20	150	9	8.9	5.6	2.2
TE	45	35	10	90	See note (a)	See note (b)	See note (b)	See note (b)
Totals	2,815	1,855	665	5,335	168	16.8	11.0	4.0

Table B3. Projected Jonsson School enrollments of degree-seeking students in 2020.

NOTES: (a) CE, SE and TE are interdisciplinary programs to which no tenure-system faculty are assigned. The CE and TE programs are supported jointly by EE and CS. SE is supported directly by CS. (b) Student/faculty ratios for EE and CS have been calculated by adding half of the CE enrollment to each of the EE and CS enrollments at the same level (e.g., EE enrollment for S/F ratio = EE major enrollment + 0.5 CE major enrollment).

APPENDIX C

Funding faculty growth

The plan for funding faculty growth is to keep the numbers of tenure-system faculty within the envelope that can be supported by instructional revenues, as shown in Table C1.

In Texas public universities, instructional revenues include state formula funding and designated tuition and fees. The formula funding per student per credit hour in a given field is calculated as the Texas Higher Education Coordinating Board base rate times a multiplier that depends on the field of study and the student's level. For 2010–2011, the base rate is $59.02 per student per credit hour, and the engineering multipliers are 2.46 (for lower-division undergraduate hours), 3.51 (for upper-division undergraduate hours), 7.39 (for master's hours), and 17.05 (for PhD hours).

Formula funding is determined from enrollment statistics during a base year. Since there is a base year only once every two years, formula funding may lag actual enrollment by as much as two years. Although this system penalizes vigorously growing degree programs, one can see from Table C1 that tuition and fee revenues are adequate to fund faculty salaries as an engineering program grows.

The designated tuition and fees for in-state students are $9,050 for engineering undergraduates (assuming a 15-hour load per semester) and $8,320 for master's and doctoral students (assuming a nine-hour load per semester). From Table C1, one can see that only at the doctoral level does formula funding exceed the revenue from tuition and fees.

In reviewing Table C1, one should bear in mind that the Jonsson School does not directly receive the instructional revenues that the school generates, and that instructional costs include more than faculty salaries. Instructional revenue goes to the University, which funds the budgets of the academic schools and administrative departments. However, it is clear from Table C1 that a full-spectrum engineering degree program with the student/faculty ratios of 16, 10 and 4 for bachelor's, master's and doctoral students can support the costs of its faculty and teaching assistants, even at a significant discount from the revenue that it generates for the University.

Funding for buildings and start-up research equipment will come from several sources, including Permanent University Fund (PUF) bond allocations through the University of Texas System, State appropriations, and UT Dallas tuition revenue bonds. UT Dallas administration believes that these sources are more than adequate to fund the expansion of the Jonsson School planned for 2010–2020.

Degree	Tuition (in-state) +fees per 9-month academic year	SCH per 9-month academic year	Formula funding per SCH	Formula revenue per student, per 9-month academic year	Total revenue per student, per 9-month academic year	Student/faculty ratio	Revenue per faculty member, per 9-month academic year
BS (lower)	$9,050	30	$145	$4,356	$13,406	8	$107,245
BS (upper)	$9,050	30	$207	$6,215	$15,265	8	$122,118
MS	$8,320	18	$436	$7,851	$16,171	10	$161,708
PhD	$8,320	18	$1,006	$18,113	$26,433	4	$105,733
TOTAL							$389,560[8]

Table C1.

Revenues per faculty member for the student/faculty ratios of 16, 10 and 4 at the bachelor's, master's and doctoral levels. Lower division means freshmen and sophomores; upper division means juniors and seniors. The calculation of total revenue per faculty member excludes lower-division bachelor's revenues because lower-division students take most of their courses outside of engineering and computer science. A student/faculty ratio of 8 for both lower-division and upper-division undergraduates leads to an overall student/faculty ratio of 16, assuming equal numbers of lower-division and upper-division students.

8 Calculated as the sum of upper-division bachelor's, master's and doctoral revenue for the indicated student/faculty ratios.