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Faculty Self-Study for External Review



UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

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1.0 Executive Summary

The Faculty of Applied Science & Engineering has strengthened its position as Canada's premier engineering school. Over the last five years, we have expanded and enriched our educational programs and research. We have enhanced opportunities for our students and researchers to engage in multidisciplinary collaboration and develop global fluency in addition to competencies in communication, leadership and entrepreneurship. We have achieved and exceeded many of the goals set out in our *Academic Plan 2011–2016*.

This self-study serves as a guide for the Faculty's 2017 external review and will inform the development of our next Academic Plan. It was created in accordance with the *Provostial Guidelines for Review of Academic Programs and Units* and the review's *Terms of Reference* and is the result of a comprehensive and iterative consultation process that included faculty members, staff, students, external partners and alumni.

1.1 Undergraduate Education (Chapter 3)

Our innovative undergraduate programming, along with targeted outreach, recruitment, communications and marketing, attracts talented and diverse students from across Canada and around the world. We have increased overall applications to our programs by 65 per cent in the last five years, and more than doubled the number of applications from international students.

By enhancing the diversity of our student body, we enrich both the student experience and the engineering profession as a whole. The proportion of women in our most recent incoming undergraduate class is 40.1 per cent, compared to 20.2 per cent a decade ago. Twenty-seven per cent of our incoming students come from outside of Canada, compared to 13.3 per cent in 2006. Our new broad-based admissions process enables us to select students who excel not only academically, but also in communication, leadership, problem solving and other key engineering competencies.

Our innovative educational and co-curricular programs provide rich opportunities for experiential learning and multidisciplinary collaboration. We have integrated engineering design across all years of study, from first-year Engineering Strategies & Practice and Praxis courses, to fourth-year capstone design courses. Nearly two-thirds of eligible students choose to complete 12- to 16-month Professional Experience Year (PEY) internships — one in 10 outside of Canada — in local startups or large multinational companies. More than half our students pursue multidisciplinary minors and certificates. In the past five years, we have created the Institute for Leadership Education in Engineering (ILead) and The Entrepreneurship Hatchery to further our commitment to developing technically strong and well-rounded engineers.

1.2 Graduate Education (Chapter 4)

Our research- and professional-stream graduate programs attract highly qualified students from around the world and prepare them to be global leaders in research, academia, industry or government. Our graduate cohort has grown to increase our research capacity and impact on the engineering profession. We have achieved and surpassed two key *Academic Plan* goals: reaching our enrolment target of 2,000 graduate students (two years early) and increasing the number of Master of Engineering (MEng) students to more than 50 per cent of full-time equivalent master's students. Strong demand for our MEng program, particularly among international

students, has resulted in a nearly three-fold increase in full-time equivalent enrolment since 2010 and a more than five-fold increase since 2006.

Demand for our research-stream programs remains very high among international students, yet we are only able to accept a limited number (4 to 14 per cent) of these highly qualified students. We have expanded our efforts to recruit more domestic students into our research-stream programs through cross-Canada graduate studies fairs and our annual Faculty-wide Graduate Research Days event. We have increased the number of students who enter PhD programs by fast-tracking MAsc students or admitting bachelor's degree students directly, thereby reducing their overall time in graduate school.

We have enriched the options available to our graduate students by creating programs such as the Collaborative Program in Engineering Education, the PhD in Biomedical Engineering (Clinical Concentration), the MEng in Cities Engineering and Management and the MEng in Biomedical Engineering. We have also created areas of emphasis for MEng students. Through programs such as Prospective Professors in Training (PPIT) and ILead's courses and workshops, we support our graduate students in developing professional competencies and preparing for their future careers.

1.3 Research (Chapter 5)

Research produced within U of T Engineering addresses global challenges, from building smarter cities to developing sources of clean energy. By leveraging government funding and developing strategic partnerships with industry, we enhance our capacity to develop novel and effective technologies. In 2014–2015, the most recent year for which complete data are available, our research operating funding per faculty member was \$283,000, up 16.5 per cent from 2009–2010 and up 47.4 per cent from 2005–2006. We achieved our *Academic Plan* goal of increasing Tri-Council research funding to \$25 million by 2015, three years ahead of schedule, and are well positioned to meet our revised goal of \$32 million this year.

Facilitating cross-disciplinary collaboration continues to be a priority. In the past five years, we have created 11 multidisciplinary research centres and institutes that bring together expertise from our Faculty and partners in industry and academia. Partnering with the Faculty of Medicine led to the creation of Medicine by Design and the Translational Biology and Engineering Program, two research initiatives that focus on addressing major challenges at the intersection of biology, engineering and regenerative medicine.

International recognition of our research excellence has enhanced our ability to attract even more talent to our programs. In 2015–2016, our faculty members earned more than 20 per cent of the major national and international honours and awards given to Canadian engineering professors, despite comprising only 6.1 per cent of the nation's engineering faculty. We are home to 77 research chairs, up from 56 in 2010, including Canada Research Chairs, NSERC Industrial Research Chairs, endowed chairs, U of T Distinguished Professorships and University Professorships. We also created seven Percy Edward Hart and Erwin Edward Hart Professorships to facilitate the research and educational activities of our early-career faculty.

We provide a suite of programs to help our researchers translate their innovations from the laboratory to the marketplace or clinic, including in-house startup accelerators and collaborative training programs. Since 2010, our faculty members have accounted for 43 per cent of all invention disclosures at the University of Toronto and have launched 36 spin-off companies.

1.4 Organizational Structure, Resources and Infrastructure (Chapters 6 & 7)

We have hired 50 tenure-stream faculty members since 2010, many of whom work at the intersection of more than one field and hold cross-disciplinary appointments. Over that same period, we also hired seven teaching-stream faculty members who bring world-leading expertise and a strong dedication to pedagogic excellence to our classrooms. Thirty-six per cent of all new hires have been women, and we have increased the proportion of female faculty members from 15.8 per cent to 21.0 per cent over the last five years. More than 300 staff members support our Faculty with expertise in financial management, information technology, communications, fundraising, human resources and classroom laboratory support and other fields. We continue to provide rich professional development opportunities for both faculty and staff.

We continue to maintain a balanced budget while advancing our Faculty's priorities. Strategic investments from the federal and provincial governments, industry partners and philanthropic donors have enabled us to expand our research facilities and create new ones, such as BioZone, the Ontario Centre for Characterization of Advanced Materials and the Centre for Industrial Application of Microcellular Plastics. We have also upgraded our educational infrastructure, building a Technology Enhanced Active Learning (TEAL) classroom and renovating a number of undergraduate teaching laboratories. Our Faculty's newest building, the Centre for Engineering Innovation & Entrepreneurship (CEIE) is scheduled to be completed in late 2017. It will set a new standard for engineering education and research by providing flexible spaces for cross-disciplinary collaboration, experiential learning and entrepreneurship.

1.5 Relationships, Contributions and Influence (Chapter 8)

We enrich our educational programs and research through collaborations with other Faculties at U of T and with industry partners, alumni and international peer institutions. These partnerships take many forms, including research collaborations, joint educational programs and student exchanges. Companies from across Canada and around the world hire our students for year-long internships and work with them to solve industrial challenges through our University of Toronto Institute for Multidisciplinary Design and Innovation or through fourth-year capstone courses.

Student mobility at the undergraduate level helps build global fluency, a key competency in an increasingly borderless world. We have grown the number of our students who complete educational or research exchanges at peer institutions worldwide, as well as those who are hired on PEY internships outside Canada. We have also developed international partnerships, such as the International Capstone Course with Peking University and Tsinghua University, which enrich the experience of our students and present new opportunities for cross-cultural exchange.

To enhance and formalize our network of more than 300 industry partners, we created the positions of Director, Corporate, Government & International Partnerships and Director, Foundation and Corporate Partnerships. These roles identify areas where the strategic priorities of our industry partners overlap with our expertise. We also continue to strengthen our vibrant, global network of engineering alumni and leverage opportunities for them to engage with our Faculty through guest lectures, mentorship of student startups and philanthropic support.

1.6 Diversity (Chapter 9)

Diversity deepens the engineering creative process and enriches the student experience by exposing all of us to new perspectives. We are committed to enhancing diversity in all its forms across our Faculty. More than a quarter of incoming undergraduates and more than a third of our graduate students come from outside of Canada. We are part of a broad national coalition that aims to increase the proportion of women to 30 per cent of all newly licensed engineers by 2030, and our recent success in increasing the number of females in our undergraduate (40.1 per cent of incoming students) and graduate (26.1 per cent of all graduate students) programs will help advance this goal.

Our commitment to diversity also extends to our faculty complement. In addition to the increasing proportion of women professors in our Faculty, women engineers now hold a number of senior leadership positions at both the Faculty and University levels, including the inaugural Vice-Provost, Innovations in Undergraduate Education and the President's Senior Advisor on Science and Engineering Engagement.

Our new Director of Engineering Pathways and Indigenous Partnerships will coordinate efforts to reach out to First Nations, Métis and Inuit communities and increase their participation in the engineering profession. Through targeted outreach, we continue to engage with youth across our country, including those in traditionally underrepresented groups. We remain committed to ensuring that our Faculty is a welcoming place where LGBTQ students, staff, faculty, alumni and allies can thrive.

1.7 Conclusion

Over the last five years, we have expanded and diversified our faculty, staff and students, enriching both our pool of talent and student experience. We have leveraged investments from governments, industry partners, alumni and friends to build world-leading infrastructure, and we have enhanced programs that develop the next generation of makers, entrepreneurs and global leaders. While we have strengthened our position as Canada's premier engineering school, opportunities remain to continue to enhance the impact of our research and educational programs. We will continue to seek out the best students and faculty the world has to offer and provide opportunities for them to develop competencies that enable them to address society's most relevant challenges.

2.0 Introduction and Context

2.1 Overview of Faculty of Applied Science & Engineering (FASE)

The Ontario School of Practical Sciences was founded in 1873 and established its physical presence in 1878, twenty-two years before it became the Faculty of Applied Science & Engineering (FASE) in 1900. The Faculty joined the University of Toronto in 1906 and from that time onward has grown to become an international leader in engineering education and research with cross-Faculty and collaborative research initiatives that extend across Canada and around the world.

Our Faculty is a diverse community that includes more than 5,400 undergraduate students, 2,300 graduate students, 260 faculty and 48,000 alumni. Through innovations in engineering education, we prepare the next generation of global engineering leaders with strong technical foundations and professional competencies in multidisciplinary research, teamwork, leadership and entrepreneurship. Our faculty members are international leaders in research who collaborate across disciplines to address key global challenges, from new diagnostics and treatments for human diseases to wearable technology, smart cities and renewable energy.

2.2 Progress towards the Faculty's Academic Priorities

2.2.1 Academic Plan 2011 – 2016: Significant Developmental Milestones

The Faculty of Applied Science & Engineering's *Academic Plan, 2011–2016* was developed through a highly consultative process involving strategic planning, beginning in autumn 2009. Approved by Faculty Council in October 2011, it renewed our 2005 *Stepping Up* plan and affirmed U of T Engineering's long-term goals, setting out the five measurable priorities that we will act upon over the next five years. The Plan provides a framework for academic and administrative units to enhance collective contributions to our community and the engineering disciplines. It allows us to measure, assess and adjust our activities, while maintaining a focus on our over-arching vision: to be a leader among the world's very best engineering schools – in its discovery, creation and transfer of knowledge and technology through teaching as well as research.

The following sections describe progress our Faculty has made toward the priorities described in the *Academic Plan*.

2.2.1.1 Culture of Excellence

U of T Engineering is the premier engineering school in Canada across all major international rankings ([Table 2.2](#)). We attract committed educators and leading researchers who demonstrate excellence in interdisciplinary research and contribute to our intellectual and cultural diversity. We have hired 50 tenure-stream faculty members since 2010. Many of these professors hold budgetary appointments in more than one academic area and conduct interdisciplinary research in fields that include smart buildings and cities, advanced cancer diagnostics and sustainable resource extraction. We also hired seven new teaching-stream faculty members, selected for their dedication to engineering education and their expertise in a wide variety of fields. In total, 36 per cent of new hires over the last five years have been women.

In 2015–2016, our faculty members earned more than 20 per cent of the major national and international honours and awards given to Canadian engineering professors, while accounting for only 6.1 per cent of the nation’s engineering faculty. This recognition includes both early-career and lifetime achievement awards. We continue to strengthen the supports available to our faculty to enable them perform at their best in education and research.

2.2.1.2 Positioning

The achievements of our students, faculty and alumni are a source of pride for our Faculty, from breaking world records — including the first sustained flight of a human-powered helicopter, the world’s fastest bicycle (twice) and the world’s most efficient light bulb — to challenging the boundaries of their fields. We leverage strategic communications initiatives to share our stories with key audiences and raise our visibility across both print and digital media.

By raising the quality of our storytelling and engaging in proactive media outreach, we have grown our impressions in print, broadcast and online media to more than one billion per year. More than half of the 3,400 media stories about our Faculty published in the last year appeared in international outlets. Our recently re-designed main Faculty website (engineering.utoronto.ca) and the U of T Engineering News website (news.engineering.utoronto.ca) together now receive more than 650,000 page views annually. We engaged more than 6,800 unique users on social media in 2015–2016 and increased our total potential reach — the number of users who saw U of T Engineering-related content — to more than 3.8 million.

2.2.1.3 Educating Future Engineers & Student Experience

We have made gains in several important areas over the past several years. These include raising the number of applications to our undergraduate programs ([Section 3.2](#)), increasing the proportion of international students ([Sections 3.2](#) and [4.2.4](#)) and female students ([Sections 3.2](#) and [4.2.1](#)) in our undergraduate and graduate cohorts, surpassing our *Academic Plan* goals for total graduate students and the proportion of MEng students ([Section 4.2.4](#)), and raising the incoming average of Ontario students ([Section 3.2](#)).

We have also enhanced our undergraduate academic and co-curricular programs by implementing task force recommendations on elements of the curriculum and student experience. These include a review of the content and delivery of all first-year programs, as well as engineering leadership education, the availability of makerspaces, student mental health and academic advising.

From first-year courses such as Engineering Strategies & Practice and Praxis, to fourth-year capstone design courses, we ensure that opportunities for experiential learning are integrated across the curriculum. We have also increased the number of third-year students who participate in Professional Experience Year (PEY) internships from 47 per cent in 2010 to 64 per cent today. Last summer, 307 of our students participated in summer research placements, up from 227 in 2010. Over that time, the number of international research placements has nearly tripled ([Section 3.7.2.1](#)).

We continue to enrich our undergraduate and graduate students' experiences by creating cross-disciplinary programs, expanding minors and certificate opportunities, and developing courses and co-curricular activities, including those offered by ILead and The Entrepreneurship Hatchery. This enables students to develop competencies in areas such as multidisciplinary collaboration, engineering business, leadership and entrepreneurship.

2.2.1.4 Research Foci

We have grown our suite of multidisciplinary research centres and institutes that bring together researchers from across our Faculty and beyond to address critical challenges such as the development of smart grids and advanced manufacturing, to more sustainable aviation.

To assist researchers in developing relationships with industry and government agencies, we created two staff positions, the Director of Foundation & Corporate Partnerships and the Director of Corporate, Government & International Partnerships. These directors also leverage funding programs designed to encourage collaboration between academia and industry, such as NSERC's Collaborative Research & Development Grants and Industrial Research Chairs. Through workshops and information sessions, we support faculty members — particularly those early in their career — to successfully fundraise for their research programs.

We achieved our *Academic Plan* goal of \$25 million in annual Tri-Council funding (NSERC, SSHRC, Networks of Centres of Excellence (NCE) and CIHR) three years early and raised our target to \$32 million. In 2014–2015, the latest year for which complete data is available, our Faculty obtained \$31.8 million in Tri-Council funding. This in turn raised our allocated proportion of Canada Research Chairs to 29 from 24 in 2010. In total, our Faculty is home to 77 research chairs including Canada Research Chairs, endowed chairs, NSERC Industrial Research Chairs, U of T Distinguished Professors and University Professors.

Our research operating funding per faculty member was more than \$283,000 in 2014–2015, up 16.5 per cent from 2009–2010 and up 47.4 per cent from 2005–2006. We secured investments from federal and provincial governments, resulting in significant upgrades to a number of our research facilities, including BioZone, the Ontario Centre for Characterization of Advanced Materials (OCCAM) and the Centre for Industrial Application of Microcellular Plastics (CIAMP).

2.2.1.5 Outreach, Collaboration & Influence

We have strengthened our engagement with institutional partners around the world, and formalized a number of agreements with them regarding research collaboration, student exchanges, and dual programs where students from peer institutions complete the final year of their undergraduate degrees at U of T Engineering and gain conditional acceptance into our MEng programs. These partner institutions include Shanghai Jiao Tong University, South China University of Technology, Tianjin University, the Warsaw University of Technology and Technische Universität Darmstadt ([Section 8.2.3](#)). We have also participated in major funding agency work (e.g. NSERC, Mitacs) and on panels and advisory boards focused on enhancing opportunities for international experience in undergraduate education.

Our Faculty has played a leading role in University-wide research initiatives such as Medicine by Design and the Translational Biology and Engineering Program (TBEP) within the Ted Rogers Centre for Heart Research (TRCHR). These programs bring together researchers from multiple

disciplines and Faculties within U of T as well as external partners in hospitals, companies and research organizations ([Section 5.3](#)).

We continue to strengthen relationships with our global network of more than 48,000 alumni. We now host over 60 alumni events per year, including the BizSkule speaker series and networking receptions in Canada, the U.S., Singapore, China, Hong Kong, Turkey, Dubai and many other locations. Last year we raised \$29.3 million in philanthropic support, including a number of donations to the forthcoming Centre for Engineering Innovation & Entrepreneurship. Since November 2011, the start of *Boundless: The Campaign for the University of Toronto*, we have raised over \$190 million, representing 95 per cent of our \$200 million campaign goal.

U of T Engineering has enhanced its network of more than 300 industry collaborators and has developed ways for students to interact with industry. These include projects brought forward by industry clients in first-year design courses and capstone courses, and through our Faculty's University of Toronto Institute for Multidisciplinary Design & Innovation. These initiatives also include research partnerships, startup mentorships through The Entrepreneurship Hatchery and Start@UTIAS, and employing students directly through Professional Experience Year (PEY) internships and the Engineering Summer Internship Program.

2.2.1.6 Resource Allocation

We continue to advance our priorities by investing in infrastructure and launching initiatives, while maintaining a balanced budget. Total revenue has increased from \$133.6 million in 2009–2010 to \$210.1 million in 2015–2016, at an annual rate of between 6 and 12 per cent. While total costs have risen, the net revenue for 2015–2016 also increased to \$116.1 million.

In 2011, we created the Dean's Strategic Fund to support initiatives that will further our *Academic Plan* goals and have a broad impact within the Faculty. More than \$24 million has been committed to date to a wide variety of collaborative research initiatives, infrastructure upgrades and new co-curricular programming. We created the Dean's Infrastructure Improvement Fund in 2016 to upgrade outdated facilities and enhance teaching and research laboratory spaces across the Faculty. This past summer, we partnered with the federal government through the Post-Secondary Institutions Strategic Investment Fund to invest a total of \$31.6 million in renovations over the next two years to 89 research laboratory facilities across our Faculty.

Our most significant infrastructure investment is the new Centre for Engineering Innovation & Entrepreneurship, currently under construction. This leading-edge facility will be a vibrant hub for engineering education and research and will inspire new levels of cross-disciplinary collaboration and experiential learning that will accelerate innovation and prepare the next generation of global engineering leaders.

2.2.2 Looking Ahead

We operate in a competitive global environment for research and engineering talent, including faculty members and graduate and undergraduate students. Although we are the leading engineering school in Canada, we must continue to distinguish ourselves on the global stage by building on our unique strengths and continuing our unwavering pursuit of excellence.

While we have made remarkable progress in diversifying our undergraduate student body, we have more work to do before it reflects the full plurality of Toronto and Canada. We will build upon our recent achievement of attracting more women to the engineering profession, and continue to reach out other underrepresented communities, particularly Indigenous youth. Our holistic approach provides rich opportunities for students to develop competencies in leadership, communication and entrepreneurship as well as in technical subjects.

We have significantly increased the size of our graduate student population, surpassing our *Academic Plan* goal of 2,000 graduate students by 2015 two years ahead of schedule. One driver of this growth is a dramatic three-fold increase in full-time equivalent MEng enrolment, particularly among international students. PhD enrolment has also increased, by 60 per cent in the last decade. We will continue our recruitment efforts, especially among domestic students, and encourage MASc students to fast-track into PhD programs. We will also strengthen our support to graduates who wish to market their expertise to industry, government and academia.

As with our undergraduate cohort, our faculty complement increasingly reflects the diversity of our city. Our research has also become more diverse as we create multidisciplinary research centres and institutes that facilitate collaboration across our Faculty and beyond. The excellence of our research is well recognized at the national and international levels, and we are leaders within the University in terms of patents and invention disclosures ([Section 5.12](#)). Going forward, we will leverage our global network of industry collaborators and alumni to accelerate the translation of our innovations into industrial or clinical application. This includes leveraging traditional technology transfer and strengthening our support for entrepreneurship, including our in-house startup incubators and commercialization fellowships. We will also guide our researchers to leverage funding programs that are geared toward startups, and to participate in the wider entrepreneurship ecosystem across U of T and the Toronto region.

We are well positioned to take advantage of emerging global opportunities in multidisciplinary engineering research and education, and will continue to strengthen our relationships with other Faculties within U of T, our peer institutions around the world, industry partners, regulatory bodies, governments and our 48,000-strong alumni network.

2.3 Consultation and Preparation for the Self-Study

This self-study of the Faculty of Applied Science & Engineering has been prepared as part of the University of Toronto's process for reviewing its academic programs and units (*University of Toronto Quality Assurance Process*, or *UTQAP*). The Faculty's current review has been timed to coincide with the end of the second term of the unit's head, Dean Cristina Amon, on June 30, 2017. Our previous external review was conducted in 2010, and the feedback we received from that consultation and review process ([Appendix A](#)) contributed to the establishment of our strategic goals for the next five years, as described in the *Academic Plan, 2011–2016* ([Appendix B](#), see also [Appendix C](#) for progress and achievements).

This document represents an intense nine-month process that began in the spring of 2016 with the creation of a Self-Study Working Group (SSWG), established and chaired by Dean Cristina Amon. The SSWG was mandated to determine the focus and structure of the self-study, gather feedback from the Faculty's diverse stakeholders, and begin a reflective discussion on progress we have made toward our *Academic Plan* goals over the last five years.

The self-study highlights major initiatives undertaken in the Faculty and comments briefly on the achievements and challenges we faced through those initiatives. Through this reflection, the document implicitly addresses recommendations from the last review ([Appendix A](#)).

The various chapters in this document address the *Terms of Reference* and guidelines presented by the Office of the Vice-Provost, Academic Programs in terms of the quality, size and scope of undergraduate and graduate academic activities and the student experience; the Faculty's research activities; organizational and financial structure; physical, research and programming infrastructure; external relationships; and student and faculty diversity.

The SSWG, in conjunction with key staff, developed preliminary position statements on topics within the self-study that formed the foundation for more extensive consultations held with a wide range of stakeholders between April and September 2016. The consultations were well received; on-line surveys had excellent response rates and in-person events were well attended.

The following groups were engaged in the consultation process:

- **Undergraduate Students** – through focus groups and surveys, and in-person and on-line consultations with student leaders (who, in turn, consulted with their constituents)
- **Graduate Students and Postdoctoral Fellows** – through a luncheon with postdoctoral fellows, on-line surveys of MEng and MASc students, and a focus group of graduate students and graduate coordinators
- **Staff** – through a focus group and on-line survey
- **Research & Industry** – through consultations with research faculty in each department and institute, attended by the Dean's Office and facilitated by the associate chairs or directors of research
- **Alumni** – through discussions with the Engineering Alumni Association and key alumni, and by in-person and online consultations
- **U of T Community** – through invited feedback and content from colleagues in other Faculties regarding their collaborations with U of T Engineering, such as collaborative specializations and combined degree programs, research collaborations and other initiatives
- **Other U of T Engineering leadership** – through regularly-scheduled meetings of the Faculty's standing committees

Content and feedback was also provided by the Faculty's Dean, Vice and Associate Deans, the Chair, First Year, and administrative unit heads. Chairs and directors of our academic units, associate chairs and directors of research, undergraduate and graduate studies, and elected members of the Engineering Society and the Faculty's seven graduate student associations were invited to provide feedback on all sections. The final draft of the self-study was made available on a public website for all Engineering faculty, students, staff, and a select group of active and engaged alumni to review.

Through the iterative data collection, drafting and review process, our Faculty produced this comprehensive overview of where our academic programs, research, organizational and financial structure, infrastructure and diversity goals currently stand. We demonstrate how these have strategically progressed and, where possible, have identified our strengths as well as our challenges, and will use this analysis to inform our upcoming academic planning exercise.

2.4 Consistency of the Academic Plan with the University of Toronto's Long-Range Plan

Our *Academic Plan, 2011–2016* was approved by Faculty Council in October 2011 after two years of consultation and planning. It set out a comprehensive strategy to strengthen our vision “to be a leader among the world’s very best schools of engineering in our discovery, creation and transfer of knowledge and technology through teaching and research.”¹ It includes concrete and measurable goals in seven key areas: positioning; culture of excellence; educating future engineers; student experience; research foci; outreach, collaboration and influence; and resource allocation. We post annual updates on our Faculty website to show the progress we have made in meeting and, in many cases, exceeding our goals.² These updates also demonstrate our commitment to transparency and accountability to stakeholders in the Faculty and across the University, as well as to our alumni, industry partners, donors, peer institutions and the engineering profession.

As one of the largest Faculties within the University of Toronto, we are committed to strengthening the University’s standing as one of the finest research and educational institutions in the world, and closely align our strategic planning to support and advance University-wide goals. Successive planning processes — *Towards 2030: A Long-Term Planning Framework for the University of Toronto* (2008)³ and *Towards 2030: The View from 2012* (2012)⁴ — established the University’s mission and identity as a globally-ranked research powerhouse, and a leader in both graduate and research-intensive undergraduate education.⁵ These reports set out broad goals in areas such as student experience, recruitment, enrolment, research strength and resources to enable the University to enhance its global standing and impact. President Meric Gertler’s recent *Three Priorities: A Discussion Paper* (2015)⁶ reaffirmed the findings and directions of the *Towards 2030* reports, while proposing three new foci to enable the University to advance its identity and mission in the face of emerging challenges and opportunities. These include leveraging our location more fully, strengthening and deepening our international partnerships, and re-examining and reinventing undergraduate education. The University’s Governing Council endorsed the *Three Priorities* in December 2015, establishing them as guiding principles for planning across the University.

The following summary demonstrates the close alignment between the *Academic Plan* and the University’s priorities and strategic directions.

2.4.1 The Academic Plan and Towards 2030

We developed the *Academic Plan* for the Faculty of Applied Science & Engineering in the context of the first *Towards 2030* document, which became the planning framework for Faculties and divisions across the University after the Governing Council approved it in 2008. The following sections discuss major themes in *Towards 2030* and the 2012 update, and demonstrate how our *Academic Plan, 2011–2016*, supports the University’s objectives in these areas.

¹ *Academic Plan, 2011–2016*, Faculty of Applied Science & Engineering, University of Toronto, p. 10. For further details, see www.engineering.utoronto.ca/files/2015/02/academicplan.pdf.

² See www.engineering.utoronto.ca/about/governance/task-forces-reports.

³ See www.towards2030.utoronto.ca.

⁴ See www.provost.utoronto.ca/planning/view2012.htm.

⁵ As summarized in *Three Priorities: A Discussion Paper*, p. 1.

⁶ See threepriorities.utoronto.ca.

The University's Distinctive Role

In *Towards 2030*, the University clearly articulated its core identity as a research-intensive institution with academically rigorous educational offerings and excellent faculty, staff and students. While emphasizing the significance of research, it affirmed the importance of all faculty members, including top researchers, teaching students at all levels. It also said that within any division, all programs must be excellent and most must be nationally pre-eminent and internationally competitive.

Virtually all sections of our *Academic Plan, 2011–2016* advance the University's goals in this area. From recruiting top students and faculty and growing research funding, to innovating educational offerings and enhancing student experience, our goals and achievements clearly strengthen the University's identity as an internationally recognized research powerhouse that is committed to excellence in both graduate and undergraduate education.

Enrolment and Institutional Balance

Towards 2030 affirmed that the University should capitalize on its unique strengths in research by focusing on graduate and professional programs. It set a goal of increasing graduate enrolment on the St. George campus to at least 35 per cent of the total student body, from approximately 26 per cent in 2007–2008, by reducing undergraduate enrolment modestly and continuing to increase graduate enrolment. At the same time, it said the University should capitalize on its research strengths to enrich undergraduate education.

The Faculty's *Academic Plan* strongly mirrors these directions. It set a goal of increasing graduate enrolment to 2,000 students by 2015, with a focus on growing the PhD and MEng cohorts, which we have now surpassed. We also committed to reducing undergraduate enrolment and strengthening the Faculty's culture of teaching excellence.

Student Recruitment and Experience

Towards 2030 identified student recruitment as a pressing issue that required immediate attention. In particular, it said further discussion was needed around enhancing non-academic admission criteria for undergraduate programs to recruit well-rounded students and students from traditionally under-represented groups. It advocated increasing the number of Canadian students from outside the Greater Toronto Area and the number of international students. It also sought to improve the student experience by increasing participatory learning opportunities, advancing the use of information technology and promoting co-curricular activities.

The Faculty's *Academic Plan* is in virtual lockstep with this section of *Towards 2030*. In it, we committed to attracting and retaining outstanding students from a wide range of backgrounds and to increasing diversity, particularly as it relates to gender. We set a goal of increasing the proportion of international students to 25 per cent of the undergraduate population, which we have now surpassed. We also committed to enhancing the student experience inside the classroom by strengthening the Faculty's culture of teaching excellence, increasing flexibility and integrating professional competencies in the undergraduate curriculum; enhancing instructional space to facilitate innovative teaching methods; and engaging more undergraduates in research activities. Other priorities include ensuring undergraduates have

enough time to participate in co-curricular activities, and promoting these activities through communications, faculty mentoring and suitable space and facilities.

Capital Plans

In *Towards 2030*, the University committed to redeveloping and enhancing its three campuses to strengthen students' academic and co-curricular experiences. It said government funding, philanthropic support and partnerships with the private sector should be pursued to improve the campus environment.

In the *Academic Plan*, we prioritize improving instructional, laboratory and co-curricular space to facilitate innovative teaching methods, enhance experiential learning and student activities, support research and strengthen the overall student experience.

Resources and Advancement

Towards 2030 noted that the University's excellent international standing was remarkable given its extremely constrained resources. In light of these financial pressures, *Towards 2030* articulated the importance of reducing gaps in per-student funding with peer U.S. universities, and between Ontario universities and schools in the rest of Canada. It advocated for more investments by the federal government in research and student aid programs. It acknowledged that tuition fees would remain an important source of revenue, and committed to maintaining accessibility. It also said industry partnerships should be considered in light of implications for academic freedom, reputational risk, social responsibility and collective agreements, and committed to enhancing institutional processes for knowledge translation and commercialization.

The *Academic Plan* articulates a number of goals to secure a strong resource base to achieve our ambitious research and education objectives. These include: increasing Tri-Council funding; diversifying and cultivating additional funding sources through federal funding agencies, corporations, industries and international granting agencies; and developing sustainable collaborations with industry partners and expanding established partnerships with affiliated hospitals and research institutes.

2.4.2 The Academic Plan and the Three Priorities

President Gertler's *Three Priorities* discussion paper, published in 2015, affirms the goals of *Towards 2030* and seeks to advance the University within that framework. The three priorities — leveraging the University's urban location more fully, strengthening and deepening key international partnerships and re-imagining and re-inventing undergraduate education — represent refinements of the *Towards 2030* goals rather than new directions, and are sparking energetic discussions across the University. President Gertler has established specific goals, milestones and deliverables for each priority, as well as the following key elements:

Table 2.1 Three Priorities

Leveraging Our Location	Strengthening International Partnerships	Rethinking Undergraduate Education
Urban research	Institutions partnerships	Research-based learning
Urban teaching	Student mobility	Experience-based learning
Local outreach and partnerships	Student recruitment	Internationalized learning
Strengthening the built environment	International presence and profile	New learning modes and technologies
	Coordination across different divisions and campuses	Facilitate the transition from study to work

Although it was developed before the genesis of the *Three Priorities* in 2015, our *Academic Plan, 2011–2016*, supports these priorities in its commitments to excellence in research and education, enhancing the student experience, weaving experiential learning and global perspectives into all aspects of our curricular and co-curricular programs, and strengthening our local and international relationships and partnerships. We have already made excellent progress in all of these areas, and the opening of the Centre for Engineering Innovation & Entrepreneurship will bring together and further amplify these exceptional strengths. We participated actively in the consultation process for the *Three Priorities*, and will continue to engage in ongoing University-wide conversations and decision-making around them.

2.4.3 Conclusion

The Faculty’s *Academic Plan* clearly aligns with and strengthens the University’s broad, long-term goals. These goals include enhancing the University’s standing as a research powerhouse and a leader in graduate and research-intensive undergraduate education. As the University refines its goals through the *Three Priorities*, our dedication to excellence in engineering education and research, our focus on collaboration and innovation, and our commitment to preparing the next generation of engineering leaders position us as a key partner in strengthening U of T’s standing as one of the world’s great universities.

2.5 World Recognition by Rankings and Other Indicators

Rankings of world universities are published annually by a number of bodies, including the Shanghai Jiao Tong Academic Ranking of World Universities (ARWU), the Times Higher Education (THE)–Elsevier World University Ranking for Engineering and Information Technology, the QS World University Rankings for Engineering and Information Technology (QS), and the National Taiwan University (NTU) Performance Ranking of Engineering Papers.

Our Faculty consistently places as the top Canadian engineering school across these international rankings. **Table 2.2** shows our current rankings compared with other engineering schools in the U15 group of research-intensive Canadian universities.

Table 2.2 Canadian U15 Universities across 2015–2016 World Rankings in Engineering

ARWU (U15 in Top 200)	THE (U15 in Top 100)	QS (U15 in Top 200)	NTU (U15 in Top 200)
U Toronto (23)	U Toronto (25)	U Toronto (49)	U Toronto (39)
U Waterloo (47)	McGill U (41)	UBC (63)	U Waterloo (60)
U Alberta (87)	UBC (46)	McGill U (67)	UBC (87)
McGill U (100)	U Waterloo (61)	U Waterloo (74)	U Alberta (89)
UBC (100)		U Alberta (179)	McGill U (125)
U Montréal (102)		U Montréal (187)	U Montréal (153)
			Western U (183)
			McMaster (191)

Among North American public universities U of T Engineering ranks in the top 10 in three of the four rankings (in the fourth, ARWU, U of T ranks 11th) (Table 2.3).

In 2015, U of T was the only Canadian university to rank in the top 25 schools globally in ARWU and the THE Engineering rankings. It was the sole Canadian school in the top 50 in the QS and NTU rankings.

Within Canada, U of T Engineering awarded 7.3 per cent of all undergraduate engineering degrees, 10.2 per cent of all engineering master’s degrees, and 11.0 per cent of all engineering PhD degrees this past year. Within Ontario, those proportions were 16.0, 20.6 and 24.6 per cent, respectively (Table 2.4).

In 2015–2016, our faculty members comprised only 6.1 per cent of Canada’s tenured and tenure-stream engineering professors, yet they earned more than 20 per cent of the major national and international awards and honours given to that group, including fellowship in the Canadian Academy of Engineering, the Royal Society of Canada and the American Association for the Advancement of Science (Section 5.10 and Appendix D: Chapter 5). Our researchers also received the single largest proportion of engineering funding from the Natural Sciences and Engineering Research Council (NSERC) in 2015 (Table 2.4).

Rankings provide insight into disciplinary trends and comparative quantification, and are influential in recruiting students and top scholars. However, with their varying methodologies and data sets, they provide only partial and limited information; for example, our strengths in biomedical research, health care and regenerative medicine are not captured in the engineering rankings. Although our position in the rankings and as the premier engineering school in Canada and within the top 10 public universities in North America remains strong, we acknowledge that the international landscape is evolving dramatically. This is especially true in the rise of universities in Asia, fueled by rapid growth and large investments, particularly in engineering.

Table 2.3 Summary of University of Toronto Engineering Performance in World Rankings

Ranking Organization	Release Date	Canada	North American Public	World
Academic Ranking of World Universities (ARWU) for Engineering / Technology and Computer Sciences	August 2016	1	14	50
ARWU Scoring Detail by Category	August 2016			
– Highly Cited (HiCi)		1	15	46
– Publications (PUB)		2	9	67
– Publications in Top Journals (TOP)		1	17	57
ARWU Subject Ranking [<i>New for 2016</i>]	June 2016			
– Chemical Engineering		1	10	39
– Civil Engineering		-	-	76-100
– Electrical & Electronic Engineering		1	10	27
– Energy Science & Engineering		-	-	151-200
– Environmental Science & Engineering		2	10	25
– Materials Science & Engineering		1	10	42
– Mechanical Engineering		-	-	51-75
Times Higher Education (THE) – Elsevier World University Ranking for Engineering & Technology	September 2016	1	9	31
QS World University Ranking for Engineering and Technology	September 2015	1	7	49
QS World University Ranking by Subject	March 2016			
– Chemical Engineering		1	16	37
– Civil & Structural Engineering		2	9	31
– Electrical & Electronic Engineering		1	12	27
– Materials Science		1	16	39
– Mechanical, Aeronautical & Manuf. Eng.		1	14	37
– Computer Sci. & Information Systems		1	7	11
National Taiwan University (NTU) Performance Ranking of Scientific Papers for World Universities	October 2016	1	9	43
NTU Performance Ranking by Subject	October 2016			
- Chemical Engineering		4	19	110
- Civil Engineering		1	10	35
- Electrical Engineering		1	7	29
- Materials Science		1	10	62
- Mechanical Engineering		1	11	47
- Computer Science		2	10	41
U.S. News and World Report World's Best Universities for Engineering and IT	October 2016	2	11	52

Table 2.4 Comparison of U of T Engineering with Ontario and Canada, 2015–2016

	U of T Engineering	Ontario	U of T % of Ontario	Canada	U of T % of Canada
Undergraduate					
Enrolment (FTE)	4,745	36,921	12.9%	80,708	5.9%
Degrees Awarded	1,035	6,465	16.0%	14,131	7.3%
% Women	22.8%	18.8%		18.8%	
Master's (MEng, MAsC and MHSc)					
Enrolment (FTE)	1,088	5,504	19.8%	13,481	8.1%
Degrees Awarded	631	3,057	20.6%	6,193	10.2%
% Women	26.0%	24.7%		24.5%	
Doctoral (PhD)					
Enrolment (FTE)	855	3,423	25.0%	9,104	9.4%
Degrees Awarded	152	619	24.6%	1,385	11.0%
% Women	29.6%	23.1%		22.0%	
Faculty					
Tenured and Tenure-Stream	226	1,566	14.4%	3,683	6.1%
Major Awards					
Major Awards Received	14	24	58.3%	67	20.9%
Research Funding					
NSERC Funding for Engineering	\$29.8M	\$122.6M	24.3%	\$292.7M	10.2%

3.0 Undergraduate Education

The Faculty of Applied Science & Engineering at the University of Toronto is Canada's premier teaching and research-intensive engineering school, with a calibre of undergraduate programs that is commensurate with the quality of the diverse student body we attract from around the world.

This section highlights the current state of our undergraduate programs and admissions. The supporting data stem from our own records and a thorough self-study consultation process that included focus groups, surveys and course evaluations. External metrics, such as data from the National Survey of Student Engagement (NSSE, [Appendix E](#)) are also included where appropriate.

3.1 Overview of Programs and Governance Structure

U of T Engineering students pursue either a Bachelor of Applied Science (BASc) or a Bachelor of Applied Science in Engineering Science (BASc Engineering Science). Students interested in the BASc can enroll in any of the Core 8 programs or the General First Year ([Section 3.1.1](#)), while students pursuing the BASc Engineering Science can choose from one of eight majors ([Section 3.1.2](#)) offered through the Division of Engineering Science.

Along with the Vice-Dean, Undergraduate, the Faculty's Chair, First Year coordinates and oversees all Year 1 programming with the support of the Director, First Year Curriculum. Second- through fourth-year programming is supported at the department or division level under the direction of each unit's Associate Chair, Undergraduate Studies. All four years of the Engineering Science program are coordinated through the division, with overall support from the division's chair.

3.1.1 Core 8 Programs and General First Year

Our Core 8 programs and the departments in which they're offered are: chemical (Department of Chemical Engineering & Applied Chemistry), civil and mineral (Department of Civil Engineering), computer and electrical (The Edward S. Rogers Sr. Department of Electrical & Computer Engineering), industrial and mechanical (Department of Mechanical & Industrial Engineering), and materials (Department of Materials Science & Engineering).

Figure 3.1 Core 8 Programs



Students can enrol in any of these disciplines or choose to complete a General First Year (also known as TrackOne) and enter one of the Core 8 disciplines in their second year. General First Year students made up 17 per cent of incoming 2016 undergraduates, compared with 9 per cent in 2007–2008, the first year the program was offered. TrackOne students with a sessional average of 60 per cent or higher in both the fall and winter terms are guaranteed their first program choice for second year.

Students in any Core 8 program can request a transfer into any other Core 8 program at the end of first year. This transfer is guaranteed for students whose sessional average is 80 per cent or above in both terms. For those who do not meet this requirement, the granting of their transfer request depends on the availability of space in that particular program. For the past four years, the Faculty and departments have worked together to approve all transfer requests, regardless of standing.

Students in any of the Core 8 programs may also pursue engineering minors or certificates in select cross-disciplinary areas, or minors in programs offered by the Faculty of Arts & Science.

In 2013, we struck a task force to review the content and delivery of the first-year curriculum in the Core 8 and General First Year programs. The task force delivered its report in 2015 and a committee was created to oversee the implementation of its recommendations, which are referenced in the following sections.

3.1.2 Engineering Science

Engineering Science is a unique program designed to challenge students at the highest academic level. It is distinguished by its focus on deriving results from first principles, and thus includes a strong focus on mathematics, science and foundational engineering principles and models. Approximately 40 to 50 per cent of Engineering Science graduates continue their engineering

education with post-graduate studies at U of T and other top-ranked institutions around the world.

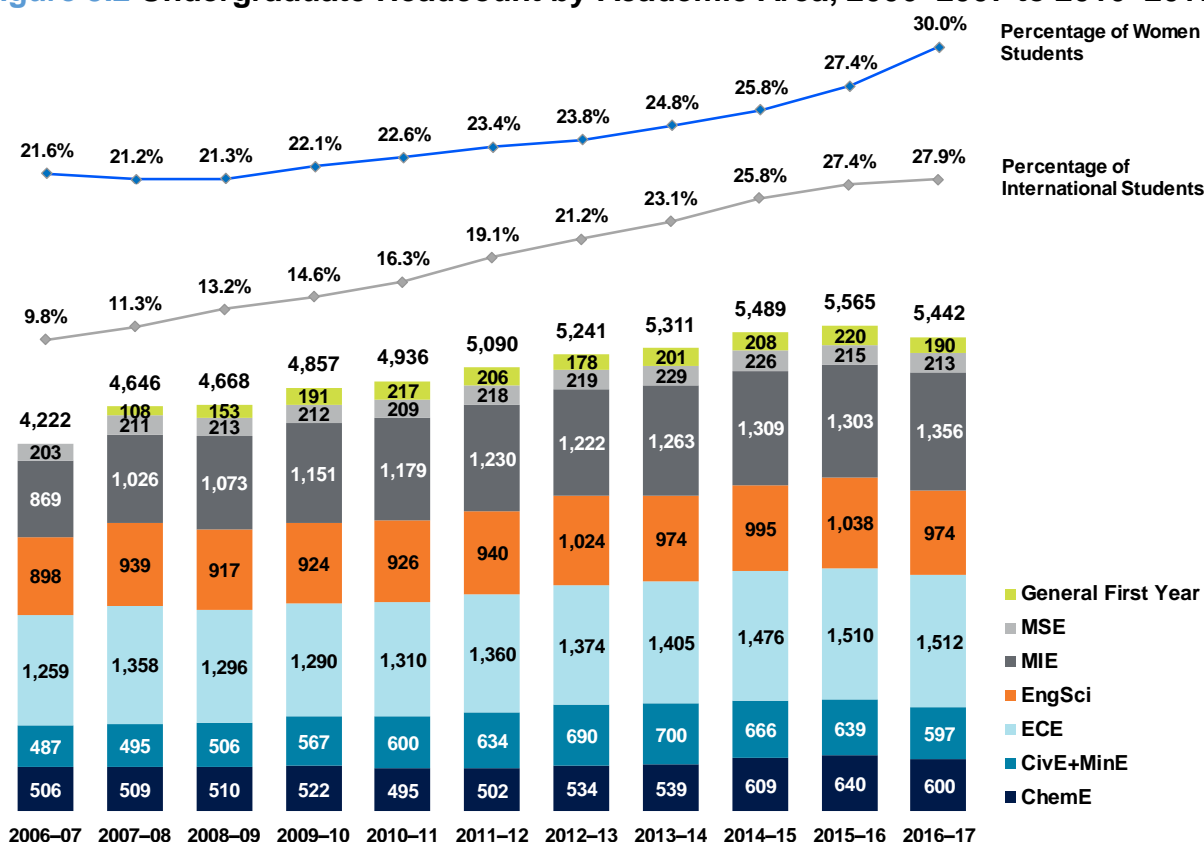
Engineering Science is structured on two years of foundation curriculum, followed by a two-year specialization in one of eight majors (also called options). These majors, and their respective founding years, are:

- Aerospace (1963)
- Biomedical Systems (2012)
- Electrical and Computer (2009, previously offered as two separate majors)
- Energy Systems (2009)
- Infrastructure (2001)
- Engineering Mathematics, Statistics and Finance (2010)
- Engineering Physics (1961)
- Robotics Engineering (2015)

3.1.3 Current Undergraduate Enrolment

Currently there are 5,442 undergraduate students enrolled across all of our programs. [Figure 3.2](#) illustrates the evolution of the entire undergraduate population over the past decade; more detail is available in [Appendix D: Chapter 1](#). As a result of our commitment to diversity within the engineering professor, we have increased the proportion of women in our undergraduate population from 21.6 per cent to 30.0 per cent over the last ten years, and the proportion of international students 9.8 per cent to 27.9 per cent. More information on activities with respect to recruitment and diversity can be found in [Section 3.2.1.2](#) and [Chapter 9](#).

Figure 3.2 Undergraduate Headcount by Academic Area, 2006–2007 to 2016–2017



3.1.4 Accreditation and Department/Institute External Reviews

The Faculty’s nine undergraduate programs (Core 8 plus Engineering Science) are evaluated for accreditation by the Canadian Engineering Accreditation Board (CEAB) on a six-year cycle. Graduation from the Faculty therefore provides students with the education necessary to begin working as an engineer-in-training and, after four years of accumulated experience, apply for professional licensure (P.Eng.) anywhere in Canada in accordance with individual provincial and territorial policies.

The criteria set out by CEAB are designed to ensure that each graduate has a minimum foundation in mathematics and natural sciences, a broad preparation in engineering sciences and engineering design, and exposure to non-technical subjects (complementary studies) that complement the technical aspects of the curriculum. Since 2014, the criteria have also included the requirement for an outcome-based assessment of 12 graduate attributes identified by Engineers Canada⁷, which include problem analysis, communication, ethics, equity and others. Canadian engineering schools, including U of T, must implement and employ processes to demonstrate that program outcomes are being assessed in the context of these attributes, and that the results of such assessments are applied to the further development of programs. All nine of our Faculty’s undergraduate programs are fully accredited and the next review visit is scheduled for the 2018–2019 academic year.

⁷ Engineers Canada, 2015 Accreditation Criteria and Procedures.
https://www.engineerscanada.ca/sites/default/files/Accreditation_Criteria_Procedures_2015.pdf

Another method of ensuring quality education is the provincial requirement for institutions to implement periodic external reviews of their academic programs and the units in which they reside. This is achieved through the implementation of institution-specific quality assurance processes, such as the University of Toronto Quality Assurance Process (UTQAP), whereby each of the Faculty's departments, divisions and institutes and their undergraduate and/or graduate programs undergo an external review within an eight-year cycle.

In addition to reviewing each unit's programs, external reviewers consider the scope, quality and relevance of its research, internal and external relationships, organizational and financial structure, long-range planning challenges, and international comparators. As a measure of the University's commitment to quality assurance, review reports are taken forward to University governance and are summarized for the Ontario Universities Council on Quality Assurance.

3.1.5 Academic Approvals: Governance

The development of academic programs and/or degrees is governed by the University of Toronto Quality Assurance Process (UTQAP) through the office of the Vice-Provost, Academic Programs. Proposals are approved by both the Faculty's and University's governance committees, and at the provincial level.

Our Faculty's Council has overall responsibility for curriculum change within degree programs, which are normally initiated and developed by the department, institute or division and reviewed by their respective curriculum committees. Faculty-wide changes, such as new minors or changes to the first-year curriculum, are generally initiated through the Faculty's Cross-Disciplinary Programs Office or task force or working group.

All curriculum changes are approved by Faculty Council through its Undergraduate Curriculum Committee, a standing committee with faculty representatives from each program and the undergraduate student body. When considering changes or new programs, the committee will analyze the implications for CEAB accreditation. Major program modifications, such as the introduction of minors or Engineering Science majors, are governed by the UTQAP, approved by Faculty Council and reported to University governance for information.

3.1.6 Student Governance: Engineering Society

Undergraduate student governance in the Faculty of Applied Science & Engineering is overseen by the Engineering Society, or EngSoc. EngSoc represents all full- and part-time undergraduate students and is comprised of elected student volunteers. It is governed by a constitution and bylaws that can be changed only by resolution of EngSoc's board of directors; such changes must be approved at an annual general meeting at which all undergraduate engineering students may vote.

EngSoc engages in academic advocacy, allocates funding to groups and initiatives in the engineering community, and provides a wide variety of services and events to students. Student representation on Faculty Council includes one undergraduate student elected annually from each year of each program by the student body, the President of the Engineering Society, and one other representative of the Engineering Society, usually the Vice-President, Academic.

3.2 Quality, Diversity and Selectivity of Students

Our Faculty received more than 12,000 applications for the 2016–2017 academic year, approximately 12 times more than the number of places available. Applications to our programs have increased by 65 per cent since 2010, and applications from international students have more than doubled during that time.

As a result of our commitment to excellence and strategic recruitment initiatives ([Section 3.2.1.2](#) and [Chapter 9](#)) the 2016 entering class was one of the most accomplished and diverse in our history. The incoming average of Ontario students was 93.2 per cent, the highest on record and up from 85.5 ten years ago ([Figure 3.4](#)). Over that same period, the proportion of women in the incoming class increased from 20.2 per cent to 40.1 per cent, and the proportion of international students grew from 13.3 per cent to 27 per cent. Retention between first and second year (within two years) has also improved, growing steadily from 80.9 per cent in 2006 to 93.8 per cent in 2014.

Figure 3.3 Applications, Offers, Registrations, Selectivity and Yield of First-Year Undergraduates, 2007 to 2016

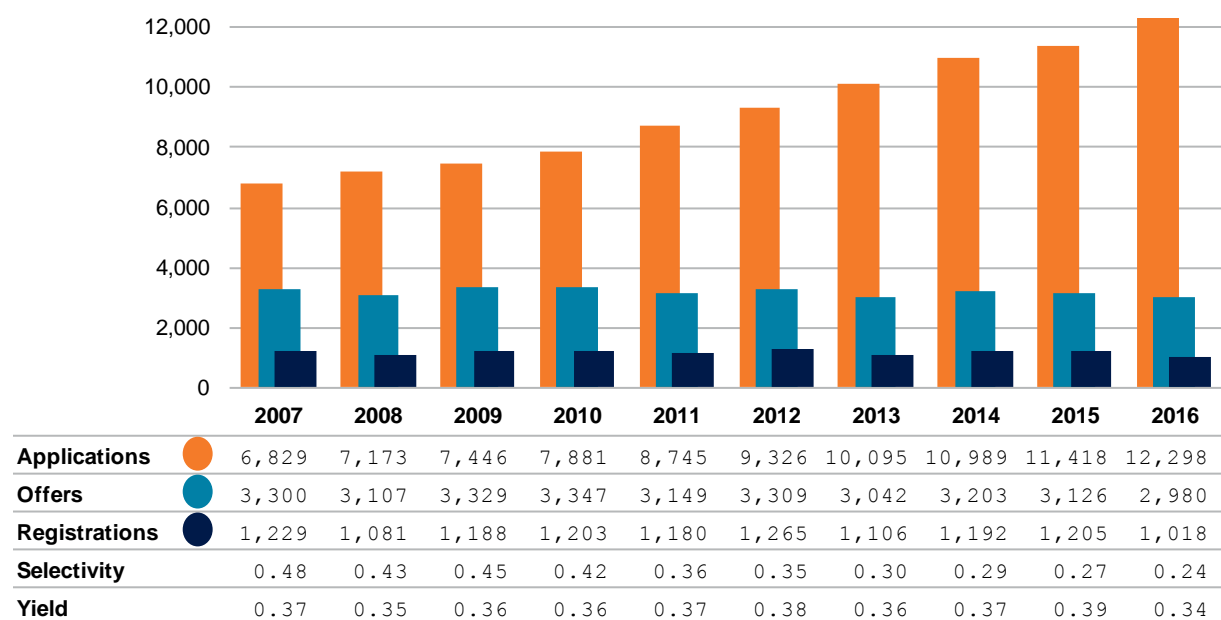
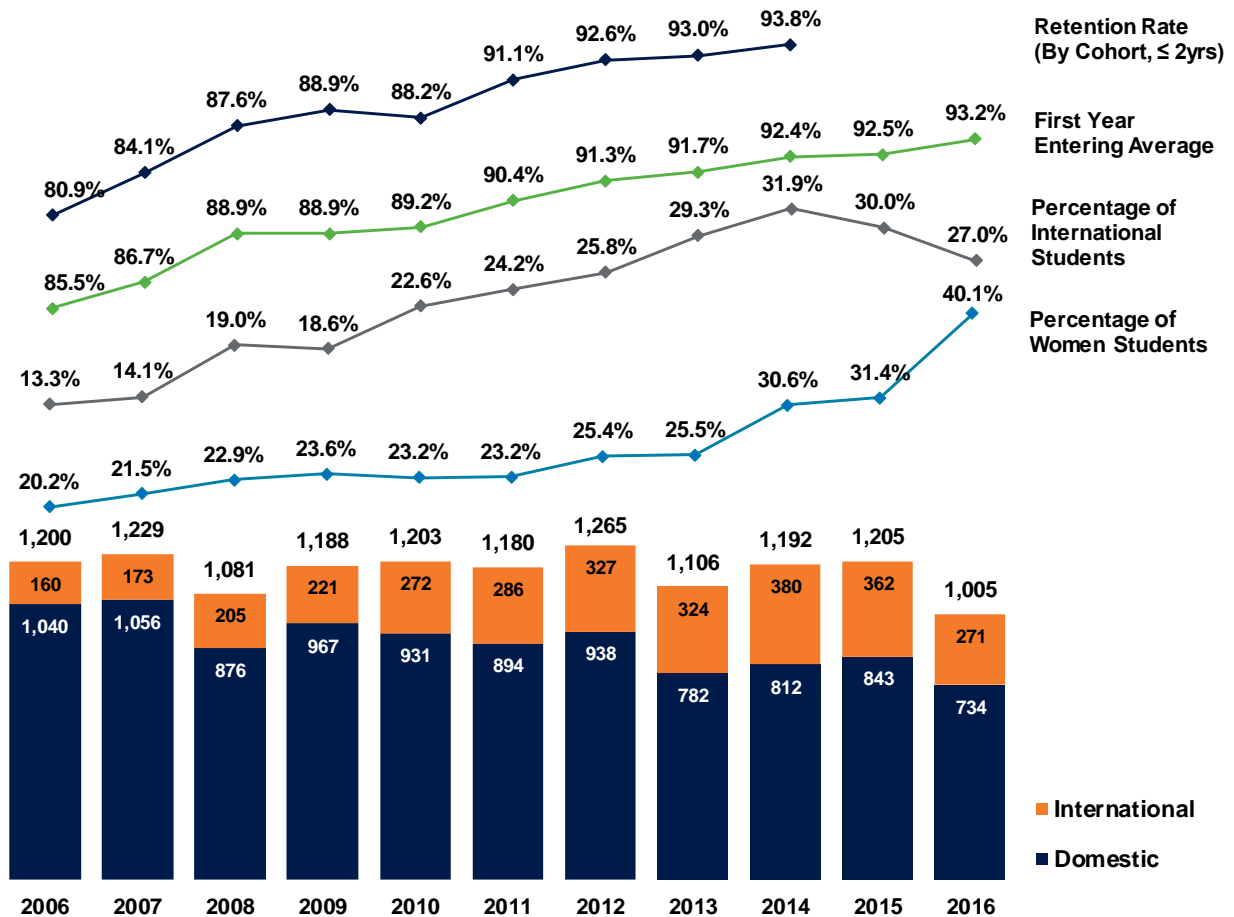


Figure 3.4 Incoming First-Year Domestic and International Undergraduates, 2006 to 2016



3.2.1 Recruitment and Enrolment Strategies

The Engineering Student Recruitment and Retention Office (ESRRO) and the Engineering Outreach Office work in tandem to promote engineering studies among pre-university students and encourage the best and brightest to choose U of T Engineering.

3.2.1.1 Outreach

The Engineering Outreach Office promotes awareness of the role of engineers within society and inspires talented students in grades 3 to 12 to consider the engineering profession as a way of making a positive impact on the world. Each year, programs delivered through the Engineering Outreach Office engage more than 9,000 pre-university students from the Greater Toronto Area and across Canada. These include the Da Vinci Engineering Enrichment Program (DEEP) Summer Academy for high school students, Jr. DEEP and Girls' Jr. DEEP summer day camps and Saturday programs for students in grades 3 to 8, and ENGage, a collaboration with U of T's Chapter of the National Society of Black Engineers that highlights black role models, encourages STEM literacy, and promotes academic and social growth.

These programs also provide important opportunities to the undergraduate and graduate students who develop and deliver them to develop key competencies in project management, communication and engineering education.

The Engineering Outreach Office also shares with elementary and high school teachers strategies for incorporating STEM topics into the classroom. For example, a series of workshops held in February 2016 attracted nearly 350 elementary-school teachers from the Toronto District School Board to learn how computer coding can help them teach everything from mathematics to literacy.

3.2.1.2 Recruitment

The Faculty's Recruitment and Retention Office collaborates with recruitment staff in Engineering departments and the University to attract applications from a diverse range of talented students across Canada and around the world. These initiatives include school visits, information sessions and applicant events, as well as digital livestreams that strategically increase international applications – which have doubled since 2010 – from both established and emerging markets in locations such as the U.S., South Asia, Latin America and the Middle East.

We host events where talented young women interact with current students, faculty and alumni to learn more about our programs and how they can impact society should they choose to become engineers. These events include the annual Young Women in Engineering Symposium, aimed at top female grade 12 science students from across the Greater Toronto Area, and the Girls' Leadership in Engineering Experience (GLEE), geared toward young women who have already gained acceptance to our program. Each year, approximately 80 to 90 per cent of GLEE participants have accepted our offers of admission.

Our Faculty remains committed to increasing the diversity of our incoming students and the engineering profession as a whole. To learn more about our efforts in this area, see [Chapter 9](#).

3.2.2 Broad-Based Admissions Process

U of T Engineering recognizes that grades alone do not fully reflect the accomplishments of the most talented students. In 2014–2015, we began a three-year pilot project involving a broad-based admissions process whereby students respond to three timed written and video questions. The responses are assessed by trained alumni, allowing us to evaluate the students' competencies in communication, adaptability, logical thinking and other key engineering qualities. By enabling a more complete view of our applicants, we can select those who will most benefit from our programs and co-curricular activities. We are collaborating with U of T's Ontario Institute for Studies in Education (OISE) to track the scores generated by this enhanced admission process with success across all years of study, to help inform and refine the process beyond the pilot phase.

3.3 Academic and Co-Curricular Programming, Cross-Disciplinary Initiatives and Experiential Learning

Our Faculty employs a holistic approach to engineering education that integrates technical competencies with training in design, teamwork, communication, leadership and entrepreneurial competencies. We have enhanced our programming by integrating engineering

design courses across the curriculum ([Section 3.3.1](#)), developing cross-disciplinary programs ([Section 3.3.2](#)), strengthening communication training ([Section 3.3.3](#)), and enriching our co-curricular programming ([Section 3.3.4](#)).

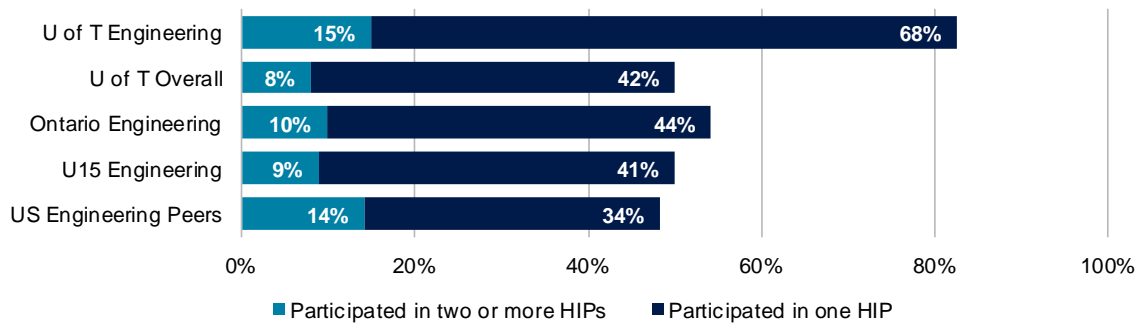
Our achievements in this area are illustrated by responses from the National Survey of Student engagement a poll for first- and senior-year students that is conducted every three years by Indiana University Bloomington. Between 2011 and 2014, NSSE was reorganized, with significant changes made to many of its key performance indicators as well as the questions that are asked of students. Because of this, all NSSE data in this chapter are from the most recent survey, taken in 2014. Data are available to compare the responses of U of T Engineering students with those of engineering students from 22 Ontario universities, the U15 groups of research-intensive Canadian universities, and select U.S. institutions chosen as comparators by U of T. (Note that U.S. comparators are chosen on a University-wide basis and do not necessarily reflect comparable engineering programs in the U.S. A complete list of peer institutions is provided in [Appendix E](#).)⁸

Data from NSSE2014 indicate that 83 per cent of our first-year students and 97 per cent of senior-year students have participated in high-impact practices such as research with faculty members, service-learning, international study, or an internship or field experience, culminating senior experience or learning community. These percentages are higher than the U of T average, as well those for comparable institutions in Ontario, peers in the U15 group of research-intensive universities in Canada, and U.S. peers. More data from NSSE is provided in [Appendix E](#).

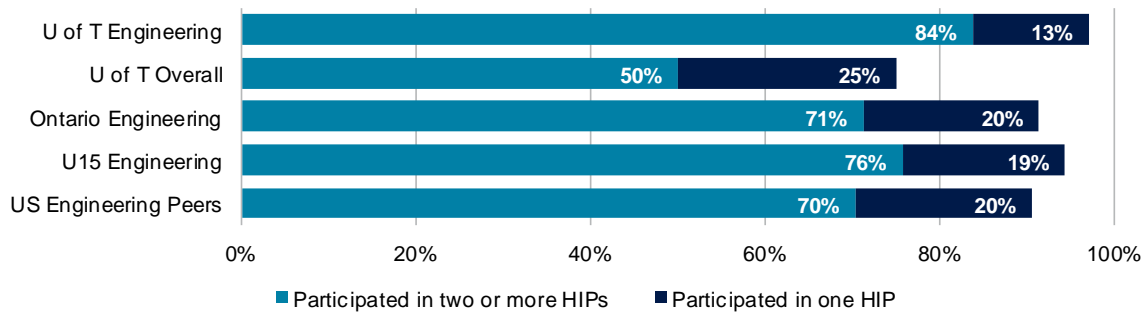
⁸ Standard error values for NSSE scores give 95 per cent confidence intervals ranging from ± 0.5 to ± 1.5 , therefore only differences greater than these are considered statistically significant.

Figure 3.5 High-Impact Practices: NSSE2014

First Year



Senior Year



High Impact Practices

First Year

- Learning community
- Service-learning
- Research with faculty

Senior Year

- Learning community
- Service-learning
- Research with faculty
- Internship or field experience
- Study abroad
- Culminating senior experience

3.3.1 Design Across the Curriculum

In the Faculty’s *Academic Plan*, we committed to providing rigorous foundational learning in engineering principles and further enhancing our high-quality educational programs. One of our goals is to ensure that students can gain practical engineering design experience by working on a specific design challenge or project, often for an external client. Key courses act as “design spines” and provide a framework into which students can integrate the competencies they learn in more theoretical courses.

The design spine begins in first year with Engineering Strategies & Practice for our Core 8 and TrackOne programs, and Praxis in Engineering Science. These courses introduce students to engineering design processes and include a culminating project. All students must complete a

capstone course in their fourth year that includes a design project for an external client, or the Multidisciplinary Capstone Project (MCP) offered by the University of Toronto Institute for Multidisciplinary Design and Innovation (UT-IMDI).

Engineering Strategies & Practice (ESP)

ESP is a two-term course sequence designed for first-year students in the Core 8 and TrackOne programs. In their first semester, students are introduced to the design process, work through a common team-based conceptual design project, and learn to identify social, human, regulatory and environmental factors that affect their success. In the second semester, teams of five or six students undertake a design project from beginning to end, usually provided by a local community-based client. For example, in 2014–2015, two teams completed a conceptual re-design of a Toronto intersection to improve safety. Through this experience, students are able to develop their communication, teamwork and project management competencies.

ESP is delivered by a cross-disciplinary teaching staff of five engineering professors, one of whom is affiliated with the Engineering Communication Program (ECP) ([Section 3.3.3](#)). In 2007, ESP was recognized with the Alan Blizzard Award for Collaborative Projects that Improve Student Learning from the Society for Teaching and Learning in Higher Education.

The Curriculum Review Task Force noted that ESP courses have evolved significantly since they were introduced more than a decade ago. It also noted that some students have difficulty with the workload and primary deliverables in the course, and with connecting the competencies taught in ESP to those in other first- and upper-year courses. We have begun an internal review of ESP courses to address these issues.

Praxis I and II

Designed for first-year students in the Engineering Science program, Praxis I and II develop students' engineering identity and build upon their competencies in design, communication and professional practice.

Praxis I has a strong focus on personal and leadership development. Students learn a variety of design strategies and viewpoints from within the established engineering disciplines and begin to articulate their own position through contributions to the Praxis Learning Community. In Praxis II, students engage with communities in the Greater Toronto Area (GTA) to identify design opportunities. Each design team collaborates with their community to frame the opportunity as an engineering design challenge, which the class subsequently works to address. Recent examples of such communities include the Royal Ontario Museum, The Hospital for Sick Children Epilepsy Classroom and the Allan Gardens Conservatory.

Praxis I and II are co-taught by an Engineering Science faculty member in engineering design and a faculty member from the Engineering Communication Program (ECP) ([Section 3.3.3](#)). In our self-study consultations, students expressed strong enthusiasm for these courses.

Capstone Design Courses

All students complete a team-based capstone design course in their fourth year. Most of these courses involve challenges proposed by industry partners or external organizations, although some allow students to pursue more entrepreneurial, self-identified projects. Professors and mentors provide guidance, while students supply ideas, insights and design solutions, helping

them develop competencies in engineering design and enabling them to better understand how the profession impacts society.

As an alternative to their disciplinary capstone course, students may choose to participate in APS490 Multidisciplinary Capstone Project (MCP). Offered through the Faculty's University of Toronto Institute for Multidisciplinary Design & Innovation (UT-IMDI), this course enables students to work in multidisciplinary teams on projects proposed by such industry partners as Defence Research & Development Canada, Bombardier Aerospace and Sunnybrook Health Sciences Centre. During our self-study consultations, students expressed enthusiasm for the MCP course and said they would like it expanded.

The Department of Mechanical & Industrial Engineering offers a number of International Collaborative Capstone courses, which vary by the partnering institution and project type. In these courses, students collaborate with an international team from a partner institution, including Beijing's Peking University and Tsinghua University, among others. Students communicate online throughout the year and meet in person in November, when the U of T teams travel abroad to meet their collaborators, and in April, when students from the partner institutions come to Toronto to present their final designs.

Second- and Third-Year Design Elements

We are strengthening design elements in the second and third years of our programs. For example, the mechanical engineering curriculum recently introduced MIE243 Mechanical Engineering Design in second year, and enhanced the design components of the third-year course, MIE301 Kinematics and Dynamics of Machines. All students in the Engineering Science foundation take AER201 Engineering Design, in which they design and build functional, autonomous mechatronic devices. Courses in all Engineering Science majors are being analyzed to contextualize the general design competencies taught in Praxis I and II. In collaboration with ESC301 Engineering Science Option Seminar, each major will designate at least one third-year course as part of the design spine. Through such innovations, we aim to ensure that a strong design spine is in place across all years of our programs.

3.3.2 Multidisciplinary Minors and Certificates

Undergraduate minors and certificates are administrated by the Faculty's Cross-Disciplinary Programs Office, led by an Associate Dean. They allow students to customize their degree programs to develop competencies in particular areas of interest, while interacting and collaborating with students from disciplines outside their own.

Minors and certificates are created to address evolving student interests. Current options include:

Minors:

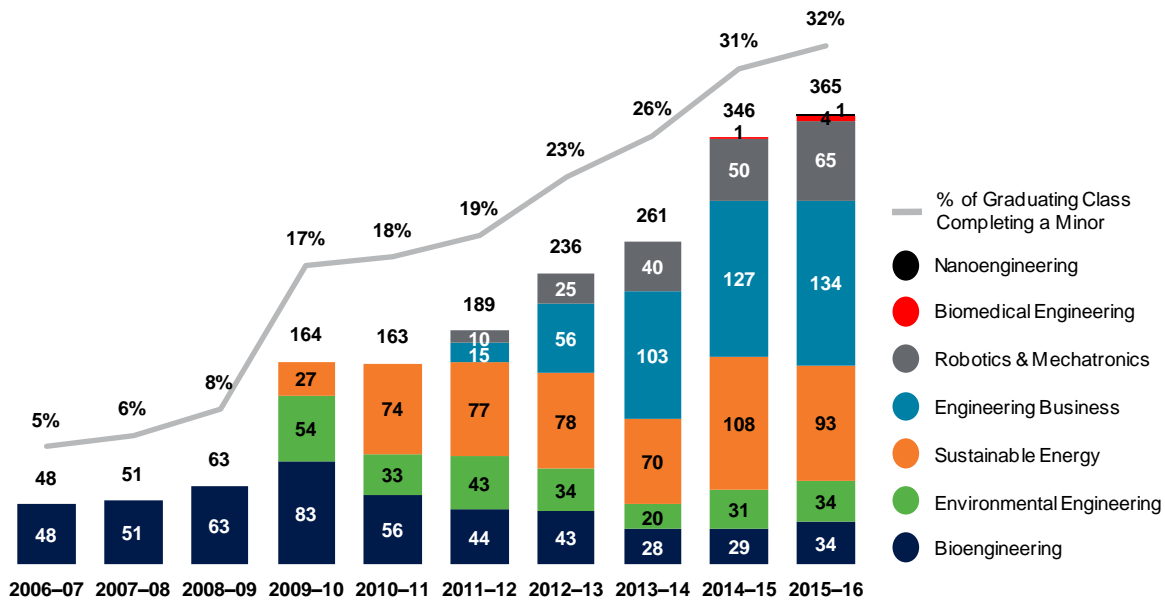
- Bioengineering (2006)
- Biomedical Engineering (2014)
- Engineering Business (2011)
- Environmental Engineering (2009)
- Nanoengineering (2015)
- Robotics & Mechatronics (2011)
- Sustainable Energy (2009)

Certificates:

- Communication (2015)
- Engineering Business (2011)
- Engineering Leadership (2014)
- Entrepreneurship, Innovation & Small Business (2010)
- Global Engineering (2010)
- Mineral Resources (2012)
- Nuclear Engineering (2013)
- Renewable Resources Engineering (2014)

Students must complete six half courses to earn a minor and three half courses for a certificate. In June 2016, 32 per cent of graduating undergraduate students completed a minor and more than half completed at least one minor or certificate. The Engineering Business minor and certificate are particularly popular, with more than one-third of students completing one or the other.

Figure 3.6 Number of Students and Percentage of Graduating Class Completing an Engineering Minor, 2006–2007 to 2015–2016



In addition to minors offered by the Faculty, students can pursue an Arts & Science minor, provided they complete associated course requirements within specific disciplines. Economics is the most commonly pursued Arts & Science minor; others include History, Political Science, Anthropology, English, Sociology, Philosophy, Fine Art, Cinema Studies and Diaspora & Translational Studies.

In our self-study consultations, students said they felt positive about minors and certificates and expressed a desire for greater awareness of the opportunities available to them. However, some noted a need for more flexibility in their schedules in order to accommodate the additional

course requirements, which is a challenge given the number of mandatory courses required by our degree programs.

Our goal is to continue to enhance the selection of minors and certificates offered. Topics currently under development include forensic engineering and advanced manufacturing.

3.3.3 Engineering Communication Program (ECP)

The Engineering Communication Program (ECP) provides integrated communication instruction across the undergraduate curriculum by partnering with Engineering faculty members on communication and design courses, supporting courses by collaborating on assignment and rubric design, and offering assignment-specific instruction. Its work is unique in Canada and it is among the few programs of its kind in North America. ECP is embedded into the first-year design courses ESP and Praxis, and in second through fourth years it tailors its programs to the core curriculum needs in each undergraduate program. It also supports first-year students identified through language assessments as needing assistance and provided 833 students with individual in-person and online tutoring sessions in 2015–2016.

ECP is delivered by five full-time teaching-stream faculty and more than 30 sessional lecturers. ECP faculty conduct research on engineering communication pedagogy and practice related to areas such as engineering design, professional identity and assessment in engineering education. ECP also contributes to many of the teaching resources for faculty ([Section 3.4.1](#)). In January 2016, ECP professor and founder Robert Irish published *Writing in Engineering: A Brief Guide*. He and former director Peter Weiss are also the authors of *Engineering Communication: From Principles to Practice* (Oxford, 2009).

The Faculty introduced an undergraduate certificate in Communication that recognizes students who go beyond the core communication requirements to take three of ECP's six Humanities and Social Sciences (HSS) electives. These electives are designed to engage students by offering humanities courses that intersect with science, technology, engineering and math (STEM) topics.

3.3.4 Co-curricular programming

Over the last several years, our Faculty has significantly expanded the number of co-curricular programs we offer to help students develop key engineering competencies, such as leadership ([Section 3.3.4.1](#)) and entrepreneurship ([Section 3.3.4.2](#)).

3.3.4.1 Leadership Education

The Institute for Leadership Education in Engineering (ILead) enables students to develop leadership competencies through courses, workshops and co-curricular activities. Examples include:

- **Courses** – ILead offers five undergraduate courses including APS446 Leadership in Project Management and APS442 Cognitive and Psychological Foundations of Effective Leadership. These courses count toward the minor in Engineering Business or the certificate in Engineering Leadership. Enrolment across all courses reached 512 students in 2015–2016.
- **Leadership Labs** – This series of workshops covers topics ranging from project management to team conflict, emotional intelligence and workplace readiness. In 2015–

2016, ILead held 25 leadership labs and delivered a further 17 in core courses by the invitation of the professors.

- **Faculty-wide Summer Leadership Program** — Launched in 2016, this eight-week course is designed to enable summer research students to learn more about their strengths and how they might be applied more broadly in their careers.
- **The Game** — This full-year co-curricular program challenges student teams to hone their leadership competencies by developing solutions to large-scale social problems ([Section 3.8.2](#)).

In 2014, ILead received the national Alan Blizzard Award from the Society for Teaching and Learning in Higher Education in recognition of innovative programming and effectiveness in delivering engineering leadership education.

3.3.4.2 Entrepreneurship

In addition to the popular minor in Engineering Business or certificate in Entrepreneurship, Innovation & Small Business, students with an interest in entrepreneurship can participate in one of our two in-house startup accelerators, The Entrepreneurship Hatchery (also known as the Hatchery) and Start@UTIAS.

The Hatchery promotes entrepreneurship and provides resources to nurture teams of undergraduate students as they develop and launch startup companies. It hosts a speaker series throughout the year that enables students to learn from seasoned professionals from all industries, and a weekly ideas market that allows students with a business idea or specific type of expertise to meet and form teams. These activities are advanced by special events such as the Accelerator Weekend and the Hackathon.

Each spring, student teams apply for admission to the Hatchery's summer program. Those accepted are assigned industry mentors who guide the creation of their business plans and connectors who help expand their professional networks. Teams can access The Hatchery's fabrications facilities — including a 3D printer — and seed funding to help them build prototypes. The culmination of the summer program is Hatchery Demo Day, held each September, where teams pitch their startups to potential investors and compete for a total of \$42,000 in seed funding. Since its inception in 2013, the Hatchery has launched 37 startups.

Created by a \$1-million donation from entrepreneur and alumnus Francis Shen (MAsc UTIAS 8T3), the Start@UTIAS program helps teams including at least UTIAS graduate student leverage the knowledge and competencies they have gained through their education to create business startups.

3.4 Quality of Teaching and Student Assessment

U of T Engineering are leaders in research and development in engineering pedagogy, applying creative and innovative approaches to the delivery of educational content ([Section 3.4.1](#)). Tools such as internal course evaluations and NSSE data allow us to measure our performance in this area, and the internal and external awards we receive recognize and encourage our excellence in engineering education ([Section 3.4.2](#)).

3.4.1 Teaching Methods, Philosophy and Professional Development

Our faculty members typically teach two or three undergraduate courses per year. While many of our classes are delivered in the traditional lecture-style format, we are leveraging technology to further engage students. “Inverted classrooms” allow students to watch recorded lectures online prior to class, reserving classroom time for reinforcing concepts through collaborative work with peers on assignments and problem sets. The inverted classroom approach is bolstered by Technology Enhanced Active Learning (TEAL) classrooms. We have piloted a TEAL classroom in the Sanford Fleming Building since 2014, which is informing the design of new spaces in the forthcoming Centre for Engineering Innovation & Entrepreneurship (CEIE) ([Sections 7.3](#) and [7.4](#)).

Design courses such as Engineering Strategies & Practice (ESP) and Praxis ([Section 3.3.1](#)) combine large lectures (approximately 1,000 students in ESP and 300 students in Praxis) with tutorials of around 25 students. Like capstone courses, they require a significant amount of work by teams of approximately five students. These course formats provide key opportunities for students to develop competencies in teamwork, life-long learning and multidisciplinary collaboration.

Related teaching resources for faculty members include:

- **Teaching Methods & Resources Committee** — One of the Faculty’s eight standing committees, this group promotes improvements to teaching methods, hosts regular educational workshops, and advises on the delivery of our undergraduate academic programs.
- **Instructional Technology Office (ITO)** – This Faculty resource facilitates the use of educational technology, such as mobile devices that solicit student interaction in large classes, and video capture for online lectures. The office runs the bi-annual EdTech conference, a one-day series of workshops that showcases best practices for innovating teaching and learning, presented by some of the University’s leaders in educational technology.
- **Engineering Instructional Innovation Program (EIIP)** – An extension of the Dean’s Strategic Fund, EIIP supports projects aimed at improving learning, pedagogies and the overall student experience, from digital course enhancements to lab renovations.
- **Practitioners of Engineering Education Research (PEER)** – An informal group of faculty members and graduate students who meet on a regular basis to discuss innovations in engineering education and take part in weekly seminars hosted by the graduate collaborative program in Engineering Education ([Section 8.1.2](#)). Many members also participate in conferences hosted by the American Society for Engineering Education and the Canadian Engineering Education Association.

In addition to these Faculty resources, our instructors can access the U of T Centre for Teaching Support and Innovation (CTSI), which provides workshops, demonstrations of educational technology and other research to support teaching development.

The Faculty also offers training and resources for teaching assistants (TAs). In 2014, we enriched our mandatory, paid TA training session ([Section 4.4.1](#)) with sessions that focus on developing classroom competencies and tools for success, including running active, collaborative tutorials. We created the role of Tutorial TA Coordinator to support the integration, through weekly meetings, of the 16 tutorials and eight lecture sections that comprise

our first-year mathematics courses. In addition, TAs can access the optional TA Training Program (TATP), provided by CTSI.

The Faculty currently offers eight online courses, two Massive Open Online Courses (MOOCs), and one MOOC specialization in iOS Development ([Appendix F](#)). Faculty members also participate in the development of Ontario Online shared courses and modules.

3.4.2 Recognition and Evaluation of Teaching

Student feedback is a major influence on our efforts to continuously improve engineering education. The students involved in our self-study consultations expressed general satisfaction with the quality and effectiveness of our faculty members. NSSE data indicate that our first-year students rate their experiences with faculty higher than the U of T average and on par with engineering Faculties at our peer institutions in terms of student-faculty interaction. Senior-year students, however, rate these experiences slightly lower than their peers at comparable institutions. More detail on our Faculty's NSSE results is provided in [Appendix E](#).

In addition to the NSSE data, we conduct detailed evaluations of our undergraduate courses and instructors by means of a confidential, standardized survey administered during the last two weeks of each course. Beginning in 2011, our Faculty's Teaching Methods & Resources Committee worked in close consultation with the University's Centre for Teaching Support and Innovation (CTSI) to develop a framework for the survey that characterizes the effectiveness of the learning experience from the student's perspective. This new evaluation process, implemented in the fall of 2013, aims to ensure that courses align with the teaching and learning goals identified by the University, Faculty, department and course, and provides actionable feedback for improvement.

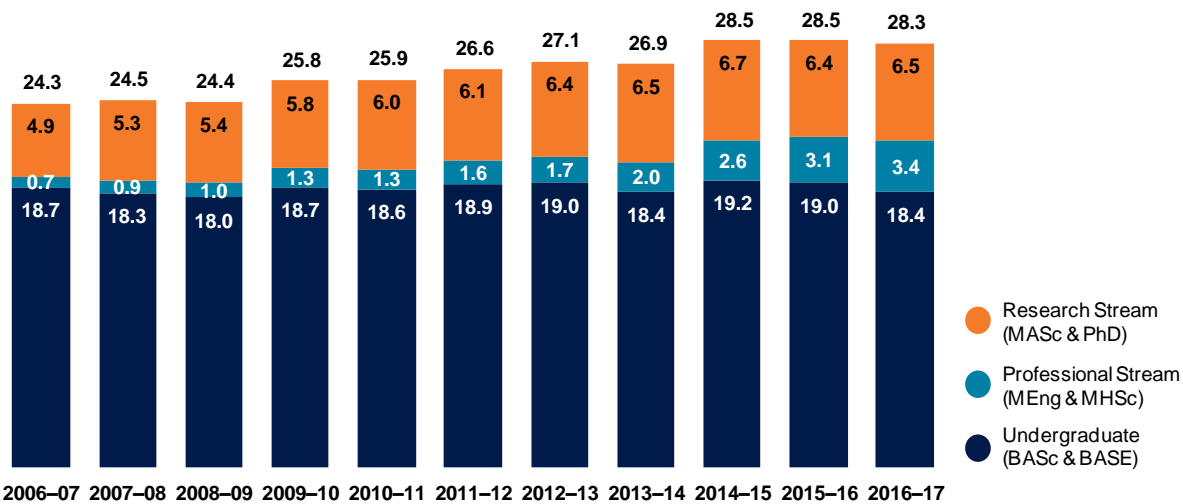
A sample evaluation form is provided in [Appendix G](#). Each statement is scored on a scale of 1 (strongly agree) to 5 (strongly disagree). The six statements are standard across U of T, with the first five used to create the Institutional Composite Mean (ICM) score. The next seven are standard across the Faculty, while the remaining questions are at the discretion of the instructor.

For the last three years, the overall ICM score for our Faculty has remained steady at 3.7 for all fall and winter semesters, with the exception of winter 2014 at 3.6. Looking at first-year courses only, the score was 3.8 across all fall and winter semesters, with the exception of fall 2015 with 3.9. In the most recent academic year of 2015–2016, the Faculty-level question, "The instructor related course concepts to practical applications and/or current research" had the highest mean score (3.9 in the fall semester, 3.8 in the winter semester). The lowest-scored question was "The course expanded my understanding of the ethical and environmental issues concerning engineering in society," with a mean of 3.1 in both semesters.

Some students in our self-study consultations suggested that conducting the course evaluations at the end of the term can result in low participation rates, as students may perceive their input to have little impact. As a result, the Engineering Society, in consultation with the Faculty, created a centralized feedback process that uses an online platform called "SpeakUp" to collect and organize casual student dialogue about course components. EngSoc's student academic representatives will invite professors to discuss the feedback regarding their class. A pilot version of this system was implemented in the fall of 2016.

3.4.3 Student-Faculty Ratios

Figure 3.7 Undergraduate and Graduate Students per Faculty Member, 2006–2007 to 2015–2016



Undergraduate student-to-faculty ratios have remained relatively constant over the last five years. Within individual departments, these ratios range from 13.6 to 20.2 and include both tenure- and teaching-stream faculty. They do not include professors from Arts & Science or other Faculties, who instruct many of our courses. For more information on student-to-faculty ratios, see [Appendix D: Figure 1.10](#).

Student-to-faculty ratios for our research-stream programs have grown from 4.9 ten years ago to 6.5 today, reflecting an increase in research intensity. Strong demand for professional-stream master’s programs (MEng & MHSc) has also led to an increase in the student-to-faculty ratio, from 0.7 ten years ago to 3.4 today. For more information, see [Appendix D: Figure 2.2c](#).

According to the most recent data available across Canada⁹, the national average student-to-faculty ratio is 23.2 for undergraduates. Within the U15 group of research-intensive Canadian universities, our close peers, the average is 17.8. We have hired 14 professors in the past year, including several teaching-stream faculty, who will contribute to reducing this ratio.

3.4.4 Academic Integrity

U of T students, faculty and staff must abide by the Code of Behaviour on Academic Matters. Teaching students to recognize and avoid academic dishonesty in all forms is part of our commitment to developing a strong culture of ethics within the engineering profession. For example, the first-year Orientation to Engineering ([Section 3.5.1](#)) course includes a tutorial that presents students with six scenarios that place the Code in context. Our instructors use Turnitin.com and Measure of Software Similarity (MOSS) to detect plagiarism in written papers and software, respectively. Instructors can report incidents of suspected plagiarism to the

⁹ Canadian Engineers for Tomorrow, Trends in Engineering Enrolment and Degrees Awarded 2010–2014. Engineers Canada: <https://www.engineerscanada.ca/sites/default/files/EnrolmentReport2014-e-r2.pdf>

Dean's designate for academic offences through the online Academic Offense Tracking Tool. A first offence typically results in a mark of zero for a given assignment, while repeat offenses can result in an incomplete mark for an entire course, an academic suspension of up to one year, or expulsion from the program.

3.5 Student Services, Retention and Graduation

Ensuring the success of students who are accepted into our undergraduate programs is a high priority for our Faculty. We recognize that the transition from secondary school to first-year engineering is particularly challenging for many students, and begin offering support in the summer before they begin their studies and continuing through the fall and winter semesters ([Section 3.5.1](#)). Students can access a full range of academic advising and career development services ([Section 3.5.2](#)), as well as programs like ILead that help them develop self-awareness and communication and leadership competencies. Other supports for students include access to the U of T Library system, the largest of its kind in Canada ([Appendix H — Library Report](#)), and a variety of information technology services ([Appendix I — ECF Report](#)).

Data from NSSE indicate that our students find our academic programs actively engage higher-order learning, reflective and integrative learning, learning strategies and qualitative reasoning ([Appendix E](#)).

3.5.1 First Year Programs

During the summer prior to starting their studies, all incoming students can access our First Year Foundations program, a suite of online tools, workshops and programs that include:

- **Success 101** — A series of three-day mini-courses, provided several times throughout the summer. Through interactions with professors, teaching assistants, upper-year students and their peers, incoming undergraduates can address their most pressing concerns and receive tips on everything from time management and note taking to effective communication and residence life.
- **Engineering Design 101** — A week-long summer course that introduces students to the engineering design process, including communicating with clients and managing a budget. Engineering Design 101 prepares students for success in future courses such as Engineering Strategies & Practice (ESP) and Praxis.
- **Computer Programming** — A week-long summer course designed to help students with little or no previous computer programming experience develop key competencies in coding.
- **Calculus Boot Camp** — A week-long summer course that reviews key mathematical concepts and demonstrates how they are applied in university-level calculus.
- **APS162 Calculus for Engineers** — Offered as a for-credit online course over the summer.
- **Academic Orientation** — Offered as online videos in June to students who cannot attend in person, these sessions provide advice on selecting courses, paying or deferring fees, getting a student card and ensuring academic success.

Once classes begin, students can access Peer-Assisted Study Sessions (PASS), led by upper-year students, to work on problem sets and share study strategies.

As recommended by our Curriculum Review task force, we introduced Orientation to Engineering as a required course in fall 2015 to help entering students in our Core 8 and

General First Year programs transition to first-year engineering studies. Through six one-hour lectures, supplemented by 12 one-hour tutorials led by upper-year TAs, the course covers key topics such as good study habits, time management and engineering ethics.

The Transition Program (T-Program) helps first-year students who fall behind in the fall session to proceed to second year on schedule by re-distributing their course load. If eligible, students in the T-Program can repeat up to three fall courses in the winter term, deferring winter term courses to the summer session. These students also meet with advisors from the Registrar's Office to identify and address the challenges they encountered.

Since 2013, our Faculty has hosted an annual First-Year Instructors Day for professors and teaching staff who work with incoming students. The goals of this workshop are to develop a strong sense of community among first-year instructors and to make them aware of the supports available to first-year students.

3.5.2 Academic Advising and Career Development

A primary academic advisor works with first-year instructors to proactively identify and assist first year students in the Division of Engineering Science, in General First Year, and in our Core 8 programs who would benefit from academic advising before the end of the first term. Academic advising for upper-year students is provided by the academic advisor attached to the unit offering the student's program of study.

The Engineering Career Centre (ECC) provides students and alumni within two years of graduation with career advising services and access to job postings, employer recruitment events and career fairs, and administers the Engineering Summer Internship Program (eSIP) and the Professional Experience Year (PEY) ([Section 3.7.2.1](#)). Students can participate in career development activities through the You're Next Career Network, a multi-disciplinary, student-run team that provides programs such as career fairs and a startup career expo.

Another source of career advice is the Alumni Mentorship Program, which connects third- and fourth-year students with U of T Engineering alumni in their chosen field. The Engineering Alumni Association (EAA) Board members have taken a leadership role in the Alumni Mentorship Program which has seen significant growth over the last five years ([Section 3.7.2.3](#)).

In 2014, the Division of Engineering Science launched a beta test of EngSci CONNECT, an online engagement platform developed by Graduway. Graduway enables us to engage alumni globally as well as third- and fourth-year students, staff and faculty. Amongst the many benefits of the platform, the community is emerged in professional development activities, and provides users with alumni working in self-identified industry sectors. There is also a job board as well as a user directory with a sophisticated search function.

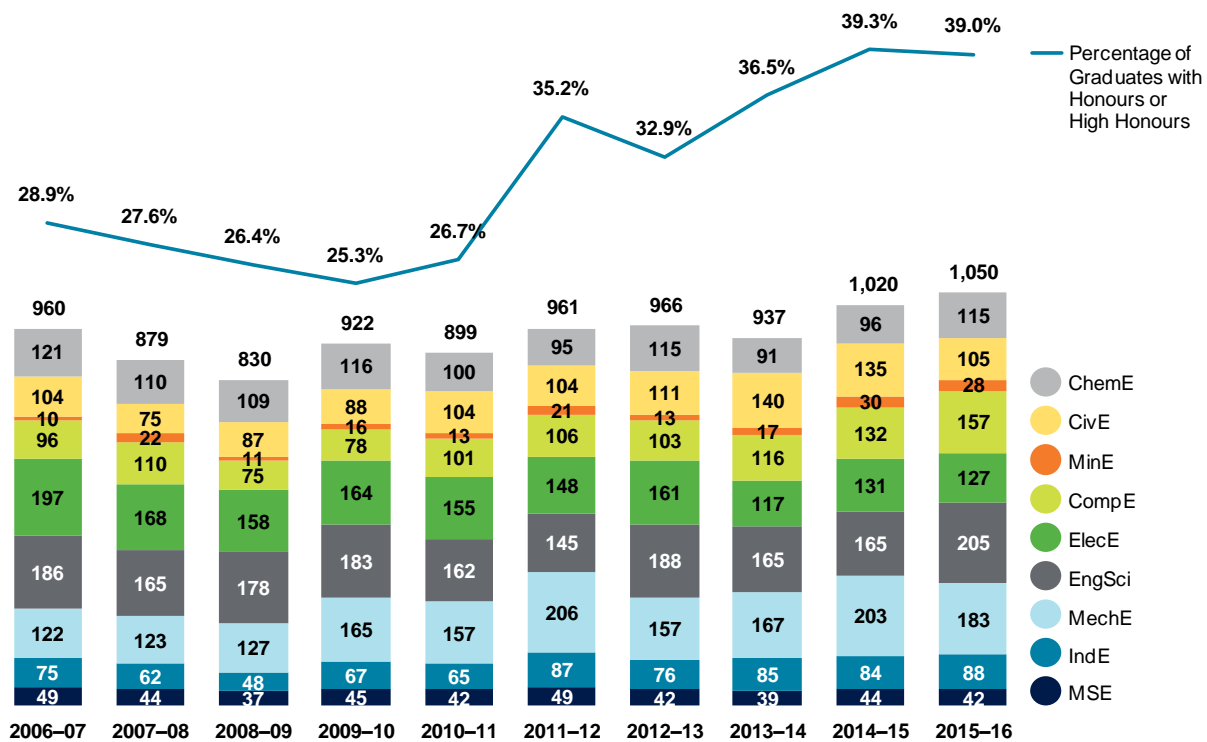
It was noted in our self-study consultations that ECC could do more to improve its level of service in terms of support, career advising, the disciplinary range of jobs it lists and the provision of timely, applicable information. Many students, particularly in first and second year, feel that the ECC does not currently meet their needs. In September 2015, we appointed the Dean's Task Force on Academic and Student Advising to review reported inconsistencies, including those related to customer service, interpretation of policies, use of clear and consistent standards, and differences in departmental roles, workloads and workflows that impact the

availability of academic advising to students. The task force has completed its work and a committee has been established to implement its recommendations.

3.5.3 Final-Year Academic Achievement

U of T Engineering awarded 1,050 degrees across all programs in 2015–2016. Degrees granted over the last 10 years are shown in [Figure 3.8](#).

Figure 3.8 Undergraduate Degrees Awarded by Program and Percentage of Graduates with Honours or High Honours, 2006–2007 to 2015–2016



We recognize high achievement among our graduates through the granting of Honours, which denotes a cumulative average of higher than 79.5 per cent across second, third and fourth years and a weighted sessional fourth-year average of 74.5 per cent or higher. The proportion of students graduating with Honours has grown from 28.9 per cent to 39 per cent over the last 10 years. In June 2015, we created the designation of High Honours for students with a cumulative average of 87.5 per cent or higher and a weighted sessional fourth-year average of 82.5 per cent or higher.

3.6 Student Funding

Our Faculty is committed to upholding the principle of the University of Toronto’s Policy on Student Financial Support, which states that no student offered admission to a program at the University of Toronto should be unable to enter or complete the program due to lack of financial means. While students are expected to first seek government aid through the Ontario Student

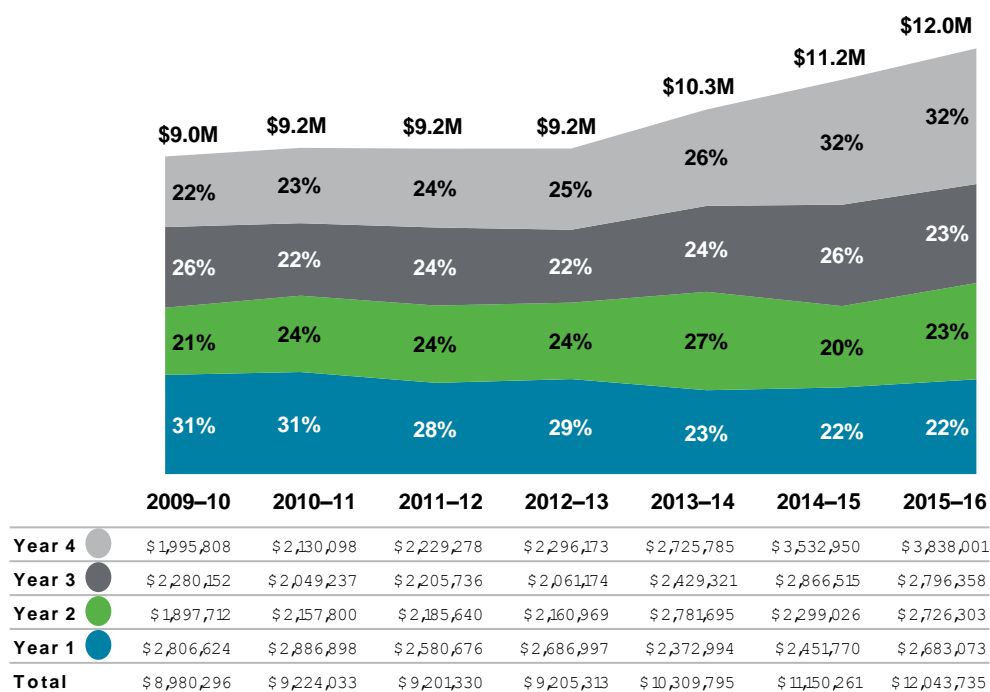
Assistance Program (OSAP), we offer a wide range of student aid options, including scholarships, bursaries and other awards based on merit and need. Our financial aid officer helps students prepare personal budgets, learn about funding sources (including University of Toronto Advance Planning for Students) and manage appeals through the OSAP process.

Scholarships and awards are typically geared toward students who demonstrate a high level of academic achievement in a particular discipline and/or strong leadership through co-curricular activities. To help students qualify for these awards, we have created the online ePortfolio tool, which students can use to create a comprehensive picture of their accomplishments that goes beyond academics. More than 2,200 students have completed a profile since ePortfolio's inception in 2007.

The Faculty distributed \$16.6 million in student aid in 2015–2016, including \$4.5 million in merit-based scholarships and awards received by students across all years and programs, and a further \$11.9 million in bursaries and grants.

In 2015–2016, 1,627 undergraduate engineering students received need-based awards, as compared to 1,814 in 2009–2010. The total amount of need-based support during this period was \$12.0 million across all four years of study and includes the need-based bursaries and scholarships described above and some additional funding sources, excluding OSAP.

Figure 3.9 Total Value of Need-Based Undergraduate Financial Assistance and Percentage Distributed by Year of Study, 2009–2010 to 2015–2016



3.7 Learning Environment and Student Experience

U of T Engineering is committed to providing a rich learning environment inside and outside the classroom. This includes ensuring that our physical space is commensurate with our position as Canada's premier engineering school ([Section 3.7.1](#)) and providing experiences such as professional internships and research placements that enable students to develop key competencies in engineering design, communication and project management ([Section 3.7.2](#)).

NSSE data indicate that our undergraduates rated the quality of their on-campus interactions on par with the U of T average and that of students in peer institutions. In terms of a supportive campus environment, U of T Engineering's scores were slightly below U.S. peer institutions for both first year and senior year students. We have worked to address this challenge through a number of recent upgrades to our physical infrastructure, and are enhancing programs that allow students to gain valuable experience working for our many industry partners or in research labs at collaborating institutions worldwide. See [Appendix E](#) for more information.

3.7.1 Space and Facilities

Our Faculty is located on a historic campus in the heart Canada's largest city. Though our campus and its location provide many benefits, a number of our buildings were built between 60 and 100 years ago. This creates unique challenges that have been addressed through renewal projects ([Section 3.7.1.1](#)) and the Centre for Engineering Innovation & Entrepreneurship (CEIE), currently under construction ([Section 7.4](#)), which will significantly expand and enhance the space available for multidisciplinary collaboration, innovation and entrepreneurship within our Faculty.

3.7.1.1 Curricular

We have recently created or upgraded a number of classrooms and laboratory facilities across the Faculty in order to better serve the needs of our students and instructors. Highlights include the creation of a prototype Technology Enhanced Active Learning (TEAL) room in the Sandford Fleming Building, an upgrade to the undergraduate computer facility in the Mechanical Engineering Building, and a renovation to the undergraduate teaching laboratory on the third floor of the Lassonde Mining Building ([Section 7.3](#)).

The CEIE will include a 500-seat auditorium with a stadium-style video wall and a number of rooms designed to facilitate active learning and collaboration ([Section 7.4](#)).

3.7.1.2 Co-curricular

Our holistic approach to engineering education includes recognizing the value of co-curricular activities, from clubs and design teams to entrepreneurship programs, which support the development of our students. Recent improvements to the spaces in which students study, build prototypes and meet to exchange ideas include:

- Renovations to the Engineering and Computer Science Library that increased the amount of study space available for students

- Additional seating installed throughout the Bahen Centre and the Wallberg Building to provide space for more than 150 students to study, collaborate or socialize between classes
- Physical and organizational upgrades to the student machine shop in the Mechanical Engineering Building that increases its opening hours and makes the space accessible to more students from across the Faculty
- Upgrades to staff and student accommodations at the Gull Lake facility where the Department of Civil Engineering's annual Survey Camp is held

We convened a working group in July 2016 to audit our makerspaces, that is, facilities where students build and test prototypes either as part of design courses or co-curricular activities. The report of the working group will be delivered later this year.

The CEIE will include numerous spaces for students to study, as well as design/meet rooms where they can collaborate on projects, whether for their academic courses or as part of their co-curricular activities. It will also include prototyping facilities where students can build and test prototypes ([Section 7.4](#)).

3.7.2 Student Experience Beyond the Classroom

Providing students with rich experiential learning opportunities helps them develop global fluency and communication, teamwork and leadership abilities. These experiences enrich their perspectives and strengthen their relationships with our Faculty, the engineering profession and the communities we serve. Whether through internships, exchanges, student clubs, design teams, or community service, our students engage with society to address key technical and social challenges. The Alumni Office and the EAA are working closely with student clubs and groups to identify volunteer opportunities and collaborations between alumni and students in both extra and co-curricular activities.

3.7.2.1 Internships and Research Placements

Internships and research placements allow students to apply concepts they learn in class to industry or research environments, while gaining valuable experience working in teams and solving complex problems. The Engineering Career Centre (ECC) operates two internship programs: the Professional Experience Year (PEY) Internship Program and the Engineering Summer Internship Program (eSIP).

Professional Experience Year (PEY) Internship Program

At almost 40 years old, U of T Engineering's PEY internship program is the largest paid internship program of its kind in Canada. The optional program enables undergraduate students to spend 12 to 16 months working for leading companies in Canada and around the world. Students are full-time employees during their internship and are paid a salary competitive with other engineering positions in the industry. The average annual salary for engineering PEY students in 2015 was \$50,000, with individual salaries ranging as high as \$104,000.

More than 1,800 PEY internships are available each year, representing more than 300 employers worldwide. These include small startups as well as large multinational corporations such as Apple and Tesla Motors. More than 70 per cent of PEY students return to their studies with offers of full-time employment after they graduate, and students with PEY internship

experience are able to negotiate a starting salary that is typically 15 per cent higher than those without.

In 2015–2016, 790 undergraduates participated in PEY internships, one in 10 of whom worked outside of Canada. This was the highest number to date, accounting for nearly two-thirds of students from the previous third-year cohort (**Figure 3.10**). We have also increased the number of international PEY internships, from 24 in 2006–2007 to 79 in 2015–2016 (**Table 3.1**).

Figure 3.10 PEY Internship Placements with Percentage Participation from Previous Third-Year Class, 2006–2007 to 2015–2016

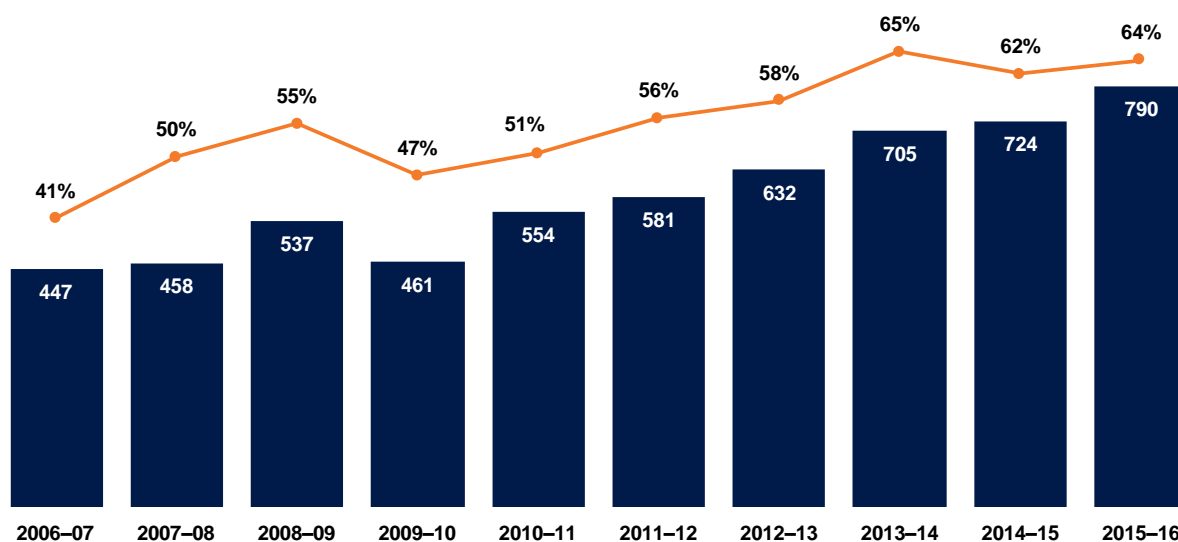


Table 3.1 Canadian and International PEY Internship Placements for Engineering Undergraduates 2006–2007 to 2015–2016

	Canadian Placements	US Placements	Other International Placements	Total PEY Placements
2006–07	423	17	7	447
2007–08	427	23	8	458
2008–09	490	31	16	537
2009–10	426	24	11	461
2010–11	530	11	13	554
2011–12	547	26	8	581
2012–13	592	24	16	632
2013–14	644	36	25	705
2014–15	663	42	19	724
2015–16	711	50	29	790

Engineering Summer Internship Program (eSIP)

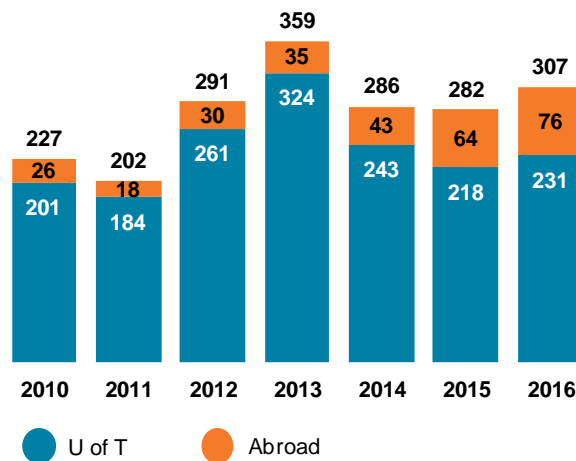
The Engineering Summer Internship Program provides an option for students who would prefer a shorter work term than the 12 to 16 months offered by a PEY internship. Internships take place from May to August and employers have included the Toronto Transit Commission, Geomechanica Inc., and Temporal Power, Ltd.

Some students in our self-study consultations expressed a desire for PEY placements that cover a wider variety of engineering disciplines, and additional and varied opportunities to take shorter-term placements.

Undergraduate Research

Undergraduate students across all years can engage in research experiences. In 2016, 231 undergraduates participated in summer research opportunities within the Faculty, and a further 76 completed summer research internships at other institutions around the world.

Figure 3.11 Undergraduate Participation in Summer Research Opportunities, 2010 to 2016



Most U of T Engineering faculty members offer summer research placements, typically administered at the departmental or divisional level. Other more structured programs, such as the Engineering Science Research Opportunities Program (ESROP), provide first- and second-year Engineering Science students with opportunities to work with faculty members in their area of interest. During these summer placements, students are mentored by graduate students, faculty members and industry partners, and contribute to leading-edge research projects in areas such as sustainability, robotics and bioengineering. Each August, these students present their findings at the Undergraduate Engineering Research Day (UnERD). In 2016, UnERD included more than 100 poster and podium presentations, with the winners given the opportunity to have their work published in the youth-focused *STEM Fellowship Journal*.

Through U of T's Centre for International Experience (CIE), we offer research programs at a number of leading institutions worldwide, including the National University of Singapore, Hong Kong University of Science & Technology and the University of Stuttgart. Beginning in 2015, the APS299Y Summer Research Abroad course has allowed students in some programs to receive

degree credit for such exchanges. The Exceptional Opportunities Award, available to Engineering Science students, helps cover some of the costs associated with overseas placements. The CIE also provides scholarships and awards.

Our self-study consultations indicated a desire for more summer research opportunities, especially among first-year students. A University-wide listing of undergraduate research opportunities is currently in the pilot stage with our Faculty which, in partnership with the Engineering Society, is participating for the first time this year.

3.7.2.2 International Student Exchanges

The participation of our students in international exchanges has historically been low, due in part to the need for courses at other institutions to count toward Canadian Engineering Accreditation Board (CEAB) requirements, and some limited flexibility given the high number of mandatory courses in engineering programs. Despite this, we have made significant progress over the last few years by creating pathways with partner institutions worldwide. We more than doubled the number of international exchanges from 35 in 2011–2012 to 89 in 2015–2016, most of which are research-based. We continue to work with our international partners to strengthen our relationships and grow the opportunities for international exchanges. Additionally, Engineering Science offers an Exceptional Opportunities Award, which provides funding for students who make their own arrangements for placements abroad. In 2015–2016, four students (not included in the Table 3.1 totals) received EOG funding.

Table 3.2 International Exchanges, 2011–2012 to 2015–2016

Exchange Year	Total Student Exchange
2015–2016	89
2014–2015	94
2013–2014	61
2012–2013	59
2011–2012	35

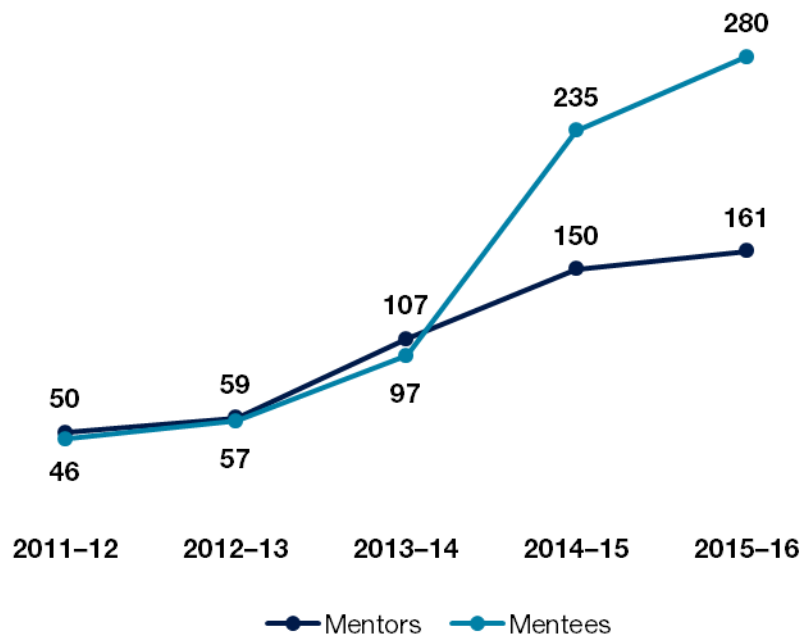
3.7.2.3 Interaction with the Profession

Across all years of study, our students have many opportunities to meet and interact with practicing engineers and learn more about the standards of the profession ([Section 8.2.5](#)). Some examples include:

- **Instructors and guest lectures** — Several courses, including CHE1431H Environmental Auditing and MIE542H Human Factors Integration, are taught by practicing engineers who bring their disciplinary expertise and professional experience into the classroom. Other courses involve industry professionals as guest lecturers. These include the first-year Orientation to Engineering course that uses guest speakers to help students in the Core 8 and TrackOne programs successfully transition into the engineering academic environment and learn about the engineering profession.

- **Design projects** — Many fourth-year culminating activities including departmental capstone courses, theses and design projects involve industry partners as project advisors and clients.
- **Clubs and the Engineering Society** — Student chapters of many professional engineering organizations, such as the Institute of Electrical and Electronics Engineers (IEEE) and the American Society of Mechanical Engineers (ASME), are active on campus. Students are also represented through the Engineering Society to Professional Engineers Ontario, the Ontario Society of Professional Engineers and Engineers Canada.
- **Career fairs** — Whether organized through the Engineering Career Centre or the student-run You're Next Career Network, a number of annual events connect students and new graduates with seasoned professionals to help jump-start their careers.
- **Alumni Mentorship Program** — This program fosters valuable relationships between engineering alumni and students in their third and fourth years, including those currently participating in PEY. At a kick-off event and several structured sessions throughout the year, students can meet experienced professionals and seek advice to help navigate important career decisions. The Alumni Mentorship program has grown significantly over the years as a direct result of participation of and strategic leadership from the Engineering Alumni Association, in partnership with key student groups such as You're Next Career Network and other student clubs such as Women in Science and Engineering.

Figure 3.12 Participation in the Alumni Mentorship Program, 2011–2012 to 2015–2016



3.7.2.4 Clubs, Conferences and Competitions

Our students can choose from more than 80 engineering clubs and teams, and hundreds more across the University; a complete list is available in [Appendix D: Appendix A](#).

Some of these organizations are focused on design competitions in which students test their abilities against those of students from other institutions around the world. Others focus on cultural pursuits, including the Skule™ Orchestra and the Muslim Students Association. Still others are service groups dedicated to improving the lives of others, such as the U of T Chapter of Engineers Without Borders or the Bridges to Prosperity program, which designs and constructs footbridges for communities isolated by geographic obstacles.

The Faculty supports student clubs and teams by providing space and direct funding. The Centralized Process for Student Initiative Funding (CPSIF) enables student groups to apply for support from multiple sources — including the departments and institutes, alumni and Dean's Office, Engineering Society and You're Next Career Network — with a single application. In 2015–2016, the Faculty distributed more than \$260,000 in support of student clubs and teams through this portal.

The Alumni Office and EAA are also working closely with student clubs to identify collaborative opportunities for mentorship as well as volunteer opportunities for alumni — all of which enrich the student experience and deepen their understanding of the role and value of alumni.

Recent notable accomplishments from Engineering clubs and teams include:

- The **Human Powered Vehicle Design** team worked in close collaboration with Aerovelo, a company founded by U of T Engineering alumni Cameron Robertson and Todd Reichert, to create Eta, the world's fastest bicycle. Eta set a world record at the World Human Powered Speed Challenge in September 2015, then went on to break its own record in September 2016 with a speed of 89.59 miles (144.19 kilometres) per hour.
- The **Blue Sky Solar Racing** team placed third at the American Solar Challenge 2016, taking the title of top Canadian team. The eight-day rally-style solar car race covered 1,975 miles (3,178 kilometres) through eight U.S. states.
- The **University of Toronto Supermileage Team** won gold at the Shell Eco-Marathon Americas 2015 in Detroit, Michigan, with an efficiency of 3,421 miles per gallon, the equivalent of 6.82 millilitres of gasoline per 10 kilometres.

Attending and hosting conferences allows our students to build professional networks, meet future collaborators, and develop leadership competencies. In 2013, a group of students revitalized the Women in Science and Engineering (WISE) National Conference, which has been hosted annually by the U of T chapter ever since. This year's conference boasted more than 250 delegates.

We also host student chapters of professional organizations, including the Institute of Electrical and Electronics Engineers (IEEE), the Canadian Society for Chemical Engineering (CSCHE), the Canadian Society for Mechanical Engineering (CSME) and many others. These student chapters regularly send delegations to national and international conferences, and host student programs when such conferences are located in the Greater Toronto Area.

3.8 Social Impact and Global Competencies

Today's engineers address a wide range of technological, economic, social, educational and environmental challenges that transcend national borders. Our Faculty recognizes the need for students to acquire global perspectives and experiences that enhance their cross-cultural fluency. Through curricular and co-curricular programming, we ensure that our undergraduates can develop competencies that will allow them to have a positive impact on people around the world.

3.8.1 Curricular Programs

In our engineering design courses, including ESP, Praxis and capstone ([Section 3.3.1](#)), students regularly develop solutions to challenges brought forward by community organizations. Recent projects include:

- **PowerWring** — A Praxis project in 2013–2014 challenged students to develop a solution to prevent injuries among caretakers and janitorial workers. The result was PowerWring, a simple device that attaches to mop wringers and reduces the amount of force required by workers. The team went on to develop PowerWring as part of the 2014 U of T Hatchery cohort, and now has patents under review in Canada and the U.S. PowerWring won second prize in the 2016 Minerva Canada James Ham Safe Design Awards competition.
- **Xposure** — Created as part of the Multidisciplinary Capstone Course, the Xposure app simplifies the process for firefighters to document hazards they come into contact with, which is critical for them to receive compensation in the event of future negative health effects. Xposure was developed in partnership with the Hamilton Professional Firefighters Association, and is now being expanded to other jurisdictions.
- **Winds of Change** — Over the past two years, several student teams in the MIE491 Capstone Design course designed and built a windmill that pumps irrigation water to residents of Pedro Arauz, Nicaragua. The project, carried out in partnership with the charity Winds of Change, will have a tremendous impact on the lives of local farmers during the dry season. It can be repaired and maintained with locally-available materials, with an initial capital cost of less than \$200.

The Centre for Global Engineering (CGEN) ([Section 8.2.3](#)) offers courses to help students develop global fluency by teaching them about models of international development, diffusion of technological innovation, and global trends in sustainable development. All CGEN courses count toward the undergraduate certificate in global engineering.

3.8.2 Co-curricular Programs

Each year, the Engineering Outreach Office ([Section 3.2.1.1](#)) reaches more than 9,000 students in grades 3 to 11 across the Greater Toronto Area and beyond, with programs that improve their understanding of engineering and inspire future talent in science, technology, engineering and math (STEM). Of equal importance is the opportunity they provide for our graduate students develop and deliver curriculum. Through these programs, our students act as ambassadors for the profession and develop competencies in communication, youth education and project management.

In 2016, a third-year MIE undergraduate was one of 12 students selected from across Canada to participate in the National Indigenous Youth in STEM (InSTEM) program run by Actua, a

national STEM charity. During July and August, she and her teammates travelled more than 8,000 kilometers to deliver workshops in seven Indigenous communities that would not normally have access to this type of programming ([Section 9.3](#)).

The social impact of engineering is also the focus of The Game, a co-curricular activity developed by ILead in 2015. Throughout the year-long program, student teams consider complex social problems that can be addressed through systems thinking and engineering problem solving. The culminating activity is a pitch competition where teams compete for a grand prize of \$5,000. In its first year, the winning team created *canact*, an online platform that helps connect people to volunteer opportunities based on their interests and expertise. In the second year, the winners developed Foodly, an app to reduce food waste.

Our students also create impact through volunteer activities. In the spring of 2016, several students from the University's student chapter of the Canadian Electrical Contractors Association (CECA) travelled to Roatán, Honduras to improve water access in a community of 600. They installed a three-kilowatt solar array that operates a water pump, saving the community more than \$250 per week in fuel expenses.

4.0 Graduate Education

The University of Toronto is a research-intensive institution that supports its graduate programs and students through numerous teaching, research and academic services.

We evaluate the experience of our graduate students in numerous ways. In 2007, 2010 and 2013, we participated in the Canadian Graduate and Professional Student Survey (CGPSS), a third-party survey that solicits student opinion on the quality of graduate supervision in MASc and PhD programs, the quality of graduate courses, and the overall impression of graduate programs and the student experience. Eight hundred and forty-nine U of T Engineering graduate students responded to the 2013 survey, a response rate of approximately 45 per cent.

We also engaged in a number of consultations with our graduate student body as we developed this self-study. In-person meetings were held with groups of research-stream graduate students and with a small group of postdoctoral fellows. We surveyed current research-stream (MASc, PhD) and professional-stream (MEng and MHSc) students, and analyzed graduate student feedback that was collected during recent department and institute external reviews.

The results of the CGPSS and consultations are referenced throughout this chapter.

4.1 Overview of Programs and Governance Structure

U of T Engineering offers two graduate program streams for students with interests ranging from leading-edge research and academia to innovation and industry application. The doctoral or research stream includes Master of Applied Science (MASc) and Doctor of Philosophy (PhD) students. The professional stream includes the Master of Engineering (MEng), Master of Engineering in Cities Engineering and Management (MEng CEM), and Master of Health Science in Clinical Engineering (MHSc) programs. These streams combined currently total 2,381 graduate students. The degree requirements for these programs are outlined in [Appendix J1](#).

Driven by strong demand for our MEng program, particularly among international students, we have increased the size of our graduate student population by 43 per cent since 2010. We have also evolved our programming to better support our professional-stream students by expanding course offerings and introducing emphases and areas of study, including an MEng that focuses on biomedical devices.

Graduate programs are administered at the department and institute level, often referred to as “graduate units” although Faculty-level initiatives also enhance programs across all graduate units. Governance processes related to initiatives and academic changes occur at the graduate unit, Faculty and University levels.

4.1.1 Research Degree Programs (MASc and PhD)

Our Faculty offers research-stream graduate programs leading to the MASc and PhD degrees in each of the following seven disciplines:

- Aerospace Science & Engineering (AER)
- Biomedical Engineering (BME)
- Chemical Engineering & Applied Chemistry (CHE)
- Civil Engineering (CIV)

- Electrical & Computer Engineering (ECE)
- Mechanical & Industrial Engineering (MIE)
- Material Science & Engineering (MSE)

Course requirements for research-stream students vary by graduate unit. (Lists of MASc and PhD course requirements and curriculum areas for each graduate unit are presented in [Appendix J](#)). MASc students are required to take between three and five half courses (i.e., single-semester courses); PhD students with a master's degree must take between two and five courses; PhD students who enter directly from an undergraduate degree, or fast-track from the MASc ([Section 4.2.3](#)), must take between six and nine courses. Some graduate units have additional requirements, such as attending a particular seminar series (CHE, MIE). These course requirements occur in the context of the major requirement for MASc and PhD students, a supervised research project leading to a thesis.

Flex-Time PhD: Students who are employed full-time and have a master's degree in engineering can choose a flex-time PhD, which is offered by several departments. This program is designed for highly motivated engineers, usually in R&D roles, to pursue a PhD on a topic closely related to their employment. This specialty degree is a partnership between a student, their employer and supervising professor, and provides an avenue for knowledge creation and exchange between industry and the University.

Graduate Collaborative Programs: Graduate students registered in any of our degree programs may choose to concurrently complete a graduate collaborative program. Collaborative programs bring together students and faculty from different disciplines, within and beyond engineering, around an area of common interest. While our Faculty hosts collaborative programs in Engineering Education and in Biomedical Engineering ([Section 8.1.2](#)), departments and institutes participate in various collaborative programs hosted by graduate units in other Faculties and divisions ([Section 8.1.2](#)), to which our students can apply.

Ethics in Graduate Research: In addition to their required coursework, all research-stream graduate students must attend a graduate ethics seminar, ideally within their first semester of study. The seminar introduces students to philosophical and practical ethics through lecture and case studies, and exposes them to the University's policies on research misconduct and expected codes of conduct in the research environment.

In the 2013 CGPSS survey, nearly 90 per cent of research-stream students rated their overall experience at U of T as good or better. A similar number of students responded positively about specific dimensions of their programs: the intellectual quality of faculty and fellow students, the quality of graduate-level teaching, and the quality of academic advising and guidance. Eighty-three per cent of respondents indicated that they would definitely or probably recommend U of T to someone considering their program.

4.1.2 Professional Degree Programs (MEng, MEng CEM and MHSc)

U of T Engineering offers a course-based professional Master of Engineering (MEng) degree through each of its seven departments and institutes ([Section 4.1.1](#)). Civil Engineering also offers a specialized MEng program in Cities Engineering and Management (MEng CEM), and IBBME offers a Master of Health Science (MHSc) in Clinical Engineering.

The 2013 CGPSS survey indicated that 90 per cent of professional-stream students rated their overall experience at U of T as good or better. Ninety per cent rated the intellectual quality of the

faculty as at least very good. Ninety-three per cent rated the quality of graduate-level teaching as at least good. Eighty per cent of respondents indicated that they would definitely or probably recommend U of T to someone considering their program. In our self-study consultations, some students noted a lack of academic support for MEng students and a desire for stronger connections to their departments or institutes.

4.1.2.1 Standard MEng programs

The MEng programs offered by six of the seven grad units — all but IBBME — are broad programs that offer students a wide variety of choices in terms of course selection. These MEng programs are designed for students who, in one year of full-time study, two years of extended full-time study, or three years of part-time study, can gain technical expertise and develop professional competencies which together enhance their career prospects. The curriculum of approximately 10 courses typically requires that students take at least six technical courses, which enables students to take up to four professional development courses. All programs also offer MEng students the option of completing a design project with a professor, usually in lieu of three half-courses (fewer in AER and CIV).

In recent years, many of the graduate units have introduced technical courses tailored to MEng students as well as curricular paths, known as emphases ([Section 4.1.2.5](#)), that guide students who wish to focus their studies on a particular topic. Completion of emphasis requirements, typically the completion of four to six courses, earns the student a certificate of completion.

The professional development courses are offered centrally by the Faculty, and are referred to as “ELITE” - the emphasis in Entrepreneurship, Leadership, Innovation and Technology in Engineering ([Section 4.1.2.6](#)).

The number of students pursuing professional master degrees (MEng, MEng CEM and MHSc) increased dramatically over the past decade, with 890 students as of October 2016, up from 265 students in 2006-2007 ([Figure 4.4](#)). International students account for a large part of the growth, comprising 37 per cent of professional master students, up from only 8 per cent in 2006–2007. With this surge in enrolment, professional master students now make up 54 per cent of all U of T Engineering master students, achieving our *Academic Plan* goal of 50 per cent. We are now closer than ever to our *Academic Plan* goal of having graduate students account for 40 per cent of our overall student population ([Figure 4.5](#)).

4.1.2.2 MEng in Biomedical Engineering

The MEng program in biomedical engineering offered by IBBME is different than the broad MEng programs offered by the six other graduate units. This is a one-year program focusing on the design and commercialization of biomedical devices and is ideal for those students planning to move directly into the biomedical device industry. Students in this program take courses in the areas of biomedical engineering technology, biomedical sciences, and commercialization and entrepreneurship. In the final semester, students take on an applied design challenge via a four-month internship at an industry partner, academic lab or hospital. The program enrolled about 10 students when it was first offered in the fall 2016 term when it was first offered, with plans to increase enrolment by an additional 10 students each year to a steady state of 50 students per year by 2020.

4.1.2.3 MEng in Cities Engineering and Management

The MEng in Cities Engineering and Management (MEng CEM) was launched in 2013 in response to a growing need for professionals with both technical expertise and a fundamental understanding of the complex and cross-disciplinary issues facing cities. This program enables students to gain a comprehensive understanding of the interaction between the systems and services of a city and its ability to generate prosperity. It also allows them to acquire the analytical and management competencies necessary to assess the environmental, economic, political and social risks and impacts of policy change related to a city's critical infrastructure.

The MEng CEM program consists of 10 courses and an integrated practicum that can be completed over 16 months of full-time study, or 24 months as an extended full-time option. Specialization areas for the program include transportation systems, cyber security, urban structures, sustainable energy systems, operations research, environmental issues for healthy cities, resilience of critical infrastructure, and communication networks.

4.1.2.4 Master of Health Science (MHSc) in Clinical Engineering

The Master of Health Science (MHSc) in Clinical Engineering program focuses on the application and implementation of medical technologies to optimize modern healthcare delivery. This two-year, full-time program consists of academic courses, a research thesis, and an internship in a hospital, private sector company or research facility. Recent internship placements have been completed at The Hospital for Sick Children, the Holland Musculoskeletal Research Program at the Sunnybrook Research Institute, and the World Health Organization in Geneva.

4.1.2.5 MEng Emphases and Projects

Single-unit Emphases: Emphases are MEng specializations that enable students to customize their degrees by taking courses that are focused in a particular area. The approach varies by graduate unit; for example, AER offers two formal emphases, Sustainable Aviation and Aerial Robotics, while MIE offers four, including Financial Engineering and Healthcare Engineering. ECE and CIV each offer a number of curricular pathways for students, including Building Science (CIV), Environmental Engineering (CIV), Photonics (ECE), and Identity, Privacy and Security (ECE). MSE and CHE do not currently offer single-unit emphases, but are considering developing these in the future.

Multidisciplinary Emphases: A number of emphases have been developed in the past few years to bring together students from different graduate units and disciplines. The emphasis with the highest enrolment is Entrepreneurship, Leadership, Innovation and Technology in Engineering (ELITE) ([Section 4.1.2.6](#)). In addition to ELITE, the following multidisciplinary emphases are available to MEng students:

- Advanced Manufacturing (AER, CHE, MIE, MSE)
- Advanced Water Technologies & Process Design (CHE, CIV, MSE)
- Engineering & Globalization (all students)
- Robotics and Mechatronics (AER, ECE, MIE)
- Sustainable Energy (AER, CHE, CIV, ECE, MIE, MSE)

New multidisciplinary emphases are planned for the coming years to build on this successful model.

MEng Projects: MEng students may pursue a project in lieu of a few courses (a list of course weights assigned to MEng projects by academic area is provided in [Appendix J](#)). In our self-study consultations, some MEng students stated their desire to pursue such a project, but were unable to find one, while a few others expressed concerns with the quality of their project and of the supervision provided. One year ago, under the leadership of the University of Toronto Institute for Multidisciplinary Design & Innovation (UT-IMDI), the Faculty introduced multidisciplinary MEng projects to bring together MEng students from at least two different disciplines to work together on projects sourced from industry and academia. Student interest in these projects has been strong. A number of projects are underway, and we plan to grow this initiative in future years.

4.1.2.6 Emphasis in Entrepreneurship, Leadership, Innovation, and Technology in Engineering (ELITE)

Engineering practice demands not only technical expertise, but professional competencies that enable engineers to become leaders, team-builders and innovators. To provide students with expanded opportunities to develop these competencies, the Faculty created an emphasis in Entrepreneurship, Leadership, Innovation and Technology in Engineering (ELITE) in 2007, the first such initiative in Canada. ELITE courses are offered Faculty-wide, primarily to MEng students. (Research-stream graduate students are also welcome to take ELITE courses, though graduate units restrict the number of the courses they can count toward their program requirements.)

ELITE courses are offered in four categories: leadership, entrepreneurship and innovation, finance and management, and engineering and society. They are taught by a mixture of professors and industry experts, with different courses offered each semester (including summer) to accommodate student schedules. Courses with the highest enrolment are taught in multiple semesters, and five online courses have been developed over the past few years. Total enrolment in the ELITE courses has grown dramatically; in 2015–2016, we offered 50 courses with a total enrolment of 1,401 students, up from 26 courses and 872 students just four years earlier.

Students who successfully complete four ELITE courses are issued a certificate of completion in addition to their graduate degree. More than 500 students have achieved this since 2007, and with the recent rapid growth of the MEng program, more than 100 students per year are now earning the certificate ([Appendix D: Figure 2.11](#)). We heard in our self-study consultations that the level of satisfaction with the ELITE courses is very high, suggesting that students understand the importance of these courses to their future career plans.

4.1.3 Academic Approvals: Faculty Council and Engineering Graduate Research Committee

The development of graduate degree programs is governed through the Office of the Vice-Provost, Academic Programs, with Faculty leadership provided by our Vice-Dean, Graduate Studies. Proposals for new programs and major program changes usually originate in graduate units, and must be approved by Faculty and University governance committees.

Faculty-level governance of graduate education is provided by the Engineering Graduate Education Committee (EGEC), a standing committee of Faculty Council chaired by the Vice-Dean, Graduate Studies, with faculty representation from each graduate unit, graduate administrative staff, and graduate students. EGEC has delegated authority from Faculty Council to approve minor and major curriculum changes and minor program changes. Major program changes are reviewed by EGEC with a report and recommendations brought to Faculty Council for approval. EGEC advises and reports on major graduate education and research issues, including admission regulations and requirements arising from regular meetings of the graduate chairs committee, external reviews of graduate departments, and concerns referred to it by members of the committee or by the Speaker of Faculty Council. It also advises Faculty Council on any matters related to governance of the graduate programs of the Faculty¹⁰.

The School of Graduate Studies (SGS) is a University-wide body that oversees graduate education and research to ensure consistency and high standards across the Faculties and divisions and to promote best practices. SGS provides expertise to individual graduate units on a variety of administrative matters related to admission offers, student registration, and non-standard program requests, and oversees national and provincial scholarship competitions. The SGS leadership also works with vice-deans of graduate studies from across the University on initiatives that affect graduate students University-wide, and to promote best practices in graduate education.

4.2 Graduate Admissions, Enrolment and Funding

Admission to graduate programs within our Faculty is competitive, particularly in the doctoral stream, although recruiting domestic PhD students has and will continue to be a challenge. We have been working to increase our graduate enrolment, particularly at the PhD and MEng levels, and to improve opportunities for graduate student funding.

4.2.1 Applications and Admissions to Graduate Studies Programs

Figures 4.1, 4.2 and 4.3 illustrate the number of applications, offers and registrations for domestic and international MASc, PhD and MEng students, respectively. While international student interest in all of our programs is very high, domestic student interest in MASc and PhD programs has been relatively flat over the past 10 years. Only the MEng programs have seen a strong increase in domestic student applications.

U of T Engineering guarantees funding for all research-stream graduate students (Section 4.2.5), which is provided through a combination of supervisor-provided research assistantships, fellowships provided by the graduate units, and internal and external scholarships. In turn, universities in Ontario, including U of T, receive provincial government funding for each domestic graduate student, but no funding for international students. To compensate for this lack of funding, the University charges international students higher tuition, but as tuition is part of the guaranteed funding provided to students, the net effect is that international students cost much more to support. As a result, we are able to extend offers to a relatively small fraction of international applicants: about 6 per cent of MASc applicants and about 14 per cent of PhD applicants.

¹⁰ *Terms of Reference* for the Engineering Graduate Education Committee

That same funding formula demands that we recruit domestic MASC and PhD students, which has proven to be a challenge. Interest in the MASC program has remained flat, as domestic students have increasingly chosen to pursue the MEng instead. Nevertheless, we receive about 600 MASC applications annually, and extend offers to only about 40 per cent of applicants, which more than 80 per cent accept.

Recruiting domestic PhD students has been more challenging. We receive approximately 200 applications per year and offer admission to more than half of those, due to the fact that many students only apply when they have informally been assured of an offer. The MEng application and admission data (Figure 4.3) show very strong growth. Interest from domestic students has grown steadily for many years, to more than 800 last year; international applications to the MEng program have increased sharply the past five years, to over 1,200 last year. These dramatic increases have allowed us to double MEng enrolment in the past five years (Section 4.2.4) to over 800 students in 2015–2016. Several of the graduate units are now no longer growing enrolment, but rather are being more selective in choosing top students from an increasing pool of applicants.

The number of female graduate students has been increasing modestly, from 24 per cent to 26.1 per cent of the total graduate student population over the past five years. With the dramatic increase in the number of women entering undergraduate engineering programs (Section 3.2), we are optimistic that the number of female graduate students will continue to increase as these undergraduate students progress in their chosen programs.

Figure 4.1 MASC Applications and Admissions Data

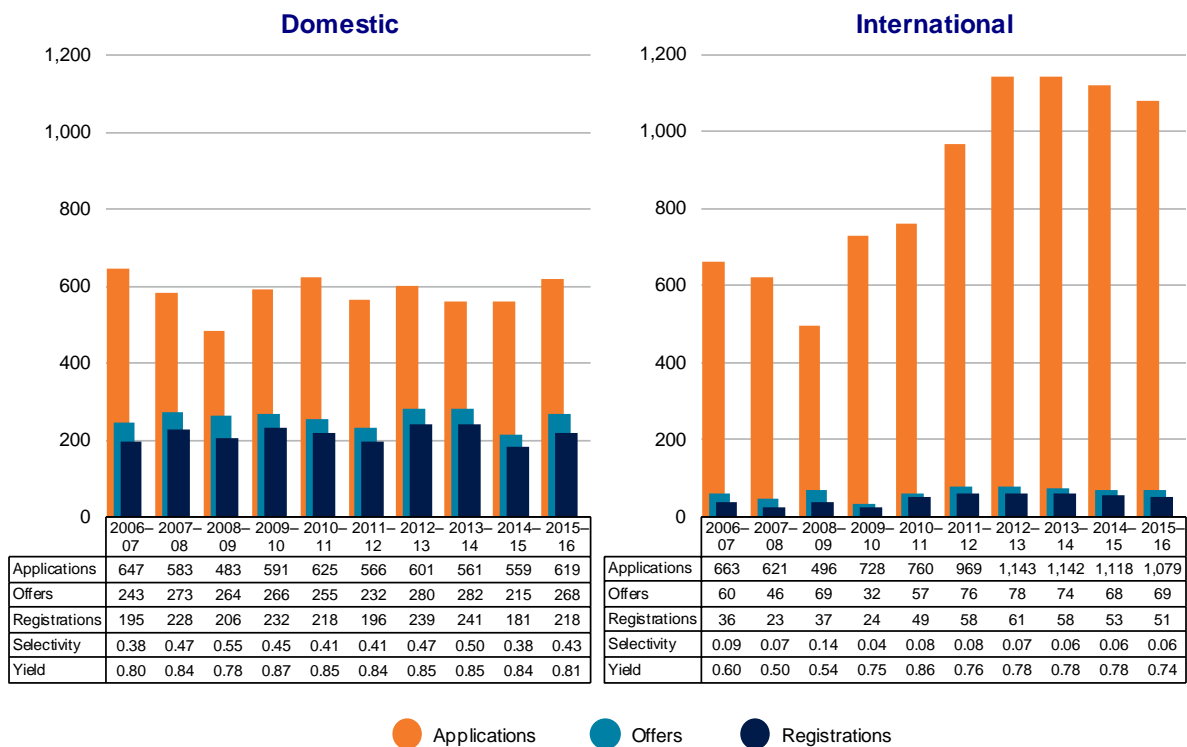


Figure 4.2 PhD Applications and Admissions Data

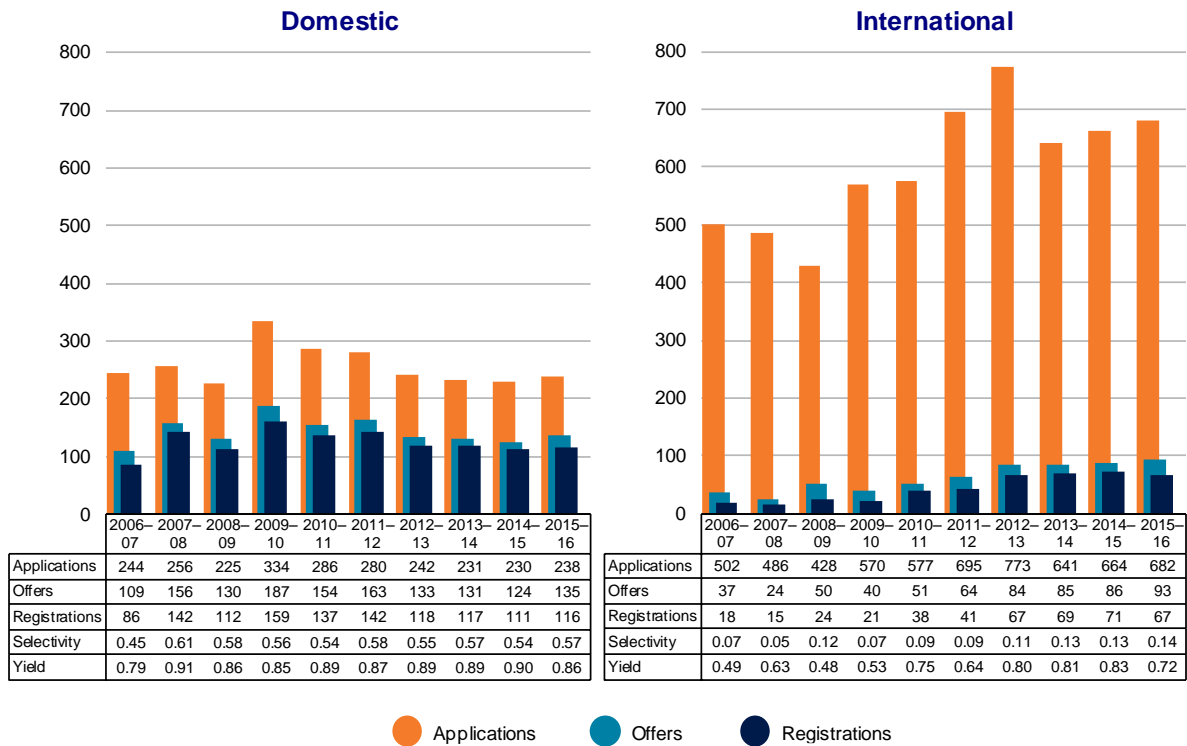
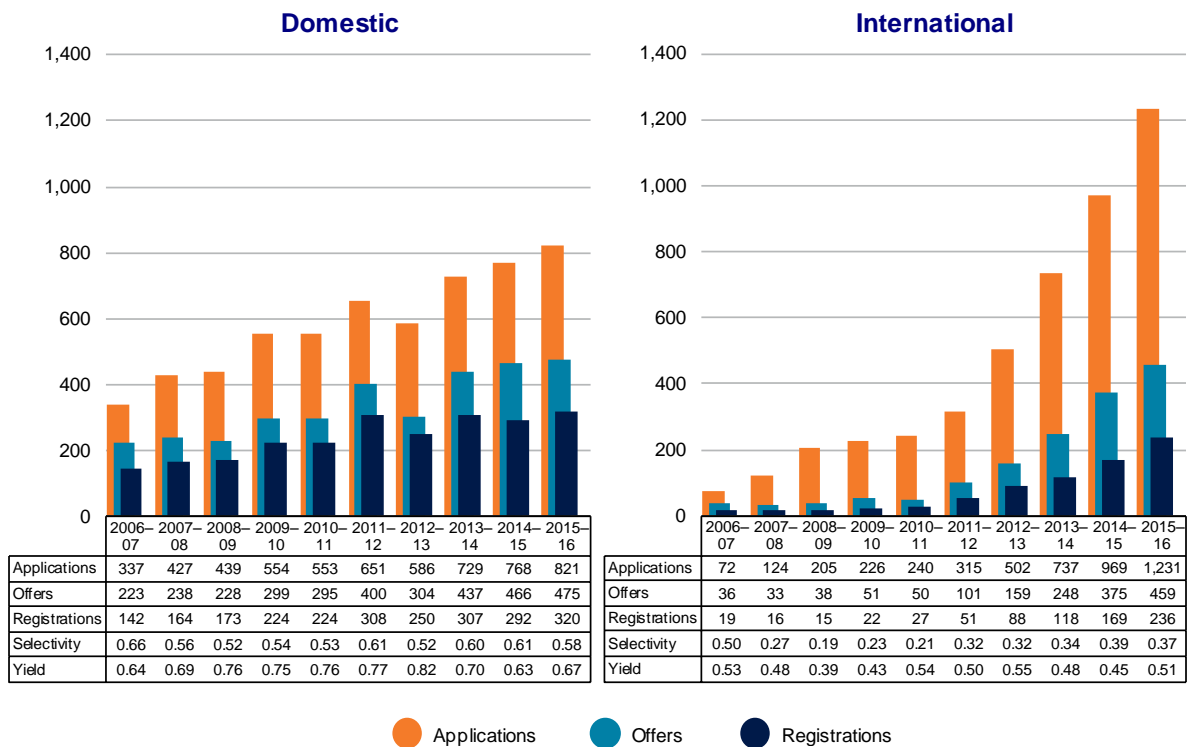


Figure 4.3 MEng+MSc Applications and Admissions Data



4.2.2 Recruitment Strategies

U of T Engineering recruits the most promising graduate students through Faculty, department and institute initiatives, and by individual professors.

For the past four years, we have partnered with engineering Faculties at four other leading Canadian universities – the University of Alberta, the University of British Columbia, McGill University and the University of Waterloo – to host large joint graduate recruiting fairs at each institution in the early fall. There are two goals of this partnership: to raise awareness among undergraduate students about pursuing graduate studies, and to recruit graduate students. In the past two years, these universities have visited schools such as the University of Calgary, Queen’s University, the University of Ottawa, and Carleton University. Most of these fairs are attended by several hundred students, and the consensus among the partner universities is that they are a very effective way to connect with prospective graduate students. U of T graduate application data for the past three years shows an upswing in applications from the schools we visit. We plan to continue and grow this initiative in the coming years.

Some departments and institutes (such as IBBME) also send graduate studies personnel to select conferences and other graduate studies fairs.

In past years, some departments have organized recruiting days or weekends to bring highly-qualified applicants to the University. In 2014, these were amalgamated into Graduate Research Days (GRD), a Faculty-wide event that first took place in February 2015 with 125 students from across Canada, and a few from abroad, in attendance. We are currently organizing GRD 2017, the third annual event. Students arrive in Toronto and attend a welcome reception on a Thursday evening; each department and institute organizes a full day of events and meetings with professors on Friday; all participants attend a dinner on the Friday evening; the event ends with a campus tour on the Saturday morning before the students head home. This allows U of T Engineering to showcase its professors, research and facilities. Most attendees receive an admission offer soon after the event, and students are able to make an informed decision. The feedback from applicants and from U of T faculty and staff who attended the first two events has been very positive.

Professors also formally and informally recruit for their labs at professional conferences and through professional connections. As well, prospective graduate students self-recruit by finding professors in their desired area of study. This is especially true of U of T Engineering undergraduate students, who will identify professors through course work and research opportunities.

4.2.3 Admissions

At U of T, graduate student applicants must meet University-wide minimum admission requirements set by the School of Graduate Studies (SGS). Graduate units are free to set higher requirements.

Admission to a master’s degree requires a four-year bachelor’s degree in a relevant field, with a final-year average of at least a mid-B (or U of T equivalent). PhD admission requires an appropriate U of T master's degree or its equivalent, with an average of at least B+ or demonstrated comparable research competence.

Graduate applicants to our Faculty are usually admitted with grades much higher than those minimums. At the application stage students apply via an SGS online system, and some graduate units use a second local system for ease of administering applications. Recruitment occurs as noted above; research-stream students must secure a supervising faculty member, who provides financial support, prior to being admitted, while MEng and MHSc students do not.

MASc to PhD Fast-Tracking: The fast-track option is available to qualified, academically strong MASc students, allowing them to transfer into the PhD program without completing the MASc, thus earning a PhD in a shorter period of time. Each graduate unit has its own policies on when a student can apply to fast-track, but it typically occurs at the end of the second or third semester. In 2015–2016, 41 students fast-tracked from the MASc program to the PhD. Data for the past 10 years is in [Appendix D: Figure 2.8a](#).

PhD Direct Entry: U of T allows exceptional undergraduate students to be admitted to PhD programs, but this is still very uncommon in our Faculty, with only IBBME, and very recently CHE, utilizing this option. In 2014–2015, 24 students were admitted directly into the PhD program. Data for the past nine years is in [Appendix D: Figure 2.8b](#).

4.2.4 Graduate Student Enrolment

Overall graduate student enrolment ([Figure 4.4](#)) has increased steadily over the past decade at a rate of 6 to 7 per cent per year. This is mostly driven by increases in PhD enrolment and strong demand for our MEng program, particularly among international students. The rising demand of the MEng program, and the increasing emphasis on encouraging research-stream students to pursue a PhD, has slowed growth in the MASc program.

This growth allowed us to surpass our *Academic Plan* goal of enrolling 2,000 graduate students by 2015 two years ahead of schedule. It is also bringing us closer to our *Academic Plan* goal of raising the proportion of graduate students to 40 per cent of our overall student population ([Figure 4.5](#)). (Note that [Figure 4.5](#) excludes undergraduate students on PEY internships.)

Figure 4.4 Graduate Student Enrolment by Degree Type, International vs Domestic

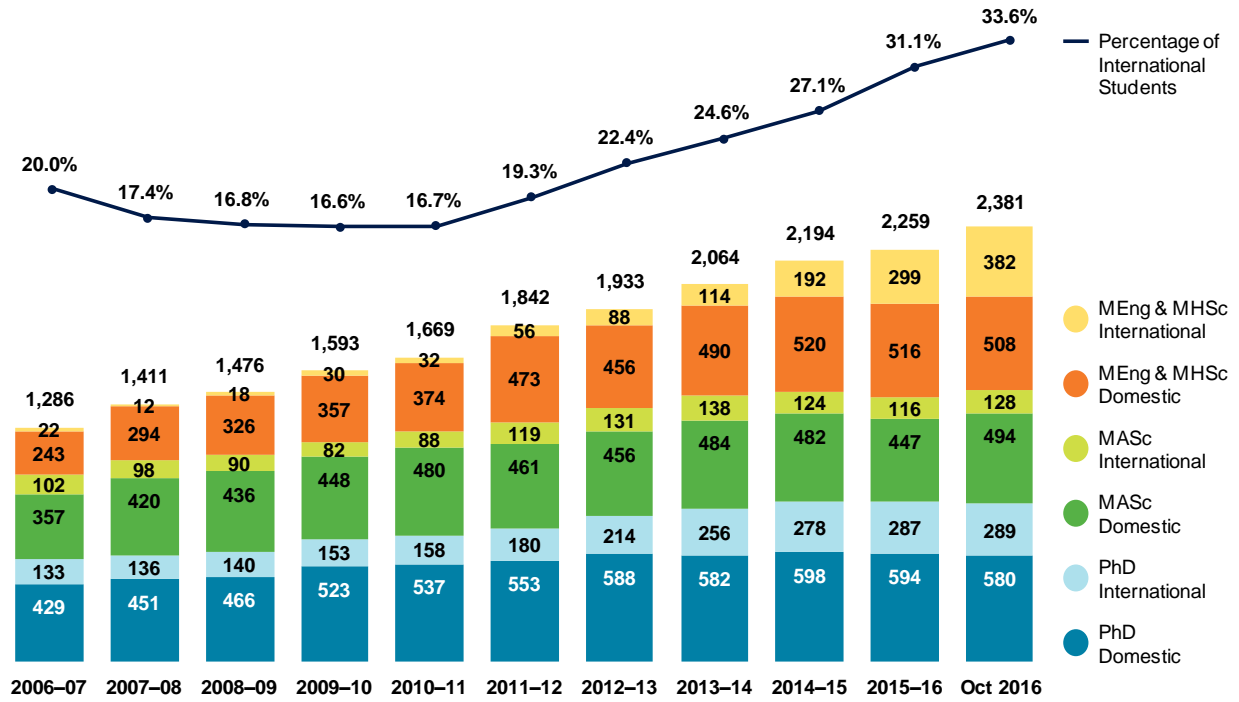
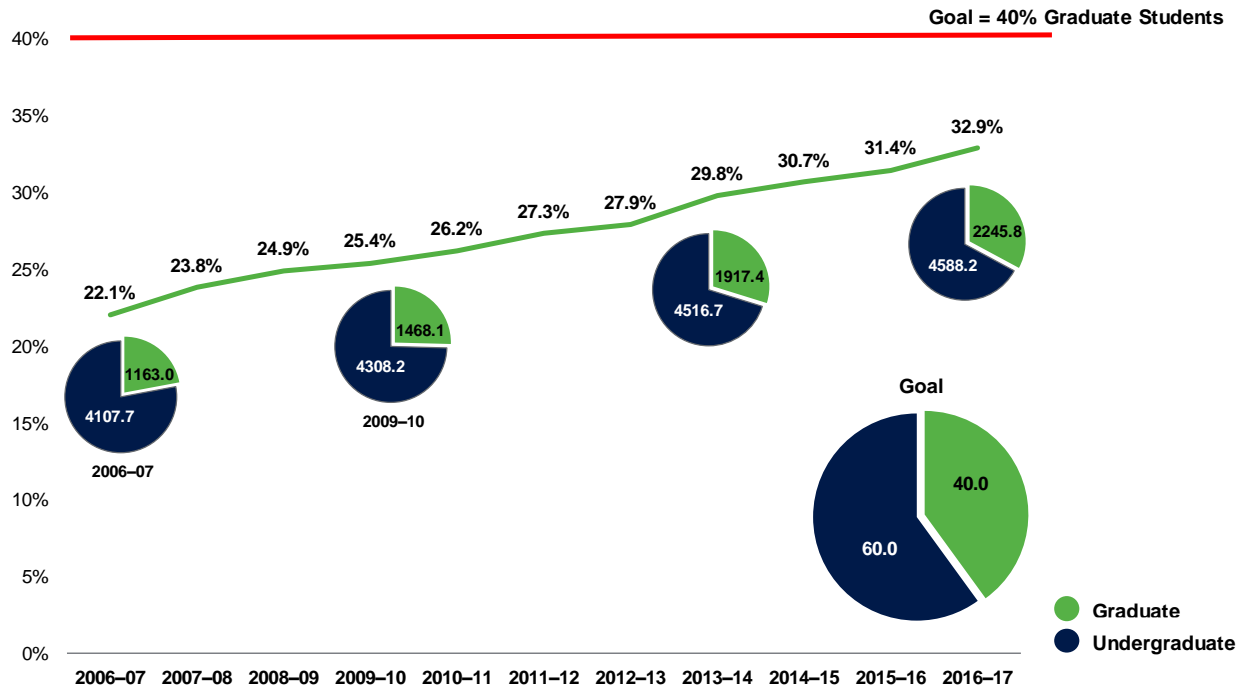


Figure 4.5 Comparison of Undergraduate and Graduate Full-Time Equivalent Enrolment and Graduate Student Proportion of Total Enrolment, 2006–2007 to 2016–2017 (excl. PEY)



4.2.5 Graduate Student Funding

U of T requires that research-stream graduate students be funded for at least five years. The minimum guarantee covers tuition and fees (and health insurance for international students), plus a \$15,000 annual living stipend. In our Faculty, most graduate units guarantee funding for two years for MASc students, four years for PhD students, and five years for fast-tracked and direct-entry PhD students.

Funding packages are comprised of a combination of supervisor-provided research assistantships, fellowships provided by the graduate units, and internal and external scholarships. When students win large scholarships, the graduate units will reduce other funding, although the net stipend that such students receive is more than \$15,000 per year. In most graduate units, teaching assistantships are awarded competitively and are paid on top of the guaranteed funding package. As well, several graduate units within our Faculty already provide increased minimum stipends, especially for PhD students. As a result, the average engineering graduate student stipend for those in the funded cohort is roughly \$25,000 per year. Professional stream students are self-funded.

Despite the fact that the average stipend is much greater than the minimum, there are a few students who receive only the minimum, an amount that was set in 2008. In our self-study consultations, students noted that it is very difficult for a single person to live on \$15,000/year in Toronto. Students also noted that minimum funding levels are increasing in other Faculties, and that the amount of guaranteed funding varies within Engineering. U of T Engineering will increase the minimum stipend for PhD students to \$17,000 in 2017.

During our self-study consultations, some PhD students noted that the PhD funding guarantee is only for four years, which can be an issue when the average time-to-graduate for PhD students is closer to five years ([Section 4.5](#)). In most cases, supervisors will continue to support their students, but graduate units no longer provide fellowships.

International research stream students pay substantially higher tuition fees than domestic students. The current differential is approximately \$14,000 per year and results from the fact that the Province of Ontario does not provide universities with funding for international students. As a result, international research-stream students must be provided a larger funding package; in 2016–2017, the required minimum, including tuition, fees, health insurance and the living stipend, is \$37,604 per year versus \$23,492 per year for domestic students. The departments and institutes also receive less money through the Faculty budget allocation for each international research-stream student. These factors magnify the interest in recruiting more domestic research students ([Section 4.2.1](#)).

External and Endowed Scholarships: Students are encouraged to apply for external (e.g. NSERC, CIHR, OGS) and internal endowed scholarships. Awardees are provided additional “top-up” funding to a level above the guaranteed minimum. The top-up rules vary somewhat by graduate unit. While students are always pleased to be awarded a scholarship, some expressed frustration in our self-study consultations that the net benefit of most scholarships is relatively small when other funding is reduced.

The number of scholarships from the provincial (OGS) and federal (NSERC, CIHR) governments has not kept up with the recent growth in graduate enrolment, nor have award amounts kept up with inflation. [Appendix D: Figures 2.7a, 2.7b](#) show little growth in total support over the past decade. The situation is exacerbated by the fact that some government scholarships are now given to universities for internal distribution, resulting in fewer scholarships for talented U of T students who in the past tended to win scholarships at a better-than-average rate.

Total graduate student funding for 2015–2016 was \$44.8 million, up from \$36.0 million in 2010–2011, with \$10.1 million coming from scholarships, \$16.2 million from Faculty, department and institute funds, and \$18.5 million from research funds ([Appendix D: Figure 2.6a](#)). These ratios vary somewhat by graduate unit ([Appendix D: Figure 2.6b](#)), each of which sets its own funding policies.

4.3 Teaching and Supervising Graduate Students

Our Faculty is committed to ensuring that faculty members adhere to high standards of teaching and supervision, and that the workload expectations of academic programs are reasonable. There is some variation among departments and institutes regarding the responsibilities and workload of graduate faculty, that is, faculty who are authorized to supervise graduate students, which at U of T Engineering includes all tenure-stream faculty and adjunct faculty who have been granted that authority. All full-time graduate faculty are expected to engage in teaching, graduate student supervision, research and administrative work, with some focus on curriculum development.

4.3.1 Graduate Faculty Teaching

Faculty members in U of T Engineering will typically teach one graduate-level half-course per year. This is in addition to undergraduate teaching responsibilities, as listed in the Undergraduate Studies chapter ([Section 3.4](#)). Graduate courses are evaluated via the same online system as undergraduate courses, and the overall results indicate that the quality of teaching is good to excellent. The Canadian Graduate and Professional Student Survey (CGPSS), last conducted in 2013, indicated that more than 86 per cent of graduate students rated the overall quality of graduate-level teaching as good or better.

In 2015–2016, 286 graduate half-courses were offered, largely by faculty members but also by adjunct faculty and some sessional lecturers with graduate faculty appointments.

Some MEng students noted a lack of variety of courses in certain technical areas, especially in the smaller graduate units, and pointed out that some courses are not offered every year. They also stated that it can be difficult to enrol in popular courses and that graduate course schedules are often adjusted at the last minute, making it difficult for them to plan their programs. Part-time students want more courses offered during evenings and on weekends.

4.3.2 Graduate Student Supervision

Graduate student supervision is managed in our Faculty at the department and institute level. Our average for research-stream supervision, in terms of the number of MAsc and PhD students, is approximately 6.4 per tenure-stream faculty member ([Appendix D: Figure 2.2a](#)). For professional-stream students (MEng, MEng CEM and MHSc) the number is 3.1, although many of these students receive little one-on-one supervision unless they are pursuing an MEng project. The number of research students supervised by each professor varies depending on available research funding and their administrative and teaching commitments.

Many students within U of T Engineering are co-supervised by professors in other Faculties: for example, students pursuing an MAsc or PhD in the Collaborative Program in Engineering Education are co-supervised by one professor from U of T Engineering and one from the Ontario Institute for Studies in Education. For more information on collaborative programs, see [Section 8.1.2](#).

Although graduate supervision is managed locally, the School of Graduate Studies (SGS) promotes best practices: it publishes and distributes *Graduate Supervision Guidelines for Students, Faculty, and Administrators* (2nd edition), offers workshops on graduate student supervision, and as of 2013, awards the JJ Berry Smith Award to two professors each year from across the University in recognition of outstanding doctoral student supervision. In 2016, Professor David Zingg of UTIAS became the first U of T Engineering recipient of this award.

SGS sets standards for PhD student supervision, requiring that a supervisory committee be formed within the first year of the student's program and that it meet at least annually with the student to review progress. SGS also oversees and conducts all PhD final oral exams. The formation of a committee to evaluate MAsc students' theses, either via an oral exam or written feedback, is administered locally by individual professors.

As assessed in the 2013 CGPSS survey, 85 per cent of the 342 doctoral students who evaluated their supervisor agreed or strongly agreed that their supervisor had performed the role well. This was based on the supervisor's knowledge, availability for student meetings, dissertation

exploration, preparation for qualifying exams, general support, ability to help direct research and other mentoring activities.

4.4 Graduate Student Professional Development

We continuously enhance our curricular and co-curricular offerings to ensure that our graduate students receive the most rigorous preparation possible, whether they aspire to work in academia, industry, the public sector or in other fields.

During our self-study consultations, research-stream students felt that professional development should be an integral part of their programs, and that to the extent possible, such programming be offered locally, by graduate units and/or the Faculty, to ensure relevancy. Such an approach to professional development would also ensure a consistent approach and reduce variations in the professional development provided by individual professors.

We make a variety of professional development opportunities available to our graduate students as they prepare to set out on their careers. MEng students in particular are well served by the many ELITE courses ([Section 4.1.2.6](#)) that we offer; the high enrolment numbers confirm that students understand the importance of the competencies and knowledge taught in these courses. A number of other initiatives are listed below, most of which focus on preparing those who aspire to become teachers and academics. We are also working on initiatives to address the needs of PhD graduates who wish to apply their specialized expertise in industry.

4.4.1 Teaching Assistantships

As noted in [Section 4.2.5](#), graduate students (including those in the MEng program) can work as teaching assistants (TAs) to increase their income and gain teaching experience by leading laboratory and classroom activities and grading assignments. Currently, TAs are paid an hourly rate of \$42.90. In our self-study consultations, a few students noted dissatisfaction with departmental policies on awarding TA positions and how this affects other funding.

TA training is mandatory. The collective agreement for employees of CUPE 3902 Unit 1 requires that all new TAs be provided with three hours of paid pedagogical training. In addition, the University-wide Teaching Assistants' Training Program (TATP) aims to enhance the teaching competencies of TAs and improve the effectiveness of grading and tutorials. Workshops, short courses and two certificate programs are also offered to assist graduate students with various aspects of teaching.

4.4.2 Outreach Programs

Graduate students interested in gaining teaching experience are encouraged to submit course proposals to the Da Vinci Engineering Enrichment Program (DEEP) summer academy, run by our Engineering Outreach Office. DEEP is a unique summer program designed to provide gifted and highly-motivated high school students from across the world the opportunity to experience a variety of engineering, technology, business and science disciplines through hands-on activities. In 2015–2016, 45 PhD students and postdoctoral fellows each created 40 hours of course material based on their current research. The program has been in place since 2003, and continues to offer a diverse range of cutting-edge pre-university engineering and science activities.

4.4.3 Prospective Professors in Training (PPIT) Program

The Faculty has offered the Prospective Professors in Training (PPIT) program to approximately 20-30 students per year since 2006. The goal of this co-curricular certificate program is to prepare upper-year PhD students and some postdoctoral fellows for the rigours of applying for academic positions, launching a successful academic career, and teaching in higher education (via the graduate-level course APS1203 Teaching Engineering in Higher Education). Over eight months, students learn how to develop an academic *curriculum vitae* and impactful teaching dossier and research statement, and how to prepare for an academic job interview. They also learn how to best balance the competing demands of starting a research group, teaching courses for the first time, and administrative duties. At the end of the PPIT program, students have developed a polished application package and a comprehensive proposal for a new course.

Our self-study consultations indicated that some students, postdoctoral fellows in particular, may not be aware of the PPIT program. We are working to increase the visibility of this option for all graduate researchers.

4.4.4 Other Opportunities for Graduate Professional Development

U of T's School of Graduate Studies (SGS) hosts a University-wide Graduate Professional Skills (GPS) program for all graduate students. This includes a large suite of workshops and classes in communications and personal effectiveness, as well as teaching and research competencies.

Mitacs is a national not-for-profit organization that designs and delivers research and training programs that connect academics to industry. As part of that mandate, Mitacs offers a range of professional development workshops that are free of charge to graduate students and postdoctoral fellows.

Finally, the Faculty offers technical writing courses to help MASc and PhD students prepare to write papers and theses. Plans are also underway to develop and offer communications courses for MEng students as part of the ELITE emphasis.

4.5 Graduate Studies Completion

For many years, our graduates have successfully entered a wide variety of careers across the private and public sectors. A recent informal survey indicates that about one-third of our PhD graduates over the past 20 years are now academics. A recent report¹¹ of the Higher Education Quality Council of Ontario (HEQCO) arrived at a similar number for PhD graduates in 2009. We are currently awaiting results of a survey of engineering PhD graduates in 2007, 2010 and 2013, that we undertook with several other Ontario universities.

One of our *Academic Plan* goals is to reduce the time-to-graduation for MASc and PhD students, yet between 2005 and 2016, the median time-to-graduation for PhD students has remained relatively constant at approximately five years; the median time-to-graduation for MASc students has remained two years; full-time MEng students tend to complete their programs in one year, and extended full-time and part-time students in less than two and three years, respectively. ([Appendix D: Figure 2.9](#) presents all of this data).

¹¹ Ontario's PhD Graduates from 2009: Where are they now?

One factor affecting overall time-to-graduation (i.e. from end of undergraduate to end of PhD) is the recent rise of the number of students fast-tracking into PhD programs or entering them directly from their undergraduate degrees. Both options are only promoted to exceptional students, in order to increase the impact of their work. On average, these students spend no more time in their PhD programs than students who have first completed an MASc, thus their overall time in graduate school is shorter than students who complete both degrees. In the past three years, the number of fast-tracked students has grown by about 20 per cent compared with the three years from 2010–2013 ([Appendix D: Figure 2.8a](#)). Last year, the number of direct-entry admissions to the PhD program tripled. Our goal is for the PhD to be the program of choice for students interested in pursuing research, and we will continue to promote accelerated paths to the PhD for exceptional students.

4.6 Graduate Student Experience and Services

U of T Engineering is dedicated to providing innovative educational programming and support to each of our graduate students, in or outside the classroom, with many elements of their experience focused at the unit level.

The School of Graduate Studies (SGS) shares responsibility for graduate studies with graduate units and divisions within each Faculty. Each Engineering department or institute has a graduate office to help students navigate their programs and achieve their goals. Graduate offices are led by a faculty member appointed as Associate Chair of Graduate Studies and Graduate Coordinator, and are typically assisted by a Graduate Administrator and one or more Graduate Assistants.

The University also provides centralized services that complement those of departments and institutes through SGS. With a mandate to support and enhance the overall graduate student experience, SGS offers a broad range of opportunities to assist students in managing their program and gaining academic and professional competencies. They also promote opportunities for students such as international exchanges, student clubs, and membership in the Grad Room, a dedicated space for student programming.

In our self-study consultations, some postdoctoral fellows expressed the wish for a coordinated approach to orientation. While they all eventually found the information they needed on the many aspects of entering a new country, joining a new institution, and settling themselves (and often their families) in a new city, they expressed the desire for a welcome package that would summarize what they need to know before their arrival.

Graduate Student-Focussed Career Services: Graduate students can access a broad range of career education services of the U of T Career Centre. The Centre delivers extensive customized career programming for graduate students and postdoctoral fellows on building resilience and identity, experiential and peer-to-peer learning, and learning how to represent themselves in the academic job application process.

Family Services: Support for families is centralized at U of T through the Family Care Office (FCO). The FCO provides students, staff, faculty, postdoctoral fellows and their families with family care-related issues, including guidance, information, referrals and advocacy, if needed. The goal of the office is to raise awareness of family care and quality of life issues central to the achievement of educational equity and employment equity at U of T. Their emphasis on inclusivity encourages all members of our diverse Engineering community to access the support and services they need for their own circumstances.

Student Associations and Unions: Each department and institute has a graduate student association that organizes social events and serves as a liaison between their graduate student body, the graduate unit, the University-wide Graduate Students' Union (GSU), and the Teaching Assistants union (CUPE 3902 Unit 1). The graduate student associations in our Faculty include:

- Aerospace Students' Association (ASA)
- Association of Mechanical and Industrial Engineering Graduate Students (AMIGAS)
- Biomedical Engineering Students' Association (BESA)
- Chemical Engineering Graduate Students' Association (CEGSA-Chem)
- Civil Engineering Graduate Students' Association (CEGSA)
- Electrical and Computer Engineering Graduate Students' Society (ECEGSS)
- MSE Graduate Students' Association (MEGSA)

The GSU represents the University's more than 15,000 graduate students, providing services such as supplementary health insurance and advocating for graduate student funding and participation on various committees at the University level. It also runs the Conflict Resolution Centre, which matches graduate students with peer advisors to discuss options for addressing concerns and starting difficult conversations, and connects them with related supports and resources.

CUPE 3902 unit 1 is a labour union local that represents only those graduate students who work as TAs and negotiates contracts with the University.

Extra-Curricular Activities and Clubs: Graduate students at U of T Engineering can join clubs related to many interests and disciplines. Examples include the Human Factors Interest Group, the Chinese Engineering Students' Association (including graduate and undergraduate students), and the Institute for Leadership Education in Engineering (ILead), which provides graduate students with the opportunity to develop self-awareness and team, communication and leadership competencies.

5.0 Research

The calibre and global impact of the research produced within our Faculty contribute to our international reputation and ranking as Canada's premier engineering school. We are further strengthening our research programs by attracting strong research investments and upgrading our infrastructure by fostering multidisciplinary collaboration within our Faculty, across U of T and with external organizations.

5.1 Overview

Our complement of more than 230 tenured and tenure-stream professors, along with nearly 1,500 research-stream master's and PhD students and more than 300 postdoctoral fellows and research assistants, produces world-leading research that addresses a range of global challenges, such as leveraging the power of robotics to explore the unknown, delivering clean, affordable and renewable energy, diagnosing disease, and extending human life.

We recognize that some of the most innovative solutions come from cross-disciplinary collaboration. We are home to 26 multidisciplinary research centres and institutes ([Section 5.4](#)), 11 of which were created in the last 5 years. These centres facilitate partnerships across our engineering disciplines and with leading experts from other U of T Faculties, peer institutions around the world, and more than 300 industry collaborators, ranging from local startups and major multinationals.

We continue to attract strong support from both federal and provincial research funding agencies and have strengthened our industry collaborations through strategic grants. In 2014–2015, the most recent year for which complete data are available, our research operating funding per faculty member was \$283,273, up 16.5 per cent from 2009–2010 and 47.4 per cent from 2005–2006. The proportion of total NSERC funding that came through NSERC Industrial Partnerships programs was 44 per cent, up from 40 per cent in 2009–2010 and 35 per cent in 2005–2006.

U of T Engineering has increased our number of research chairs, including endowed research chairs, Canada Research Chairs, U of T Distinguished Professorships and University Professorships, from 56 in 2010 to 77 today. Our faculty members are recognized nationally and internationally as leaders in their fields, from early-career awards to lifetime achievement awards ([Appendix D: Chapter 5](#)). We have enhanced our support for early-career faculty over the past years by conducting workshops on research fundraising, and by establishing seven Hart Professorships that provide early-career professors with annual funding for three years for research and graduate student support ([Section 5.9](#)).

We have further strengthened our research infrastructure through strategic retrofits, and this past year, secured an investment of \$31.6 million to support renovations to 89 laboratory facilities through the Post-Secondary Institutions Strategic Investment Fund (SIF). The forthcoming Centre for Engineering Innovation & Entrepreneurship will provide a new home for several research institutes and centres, and will enable us create more laboratories in other buildings.

5.2 Strategic Research Themes and Priorities

We identified four themes in our *Academic Plan* to represent our multidisciplinary research: Sustainability, Bioengineering, Information and Communication Technology (ICT), and Enabling Technologies. These are aligned with the University of Toronto's research goals and with the research agendas of our major funding agencies.

Research strategies within each theme have evolved to address challenges and opportunities, and collectively point to a renewed vision that harnesses our strengths. Our progress within these four themes is summarized below.

5.2.1 Sustainability

Sustainable accommodation of the world's energy needs is a challenge that will continue into the next century. As energy systems become increasingly connected and complex, engineering will play an increasingly important role, particularly with respect to system control and human factors required to ensure safe and efficient operation. Engineering research can contribute to the development of emerging renewables — maximizing their existing potential and developing new forms — and the mitigation of the impact of current energy sources through efficiencies, switching sources, and storing and utilizing carbon. Energy can also be linked to water challenges, and engineers can help address these issues in both developing and developed regions throughout the world.

During the self-study consultation process, our researchers noted that the following sustainability themes merit further exploration:

- Built environment
- Resilience and sustainability
- Urban infrastructure
- Economics, public policy and human factors

The following multidisciplinary research areas present further opportunities for faculty members across the University:

- Climate change mitigation
- Mining and natural resources
- Oil and fossil fuels
- Sustainable water use and resource extraction
- Transportation initiatives between UTTRI, UTIAS, ECE, MIE and U of T

5.2.2 Bioengineering

We broadly considered the bioengineering theme during the self-study consultation process, addressing the breadth of research within the Faculty and taking into account its human health and environmental aspects. Our Institute of Biomaterials and Biomedical Engineering (IBBME) is world-renowned for bioengineering research with human health applications, while BioZone, a multidisciplinary centre based in Chemical Engineering & Applied Chemistry, is exemplary of our bioengineering research with a focus on applications across many sectors including sustainability and human health.

Canadian healthcare expenditures are nearly \$220 billion annually (11 per cent of Canada's GDP) which equates to over \$6,000 per person. U of T Engineering advances the effectiveness and efficiency of these expenditures from a multitude of angles. Our researchers are developing engineering innovations to improve the capabilities of medical treatments through stem cell and tissue engineering, analysis of blood flow, and development of cutting-edge biomaterials. They examine the healthcare system to improve resource utilization so that more people can be treated faster, analytically support medical decision-making, and design systems that reduce human errors in medicine. Robotic devices and sensor networks provide automated systems of care delivery.

A strategic area of interest under the human health theme is neuromodulation, which refers to invasive or non-invasive techniques that can alter the activity of the brain, spinal cord or peripheral nerves to improve health and quality of life. Examples of invasive neuromodulation are deep brain stimulation for Parkinson's to stop tremors, vagus nerve stimulation for epilepsy, and spinal cord stimulation for chronic pain. This multidisciplinary research includes faculty members from neurosurgery, neuroscience and several U of T Engineering departments and institutes.

Environmental aspects of bioengineering include the use of microorganisms to produce renewable plastics, fuels, medicines and other commodity chemicals, as well as bioremediation, which is the use of microorganisms to degrade or destroy pollutants. The research carried out in BioZone ([Section 5.4.1](#)) exemplifies these fields.

5.2.3 Information and Communications Technology (ICT)

U of T Engineering is designing advanced solutions to global communication and technology challenges that ensure our personal data are stored and transmitted as efficiently as possible, while maintaining the highest standards of security.

In our self-study consultations, many researchers observed that the ICT theme has been broadened to better encompass the breadth of research within our Faculty, specifically regarding the increasing demand for big data application and analytics in engineering research and industry, including:

- Researching big data, the internet of things, smart cities and smart sensing
- Collecting data and storing massive amounts of sensor data, securely, privately, efficiently and at scale
- Processing data to gain insight, ethically, efficiently and at scale
- Using value-added information to support data-driven "smart" applications, dynamically, flexibly, cost effectively, efficiently and at scale

Another evolution of the ICT theme is the field of machine learning, which grew exponentially in terms of research and development between 1995 and 2015, and has changed expectations as to what can be done with this technology. Machine learning allows companies to establish feedback loops in real time, representing a shift in the way they do business. Examples include:

- Human-computer interaction (feedback loops between human and machine intelligence, data awareness, acceptance of imperfect software)
- Algorithms (integration of different data types into multi-task system frameworks)
- Multiple sensors allow different types of data to be fed into the same learning systems, making feedback possible throughout a process, not just at the end

Today, the field lacks systems that are reliable, scalable and trustworthy, providing an opportunity for further research in this area, and an evolution in how we think of ICT.

5.2.4 Enabling Technologies

Our researchers are developing novel technologies that contribute to our quality of life by making certain tasks easier, safer and more efficient.

A broad theme used by many of our researchers is advanced materials and manufacturing. This includes 3D printing and the corresponding maker culture it has inspired. Our researchers leverage expertise in micro- and nano-engineering to advance fabrication methods and applications, including at the smallest scales.

Robotics and mechatronics also represent key enabling areas. U of T Engineering researchers are making significant progress in developing more intelligent, flexible, modular and adaptive robots and devices for a wide variety of applications, including medicine and healthcare, manufacturing, rescue and exploration, and assisting our rapidly aging population. We are leveraging expertise in mechanical design, actuation, sensing, control, human-machine interactions and artificial intelligence to develop these technologies.

Included within this theme is an emerging focus on next-generation vehicles, including self-driving cars and electric vehicles. Our faculty members are partnering with forward-thinking industries to develop technologies that will reduce the environmental impact of automotive transportation while increasing safety and freeing up human drivers for other tasks.

Sustainable aviation is a key area related to both advanced materials and robotics. Air transportation currently accounts for five per cent of global greenhouse gas emissions, and is growing at a rate of five per cent each year. Through lightweight, multifunctional structures, as well as unconventional aircraft configurations and adjustments that enable the use of biofuels, researchers in our Faculty are at the forefront of reducing the environmental impact of air travel.

Smart cities also coalesced as a theme of broad and increasing interest across the Faculty. Efficient and effective delivery of services, from traffic management to water delivery and medical services, can be enhanced through the application of operations research, information engineering and human factors.

The Faculty has made tremendous strides in a multitude of areas under the *Enabling Technologies* banner, and there was a sense in our self-study consultations that the variety of applications and technologies has outgrown this very general classification.

A set of focus application areas includes smart cities, sustainability (energy, water, air and climate change) and human health, with key enabling areas including big data analytics, advanced materials and manufacturing, robotics and mechatronics, and bioengineering.

These application areas reflect today's greatest challenges and opportunities, and are areas where the Faculty is uniquely positioned to address.

5.3 Major Collaborative Research Initiatives

Over the past five years, through strategic collaboration with other Faculties within U of T and leading researchers across the GTA, we have played a leading role in creating two large-scale, multidisciplinary research initiatives that address significant societal challenges: the Translational Biology and Engineering Program (TBEP) ([Section 5.3.1](#)) and Medicine by Design (MbD) ([Section 5.3.2](#)).

5.3.1 Translational Biology and Engineering Program (TBEP)

TBEP was established in 2014 and leverages emerging technologies in tissue engineering, stem cell culture and cell signaling to develop therapies that can regenerate damaged hearts. TBEP brings together principal investigators from the Faculties of Medicine and Dentistry as well as four from U of T Engineering, including its executive director. TBEP is part of the Ted Rogers Centre for Heart Research (TRCHR), which was made possible through a \$130-million donation from the Rogers family ([Section 8.1.3.2](#)).

In December 2015, TBEP opened its facility on the 14th floor of the MaRS West Tower, which includes an open-concept lab area with banks of movable benches that provide working space for up to 120 researchers. Seventeen anterooms house specialized equipment for tissue culture, proteomics and genomics, microscopy, histology, surgical isolation, materials synthesis and characterization, and microfabrication.

5.3.2 Medicine by Design (MbD)

Medicine by Design (MbD)'s research focuses on the convergence of physical and life sciences, engineering, mathematics and medicine to transform regenerative medicine and cell therapy. This research could lead to new therapies for diseases ranging from diabetes to cancer.

Launched in July 2015, MbD is a collaboration between the Faculties of Applied Science & Engineering, Arts & Science, Medicine, and the Leslie Dan Faculty of Pharmacy, as well as a number of affiliated hospitals ([Section 8.1.3.3](#)). Sixteen U of T Engineering professors participate in Medicine by Design, including its executive director, representing IBBME, MIE, ChemE, ECE, and MSE. It is funded by a \$114-million grant — the largest research grant in U of T's history — from the federal government's Canada First Research Excellence Fund.

This past August, MbD announced the first 20 projects that will be funded under the program. The goals of these projects include strategies for restoring vision in patients with age-related macular degeneration and better treatments for stroke and liver disease. In November, MbD hosted its first scientific symposium: *Engineering Discoveries at the Convergence of Biological Design*.

5.4 Multidisciplinary Research Centres and Institutes

In addition to the initiatives mentioned in the previous section, our Faculty is home to 26 research centres and institutes that bring together world-leading expertise from many fields ([Appendix K — Research Centres and Institutes](#)). Eleven units created within the Faculty in the last five years are profiled below:

5.4.1 BioZone

Launched in 2011, BioZone is a multidisciplinary unit that leverages recent advances in molecular biology and genomics to address engineering challenges in a number of sectors, including environmental bioremediation, energy and human health. Solutions include enriched microbial cultures that can degrade hazardous compounds, bio-derived fuels and other commodity chemicals, and large-scale production of protein-based medical products. BioZone houses state-of-the-art infrastructure for molecular biology, protein purification and identification, enzyme kinetics, substrate and metabolite analysis, microscopy and cell growth, in order to support research, innovation and student learning ([Section 7.2](#)).

5.4.2 Centre for Aerial Robotics Research & Education (CARRE)

CARRE was established in 2015 at the University of Toronto Institute for Aerospace Studies (UTIAS). It aims to meet the growing demand for engineers and scientists with the highly interdisciplinary training needed to contribute to the field of aerial robotics, including unmanned aerial vehicles. Supported by the Dean's Strategic Fund (DSF), CARRE will become the nucleus of aerial robotics research and teaching at U of T, and an internationally recognized centre of excellence in the field.

5.4.3 Centre for Power and Information (CPI)

Established in 2015, CPI is a multidisciplinary centre in The Edward S. Rogers Department of Electrical & Computer Engineering. It focuses on researching and developing the power grid of the future, addressing a pressing societal energy issue at an infrastructural level through fundamental research, industry collaboration and education. Its research themes include renewable integration, cyber-physical security and demand response.

5.4.4 Centre for Research in Sustainable Aviation (CRSA)

CRSA was created in 2013 to enable scientists and engineers to develop future generations of environmentally sustainable aircraft. The Centre brings together technical specialists in key areas such as aerodynamics, propulsion, structures, aeroacoustics and control to design airplanes. The participation of experts in atmospheric physics, biofuels, life-cycle assessment and aviation policy generates a unique opportunity for interdisciplinary research and teaching. CRSA also takes advantage of the technical and professional expertise within UTIAS and its partners, including peer universities in Canada, the U.S. and the U.K., as well the largest employers for aeronautical engineers and researchers in Canada.

5.4.5 Centre for Resilience of Critical Infrastructure (CRCI)

Established in 2013 to enhance understanding of infrastructure systems and advance practice in infrastructure resilience, CRCI investigates the dynamic performance of structures under extreme stress and the behaviour of infrastructure systems as a whole. CRCI was the first to successfully map the complex relationships between infrastructure performance and city function and to optimize the balance of investment between protection and resilience measures. CRCI also researches the nature of vertical communities and the influence of demand clusters and resource (food) deserts on municipal recovery in the event of a disaster.

5.4.6 Institute for Leadership Education in Engineering (ILead)

ILead was created in 2010 to provide transformative learning opportunities for students and professionals to develop leadership success competencies. Its mandate is to empower engineers to maximize their potential and contributions. ILead undertakes student programming ([Section 3.3.4.1](#)), academic and industry-focused research, and outreach to engineering leadership educators and engineering-intensive enterprises.

5.4.7 Institute for Water Innovation (IWI)

Established in 2015 with support from the Dean's Strategic Fund (DSF) ([Section 6.7.5](#)), the Institute for Water Innovation develops innovative solutions for sustainable water management. In collaboration with industry partners, its researchers conduct market-relevant research and create advanced technologies that address domestic, commercial and industrial water challenges.

5.4.8 Ontario Centre for the Characterization of Advanced Materials (OCCAM)

Housed within the Departments of Chemical Engineering & Applied Chemistry and Materials Science & Engineering, OCCAM is a multidisciplinary facility that provides leading-edge equipment – including electron microscopes and mass spectrometers – and expertise in the imaging, analysis and manipulation of materials at the nanometre scale. This advances a wide range of fields, including photovoltaic power, structural components for transportation vehicles, and biomedical engineering. OCCAM was created with strategic investments from the Canada Foundation for Innovation (CFI), the Ontario Ministry of Research and Innovation (MRI), and Hitachi High-Technologies Canada ([Section 7.2](#)).

5.4.9 Toronto Institute for Advanced Manufacturing (TIAM)

Created in 2014, TIAM expedites the research and development of advanced manufacturing technologies by creating a multidisciplinary network focused on sharing knowledge, ideas and resources. The Institute demonstrates global leadership by translating lab-based technologies into commercial, scaled-up processes and by contributing to the education and training of highly qualified personnel in the manufacturing sector.

5.4.10 University of Toronto Institute for Multidisciplinary Design and Innovation (UT-IMDI)

UT-IMDI was established in 2012 as a cornerstone of our Faculty's strategy to foster the maker and innovator in each of our students. It enables teams of undergraduate students to complete design projects that address challenges proposed by industry partners. These projects are completed through courses aimed at either undergraduate ([Section 3.3.1](#)) or MEng students. The Institute also provides professional development for different aspects of design such as training in 3D modelling software, and workshops to model and simulate multi-domain systems.

5.4.11 University of Toronto Transportation Research Institute (UTTRI)

UTTRI was established in 2014 as a cross-disciplinary institute that includes 25 principal investigators across the University. Its members study urban transport systems and designs new ones that are efficient, cost-effective, equitable, sustainable and resilient. UTTRI takes a

leadership role in contributing to the development of local and regional city regions that are sustainable, healthy and prosperous.

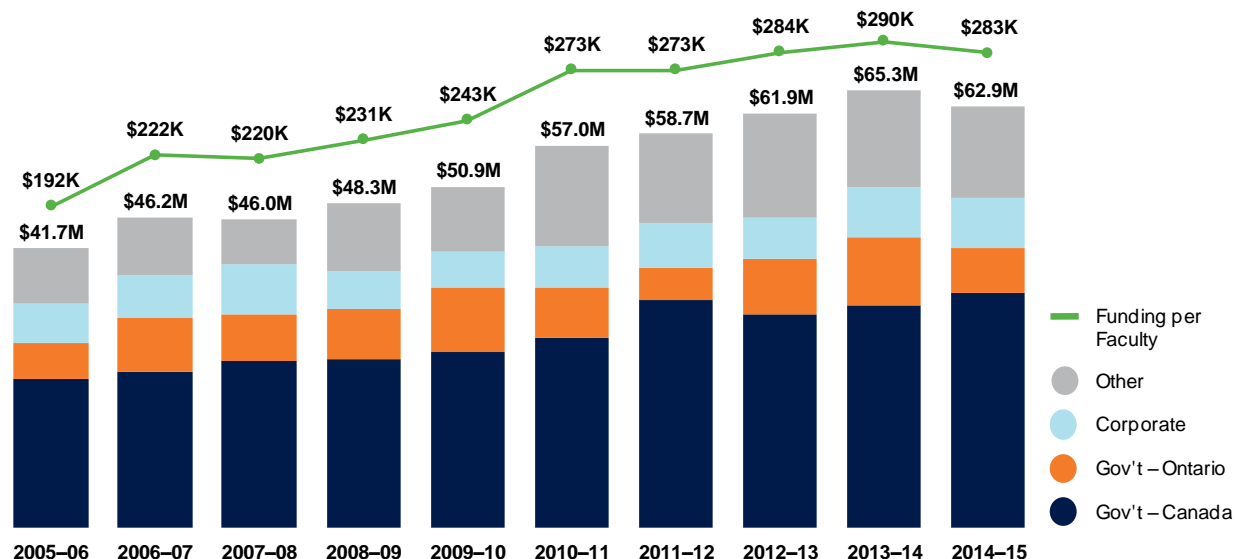
5.5 Research Funding

Our *Academic Plan* includes a goal of increasing Tri-Council research funding — which includes the Canadian Institutes of Health Research (CIHR), the Natural Sciences and Engineering Research Council of Canada (NSERC), the Social Sciences and Humanities Research Council (SSHRC) and the Networks of Centres of Excellence (NCE) — to \$25 million by 2015. We achieved this goal two years early and set a new goal of \$32 million. In 2014–2015, the most recent year for which complete data are available, we reached a record \$31.8 million in Tri-Council funding, leaving us well-positioned to achieve our new goal.

From 2010–2011 to 2014–2015, U of T's cumulative share of NSERC funding was 9.3 per cent, greater than that of any other Canadian university ([Figure 5.1](#)). The allocation of CRCs to U of T and its divisions is updated every two years and is based on its portion of national Tri-Council funding (including NCE). In 2015–2016, we received seven new or renewed Canada Research Chairs, bringing our total to 29. We also received two new Collaborative Research and Training Experience (CREATE) grants from NSERC, bringing our Faculty's total to eight as compared to three in 2010.

Each Engineering faculty member received on average \$283,273 in annual operating research funding, up 16.5 per cent from \$243,477 in 2009–2010, and up 47.4 per cent from \$191,956 in 2005–2006.

Figure 5.1 Research Operating Funding by Year, Source and Funding per Faculty Member, 2005–2006 to 2014–2015



	Funding per Faculty Member	Gov't – Canada	Gov't – Ontario	Corporate	Other	Total
2005–06	\$191,956	\$22,238,632	\$5,241,595	\$5,848,143	\$8,326,178	\$41,654,548
2006–07	\$222,300	\$23,357,386	\$7,817,967	\$6,583,699	\$8,479,398	\$46,238,450
2007–08	\$219,998	\$24,763,970	\$7,168,950	\$7,520,781	\$6,525,854	\$45,979,555
2008–09	\$231,217	\$25,043,728	\$7,618,346	\$5,666,153	\$9,996,059	\$48,324,286
2009–10	\$243,477	\$26,194,223	\$9,562,402	\$5,415,268	\$9,714,802	\$50,886,695
2010–11	\$272,965	\$28,404,920	\$7,395,585	\$6,096,677	\$15,152,585	\$57,049,767
2011–12	\$273,182	\$34,091,979	\$4,636,724	\$6,705,219	\$13,300,258	\$58,734,180
2012–13	\$283,808	\$31,751,929	\$8,425,047	\$6,062,015	\$15,631,214	\$61,870,205
2013–14	\$290,231	\$33,297,369	\$10,173,279	\$7,476,802	\$14,354,519	\$65,301,969
2014–15	\$283,273	\$35,137,026	\$6,594,253	\$7,504,880	\$13,650,347	\$62,886,506

5.5.1 Support in Obtaining and Managing Research Funding

Growth in research funding continues to be a strategic priority in our Faculty. We hold various workshops and information sessions on NSERC and other major funding competitions to help our faculty members prepare excellent applications, and are considering expanding this support to other Tri-Council funding opportunities, including SSHRC.

A range of initiatives exist within U of T Engineering and through the University of Toronto's Office of the Vice-President, Research and Innovation (OVPRI) for faculty members, students, research staff and administrators. OVPRI's mandate is to support U of T in becoming one of the top public research universities in the world, and to facilitate an environment that promotes and fosters innovation and research across our campuses in conjunction with all funding sponsors, research hospitals and other partners in the public and private sectors. OVPRI's services include pre- and post-award management, accounting and ethics oversight, entrepreneurship and innovation activities, and guidance on policies and procedures. OVPRI offers some support for

grant writing and budget review, but it is limited due to the large number of faculty members and students at the University.

U of T Engineering provides several initiatives to help our researchers obtain and manage research funding. Overseen by our Vice-Dean, Research, our Faculty's research committee is comprised of Associate Chairs, Research from our departments and institutes. Supported by the Faculty's Research and Graduate Coordinator, the committee promotes research, mentors colleagues, and identifies and creates multidisciplinary research opportunities. In addition, our departments and institutes support their unique strengths and redefine the forefront of research and innovation in their fields, further strengthening our Faculty's research endeavors.

In partnership with the Associate Chairs, Research and as noted in our *Academic Plan*, our Faculty has implemented mechanisms to increase research funding success and commercialization activities, including:

- Offering extensive support to early-career faculty members and emerging research leaders in grant preparation, and through the Faculty's research committee and our Directors of Corporate Partnerships, identifying and pursuing new industry partners
- Hosting panel sessions for faculty members on best research practices, with a focus on partnerships and collaborative research
- Hosting workshops and internal expert reviews during award competitions to critique faculty members' applications and increase research success
- Establishing a peer review or mentorship program in each department to support and guide faculty members in the development of their NSERC Discovery Grant and Research Tools and Instruments grant applications
- Providing seed funding and strategic support to new research areas, such as CIHR-NSERC partnerships funding for CHRP (Collaborative Health Research Projects)
- Providing operational support funding for large infrastructure projects, such as CFI

To further identify areas where our industry partners' medium-to-long-term strategic priorities overlap with the expertise of our professors and further develop productive partnerships, we created position of Director, Corporate, Government & International Partnerships in 2012 and the position of Director, Foundation and Corporate Partnerships in 2013 ([Section 8.2.1](#)). These directors are facilitating a move from one-time, project-based collaborations to a more strategic approach that includes a suite of projects related to common areas.

During our self-study consultations, researchers noted that despite the strong growth in research funding and success, in certain units the average research funding per faculty member was as much as twice the median funding. This difference indicates that well over half of the faculty in a given unit is below the average, and implies that there is an opportunity for a majority of our departments and institutes to significantly grow their sponsored research. Stakeholders recommended that we:

- Continue to identify and form larger multidisciplinary research teams (that include several faculty members) under strategic research themes to apply for and undertake larger, more impactful research, with the goal of securing group funding
- Employ professional technical grant writers to support these expanded research teams
- Expand the current internal grant review processes to strengthen grants prior to submission
- Consider hiring additional administrative or Faculty-wide research staff to help prepare progress reports and support large-team project management

5.5.2 Recent Successes in Research Funding

Research funding in the Faculty has increased since 2010, and we have secured research funds from a number of different and new programs. This section highlights some of the programs and competitions in which our researchers have been awarded.

Program	Canada First Research Excellence Fund (CFREF)
Description	<p>Launched in December 2014, with the inaugural competition held in 2015, CFREF supports:</p> <ul style="list-style-type: none"> • Complex institutional initiatives demonstrating the potential for global leadership in focus areas of strategic relevance for Canada • Projects for smaller-scale initiatives that are more narrowly focused in scope, yet still potentially world-leading and capable of resulting in partnerships with other global leaders. <p>All proposals are held to the same standards of globally leading research excellence¹².</p>
Measure of Success	<p>Medicine by Design (MbD) brings together more than 90 high-calibre researchers in a globally competitive hub focused on regenerative medicine and cell therapy, including the design and manufacture of cells, tissues and organs that can be used in research, drug discovery and clinical treatments. The CFREF awarded MbD \$113.9 million over seven years, the largest single research grant in U of T's history.</p>

Program	NSERC Strategic Partnership Grants for Projects and Networks
Description	<p>The goal of NSERC's Strategic Partnership Grants is to increase research and training in targeted areas that could strongly enhance Canada's economy, society and/or environment within the next 10 years. Research and training under these grants must be conducted through a partnership between academic researchers and industry or government organizations¹³. Two programs exist: Strategic Partnership Grants for Projects fund early-stage project research in targeted areas and last for one to three years. Strategic Partnership Grants for Networks fund large-scale, multidisciplinary research projects that involve collaboration between academic researchers and Canadian-based organizations, and last for five years.</p>
Measure of Success	<p>Two major Strategic Networks have been created in the last five years: the Smart Applications on Virtual Infrastructure (SAVI) network, and the Industrial Biocatalysis Network. Total funding for both project-based and network-based grants was \$25 million over the last five years, compared with \$15.8 million in the five years leading up to 2010.</p>

Program	NSERC Collaborative Research and Training Experience (CREATE) Program
Description	The CREATE Program is designed to improve the mentoring and

¹² <http://www.cfref-apogee.gc.ca/program-programme/index-eng.aspx>

¹³ http://www.nserc-crsng.gc.ca/Professors-Professeurs/RPP-PP/SPG-SPS_eng.asp

	training environment for the Canadian researchers of tomorrow by improving training in areas such as professional competencies, communication and collaboration, and provide experience relevant to both academic and non-academic research environments. The CREATE Program promotes and furthers the development of new researchers within the natural sciences and engineering (NSE) disciplines, or at the interdisciplinary frontier between NSE and the areas covered under the umbrella of the two other federal granting agencies, the Social Sciences and Humanities Research Council of Canada (SSHRC) and the Canadian Institutes of Health Research (CIHR) ¹⁴ .
Measure of Success	<p>Since 2011, our Faculty has been awarded seven CREATE grants:</p> <ul style="list-style-type: none"> • Distributed Generation for Remote Communities (DGRC) (MIE/ECE/MSE, 2011) • Program in Environmentally Sustainable Aviation (UTIAS/MIE, 2012) • Manufacturing, Materials and Mimetics (M3) (IBBME/ChemE, 2013) • Remediation Education Network (RENEW) (CivE/ChemE, 2014) • Research and Training Program in Unmanned Aerial Vehicles (UTIAS, 2015) • Guided Light, Tightly Packed: novel concepts, components and applications (ECE, 2016) • Training program in organ-on-a-chip engineering and entrepreneurship (TOeP) (IBBME/ChemE, 2016)

Program	Canada Foundation for Innovation (CFI)
Description	The John R. Evans Leaders Fund enables a select number of excellent researchers in an institution to undertake leading-edge research by providing them with the foundational research infrastructure required to be or become leaders in their field. This fund also offers institutions the opportunity to create competitive research support packages in the form of infrastructure and a portion of the operating and maintenance costs, coupled with direct research costs from partner organizations ¹⁵ . Through the Innovation Fund, CFI supports promising and innovative research or technology development in areas where Canada currently is, or has the potential to be, competitive on the global stage ¹⁶ .
Measure of Success	Total CFI funding over the last five years has been \$34.8 million, compared with \$27.8 million from 2005–2010.

Program	NSERC Discovery Grants
Description	The Discovery Grants Program supports ongoing programs of research (with long-term goals) rather than a single short-term project or collection of projects. These grants recognize the creativity and

¹⁴ http://www.nserc-crsng.gc.ca/Professors-Professeurs/Grants-Subs/CREATE-FONCER_eng.asp

¹⁵ <https://www.innovation.ca/awards/john-r-evans-leaders-fund>

¹⁶ <https://www.innovation.ca/awards/innovation-fund>

	innovation that are at the heart of all research advances. Discovery Grants are considered “grants in aid” of research as they provide long-term operating funds to support the costs of a research program ¹⁷ .
Measure of Success	Total funding through NSERC Discovery grants has been \$38.4 million over the last five years, compared with \$35.9 million from 2005–2010.

Program	Ontario Research Fund - Research Excellence (ORF-RE) Award
Description	The Ontario Research Fund – Research Excellence (ORF-RE) provides research institutions with funding to help support the operational costs of large-scale transformative research of strategic value to the province ¹⁸ .
Measure of Success	In the most recent round, U of T Engineering received a total of \$11.3 million to fund four projects ranging from sustainability to bioengineering. Our success rate is 33 per cent.

Program	Early Researcher Awards
Description	The Early Researcher Awards (ERA) program gives funding to new researchers working at publicly-funded Ontario research institutions to build a research team ¹⁹ . Funds support research assistants/associates, technicians, undergraduates, graduate students and postdoctoral fellows.
Measure of Success	In the last 10 years, more than 50 of our early-career faculty members have secured ERA funding, including six in the most recent round.

5.6 Research Infrastructure

To compete at an international level, we require leading-edge facilities for our collaborative and multidisciplinary research initiatives. Over the past several years, we have renovated a number of existing facilities and created new ones through strategic investments. Examples include the Translational Biology & Engineering Program (TBEP) Lab on the 14th floor of the MaRS Discovery District West Tower, and BioZone on the third and fourth floors of the Wallberg Memorial Building ([Section 7.2](#)). Replicating the success of bringing interdisciplinary researchers together to share resources will continue to have a major beneficial impact across the Faculty.

Through future efforts with large-scale, collaborative research applications, we will continue to support our research initiatives in the form of pre- and post-award management and other needed resources for infrastructure growth. In addition, the Dean’s Strategic Fund (DSF) is available to seed new institutes and facilities ([Section 6.7.5](#)).

Strengthening our research infrastructure to be in line with our global reputation continues to be an area of focus. This past summer, we secured an investment from the federal government’s Post-Secondary Institutions Strategic Improvement Fund that, when coupled with matching funds from the Faculty, will result in \$31.6 million in renovations to 89 laboratory facilities, impacting over 330 researchers, students and staff ([Section 7.1.1](#)). Construction is well underway on the Centre for Engineering Innovation & Entrepreneurship (CEIE) ([Section 7.4](#))

¹⁷ http://www.nserc-crsng.gc.ca/Professors-Professeurs/Grants-Subs/DGIGP-PSIGP_eng.asp

¹⁸ <https://www.ontario.ca/page/ontario-research-fund-research-excellence>

¹⁹ <https://www.ontario.ca/page/early-researcher-awards>

which will house several of our multidisciplinary research centres and institutes, and further catalyze collaborations with industry and other external partners.

5.7 Benchmarks of Success: Publications and Citations

We measure the impact of our research in numerous ways, including awards and honours received by faculty members, success rates for funding programs, and media coverage. Bibliometrics based on numbers of publications provide an additional way to benchmark our progress.

According to 2016 InCites™ Journal Citation Reports from Thomson Reuters, our Faculty produced 2,582 publications in the past year which received a total of 27,932 citations. We ranked second among our peers in the Canadian U15 group of research-intensive universities in terms of the number of publications, and first in the number of citations. Among our wider group of peers in the Association of American Universities, we ranked ninth in publication count and 10th in citation count.

More data on publications, citations and rankings can be found in [Appendix D: Chapter 6](#).

5.8 Activities in Support of Undergraduate/Graduate Student Research and Learning

Opportunities to participate in research at the undergraduate level — whether through thesis projects or summer research placements — are beneficial to all students, helping them develop abilities in project management, data analysis and communication. For students who plan to pursue research at the graduate level, such experience is crucial in acquiring research competencies and building professional networks.

All Engineering Science students complete an undergraduate thesis, supervised by a professor within our Faculty. Research is carried out throughout the term and is presented before a committee, enabling students to receive valuable feedback. Students in several other departments may choose an optional thesis if desired. Some students participating in our self-study consultations noted that such thesis projects are not always effective in their current format, primarily due to the time constraints imposed by courses. One concept discussed was to link the thesis course with a summer internship to enable students to engage more deeply in their research.

In 2016, 231 undergraduates participated in summer research opportunities within the Faculty, and a further 76 completed summer research internships at other institutions around the world, for a total of 307. This is 50 per cent more than in 2010, tripling the number of international summer research placements ([Figure 3.11](#)). Summer undergraduate research opportunities were described in our self-study consultations as an effective way to capture and introduce undergraduate students to our research, and to recruit for graduate studies ([Section 3.7.2.1](#)).

For more than a decade, U of T Engineering has organized the Undergraduate Engineering Research Day (UnERD), a one-day symposium where undergraduate engineering students present the research they have conducted over the summer. It allows students to share their work with professors, graduate students and other undergraduate fellows across disciplines, through either a podium or poster presentation which is evaluated by an expert panel of faculty members.

5.9 Research Chairs

One reflection of the exceptional calibre of our investigators and their work is the number of research chairs and grants awarded to the Faculty. In 2010, we had 56 research chairs; today, we have 77, held by 69 individual chairholders. These include 29 Canada Research Chairs, 27 Endowed Chairs, eight Industrial Research Chairs, eight U of T Distinguished Professors and five University Professors ([Appendix D: Appendix D](#)).

The national reallocation of Canada Research Chairs (CRCs), which occurs every two years, is based on the proportion of Tri-Council and Networks of Centres of Excellence (NCE) funding that each university receives. U of T Engineering's five-year cumulative share of NSERC funding was 9.3 per cent, greater than that of any other Canadian engineering school. We continue to work with our industry collaborators and alumni network to develop strategic partnerships and secure the funding necessary for further research chairs.

We also support our faculty members in research and education through professorships. In 2016, a landmark bequest enabled us to create the Percy Edward Hart and Erwin Edward Hart Professorships, which support seven professors within the first 10 years of their academic careers. Each professor receives \$75,000 per year for three years for research and graduate student support.

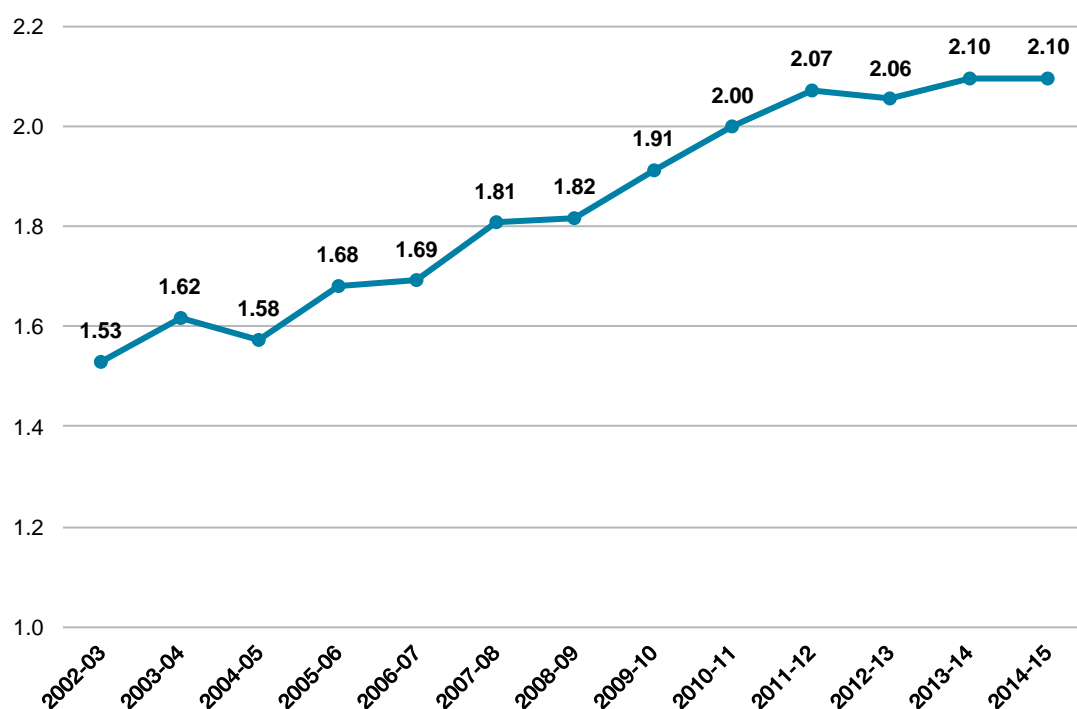
5.10 Research Honours and Awards

Our faculty members are recognized for achievements in research and education, receiving early career to lifetime achievement awards. In 2015–2016, our faculty earned more than 20 per cent of the major national and international honours and awards given to Canadian engineering professors, despite making up only 6.1 per cent of the nation's engineering faculty. A complete listing of recent awards and honours can be found in [Appendix D: Chapter 5](#).

Our Faculty's Committee on Honours and Awards nominations and our Director of Awards and Honours position have increased the success of our awards nomination program. Internally, we created the Research Leader Award in 2012 to recognize faculty members who have shown leadership in innovative, interdisciplinary and/or collaborative research initiatives that have enhanced the Faculty's research profile within the broader community.

We have also enhanced the process and capacity for disciplinary awards at the departmental and institute level by establishing awards committees in each unit and creating a centralized administrative position to help them develop nomination and award strategies. Over the last ten years, the number of research awards per faculty member (e.g. Discovery Grants, Strategic Partnership Grants, Collaborative Research and Training Experience, etc.) has increased from 1.53 to 2.10, meaning that on average, each faculty member is supported by both a Discovery Grant and at least one other NSERC funding program.

Figure 5.2 NSERC Grants Awarded per U of T Engineering Faculty Member, 2002–2003 to 2014–2015



5.11 External Relationships: Contributions and Influence

Engineering research addresses global challenges that are inherently multidisciplinary. Developing solutions to these challenges requires collaboration with leading experts in other fields, from medicine and public health to chemistry and computer science.

Our researchers collaborate within U of T Engineering, with Faculties and divisions across the University, and with many external bodies, including associated hospitals, industry partners, professional organizations and peer institutions across Canada and around the world. These partnerships may be facilitated by our multidisciplinary research centres and institutes, or created to address specific challenges at the intersection of multiple fields. Each year, the Faculty hosts an Industry Partners Reception to recognize and celebrate our more than 300 industry partners and to develop new relationships. Our partners include large multinationals such as Apple, Intel and General Electric, to local businesses such as the Greater Toronto Airports Authority and U of T spinoffs such as Crowdmark. Individual academic units also host industry events, such as open houses, career fairs, panels and networking receptions to connect with industry on strategic areas relevant to their expertise ([Chapter 8](#)).

We have also enabled additional multidisciplinary research collaborations through the Dean's Strategic Fund. Some projects recently funded under this program include the Food and Nutrition Security Engineering Initiative and the Public Health Diagnostics Initiative ([Section 8.1.3.1](#)).

During our self-study consultations, faculty members identified the need for more networks, workshops, lunches and invitations to outside researchers to explore new ideas and collaborative opportunities. They also suggested increasing the opportunities for graduate student co-supervision as well as creating linkages or developing collaborative programs with other departments. They suggested we leverage the multidisciplinary nature of the Engineering Science program by employing more of these students in summer research internships.

5.12 Innovation and Commercialization

U of T Engineering fosters an environment that support the translation of innovations into commercial ventures. Over the past five years, our faculty members have accounted for 43 per cent of all invention disclosures at the University ([Table 5.1](#)), and have launched 36 spin-off companies ([Appendix D: Appendix F](#)).

Table 5.1 Invention Disclosures by Academic Area, 2011–2012 to 2015–2016

	2011–12	2012–13	2013–14	2014–15	2015–16	5-Yr Total
UTIAS	1.0	1.0	1.0		1.0	4.0
IBBME	14.0	8.2	5.9	6.5	8.0	42.6
ChemE	5.8	12.4	10.3	9.0	7.0	44.5
CivE	3.3	1.8	5.0	5.0	6.0	21.1
ECE	24.5	38.1	16.5	41.6	24.6	145.3
EngSci		0.5	1.2		1.0	2.7
MIE	20.7	13.1	9.5	18.8	16.8	78.9
MSE	3.0	4.0	2.5	1.5	1.3	12.3
Annual Total	72.3	79.1	51.9	82.4	65.7	351.4
University Annual Total	158.0	166.0	147.0	176.0	169.0	816.0
Engineering Percentage	46%	48%	35%	47%	39%	43%

As noted in [Section 5.5.1](#), the Office of the Vice-President, Research & Innovation (OVPRI) and its Innovations & Partnerships Office (IPO) provide research-related commercialization support to the Faculty. The University has developed internal policies to allow inventors the flexibility to take personal ownership of and commercialize inventions on their own, or alternatively, utilize the commercialization services the University provides.

Startup creation provides a clear pathway for commercialization, and U of T Engineering provides a full suite of supports for graduate and undergraduate students who wish to become successful entrepreneurs. These include:

- **Heffernan Commercialization Fellowships** — The Heffernan Commercialization Fellowships were established in 1997 to provide seed funding to assist graduate students in turning their research into viable businesses. The program was expanded significantly in 2014 as part of a \$5 million gift to the Faculty.
- **Start@UTIAS** — Founded in 2014, Start@UTIAS is a program that enables graduate students to leverage the knowledge and competencies they have gained through their education to create business startups. The program includes mentorship, legal and accounting advice, a speaker series, networking opportunities and seed funding.
- **The Entrepreneurship Hatchery** — The Hatchery was created in 2012 to enable teams of undergraduate students to build startups through an intensive summer program that includes mentorship, pitching sessions, access to fabrication facilities and seed funding ([Section 3.3.4.2](#)). The Hatchery’s mandate was expanded in 2016 with support from the Dean’s Strategic Fund (DSF) to also focus on the incubation of graduate-level, research-driven startups.

Our researchers can also access other supports across the University community, such as the Banting & Best Centre for Innovation & Entrepreneurship, home to a number of entrepreneurship accelerators including the University of Toronto Early Stage Technology Program, the Health Innovation Hub, the Impact Centre and the Creative Destruction Lab. Through U of T, our Faculty is also a member of MaRS Innovation, a non-profit organization that acts on behalf of Toronto’s top universities, institutions and research institutes to bring their most promising research breakthroughs to market.

There are multiple Commercial Licensing Agreements within the University, and we believe there is more work to be done on a coordinated umbrella structure that serves both our students and faculty members. Faculty-specific workshops and seminar series on innovation and entrepreneurship could better prepare and train our principal investigators to plan and manage the outcomes of their research.

Increasingly, governments, funding agencies and institutions like U of T are recognizing the important economic role played by commercialization and entrepreneurship based on academic research. Given the applied nature of our research and the strong networks we have built to support commercialization and entrepreneurship, our Faculty is well-positioned to be a leader in this area.

6.0 Organizational Structure & Resources

Overall leadership in our Faculty is provided by the Dean. The Dean is assisted by the Senior Academic Administrative Leadership Team, which consists of three Vice-Deans (Undergraduate, Graduate Studies and Research); an Associate Dean, Cross-Disciplinary Programs; the Chair, First Year; the chairs and directors of the Faculty's academic departments, institutes and divisions; and a number of administrative directors, including the Executive Director of Advancement, Faculty Registrar, Chief Financial Officer and others ([Appendix L — Organizational Chart 2016](#))

The Chief Financial Officer position was created in 2011 to oversee the implementation of the Faculty's budget model, which had previously been assigned to a Chief Administrative Officer (CAO). The CAO's other duties were assigned to the Assistant Dean, Administration, who in 2013 began to oversee the administrative and academic human resources portfolio.

6.1 Administrative Leadership and Structure

Our formal governance body is the Council of the Faculty of Applied Science & Engineering, which sets and approves academic policy, principles, priorities and the general direction for the teaching and research activities of the Faculty. It also approves and regulates standards of admissions, establishes committees for the conduct of Council business, and advises the Dean on academic matters. Faculty Council generally meets four times each academic year and is effectively meeting our needs.

Faculty Council is comprised of all faculty members and representatives of undergraduate and graduate students, professors emeriti, administrative staff and alumni. It oversees an Executive Committee and the following standing committees:

1. **Admissions Committee** – Initiates and implements policies and procedures with respect to the selection and admission of all undergraduate applicants to the Faculty and grants any advanced standing in courses (course exemptions). The committee is also responsible for initiating and implementing policy with respect to academic awards for incoming first-year students.
2. **Community Affairs and Gender Issues Committee** – Recommends strategies related to student recruitment and outreach, and quality of life within the Faculty community.
3. **Examinations Committee** – Administers the implementation of grading policies and procedures within the Faculty, and advises on the academic promotion of engineering undergraduate students.
4. **Engineering Graduate Education Committee** – Approves and reports course changes and minor program changes to Council for information, and reviews and recommends major program changes to Council for approval.
5. **Research Committee** – Serves as an advisory and coordinating body to advance engineering research excellence and innovation, and strengthen the Faculty's research community. Advises on and supports implementation of strategic planning pertaining to research.

6. **Scholarships and Awards Committee** – Administers the Faculty’s undergraduate academic awards and grants, and advises on related policy.
7. **Teaching Methods and Resources Committee** – Promotes improvements to teaching methods and advises on the general delivery of undergraduate academic programs within the Faculty. Promotes advances in methods related to evaluating and rewarding teaching effectiveness, and initiates, supports and encourages innovative teaching projects.
8. **Undergraduate Curriculum Committee** – Monitors, coordinates and revises, with the approval of Council, the curriculum of all engineering undergraduate academic programs and courses, reporting on significant resource implications. Defines and promotes competencies expected of graduating students, and reviews and develops curriculum-related policies. A revised *Terms of Reference* will be coming forward to Faculty Council in 2016–2017, incorporating responsibilities related to the Canadian Engineering Accreditation Board (CEAB) graduate attributes process.

Council also oversees an Academic Appeals Board, which rules and reports on appeals of undergraduate students against decisions of standing committees that relate to petitions for exemptions from the application of academic regulations or standards.

6.2 Faculty Governance Structure and the Governance Task Force

The governing structure at the University of Toronto is unique among Canadian universities, with a unicameral system of Governing Council formed in 1972 by provincial statute that replaced the more common bicameral system of Senate and Board of Governors. To learn more about the structure and makeup of Governing Council, see [Appendix M — Governing Council](#).

Similarly, governance in the Faculty of Applied Science & Engineering is based on a unicameral system, with a council serving as the Faculty’s highest academic decision-making body. Council has oversight and authority over the Faculty’s undergraduate and graduate programs, including the establishment of policies and practices for undergraduate admissions, curricula and examinations, and for graduate education. Most of Council’s work is delegated to its eight standing committees listed above, which report to Council through its Executive Committee; however Council itself oversees and approves much of this work.

We established a Dean’s task force in September 2012 to review the Faculty’s constitution and propose a model for a smaller, more active and effective Council. This task force included representation from faculty, undergraduate and graduate students, alumni and administrative staff. It consulted broadly with faculty, student leaders, staff representatives, standing committee chairs, academic administrators, professors emeriti and alumni over a five-month period, and submitted its recommendations to the Dean in March 2013. After extensive consultation, the Dean announced in October 2013 that the task force’s recommendation to reduce and restructure the composition of Council from over 330 to 65 elected members would not be going forward at that time.

Instead, efforts were made to improve the effectiveness of Council processes within its current composition. These initiatives included working with the chairs and directors of departments, divisions and institutes to encourage members to attend meetings, spend more time discussing strategic issues, and bring forward items of broad interest for discussion earlier in their development cycle so that members can become fully familiar with them and provide early and

meaningful input. At its April 2013 meeting, Council approved changes to modernize and standardize the language in the Faculty's constitution, and to accept the authority delegated from Governing Council to modify existing programs, terminate certificates and create graduate emphases.

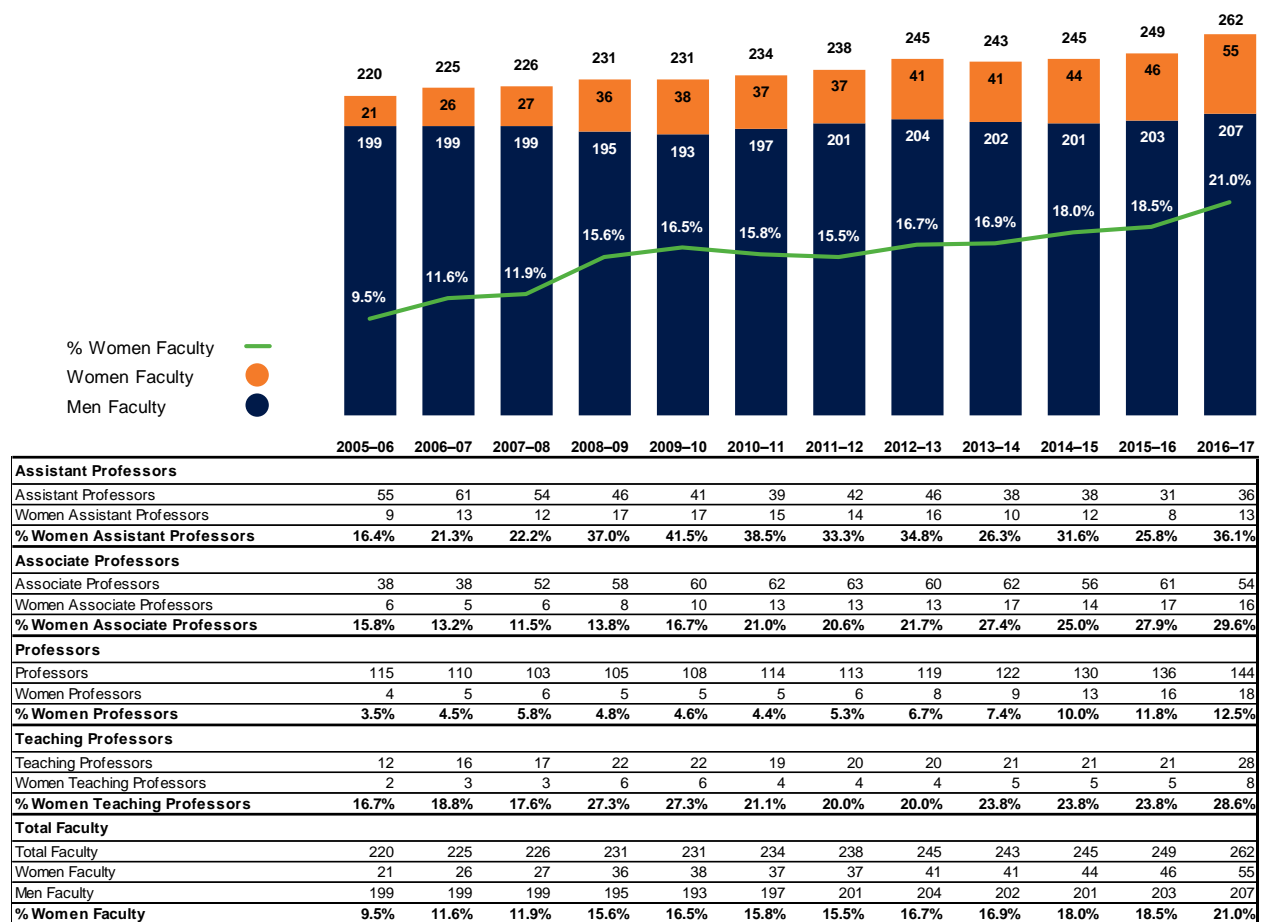
Since then, Council meetings have included fruitful discussions on such topics as the core program curriculum, sponsored research, broad-based admissions, academic technology renewal, course evaluations, student mental health, technology-enhanced active learning rooms, and graduate attributes and accreditation, among others. Minutes and documents from Council meetings are available on our website (www.engineering.utoronto.ca/about/governance/faculty-council/).

6.3 Faculty

As of July 2016, the Faculty's academic staff complement consisted of 262 tenured, tenure-stream and teaching-stream appointments.

In 2015–2016, our faculty members made up only 6.1 per cent of Canada's tenured and tenure-stream engineering professors, yet they earned more than 20 per cent of the major national and international awards and honours given to that group ([Section 5.10](#)).

Figure 6.1 Total Academic Staff by with Proportion of Women, 2005–2006 to 2016–2017



U of T Engineering has been in a very active academic recruitment phase since 2010, hiring 50 tenure-stream faculty members. Of these, 18 are women, representing 36 per cent of all hires over the last six years. We have strategically initiated broad, Faculty-wide searches focused on hiring for excellence in interdisciplinary areas of research and increasing faculty diversity. The first of these searches took place in 2013–2014, when we hired three female faculty members, and was repeated in 2015–2016, resulting in the hiring of four additional female faculty members. All seven of these hires have budgetary cross-appointments to more than one of our departments. Not only do these Faculty-wide searches contribute to our interdisciplinary and diversity priorities, they engage our academic chairs and directors in a collaborative approach to recruitment and hiring.

We have also added to our teaching-stream faculty complement, with six hires recruited within the past year. This increase is partially related to several retirements of existing teaching-stream faculty, and responds to our strategy to add expertise in areas such as curriculum design, pedagogy and leadership education.

Our faculty members produce research that cuts across many engineering disciplines and areas of study. We have particular strengths in our strategic focus areas of bioengineering,

information and communications technologies, sustainability, and enabling technologies. For more information on research, see [Chapter 5](#).

The most recent survey data (2014) from the Collaborative on Academic Careers in Higher Education (COACHE), a Harvard-based consortium of institutional leaders that aims to improve outcomes in faculty recruitment, development and retention, showed that 86.3 per cent of our faculty members were satisfied with U of T Engineering as a place of work, compared with 77.9 per cent across the entire University. When asked if their departmental culture encourages promotion, 84.5 per cent agreed compared with 66.8 per cent across U of T. The effectiveness of mentoring within departments was rated as satisfactory by 64.1 per cent of faculty compared to 62.1 per cent across U of T, although this was much higher in some departments (e.g. 90 per cent in ChemE).

6.4 Administrative and Technical Staff

U of T Engineering employs 312 highly qualified and engaged administrative and technical staff members. Their breadth of expertise ranges widely and includes financial management, information technology, writing and communications, fundraising, human resources, classroom laboratory support, among many others. In addition to the staff development support offered by the University, administrative and technical staff are provided opportunities to attend conferences, serve on committees, and have a strong and valued voice in strategic decision-making within the Faculty.

In 2013, we established an Engineering human resources office that is fully integrated within the Faculty to provide strategic and operational HR support. Prior, human resource services had been delivered through an office that supported Engineering as well as five other Faculties on campus.

We conducted a survey in May and June 2016 to assess how well the Faculty is perceived to support staff development. Eighty-nine per cent of respondents felt they had the opportunities and resources required for career development, personal growth and innovation within their work space, and 79 per cent felt that their work and opinions were valued by their unit and the Faculty. We also conducted a consultation luncheon where staff members expressed their desire for more community building and opportunities to network with people in other departments, divisions and institutes, and for additional training on issues and technologies specific to our Faculty.

6.5 Advancement and Alumni Relations

The Office of Advancement and Alumni Relations is responsible for fundraising and alumni relations within the Faculty. This work is carried out in close collaboration with the Engineering Alumni Association (EAA) Board, which provides advice and support for alumni initiatives and linkages to the U of T Engineering alumni community locally, nationally and internationally.

The Faculty advancement team also works collaboratively with U of T's Vice-President and Chief Advancement Officer and the staff in the Division of University Advancement (DUA) to ensure alignment and consistency with the overall goals of the University. DUA has primary responsibility for data support, reporting services, prospect research, as well as programmatic support for Annual Giving, Principal Giving and Alumni Relations. Alumni Relations collaborates with departments, divisions, institutes and centres to identify funding priorities and donors, and to execute strategies to support those priorities.

In 2015–2016, we attracted \$29.3 million in philanthropic support, bringing the total funds raised since the November 2011 launch of *Boundless: The Campaign for the University of Toronto* to \$190 million, which is 95 per cent of our \$200 million goal. Additionally, we have secured more than \$80 million for the construction the Centre for Engineering Innovation & Entrepreneurship (CEIE), a cornerstone of our Boundless campaign, including \$26 million in philanthropic donations, \$1 million from the U of T Engineering Society, and an investment of \$15 million from the Government of Ontario.

6.5.1 Restructuring and Staffing

Roles within Alumni Relations have been redefined over the past several years to more closely align with development and engagement work supporting each department, division and institute, and the overall Faculty. The current leadership team includes an Executive Director, a Director of Development, a Director of Alumni Relations, and an Associate Director of Development. The unit also has two Senior Development Officers, Major Gifts, a Senior Development Officer, Leadership Giving, and a recently created Development Officer, Stewardship & Donor Relations.

In partnership with our Vice-Dean, Research and DUA, our Faculty created two positions to support corporate and foundation advancement activities for U of T Engineering. The current Director of Corporate, Government and International Partnerships and the Director, Foundation and Corporate Partnerships each hold a PhD from our Faculty and have extensive experience with industry, research and building successful collaborative relationships. They are responsible for bridging the gap between corporations that are interested in sponsored research and philanthropy, and work with foundations to create research funding opportunities with foundation prospects interested in supporting these program areas ([Section 8.2.1](#)).

6.5.2 Principal Giving

With an ambitious goal of achieving sustained philanthropic revenue of \$20 million per year by the end of the Boundless Campaign, Advancement has focused considerable effort on building a Principal Gifts program within the Faculty. Working in partnership with DUA Principal Gifts, the team identifies prospects and projects that will attract donors of \$5 million or more.

The Faculty has received several principal gifts over the last few years in support of research, education and capital projects. Our Faculty's Principal Gifts' portfolio is identifying and defining

new prospects. In the short term, a key priority will be to successfully identify at least six “Big Ideas” that are cross-disciplinary (or cross-Faculty), globally relevant, and demonstrably supported by industry, government and research funding agencies.

6.5.3 Major Giving

Major Giving continues to be a significant priority for our Faculty. To support and guide major gift endeavours across U of T Engineering, we assign Advancement staff to the Faculty’s departments, divisions, and institutes to work closely with the respective academic leaders in major gift solicitations.

We have achieved strong fundraising results over the last three years, however much of this success has been due to several principal gifts rather than strong, consistent major gift fundraising. More effectively identifying, cultivating and soliciting donors, prospects and alumni will be a priority over the next five years. Better use of reporting, data mining and fundraising metrics will boost the number of successful solicitations, and expanded stewardship will make the donor experience more fulfilling.

6.5.4 Planned Giving

Planned Giving is an area of great potential in our Faculty: one of the principal gifts received in the last five years was a \$20 million estate gift. Many of the Faculty’s current major gift donors are also ideal planned gift prospects who remain actively involved with their alma mater. A renewed partnership with DUA Planned Giving and our Advancement Office aims to dramatically increase the number of successful Planned Gift solicitations.

We are increasing the exposure of Planned Giving to thousands of alumni every year through our expanded class and reunion giving programs. Since at least 50 per cent of Planned Gifts are made without the University’s awareness, it will take some years to determine the true value of this current work. Fundraising statistics indicate, however, that it will have a transformative effect on Faculty fundraising seven to 10 years in the future.

6.5.5 Case for Support Development

Our Faculty’s Senior Academic Administrative Leadership Team developed a *Catalogue of Priorities* with input and broad consultation from all departments, divisions and institutes ([Appendix N — Catalogue of Priorities](#)). This catalogue is continually being refreshed and expanded as projects come forward. There remain a number of consistent areas requiring support within each unit — including capital projects, student support and core programming — and Advancement works with the leadership to meet those goals.

We are developing a “Big Ideas” list for multi-disciplinary initiatives that will incorporate some of the projects from the *Catalogue of Priorities*. As that list is finalized in the fall of 2016, the *Catalogue* will be revised to reflect the changes.

6.5.6 Annual and Leadership Giving

The Annual and Leadership Giving program is defined by the University as gifts below \$25,000. U of T Engineering further classifies gifts of \$1,200 – \$24,999 as Skule™ Society gifts. The primary goals of this program are to grow the traditional base of Skule™ Society donors while building a Young Alumni Program for graduates one to five years from graduation, significantly

expanding the Class Giving and Reunion Giving Programs, and expanding our opportunities for acquiring alumni donors through partnership with our departments, divisions, institutes and centres.

6.5.7 Alumni Relations

Increasingly, we are increasingly recognizing the global nature of our 48,000-strong alumni network and are providing a wider variety of ways in which alumni can connect with us, whether by mentoring a current student, delivering a guest lecture, or advising a multidisciplinary team completing a capstone project. By aligning more closely with development programs in departments, divisions, and institutes, we are discovering additional ways to strengthen our relationships with alumni ([Section 8.2.2](#)).

A major activity over the last five years has been the establishment of EAA chapters in Hong Kong, Calgary and California's Silicon Valley. These chapters, established with the guidance and support of the EAA Board, enhance our global presence and strengthen our entire community.

6.5.8 Volunteer Structure and Recruitment

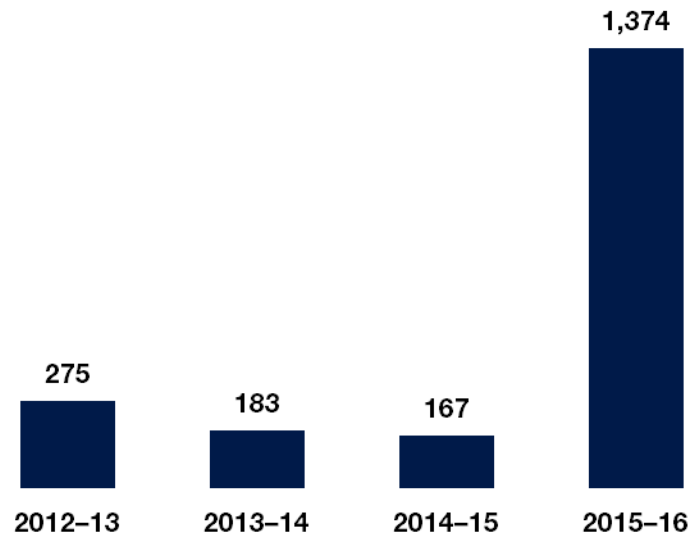
Volunteers are a critical part of any successful major gift campaign. Ongoing activities across all areas of the Faculty support and develop opportunities to expand volunteer engagement. Some notable examples include:

- Revitalized departmental advisory boards
- External volunteer boards created for The Entrepreneurship Hatchery and ILead, and an increase in the number of industry advisory boards
- Revitalized Engineering Alumni Association, including the creation of a *Terms of Reference*
- Increased number of Faculty-wide leadership volunteers who actively cultivate and solicit donors

The EAA Board continues to play a key role in Alumni Relations. Composed of dedicated volunteers and representing a wide variety of disciplines and graduating years, the Board meets four times per year. A major focus of the EAA Board in recent years has been identifying and facilitating opportunities to increase the visibility of alumni amongst students, including volunteer positions across the Faculty. Engineering alumni can also be found moving into university governance roles overseeing broader functioning of the University.

Figure 6.2 shows the increase in volunteerism over the last four years. The large increase in 2015–2016 is driven by the adoption of online platforms such as EngSci CONNECT, which have allowed us to reach and mobilize larger numbers of alumni for mentorship or other volunteer activities.

Figure 6.2 Alumni Volunteers, 2012–2013 to 2015–2016



6.6 Engineering Strategic Communications

In 2007, we reorganized Engineering Strategic Communications (ESC) from its previous focus on advancement toward a broader, Faculty-wide unit that reports directly to the Dean. This has allowed us to pursue a more proactive approach to external media relations and internal communications, which has enhanced the reputation and positioning of U of T Engineering while fostering a cohesive sense of community within the Faculty.

ESC generates communications strategies that advance the Faculty's *Academic Plan*. This includes a number of communications vehicles and products in both print and online media:

- More than a dozen website, including the main Faculty website (engineering.utoronto.ca/), the Faculty news website (news.engineering.utoronto.ca) and sites focused on recruitment (discover.engineering.utoronto.ca), graduate studies (gradstudies.engineering.utoronto.ca) and specific media campaigns (women.engineering.utoronto.ca)
- Social media feeds (Twitter, Facebook, Instagram, Snapchat)
- *Skulematters* alumni magazine
- Offer package for admitted students
- Undergraduate and graduate recruitment materials
- *Annual Report of Performance Indicators* (internal-facing annual report)
- *Year in Review* (external-facing annual report)
- Monthly faculty and staff e-newsletter, student e-newsletter and alumni e-newsletter
- Other materials that advance research institutes, The Entrepreneurship Hatchery and other groups within the Faculty

ESC also coordinates campaigns that focus on specific goals. Recent examples include:

- **Research and Innovation** – Flight of the Ornithopter (2010). The flight of Snowbird, the world’s first human-powered ornithopter built by alumnus Todd Reichert (EngSci oT5, UTIAS PhD 1T1) and Cameron Robertson (EngSci oT8, UTIAS MAsc oT9), was ESC’s first true viral marketing success. The videos we posted to Vimeo and YouTube were viewed more than 1.3 million times. The project met our *Academic Plan* goal of using best-in-class practices and keeping pace with emerging technologies and their uses by our target audiences.
- **Diversity in Undergraduate Recruitment** – Say Yes to Engineering (2014–2015). This campaign was built around our *Academic Plan* goal to increase gender diversity among students and faculty. It included a microsite (women.engineering.utoronto.ca), online news stories, and focused media relations efforts. During the campaign, the proportion of women in the incoming undergraduate class increased from 30.6 per cent to 31.4 per cent, reaching 40.1 per cent the following year.
- **Entrepreneurship and Collaboration** – CEIExSKAM (2015). ESC commissioned a 276-foot-long street art installation on the construction hoarding around the site of the new Centre for Engineering Innovation & Entrepreneurship (CEIE) that highlights the importance of engineering in society and depicts the Faculty’s rich history, innovative education and world-class research. In October 2015, more than 5,000 people visited the mural during Scotiabank Nuit Blanche, a city-wide, all-night art festival. Targeted media pitching resulted in 12 stories about the mural in regional media outlets, and more than 5.5 million impressions. CEIExSKAM meets our *Academic Plan* goal of strengthening the Faculty’s key messages and customizing them for target audiences. The wall has extended the conversation about the CEIE and the role of engineering in society during the construction of the building.

ESC continues to build relationships and communications with traditional media. From May 2015 to April 2016, proactive pitching combined with strategic planning and execution secured more than 3,400 media stories about the Faculty. Nearly 60 per cent of these stories appeared in international outlets. In total, this coverage earned more than one billion impressions worldwide.

We have also made progress on our *Academic Plan* goal of increasing the Faculty’s presence, visibility and reputation on social media platforms. Our annual reach across Facebook, Twitter, Instagram and Snapchat – that is, the number of users who saw U of T Engineering-related content – has grown to 3.8 million.

The Say Yes to Engineering and CEIExSKAM media campaigns earned Gold Quill Awards from the International Association of Business Communicators (IABC). In 2015–2016, ESC earned more than a dozen national and international communications awards and was named Not-for-Profit Communication Department of the Year (globally) by the IABC.

6.7 Finances

6.7.1 University of Toronto Budget Model

In 2004, the University began to develop a budget model loosely based on the practice of Responsibility Centered Management (RCM). This new model was implemented across the University in 2007–2008.

Under this model, all revenue coming into the University is fully attributed to the academic divisions. University-wide costs are apportioned to the academic divisions based upon related activity-based cost drivers, leaving divisions to manage their own financial well-being. The method incentivizes entrepreneurial behavior at the unit level.

RCM models also rely upon strategic funds to support initiatives, promote interdivisional collaboration and fund academic priorities. The University Fund supports those academic initiatives that may not otherwise be financially funded through public grants and tuition funding. Revenue, as defined under the new budget model, includes:

- Tuition
- Ontario Provincial Operating Grant
- Research overhead
- Endowment income
- Canada Research Chair (CRC) income
- Investment and other income

Tuition and Ontario Provincial Operating grants are student-generated and comprise 85 per cent of the total revenue from all sources. However, research funding is not considered as part of the operating budget. The magnitude of student-generated income is an important consideration when setting annual enrolment targets for the Faculty. Any change in the number or mix of students (for example, between graduate and undergraduate, doctoral stream and professional stream, and international and domestic) impacts the Faculty's revenues. The full amount of each of these income types is now reported and is transparent to each of the academic divisions.

The University charges the academic divisions for all University-wide expenses, including:

- Space and utilities
- Information technology infrastructure and support
- University management
- Financial management
- Pension deficit
- Human resources
- University advancement
- Library system
- Research administration
- Student and registrarial services
- University-wide academic expenses
- University-wide general expenses

All costs of running the University are collected into 12 cost bins before being apportioned to the academic divisions based upon their imputed consumption, using activity-like cost drivers.

Two other cost components are deducted from revenues. The first is the Student Aid Set-Aside, which is an annual levy based on enrolment targets to cover the student aid needed that year. A portion of this amount is offset by a revenue stream from endowed scholarships flowing to the division as endowment income.

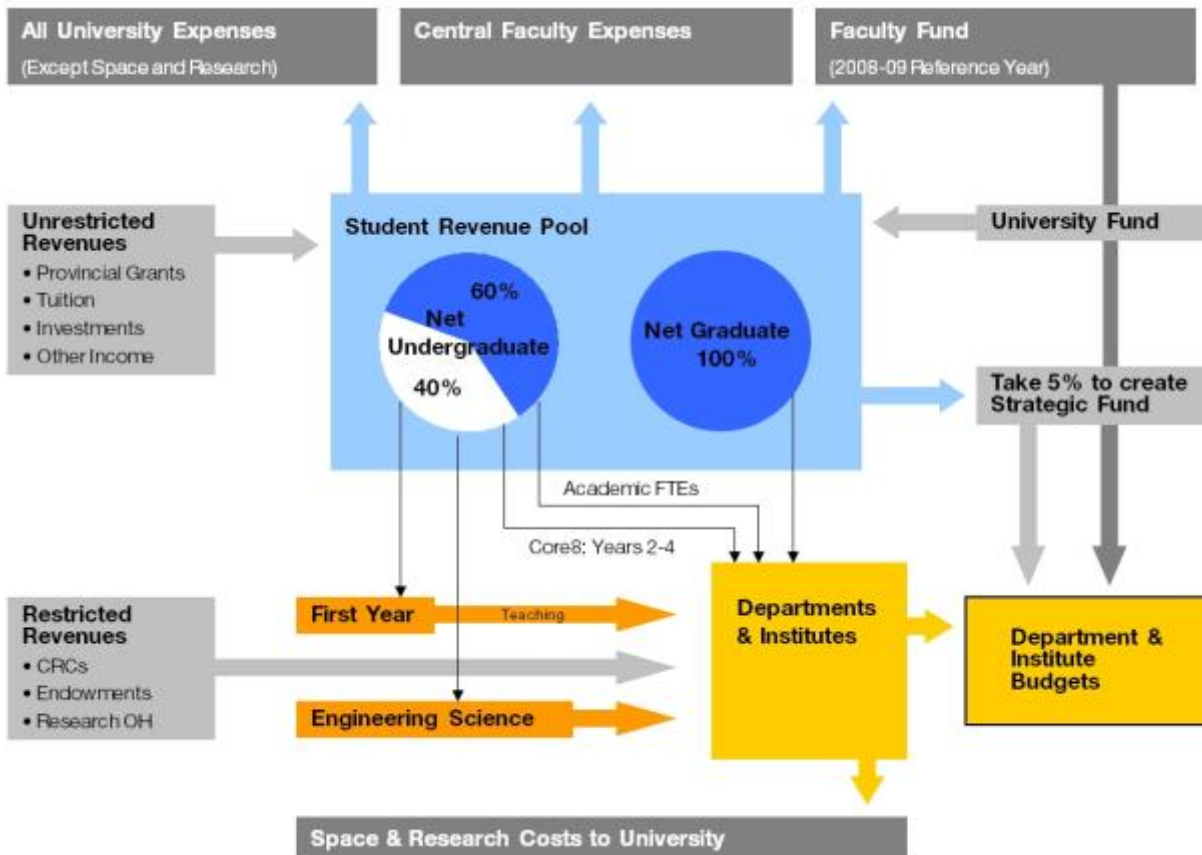
The second deduction is the division's contribution to the University Fund, which is derived from a 10 per cent tax on the total revenue from the Ontario Provincial Grant, tuition, and investment and other income. The tax is not applied to restricted revenues such as endowment, CRC or Research Overhead income. The University Fund is a key mechanism in the new model in that it allows the Provost to provide funds for academic priorities, and was used to make all divisional budgets the same for the first year, as they would have been under the former model.

This new approach to budgeting provides academic divisions with a greater understanding of the effect of their enrolment and consumption on their budgets, which in turn allows for a better alignment of academic decisions with financial outcomes. It incentivizes divisions to increase research funding and service contract revenue, raise funds from philanthropic sources, and set enrolment targets and mixes that best meet their needs.

6.7.2 Faculty Budget Model

U of T Engineering established a budget committee in November 2005 to track the changes to the University's budget model and to advise on the need for internal changes. In July 2006, the committee was mandated to redevelop the Faculty's internal budget allocation process and this new model, implemented in 2009–2010, gave departments, divisions and institutes similar incentives to manage their budget funding, increase revenues and contain costs ([Figure 6.3](#)). The concept of attributing revenues and expenses and the principle of transparency were carried through, with the addition of student and faculty income metrics to guide units in their enrolment revenue generation.

Figure 6.3 Faculty Budget Allocation Process



The revenue sources in the Faculty budget model remain consistent with the budget model for the University. These are unrestricted and restricted revenues. The restricted revenues are Canada Research Chairs, endowments, and research overhead and flow directly to internal units with no discount for central services. The remaining streams, such as provincial grants, tuition, investment and other income, are considered unrestricted. These revenues are first used to pay for selected University-wide and then central Faculty expenses. The method to allocate these revenues to the various internal units is based on a combination of student headcount, academic FTE, and teaching in First Year and Engineering Science courses.

Specifically, the expenses paid by the Faculty to the University are the Student Aid Set-Aside, the Faculty's contribution to the University Fund, and 10 of the 12 cost bins. The two remaining cost bins, occupancy and research administration, are to be paid directly by the academic units within the Faculty. In total, these costs add up to approximately 50 per cent of all Faculty revenues.

The revenue is then collectively used to pay for the central Faculty costs, which consist of salaries and benefits for the staff within the administrative units (Registrar's Office, Advancement, Student Recruitment and Retention, the Engineering Outreach Office, Engineering Computing Facility, Engineering Communication Program, and decanal portfolios), as well as the operating costs for those units. The cost for some units is partially offset by revenues from participants, most notably the Engineering Outreach Office. The central Faculty expenses also include transfers to departments and institutes in support of research for chairs

and directors as well as the Professional Expense Reimbursement Allowance (PERA) for all academic staff. In total, the central Faculty expenses form approximately 17 per cent of the net Faculty budget.

The final input to the Faculty's budget funding is the University Fund allocation. The Faculty is a net financial contributor to the University Fund, contributing on average two times more into the fund than is received as an allocation from the University Fund.

A mechanism similar to the University Fund is employed by the Dean to make discretionary allocations. After an initial equalizing of new to old budgets in 2008–2009, the amount needed to achieve this equilibrium (representing 10 per cent of unrestricted net revenues) is known as the Faculty Fund and will be preserved going forward. A separate fund, known as the Dean's Strategic Fund, is generated each year at a level of 5 per cent of net Faculty revenues to support strategic initiatives ([Section 6.7.5](#)).

We apportion the pool of remaining revenues to the academic units based on several revenue drivers. The revenue associated with graduate students is distributed fully on the basis of graduate student counts. The revenue associated with undergraduate students is divided as follows: 60 per cent allocated to the academic units based on their full-time equivalent academic staff counts and 40 per cent distributed based on their undergraduate student counts. Since students in First Year and Engineering Science are taught by the other academic units, we created an algorithm to distribute this revenue based on teaching. Similarly, courses taught for other units, specifically in minor programs, have been identified and an algorithm constructed to charge back the cost to the students' home departments.

The departments and institutes also receive 100 per cent of the revenues from Canada Research Chairs, endowed chairs and research overhead.

The academic units are then charged for their occupancy and research administration costs. The cost driver for the occupancy bin is the space in net assignable square metres (NASMs) in a unit's inventory. The three cost drivers for the research administration bin are total research funding (three-year average), the number of research funding applications, and the number of active research funds. The balance remaining is supplemented by their respective allocations from the Faculty Fund (as determined in the equalization year 2008–2009), and the total forms their operating budget. During the year, academic units are funded on a one-time-only basis for approved initiatives from the Dean's Strategic Fund.

In the summer of 2013, the Faculty undertook a review of its new budget model after three years of use. It was concluded that the Faculty's new budget model was serving the Faculty extremely well and that no significant change in direction was required. Only minor changes and a realignment of the allocation of Central research and innovation administration costs to be consistent with a change made in the University's budget model were recommended.

6.7.3 Overview of Faculty Finances

[Figures 6.4](#) and [6.5](#) show the Faculty's budget values for revenue earned and associated central costs attributed prior to any year-end adjustments for the last nine years corresponding to the implementation of the University's new budget model.

Figure 6.4 Total Revenue, 2006–2007 to 2015–2016

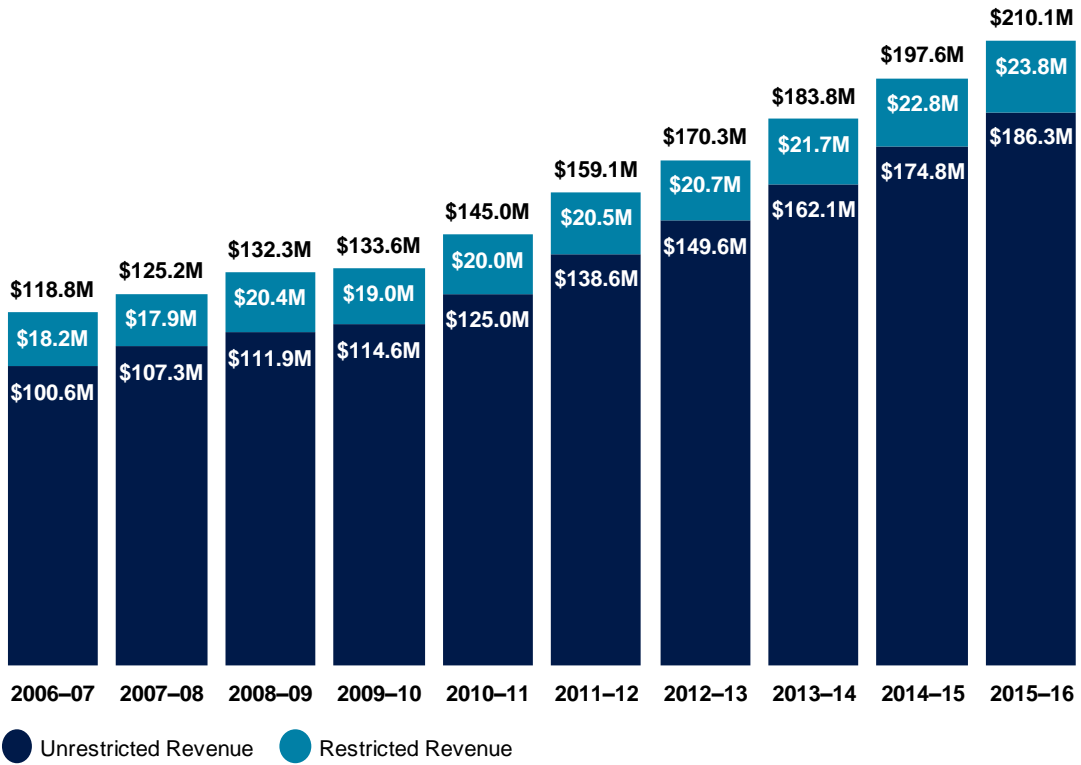


Figure 6.5 Total Central Costs, 2006–2007 to 2015–2016

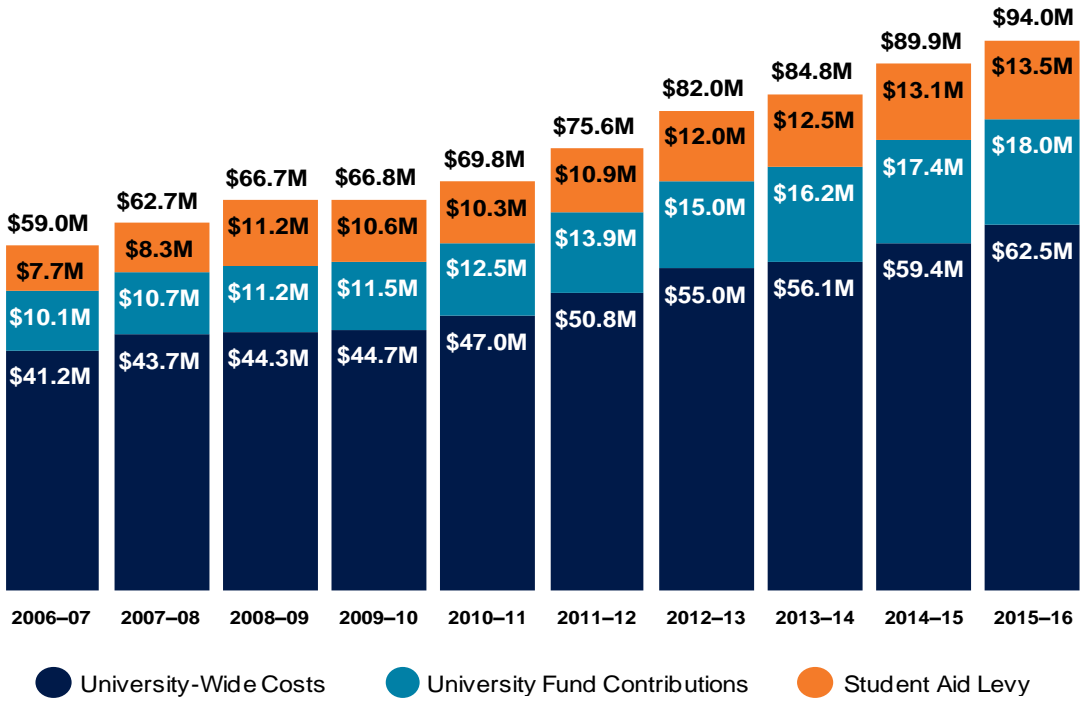


Figure 6.6 Revenue Distribution, 2015–2016

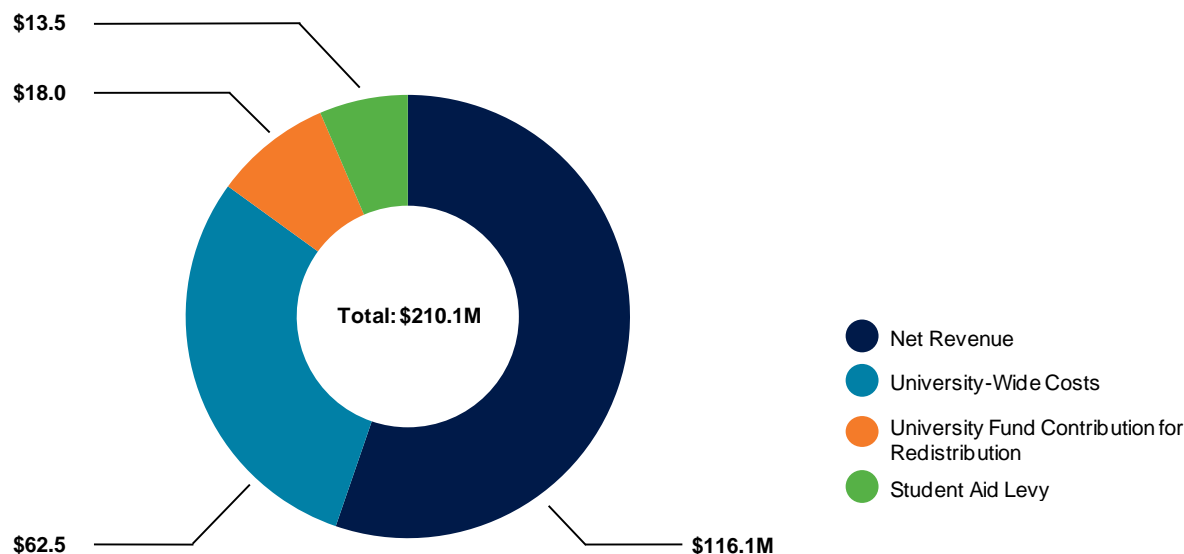
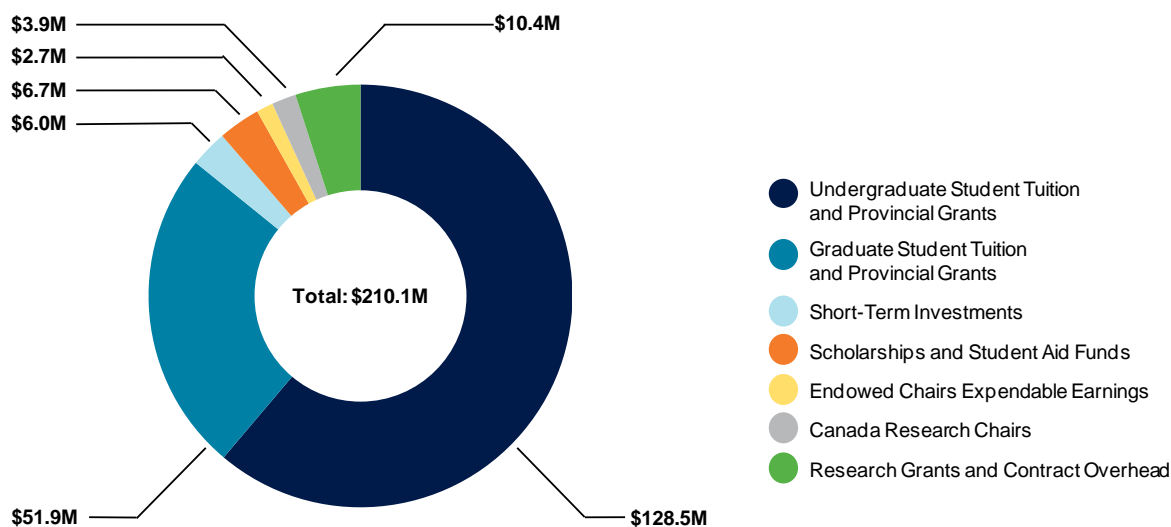


Figure 6.7 Revenue Sources, 2015–2016



6.7.4 Interdivisional Teaching Agreement with the Faculty of Arts and Science

The Faculty of Arts & Science and the Faculty of Applied Science & Engineering have a longstanding teaching relationship wherein Arts & Science provides teaching to undergraduate students in Engineering. In 2013–2014, they taught 16 per cent of the undergraduate curriculum for Engineering students, principally across mathematics, physics, computer science and electives.

Prior to the introduction of the University’s new budget model in 2006–2007, the teaching and funding relationships between the two Faculties were governed by a number of agreements at

both the divisional and departmental levels. After the implementation of the new budget model, these arrangements were essentially frozen into the budgets of the two divisions with no systematic approach to funding the incremental cost of interdivisional teaching provided by Arts & Science to Engineering since 2006–2007.

A revenue-sharing agreement between the Faculties commenced in May 2015 to address the funding of teaching and to provide an academic framework whereby we commit to work together to achieve our educational missions to the benefit of students, faculty and administrators across the units. We established joint committees to oversee and guide interdivisional teaching activities between the divisions and ensure that the main academic objective of maximizing benefit to the students is realized on an ongoing basis. The agreement includes an incentive structure that is positive and appropriate for both divisions and focuses on enhancing the quality and quantity of teaching provided.

6.7.5 Dean's Strategic Fund (DSF)

U of T Engineering launched the Dean's Strategic Fund (DSF) in 2011 to provide seed funding for multi-departmental and collaborative initiatives that will have a broad impact within the Faculty and advance the goals of our *Academic Plan*. Following the most recent call for proposals in 2016, we committed \$7.26 million for 15 projects, bringing total funding to more than \$24 million since the DSF was created. Some recent examples of DSF-funded initiatives include:

- **The Entrepreneurship Hatchery Phase 1 and 2 (2016)** — The Hatchery provides resources to launch and support student start-ups within the Faculty ([Section 3.3.4.2](#)) The DSF will support continued improvements to the existing model, as well as a new program dedicated to the incubation of graduate-level, research-driven start-ups
- **Expansion of MIE Machine shop (2016)** — U of T Engineering is home to more than 80 student clubs and design teams, as well as a variety of design courses, each of which could benefit from more fabrication space. Expanding the MIE student machine shop's physical capacity and hours of operation will allow it to be opened up to students from all departments
- **Toronto Institute of Advanced Manufacturing (2015)** — This multidisciplinary institute will expedite the research and development of advanced manufacturing technologies by creating a multi-departmental network focused on sharing knowledge, ideas and resources
- **Nanomaterials for Energy (2014)** — A three-day international symposium held as part of the Connaught Global Challenge program, this initiative brought together industry partners, leading researchers in sustainable energy, and more than 300 graduate students to participate in talks, poster sessions and networking events
- **Institute for Research on Exposomics Based Assessment (IREBA) (2013)** — This multi-disciplinary research collaboration between our Faculty and the Dalla Lana School of Public Health studied interactions between the human genome and cumulative environmental exposure, believed to be the underlying cause of many chronic diseases

6.7.6 Engineering Instructional Innovation Program (EIIP)

We allocate part of the DSF to the Engineering Instructional Innovation Program (EIIP), which supports the development of teaching approaches and a strong curriculum. The following EIIP initiatives were funded in 2014–2015, bringing the total number to 11:

- **Parallel Classrooms** — We renovated two classrooms, in the University of Toronto Institute for Aerospace Studies and in Mechanical & Industrial Engineering, to provide leading-edge tools and audiovisual equipment that enable students to participate in lectures delivered from either location. We will also develop a pilot graduate course designed specifically for the parallel classrooms
- **Re-engineering Mathematics Education** — This initiative will improve engineering education and re-energize engineering mathematics instruction across the undergraduate curriculum through innovative teaching methods and ongoing research
- **Enhancing Instruction in Thermodynamics** — We awarded funding for curriculum development work which will better connect theory with practice in thermodynamics courses

Previously-funded EIIP initiatives include the development of collaboration competencies in chemical engineering technical courses using team-based learning, and the redesign of the first-year materials program to improve the student experience through the creation of several types of reusable learning objects.

6.8 Challenges and Opportunities

The rising proportion of international undergraduates (now at 27.9 per cent across all years and academic areas) has had a positive effect not only on enriching our diverse environment, but also on funds raised through tuition. This has been particularly important in light of provincial limits on domestic tuition and reductions in the size of provincial grants received for each domestic student. International undergraduate tuition accounts for 55 per cent of undergraduate enrolment tuition revenue and 42 per cent of overall undergraduate revenue.

A healthy balance of domestic students and international students from a diverse set of countries not only enriches our programs, but also protects against regulatory or geopolitical changes that could affect the number of admissions we are able to offer to students in any one jurisdiction. We continue our strategic recruitment efforts domestically and in emerging markets, including the Middle East and Latin America, to achieve these goals. We also maintain a \$20-million unencumbered operating reserve at the decanal level to mitigate the immediate financial consequences of any unforeseen events.

We guarantee our graduate student funding through a combination of fellowships and assistantships for research and teaching. Provincial grants cover the bulk of these costs for domestic students, but costs for graduate students must be covered out of operating funds. We currently receive approximately 74 per cent more applications for MAsc degrees from international students than from domestic; for PhD students, the number of international applications is 2.8 times larger than the domestic number. In response, we have ramped up our efforts to recruit highly qualified students from Canada ([Section 4.2.2](#)). We have also successfully petitioned the Government of Ontario to provide some funding for international PhD students in certain circumstances. We will continue these efforts in the coming years to provide the best options to our students, while serving both Canada and the world.

7.0 Infrastructure

7.1 Physical Infrastructure: Challenges and Opportunities

A comprehensive Space Review undertaken in 2008–2009 determined that the quantity and quality of the physical space available at that time no longer met the needs of the Faculty. We have since completed major upgrades and renovations to research, teaching and student space. Most critically, we have started construction on the Centre for Engineering Innovation and Entrepreneurship (CEIE), which will open in 2017– 2018 ([Section 7.4](#)).

The Faculty occupies 64,524 net assignable square metres (NASMs) across 16 buildings. The availability of space, in particular lab space that meets current environmental health and safety regulations, remains an important issue although we anticipate that with new teaching and learning space becoming available in the CEIE, some current space can be retrofitted to expand the number of research labs and create multi-purpose teaching labs that can be used for many courses across the Faculty.

Table 7.1 Summary of Buildings and Total Net Assignable Square Metres (NASMs) Occupied by the Faculty of Applied Science & Engineering, 2015–2016

Building	Dean's Office	EngSci	UTIAS	ChemE	Civ/MinE	ECE	IBBME	MIE	MSE	Total NASMs
Aerospace (Downsview)			5,294							5,294
Bahen Centre	1,113	575		67		5,741		1,375		8,871
CCBR				667			889			1,556
Engineering Annex	237					946		91		1,274
Electrometal									149	149
Fields Institute	340									340
Galbraith	1,667				4,869	4,174				10,710
Haultain				198	110			639	721	1,668
MaRS West Tower						132	791	183		1,110
Mining							1,379	1,885	830	5,299
Mechanical Engineering	63							5,391		5,454
D.L. Pratt						1,330			1,491	2,821
Rosebrugh							814	2,096		2,910
Sandford Fleming	766		692		1,559	3,556				6,573
Wallberg	375			8,135		130			1,327	9,967
256 McCaul	528									528
Total	5,089	575	5,986	9,067	7,743	16,013	3,873	11,660	4,518	64,524

7.1.1 Post-Secondary Institutions Strategic Investment Fund (SIF)

In 2016, the Government of Canada launched the Post-Secondary Institutions Strategic Investment Fund (SIF), a program that will provide up to \$2 billion over the next three years to accelerate infrastructure projects at universities and colleges across Canada. Our Faculty actively participated in the University of Toronto's Lab Innovation for Toronto (LIFT) project, which sought support from this fund and from the Province of Ontario for improvements to research infrastructure.

In July 2016, we partnered with the federal and provincial governments to invest a total of \$31.6 million in renovations to 89 laboratory facilities across our Faculty over the next two years through the LIFT project. The work will benefit more than 330 U of T Engineering researchers, including professors, graduate students and undergraduate students. Some of the proposed improvements include:

- Renovations to lab space in the Galbraith, Sandford Fleming and the Engineering Annex buildings to further enhance collaboration among researchers, within and across disciplines. These renovations will also upgrade environmental controls to protect sensitive research equipment and experimental processes.
- Purchase of new laboratory equipment, including more fumehoods to increase the number of experiments that can be run simultaneously, for labs at the Institute of Biomaterials & Biomedical Engineering, the Department of Chemical Engineering & Applied Chemistry and the Department of Mechanical & Industrial Engineering.
- Expansion of the Sustainable Aviation Design Lab at the University of Toronto Institute for Aerospace Studies, enhancing the work of researchers who are reducing emissions and cutting fuel costs in the global aviation industry.

7.1.2 Dean's Infrastructure Improvement Fund (DIIF)

We created the Dean's Infrastructure Improvement Fund (DIIF) in 2016 to fund large-scale infrastructure improvements within our Faculty. These projects are brought forward by the sponsoring departments or institutes, who share the costs 50:50 with the Faculty.

The purpose of the DIIF is to upgrade outdated facilities and enhance teaching and research laboratory spaces in order to improve the student experience. Projects funded under the DIIF include:

- **Aiming for a Higher CALIBRE Experience** — An extension to the recent renovations of the IBBME teaching laboratory in the Lassonde Mining Building ([Section 7.3](#)), this project involves upgrading a number of systems, including electrical work, CO₂ gas lines, and eyewash stations.
- **Undergraduate Materials Science Labs** — These labs in the Wallberg Building are widely used in first-, second- and third-year courses. They will receive a complete renovation, including new fumehoods, lab benches and moveable furniture.
- **The Catapult Innovation Research Space** — This project will create a joint facility for the Institute of Biomaterials & Biomedical Engineering and the Department of Medical Imaging. It will upgrade a laboratory facility on the fourth floor of the Rosebrugh Building to Level 2 biosafety standards, which includes a new fumehood, new lab benches and electrical upgrades.
- **Lecture Theatres** — Air-conditioning systems will be added to three lecture theatres in the Mechanical Engineering Building to improve student comfort during lectures.

7.2 Research Infrastructure

We have created facilities and renovated existing ones in order to accelerate the world-leading research of our faculty members. Some highlights include:

- **Translational Biology & Engineering Program Lab (2015–2016)** — This facility occupies the 14th floor of the MaRS Discovery District West Tower. It includes offices, meeting facilities and an open-concept research lab encompassing 1,100 square metres, all of which serve 130 researchers focused on advanced techniques for studying cardiovascular disease and developing novel therapies.
- **Gas Turbine Combustion Research Lab (2014–2015)** — Constructed at the University of Toronto Institute for Aerospace Studies at Downsview, this facility uses

lasers to enable advanced analysis of the gas turbines used in aircraft and power generation plants. This research could inform the design of next-generation turbines that could improve efficiency or be adapted to run on renewable fuels, all without compromising performance or safety.

- **BioZone (2010–2014)** — This multidisciplinary research centre was funded in two phases by major investments from the Canada Foundation for Innovation (CFI) and the Ontario Ministry of Research and Innovation (MRI), as well as the Faculty of Applied Science & Engineering. Housed on the third and fourth floors of the Wallberg Building, the facility includes specialized equipment for the analysis of proteins, as well as bioreactors to house microbial cultures. BioZone brings together nine principal investigators and more than 90 graduate students, postdoctoral fellows and research associates who leverage their knowledge of biotechnology, genomics and microbial diversity to clean contaminated sites, create more sustainable materials and advance clean energy applications.
- **Ontario Centre for the Characterization of Advanced Materials (OCCAM) (2013–2016)** — An interdisciplinary collaboration between the departments of Chemical Engineering & Applied Chemistry and Materials Science & Engineering, OCCAM was made possible by strategic investments from CFI, MRI and Hitachi High-Technologies Canada. The \$20 million facility is housed in the Wallberg Building and includes a number of advanced electron microscopes and leading-edge spectroscopy equipment for imaging, analyzing and manipulating materials with nanometre-scale precision. Each year researchers from across the University and external industrial partners bring hundreds of samples to OCCAM for analysis, enabling them to find new solutions to a diverse range of critical problems in both research and industrial applications.
- **Centre for Industrial Application of Microcellular Plastics (CIAMP) (2012–2013)** — A state-of-the art, industry-scale research facility, CIAMP is an extension of the earlier Microcellular Plastics Manufacturing Laboratory (MPML). It includes extrusion lines and an injection molding machine, complete with an overhead crane. This equipment will offer insights into new uses for plastic foaming technologies with applications in many industries, including automotive, aircraft, packaging and more.

7.3 Teaching Laboratories and Educational Programming Infrastructure

Recent upgrades to classroom and laboratory facilities include:

- **Technology Enhanced Active Learning (TEAL) prototype room (2014)** — Unlike traditional classrooms where students are seated in rows, this prototype facility in the Sandford Fleming Building (SF 3201) contains hexagonal tables that encourage student collaboration. The tables can be quickly re-arranged to suit the needs of any course exercise or project and large wall-mounted screens ensure that students can view course material from any direction. The experiences of students and staff with this prototype facility have informed the design of TEAL rooms in the CEIE ([Section 7.4](#)).
- **Undergraduate computer facility (2013)** — We upgraded and relocated the undergraduate computer teaching facility from the Haultain Building to the Lassonde Mining Building, doubling the facility's capacity to 65 workstations and adding advanced audiovisual systems and computer hardware.
- **IBBME undergraduate teaching laboratory (2010–2012)** — This project combined two separate clusters of rooms on the third floor of the Lassonde Mining Building into a single 3,000-square-foot, state-of-the-art wet lab with a self-contained microscope room. Ceiling-mounted screens allow instructors to share video feeds from

their microscopes or offer visual instructions to students. The facility is used for biomedical engineering courses, as well as courses within many other departments.

7.4 Centre for Engineering Innovation & Entrepreneurship (CEIE)

The space audit conducted in the lead-up to the 2010 external review confirmed a shortage of teaching and research facilities. In 2012, the University of Toronto allocated Site 10 (the Simcoe Hall parking lot at 47-55 St. George Street) to the Faculty of Applied Science & Engineering. We immediately formed a project planning committee to begin defining our newest building, the Centre for Engineering Innovation & Entrepreneurship (CEIE). Today, construction on the building is well underway and its grand opening is set for 2017–2018.

Features of the CEIE will include:

- **500-seat Auditorium** — The podium in this space will be large enough to accommodate a vehicle and will include a stadium-style video wall. Rather than in rows, seats are arranged in groups of six with tables to facilitate group activities. An integrated data communications system will allow students to share content with their instructor and one another, and enable enhanced engagement and nimble transitions between lectures and group discussions.
- **Technology Enhanced Active Learning (TEAL) Rooms** — These spaces will offer an innovative approach to education that will facilitate collaboration and experiential learning, assisted by technology and strategic design. The rooms will contain moveable chairs and tables serviced by multiple flat-panel screens, which will allow for a variety of configurations.
- **Design, Fabrication & Prototype Facilities** — Rapid prototyping and light fabrication facilities will allow students to turn their ideas into working prototypes. Large, open-concept rooms will hold specialized equipment as well as 3D printers. The workspaces will be located near design/meet rooms so students can move quickly between the planning and production stages of projects.
- **Versatile Student Club Space** — The lower level will support the Faculty’s student clubs and teams with meeting rooms, storage, fabrication facilities and a flexible arena-like space, available for social events and building capstone projects. The lower level will also house a computer teaching lab and a visualization facility with immersive screen technology.
- **Entrepreneurship Development** — our existing Entrepreneurship Hatchery will provide space, equipment, mentoring and connections to support student ventures from concept to prototype. The CEIE will include space for day use that will act as a “home on campus” for mentors, alumni or industrial collaborators.
- **Multidisciplinary Collaboration, Global Engineering & Leadership Development** — The CEIE will provide new homes for many of the Faculty’s recently launched multidisciplinary research centres, including the Institute for Sustainable Energy (ISE), the U of T Institute for Multidisciplinary Design & Innovation (UT-IMDI), the Institute for Robotics & Mechatronics (IRM), the Institute for Water Innovation (IWI), the Centre for Global Engineering (CGEN) and the Institute for Leadership Education in Engineering (ILead).
- **Sustainability features** — The building is designed to draw daylight deep inside, reducing the need for artificial lighting, and will include systems for rainwater collection and retention and advanced air delivery.

The CEIE has been made possible by the visionary leadership of the project planning committee and by the generous support of the entire U of T Engineering community, including faculty members, staff, alumni, industry partners and students. We have secured more than \$80 million for the CEIE's construction, including \$26 million in philanthropic donations, a generous \$1-million donation from undergraduate students through the U of T Engineering Society, and an investment of \$15 million from the Government of Ontario.

8.0 Relationships, Contributions and Influence

U of T Engineering actively seeks strategic collaborations with other Faculties and divisions at the University as well as with peer institutions in Canada and around the world. These partnerships enrich our educational programs, accelerate our world-class research, and ensure that our innovations are translated to the marketplace or clinical setting. We are committed to strengthening our existing partnerships, including our network of more than 300 industry partners and more than 48,000 alumni worldwide, while developing partnerships through strategic initiatives such as joint teaching, exchanges, internships, research collaborations and policy discussions.

8.1 Relationships with U of T Faculties and Divisions

The University of Toronto – comprised of 20 Faculties and divisions and an even greater number of departments, colleges, centres and institutes – is among the top 50 institutions worldwide across all major international rankings. Collaborations between our Faculty and other groups within U of T include joint degree programs ([Sections 8.1.1](#) and [8.1.2](#)) and multidisciplinary research networks ([Section 8.1.3](#)). Current partners include the Faculties of Arts & Science, Forestry, Pharmacy, Information, Dentistry and Medicine, as well as the Dalla Lana School of Public Health, the Ontario Institute for Studies in Education (OISE), and the Rotman School of Management.

8.1.1 Collaboration in Undergraduate Programs

We provide our undergraduate students with opportunities to complement their degrees with non-technical elective courses offered by other Faculties within the University of Toronto. We also collaborate with other Faculties to provide technical and math offerings in our programs. In 2015, we developed an Interdivisional Teaching Agreement with the Faculty of Arts & Science to formalize this relationship ([Section 6.7.4](#)). This agreement enables our Faculties to work together more effectively and guarantees a number of non-technical elective course slots for engineering students.

Many of our minors and certificates are delivered in collaboration with other U of T Divisions, such as the Environmental Engineering minor (School of the Environment, Department of Geography & Planning, Faculty of Forestry) and the Engineering Business minor and certificate (Rotman School of Management). Some engineering students undertake additional courses to complete an Arts & Science minor program, such as economics, sociology, languages, cinema studies, philosophy, history and music, among others.

8.1.2 Collaboration in Graduate Programs

Our graduate collaborative programs formally recognize multidisciplinary expertise and enable our graduates to distinguish themselves in a competitive global environment. In addition to receiving a graduate degree conferred by their home program, students who complete a collaborative program receive a transcript notation indicating the additional specialization.

The Faculty administers two graduate collaborative programs:

- **Collaborative Program in Biomedical Engineering** — Offered by the Institute of Biomaterials & Biomedical Engineering, MSc, MASc and PhD students in this program can expand their expertise in a particular research field while gaining knowledge in biomedical engineering. Students are supervised or co-supervised by faculty with an appointment to IBBME, and come from the following participating units:
 - Faculty of Applied Science & Engineering (ChemE, ECE, MSE, MIE)
 - Faculty of Arts & Science (Chemistry and Physics)
 - Faculty of Dentistry
 - Faculty of Medicine (Biochemistry, Laboratory Medicine & Pathobiology, Medical Biophysics, Physiology, Institute of Medical Science, Rehabilitation Science Institute)
 - Leslie Dan Faculty of Pharmacy (Graduate Department of Pharmaceutical Sciences)
- **Collaborative Program in Engineering Education (EngEd)** — Created in 2014, this program enables MA, MASc and PhD students to join a community of scholars interested in research and learning at the nexus of education and engineering practice. A key component of the EngEd program is a weekly seminar course that explores the theoretical foundations, methods and topics related to engineering education research. Participants come from the following units:
 - Faculty of Applied Science & Engineering (ChemE, CivE, MIE)
 - Ontario Institute for Studies in Education (OISE) (Curriculum Studies and Teacher Development)

In addition to these programs, our students can choose to participate in a number of other collaborative programs led by other Faculties within the University:

- **Cardiovascular Sciences** (Faculty of Medicine) — Open to MASc, MHSc (Clinical Engineering) and PhD students in IBBME, and MASc and PhD students in ChemE.
- **Developmental Biology** (Faculty of Medicine) — Open to MASc, MHSc (Clinical Engineering) and PhD students in IBBME.
- **Environmental Studies** (Faculty of Arts & Science) — Open to MASc, MEng, PhD students in ChemE.
- **Genome Biology and Bioinformatics** (Faculty of Medicine) — Open to PhD students in ChemE and IBBME.
- **Global Health** (Dalla Lana School of Public Health) — Open to PhD students in ChemE.
- **Human Development** (Faculty of Medicine) — Open to PhD students in IBBME.
- **Knowledge Media Design** (Faculty of Information) — Open to MASc, MEng and PhD students in MIE.
- **Musculoskeletal Sciences** (Faculty of Medicine) — Open to MASc and PhD students in IBBME.
- **Neuroscience** (Faculty of Medicine) — Open to MASc, MHSc (Clinical Engineering) and PhD students in IBBME.
- **Optics** (Arts & Science) — Open to MASc students in ECE and MIE.
- **Resuscitation Sciences** (Faculty of Medicine) — Open to PhD and MHSc (Clinical Engineering) students in IBBME, and MASc, MEng, PhD students in MIE.

8.1.3 Collaborations in Research

Our faculty members and students address complex challenges that cut across traditional disciplines. Through our active partnerships with industry and collaborations with other Faculties and divisions across U of T, we ensure that our research and commercialization solutions are timely and relevant.

8.1.3.1 Multidisciplinary Research Centres, Institutes and Initiatives

Our Faculty leads 25 multidisciplinary research centres and institutes that unite professors from across the University. Examples include:

- **Institute for Sustainable Energy (ISE)** — Significantly expanded in 2013, ISE now brings together more than 50 principal investigators from U of T Engineering and the Faculty of Arts & Science to advance solutions in areas as diverse as wind turbines, solar power, fuel cells and hydroelectricity.
- **University of Toronto Transportation Research Institute (UTTRI)** — UTTRI was launched in 2014 as a cross-disciplinary institute that includes 25 principal investigators from U of T Engineering, the Faculty of Arts & Science, the Martin Prosperity Institute, the Munk School of Global Affairs, and the School of Public Policy and Governance. UTTRI studies and designs urban transport systems that are more efficient, cost-effective, equitable, sustainable and resilient.
- **Institute for Robotics and Mechatronics (IRM)** — Created in 2014, this IRM brings together researchers from U of T Engineering, the Faculty of Arts & Science and the Toronto Rehabilitation Institute. Its members study a wide range of robotics applications, from planetary exploration to the delivery of health care.
- **Southern Ontario Centre for Atmospheric Aerosol Research (SOCAAR)** — SOCAAR is focused on understanding the origins, characteristics, environmental impact, and human health consequences of atmospheric aerosols. Its principal investigators include researchers from U of T Engineering, the Faculty of Medicine, the Faculty of Arts & Science, the Dalla Lana School of Public Health, and Environment Canada.
- **Identity, Privacy and Security Initiative (IPSI)** — IPSI was created to generate sustainable solutions to identity integrity, privacy and security in the modern digital landscape. It includes researchers from U of T Engineering, the Faculty of Information, the Faculty of Law, the Dalla Lana School of Public Health, and the Faculty of Arts & Science.

The Dean's Strategic Fund (DSF) ([Section 6.7.5](#)) provides seed funding for projects that advance our *Academic Plan* goals. It has supported a number of multidisciplinary research collaborations, most recently:

- **EMHSeed** — This seed funding program supports collaborative research projects that bring together co-principal investigators from U of T Engineering, and either the Faculty of Medicine or the Toronto Academic Health Sciences Network. Eleven projects were funded in its first year.
- **Food & Nutrition Security Engineering Initiative (FaNSEI)** — This initiative recognizes that food and nutrition are complex challenges that are often intertwined with other issues such as agricultural productivity, water availability, energy resources, food preservation, transport and storage. It brings together more than a dozen principal investigators from our Faculty, as well as the Faculty of Arts & Science and the Dalla

Lana School of Public Health.

- **Public Health Diagnostics Initiative (PHDi)** — This project creates low-cost, easy-to-use diagnostic systems to detect toxins, pathogens or pollutants in air, water and food. Collaborators include the Dalla Lana School of Public Health and the Canadian Centre for World Hunger Research.

DSF support is available for one year for one-time-only initiatives, or for up to three years for more comprehensive projects. By the completion of the funding period, the goal is for a project to become self-sustaining, either through generation of its own revenue or by being incorporated into the budget of participating units. The intent of the DSF is to encourage ideas that might otherwise not be implemented due to lack of startup funding. A DSF Advisory Committee reviews submissions and makes recommendations on the awards to be granted. Funded projects must prepare an annual report on progress against milestones, and for multi-year projects, progress is assessed prior to the release of any further funding.

8.1.3.2 Translational Biology and Engineering Program (TBEP)

The Translational Biology and Engineering Program (TBEP) was created in 2014 to focus on stem cell technologies, cellular and tissue engineering techniques, cell signaling, experimental platform development, and clinical research in heart regeneration. By building ever more life-like models of heart tissue in the lab, the team will be able to better understand the mechanisms by which heart disease progresses and develop therapies. Eventually, such lab-grown tissues may be implanted back into the body to repair damaged hearts.

TBEP involves principal investigators from the Faculties of Medicine and Dentistry, and from U of T Engineering (IBBME, MIE and ECE), including its scientific director. TBEP is part of the Ted Rogers Centre for Heart Research (TRCHR), a research centre made possible by a \$130-million donation from the Rogers family, bringing together The Hospital for Sick Children, the University Health Network, and the University of Toronto.

8.1.3.3 Medicine by Design (MbD)

Launched in July 2015 by the University of Toronto, Medicine by Design (MbD) focuses on research the convergence of physical and life sciences, engineering, mathematics and medicine to undertake transformative research in regenerative medicine and cell therapy. This research could lead to new therapies for diseases ranging from diabetes to cancer. The program is funded by a \$114-million grant — the largest research grant in U of T's history — from the federal government's Canada First Research Excellence Fund.

MbD was launched in July 2015 and is a collaboration between the Faculties of Applied Science & Engineering, Arts & Science, Medicine, and the Leslie Dan Faculty of Pharmacy, as well as a number of affiliated hospitals. It brings together more than 90 researchers and clinicians from disciplines that range from biochemistry to tissue engineering, and is focused on building a seamless regenerative medicine pipeline from fundamental discovery to clinical translation and commercialization.

Sixteen U of T Engineering professors participate in Medicine by Design, including its director, representing IBBME, MIE, ChemE, ECE and MSE.

8.2 Relationships with Industry and Other External Partners

We continue to establish and nurture a broad set of relationships on the local, regional, national and international levels in order to remain at the leading edge of global engineering education and research.

8.2.1 Industry Collaborations

We engage with more than 300 industry partners from across Canada and around the world, including multinationals such as Airbus, Apple and Manulife Financial, and Ontario companies such as St. Mary's Cement and Geosyntec Consultants. A full list of recent industry partners can be found on page 54 of [Appendix D](#).

Many of these partners collaborate with professors or institutes on research and may sponsor design projects through capstone courses or the University of Toronto Institute for Multidisciplinary Design & Innovation. They may also employ students directly through internships, hold recruitment fairs, deliver guest lectures in our Faculty, or provide philanthropic support.

In 2012, we created the position of Director, Corporate, Government & International Partnerships and in 2013, the position of Director, Foundation and Corporate Partnerships. Together, these directors identify areas where our partners' medium-to-long-term strategic priorities overlap with the expertise of our professors, facilitating a move from one-time, project-based collaborations to a more strategic approach that includes a suite of projects related to common areas. For example, building upon ongoing research collaboration in Engineering, the University of Toronto signed a major agreement in April 2016 with Huawei, a multinational telecommunications equipment and services company headquartered in Shenzhen, China. Under the agreement, the company will invest \$3 million in a number of research projects carried out by researchers in The Edward S. Rogers Sr. Department of Electrical & Computer Engineering and U of T's Department of Computer Science.

The University of Toronto's Innovations & Partnerships Office (IPO) also enables researchers to strengthen their relationships with industry. For example, IPO and our Faculty have partnered to organize industry visits that showcase our unique capabilities. In our self-study consultations, researchers noted that such activities are helpful, and must be highly targeted. There is also an opportunity to further improve IPO's intellectual property agreement process by streamlining the procedures, reducing the turnaround time, and developing clear timelines and milestones.

8.2.2 Alumni Partnerships

Our network of more than 48,000 alumni enrich the educational and research activities of our Faculty by delivering guest lectures, serving on advisory boards and mentoring students. The Engineering Alumni Association (EAA) Board has played a major role in identifying volunteer opportunities and making connections between students and alumni. Philanthropic contributions from our alumni support new research facilities, educational initiatives, co-curricular activities and improved infrastructure.

We have been making great efforts to develop, nurture and engage our global alumni network and to develop opportunities to strengthen the role that alumni play in mentorship, entrepreneurship and innovation.

Select alumni initiatives include:

- **Regional activities** — We encourage and support regional alumni chapters all over the world, and have strengthened our connections to alumni in the Asia-Pacific region. This has included multiple trips to the region by the Dean and other Faculty leaders. In the past year, we hosted more than 60 alumni events, including BizSkule speaker series and networking receptions in Canada, the U.S. and the Middle East. These events are designed to strengthen these alumni communities, and we have worked with U of T's central alumni office to expand activities in these regions. Another major development has been the establishment of EAA chapters in Hong Kong, Calgary and California's Silicon Valley. In our self-study consultations, alumni suggested more structure and support for regional leaders could help further nurture local chapters.
- **Volunteering** — Alumni assist in a number of volunteering activities, including the evaluation of the undergraduate admissions process as part of the Faculty's broad-based admissions initiative and mentoring students through The Entrepreneurship Hatchery, ILead or the Engineering Society. We continue to look for ways to partner alumni with on-campus groups to provide rich and meaningful volunteer opportunities for alumni, from co-supervising theses or capstone projects to assisting at outreach events and advising new startups. In our self-study consultations, alumni agreed with this approach, particularly as it relates to entrepreneurship.
- **Mentorship** — We have greatly increased participation in our Alumni Mentorship Program, which connects third- and fourth-year students with U of T Engineering alumni who work in the students' chosen field, doubling the number of face-to-face matches in the past five years. This was in part due to strategic partnerships with the You're Next Career Network, a student-run career development organization. New online tools have also been leveraged to enable students and mentors in different geographical locations to connect. During our self-study consultations, alumni expressed a desire for more mentorship opportunities.
- **Graduway** — Graduway is an online platform that integrates with a user's LinkedIn profile, facilitating communications with our vast geographic network of alumni. It also provides detailed information about alumni's current status, position and level of engagement. After successful beta-testing in Engineering Science (EngSci CONNECT) Graduway has been expanded to include CivE, MinE, ChemE and MIE alumni, with the goal of making it available to alumni in all of our programs.

8.2.3 Global Initiatives

Our Faculty is committed to providing students with experiences that enrich their understanding of complex global challenges. These experiences develop their cross-cultural fluency, which is crucial to working with partners of all backgrounds, disciplines and perspectives, anywhere in the world.

In 2009, we created the Centre for Global Engineering (CGEN), which runs a suite of research, curricular and co-curricular programs, including undergraduate and graduate-level courses, cross-disciplinary certificates and scholarship programs that fund research for both professional- and research-stream graduate students. These activities address global issues in sanitation, alternative energy, health and clean water, particularly in developing countries where solutions can have the greatest impact. Recent CGEN research projects include:

- **Reinvent the Toilet** — Since 2011, a CGEN-led team has been developing a solution for the 2.5 billion people who do not have access to safe sanitation. The project is a response to a challenge by the Bill & Melinda Gates Foundation to design a toilet that can disinfect human waste without connections to water, sewer or grid power at a cost of less than five U.S. cents per person per day. The team placed third at the first Reinvent the Toilet Fair in 2012 and has received continued support from the Gates Foundation to further refine and field test the prototype.
- **Mother’s Milk** — Growing out of the “Interdisciplinary Approach to Global Challenges” course, this project involves installing hospital-grade breast pumps and a CGEN-designed pasteurization system in factories that employ women in Bangladesh. The system allows breast milk to last longer without refrigeration and enables working women to continue breastfeeding instead of having to switch to baby formula. This in turn has a positive impact on infant nutrition.

Another way for students to develop global fluency is through international exchanges and Professional Experience Year (PEY) internships abroad. In 2015–2016, 89 U of T Engineering students participated in either course-based or summer research exchanges with institutions such as the National University of Singapore, Hong Kong University of Science & Technology and the University of Stuttgart. A further 79 were hired for PEY internships outside of Canada lasting a year or more.

U of T Engineering maintains partnerships with more than 30 institutions around the world, allowing us to facilitate student exchanges, establish research collaborations and create joint programs. Some examples include:

- **MIE International Capstone Course** — This course allows fourth-year mechanical and industrial engineering students to collaborate with peers at universities around the world on projects sponsored by industry partners. Students meet in person twice, once to determine the scope of the project, and a second time to present the results, communicating electronically throughout the year. Partner institutions include Peking University and Tsinghua University in Beijing, the National University of Singapore, and the University of California, Irvine.
- **Globex** — Hosted annually at Peking University, the Global Education Exchange (Globex) brings together students and faculty from 21 engineering schools around the world to exchange ideas about culture, technology and innovation through a series of summer courses. U of T Engineering became Globex’s first Canadian partner in 2013, through participation of the Department of Mechanical & Industrial Engineering (MIE).
- **International Partnerships** — Over the past few years, we have formalized a number of agreements with institutional partners around the world. These include memoranda of understanding to collaborate on research, facilitate exchanges and create dual programs where students from partner institutions can complete the final year of their undergraduate degrees at U of T Engineering and gain conditional acceptance into our MEng programs. The new agreements include institutions such as Centrale Supélec (France), Shanghai Jiao Tong University (China), South China University of Technology (China), Tianjin University (China) and Yonsei University (South Korea).

We have also actively engaged with programs that support student mobility, including:

- **Ciência sem Fronteiras (CsF)** (formerly Science Without Borders) — Funded by the Government of Brazil and private industry, CsF sends Brazilian students abroad to study science, technology, engineering and mathematics. U of T Engineering has welcomed

548 undergraduate students since 2012 through this program, which is now being phased out by the Government of Brazil.

- **International Foundation Scholars Program (IFP)** – IFP enables academically strong students who do not meet the University’s minimum English proficiency requirements to receive conditional offers of admission as non-degree students. Students in IFP complete an intensive, eight-month English-language program as well as Engineering Strategies & Practice and continue in their second year into the Core 8 program of their choice. Over the last five years, 168 students have joined our Faculty through this program.
- **MasterCard Foundation Scholars Program** – Funded by the MasterCard Foundation, this program provides talented young people from economically disadvantaged communities, particularly in sub-Saharan Africa, with access to quality and relevant education. In April 2013, U of T was selected as one of three Canadian institutions to participate in this program and will welcome 67 students over five years to study at either the Faculty of Art & Science or the Faculty of Applied Science & Engineering. Twenty-three of those students have joined our Faculty over the past two academic years.

8.2.4 Community Building

Located in the heart of Canada’s largest metropolitan centre, we leverage our urban setting to contribute to the life of our local community. Examples include:

- Local groups facing challenges frequently solicit projects in our design courses such as Praxis ([Section 3.3.1](#)). The most recent Praxis showcase included a new exhibit for the Royal Ontario Museum, an improved honey-bottling system for Toronto’s Urban Beekeepers Association, and a better writing tool to help children with reduced fine motor control for the Epilepsy Classroom at SickKids Hospital.
- CEIExSKAM, our 276-foot-long graffiti installation painted on the construction hoarding surrounding the site of the new Centre for Engineering Innovation & Entrepreneurship (CEIE), was featured as part of Scotiabank Nuit Blanche in October 2015. This all-night city-wide art festival attracted more than 5,000 visitors, many of whom learned more about our Faculty and the engineering profession.
- Since 2009, students and staff from U of T Engineering have operated the Sky Garden on the roof of the Galbraith Building. During the late summer and early fall, the garden typically generates more than 20 kg of food per week, much of which is donated to charities like the Scott Mission and the University of Toronto Student Union Food and Clothing Bank.

8.2.5 Relationships with External Government, Academic and Professional Organizations

U of T Engineering is a key player in the research and innovation policy landscape locally, nationally and internationally. We maintain strong relationships with external organizations, including governments, funding agencies and professional associations to help shape their mandates and goals, and to ensure that our voice is part of strategic discussions that will influence future decisions.

Recent examples include:

- We partnered with the University of Toronto’s Office of the Vice-President, Research & Innovation and the Ontario Council of University Research in 2015–2016 to successfully make the case to Ontario’s Ministry of Research, Innovation and Science to improve transparency in its review process for the Ontario Research Fund — Research Excellence program.
- In 2014, we met with several ministers and Tri-Council leadership, including Reza Moridi, Ontario Minister of Research and Innovation, to discuss entrepreneurial advances and research infrastructure across our Faculty.
- We worked with the Ontario Centres of Excellence (OCE) in 2013 to harmonize the applications process for OCE partnerships grants and allied NSERC Collaborative Research and Development submissions.

Advocacy has resulted in critical support from governments. For example, in the 2016 Ontario provincial budget, \$15 million was allocated to support the construction of our Centre for Engineering Innovation & Entrepreneurship (CEIE) ([Section 7.4](#)). This speaks to the strategic alignment of our goals with those of provincial policymakers.

We also work closely with professional organizations, such as the Engineering Institute of Canada, the Canadian Academy of Engineering, and the Canadian Society for Mechanical Engineering. Over the past several years, our professors have served as president of these groups, and each year our faculty members are honoured with fellowships or awards from their disciplinary societies.

We actively contribute our expertise on NSERC and other government agency panels, as well as on CEAB accreditation review teams. The faculty members who participate not only strengthen these organizations, but also gain valuable insight into how we can enhance our own programs and internal systems to align with the best practices they observe.

Each year, we partner with Engineers Canada, Professional Engineers Ontario and the Ontario Society of Professional Engineers on a number of initiatives that promote excellence in the engineering profession and enhance public understanding of its impact on society. These events include National Engineering Month and the Professional Engineering Awards Gala.

9.0 Diversity

Diversity in all forms is critical to engineering. Diverse perspectives and new ideas deepen the creative process, strengthen innovation and enrich the learning environment. It is our Faculty's responsibility to ensure that the diversity of the engineering profession reflects that of our society at large.

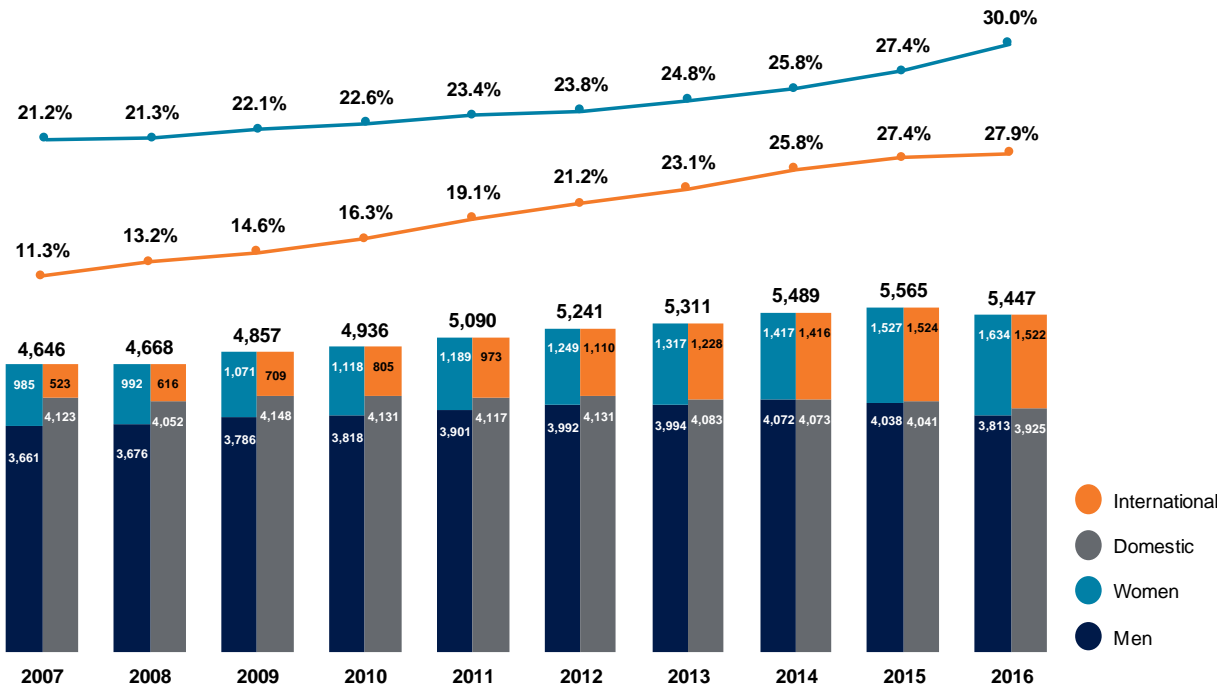
Women and Indigenous peoples are underrepresented within the Canadian engineering community. Currently, less than 12 per cent of practicing, licensed engineers in Canada are women. To help counter this, we have joined a broad national coalition that aims to increase the proportion of women to 30 per cent of all newly licensed engineers by 2030²⁰.

The significant progress our Faculty has made toward enhancing diversity, in all its forms, is highlighted below.

9.1 Students

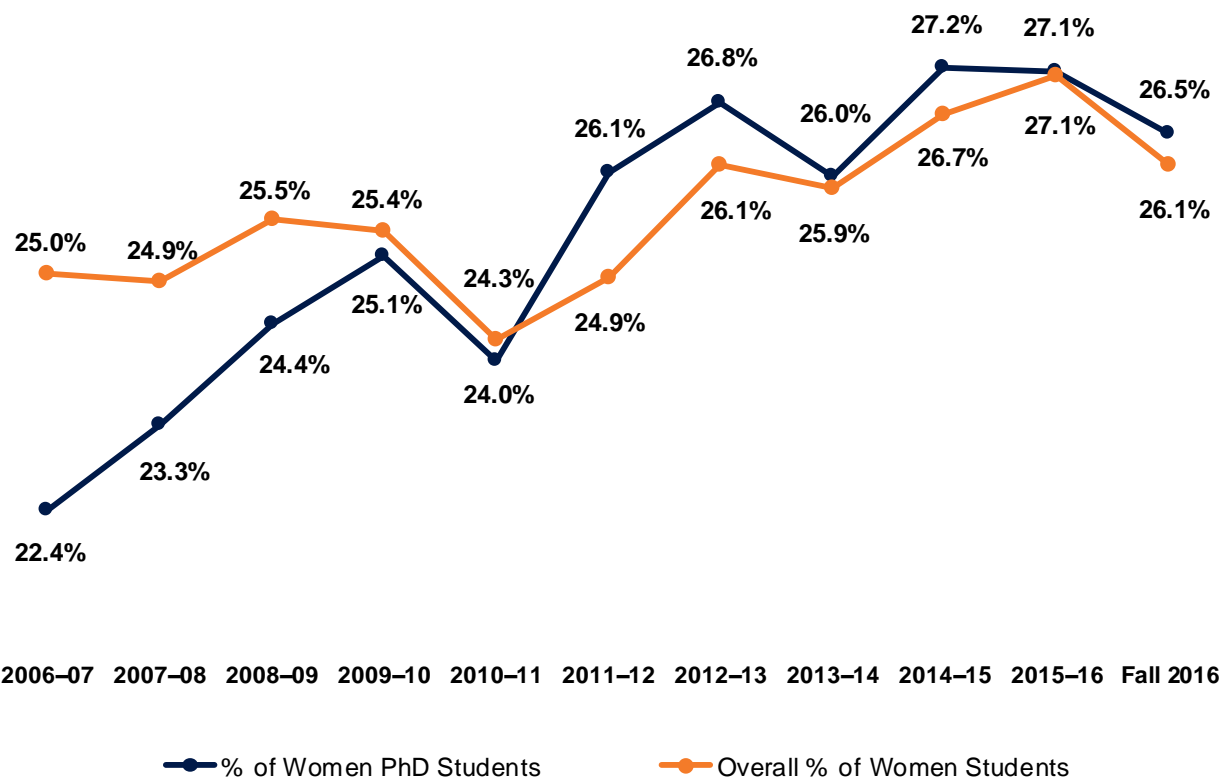
Our student body is becoming increasingly diverse. More than 25 per cent of our undergraduate students now come from outside of Canada, in line with the goals of our *Academic Plan*. The proportion of women in undergraduate programs is 30 per cent (Figure 9.1), a record high. Among graduate students, 33.6 per cent are from abroad and 26.1 per cent are women.

Figure 9.1 Undergraduate Enrolment with Proportion of Women and International Students, 2007 to 2016



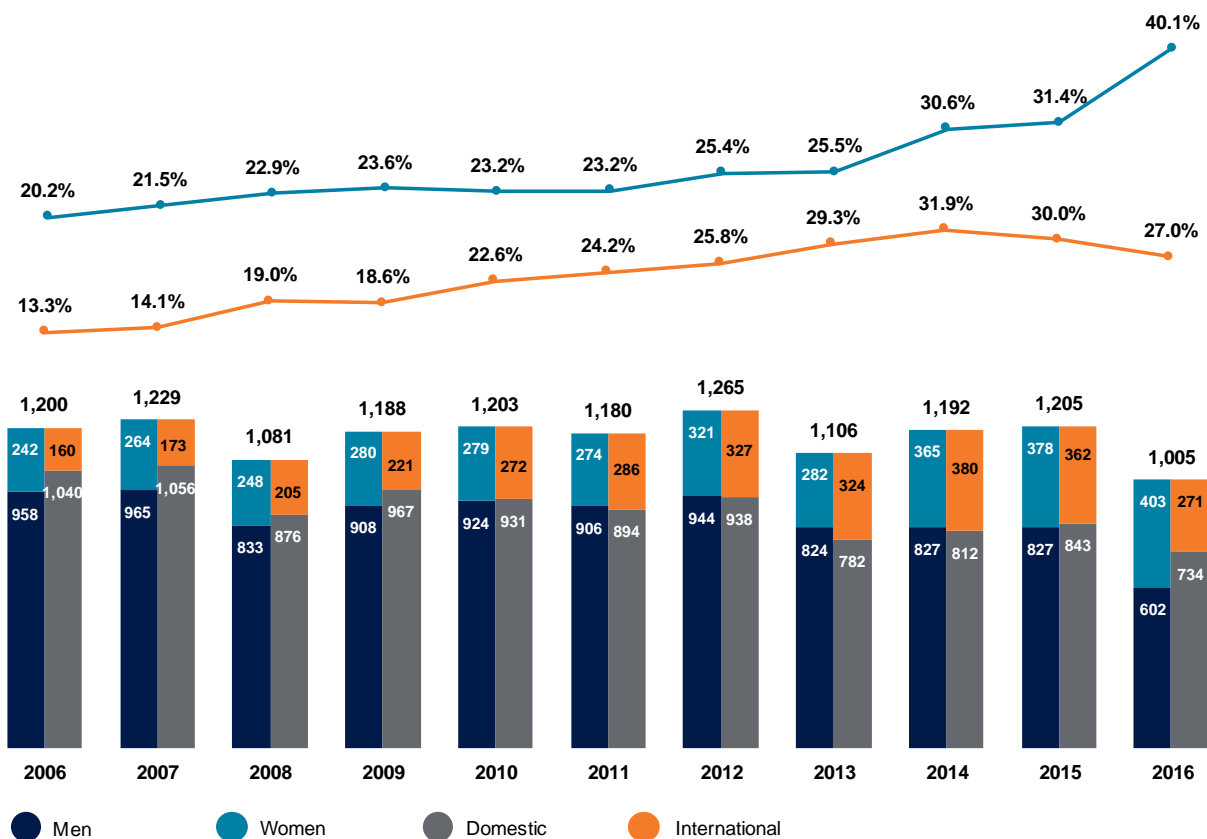
²⁰ Engineers Canada, <https://www.engineerscanada.ca/diversity/women-in-engineering>

Figure 9.2 Graduate Students by Degree Type and Gender with Percentage of Women Students, 2006–2007 to 2015–2016



These trends are more pronounced within the incoming undergraduate cohort. The proportion of incoming undergraduate women has been above 30 per cent over the last three years, reaching 40.1 per cent in the fall of 2016. The proportion of incoming international students has increased from 13.3 to 27.0 per cent over the last decade.

Figure 9.3 Incoming First-Year Undergraduates with Percentage of Women and International Students, 2006 to 2016



Support for diversity is a fundamental priority in our Faculty, and is woven throughout our activities. We work closely with female alumni and industry leaders to address our immediate goal of increasing diversity in the engineering profession, and to address systemic barriers in the long term. For example, since 2013, U of T Engineering has hosted the Women in Science and Engineering (WISE) national conference, which catalyzes change by providing a venue for students to connect with science and engineering leaders from all disciplines.

Gender diversity is also reflected in the engineering lecture series organized by our departments and institutes, and in the guest speakers we invite into engineering classrooms. We use various communications platforms — such as our alumni magazine *Skulematters*, Faculty website and social media feeds — to profile inspirational figures in science and engineering and to model the diversity we are working toward in our Faculty. In 2015, we supplemented these efforts with an integrated media campaign that combined proactive public relations, social media and online engagement to generate a national discussion on the role of diversity in science, technology and engineering, and to inspire young women (and their parents) across Canada to consider engineering as a vibrant and rewarding career option.

We engage with the wider community through high school classroom visits, alumni and industry engagement, applicant events, and workshops delivered by our professors and outreach and recruitment staff. Our goal is to inspire students of all backgrounds to learn more about the role of engineers in society and the positive impact they can make by joining the profession. This is

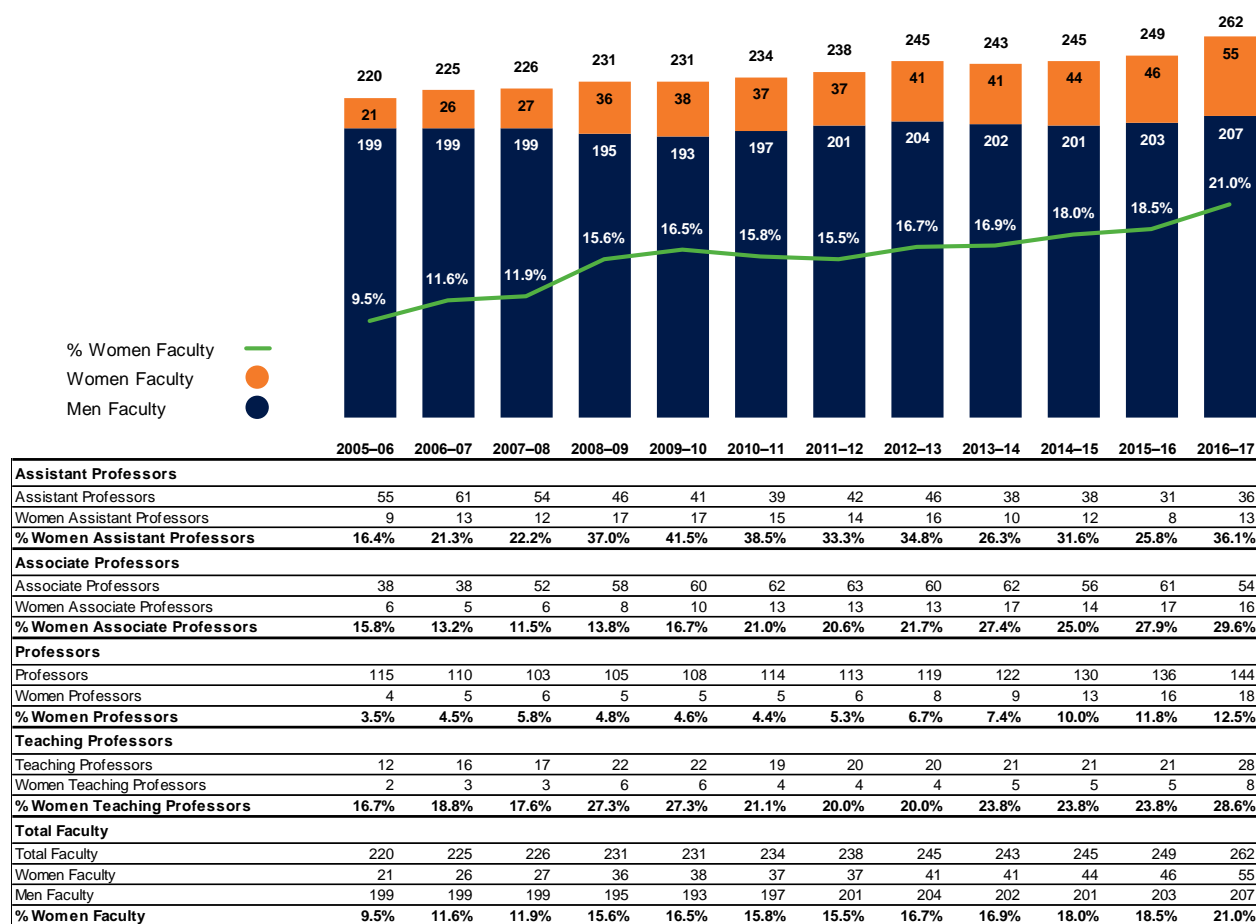
reinforced by the engineering education workshops we hold for elementary and high school teachers and counsellors, who will continue to spread the message of engineering and diversity in their classrooms.

Our efforts also include events such as the Young Women in Engineering Symposium (YWIES) and the Girls' Leadership in Engineering Experience (GLEE), which enable talented young women to meet with the Dean, program chairs, professors, alumni and current students to learn about their experiences studying and working in engineering. GLEE, a weekend-long program for students who have offers of admission to U of T Engineering, inspires students to learn more about the contributions they can make as engineers and the unique opportunities our Faculty offers. In 2015, 79 of the 87 students who participated in GLEE accepted their offers of admission.

9.2 Academic Staff and Leadership

Our Faculty attracts and recruits talented tenure- and teaching-stream faculty from around the world. The proportion of women professors at U of T Engineering, shown in [Figure 9.4](#), has increased to 21.0 per cent from 15.8 in 2010, and 9.5 per cent a decade ago. Of 14 recently-hired professors, nine are women. As they join us in the coming months, they will further enrich our Faculty with innovative cross-disciplinary research and educational initiatives.

Figure 9.4 Total Academic Staff with Proportion of Women, 2005–2006 to 2016–2017



In contrast to 2005–2006, when none of our academic leadership positions were occupied by women, our current Dean is a woman engineer, as are leaders of six of our multidisciplinary research centres and institutes, one department and one division. Our Faculty’s women engineers also hold senior leadership positions within the University, including our former Vice-Dean, Undergraduate who has been appointed the inaugural Vice-Provost, Innovations in Undergraduate Education and the President’s Senior Advisor on Science and Engineering Engagement.

9.3 Diversity: Selected Highlights

Engineering Outreach

We created the Engineering Outreach Office in 2009 to coordinate and support the delivery of outreach activities undertaken by students, staff and faculty. Today, the Engineering Outreach Office engages more than 9,000 pre-university students in science, technology, engineering and math (STEM) each year. We are committed to ensuring that all students, including women and girls, Indigenous youth and other underrepresented communities, have the opportunity to learn more about STEM and to understand the impact they can make as engineers.

Outreach programs include:

- The **Da Vinci Engineering Enrichment Program (DEEP) Summer Academy** attracts high school students from around the world to U of T Engineering, allowing them to experience a variety of engineering, technology, business and science topics, from biotechnology to robotics, through a series of week-long, hands-on courses.
- **Jr. DEEP and Girls' Jr. DEEP** are summer day camps and Saturday programs that extend the DEEP experience to students in grades three to eight.
- **Go Eng Girl and Go CODE Girl** allow girls in middle and high school to explore computer coding and engineering.
- **ENGage**, a collaboration between U of T's chapter of the National Society of Black Engineers and the Faculty of Applied Science & Engineering, highlights black role models, encourages literacy in science, technology, engineering and math (STEM), and promotes academic and social growth.

Our students also engage in outreach by partnering with national STEM education organizations. In 2016, a third-year MIE student was one of 12 selected from across Canada to facilitate the National Indigenous Youth in STEM (InSTEM) program run by Actua, a national STEM charity ([Section 3.8.2](#)). For the past five years, a team of graduate students has partnered with the Sandy Lake First Nation in northern Ontario to deliver a series of workshops through another national STEM charity, Let's Talk Science. These programs help students learn more about the potential of engineering, regardless of their geographic location.

Director of Engineering Pathways and Indigenous Partnerships

In 2016, we created the position of Director of Engineering Pathways and Indigenous Partnerships within the Dean's Office. Working with engineering staff and faculty members, the Director leads our response to Truth and Reconciliation Commission of Canada's call to reduce the educational gaps between Indigenous and non-Indigenous Canadians. The Director coordinates efforts across the Faculty to reach out to First Nations, Métis and Inuit communities, with the goal of increasing the rate of participation of Indigenous students in engineering, and facilitates greater integration of existing outreach, recruitment and retention initiatives, both within the Faculty and across the University, that affect Indigenous engineering students.

Positive Space

Our Faculty has had representation on the Positive Space Committee since the committee's inception in 1996. The committee promotes safe and inclusive spaces for LGBTQ students, staff, faculty, alumni and allies, which are marked by rainbow triangle stickers posted on doors and in offices across campus. At a 20th anniversary panel held in March 2016, a third-year undergraduate in Industrial Engineering spoke about the experience of being the first non-binary person to take on the role of Godiva's Crown, a spirit position within the Engineering Society that has historically been held by female students.

We also host a number of events that celebrate diversity and demonstrate our commitment to ensuring that all engineering space is positive space, including participation in Pink Shirt Day and Pride Month. In June 2014 at the World Pride festival in Toronto, U of T Engineering convened a first-of-its-kind panel discussion on LGBTQ experiences in the engineering profession. The panel, which was moderated by an alumnus and included eight members of the

U of T Engineering community representing students, faculty, staff and alumni, drew an audience of more than 100.

International Diversity Initiative in Engineering Education

Our Faculty joined more than 90 North American engineering schools in 2015 to lead a transformative movement to boost diversity in engineering by recruiting more women and underrepresented minorities in our student and faculty populations, and to foster a culture of inclusivity across our programs and the broader engineering profession.

New Godiva's Hymn Verses Celebrate Diversity in Engineering

Godiva's Hymn is a traditional song set to the tune of the *Battle Hymn of the Republic*. It is often performed by university engineering students across Canada.

In January 2016, U of T Engineering held the *Godiva's Hymn* contest. Organized by the Engineering Society, the contest challenged our community to create lyrics to this traditional song that better convey the diversity and vibrancy of the profession in the 21st century. The winning entry was:

*I came across a girl whose skin was glazed a purple hue,
Her aura proud, her spirit loud, her words were strong and true,
She led a group of hundreds who were chanting far and near,
And in my mind, I had no doubts — she led the engineers!*

Glossary

Faculty of Applied Science & Engineering

2016 Self-Study

AER	Aerospace Science and Engineering
BASc	Bachelor of Applied Science
BME	Biomedical Engineering
CEAB	Canadian Engineering Accreditation Board
CEIE	Centre for Engineering Innovation and Entrepreneurship
CFI	Canada Foundation for Innovation
CGEN	Centre for Global Engineering
CGPSS	Canadian Graduate and Professional Student Survey
CHE	Chemical Engineering and Applied Chemistry
CIHR	Canadian Institute of Health Research
CIV	Civil Engineering
COMP	Computer Engineering
CRC	Canada Research Chair
CRD	NSERC - Collaborative Research and Development
CREATE	NSERC – Collaborative Research and Training Experience
CTSI	Centre for Teaching Support and Innovation
DEEP	DaVinci Engineering Enrichment Program
DSF	Dean’s Strategic Fund
DUA	Division of University Advancement
EAA	Engineering Alumni Association
ECC	Engineering Career Centre
ECE	Electrical and Computer Engineering
ECP	Engineering Communication Program
EDU	Extra-Departmental Unit
EGEC	Engineering Graduate Education Committee
EIIP	Engineering Instructional Innovation Program
ELEC	Electrical Engineering
ELITE	Entrepreneurship, Leadership, Innovation and Technology in Engineering
Eng Sci	Engineering Science
Eng Soc	Engineering Society (undergraduate student government)
ERA	Early Researcher Award
ESIP	Engineering Summer Internship Program
ESP	Engineering Strategies and Practice
ESRRO	Engineering Student Recruitment and Retention Office
FTE	Full-Time Equivalent
GSU	Graduate Student Union

IBBME	Institute of Biomaterials and Biomedical Engineering
ICT	Information and Communication Technology
IEEE	Institute of Electrical and Electronics Engineers
Ilead	Institute for Leadership Education in Engineering
IND	Industrial Engineering
IPO	Innovation & Partnerships Office
MASc	Master of Applied Science
MB	Mining Building
MEC	Mechanical Engineering
MEng	Master of Engineering
MHSc	Master of Health Science
MIE	Mechanical and Industrial Engineering
MIN	Mineral Engineering
MSE	Materials Science and Engineering
NAE	National Academy of Engineering
NASM	Net Assignable Square Metres
NCDEAS	National Council of Deans of Engineering and Applied Science
NSERC	Natural Sciences and Engineering Research Council
NSSE	National Survey of Student Engagement
OAC	Ontario Academic Credit
OCGS	Ontario Council of Graduate Studies
OGS	Ontario Graduate Scholarship
ORF-RE	Ontario Research Fund – Research Excellence
P.Eng.	Professional Engineer
PEO	Professional Engineers Ontario
PERA	Professional Expense Reimbursement Allowance
PEY	Professional Experience Year
PhD	Doctor of Philosophy
PPIT	Prospective Professors in Training
PTR	Progress Through the Ranks
RA	Research Assistant
RC	Research Committee
SCS	School of Continuing Studies
SGS	School of Graduate Studies
SNG	NSERC - Strategic Network Grants
SSHRC	Social Sciences and Humanities Research Council of Canada
SSWG	Self-Study Working Group
TA	Teaching Assistant
THE	Times Higher Education
TMRC	Teaching Methods and Resources Committee
UCC	Undergraduate Curriculum Committee

UnERD	Undergraduate Engineering Research Day
U of T	University of Toronto
UTEK	University of Toronto Engineering Kompetition
UTIAS	University of Toronto Institute for Aerospace Studies
WISE	Women in Science and Engineering

Appendix A: 2010 Faculty Review Summary and Response

REVIEW SUMMARY

DIVISION/UNIT:	Faculty of Applied Science and Engineering
DATE:	May 5-6, 2010
COMMISSIONING OFFICER:	Vice-President and Provost
PROGRAMS OFFERED:	<i>Note: The academic undergraduate and graduate programs are reviewed separately.</i>
Undergraduate	BASc in Chemical Engineering, Civil Engineering, Mineral Engineering, Bioengineering, Environmental Engineering, Sustainable Energy, Electrical Engineering, Computer Engineering, Engineering Science, Aerospace Science, Biomedical Engineering, Electrical and Computer Engineering, Infrastructure Engineering, Nanotechnology, Engineering Physics, Engineering Mathematics, Statistics and Finance, Materials Science, Mechanical Engineering, Industrial Engineering
Graduate:	Aerospace Science and Engineering, MAsc, MEng, PhD Biomedical Engineering, MAsc, PhD Clinical Engineering, MHSc Chemical Engineering and Applied Chemistry, MAsc, MEng, PhD Civil Engineering, MAsc, MEng, PhD Electrical Engineering and Computer Engineering MAsc, MEng, PhD Materials Science and Engineering, MAsc, MEng, PhD Mechanical and Industrial Engineering, MAsc, MEng, PhD Advanced Design and Manufacturing, MEngDM
EXTERNAL REVIEWERS	
Canadian	Prof. Adel Sedra, Dean, Faculty of Engineering, University of Waterloo
International	Prof. Vijay Dhir, Dean, Henry Samueli School of Engineering and Applied Science, UCLA Prof. Steve Director, Provost and Senior Vice-President for Academic Affairs, Northeastern University
PREVIOUS REVIEW DATE:	2005

SUMMARY FINDINGS AND RECOMMENDATIONS OF PREVIOUS REVIEW:

Academic Programs:

- The curricula are very similar to those of other top North American universities with UofT students receiving more hands-on laboratory instruction.
- Laboratories and computing facilities are modern, well-equipped, and well-maintained.
- Curriculum content is kept up-to-date by the research-engaged faculty.
- The Faculty should continue to examine its curriculum from the perspective of broadening career opportunities for its graduates.
- Canadian engineering educators may need to become more involved with the licensing process for professional engineers.

Undergraduate programs:

- The new first year course for all students entitled "Engineering Strategies and Practice" is a most worthy undertaking.
- The undergraduate programs are successful in attracting and retaining top students, and in providing an excellent academic experience.
- The Faculty should give careful consideration to having the math and science departments provide instruction in basic math and sciences that are currently taught by Engineering faculty.
- The educational experience provided to students beyond the classroom is less rich than that offered by peer institutions. Student-led activities, such as student branches of professional engineering societies, national or international honorary societies, student-alumni programs, and exchange programs, should be encouraged.

Graduate programs

- Faculty members have substantial graduate teaching assignments and further increases in enrolment should be undertaken only after serious deliberation.
- Some students expressed concern that the PhD standards and processes for dissertation were not clearly conveyed, with uneven performance standards across the Faculty.

Faculty members:

- Most faculty members are active in research and graduate student supervision. The Faculty is fully competitive with comparable units at top 10 North American research universities.
- The teaching staff are providing good teaching experiences, being especially strong at integrating lecture, laboratory, and computer simulation as complementary instructional components.
- The Faculty has many excellent relationships with cognate units. Excellent opportunities for student learning are one important result.

Governance and long-term planning:

- The Faculty Council is ineffective. Leading members of the faculty do not participate, it is difficult to achieve a quorum for action, and the Council has not been influential in key matters of budgeting and space allocation.
- Critical matters affecting the whole Faculty relate to teaching assignments and the high student-faculty ratio. Another key issue is the balance to be struck between teaching and tenure-track faculty, and lecturers or other non-research appointees.
- More members of the Faculty need to be involved with advancement and outreach to industry, alumni, the professional accreditation bodies, and groups underrepresented in the faculty and student body. The DEEP Summer Academy for pre-college students is a specific program that should be expanded to encompass all science and engineering programs at the University of Toronto.

DOCUMENTATION PROVIDED TO REVIEWERS:

Terms of Reference
Faculty of Applied Science and Engineering Self Study, April 2010
Previous External Review Report
Towards 2030: A Third Century of Excellence at the U of T, Framework

CONSULTATION

The reviewers met with the Vice-President and Provost; Vice-Provost Academic Programs; Dean, Vice-Deans and Associate Deans of FASE; Chairs and Directors of academic units; junior and senior faculty members; administrative staff; undergraduate and graduate students; representatives from cognate units; members of the external community; and the Advisory committee for the Search for the Dean.

FINDINGS AND RECOMMENDATIONS - OVERALL ASSESSMENT AND SPECIFIC ISSUES

The reviewers were very impressed with the accomplishments of the Faculty and the substantial progress it has made under the leadership of Dean Amon. The Faculty has enhanced its diversity at all levels, created programs to increase the number of women students and faculty, expanded outreach activities to high schools, and revitalized the development operation. The Faculty's profile has been raised both nationally and internationally. The reviewers contend that the research enterprise in the Faculty is thriving and that funding, publication and citation rates are outstanding when judged against international standards. Excellent new faculty have been hired, and Engineering enjoys excellent collaborative relations with a number of other Faculties. The Faculty is making effective use of the new budget system of the University and appears to be financially strong.

Undergraduate Studies

The Faculty offers excellent undergraduate programs to well-qualified students. The entering average of the first year students in 2009 was 88.9% and has shown a steady increase over the past few years. The student body is culturally diverse and in the last four years there has been an increase in the percentage of female and international students. Currently 23.9 % of the first year students are females.

With the establishment of the Engineering Communication Program, the Faculty deserves to be congratulated for placing emphasis on communication skills that are so important for engineers to succeed in the profession and in academia. However, there are a few issues with the program that can be improved: The program is diffuse and there is no mechanism to assess its effectiveness, it is not consistent across disciplines, and students claim that they do not receive sufficient feedback on their written work in a timely manner. The Engineering Strategies and Practice course serves a very important educational function of exposing students to design process, problem solving, project management, team work, ethics, and communication.

The curriculum is quite constrained and demanding and students have to typically take five courses per term to graduate within four years. There is a need for revision of the curriculum to make it more flexible and to recognize the evolving nature of engineering. Participation in student clubs is limited because of the little free time the students have beyond their formal educational activities.

The Professional Experience Year Internship Program is an excellent program under which students carry out 12-16 month paid internships (including two summers) in industry nationally and internationally. Students value this program and more than half of them participate in it. Four month summer internships are also available to students under the Engineering Summer Internship Program, however, efforts should be made to invigorate the program to increase participation. Further, more opportunities for undergraduate student research experiences are encouraged.

The tenure and tenure-stream faculty teach three half courses per year on average, are engaged, and give importance to classroom and laboratory teaching. Although a mechanism for evaluation by students of faculty teaching is in place, students are not sure if their feedback is valued. Policies on course evaluation by students and evaluations of students may need review. There appears to be no process in place for training and evaluation of teaching assistants. Finally, academic counselling activities for both first-year and upper-year students need to be reviewed in the context of changing student needs.

Graduate Studies

The graduate program is in excellent shape. Over the past four years, the Faculty has expanded enrolment in graduate programs, and in particular the PhD and MEng. The Faculty attracts outstanding students from across Canada and abroad. The average number of research graduate students per faculty member stands at five which is reasonable, the 25% graduate proportion of the total student body is excellent in the Canadian context. Significant enhancements to the MEng program have been introduced including the Entrepreneurship, Leadership, Innovation and Technology in Engineering (ELITE), the Engineering and Public Policy (EPP) certificates and the Prospective Professors in Training program.

Although it is highly desirable and even essential that research graduate students receive full funding, the periods of funding commitment were viewed as rather long: two years for the MASc and a total of six years for doctoral students. Both numbers were viewed as somewhat excessive and this has had the opposite effect to that expected of funding graduate students, that is, it has resulted in lengthening the time-to-degree which is relatively high at U of T Engineering.

As is the case in many Canadian Universities but unlike the situation in U.S. schools, the Faculty expends substantial effort and resources on the MASc degree. In the reviewers' view, some of this effort should be directed toward the PhD program. The review team was impressed with the size and quality of the MEng program.

Even though an annual average of one graduate course per faculty member should result in a reasonable number of course offerings, the reviewers heard calls for increasing the number and scope of graduate courses. They also heard some criticism of the unevenness of the quality of graduate instruction and the need for a standardized method for evaluating graduate teaching.

Research

The Faculty's research enterprise is extensive, comprehensive, and of very high quality. Most of the faculty are active researchers engaged in leading-edge work, and have been very successful in attracting external funding. The publication and citation rates are outstanding as judged by international rankings.

The Faculty has recently established a number of interdisciplinary and multidisciplinary centres and institutes. The reviewers felt these initiatives should be encouraged, but cautioned however that to be successful each center must have a critical mass of interested faculty members and must have sufficient resources.

An important and laudable initiative that the Faculty has undertaken is the establishment in most Departments of the position of Associate Chair, Research. These academic administrators can no doubt play an important role in helping colleagues with their research proposals, setting up consortia to apply for large research and infrastructure grants, and promoting research opportunities in their Departments.

The Faculty needs to increase its industry-funded research and to facilitate the transfer of research results to the market place. The reviewers heard many remarks to the effect that the University's intellectual property policy is not sufficiently effective, and that the process of negotiating research contracts needs streamlining.

The Faculty is engaged in fruitful research collaborations with the Faculty of Medicine. Given U of T's extremely rich medical research environment, Engineering should strive to sustain and indeed expand these collaborations. Another research collaboration worthy of note is the recently established Cities Centre, which is a collaboration with the John H. Daniels Faculty of Architecture, Landscape and Design, the Faculty of Arts and Science and the School of Graduate Studies. Given U of T's geographical location at the centre of a great city, pursuing this research theme is most appropriate.

Organizational Structure and Resources

The Dean has made significant changes in the administrative structure of the Faculty that seem to have been well received by the faculty and staff and have improved the Faculty's operation. The Dean's open style of communication with the faculty is appreciated. Some did express concern over how well the University's budget model will work inside the Faculty. The reviewers suggest that the Dean's budget director hold regular meetings with the departmental budget administrators to facilitate the success of the new budget model.

Several department chairs and faculty members commented that space was an issue. Although the reviewers did not have sufficient time to study space issues, it appears to them that the total space holdings are reasonable.

ADMINISTRATIVE RESPONSE



UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Cristina Amon, Dean

September 2, 2010

Professor Cheryl Regehr
Vice-Provost, Academic Programs
University of Toronto
27 King's College Circle

Dear Cheryl

I write in response to the Report prepared by the external reviewers based on their visit to the Faculty on May 5 & 6, 2010. We are very pleased with the overall content of the review report and are grateful to the reviewers for their time, their keen observations and the thoughtful recommendations they have made. For ease of reading, a summary of each major issue identified in the review report is followed by the Faculty's administrative response.

1. The reviewers are positive about the Engineering Communication Program but suggest that improvements could be made with respect to structure and student feedback.

Administrative Response:

As stated by the reviewers, our Engineering Communications Program is a unique feature of our Faculty and provides excellent educational value for our undergraduate students. As we also indicated in the Self-Study, we agree that assessment of the communication program's effectiveness across our programs is required. We plan to address this through a recently initiated Faculty wide committee (the Graduate Attributes Committee) in the context of the development of Graduate Attributes/Degree Level Expectations for each of our programs. These will be consistent with new requirements for Engineering Accreditation in Canada and Quality Assurance in Ontario. Communications is identified as one of the 12 Graduate Attribute categories that will be developed, mapped to courses and linked to measurable criteria. Regular assessment of our students, along with their feedback, will be analyzed on a program wide basis for continuous improvement.

2. The undergraduate engineering program is described as "quite constrained and demanding" and the reviewers suggest that it is time to revise the curriculum to increase flexibility and to "recognize the evolving nature of engineering".

Administrative Response:

We recognize that the engineering curriculum is highly constrained and time-demanding which limits the time our students have to pursue co-curricular and extracurricular activities. We will be addressing this issue as part of the curriculum review taking place in the context of the development of Graduate Attributes listed above. In particular, curriculum content and student workload will be considered carefully.

3. The Summer Internship Program is described as excellent and the reviewers suggest that efforts should be made to encourage more students to become involved in the program. Further, more opportunities for undergraduate student research experiences are encouraged.

Administrative Response:

The Engineering Summer Internship Program (ESIP) is a recent initiative that builds upon our highly successful Professional Experience Year (PEY) program and its employer base, providing our second and third year students with preparation, direction and training for their careers in addition to placements. Student interest continues to be strong with 537 students (more than 55% of our 3rd year students) placed in internships through the PEY program and 289 students registering for ESIP in 2009. We note that the required \$100 fee for ESIP does result in a low number of students who report their placement to the Engineering Career Centre. We plan to continue to grow the ESIP placement opportunities through raising the awareness of it with students and employers. In addition, we plan to review the fee structure in a way that encourages the reporting of placements by students. We also note that a typical PEY placement includes employment for two summers and one academic year. Therefore, more than half of our students are engaged in meaningful engineering employment for at least two summers through a PEY internship.

While we have not regularly tracked the number of summer research undergraduate students, recently assessed data indicates that we have 292 students employed as summer research assistants across our Faculty in 2010. In addition, we had 10 undergraduate students participate in summer research internships in Singapore in 2009 and 7 students in 2010. We have actively encouraged summer research at the Faculty level since 2006, and launched an annual Undergraduate Engineering Summer Research Day (<http://unerd.skule.ca/>) event, in which undergraduate students make presentations (oral and poster) to students, faculty and alumni. This event included 72 student presentations in 2010 and attracts many more attendees including students (undergraduate and graduate) and faculty. Increasing opportunities for students to engage in research work over the summer will be provided across the Faculty. Exposure to research during the academic year happens at varying degrees through faculty members who bring aspects of their research to the classroom experience. A more active participation in research takes place among the large percentage (over 40%) of engineering students who undertake a research thesis in their final year.

4. Questions were raised about the methods for teaching evaluation, the impact of student evaluations on teaching at both the graduate and undergraduate levels, and the training of teaching assistants.

Administrative Response:

We recognize that the quality of instruction by our faculty and our teaching assistants is of critical importance to the education of our students, and we must continue to be dedicated to continuous improvement. We will improve our course evaluation system by working with the University's Course Evaluation Working Group to develop an effective and flexible centralized on-line system that takes advantage of the latest research to provide a useful bank of questions to draw upon. In addition, this past year we have worked with our student run Engineering

Society to provide undergraduate course evaluation information on the Engineering Society's website along with a section for comments and other course information.

With regards to graduate courses, historically each Department/Institute has developed its own evaluation process, spanning the use of the same undergraduate evaluation form to the use a specialized simplified form. During the fall term of the 2010-11 academic year, the Vice-Dean, Graduate Studies, in conjunction with Associate Chairs and Directors for Graduate Studies, will work to develop a standardized form and processing procedure for evaluating graduate courses. As stated above, the University is implementing an on-line course evaluation system which we will consider for use in graduate courses. We have tasked our Teaching Methods and Resources Committee to develop and implement initiatives to support improved teaching across the Faculty, including workshops on various aspects of teaching, sharing teaching best practices and implementing a teaching award for Teaching Assistants to recognize excellence. In the coming year, the Committee will examine improvements to the mandatory training of our teaching assistants and, in the context of a new course evaluation system, to improve the evaluation of teaching assistants.

5. The current time-to-degree for MASc and PhD degrees were considered high by the review team. Efforts should be made to reduce these numbers. In addition, the reviewers suggest that some of the substantial resources that are expended on the MASc degree as a terminal degree should be directed toward the PhD program.

Administrative Response:

We propose to deal with the time-to-degree issue by standardization of the funding commitment across the Faculty and attempt to reduce the length of the periods of guaranteed funding. In particular, we have been successful at reducing the guaranteed funding duration for the MASc to 20 months. The Faculty will explore ways in which we can address the reviewers' comment on the high time-to-degree for PhD students.

We have implemented a fast-track option that now permits successful MASc students to transfer to a PhD program within their first year of study. We will actively encourage the use of this improved promotion mechanism.

6. While research was viewed as outstanding, the reviewers encouraged the further development of industry collaboration, resulting in an increase of industry-funded research.

Administrative Response:

The Faculty has been working in a proactive manner with the Vice-President, Research Office to identify ways to improve the timely processing and coordination of research contracts. Our faculty members are responsible for a large percentage of the research contracts processed at the University and so the Faculty has made a commitment to provide the financial resources necessary for the University research contracts office to add an additional contracts officer. We will continue to monitor this issue with the goal to facilitate the administrative process which will result in an increase in the industry-funded research conducted in the Faculty.

7. While the Faculty has done well under the University of Toronto Budget Model, some concerns were raised about the application of the model at the departmental level. Ongoing analysis and assessment of the budget by the Dean and the Senior Academic Administrative Team is recommended.

Administrative Response:

Details of the Faculty's new budget allocation process were included in the Self-Study, however, we did not have the opportunity to engage in a detailed discussion on this topic during the short visit of the review team. The budget model implemented within the Faculty in 2010 is a hybrid of an RCM-based and an expense-based approach. While it takes some of the attributes of the University's new budget model, the Faculty's process has been modified substantially. The key differentiating feature and one that is not in keeping with the RCM philosophy, is the allocation of approximately \$135,000 per academic FTE to each department. This construct was designed to recognize the on-going expense of a tenured faculty member which does not change as quickly as fluctuations in student enrolment.

The Faculty's hybrid model gives the departments and institutes autonomy to manage their budget and provides incentives to increase revenues and contain costs. This has been achieved by drawing on the principles behind the University's model such as the transparency and attribution of revenues and costs.

The Dean will continue to conduct annual budget meetings with the Chair or Director of each academic unit and the Chief Administrative Officer of the Faculty. In these meetings we review each unit's budget position and the associated implications for achieving its goals. Budget managers have access to expert support from the CAO's Office, and training on the new budget allocation process is on-going. We also plan to review the model's effectiveness once it has been running for a few years to ensure that it continues to foster collaboration, and is driven by academic considerations along with prudent fiscal management.

We are grateful for the opportunity to address these issues raised by the review team and look forward to the continued development of the future directions of the Faculty of Applied Science and Engineering.

Sincerely



Cristina Amon

Appendix B: Academic Plan 2011–2016



UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Academic Plan

Faculty of Applied Science & Engineering
University of Toronto
2011 to 2016

Approved by Faculty Council October 6, 2011

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Executive Summary

The Faculty of Applied Science & Engineering's Academic Plan was developed through a highly consultative process involving strategic planning since autumn 2009 and was approved by Faculty Council on October 6, 2011. It renews our 2005 *Stepping Up* plan and affirms U of T Engineering's long-term goals, setting out the five-year measurable priorities that we will act upon. This Plan provides a framework for academic and administrative units to enhance collective contributions to our community and their disciplines. It allows us to measure, assess and adjust our activities, while maintaining a focus on our over-arching vision: to be a leader among the world's very best engineering schools – in its discovery, creation and transfer of knowledge and technology through teaching as well as research.

The Faculty has undertaken a number of strategic initiatives over the past six years that responded to the 2005 *Stepping Up* plan and External Review. The *Preamble* of this document provides a high-level overview of these key initiatives that assessed opportunities and challenges our Faculty addressed and provides the context of this Academic Plan.

In 2009-2010, within the framework of the University of Toronto's *Towards 2030* planning document, the Faculty prepared the Self-Study in accordance with the *Provostial Guidelines for Review of Academic Programs and Units*. Following intensive cross-Faculty discussions, the 2010 Self-Study represented a comprehensive overview, critical reflection and assessment of U of T Engineering's academic and administrative performance from 2005-2006 to 2009-2010. This document was provided to the External Reviewers who visited Engineering in May 2010. Their final report commended the Faculty on the quality and strength of our engineering education and research activities. It also identified many of the opportunities arising from the Self-Study, now addressed by this Academic Plan.

The Academic Planning Steering Committee with representatives from across the Faculty, in conjunction with academic and administrative leaders, developed an *Academic Planning Framework*. Engineering's departments, institutes and divisions, as well as administrative units, students and alumni, responded to the Framework, providing feedback upon which the Plan has been built. In addition, our academic and administrative units continue to develop their own plans, setting their sights on goals that support and contribute to the Faculty's goals, and that advance their research, educational and service priorities.

In 2007, U of T Engineering undertook an extensive positioning exercise that helped us understand how we perceive ourselves, how we communicate within and outside the Faculty, and how others perceive us. Building on that exercise, *Positioning* establishes our five-year goals to strengthen our messaging and enhance our communications abilities. Developing a strong communications complement, we will convey our excellence in engineering education and research programs, who we are, and how our alumni, faculty and students contribute to society through innovation and knowledge-sharing. We will clearly differentiate and articulate our messages, promoting our internationally renowned undergraduate and graduate programs and highlighting our educational and research missions. The Faculty aims to present a cohesive visual identity, strengthening our reputation and visibility across Canada and around the world.

Engineering excellence is a key component of our goal to create an environment that enables faculty, staff and student contributions, and where we build connections with our remarkable alumni. Our departments, institutes and divisions play a critical role through their contributions

to a *Culture of Excellence*. We plan to develop and share best practices, maximizing the skills of our administrative and technical staff who assist the Faculty to pursue this aim. This chapter outlines our priorities to increase gender, academic and international diversity, strengthen industrial partnerships and foster innovation, which enriches our educational and research pursuits. We will measure our progress towards our goals through annual reporting and building upon the opportunities arising from the cyclical reviews.

One of our Faculty's central missions is *Educating Future Engineers*. We will continue to strengthen our highly regarded undergraduate and graduate programs through curriculum reviews at both the Faculty and departmental levels. The Graduate Attributes Committee, in collaboration with departmental curriculum committees, will map Engineering's accreditation requirements with the University of Toronto Quality Assurance Process cyclical program reviews, measuring program quality and assessing graduating students' competencies.

We will continue to provide rigorous foundational learning in engineering principles and further enhance our high-quality educational programs. Across the Faculty, we will enrich students' learning experiences by integrating design, communication, entrepreneurship, leadership, global engineering and professional engineering competencies into Engineering's forward-looking curricula. We will also help students link their technical knowledge and engineering skills by providing opportunities for them to apply their learning in engineering settings. Our goal is to develop our students into lifelong learners and future global engineering leaders in the fields of their choosing.

To reach this goal, we must continue to attract the world's top applicants, as well as increase gender and international diversity within our student body. We must improve infrastructure, review our IT and computing facilities, support effective teaching, review grading practices, and provide effective knowledge transfer. We will enrich the MEng course offerings and instruction, work towards reducing dwell times for our research-stream graduate students, and balance the undergraduate-to-graduate enrolment.

Student Experience and *Educating Future Engineers* are naturally linked; together they support student learning and development as future global engineering leaders both inside and outside the classroom. Innovative teaching and engaged learning significantly impacts student experience. U of T Engineering will promote effective teaching practices to enhance learning, and bring in instructors from industry to share their perspectives and knowledge with undergraduate and MEng students. We anticipate that the curriculum review will result in enhanced opportunities for students to reflect on and integrate their learning, to participate in extra- and co-curricular activities, and to contribute to – and benefit from – the U of T community.

Our priorities include increasing undergraduate research opportunities, strengthening our summer internship and Professional Experience Year (PEY) programs, and better facilitating international exchanges. The Faculty and our academic units will also enhance graduate students' sense of connection and community. Effective communication between students and their home department, division or institute and the Faculty includes open dialogue, sharing timely information, and responding to educational and non-academic needs.

U of T Engineering faculty members are global research leaders whose pursuits advance the forefront in their fields. A significant number of our endeavours touch upon at least one of our four broad, cross-Faculty *Research Foci* that we have established in the Academic Plan: Bioengineering, Sustainability, Information and Communication Technology, and Enabling

Technologies. In addition, departments and institutes are also setting research priorities that contribute towards and support Engineering's research excellence. We will leverage our strengths to develop multi-disciplinary research programs, enable our researchers to make significant impacts, advance engineering knowledge and innovation, and promote the Faculty's profile.

We will increase government research funding and seek alternative financial support mechanisms through strengthened collaborative industrial partnerships. Our world-renowned researchers will support our new and emerging faculty, sharing their expertise with the future generations of Engineering innovators. Our plans include ways to broaden our reach, engaging with policy makers, granting agencies and all levels of government.

This Academic Plan establishes priorities to broaden *outreach*, encourage *collaboration*, and enhance Engineering's *influence*. Our activities will help us attract academically strong, diverse students and internationally renowned scholars. We plan to further develop meaningful collaborations across U of T Faculties, among peer engineering institutions and with a broad range of industrial partners and engineering organizations in order to contribute to the technological, economic, and social prosperity of the region and of Canada. As a main participant in the U of T Campaign, we will expand our culture of stewardship and reinforce ties with alumni, friends and donors whose contributions enable us to pursue our mutual vision of excellence.

U of T Engineering allocates three main resources – academic time, infrastructure and finances – to enable research and educational activities. Driven by our academic priorities, *Resource Allocation* outlines how we balance, maintain and strengthen our resources to pursue our academic plan. Engineering's resource goals include faculty and staff hiring, infrastructure renewal, philanthropic fundraising, as well as balancing academic workload. Our Faculty continues to focus on the significant need to improve our physical infrastructure. To this end, we will enhance research facilities; create teaching, design, student club and flexible lab spaces; and develop reliable and effective computing and study spaces for undergraduate and graduate students.

This Academic Plan was developed closely with students, faculty and staff, with input from alumni. Together we pursue excellence in engineering education, innovation, knowledge creation and transfer. To remain a leading-edge Faculty, we must continuously measure, assess and strengthen our progress towards our goals. This Plan represents the first phase during this exciting time of renewal.

Chapter 1: Preamble

The University of Toronto's (U of T) Faculty of Applied Science & Engineering, founded in 1873, is a preeminent research and teaching institution. U of T affirmed in *Towards 2030* to strengthen its position as one of the world's leading publicly assisted universities. Key University objectives include:

- Maintaining our research-intensive culture, the academic rigour of our educational offerings at all levels, and the excellence of faculty, staff and students across all three campuses and partner institutions;
- Enhancing our global reputation for the generation of new ideas and transformative discoveries;
- Engaging all categories of faculty with our teaching mission, and maintaining an emphasis on nurturing inquiring minds and building the creative and analytical capacity of our students at all levels;
- Reinforcing our strengths in research and scholarship through our enrolment and recruitment strategies, and maintaining our leadership position in graduate and secondary professional education;
- Providing an excellent experience for students, inside and outside our classrooms; and,
- Contributing substantially to the prosperity of the Greater Toronto area, Ontario and Canada.

Our vision is to continue to be a leader among the world's very best Engineering Schools in our discovery, creation and transfer of knowledge and technological innovation through teaching and research.

Concurrent to the Faculty's planning activities, the University developed the *University of Toronto Quality Assurance Process* (UTQAP). This cyclic review process endeavours to monitor the academic standards of undergraduate and graduate programs, to ensure ongoing plans for improvement. The Canadian Engineering Accreditation Board (CEAB) identified 12 graduate attributes to which we align the outcomes. We will map these graduate attributes to the UTQAP Degree Level Expectations. These reviews, combined with our commitment to excellence in engineering education, ensure that our academic programs continue to strengthen and evolve.

Over the past five years, our rankings demonstrate a positive trajectory. Based on 2011 peers and publications and other external assessments, U of T Engineering is ranked the top program in Canada and among the very best in the world. We place first in all disciplines, according to the first-ever *QS (Quacquarelli Symonds) World University Rankings by Subject* in 2010. Being placed as one of the finest international engineering schools in the global rankings is an anticipated outcome of our success in approaching our goals, and reflects our main focus of supporting excellence in knowledge creation, discovery and engineering education.

Rankings highlight external perspectives on our Faculty. We are proud of our progressive environment that fosters excellence in engineering education through innovative teaching, cross-disciplinary learning and multidisciplinary and influential research. Our internationally renowned faculty, diverse and academically strong students, committed staff and vibrant alumni community all contribute to our reputation.

Since 2004, our initiatives, planning and consultations have helped us address goals identified in the Faculty's 2004-2010 academic plan, *Stepping Up*. Our strategic evolution and our collective efforts have prepared us for this time of renewal as we update our Academic Plan to guide us for the next five years.

As part of our pursuit of excellence as a highly regarded international engineering school, we continuously review our activities, define emerging areas and assess our progress towards our objectives. This aligns with the University's planning model that asks divisions to consider the budgetary impact of changes, and connect them with academic directions.

To draw on our collective wisdom, our reviews and reflections have included in-depth engagement with our faculty, staff, students, alumni and the broader University community. Together, our efforts represent our Faculty's extensive consultative and iterative processes, and draw upon cross-Faculty perspectives and input. The following initiatives form foundational understanding and build further support for our continued pursuit of excellence.

In 2007, we began our *Positioning Exercise*, a strategic process that has helped us articulate the core values that underlie all aspects of our Faculty. Consultations with more than 800 Faculty community members, leaders from peer institutions, and University senior administration identified how we perceive ourselves and how the outside world perceives us. This enabled us to consider how we can further strengthen our internal and external visibility and positioning.

The *Dean's Task Force on Globalization and Engineering* in 2008 considered how the Faculty's education and research missions include globalization trends and challenges. To further our goals in preparing graduates for a global workplace and to address and influence global challenges through research, we established the Centre for Global Engineering in 2009. The Centre also serves as the focal point to invigorate our global activities and to engage alumni, faculty and students to continue advancing Canada's innovation agenda nationally and around the world.

The *Engineering and Public Policy Task Force*, which included Faculty members and colleagues from the School of Public Policy and Governance, developed a mandate in 2008 to articulate, evaluate and develop concepts for programming in engineering and public policy at both undergraduate and graduate levels.

From May 2008 to June 2009, the *Outreach Task Force* examined Engineering's outreach programs, in particular those focused on pre-university outreach. The Task Force recommended that the Faculty encourages outreach programs that support our mission, complement student interests, and help us attract academically strong students to the Faculty from a broad diversity of constituencies. The success of these outreach programs is measured in three areas: student experience, recruitment, and community impact. The Engineering Student Outreach Office (ESOO) was created in autumn 2009 to develop and administer our core outreach programs.

The 2009 *Catalogue of Advancement Priorities* focuses on six primary areas: Student Experiences; Globalization; Bioengineering; Energy, Environment and Sustainability; Information and Communications Technology; and, Nanoengineering. These philanthropic priorities financially support the Faculty's research and educational goals and our infrastructure needs.

In 2008, we began a comprehensive *Divisional Space Review and Development of a Master Plan* that evaluated the quality and quantity of space within the Faculty, as well as determined

our current and projected space requirements. The review determined that our current physical space no longer meets our needs as a world leader in engineering research and education. The Faculty continues to address these deficiencies, and is preparing new infrastructure plans.

The *Dean's Task Force on Engineering Leadership Education* reviewed the advances made by the Engineering Leaders of Tomorrow program and developed strategic directions to prepare engineers to address increasingly complex global challenges. The Task Force identified the need for engineers who can balance the ambitions of their organizations with the limits of the planet, and who can mobilize others towards a common good. The final report recommended to Faculty Council the establishment of a Centre for Leadership Education in Engineering, approved in the spring of 2010.

We formally engaged administrative and technical staff in the academic planning process at the *Defining Administrative Excellence Workshop* in February 2010. Participants developed a strategic plan for administrative and technical functions, identified three levels where administrative staff collaborate for excellence, and defined four visions of excellence.

The inaugural *Engineering Faculty's Annual Report 2009: Performance Indicators* compared Faculty data from 2008-2009 with both the Faculty's own historical data from as far back as 2000, and data from peer institutions. This report set the milestones by which we measure our progress, and it supplied the foundation material upon which we reflected in our self-study. Our *2010 Annual Report* builds upon the previous Report, and highlights the Faculty's most recent initiatives. The Annual Reports demonstrate the Faculty's commitment to transparency, accountability and critical reflection on our progress over time.

The *Faculty of Applied Science & Engineering Self-Study* was prepared within the University's academic planning framework that requires a broad-based review, and a reflective report on our academic programs and units. In September 2009, Dean Cristina Amon established the Self-Study Working Group that, through broad and intensive dialogue across the Faculty and the University, critically reflected on our achievements and evolution since *Stepping Up*. This process drew upon our previous initiatives and our reporting in the 2009 Annual Report. Consultation groups included Faculty academic leaders, undergraduate and graduate students, administrative managers, Faculty Council standing committees, faculty, alumni and staff. The *Self-Study* identified our strengths, opportunities, and challenges.

In May 2010 the Faculty's external reviewers, commissioned by the Provost, met with University and Faculty leaders, staff, faculty, students and alumni. As a part of the University's cyclic unit reviews, the external reviewers assessed our undergraduate and graduate studies and experiences, research activities, and organizational structure and resources. The resulting External Review Report acknowledged our accomplishments and performance over the past five years. It also provided an overall assessment of our areas of strength and opportunity. The Faculty's Administrative Response was approved by the University's Committee on Academic Policy and Programs in September 2010.

Academic Planning

The Faculty of Applied Science & Engineering's academic planning process has relied heavily on a carefully constructed, iterative loop of assessment, consultation, reflection and planning. In autumn 2009, the Dean struck an Academic Planning Steering Committee (for 2009-2010) with representatives from our major constituencies:

Cristina Amon, Dean; Professor, MIE
Grant Allen, Vice-Dean, Undergraduate; Professor, ChemE
Erika Bailey, Director, Office of the Dean
Catherine Gagne, Chief Administrative Officer
Jason Grenier, Graduate Student, ECE
Greg Jamieson, Associate Professor, MIE; Curriculum Committee Chair
Wayne Lin, VP, Student Life, Engineering Society; Undergraduate Student, IndE
Brenda McCabe, Chair, CivE
Eugene Polistuk, Alumnus and Member, Dean's Advisory Board
Paul Santerre, Director, IBBME; Professor, Faculty of Dentistry
Ted Sargent, Associate Chair, Research; Professor, ECE

In consultation with Faculty leaders, the Steering Committee developed an Academic Planning Framework designed to elicit responses that reflect the Faculty's collective wisdom. It presented a list of focus questions in eight topic areas: Positioning; Culture of Excellence; Educating Future Engineers; Student Experience; Research Foci; Outreach, Collaboration and Influence; Resource Allocation; and Priorities, Weaknesses and Implications.

Between December 2009 and May 2010, academic and administrative units responded to the Framework questions and were encouraged to conduct cross-Faculty discussions during early stages of their parallel academic planning. Unit responses provided input on emerging themes of our most important foci, identified cross-Faculty synergies, and helped us consider how we will renew our strategic directions. Ultimately, the Framework provided Faculty-wide input that represents us as a community dedicated to the highest standards of engineering research, teaching and student experience.

Responses from departments and institutes to the Framework, formative material from the ongoing initiatives and reports, and our internal reflective processes through the cyclic reviews form the foundations of the Faculty's Academic Plan chapters. We developed the Plan's three core chapters through the summer of 2010, and built the remaining chapters through the 2010-2011 academic year.

This Plan is a result of broad and iterative consultations with the Faculty's central leadership, Chairs and Directors of academic units, Associate Chairs, the Faculty's governing committees, Faculty Council members, faculty, undergraduate and graduate students, staff members, alumni and University stakeholders.

This Academic Plan sets our academic and administrative directions within the University's strategic context for the next five years and aims to achieve our goals to continue strengthening our research-intensive culture, academic rigor, global reputation and visibility, enrolment, excellence in students experiences inside and outside the classroom, funding models and our internal and external collaboration, outreach and influence. It was approved by Faculty Council on October 6, 2011.

Chapter 2: Positioning

Introduction

Beginning in 2007, the Faculty of Applied Science & Engineering engaged in a highly consultative and comprehensive process to determine our positioning statement that uniquely places us among our peers, by identifying our brand promise, gaps in internal and external perceptions and aspirations. Through this activity, we sharpened and clarified the way we communicate our unique messages. Through a multi-year exercise involving a third-party branding firm, we led approximately 800 contact conversations that helped articulate the Faculty's vision, mission and key messages:

Vision

The Faculty of Applied Science & Engineering will be a leader among the world's very best Schools of Engineering in its discovery, creation and transfer of knowledge and technology through teaching and research.

Mission

- To discover and share knowledge with students by offering undergraduate, professional and graduate degree programs of the highest quality in an environment that provides immersion in world-class research and ensures a supportive student experience;
- To ensure our students are equipped with the leadership skills, communication skills and global awareness required by the engineering profession and by society in general;
- To create new knowledge and to contribute to society through advanced research, innovation and technology transfer; and,
- To realize an exemplary degree of citizenship and ethical behaviour among our faculty, staff, alumni and students.

Key Messages

The world's cultural and commercial convergence makes for an unprecedented richness in opportunity for Engineering.

The University of Toronto's Faculty of Applied Science & Engineering pursues this important opportunity by enabling our community of today's students and tomorrow's Engineering leaders to build a stronger global society.

We prepare well-rounded future world leaders who flourish in the breadth and depth of our rigorous, inter-Faculty academic and co- and extra-curricular Engineering programs.

Our longstanding tradition and spirit of innovation in Engineering leads us to excel at integrating creative techniques and ideas from dynamic, evolving sources to catalyze meaningful new research directions that address the needs for building a stronger global community.

During this exercise, and through follow-up discussions and input from internal and external stakeholders, we have identified opportunities to further develop these statements and deliver a concise message that sets us apart. The Faculty does a great deal well; our innovative staff, researchers and educators generate great stories and bold ideas. We offer undergraduate and graduate programs that empower students to achieve academic excellence, technological savvy, a sense of global and societal responsibility, and superior leadership capability. An effective marketing and communications strategy cannot focus on everything, or we will end up focusing on nothing. A revitalized positioning must:

- Set us apart from our peers;
- Clearly identify our core, cross-disciplinary strengths;
- Capture the attention of academically strong prospective students and attract top scholars and staff;
- Establish a strong platform for relevant news stories;
- Align with the Academic Plan's long-range goals; and,
- Define a clear and cogent set of messages that says what makes us unique in the engineering higher education marketplace and why it matters.

This positioning must be based on our core values and competencies and needs to be backed up by the Faculty's abilities and track record.

We also need to analyze the competitive marketplace. What are our top competitors saying about themselves and how are they saying it? As well, we need to speak to our primary audience(s), using the words and media that resonate with them.

The Faculty identified a number of Canadian and international peer and aspirational institutions with which we collaborate and compete. The University of Waterloo, University of Alberta, University of British Columbia and McGill University were ranked as our top national peers. Internationally, Massachusetts Institute of Technology, University of California – Berkeley, University of Michigan and Georgia Tech are identified both as peers and as aspirational engineering schools. We also identified discipline-specific institutions or departments with which we aspire to compete.

We must get our message out to diverse audiences, considering the unique media of choice, language (e.g., level of diction, vocabulary) and frequency of contact of each. Our target audiences include:

- University of Toronto leadership, faculty and staff
- Current and prospective students
- Influencers such as parents, spouses and high school guidance counsellors
- Colleagues at peer post-secondary institutions
- Alumni and donors
- Industry and corporate partners
- Funding agencies and government
- Traditional print and broadcast media
- Bloggers and other social media leaders

Universities, including many of our peers, are growing adept at using social media, blogging, mobile devices and emerging technology to communicate effectively and immediately across audiences. Concurrently, traditional media have re-imagined themselves, yet the demands of more traditional publications and delivery tools do not slacken. It is within this context that the Faculty will move forward in our positioning and communications strategies to support the Academic Plan.

Goals

The following goals will guide our Faculty's strategic communications activities for the next five years.

1. Deliver a plan that articulates our communication goals, maintains consistency of our branding and products, keeps on top of markets and clearly outlines methods so that we can remain competitive and set the Faculty apart.
2. Strengthen the Faculty's key messages and customize them for target audiences.
3. Establish the Faculty as the go-to resource for media looking for comments and engineering expertise on breaking news issues.
4. Continue to increase the quality of our storytelling, journalism and communications processes and tools to make our practices best-in-class and in pace with emerging technologies and their uses by our target audiences.
5. Remain flexible to changing media and technologies, nurture blogger and social media relationships, and build relationships and communications with traditional media.
6. Increase the Faculty's presence, visibility and reputation on modern social media platforms.

Chapter 3: Culture of Excellence

Introduction

A culture of excellence is a key component of the vision of the Faculty of Applied Science & Engineering. We strive to be a leader among the world's very best Schools of Engineering in our discovery, creation and transfer of knowledge and technology through teaching and research. Our departments, divisions, institutes and extra-departmental units play a vital part of this culture of excellence, making unique contributions in their fields and to our community.

The Faculty aims to attract the top, diverse faculty, staff, and students and thereby conduct ground-breaking, leading-edge research and provide exceptional engineering education in Canada and the world. Diversity – whether gender, academic or international – helps us achieve excellence in an enriched learning and innovative environment. It is a place where the entire community aspires towards excellence in the outcomes of all our activities: research, innovation, technology transfer, knowledge generation and engineering education.

Our overarching vision, our students, faculty and staff, systems and processes, and our resource management enable us to strengthen the foundations of our *Culture of Excellence*. Together, we contribute toward U of T Engineering's educational and research mission, and create an environment in which students, faculty and staff can flourish.

Spearheading our research and teaching excellence are our internationally renowned faculty members. Leading-edge research, as further articulated in the chapter on *Research Foci*, redefines a field, creates new engineering devices or techniques, and influences policy, innovation and industry. Our faculty members advance their research to benefit society, to support Canada's research agenda and to answer the world's most pressing concerns.

Teaching excellence links to research excellence through our professors, instructors and teaching assistants. We strive to impart knowledge and a strong engineering foundation, develop innovative courses and delivery methods, and contribute to Engineering's learning environment.

The chapters on *Educating Future Engineers* and *Student Experience* both focus on the ways we plan to strengthen the educational environment for our students, building on our excellence in undergraduate education and enriching student experiences. Undergraduate students develop their professional engineering skills during international exchanges, professional experiences during summer or Professional Experience Year placements, in research opportunities, and by being involved in co-curricular and extra-curricular activities. Our graduate students contribute towards the Faculty's research and learning mission as emerging researchers, as teaching assistants and as aspiring engineering professionals and leaders.

University of Toronto Engineering alumni further build upon their education as life-long learners who apply fundamental engineering skills, professional outcomes and an engineering knowledge base as they become members of academic, professional and global communities. In turn, our alumni give back, supporting their alma mater through their advisory, volunteer and philanthropic contributions.

Enabling the Faculty's priorities and activities, our technical and administrative staff are innovative professionals who are agents of change, and who collaborate to provide a stable, reliable and efficient environment for the Faculty to achieve its goals. Their contributions create a positive work environment, developing strong collaborations throughout functions and across

the Faculty. They provide high-quality service, communication and the necessary technology, knowledge and support to community members.

The systems we establish and use serve as a framework to support our Faculty's endeavours. These systems include governance, cyclical program reviews and quality assurance processes; evaluations, surveys and reporting activities; a budgetary model; strategic hiring, recruitment, training and performance review processes; and the ways in which we acknowledge, communicate and celebrate our successes.

The Annual Reports and this Academic Plan work in tandem to measure our progress towards our goals. These tools help us to critically reflect on what we do, to identify ways in which we can build on our strengths and create new opportunities, and to adjust our direction when necessary.

How well the Faculty functions and fulfils our vision and mission is critically dependant on sound resource management. *Resource Allocation* details how we enable our culture of excellence. Our academic and administrative efforts, budget model, technological resources and our infrastructure all allow us to innovate, share knowledge, work, learn and teach.

Goals

Culture of Excellence goals are applicable across all constituencies, referencing the excellence of our student and faculty members in dedicated chapters, while giving emphasis here on the goals for staff and alumni. The following broad, cross-Faculty goals aim to strengthen our culture of excellence.

1. Maintain a strong Faculty vision for excellence in engineering education and research.
2. Measure our progress in achieving our mission and vision.
3. Increase diversity, focusing on gender diversity among students and faculty.
4. Support the development of faculty members as outstanding engineering educators and researchers.
5. Support our students by strategic efforts to build upon educational, extra- and co-curricular experiences.
6. Maximize the skills of our staff members and create opportunities to strengthen their performance and develop them as integral contributors to the Faculty's mission.
7. Increase staff retention and enhance succession planning within the Faculty.
8. Build upon alumni involvement with the Faculty to share their world-based expertise and perspectives, to strengthen our reputation and to inspire the next generation of U of T engineers towards innovation and excellence.
9. Enhance governance processes, cyclical reviews and quality assurance processes.
10. Strengthen communications both internally and externally.
11. Continue to acknowledge the accomplishments of our students, faculty and administrative staff.

12. Establish and maintain a strong resource base to enhance teaching and design facilities; to provide reliable, accessible, effective computing services and study spaces; to standardize graduate student funding; and to increase research funding.

Chapter 4: Educating Future Engineers

Introduction

The Faculty of Applied Science & Engineering at the University of Toronto currently offers nine fully accredited, highly rated and internationally competitive undergraduate programs and two undergraduate degrees: the Bachelor of Applied Science (BASc) and the Bachelor of Applied Science in Engineering Science. These programs attract academically strong, culturally diverse students from across Canada and around the world.

Since 2000, we have enhanced our undergraduate curricula to integrate collaborative teamwork, design, communication, leadership and other professional competencies. Our undergraduate curricula have also been evolving to offer Faculty-wide minors and certificates that allow students to tailor their programs to their unique interests. We continue to build upon our superior curricula and seek innovative approaches to further strengthen our course delivery, teaching and learning methods.

The Faculty offers seven highly sought-out graduate programs and four graduate degrees: Doctor of Philosophy (PhD), Master of Applied Science (MASc), Master of Engineering (MEng) and Master of Clinical Engineering MHSce. The quality of our graduate programs is unsurpassed among Canadian schools and further contributes to our position among the world's best engineering schools. Our graduate programs include highly regarded Faculty-wide certificate courses that link technical subjects to engineering practice and collaborative programs that encompass cross-disciplinary interests. We attract excellent graduate students, provide them with outstanding course programming, and offer them opportunities to advance the frontiers of engineering knowledge by conducting leading-edge research with professors who are the top experts in their fields. We seek to produce graduates who are exceptionally well-prepared for roles as academic faculty, researchers, leading engineering practitioners in industry, and business leaders.

Our constant pursuit of engineering education excellence aligns with requirements that have been defined by the University, the Province, and the Canadian Engineering Accreditation Board (CEAB). Ontario's provincial Quality Assurance Framework (QAF) requires that we articulate our Undergraduate and Graduate Degree Level Expectations (UDLEs and GDLEs). The *University of Toronto Quality Assurance Process (UTQAP)* for academic programs, developed in response to the provincial QAF, supports our collective goal of "being an internationally significant research university, with undergraduate, graduate and professional programs of excellent quality." CEAB moved towards an outcome-based approach to undergraduate program reviews and will require that by 2014, we monitor and improve our programs based on our students' success in meeting criteria within 12 categories of Graduate Attributes.

Educating Future Engineers and *Student Experience* are inextricably linked. Our students' time at the Faculty primarily focuses on academic curriculum requirements. How our students learn, their co- and extra-curricular activities, and their engagement beyond classroom walls play a vital part in their ability to succeed as students and as our alumni. This chapter's priorities focus on the in-class and co-curricular learning experiences that help our students achieve academic outcomes at the time of their graduation as future engineers in whatever field they choose to pursue.

For the purposes of the Faculty's Academic Plan, this chapter, *Educating Future Engineers*, elucidates the curriculum-based goals including infrastructure, technology and teaching. The

following chapter, *Student Experience*, will include other important aspects including participation in sports, clubs, arts, research, international opportunities, and summer and professional work experiences.

Goals

In parallel with our aim to develop and provide superior engineering education, excellence in teaching and innovative course delivery, the Faculty's Self-Study and External Review identified opportunities to address and further our goals for Educating Future Engineers. The following goals will guide our Faculty's activities pertaining to undergraduate and graduate student learning for the next five years.

1. Maintain and strengthen our high-quality education through continued review and assessment of our programs and curricula for currency, vision and relevance. Establish desired learning outcomes for graduates and undergraduate students to ensure they are well prepared as future engineers. Evolve our cyclic reviews and plan for continuous quality assessment within the new UTQAP and CEAB Graduate Attribute systems.
2. Further integrate professional competencies, such as global engineering, entrepreneurship, leadership and communication into undergraduate and graduate curricula. Define, assess and measure our programs and curricula successes through the UTQAP UDLEs, GDLEs and cyclic reviews and through the CEAB Graduate Attributes.
3. Enrich the quality of undergraduate academic experience by increasing the flexibility in undergraduate curriculum, continuing to develop progressive opportunities for students to pursue their professional interests, and integrating professional competencies throughout the curriculum.
4. Continue to support and enhance undergraduate students' opportunities for self-directed learning and study time, and participation in the enriching extra-curricular activities within our Faculty, across the University, and beyond.
5. Enhance our instructional space to facilitate innovative teaching methods and create efficiencies on how we share space. This includes flexible interactive teaching space for substantial numbers of students, design and group project space and lecture/lab combination space.
6. Provide reliable, accessible, effective computing services and study spaces within and outside computer laboratories, library and classrooms to enhance efficient interactive learning and socialization where today's student 'lives'.
7. Link the quality of student learning, the quality of their education and their improved future performance with teaching effectiveness. Continue to inspire and support the Faculty's culture of teaching excellence and encourage Faculty members and teaching assistants to reflect upon their teaching effectiveness through enhanced feedback mechanisms. Support teaching initiatives and opportunities that will improve their professional development as educators.
8. Continue to attract and retain diverse, outstanding students from a wide range of backgrounds in order to provide an exceptional education for future global engineers

and leaders. In particular, we must strive to attract more female students into our programs.

9. Strategically award admission scholarships to meet our student recruitment goals.
10. Reduce the dwell time for MASc and PhD students and address time-to-graduation issues.
11. Continue to develop vibrant MEng programs and offer a larger variety of courses suitable to MEng students.
12. Increase graduate student enrolment to reach 2,000 graduate students by 2015, with particular focus on increasing PhD and MEng students and aiming to reach an average of one PhD graduated annually per faculty member. At the same time, we will endeavor to reduce our undergraduate student enrolment to 4,000 by 2015, with 25% of undergraduates consisting of international students. In fall 2010, the November 1 Full-Time Equivalents (FTE) were 4,599 undergraduate and 1,527 graduate students, a percentage of 75.1% to 24.9%.

Chapter 5: Student Experience

Introduction

Engineering students' gender and cultural diversity, academic strengths, interests and experiences enrich this dynamic learning and research environment, both in and outside the classroom. Our unique community offers the benefits of being part of a large, research-intensive university located in a major urban centre. Student diversity, our large commuter population and our multicultural urban environment present both opportunities and challenges. Our programs and infrastructure go beyond basic student needs, supporting students to face these challenges and providing them with opportunities to excel outside of the classroom.

In this chapter, we outline the goals that will further support our students and their active engagement with the Faculty and across the University, which enhances their development as future global engineering leaders.

The Faculty's goals to improve student experience stem from input received from many sources: comprehensive consultation with students, faculty members and staff across our Faculty during the Self-Study and subsequent External Review; responses from Departments, Institutes and Administrative Units in the academic planning process; and ongoing student dialogue with the Engineering Society and through the regular Dean's Student Town Hall meetings.

Student Experience focuses on how we will enhance undergraduate and graduate students' co- and extra-curricular experiences, including participation in sports, clubs, arts, research, internships, international student exchange opportunities, and summer and professional work experiences. We will continue to support and promote student-oriented activities, particularly those affiliated with our Engineering Society. Student experience also includes factors such as teaching effectiveness, infrastructure, student information systems, communications, counselling and academic and personal support systems. The previous chapter, *Educating Future Engineers*, highlighted the curriculum-based goals including infrastructure, technology and teaching.

As noted in the previous chapter, *Educating Future Engineers* and *Student Experience* are inextricably linked. Our students' time at the Faculty primarily focuses on academic curriculum requirements. How our students learn, their co- and extra-curricular activities and their engagement beyond the classroom play a vital part in their ability to succeed as students and, ultimately, as Engineering alumni. Both academic and extra-curricular activities impact students' holistic experiences; the connections they make between cohorts, disciplines and activities that deepen student learning and broaden their perspectives as global engineering leaders in whatever field they choose to pursue.

Goals

We continue to strive for excellence in student experience. The following goals will direct our Faculty's activities pertaining to undergraduate and graduate student experience for the next five years.

1. Ensure that all of our undergraduate curricula provide our students with sufficient self-directed time to fully reflect on and understand the material in their program, the vision and relevance to 'learn how to learn', and the advantage of taking opportunities to experience and engage in University life outside the classroom through extra-curricular and co-curricular activities.

2. Engage more undergraduate students in faculty research activities. Enhance summer opportunities for our undergraduate students by expanding the Engineering Summer Internship Program (eSIP) and by increasing summer research opportunities both within the Faculty and through agreements with international institutions.
3. Enhance our students' access to electives outside technical courses.
4. Enhance our undergraduate and graduate students' non-traditional educational opportunities, including international academic exchanges and internships, courses offered abroad, field courses, and credit for work in extra-curricular activities such as design teams.
5. Continue to inspire the Faculty's culture of teaching excellence and support teaching initiatives that improve student experience, support their connections with course content, increase in-class engagement and strengthen students' understanding of course relevance.
6. Promote extra-curricular activities through communications, faculty mentoring and suitable space and facilities.
7. Actively engage and support students in their unique academic and non-academic experiences as soon as they enter our Faculty, so they can thrive throughout their studies.
8. Engage Master of Engineering (MEng) students to improve the quality of their experience.
9. Enrich graduate students' academic life and build a stronger sense of community among graduate students across the Faculty.

Chapter 6: Research Foci

Introduction

The Faculty of Applied Science & Engineering supports a vibrant research community, situated within a research-intensive, pre-eminent university. Our Faculty members diligently raise funding through Tri-council, provincial and industry programs, participate in major research initiatives both nationally and internationally, build and lead spin-off companies, and collaborate with key industrial sectors. The Faculty's extended research community includes research associates, undergraduate and graduate students, postdoctoral researchers and laboratory technicians. A number of our research initiatives are interdisciplinary and involve faculty members from multiple departments across the University of Toronto.

Through our research endeavours, we create new knowledge and technologies and share these results with local, national and international research communities, and with industry, through publications, patents and technology transfer. These require interdisciplinary engineering innovation that benefits Canadians and our increasingly inter-connected global community.

Starting in 2007, we have created Associate Chairs, Research positions in all departments. These Associate Chairs, along with the Directors of the University of Toronto Institute for Aerospace Studies (UTIAS) and the Institute of Biomaterials & Biomedical Engineering (IBBME), serve on the Faculty's Research Committee. Through this Committee's work, U of T Engineering promotes research, mentors colleagues and identifies cross-Faculty research opportunities.

Our world-class departments and institutes support unique strengths and provide research leadership, redefining the forefront of innovation in their fields and further strengthen our research endeavours.

Chemical Engineering & Applied Chemistry has research strengths in biomolecular and biomedical engineering, bioprocess engineering, chemical and materials processing, environmental science and engineering, informatics, pulp and paper, surface science, and sustainable energy.

Civil Engineering is concerned with virtually all aspects of the urban habitat and the interactions that exist between the built, natural and human environments, including geoscience, mining, building, environmental, transportation, and structural engineering.

Electrical & Computer Engineering has research strengths in communications, computer engineering, energy systems, systems control, biomedical engineering, electro-magnetic engineering, electronics, and photonics.

Materials Science & Engineering provides a research focus for advanced materials applications that have a global impact in sustainability and energy systems. These include advanced electronic materials and systems; alternative energy systems; nanomaterials; and sustainable materials processing.

Mechanical & Industrial Engineering includes research foci on applied mechanics; robotics and manufacturing; biomedical engineering; computer-aided design and materials engineering; energy studies; thermodynamics and surface science; environmental engineering; fluid sciences and mechatronics; human factors and ergonomics; information engineering as well as operations research.

UTIAS' scope of research includes aeronautical engineering (aircraft flight systems, flight simulation, propulsion, combustion, aerodynamics, computational fluid dynamics and structural mechanics) and space systems engineering (spacecraft dynamics and control, space robotics, mechatronics as well as microsatellite technology).

IBBME is a cross-Faculty institute in collaboration with Engineering, Medicine and Dentistry. As an interdisciplinary institute, its research includes neural sensory system and rehabilitation engineering, biomaterials, tissue engineering and regenerative medicine, molecular imaging and systems biology and engineering in a clinical setting.

Growing from these key strengths, the Faculty establishes extra-departmental units to foster research that focuses on specific cross-Faculty and University-wide areas (See Appendix 14 for full list). Our research enhances collaborations within our community, supports undergraduate and graduate student research skills, builds external partnerships, increases our funding portfolio and draws donor support that will further enable research initiatives.

Through our Self-Study and Academic Planning processes, we adopted four broad themes that represent cross-Faculty research foci. They align with the University of Toronto's research goals, and contribute to the local and national research agendas. Our internationally recognized Research Chairs – funded by governmental agencies, industry or by endowments – enable and drive initiatives within the four themes.

Many of Engineering's research pursuits touch upon at least one of the four themes. In addition, major initiatives, which will be expanded upon in departments' and institutes' own academic plans, contribute towards their unique research fields. Due to our interdisciplinary research community, these themes overlap; they enable the other foci, and are also advanced by the other research themes.

Bioengineering

This theme is broken down into two broad areas within Bioengineering: Biomedical Engineering Research that pertains to mammalian-based research initiatives, focused on innovations within the broad sector of health care research and technologies; and Bioprocess and Bioproduct Research. As it is with our four broad themes, these two sub-headings naturally – and necessarily – connect in innumerable ways.

Biomedical Engineering: The integration of engineering practices with medical sciences, as well as the collaboration among Engineering, the Faculties of Medicine and Dentistry, and the University affiliated hospitals, help us identify and study more efficient diagnostic strategies and better disease-monitoring leading to an enhanced quality of life. In particular, we have core research strengths in biomaterials, tissue engineering, biomechanics, molecular imaging, neuro-engineering, and medical devices.

Bioprocess and Bioproduct Engineering: This includes use of engineered microbiological (bacterial and algal) systems for treating waste air and water streams, for regeneration of polluted land and groundwater, and for generating biofuels, bio-electricity and new high-value bio-products. In addition researchers are exploring the use of Canadian forestry products in non-traditional applications, including industrial foams, flame-retardant materials, and paper surface science.

Sustainability

Natural Environment, Urban and Industrial Environments, Infrastructure, and Sustainable Energy are included in this over-arching research theme; these frequently intersect and are inter- and cross-disciplinary research subsets:

Natural Environment: Engineers have long been aware of the impact of their activities on the environment, including reducing the impact of aviation pollutions, extracting natural resources and minerals, monitoring the earth from micro and nano satellites, and distributing energy efficiently.

Urban and Industrial Environments: Our interdisciplinary approach to research provides an excellent position to address the increasingly complex issues associated with the urban and global environments: new transportation systems, energy efficient and healthy buildings, sustainable materials processing, industrial processes and manufacturing activities, drinking water, impact of air quality on human health and sustainable urban environments.

Infrastructure: Research in this sub-theme includes product life cycle, sustainable urban environment and green information technology, sustainable industrial processes and ecosystems, advanced recycling, structural engineering, concrete, and transportation planning.

Sustainable Energy: The Faculty's research strengths include energy distribution systems and renewable energy, particularly in the areas of solar, fuel cells, hydrogen production, bio-fuels, and wind. We also have foci in energy recovery, and in sustainable use of energy in aerospace, industrial processes, and energy transportation.

Information and Communication Technology (ICT)

This research area includes Internet use, mobile communications and online video drives demand for increased performance, information and identity security, and reliability of our ICT infrastructure. Computer networking, distributed systems, and middleware constitute a large part of ICT, as do computer architecture and parallel systems spans processor architecture, multiprocessors, multi-cores and on-chip interconnection networks. Sustainable ICT uses the Internet to reduce the environmental impact of our day-to-day lives. Exascale computing enhances medical imaging studies that deepen our understanding of brain function and improve therapies. ICT research foci also include microelectronics, systems control; analog and mixed-signal/RF electronics; integrated circuits simulation and modeling; and wireless, wired and optical communications.

Enabling Technologies

Enabling Technologies are fundamental research directions within the Faculty that under-pin and support the development of the three other strategic research themes. The Faculty's enabling technologies researchers develop a range of engineering innovations, including manufacturing, mathematical modeling, nanotechnology, biotechnology, photonics, and advanced materials.

Goals

We continue to advance engineering research excellence and innovation, and strengthen our Faculty's research community. The following goals will drive our Faculty's research activities over the next five years.

1. Create new and support current research centres around strategic research themes that make significant, relevant impacts on society.
2. Increase our Tri-council funding level to \$25M per annum by 2015.
3. By 2015, increase the number of Canadian Research Chairs by eight (to a total of 30), increase Industrial Research Chairs by six (to a total of 10), and increase Endowed Chairs and Limited Term Chairs by 13 (to a total of 40).
4. Develop additional funding sources through the Social Sciences and Humanities Research Council (SSHRC), the Canadian Institutes of Health Research (CIHR), corporations, industries and international granting agencies.
5. Support junior faculty members and emerging research leaders to ensure that they successfully secure external research funding from industry, federal and provincial sources.
6. Raise awareness and promote our research contributions and breakthroughs with peers, funding agencies, industry and the public.
7. Generate synergistic research partnerships with industry, peer institutions within Canada, and strategic international partners, while taking on leadership roles at the national and international levels.
8. Increase participation and provide leadership on external review committees in granting agencies such as the Natural Sciences and Engineering Research Council (NSERC), Ontario Centres of Excellence (OCE), and the Ontario Ministry of Research and Innovation (MRI).
9. Enhance multidisciplinary, collaborative research endeavours.
10. Engage more undergraduate and international graduate students in faculty research activities.

Chapter 7: Outreach, Collaboration and Influence

Introduction

U of T Engineering is an international leader in engineering education and research. Our creative, interdisciplinary nature firmly situates us as a highly valued, sought-after, innovative partner. We make significant contributions towards U of T's research-intensive and educational excellence priorities. Our reach and influence extend beyond the Faculty and University. From Toronto communities to peer international institutions, from Canadian high schools to industry, from professional journals to alumni and donors, Engineering continues to develop broad collaborative circles.

In the chapter on *Research Foci*, we outline our research-focussed industrial partnership goals that develop these collaborations. Here, these partnerships are further expanded upon as unique opportunities to increase student work placements, collaborate across disciplines and to share expertise between industry and academia.

This chapter outlines our goals regarding external outreach and collaboration activities and resulting influences. Those activities within the Faculty and those conducted throughout U of T with other Faculties such as Arts & Science, Medicine, Dentistry, and Architecture, Landscape & Design, are included in previous chapters. External outreach, collaboration and influence further strengthen our ability to attract top scholars, to recruit academically strong students and creative, collaborative, professional staff, to create dynamic learning environments, and to support engineering knowledge generation. Outreach, collaboration and influence activities also develop and sustain relationships with alumni, donors and volunteers who contribute to our Faculty.

Outreach promotes the Faculty and the engineering discipline to targeted groups outside the Faculty by:

- Inspiring pre-high school and pre-university future engineers;
- Contacting prospective undergraduate and graduate students;
- Connecting current students with prospective students;
- Encouraging alumni and volunteers to return and inspire prospective students;
- Connecting with local and international industry to increase student job placements, build research partnerships, and promote knowledge-sharing; and,
- Seeking-out and deepening our relationships with our alumni, donors and volunteers.

Collaboration occurs when:

- Two or more researchers, research groups, student groups or staff groups innovate together;
- Students work with international or local industries and companies;
- Students and professors study, teach or research within U of T, across disciplines, and with Canadian universities and international peer institutions; and,
- Staff meet or participate in Working Groups/Task Forces.

Influence arises from both outreach and collaboration, and is an important result of our Faculty's efforts. We influence when we:

- Engage with others to bring expertise and an engineering perspective to policy and industrial standards, and to government and media;
- Participate in professional academic or administrative organizations and groups;

- Educate the next generation of global engineers who will be influential leaders in their chosen careers and in society;
- Transfer our knowledge and expertise to industry through the creation of technologies that influence local and global economies, create jobs, build wealth, and advance Canada's research agenda;
- Contribute to engineering as a discipline through participation in conferences; and,
- Publish in top journals and discipline publications that widen our external contact base, increase our visibility, and further engineering as a discipline.

Goals

To strengthen our outreach, collaboration and influence, we have set the following goals to understand what we already do, and to direct our Faculty's efforts in these areas for the next five years.

1. Better understand the breadth of the Faculty's current outreach, collaborative and influencing efforts, then efficiently manage, support, develop and communicate these activities.
2. Continue building meaningful involvement and relations with Engineering alumni.
3. Strengthen relationships with other University of Toronto Faculties.
4. Further develop sustainable collaborations with industry partners, and expand established partnerships with affiliated hospitals and research institutes.
5. Further develop connections with local communities, businesses and the City of Toronto.
6. Build upon high school outreach and continue to assess our pre-university activities with the goal of optimizing faculty and student involvement.
7. Increase staff, faculty and student awareness of and involvement in professional societies and organizations and governing bodies.
8. Develop strategic relationships with desirable peer, national and international Engineering schools.
9. Increase influence in government and public policy decisions.
10. Develop a culture of stewardship and gratitude to the alumni and donors who provide philanthropic support to the Faculty.
11. Encourage the participation of administrative staff in professional associations related to their area of expertise, and in the mentoring programs offered by the University.

Chapter 8: Resource Allocation

Introduction

Adequate resources are an integral part of the Faculty's ability to advance our Academic Plan goals as outlined in the previous chapters. These goals, in turn, impact our academic time, physical space, administrative and technical staff, and budget, either by drawing upon these resources or by creating efficiencies. In all cases, our resource allocation must support our academic goals and vice versa; they are inextricably linked.

The Academic Plan and plans from all academic units contain three common themes related to resources: academics need more time for high-value activities; physical space requires upgrading; and budget funds are constrained. We have examined our goals as they relate to these three themes and how we might improve our resource levels *to pursue*, and *by pursuing*, our Academic Plan goals.

The Faculty attracts top scholars whose research and teaching add greatly to our engineering education and research goals. In turn, we attract some of the world's best and brightest engineering students. Our faculty members continually strive to establish a balance between teaching and research. On the one hand, teaching activities share leading-edge knowledge and inspire future generations of engineering leaders. On the other, our scholars' research brings in funding, strengthens our Faculty's intensive, collaborative research community, enhances our student education, and responds to Canada's and the world's most pressing concerns. Both activities are equally important and are necessarily linked.

The Divisional Space Review in 2008-2009 determined that our Faculty's space no longer met our needs as a world-class engineering research and education institution. The Faculty has limited access to classroom space for instructional methods other than lecturing or traditional tutorials. Resources to support our space goals come from either external funding – philanthropic and government – or redeployment of operating funds. External granting agencies often have short windows of opportunity to submit infrastructure funding proposals. Some academic units have trust funds built up over time that are dedicated to improving space.

To strengthen our fiscal stability and processes, we reviewed and revised our internal budget allocation model between 2006 and 2009. The Faculty's new budget model includes the concept of attributing revenues and expenses and the principle of transparency. It also gives departments and institutes incentives to manage their budget funding based on their academic priorities to increase revenues and contain costs.

Opportunities exist to release some of the Faculty's operating budget by finding alternative sources for some expenses, such as fully funding PhD and MSc students through research grants and graduate fellowships during the recognized government time-to-completion. Graduate student support is only partially funded by endowments and research grants. A significant portion (36% in 2010) of this expense is currently financed from the operating budget.

The Faculty's renewed fundraising goals serve as an additional source to finance our academic efforts. As we move into the campaign, we will focus on raising funds to support the Faculty's key priorities identified in the Catalogue of Priorities in May 2009. The next stage of this process is to develop the Campaign Case for Support – an articulation of how philanthropic resources will assist faculty and students in our aim to innovate, share and advance engineering knowledge.

The campaign affords opportunities to involve alumni and friends of the Faculty in a manner that will improve available resources to support our Faculty's goals.

Our approach to resource management will be a mix of setting appropriate priorities, transferring costs to alternative sources of funding, building on our collaborations with centrally provided services, and increasing the efficiency of our operations. This will allow us to free up existing resources for redeployment and investment in forward-looking, compelling initiatives.

Goals

We will pursue resource stability by aiming for the following goals, many of which align with goals previously outlined in the Academic Plan. These will impact academic time, physical space and operating budget resources to support our Faculty's priorities for the next five years.

1. Maximize quality academic time and effectiveness by increasing engagement in high-value activities that support students' academic experience, contribute to knowledge-creation, and advance engineering research frontiers.
2. Place emphasis on Engineering's strategic research areas when considering faculty hires.
3. Provide a supportive environment for faculty members through mechanisms such as start-up funding, teaching skills workshops, and assistance via Associate Chairs, Research to create successful research proposals.
4. Improve our chances of being awarded funding for capital projects by pre-planning for various opportunities consistent with our goals and suitable for external funding sources such as CFI, Ontario Ministry of Training, Colleges and Universities (MTCU) and other capital grants. Increase the quality and quantity of space particularly through fundraising for new and revitalized buildings.
5. Enhance teaching and design facilities, upgrade undergraduate laboratory space, and make flexible space available for extra-curricular activities
6. Provide reliable, accessible, effective computing services; create study spaces within and outside computer laboratories, library and classrooms so as to enhance interactive learning and socialization where today's student 'lives'.
7. Encourage timely degree completion among doctoral stream students; increase research funding and graduate fellowships to support graduate students.
8. Establish a strong Case for Support that addresses the Faculty's resource requirements and aligns the Faculty's critical need for improved space in the context of addressing educational and research priorities.
9. Increase long-term philanthropic support by strengthening the culture of advancement within the Faculty.

Closing Thoughts

Engineering's Academic Plan is the first phase of a cycle that builds on our Faculty's rich history and proud traditions of engineering innovation and excellence. With our five-year goals established, we enter Phase Two, planning our actions, establishing timelines and metrics, by which we will measure our progress. The vast majority of our actions will be accomplished collaboratively, across functions, growing from our varied expertise, and involving faculty, staff, students and alumni. This demonstrates the interdisciplinary, team-oriented nature of our community. As an appendix, we include a list of actions and metrics that will be used as a guide towards achieving our goals.

Phase Three will see us continue to measure and critically assess our progress, adjusting our direction or actions as required.

Over the next five years, U of T Engineering will pursue the goals of this Academic Plan with passion and commitment. By focusing on educating future engineering leaders and advancing the research agenda, we will continue to collaborate with the Engineering community to address challenges and work towards solving some of the world's most pressing concerns.

Appendix C: Academic Plan Progress and Achievements



UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Academic Plan 2011–2016

Year Four: Progress and Achievements

Cristina Amon, Dean

Faculty of Applied Science & Engineering
University of Toronto
November 2015

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1. Executive Summary

The Faculty of Applied Science & Engineering's five-year *Academic Plan 2011–2016*, outlines our goals in seven areas: culture of excellence; positioning; educating future engineers; student experience; research foci; outreach, collaboration and influence; and resource allocation. We developed our Academic Plan through a highly consultative planning process involving our U of T Engineering community and other key stakeholders. Over the past four years, its framework has guided and inspired us, and we have made remarkable progress in realizing, and often exceeding, the ambitious goals set out in this document. As we enter into the final year of the Academic Plan, we are pleased to present our Year Four progress report.

Our commitment to providing an outstanding student experience, as well as our reputation for academic excellence, attracts the brightest students from across Canada and around the world. In 2014–2015, we drew a record 10,989 applications for only 1,130 undergraduate places. From that pool, we admitted the most accomplished first-year class in our history, with the mean entering average of Ontario secondary school students increasing to 92.4 per cent. It was also the most diverse: 30.6 per cent of our first-year students were women, the highest proportion of any entering class in Canada, and 31.9 per cent were international students. Across our undergraduate and graduate cohorts, our students came from 109 countries, providing the cultural diversity to ensure rich intellectual conversations and a global outlook.

Interest in our doctoral and masters programs continued to grow, with the graduate cohort increasing to 2,194 students in 2014–2015 after surpassing our Academic Plan goal of 2,000 graduate students, two years ahead of schedule. This graduate expansion resulted in an undergraduate-to-graduate ratio of 2.24 to 1 in 2014–2015, down from 2.35 to 1 in 2013–2014, bringing us closer to our long-term goal of 1.5 undergraduates for every graduate student.

International educational exchanges, both outgoing and incoming, allow our students to gain cross-cultural fluency and experiences that enhance their understanding of today's complex challenges. In 2014–2015, we welcomed 147 students from more than 30 peer institutions and sent 94 of our students to 26 partner universities across the globe. Our partnership with Brazil's *Ciência sem Fronteiras* program continues to be strong, with 490 students coming to U of T Engineering since the program's inception in 2012.

We remain the premier engineering school in Canada and one of the world's best across all international rankings. Actively working to foster a culture of excellence, U of T

Engineering continues to be the leader among its Canadian peers. We received 25 per cent of all the major awards given to Canadian engineering faculty members, despite the fact that our professors make up only 5.5 per cent of the national total. We continue to innovate and evolve our curriculum to enhance experiential and collaborative learning opportunities and enable students to customize their degrees. For example, in 2015 we introduced a new minor in Nanoengineering and a certificate in Communication. We further enhanced our graduate offerings through the creation of an MEng in Biomedical Engineering, emphases in the leading-edge areas of Sustainable Energy and Advanced Manufacturing, and a collaborative program for masters and doctoral students in Engineering Education. In 2014–2015 the Core Curriculum Review Task Force completed its assessment of the content and delivery of first-year core curriculum and we have begun implementing the recommendations.

Our Academic Plan outlined a key goal with respect to our research portfolio: to increase our Tri-Council funding to \$25 million per year by 2015. We surpassed this goal three years early, reaching \$26.3 million in 2012–2013, and are making excellent progress toward our newly established goal of \$32 million by 2015–2016. Fostering multidisciplinary and collaborative research is a vital component of our Academic Plan, and in 2014–2015 we established new partnerships and centres including the Translational Biology and Engineering Program — part of the new Ted Rogers Centre for Heart Research — and the University of Toronto Centre for Aerial Robotics Research and Education.

We had a highly successful fundraising year for philanthropic and research gifts, with support from alumni, graduating students and other members of our vibrant community reaching \$34.9 million. Our fundraising has accomplished more than \$152 million toward the goal of \$200 million for Boundless: The Campaign for the University of Toronto. A major focus for our campaign is the Centre for Engineering Innovation & Entrepreneurship (CEIE), which started construction in June 2015 and will set a new standard for engineering education and research. Collectively, with the generous support of alumni and friends, along with Faculty and University commitments, we have raised almost \$80 million toward this transformative project. We have continued to manage our resources strategically and maintained a strong financial position, with a 7.5 per cent increase in revenue in 2014–2015 compared with the previous year.

Together, we made tremendous progress and impact over the past four years, and we invite you to read more about our achievements in the following report. We look forward to another year of excellence in our final year of the Academic Plan.

2. Culture of Excellence

At U of T Engineering, we promote and nurture a culture of excellence. We are committed to strengthening our position among the best engineering schools in the world, and continuing to innovate by enriching our offerings, fostering research excellence and preparing our graduates to lead in a complex global engineering environment. We measure our progress toward our organizational goals in numerous ways.

Awards and Honours

Our Faculty continues to be the leader among our Canadian peers in awards and honours, while also making excellent progress with our strategy to nominate junior faculty for early-career awards. In 2014, we earned 25 per cent of all major awards received by engineering faculty across the country with only 5.5 per cent of the overall faculty members in Canada. This is three times as many awards as the next most successful Canadian engineering school. Our early-career professors and alumni also won a remarkable number of major emerging leader awards, further reflecting our reputation for attracting the most talented young engineering scholars. These included:

- the American Society for Engineering Education's Top 20 under 40;
- the Alexander von Humboldt Fellowship for Experienced Researchers;
- the Borg Early Career Award;
- Ontario Professional Engineers Awards Young Engineer Medal; and
- the E.W.R. Steacie Fellowship.

In 2014 our professors and alumni received more than 40 international, national and provincial awards for excellence in their respective fields, including eleven 2014 and 2015 Canadian Academy of Engineering Fellows/Honorary Fellows, two Engineering Institute of Canada Fellows and the PEO gold medal. The success of our faculty in winning honours not previously awarded to U of T Engineering attests to the growing impact of our research and innovation. These awards included the Ernest C. Manning Principal Award, Foreign Associate of the Institute of Medicine of the U.S. National Academies of Science and the L'Oréal-UNESCO "For Women in Science" Laureate for North America. In 2015, the University of Toronto also honoured our Faculty with three Inventor of the Year awards, three Distinguished Professorships, the Vivek Goel Faculty Citizenship Award, and one University Professorship.

U of T Engineering is also proud of the awards we received in recognition of our outstanding educational and teaching achievements, such as the Joan E. Foley Quality of Student Experience Award, the President's Teaching Award and the Engineers Canada Medal for Distinction in Engineering Education.

Student and Alumni Achievements

Our outstanding students and graduate alumni have embraced innovation and excellence, and this past year, we continued to see their tremendous achievements. A number of companies were created including Onyx Motion, which is building the next generation of artificial intelligence for sports coaching, and Nvest, a social network that allows users to trade stock tips and transparently track their success. The Entrepreneurship Hatchery's 2015 Demo Day highlighted many new student startups including Kepler Communications, which hopes to revolutionize communications infrastructure in space and TeleHex, a unique telescoping hex key that simplifies bicycle repair.

Our talented and driven alumni include many entrepreneurs who created companies such as Cast ConneX, a startup that designs steel castings to strengthen buildings for earthquake resistance, and Attollo, a social entrepreneurship initiative aimed at improving the vocabulary of children in developing countries. Across diverse disciplines and sectors, U of T Engineering continues to have a profound impact, both locally and globally.

Diversity in Faculty and Student Recruitment

Our outstanding reputation and culture of excellence are key drivers in attracting world-class students and faculty. We continue to create opportunities for interdisciplinary and collaborative research and nurture engaging, experiential learning for students. In addition to last years' addition of three stellar cross-appointed female professors, we are currently undertaking an interdisciplinary academic search for three new faculty members, focusing on cross-disciplinarity, diversity, research and teaching excellence. The proportion of international and female students relative to our total enrolment continues to grow. In 2014, 31.9 per cent of the first-year class was comprised of international students, and 30.6 per cent were female. Our faculty members are also becoming more diverse, since 2005–2006, the number of female faculty members has doubled from 21 to 44, and the proportion of faculty members who are women has grown from 9.5 to 18.0 per cent — a testament to our recruitment efforts, but there is still progress to be made in this area.

Strategic outreach efforts to encourage more women to consider a career in engineering begin at an early age, through the Faculty's pre-university recruitment initiatives. We created and delivered a number of successful programs targeted at girls from elementary school age through high school to interest them in science, technology, engineering and math (STEM). For the fourth year in a row, we hosted Girls' Leadership in Engineering Experience (GLEE), a weekend-long program that empowers and inspires female engineering applicants by connecting them with women faculty, students and alumni. In 2015, 89 per cent of the 88 students participating in GLEE accepted our offer of admission, compared with 77 per cent in 2014. After the success of the inaugural Young Women in Engineering Symposium, we held the second annual event in October 2015, attracting more than 70 top female high school science students from across the Greater Toronto Area.

Curriculum Innovation

To strengthen our place as the premier engineering school in Canada and among the very best in the world, we continue to lead in evaluating and improving our curriculum and teaching within the Faculty. To that end, this year the first-year Core Curriculum Review Task Force delivered its final report and we are implementing recommendations coming out of the review. Areas of focus include improved first-year teaching and course delivery, in-depth mathematics and science curriculum reviews, integration between courses, and transition to the University learning experience.

We also assess our progress within departments and units through cyclical external or internal reviews. In 2014, we started the practice of conducting comprehensive internal reviews of academic programs, extra-departmental units (EDUs) and administrative units, structured with a self-study, two-day review team visit and subsequent report and administrative response. This past year, we initiated review of the Engineering Outreach Office and completed reviews of the Lassonde Mineral Engineering Program, the Engineering Communications Program and the Institute for Leadership Education in Engineering (ILead) resulting in enhancements in programming and sustainability. In 2015–2016, we will perform external reviews and academic leadership searches for Chemical Engineering & Applied Chemistry, Engineering Science and the University of Toronto Institute for Aerospace Studies. Our reflective department and institute self-studies, with subsequent external reviews, result in thoughtful recommendations and praise for the excellent quality of our educational programs, research, faculty and students, while noting any areas to fine-tune or adjust. This coming year we will also complete internal reviews of the Engineering Career Centre/Professional Experience Year (PEY) and the Cross-Disciplinary Programs Office.

CULTURE OF EXCELLENCE: YEAR 4 PROGRESS HIGHLIGHTS

2.1 Maintain a strong Faculty vision for excellence in engineering education and research.

- Maintained our position as the premier Canadian engineering institution and one of the best in the world in all international rankings
- Garnered 25 per cent of major national and international engineering awards received by engineering faculty across Canada, three times as many as any other Canadian engineering school, while representing only 5.5 per cent of Canadian engineering faculty (up from 21.3 per cent of 5.6 per cent overall faculty in 2013)

2.2 Measure our progress in achieving our mission and vision.

- Assessed our progress through key metrics and published our 7th *Annual Report of Performance Indicators* in September 2015
- Reviewed our actions towards achieving our Academic Plan goals and in October 2015 presented to Faculty Council our Year 4 Progress Report

2.3 Increase diversity, focusing on gender diversity among students and faculty.

- Initiated an interdisciplinary academic search for three new faculty members, focusing on cross-disciplinarity, diversity, research and teaching excellence
- Increased percentage of women academic staff to 18.0 per cent (up from 16.9 per cent in 2013–2014)
- Reached a tremendous milestone in increasing gender diversity among students: 30.6 per cent of 2014 incoming undergraduate students were female, the largest proportion of women in any incoming engineering class in Canada
- Achieved an impressive gender mix among all students in 2014–2015: 25.8 per cent of all undergraduate students were female (up from 24.8 per cent in 2013–2014) and 26.7 per cent of graduate students were female (up from 25.9 per cent in 2013–2014)
- In 2014–2015, our students came from 109 different countries: 25.8 per cent of all undergraduate and 27.1 per cent of graduate students were international students (up from 23.1 per cent and 24.6 per cent in 2013–2014)
- Continued to offer robust outreach initiatives to support strategic recruitment; for example, 89% of the 88 female high school students who attended the 2015 Girls' Leadership in Engineering Experience (GLEE), an event for female high school students with offers of admission to the Faculty, subsequently accepted our offers (up from 77% in 2013–2014)
- Held the second annual Young Women in Engineering Symposium, attracting more than 70 top female high school science students from across the Greater Toronto Area (October 2015)

2.4 Support the development of faculty members as outstanding engineering educators and researchers.

- Won a remarkable number of major emerging leader/early career awards, including the Ontario Professional Engineers Awards Young Engineer Medal and the E.W.R. Steacie Fellowship
- Held a lunch-time panel series for faculty on best practices in research, including a session on collaborative and partnership research
- Prepared junior faculty to apply for Early Research Awards (ERA) by hosting a panel called “Succeeding in the ERA” and initiating an internal expert review during the competition to critique each of the Faculty’s applications
- Enhanced the nomination process for disciplinary awards at the departmental/institute level by establishing awards committees in each unit
- Enhanced the Faculty’s Awards and Honours portfolio by adding a partial administrative position to build the capacity within units to develop nomination and award strategies
- Held the third annual First-Year Instructors Day, which helps ensure consistency in the student experience and raises awareness of the various support systems that are in place (September 2015)
- Initiated a year-long teaching and learning workshop series coordinated jointly by the office of the Vice-Dean, Undergraduate, the Teaching Methods and Resources Committee, and students in the Masters/PhD collaborative program in Engineering Education
- Hosted the biannual Educational Technology Workshop “EdTech” to help instructors share best practices for innovative teaching and learning (May 2015)

2.5 Support our students by strategic efforts to build upon educational, extracurricular and co-curricular experiences.

- Supported expansion of programs including the Peking University Cross-Cultural Capstone Design Projects and Brazil’s *Ciência sem Fronteiras*
- Signed memoranda of understanding with Shanghai Jiao Tong University, Warsaw University of Technology, and the National Institute for Materials Science (Tsukuba, Japan), and a letter of intent with CAF, the development bank of Latin America, to enhance and support various education and research collaborations
- Reached a record of 724 engineering students participating in the Professional Experience Year in 2014–2015 (up from 705 in 2013–2014)
- Stream-lined the process for student club funding by creating the Centralized Process for Student Initiative Funding (CPSIF) which allows student groups to apply to various funding resources from within the Faculty of Applied Science & Engineering in a single application
- Established new certificates in:
 - Communication;
 - Engineering Leadership; and

➤ Renewable Resources.

- Created a new minor in Nanoengineering
- Developed a new Engineering Science major in Robotics Engineering
- Launched minor in Biomedical Engineering
- Continued growth in minor enrolment and completion, with 31 per cent of 2014–2015 graduating students completing a minor
- Developed a list of major student awards to improve the process for student nominations; in conjunction with the Registrar, developed a process in which the committee responsible for allocating internal scholarships will also seek candidates for the above-mentioned student awards
- Experienced another successful summer program through The Entrepreneurship Hatchery; of the 50 teams (150 students) who applied, 37 teams (109 students) were accepted and 13 teams (42 students) presented at Hatchery Demo Day (September 2015)

2.6 Maximize the skills of our staff members and create opportunities to strengthen their performance and develop them as integral contributors to the Faculty’s mission.

- Relocated the Human Resources office to the Fields Institute to improve service delivery
- Recognized the successes and contributions of staff through several Faculty awards
- Encouraged secondments throughout the Faculty as appropriate to enable staff to develop new skills
- Contributed to staff skill development for business administrative staff and student support staff through network groups and presentations from University experts on relevant issues, policies and procedures
- Offered three staff sessions on the services/mental health support provided by the Employee and Family Assistance Program and offered a mental health session to chairs and directors to assist in supporting staff and faculty

2.7 Increase staff retention and enhance succession planning within the Faculty.

- Continued to foster collaboration and communication between Human Resources, the Business Administration group and the Engagement & Development Network to share information and best practices
- Contributed to the engagement of faculty and staff with the first “Engineering Family Outreach Day”, inviting children of staff and faculty from Grades 1 through 8 to take part in engaging, hands-on activities related to STEM

2.8 Build upon alumni involvement with the Faculty to share their world-based expertise and perspectives, to strengthen our reputation and to inspire the next generation of U of T engineers towards innovation and excellence.

- Continued to offer mentorship and sponsorship opportunities for alumni through The Entrepreneurship Hatchery

- Enhanced the “You’re Next” Career Network to strengthen the Alumni Mentorship Program
- Strengthened outreach and engagement through strategic events and topical seminars in the Asia-Pacific, Silicon Valley and Middle East regions, and through a new initiative that connects professors emeriti and retired staff with recent graduates
- Hosted 68 alumni events, with 13 taking place outside of Canada (San Francisco, Palo Alto, Turkey, Dubai and Asia-Pacific (Hong Kong, Korea, Singapore and Taiwan))
- Hosted our first Dean’s reception for parents, in conjunction with an alumni event in Dubai, to engage parents of current international students and raise the profile of the University in the region
- Proactively participated in events such as the U of T Arbor Awards to ensure dedicated alumni are recognized
- Supported alumni volunteerism, with more than 167 alumni participating in various committees and advisory boards at both the Faculty and University level
- Organized an engaging Spring Reunion with events including the Skule™ Young Alumni Reunion and Skule™ Reunion Picnic
- Expanded partnerships between our Engineering Recruitment Office and the Central Recruitment Office through:
 - a postcard campaign inviting alumni in key regions to serve as recruitment ambassadors;
 - a pilot with the Engineering Recruitment Office to invite select alumni to participate in a post-offer reception in Vancouver;
 - improved coordination of alumni contacts between offices; and
 - analysis of current student geographic demographics to predict future alumni regional trends.
- Engaged 30 alumni with the Alumni Assessor Program to review applicant personal profiles as part of the Faculty’s enhanced broad-based admissions process
- Partnered with the Engineering Society to launch Skule™ Alumni Outreach (SkuleAO), a student-run program to assist alumni who wish to support and enhance the experiences of current students
- Expanded engagement with current students — our future alumni — by creating a new Alumni Outreach Director position on the Engineering Society, initiating the inaugural Engineering Society Reunion of current and past officers of the Engineering Society and increasing participation in Gratitude, which encourages graduating students to give back to future students

2.9 Enhance governance processes, cyclical reviews and quality assurance processes.

- Completed the first internal review at the Decanal level of an extra-departmental unit, the Institute for Leadership Education in Engineering (ILeAD)
- Completed an internal review of the Lassonde Mineral Engineering Program (LMEP)

- Initiated a review of the Engineering Outreach Office and completed an internal review of the Engineering Communications Program
- Commissioned external reviews of Chemical Engineering & Applied Chemistry, Engineering Science and the University of Toronto Institute for Aerospace Studies
- Submitted interim reports to the Canadian Engineering Accreditation Board for engineering science, electrical engineering, computer engineering and the mineral engineering programs
- Delivered governance orientation sessions to relevant stakeholders
- Shared annual progress reports on department and institute external review recommendations at regularly scheduled chairs and directors meetings

2.10 Strengthen communications both internally and externally

- Enhanced the e-newsletter for faculty and staff with a new design and content strategy to share information more effectively across the Faculty, with the average open rate increasing by five percentage points
- Started a survey for staff and faculty to assess the volume of communications that students are receiving as part of a Faculty-wide initiative to enhance and create best practices for student communications
- Increased collaboration, knowledge-sharing and skills-building for the Faculty communicators who make up the Engineering Communications Network (ECN) through more frequent gatherings, professional development and ongoing use of the ECN Hub
- Grew the Engineering Engagement & Development Network— a cross-Faculty group for staff and faculty — to more than 80 members, helping them engage in and become more aware of activities and events happening across the Faculty and providing professional development-oriented workshops, webinars and discussion forums

2.11 Continue to acknowledge the accomplishments of our students, faculty and administrative staff

- Held the 8th Annual Celebrating Engineering Excellence Reception to honour recipients of staff, teaching and research awards (April 2015)
- Increased internal and external media coverage of student and faculty accomplishments through the U of T Engineering News, *The Engineering Newsletter* and the Faculty's websites
- Ensured that senior administrative staff were nominated for and participated in the University's New Manager Academy and Business Manager Leadership Program

3. Positioning

Another year of remarkable advances and exceptional achievements provided opportunities for our Faculty to increase our visibility and enhance our profile regionally, nationally and internationally. U of T Engineering was once again recognized as the premier engineering school in Canada and among the world's best across all major international rankings. We continued to leverage our innovative undergraduate and graduate programs, our world-leading research and the remarkable accomplishments of our current students, faculty and alumni to attract the most talented domestic and international students, increase the diversity of our research and learning community, and foster relationships with our alumni, friends and industry partners.

Our mandate is to be a global leader among the very top engineering schools and we strive to disseminate and transfer the knowledge created through our groundbreaking teaching and research. In Year 4 of our Academic Plan, this vision informed our strategy to accomplish our goals related to positioning and effectively communicating U of T Engineering's unique messages. In the past year, we further fine-tuned our positioning and communications strategies to support and enhance the Faculty's priorities and seize emerging opportunities through print and media channels.

We continue to utilize a variety of communication vehicles to celebrate the excellence of our diverse U of T Engineering community and ensure we effectively highlight the wealth of stories we have to tell. In 2014–2015, we had a total of 12,985 stories in the media, an increase of 38 per cent over the previous year. Our impressions — the estimated number of people who may have interacted with a story based on circulation (newspaper/magazines), viewers (TV), listeners (radio) and unique monthly visitors (online) — reached 6.6 billion, an increase of 62 per cent over the previous year. Robust media coverage built the Faculty's and University's national and international reputation in strategic areas of focus and raised the profile of several key Faculty initiatives in bioengineering/health, sustainability, engineering experiential learning and entrepreneurship. Our social media presence grew as we enhanced efforts to drive audiences to our online content. We increased our average monthly Twitter impressions by 14 per cent and doubled our engagement to 2 per cent, nearly double from the previous year. Our Facebook followers also doubled, and the Faculty's Instagram account, which gained more than 300 followers in its first six months, continues to grow.

We demonstrated our commitment to effective and transparent communication with two major publications in 2015. Our *Annual Report of Performance Indicators*, now in its seventh edition, measures our progress over the past 10 years in key areas and highlights

major activities from the previous year. While the *Annual Report of Performance Indicators* primarily serves an internal audience, its companion document, *Innovation Lives Here – Year in Review 2015*, is a succinct and strategic piece for alumni, key donors, industry partners and secondary external audiences such as parents, media and the general public. The *Year in Review* distils the more comprehensive performance indicator information found in our Annual Report and provides a snapshot of the Faculty's progress and contributions in education, research, awards, finances and philanthropy. Both publications provided updates on the progress of our new building, the Centre for Engineering Innovation and Entrepreneurship (CEIE), which will open in 2017.

In 2014–2015, we refined our strategic communication foci to support our Academic Plan objectives, alongside the University's strategic priorities. We completed several initiatives this year, including the launch of the new engineering news site, which enables us to better profile our Faculty's innovative and world-leading research. Since the launch of the site, we have gained traction in our local and international readership, with a total of 125,874 pageviews, up nearly 70 per cent from the previous year. Average pageviews per article also increased 70 per cent on the new platform, with a 140 per cent increase in readership from the United States and 57 per cent more readers from outside North America. In 2014–2015, our top stories on the Engineering News and U of T News websites were:

- *Machine learning reveals unexpected genetic roots of cancers, autism and other disorders (December 2014);*
- *New technique offers spray-on solar (November 2014);* and
- *U of T Engineering celebrates record number of female first-year students (February 2015).*

In addition to launching the engineering news site, we also redesigned our Faculty website in May 2015 to enhance our online presence, communicate more effectively with our diverse audiences and provide better integration with social media channels. Our website is often the first point of contact with prospective students and media from around the world and we developed a clean, modern design with improved information architecture that is more user-friendly and easily accessible to the increasing proportion of visitors who interact with our website on tablets and mobile phones. The site also complies with the World Wide Web Consortium Web Content Accessibility Guidelines (WCAG) 2.0.

Engaging our faculty, staff, students and alumni and fostering a culture of involvement, community and pride continues to be a priority. We redesigned *The Engineering Newsletter* for faculty and staff in January 2015 to increase engagement and share information more effectively across the Faculty. We implemented the new format after a survey of faculty and

staff indicated that internal groups wanted more concise and curated information. Increased open rates, combined with relatively level engagement (measured as average click rate), indicate that these changes were effective in meeting the needs of our internal audience.

As we move forward into the last year of our Academic Plan, our Faculty will improve stakeholder engagement via social media and establish further communication benchmarks, in addition to aligning our message with the core themes identified by U of T Engineering and the University. We will also establish specific recruitment and research communications goals and continue to enhance and strengthen our media relations strategy by developing and promoting stories that profile our research excellence and innovative educational programs.

POSITIONING: YEAR 4 PROGRESS HIGHLIGHTS

3.1 Deliver a plan that articulates our communication goals, maintains consistency of our branding and products, keeps on top of markets, and clearly outlines methods so that we can remain competitive and set the Faculty apart.

- Completed in early 2013; refined strategic communications foci in 2014–2015
- Updated plan to align editorial content with the Faculty’s Academic Plan, the Boundless Campaign and the University’s strategic priorities, including the following areas of focus for the foundation of our media outreach, news stories and overall Faculty messaging including:
 - world-class research;
 - entrepreneurship and innovation;
 - student experience; and
 - enriching engineering education.

3.2 Strengthen the Faculty’s key messages and customize them for target audiences.

- Assessed metrics in key areas and published our seventh *Annual Report of Performance Indicators*
- Launched our new Faculty website to further enhance our online presence, communicate more effectively with our diverse audiences and provide better integration with social media channels
- Executed our first targeted media campaign to celebrate women in engineering and build on our successful efforts to recruit more women to U of T Engineering, including a microsite, online news stories, social media and focused media relations efforts; campaign highlights included 12,500+ reads and a 653,000-impression social media reach on a web story celebrating record-high female enrolment, as well as 120 media stories with more than 23 million impressions over four months in mainstream, industry

and peer publications; campaign won a 2015 Silver Leaf Award of Excellence in Marketing Communication from the International Association of Business Communicators

- Conducted a readership survey for our *Skulematters* alumni magazine, following the completion of the issue on entrepreneurship and commercialization, to ensure we are meeting the interests of our alumni; feedback gathered was used to enhance the content and layout in the fall 2015 *Skulematters* highlighting “Women in Engineering: A Tradition of Excellence”
- Published the second *Innovation Lives Here – Year in Review 2015*, a 20-page publication highlighting key accomplishments within the Faculty and targeted toward alumni, key donors, industry partners and secondary external audiences such as parents, media and the general public
- Enhanced the e-newsletter for faculty and staff with a new design and content strategy to share information more effectively across the Faculty, with the average open rate increasing by five percentage points
- Supported the Engineering Student e-News, a monthly publication from the Registrar’s Office
- Produced several new research inserts on water, advanced manufacturing, healthcare engineering, nanoengineering and sustainable mining to support corporate outreach activities and industry partnerships
- Launched a number of strategic initiatives, including proactive media outreach, an enhanced online presence and improved marketing materials, aimed at strengthening our visibility and our reputation for excellence
- Completed and executed a comprehensive communications strategy for the Centre for Engineering Innovation and Entrepreneurship (CEIE) groundbreaking ceremony in June 2015
- Completed a foreword for a book by Dr. Lynnette Madsen of the U.S. National Science Foundation, entitled *Successful Women Ceramic and Glass Scientists and Engineers: 100 Inspirational Profiles*, for The American Ceramic Society on the topic of women glass scientists and engineers
- Partnered with U of T Alumni Relations and Advancement Communications to refresh the Engineering Alumni Association’s word mark; the renewed design will be launched after consultation with the U of T Engineering alumni community and will reflect the Association’s new identity as the U of T Engineering Alumni Network

3.3 Establish the Faculty as the go-to resource for media looking for comments and engineering expertise on breaking news issues.

- Continued to build the Faculty’s national and international reputation in strategic areas of focus by securing significant media coverage in 2014–2015, including 12,985 media stories (38 per cent increase over 2013–2014) with 6.6 billion impressions (62 per cent increase over 2013–2014)
- Increased proactive pitching tied to breaking news and current affairs and secured media stories along strategic communications themes by proactively offering our professors as

experts for media; examples include senior administrative leaders commenting on recent nation-wide reports about the lack of diversity in STEM (*Globe and Mail, Maclean's*) and a U of T civil engineering professor commenting in national media coverage on the urban-related Toronto Mystery Tunnel (*National Post, CBC The National, Ottawa Citizen, Montreal Gazette*)

- Grew international media presence and secured ongoing regional, national and international media coverage through proactive pitching, with stories in non-Canadian outlets increasing proportionately to 60 per cent (from 47 per cent in 2013–2014)

Highlights included:

- **Bioengineering/Health**
 - ECE researchers published a paper in *Science* on decoding the human genome using machine learning (*Globe and Mail, Scientific American, WIRED Magazine, National Post, Ottawa Citizen, Vancouver Sun*).
 - Two IBBME PhD students won the Canadian James Dyson Award for a 3D skin bio-printer (*CBS News, Fast Company, Huffington Post, CBC News Online*).
- **Sustainability (including Sustainable Cities)**
 - A CivE researcher published two different papers, one in *Nature Climate Change* that demonstrated how electricity must come from low-carbon sources for green technologies to lower emissions, and another in the Proceedings of the National Academy of Sciences that tracked resource use in megacities (*BBC World Service, Quartz, NBC News, The Atlantic CityLab, NU.nl, Tendencias21, Globe and Mail, CBC Radio One, Smithsonian Magazine, Discovery News*).
 - ChemE researchers demonstrated that air pollution from vehicles travels farther than thought (*CBC The National, VICE Motherboard, Toronto Star, CP24, 680 News, Huffington Post Canada*).
 - ECE postdoctoral fellow designs technology that could enable spray-on solar cells (*UK Daily Mail, Popular Science, Fast Company, GigaOm, Futurism, Gizmag, CBC News, Discovery Channel, Space Channel*).
- **Engineering Experiential Learning**
 - Engineering students design fuel-efficient car and win international Eco-Marathon (*Fast Company, About.com, CBC News, FOX News Online*).
 - U of T breaks ground on new Centre for Engineering Innovation & Entrepreneurship (*680 News Toronto, Canadian Architect*).
 - Engineering students design, build and race concrete canoes across Toronto's waterfront in the 2015 Canadian National Concrete Canoe Competition (*Global News National, CTV News National, CBC Radio One, CP24 Toronto, Fairchild TV*).
 - U of T joins U.S. engineering education initiative announced at White House (*Metro Toronto, Daily Commercial News, Yonge Street Media*).
- **Entrepreneurship**

- U of T Engineering startup OTI Lumionics expands with organic LED manufacturing (*Financial Post, TreeHugger, Forbes, Canadian Manufacturing, Ottawa Business Journal, Gizmag*).
- Engineering alumni startup Bionym continues to develop and expand Nymi, its wearable, encrypted, bracelet-like device (*Forbes, Business Insider, Tech Crunch, Denver Post, CNET, Globe and Mail, BC's The Province*).

3.4 Continue to increase the quality of our storytelling, journalism and communications processes and tools to make our practices best-in-class and in pace with emerging technologies and their uses by our target audiences.

- Increased pageviews on our Engineering News site to 125,874 (up nearly 70 per cent from 74,661 in 2013–2014), by posting more engaging, shareable, strategic and mobile-friendly content; also contributed to an increase in average pageviews per story of more than 70 per cent
- Attracted more international interest in our stories, with pageviews from the United States reaching 14,106 (up more than 140 per cent from a year earlier) and pageviews from outside North America reaching 17,554 (up 57 per cent from a year earlier)
- Continued to integrate more multimedia components, such as photo galleries, infographics, illustrations and animated GIFs, into web communications to enhance our storytelling
- Explored new methods of news storytelling, such as leveraging events with large visual opportunities and interview prospects to tell news stories using video only, such as for the Multidisciplinary Capstone Design Projects showcase
- Hosted several professional development sessions in web writing, editing and news writing for the more than 30 Faculty communicators who make up the Engineering Communications Network
- Continued to improve stakeholder engagement via social media and establishing communication benchmarks
- Set specific recruitment and research communications goals through special media campaigns
- Continued to use social media during events to increase engagement and public awareness

3.5 Remain flexible to changing media and technologies, nurture blogger and social media relationships, and build relationships and communications with traditional media.

- Created and shared new multimedia assets, such as illustrations, animated GIFs and videos, for use when pitching online media outlets, which resulted in Faculty-created visual assets being distributed across significant news sites, such as *Gizmodo, VICE Motherboard, WIRED Magazine, the Toronto Star* and others
- Regularly updated our social media platforms, such as Twitter, Facebook, Instagram and Flickr

- Improved reach in online coverage, with almost 86 per cent of overall media articles coming from online news outlets, blogs and websites, up almost three quarters from the previous year

3.6 Increase the Faculty's presence, visibility and reputation on modern social media platforms.

- Enhanced social media engagement across each of our social media feeds (Twitter, Facebook and YouTube), providing additional opportunities to steer traffic to our comprehensive online content, with Twitter monthly impressions and engagement up 14 per cent and 82 per cent over the previous year and Facebook followers increasing by 105 per cent over the previous year
- Launched an Instagram account and scaled our use of social photos to reach current and prospective students with engaging multimedia content
- Created concise YouTube videos to share on social media and drive engagement, such as a 16-second YouTube video to accompany our spray-on solar story that secured more than 50,000 views in three months
- Secured more clickthrus to our new stories from social channels, with a web story celebrating high female enrolment breaking a new record of more than 2,000 clickthrus on Twitter and Facebook

4. Educating Future Engineers and Student Experience

As Canada's top engineering school and one of the world's best, we are committed to offering outstanding academic programs and unparalleled co-curricular opportunities that prepare our students to become global engineering leaders. As we enter the final year of our Academic Plan, we have already achieved or exceeded our goals in many of these areas and are making strong progress toward the rest.

Our academic excellence, outstanding international reputation and recruitment activities attracted some of the brightest students from around the world in 2014–2015, drawing a record 10,989 applications for only 1,130 undergraduate places. From that pool, we admitted the most accomplished first-year class in our history, with the mean entering average of Ontario secondary school students increasing to 92.4 per cent. It was also the most diverse: 30.6 per cent of our first-year students were women, the highest proportion of any entering class in Canada, and 31.9 per cent were international students. To continue admitting the most talented undergraduate students, we implemented a new component in our broad-based admissions process for candidates seeking entry in fall 2015. This pilot project — the first of its kind among Canadian engineering schools — uses videos and timed written responses to give our admissions committee more comprehensive knowledge of each applicant. Growth also remained strong in our doctoral and masters programs, with the graduate cohort increasing to 2,194 students in 2014–2015 after surpassing our Academic Plan goal of 2,000 graduate students in 2013–2014, two years ahead of schedule.

U of T Engineering is a leader in advancing diversity, which deepens the engineering creative process, prepares our students to engage different perspectives and enriches our profession. Women now comprise more than one-quarter of our undergraduates thanks to our robust pre-university outreach programs, such as Girls' Leadership in Engineering Experience (GLEE) and the Young Women in Engineering Symposium (YWIES). We also leveraged the record number of women in the 2014–2015 entering class to launch an award-winning media campaign in early 2015 that celebrated women in engineering and drew attention to U of T's leadership in this area. Thanks to our excellent international reputation and strategic recruitment in key global regions, we also attracted outstanding students from around the world, with international students making up 25.8 per cent of undergraduates, in line with our Academic Plan goal of 25.0 per cent by 2015.

We continue to be at the forefront of curriculum innovation and experiential and collaborative learning opportunities that prepare our students to lead in a complex global engineering environment. In December 2014, we received the final report of the Dean's

Task Force for Core Curriculum Review and appointed a working group to oversee implementation of the Task Force's recommendations to improve our first-year curriculum and overall student experience. In fall 2015, we strengthened opportunities for undergraduate students to customize their education by launching a minor in Nanoengineering, a certificate in Communication and an Engineering Science major in Robotics Engineering. We continued to pilot a Technology Enhanced Active Learning (TEAL) room in the Sandford Fleming building to inform decisions about the design of TEAL rooms in the Centre for Engineering Innovation and Entrepreneurship (CEIE). We also offered online versions of some key courses, as well as an "inverted classroom" model, where students watch lectures online prior to class and use classroom time to engage in experiential learning. Participation continued to grow in our multidisciplinary design courses, which offer students in different disciplines opportunities to work in teams on industry challenges. Our Professional Experience Year (PEY), the largest optional internship program of its kind in Canada, also engaged an increasing number of students. In 2014–2015, 724 students — or more than 60 per cent of those eligible — participated in 12 to 16-month work placements, and the number of international positions rose to 61, nearly double the number at the beginning of the Academic Plan in 2011. The PEY program benefits participating students, who can then apply their newly acquired engineering competencies in a professional environment, as well as their employers who gain fresh perspectives and ideas. This past year, demand for our MEng program increased as we strengthened our offerings with new emphases in Sustainable Energy and Advanced Manufacturing and approved creation of a new MEng in Biomedical Engineering, beginning in 2016, which will focus on medical device design.

We are committed to ensuring student success and supporting teaching excellence. Our first-to-second-year undergraduate retention rate increased to 96.3 per cent in 2014–2015, from 94.6 per cent the previous year, due to our enhanced selectivity and the range of supports we offer to transition from high school to university, including Success 101, a summer workshop for admitted students that teaches time management, studying and note-taking skills. We introduced new mechanisms for students to interact with their instructors and provide feedback on courses, and incorporated new training requirements for teaching assistants for different types of tutorials and labs. In May 2015, our biannual Educational Technology Workshop drew 250 instructors from the Faculty, the University and our hospital partners to learn how to integrate the latest learning technologies into their teaching. In 2015, we issued a call for proposals for the Engineering Instructional Innovation Program (EIIP), which was created in 2013 to foster curriculum innovation through strategic investments to improve learning pedagogies and the student experience. From this call, we supported a project to re-energize engineering mathematics instruction through enhanced and focused teaching techniques, and a project to create "parallel

classrooms”, which will enable us simultaneously to deliver integrated and complementary courses to MEng students from a classroom in the Mechanical Engineering Building and a classroom at the University of Toronto Institute for Aerospace Studies (UTIAS), which is located about 20 kilometres north of the St. George campus. Members of our Faculty garnered recognition for teaching excellence both inside and outside the University, including in 2015 the President’s Teaching Award, U of T’s highest teaching honour, and the Ontario Confederation of University Faculty Associations Teaching Award.

We offer an unparalleled student experience through our rich and vibrant co-curricular activities, international opportunities and student clubs. Fostering entrepreneurship continues to be a key priority of the Faculty, and we have two incubator programs that offer mentoring, networking and resources to help students take their ideas from prototype to startup. In 2015, 37 teams comprised of 109 students worked throughout the summer on their startup ideas at The Entrepreneurship Hatchery, with 13 teams of 42 students pitching their ideas at Hatchery Demo Day in September 2015. Prize-winning projects included a system that could revolutionize satellite communications in space and a telescoping hex tool that simplifies bicycle repair. Throughout the year, the Hatchery held 44 events aimed at nurturing student entrepreneurship, including a speaker series and weekly “idea markets.” The Hatchery Circle is a new forum for women to discuss entrepreneurship and innovation. A second incubator program, Start@UTIAS, encourages UTIAS graduate students to use the knowledge and competencies they have gained through their education to create startups. In 2015, it provided mentoring and funding to 15 teams, with six of those teams presenting their ideas at a pitch event in fall 2015. Our students can also nurture their passions and interests through more than 80 U of T Engineering student clubs and teams, ranging from the Skule™ Orchestra to the Blue Sky Solar Racing team, and hundreds more student activities across U of T. They can also gain recognition for the competencies they develop in these activities through the U of T Co-Curricular Record. We remain committed to listening to students, and to holding regular Dean’s Town Hall events on topics such as undergraduate research opportunities, improving assessment feedback for students and “ask us anything” sessions.

The CEIE is a cornerstone of our strategy to enhance our academic programs and innovative co-curricular opportunities and strengthen our position among the world’s leading engineering schools. When it opens in 2017, this state-of-the-art building will foster experiential learning, heighten opportunities for cross-disciplinary collaboration and offer flexible space for students clubs, sparking a new era in engineering education.

4.1 EDUCATING FUTURE ENGINEERS: YEAR 4 PROGRESS HIGHLIGHTS

4.1.1 Maintain and strengthen our high-quality education through continued review and assessment of our programs and curricula for currency, vision and relevance. Establish desired learning outcomes for graduate and undergraduate students to ensure they are well prepared as future engineers. Evolve our cyclic reviews and plan for continuous quality assessment within the new UTQAP and CEAB Graduate Attribute systems.

- Received the final report of the Dean's Task Force for Core Curriculum Review in December 2014 and appointed a working group to guide and oversee the implementation of these recommendations to improve our first-year curriculum and overall student experience
- Continued meetings of the Graduate Attributes Committee and collected data through various initiatives for analysis
- In the process of creating a common database for generating the required curriculum maps for the Canadian Engineering Assessment Board (CEAB) review and developing the documentation processes to monitor curriculum changes; reviewed the terms of reference of the Undergraduate Curriculum Committee to ensure this will occur in a systematic and organic approach

4.1.2 Further integrate professional competencies, such as global engineering, entrepreneurship, leadership and communication into undergraduate and graduate curricula. Define, assess and measure our programs and curricula successes through the UTQAP UDLEs, GDLEs and cyclic reviews and through the CEAB Graduate Attributes.

- Launched the undergraduate certificate in Communication in fall 2015
- Enhanced experiential learning opportunities with a team-based, industry-sponsored multidisciplinary design project course; to date more than 150 students have participated in 37 projects sponsored by 23 clients
- Conducted internal reviews of the Lassonde Mineral Engineering Program and the Institute for Leadership Education in Engineering (ILead) in fall 2014

4.1.3 Enrich the quality of undergraduate academic experience by increasing flexibility in the undergraduate curriculum, continuing to develop progressive opportunities for students to pursue their professional interests, and integrating professional competencies throughout the curriculum.

- Experienced tremendous growth in minor enrolment and completion, with 31% of the 2014–2015 graduates completing an Engineering minor
- Saw particularly strong interest in the Engineering Business minor and certificate, with 29 per cent of graduates receiving one of these qualifications

- Launched new undergraduate cross-disciplinary programs in fall 2015 to strengthen opportunities for students to customize their degrees, including a minor in Nanoengineering and a certificate in Communication
- Introduced a new Engineering Science major in Robotics Engineering
- Increased Professional Experience Year (PEY) placements to 724, from 705 in 2013–2014, with 61 students completing their work terms outside Canada
- Launched the 2015 internal review of the Engineering Career Centre/Professional Experience Year (PEY) and the Cross-Disciplinary Programs Office

4.1.4 Continue to support and enhance undergraduate students' opportunities for self-directed learning and study time, and participation in the enriching extracurricular activities within our Faculty, across the University, and beyond.

- Offered four first-year courses online in fall 2015 to allow students more choice in how they access educational material: APS 160 — Mechanics, APS 162 and 163 — Calculus for Engineers I and II, and APS 164H1 — Introductory Chemistry from a Materials Perspective
- Continued lecture capture for most first-year classes to provide more flexibility to students and enable them to review lectures outside of class
- Drew more than 11,000 people to our second massive open online course (MOOC), Wind, Wave and Tides: Alternative Energy Systems

4.1.5 Enhance our instructional space to facilitate innovative teaching methods and create efficiencies on how we share space. This includes flexible interactive teaching space for substantial numbers of students, design and group project space and lecture/lab combination space.

- Enhanced teaching and design facilities and upgraded undergraduate laboratory space including:
 - the installation of a new audio-visual system in the IBBME undergraduate teaching lab to improve content delivery;
 - renovation of the Unit Operations Laboratory in the Wallberg Building to create an additional 200 net assignable square metres (NASMs) of wet lab space and increase student capacity from 48 to 60;
 - phase 2 renovations to the ECE Electrical Energy Systems Lab to install new infrastructure to expand the lab's capabilities to support a wider array of courses; and
 - addition of digital displays outside undergraduate computer labs to show the status of all labs, including course bookings, drop-in availability and open seat counts.
- Began construction in June 2015 on the Centre for Engineering Innovation & Entrepreneurship (CEIE), which will offer Technology Enhanced Active Learning (TEAL) rooms, a 500-seat auditorium featuring small-group seating and highly interactive learning and communications technology and prototyping and light fabrication facilities

- Continued to test a prototype TEAL room in the Sandford Fleming building that will inform the design of TEAL rooms in the CEIE
- Through the EIIP, supported a joint project by UTIAS and MIE to create “parallel classrooms” to allow MEng students in each program to participate simultaneously in lectures delivered from either of two locations
- Undertook a space audit of undergraduate teaching labs, with the final report expected in December 2015

4.1.6 Provide reliable, accessible, effective computing services and study spaces within and outside computer laboratories, library and classrooms to enhance efficient interactive learning and socialization where today’s student “lives.”

- Added 87 student study spaces to the Bahen Centre inventory of hallway seating
- Currently installing another 63 student study spaces in the Bahen Centre and 20 spaces in the Wallberg Building
- Renovated space in the Lassonde Mining Building for a study space and conferencing centre
- Launching a 2015 review of student computing services

4.1.7 Link the quality of student learning, the quality of their education and their improved future performance with teaching effectiveness. Continue to inspire and support the Faculty’s culture of teaching excellence and encourage Faculty members and teaching assistants to reflect upon their teaching effectiveness through enhanced feedback mechanisms. Support teaching initiatives and opportunities that will improve their professional development as educators.

- Supported through the EIIP a project to re-energize engineering mathematics instruction through improved and focused teaching techniques
- Held the third annual First-Year Instructors Day, which helps ensure consistency in the student experience and raises awareness of the various support systems that are in place (September 2015)
- Hosted the biannual Educational Technology Workshop “EdTech” to help instructors share best practices for innovative teaching and learning (May 2015)
- Garnered major teaching awards, including the President’s Teaching Award, U of T’s highest teaching honour, and the Ontario Confederation of University Faculty Associations Teaching Award
- Introduced new feedback mechanisms, including broader use of Piazza, an online platform where instructors can answer students’ questions, the use of an online anonymous feedback tool and teaching assistant coordinators for Calculus I, II and Linear Algebra
- Incorporated new training requirements for different types of tutorials and labs into teaching assistant training

4.1.8 Continue to attract and retain diverse, outstanding students from a wide range of backgrounds in order to provide an exceptional education for future global engineers and leaders. In particular, we must strive to attract more female students into our programs.

- Drew a record 10,989 undergraduate applications for the fall 2014 incoming class
- Admitted the most accomplished and diverse first-year class in our history:
 - Mean entering average of Ontario secondary school students was a record 92.4%
 - 30.6% women, the highest proportion of any entering engineering class in Canada, and 31.9% international students
- Leveraged the record number of women in our entering class to launch a targeted media campaign in early 2015 that celebrated women in engineering and drew attention to U of T's leadership in this area; this campaign won a 2015 Silver Leaf Award of Excellence in Marketing Communication from the International Association of Business Communicators
- Continued to offer robust outreach initiatives to support strategic recruitment; for example, 89% of female high school students who attended the 2015 Girls' Leadership in Engineering Experience (GLEE), an event for female high school students with offers of admission to the Faculty, subsequently accepted our offers, up from 77% in 2014
- Held the second annual Young Women in Engineering Symposium, attracting more than 70 top female high school science students from across the Greater Toronto Area (October 2015)
- Continued to increase diversity across our student body in 2014–2015:
 - 25.8% of undergraduate students and 26.7% of graduates students were women
 - 25.8% of undergraduates and 27.1% of graduate students were international students, with our study body coming from 109 countries
- Increased undergraduate recruitment efforts in South and Central America, with events in Peru, Colombia, Costa Rica, Guatemala and Brazil, to broaden the geographical diversity of our student body and increase their global outlook
- Hosted a reception in Dubai for alumni and parents of U of T Engineering students, which provided opportunities to engage with parents of current and prospective students and raise the profile of the Faculty in this region (December 2014)
- Expanded the broad-based admissions process for candidates seeking admission to our undergraduate programs in fall 2015 with videos and timed essays; this pilot project, the first of its kind among Canadian engineering schools, gives our admissions committee more comprehensive knowledge of each applicant

4.1.9 Strategically award admission scholarships to meet our student recruitment goals.

- Introduced two new entrance scholarships for international students; the U of T Engineering International Scholar Award covers the full cost of tuition (up to \$45,700) and is renewable for four years; awarded two scholarships to students from Jordan and Singapore
- Improved the visibility of our entrance scholarship program by overhauling the “Money” section of the Discover Engineering website to better communicate scholarship opportunities to prospective students; the scholarship page now includes basic tables indicating available awards, dollar amounts, and eligibility criteria
- Communicated available scholarship and financial assistance (UTAPS) opportunities and related deadlines through targeted applicant updates

4.1.10 Reduce the dwell time for MASc and PhD students and address time-to-graduation issues.

- Awarded a record number of graduate degrees in 2014–2015, with 772 students completing their degrees
- Held time to graduation to an average of 5.3 years for PhD students and 2.0 years for MASc students
- Implemented a new software tracking system in ECE to record the progress of PhD students, which will also be available for use in other departments and institutes

4.1.11 Continue to develop vibrant MEng programs and offer a larger variety of courses suitable to MEng students.

- Launched new MEng emphases in Sustainable Energy and Advanced Manufacturing, bringing the total number of areas of emphasis to 11
- Offered more than 15 graduate courses aimed at only MEng students
- Approved creation of an MEng in Biomedical Engineering, to launch in fall 2016, that will focus on medical device design

4.1.12 Increase graduate student enrolment to reach 2,000 graduate students by 2015, with particular focus on increasing PhD and MEng students and aiming to reach an average of one PhD graduated annually per faculty member. At the same time, we will endeavor to reduce our undergraduate student enrolment to 4,000 by 2015, with 25% of undergraduates consisting of international students. In fall 2010, Full-Time Equivalents (FTEs) were 4,599 undergraduate and 1,527 graduate students, a percentage ratio of 75.1% to 24.9%.

- Increased graduate students to 2,194 in 2014–2015 after surpassing our Academic Plan goal of 2,000 in 2013–2014, bringing us closer to our longer-term objective of enrolling 1.5 undergraduates for every graduate student
- Continued to participate in a consortium of top Canadian engineering schools to seek out candidates for our research-stream graduate programs
- Continued to expand enrolment in professional masters degrees to 712, up 75 per cent from five years ago, and expanded offerings in these programs
- Increased PhD enrolment to 876, up 26 per cent over the past five years
- Surpassed goal of enrolling 25% international undergraduate students, reaching 25.8%, up from 23.1% the previous year

4.2 STUDENT EXPERIENCE: YEAR 4 PROGRESS HIGHLIGHTS

4.2.1 Ensure that all our undergraduate curricula provide students with sufficient self-directed time to fully reflect on and understand the material in their program, the vision and relevance to ‘learn how to learn,’ and the advantage of taking opportunities to experience and engage in University life outside the classroom through extracurricular and co-curricular activities.

- Increased first-to-second-year retention rate in 2014 to 96.3%, from 94.6% the previous year
- Used the inverted classroom model, in which students watch lectures online prior to class, in classes such as ECE 221 — Electricity and Magnetism and CIV 235 — Civil Engineering Graphics
- Accepted 37 teams comprised of 109 students in The Entrepreneurship Hatchery’s summer program, culminating in investor pitches by 13 teams of 42 students in September 2015
- Implemented the University’s Co-Curricular Record (CCR), an official U of T document that provides students with recognition for the competences they gain through their roles on athletic teams, student government, cultural clubs, design teams and other campus organizations:
 - In 2014–2015, the CCR expanded the list of roles it recognizes from 15 to 215
 - U of T Engineering offers and supports more than 80 student clubs and teams

4.2.2 Engage more undergraduates in faculty research activities. Enhance summer opportunities for our undergraduates by expanding the Engineering Summer Internship Program (eSIP) and by increasing summer research opportunities both within the Faculty and through agreements with international institutions.

- Provided summer research opportunities to 282 undergraduate students in 2014–2015, including 64 who participated in research abroad
- Launched in 2015 a new credit course APS 299Y — Summer Research Abroad, for students who wish to receive degree credit for summer research
- Held the 2015 Undergraduate Research Day UnERD, a one-day research symposium for students to celebrate undergraduate engineering research carried out over the summer and allowing students to gain key competencies through abstract writing and collaborative networking (August 2015)

4.2.3 Enhance our students' access to electives outside technical courses.

- Signed an Interdivisional Teaching Agreement with the Faculty of Arts & Science, which includes an academic framework to enable the two Faculties to work together to achieve our educational mission for the benefit of students and faculty, and allow us to focus on pedagogy rather than funding (June 2015) — including a number of course slots guaranteed at the Faculty of Arts & Science for engineering students
- Added four complementary studies courses:
 - APS 444 – Positive Psychology for Engineers
 - APS 445 – The Power of Story
 - APS 446 – Leadership in Project Management
 - APS 343 – Foundations of Engineering Leadership

4.2.4 Enhance our undergraduate and graduate students' non-traditional educational opportunities, including international academic exchanges and internships, courses offered abroad, field courses, and credit for work in extracurricular activities such as design teams.

- Sent six students and one faculty member to Peking University in Beijing, China through the Global Educational Exchange (Globex) program for an intensive, three-week program that exposed them to new ideas, research, people and culture
- Welcomed 64 exchange students from universities around the world and sent 94 U of T Engineering students to 26 partner institutions in Europe, Asia, Australia, India, Mexico, Turkey and Israel
- Welcomed 83 new students in fall 2014 through Brazil's *Ciência sem Fronteiras* program (formerly Science without Borders), bringing the total number of students the Faculty has hosted through this program since 2012 to 490 — enrolment per session for all students was 260 in September 2014 and 78 in January 2015
- Enhanced our partnership with Technion Israel Institute of Technology for graduate student and postdoctoral fellow exchanges and accelerated joint research initiatives,

supported by a \$1 million gift to U of T Engineering from alumnus Lyon Sachs (IndE 4T9)

- Offered guidance, tools and resources through The Entrepreneurship Hatchery to 37 teams comprised of 109 students who wanted to develop startups, with 13 teams of 42 students pitching their ideas at Hatchery Demo Day in September 2015

4.2.5 Continue to inspire the Faculty's culture of teaching excellence and support teaching initiatives that improve student experience, support their connections with course content, increase in-class engagement and strengthen students' understanding of course relevance.

- Received recommendations from the Dean's Task Force for Core Curriculum Review in December 2014 and appointed a working group to guide and oversee the implementation of these recommendations to improve our first-year curriculum and overall student experience
- Held the third annual First-Year Instructors Day, which helps ensure consistency in the student experience and raises awareness of the various support systems that are in place (September 2015)
- Piloted a TEAL room and inverted classroom models in several courses
- Through the Engineering Instructional Innovation Program (EIIP), supported several projects, including one to re-energize engineering mathematics instruction through improved and focused teaching techniques

4.2.6 Promote extracurricular activities through communications, faculty mentoring and suitable space and facilities.

- Continued to develop plans for versatile student club space on the lower level of the Centre for Engineering Innovation & Entrepreneurship, which will include storage, fabrication spaces and meeting rooms
- Stream-lined the process for student club funding by creating the Centralized Process for Student Initiative Funding (CPSIF) which allows student groups to apply to various funding resources from within the Faculty of Applied Science & Engineering in a single application
- Held third annual Pink Shirt Day to raise awareness about bullying and discrimination, including a photo booth where people recorded statements about diversity

4.2.7 Actively engage and support students in their unique academic and non-academic experiences as soon as they enter our Faculty, so they can thrive throughout their studies.

- Offered a range of academic supports, such as:
 - Success 101, a summer workshop offered free-of-charge to newly admitted undergraduates that teaches diverse styles of learning, time management, studying and note-taking;

- the First-Year Foundations program, which helps students sharpen their technical skills, become familiar with the campus, meet future classmates and gain valuable advice from current students and professors;
- embedded counsellors who provide guidance and identify students who may benefit from extra support;
- Peer-Assisted Study Sessions (PASS), led by highly successful upper- year students; and
- Supports for international students including international student transition advising, online chats from June to September for international students to ask questions and receive assistance, and the International Foundation Program, which allows academically strong students to gain conditional admission as non-degree students while they complete intensive English-language training and the Engineering Strategies and Practice course series.
- Connected students with programs offered by the Centre for International Experience, including:
 - iConnect, an intercultural mentorship program; and
 - Step Up, a week-long, residential pre-orientation program that prepares international students for their studies at U of T with the Engineering First-Year Office providing engineering-specific input to Step Up.
- Held send-off events in Calgary and Istanbul, Turkey, where alumni and current students welcomed newly admitted students and their parents to U of T Engineering

4.2.8 Engage Master of Engineering (MEng) students to improve the quality of their experience.

- Engaged MEng students with graduate student associations reaching out to involve them in social and professional development opportunities
- Offered MEng-only orientations in many departments to meet specific needs of professional graduate students
- Hosted a welcome event for new MEng students in September 2015, which attracted more than 150 students

4.2.9 Enrich graduate students' academic life and build a stronger sense of community among graduate students across the Faculty.

- Welcomed first cohort in the collaborative program in Engineering Education (EngEd), a partnership with the Ontario Institute for Studies in Education (OISE)
- Offered the Prospective Professors in Training program, which gives PhD candidates who are interested in careers in academia the opportunity to design courses and research programs, develop effective academic curriculum vitae, teaching dossiers and research statements, and prepare for academic job interviews

5. Research Foci

Our Faculty is an international leader in research and innovation and we are known for addressing complex global challenges. The impact of our research is local, national, and international in scale. Our multidisciplinary collaboration and ingenuity drive new technologies and processes that power economic development, improve lives and protect the planet. Our engineers are known as creators and innovators and at U of T Engineering we continue to distinguish ourselves as the premier engineering school in Canada and among the best in the world.

The innovation at U of T Engineering attracts top researchers and students from across Canada and internationally, and enables us to leverage the agency funding and industrial partnerships necessary to continue our groundbreaking work. In addition, our distinguished research institutes and centres contain unique facilities and expertise. Inherently multidisciplinary and collaborative, we bring together technical knowledge and diverse perspectives to solve the complex problems society faces today.

Our Academic Plan outlined a key goal with respect to our research portfolio: to increase our Tri-Council funding to \$25 million per year by 2015. We surpassed this goal three years early, reaching \$26.3 million in 2012–2013, and are making excellent progress toward our new goal of \$32 million by 2015–2016. The importance of this funding is underscored by the fact that the national reallocation of Canada Research Chairs (CRCs), which occurs every two years, is based on the proportion of Tri-Council and Networks of Centres of Excellence (NCE) funding that each university receives. CRCs represented \$3.5 million in revenue for the Faculty in 2013–2014, and \$3.9 million in each of 2014–2015 and 2015–2016. The growth in Tri-Council funding translated into U of T Engineering receiving an additional two Tier II equivalent CRCs in the 2015 reallocation.

In 2013–2014, U of T Engineering attracted \$81.6 million in research infrastructure and operating funds — the highest annual total in our Faculty’s history and a 21 per cent increase over the previous year. Through our collective efforts, we have pursued and attracted more support for our research programs, including \$3.1 million from the Canadian Institutes of Health Research (CIHR), which has tripled in the past decade from \$1 million in 2004–2005. This increase is in line with our Academic Plan goals and supports our world-renowned research in biomedical engineering and health-systems research. We have also received significant support to enhance our outstanding research infrastructure. In January 2015, six professors in our Faculty received a total of more than \$1 million from the Canada Foundation for Innovation’s (CFI) John R. Evans Leaders Fund to build their research capacity with new, cutting-edge equipment. The new infrastructure

will support research that will facilitate the creation of new telecommunications devices and the development and use of chemical isotopes to track emerging environmental contaminants, such as pharmaceutical products in wastewater.

In July 2015, the University of Toronto was awarded the first grant through the Federal Government's Canada First Research Excellence Fund (CFREF). The \$114 million initiative *Medicine by Design* is a collaborative project with U of T Engineering, our partner research hospitals, the Faculties of Medicine, Pharmacy and Arts & Science and other academic and industry collaborators. *Medicine by Design* will enhance U of T Engineering and U of T's position as leaders in transformative research and clinical translation in regenerative medicine. In addition, the initiative will enhance capability in synthetic biology and computational biology, will foster clinical impacts and will lead the evolution of Canada's global medical industry with the significant creation and supply of regenerative medicine technologies.

Our collaborations and partnerships with industry allow us to not only leverage funding opportunities but also enhance commercialization and knowledge transfer. In the past year, we attracted numerous corporate partners, including those leveraged through the Natural Sciences and Engineering Research Council's (NSERC) Strategic Partnership Grants (SPG), which seek to increase research and training in targeted areas that could enhance Canada's economy, society or environment. In 2014–2015, our Faculty received \$3.5 million in funding from the NSERC SPG program for eight new initiatives. These include research into new catalysts that can convert waste gas into useful fuels and a project investigating the use of nanofibre membranes for water filtration and treatment.

In total, more than 300 partners provide funding through sponsored research agreements or as part of consortia. In support of corporate outreach activities and new industry partners, this year we also created a series of insightful new research inserts in key areas of focus. These publications highlight the benefits of partnership with U of T Engineering and emphasize strategic research and development strengths within the Faculty. We also relaunched our main Faculty website — including a redesigned Research and Innovation page — to further support marketing to and communications with potential and existing partners. In November 2015, we will also hold our fourth annual Industry Partners Reception, our premier networking event to facilitate introductions that could lead to new partnerships and ideas for collaborative projects.

In addition to our NSERC SPG success, in 2014–2015, U of T Engineering had the lead role on nine NSERC Collaborative Research and Training Experience (CREATE) grants, including two new grants awarded during the year. The CREATE program allows us to enhance our

capacity to develop highly qualified students and postdoctoral fellows through innovative initiatives that encourage collaborative and integrative approaches to research. Students and postdoctoral fellows will then be able to successfully transition into the workforce. In May 2015, Professor Hugh Liu received a \$1.65 million CREATE grant to train 150 new experts in the use of unmanned aerial vehicles (UAVs) for a variety of purposes, from agriculture to environmental monitoring. Liu's team, the Flight Systems and Control Research Laboratory, develops algorithms that can help UAVs respond intelligently to a variety of inputs. The CREATE grant will build on previous work and allow Liu and his collaborators to design UAVs for many other possible applications, including scouting for mineral deposits or other natural resources, monitoring pipelines or railways for damage, checking on crops and applying fertilizers. In July 2014, Professor Brent Sleep received a CREATE for the Remediation Education Network (RENEW). This award supports student training in environmental remediation, such as determining new methods for decontaminating groundwater.

Across U of T Engineering we have actively worked on numerous programs that will benefit our entire community, including faculty members at all stages of their careers, undergraduate and graduate students and our collaborative stakeholders in industry, academia and partner research hospitals. All our initiatives provide support and resources across the Faculty and ensure our continued success and excellence in research.

RESEARCH FOCI: YEAR 4 PROGRESS HIGHLIGHTS

5.1 Create new and support current research centres around strategic research themes that make significant, relevant impacts on society.

- Supported two U of T Engineering institutes submitting proposals to FedDev
- Assisted researchers and our Faculty-appointed Principal Investigator (PI) via Faculty participation in the Canada First Research Excellence Fund (CFREF); resulting in a \$114 million award to the U of T for *Medicine by Design*, a collaborative project enhancing U of T's position as a leader in regenerative medicine
- Supported NSERC CREATE applications
- Advanced U of T Engineering NSERC Strategic Research Networks
- Reinvested in the Centre for Healthcare Engineering (formerly the Centre for Research in Healthcare Engineering)

5.2 Increase our Tri-council funding level to \$25 million per annum by 2015.

- Met and surpassed goal three years early, reaching \$26.3 million in 2012–2013; made excellent progress toward new goal of \$32 million by 2015–2016, achieving a record \$27.4 million in Tri-Council funding in 2013–2014

5.3 By 2015, increase the number of Canada Research Chairs by eight (to a total of 30), increase Industrial Research Chairs by six (to a total of 10) and increase Endowed Chairs and Limited Term Chairs by 13 (to a total of 40).

- Actively worked to identify new Industrial Research Chair (IRC) and Endowed Chair prospects — currently we have 7 IRCs and 27 Endowed Chairs — across the Faculty we have a total of 71 research chairs held by 63 individual chairholders
- Increased number of CRC Tier II equivalents by 2 to 41 in 2014–2015
- Gained four new CRCs in 2014–2015, bringing the total to 27 across the Faculty
- Continued to share best practices through the Faculty’s Research Committee to foster growth of sponsored research, which in turn impacts the Faculty’s CRC allocation

5.4 Develop additional funding sources through the Social Sciences and Humanities Research Council (SSHRC), the Canadian Institutes of Health Research (CIHR), corporations, industries and international granting agencies.

- Hosted the third annual U of T Engineering Industry Partners Reception to celebrate existing collaborators and welcome new ones, with more than 120 people attending (November 2014)
- Pursued CIHR-NSERC partnerships funding such as CHRP (Collaborative Health Research Projects)
- Supported NSERC Strategic Partnership Grants applications
- Provided support to Ontario Research Fund–Research Excellence (ORF-RE) team applications and worked with faculty to build their industry consortia
- Focused on industry-sponsored research and matching funding for various granting agency competitions
- Actively pursued opportunities with top corporate prospects to leverage partnerships and add value to research and technology development

5.5 Support junior faculty members and emerging research leaders to ensure that they successfully secure external research funding from industry, federal and provincial sources.

- Worked with junior faculty, through the Faculty’s Research Committee and Directors of Corporate Partnerships, to identify and pursue industry partners
- Held a lunch-time panel series for faculty on best practices in research, including a session on collaborative and partnership research
- Prepared junior faculty to apply for Early Research Awards (ERA) by hosting a panel called “Succeeding in the ERA” and initiating an internal expert review during the competition to critique each of the Faculty’s applications
- Successfully supported faculty, resulting in six receiving Connaught New Researcher Awards

5.6 Raise awareness and promote our research contributions and breakthroughs with peers, funding agencies, industry and the public.

- Awarded the third annual Research Leader Award to Professor Honghi Tran for leadership in interdisciplinary and multiple investigator initiatives that have enhanced the Faculty's research profile with the broader community
- Produced several new research inserts on water, advanced manufacturing, healthcare engineering, nanoengineering and sustainable mining to support corporate outreach activities and industry partnerships
- Launched a number of strategic initiatives, including proactive media outreach, an enhanced online presence and improved marketing materials, aimed at strengthening our visibility and our reputation for excellence
- Increased proactive pitching tied to breaking news and current affairs and secured media stories along strategic communications themes by proactively offering our professors as experts for media
- Celebrated with the University of Toronto community, the announcement of the largest CFREF award in Canada, *Medicine by Design*, with Minister of State for Science and Technology Ed Holder in attendance
- Participated in the University of Toronto Science & Engineering Engagement (SEE U of T) event for Sustainability & Engineering, with a presentation on "Environmentally Sustainable Aviation" (September 2015)

5.7 Generate synergistic research partnerships with peer institutions within Canada, and strategic international partners, while taking on leadership roles at the national and international levels.

- Enhanced collaboration and partnership with the Vice-President of University Relations and the Vice-President, Research and Innovation on international partnership development
- Partnered with multiple Canadian institutions on NSERC CREATE, Strategic Research Network, and CFREF applications
- Recruited a Director of Government, International and Corporate Partnerships

5.8 Increase participation and provide leadership on external review committees in granting agencies such as the Natural Sciences and Engineering Research Council (NSERC), Ontario Centres of Excellence (OCE), and the Ontario Ministry of Research and Innovation (MRI).

- Worked with the Office of the Vice-President, Research and Innovation (OVPRI) and the Ontario Council of University Research (OCUR), to successfully make the case to Ontario's Ministry of Research and Innovation to improve transparency in its review process for the ORF-RE program

- Continued engagement with the Ontario Centres of Excellence to provide matching support for the Heffernan Entrepreneurship Fellowships
- Presented highlights of U of T Engineering sustainability research to NSERC staff in Ottawa (February 2015)

5.9 Enhance multidisciplinary, collaborative research endeavors.

- Established the Translational Biology and Engineering Program (TBEP) in collaboration with the Faculties of Medicine and Dentistry (April 2015)
- Awarded the first federally-funded Canada First Research Excellence Fund (CFREF); the \$114 million grant to the U of T for *Medicine by Design*, a collaborative project among the Faculty of Applied Science & Engineering, the Faculties of Medicine, Pharmacy and Arts & Science, partner research hospitals and other academic and industry collaborators
- Attracted two new NSERC CREATE grants, bringing the total U of T Engineering lead roles to nine
- Ramped up the newly established Ontario Centre for Characterization of Advanced Materials (OCCAM), the Toronto Institute of Advanced Manufacturing (TIAM) and the Centre for Healthcare Engineering (CHE)
- Enabled 13 collaborative research centres and initiatives through the Dean's Strategic Fund, including the Centre for Aerial Robotics Research and Education, the Institute for Neural Engineering and EMH:Seed: Seeding Innovative Research Partnerships between Engineering, Medicine, and the Research Hospitals, the latter which provides seed funding to enable significant, externally-supported projects and encourage multidisciplinary collaborations
- Awarded eight NSERC Strategic Partnership Grants (SPGs), a 2014 success rate of 30 per cent, up from the 2013 success rate of 22 per cent, and improving over the typical Canadian national average of 23 to 25 per cent
- Attracted two new ORF-RE grants with total project value over \$30 million (of which \$9 million is from the Province of Ontario)

5.10 Engage more undergraduate and international graduate students in faculty research activities

- Hosted a roundtable on undergraduate research opportunities at the Dean's Town Hall (September 2015)
- Held the 2015 Undergraduate Research Day UnERD, a one-day research symposium for students to celebrate undergraduate engineering research carried out over the summer and allowing students to gain key competencies through abstract writing and collaborative networking (August 2015)
- Increased the number of international PhD graduate students to 278 in 2014–2015, from 256 in 2013–2014

6. Outreach, Collaboration and Influence

Successful collaborations and outreach allow us to influence and engage within our Faculty and the University of Toronto, and with our external community. U of T Engineering continues to nurture and establish new relationships and initiatives that strengthen our ability to create innovative learning environments, shape best practices in engineering education, recruit the most promising students and support groundbreaking research and knowledge translation.

To achieve our goals, we pursue strategic collaborations with industry, individuals, government and peer academic organizations to grow and communicate our expertise as educators, researchers and global leaders in advancing solutions to the world's most critical challenges. The Faculty's activities and partnerships extend across sectors and borders to attract internationally renowned scholars, enhance linkages with prospective donors and alumni and build strong connections with other stakeholders.

As Canada's premier engineering school and one of the world's best, we recruit top exchange students from around the globe. In 2014–2015, we welcomed 147 students from more than 30 peer institutions and sent 94 of our own students to 26 partner universities in 17 countries including Australia, Japan, China, Germany and Ireland. Our partnership with Brazil's *Ciência sem Fronteiras* program (formerly Science without Borders) continues to be successful and we remain the first choice for students studying in science, technology, engineering and math (STEM). Since the program's inception, 490 students have come to U of T Engineering. Whether inbound or outbound, educational exchanges allow for cross-cultural learning, diverse experiences and an enhanced world view of today's pressing issues. Exchanges are also a form of outreach that allow us to engage and influence internationally. We know that when students leave U of T Engineering they act as ambassadors in their home countries, disseminating information about our outstanding educational programs and student experience.

We continue to create opportunities to bring our outstanding research to the world and ensure our students expand their global fluency through dedicated initiatives for a fulfilling and comprehensive experiential education. In 2014–2015 we solidified relationships with peer universities in Brazil, China, Japan and Poland. We also signed a letter of intent (LOI) with CAF, the development bank of Latin America, to explore sustainable urban development. This past year we strengthened relationships in China by signing a memorandum of understanding (MOU) with Shanghai Jiao Tong University (SJTU) to support aerospace research and education collaboration. We also developed a 3+1+1 pilot program with Tianjin University that will allow some of the brightest students from Tianjin

to complete their fourth year of undergraduate studies at U of T Engineering and gain conditional acceptance to our MEng program in Electrical and Computer Engineering. We also signed an MOU with the Faculty of Transport at Poland's Warsaw University of Technology, to further educational and research collaboration. In conjunction with U of T Engineering's Department of Materials Science & Engineering, we also established an MOU with the National Institute for Materials Science (NIMS) in Tsukuba, Japan, in the area of nanomaterials and nanotechnology to promote the exchange of personnel and scientific and technical information, host joint symposia and expand research opportunities.

In addition to formal agreements with other peer institutions, we have numerous opportunities within the Faculty for students to address today's complex world issues. Through the Centre for Global Engineering (CGEN), we offer the Engineering and Globalization Certificate which enables our students to develop the wide range of professional skills necessary to solve the evolving technological challenges in an increasingly global society. The Interdisciplinary Approach to Global Challenges course — JRC1000Y — has worked on several initiatives including air pollution and childhood malnutrition in developing countries.

Outreach includes building meaningful relationships with other University of Toronto Faculties. This year, in addition to the Canada First Research Excellence Fund (CFREF) grant for *Medicine by Design* with the Faculties of Medicine, Pharmacy and Arts & Science, we also established the Translational Biology and Engineering Program (TBEP) within the Ted Rogers Centre for Heart Research (TRCHR) in collaboration with the Faculties of Medicine and Dentistry. We also established two new certificates in Communication and Renewable Resources, with course options in the Faculty of Arts & Science and the Faculty of Forestry.

The U of T Engineering alumni community is truly global and includes more than 47,000 graduates across North America, South America, Africa, Europe, Asia and Oceania. Our passionate alumni are proud of our Faculty, and we continue to build and cultivate these important relationships. Skule™ alumni are our ambassadors to the world, acting as our representatives and advocates and ensuring we are successful globally with our outreach, collaborative initiatives and resulting influence. Our Faculty's dedicated alumni contribute back to Skule™ in myriad ways, in time, expertise and financial gifts. Our alumni participate in a range of initiatives, such as assessing applications through our broad-based admissions process, mentoring student startups through The Entrepreneurship Hatchery and through generous donations to student scholarships, awards and now the Centre for Engineering Innovation & Entrepreneurship (CEIE). In 2014–2015, more than 167 alumni

participated in various committees and advisory boards at both the Faculty and University level, making a difference to U of T Engineering and our broader community.

Engaging new strategic industry partnerships and strengthening existing ones expands sources of funding and other resources that are available for Faculty initiatives. These partnerships are mutually beneficial, with industry collaborators gaining access to our cutting-edge research and the best academic researchers and facilities to create, test and commercialize new products, technologies and processes. Through departmental open houses, topic-specific research days and Faculty-wide programming, we continue to foster our relationships with industry, while increasing our outreach efforts to establish new ones. For example, this year we hosted the third annual U of T Engineering Industry Partners Reception, and will be holding a fourth event in November 2015. We also produced several new research inserts to support corporate outreach activities and industry partnerships.

We strengthened outreach and engagement with our alumni not only through strategic events and topical seminars throughout the Asia-Pacific, Middle East, U.S. and across Canada, but also through the creation of a new program that connects professors emeriti and retired staff with recent graduates. To build and support U of T Engineering alumni communities across the globe, in 2014–2015, Dean Amon hosted alumni events in North America (San Francisco, Palo Alto, Calgary and Vancouver), Turkey and Asia-Pacific (Hong Kong, Korea, Singapore and Taiwan). In Dubai, we hosted the first Dean's reception for parents, in conjunction with an alumni event. This was very well received and will act as a model for future events to engage parents of current international students in strategic regions. On campus we expanded engagement with current students — our future alumni — by creating new outreach initiatives and increasing participation in Graditude, our program for fourth-year graduates to give back to future students. This year we will increase the number of topical events held in the Asia-Pacific region and continue our efforts to strengthen the ties and traditions that connect us to our largest alumni base outside of Canada. We also aim to build a stronger sense of community among our alumni, and impact philanthropic giving in a positive and substantive way. To continue philanthropy in the region, in fall 2015 the Dean will travel to Hong Kong and Singapore to host several advancement events and meet with donors, alumni and other supporters of U of T Engineering and the University. Part of the focus of the trip will be to continue fundraising for the remaining \$20 million for the CEIE.

In 2014–2015, U of T Engineering experienced a highly successful fundraising year, securing another \$34.9 million in philanthropic and research gifts, including support of entrepreneurship in our aerospace program through a generous \$1 million gift from

Francis Shen, one of our dedicated and committed alumni, and a \$20.5 million gift from the Rogers Family — part of the unprecedented \$130 million gift to create the TRCHR. To date we have secured more than \$80 million towards the CEIE, which is one of the cornerstones of our Boundless Campaign. Our philanthropy success is a testament to the strong commitment of our alumni, friends, faculty, staff and students to our shared vision for our Faculty's future. We are committed to our fundraising to fully offset the remainder of the CEIE financing, drive research innovation, further enhance the student learning experience and pursue other Faculty initiatives, such as supporting endowed chairs and student scholarships.

OUTREACH, COLLABORATION AND INFLUENCE: YEAR 4 PROGRESS HIGHLIGHTS

6.1 Better understand the breadth of the Faculty's current outreach, collaborative and influencing efforts, then efficiently manage, support, develop and communicate these activities.

- Completed our main Faculty website redesign, meeting with stakeholders to assess their perceptions and needs of the site and working with test groups on the launch
- Started a survey for staff and faculty to assess the level to which different groups are communicating with students as part of a Faculty-wide initiative to enhance and create best practices for student communications
- Conducted a readership survey for our *Skulematters* alumni magazine, following the completion of the issue on entrepreneurship and commercialization, to ensure we are meeting the needs and interests of our alumni; feedback gathered was used to enhance the content and layout in the fall 2015 *Skulematters* highlighting "Women in Engineering: A Tradition of Excellence"
- Created a marketing insert distributed through *Skulematters* to more than 600 alumni in the Asia-Pacific region that demonstrates our many research, student and alumni connections in the region, fostering stronger ties between Asia-Pacific alumni and U of T Engineering
- Partnered with U of T Alumni Relations and Advancement Communications to refresh the Engineering Alumni Association's word mark; the renewed design will be launched after consultation with the U of T Engineering alumni community and will reflect the Association's new identity as the U of T Engineering Alumni Network
- Continued analysis and increased targeted media pitching of research stories along four key strategic communications themes by proactively offering our professors as experts for media
- Produced several new research inserts on water, advanced manufacturing, healthcare engineering, nanoengineering and sustainable mining to support corporate outreach activities and industry partnerships

6.2 Continue building meaningful involvement and relations with Engineering alumni.

- Hosted 68 alumni events, including 13 outside of Canada (USA, Turkey, Dubai and the Asia-Pacific (Hong Kong, Korea, Singapore and Taiwan))
- Showcased engineering leadership through BizSkule events in San Francisco, Calgary and Toronto that featured compelling speakers and panelists
- Strengthened outreach and engagement through strategic events and topical seminars in the Asia-Pacific, Silicon Valley and Middle East regions, and through a new initiative that connects professors emeriti and retired staff with recent graduates
- Continued supporting alumni volunteerism, with more than 167 alumni participating in various committees and advisory boards at both the Faculty and University level
- Partnered with the Engineering Society to launch Skule™ Alumni Outreach (SkuleAO), a student-run program to assist alumni who wish to support and enhance the experiences of current students
- Engaged 30 alumni with the alumni assessor program to review applicant personal profiles as part of the Faculty's broad-based admissions process

6.3 Strengthen relationships with other University of Toronto Faculties.

- Established two new certificates in Communication and Renewable Resources, with course options in the Faculty of Arts & Science and the Faculty of Forestry
- Launched the Master's/PhD collaborative program in Engineering Education with the Ontario Institute for Studies in Education (OISE)
- Signed an Interdivisional Teaching Agreement with the Faculty of Arts & Science, which includes an academic framework to enable the two Faculties to work together to achieve our educational mission for the benefit of students and faculty, and allow us to focus on pedagogy rather than funding (June 2015) — including a number of course slots guaranteed at the Faculty of Arts & Science for engineering students
- Collaborating with the Faculties of Medicine, Pharmacy and Arts & Science, and other partners, was awarded the Canada First Research Excellence Fund (CFREF), resulting in a \$114 million grant to the U of T for *Medicine by Design* (July 2015)
- Offered through the Centre for Global Engineering (CGEN), JRC1000Y — the Interdisciplinary Approach to Global Challenges course which brought together graduate students from U of T Engineering, the Dalla Lana School of Public Health, the Rotman School of Management and the Munk School of Global Affairs
- Established the Translational Biology and Engineering Program (TBEP) in collaboration with the Faculties of Medicine and Dentistry (April 2015)

6.4 Further develop sustainable collaborations with industry partners, and expand established partnerships with affiliated hospitals and research institutes.

- Hosted the third annual U of T Engineering Industry Partners Reception to celebrate existing collaborators and welcome new ones, with more than 120 people attending, with a fourth event planned (November 2014)
- Actively pursued opportunities with top corporate prospects to leverage partnerships and add value to research and technology development
- Engaged through the University of Toronto Institute for Multidisciplinary Design & Innovation (UT-IMDI), numerous industry clients such as Pratt & Whitney and Magellan Aerospace for summer projects and multidisciplinary capstone design projects
- Continued to offer mentorship and sponsorship opportunities for alumni in industry through The Entrepreneurship Hatchery
- Established *Medicine by Design's* inaugural international partners, including China's Peking University, Technion Israel Institute of Technology, the United Kingdom's Regenerative Medicine Program, Sweden's Karolinska Institutet and Germany's REBIRTH Cluster of Excellence at Hannover Medical School
- Published our second external annual report, *Innovation Lives Here – Year in Review 2015*, in summer 2015 to share key achievements with industry partners, alumni and prospective donors

6.5 Further develop connections with local communities, businesses and the City of Toronto.

- Contributed to better urban development through the creation of the upcoming iCity, which will allow planning officials to demonstrate how different transportation projects, such as a new subway or LRT line, or building “complete streets,” will affect communities and the surrounding city
- Worked to improve social services with the Centre for Social Services Engineering (CSSE), which applies industrial and systems engineering techniques — including mathematical analysis, big data and machine learning — to improve the delivery of goods and services to vulnerable populations in urban centres
- Participated in Scotiabank's Nuit Blanche, highlighting the CEIE's 276-foot street art installation (October 2015)
- Continued for a fifth year the Sky Garden, a roof-top garden on the Galbraith Building that in 2015 donated more than 225 kilograms of vegetables to local charitable organizations
- Engaged and worked with local communities through the University of Toronto Transportation Research Institute (UTTRI), with several initiatives including a workshop on Travel Methods for the Greater Golden Horseshoe (October 2014), the Intelligent Transportation Systems Research Day (December 2014) and the fourth Freight Day Symposium (February 2015)

6.6 Build upon high school outreach and continue to assess our pre-university activities with the goal of optimizing faculty and student involvement.

- Inspired more than 7,000 youth through our pre-university outreach programs, including the In-School Workshop program for students in grades three to eight, March Break programs, Saturday workshops, and the Da Vinci Engineering Enrichment Program (DEEP), reaching students in Grades 3 through 12 and allowing participants to explore cutting-edge engineering applications such as sustainable energy, biomedical engineering and robotics
- Contributed to the engagement of faculty and staff with the first “Engineering Family Outreach Day”, inviting children of staff and faculty from Grades 1 through 8 to take part in engaging, hands-on activities related to STEM
- Offered for a fourth year the Girls’ Leadership in Engineering Experience (GLEE), which drew 88 female students with offers of admission and engaged them in a weekend of community-building activities; 78 of these participants accepted their offer of admission (a ratio of acceptances to attendees of 89% in 2015 vs. 77% in 2014)

6.7 Develop strategic relationships with desirable peer, national and international Engineering schools.

- Participated for the third year in the Global Educational Exchange (Globex) initiative with Peking University
- Established U of T Engineering as a leading partner in Brazil’s *Ciência sem Fronteiras* program, welcoming 490 students from September 2012 through December 2015
- Hosted 64 exchange students from universities around the world and sent 94 U of T Engineering students outbound to 26 different partner institutions in Europe, Asia, Australia, India, Mexico, Turkey and Israel
- Enhanced our partnership with Technion Israel Institute of Technology for graduate student/postdoctoral fellow exchanges and accelerated joint research initiatives, supported by a \$1 million gift from alumnus donor Lyon Sachs
- Further strengthened our relationship with Shanghai Jiao Tong University (SJTU), China through an MOU to support aerospace research and education collaboration
- Developed a 3+1+1 pilot program with the School of Electronic Information Engineering, Tianjin University, China that will allow select top students from Tianjin to complete their fourth year of undergraduate studies at U of T Engineering, with conditional acceptance to our MEng program in ECE
- Signed a LOI with CAF — the development bank of Latin America — to explore innovative methods for sustainable urban development
- Hosted a high-level delegation from Poland that included members of Parliament, the Senior Trade Commissioner, Commercial Department, Embassy of Canada in Warsaw, and professors from the Faculty of Transport, Warsaw University of Technology; culminated in the signing of an MOU to further education and research collaboration

- Established an MOU with the National Institute for Materials Science (NIMS) in Tsukuba, Japan

6.8 Increase influence in government and public policy decisions.

- Worked with the Office of the Vice-President, Research and Innovation (OVPRI) and the Ontario Council of University Research (OCUR) to successfully make the case to Ontario's Ministry of Research and Innovation to improve transparency in its review process for the Ontario Research Fund-Research Excellence (ORF-RE) program
- Continued engagement with the Ontario Centres of Excellence to provide matching support for the Heffernan Entrepreneurship Fellowships
- Presented highlights of U of T Engineering sustainability research to NSERC staff in Ottawa (February 2015)

6.9 Develop a culture of stewardship and gratitude to the alumni and donors who provide philanthropic support to the Faculty.

- Publicly recognized major donors through communications and celebration events
- Organized our fourth Annual Dean's Dinner to recognize donors and acknowledge their generous gifts in support of the Faculty (September 2015)
- Celebrated eight alumni at the U of T Arbor Awards (September 2015)
- Fostered dialogue with alumni and friends in support of our Engineering Campaign goals
- Planned and hosted a dynamic groundbreaking ceremony for the Centre for Engineering Innovation & Entrepreneurship (CEIE) that engaged donors and the broader U of T community (June 2015)
- Held the Engineering Alumni Association Awards Dinner to celebrate and recognize alumni for their outstanding achievements (November 2015)

6.10 Encourage the participation of administrative staff in professional associations related to their area of expertise, and in the mentoring programs offered by the University.

- Ensured that senior administrative staff were nominated for and participated in the University's New Manager Academy and Business Manager Leadership Program
- Through regular meetings of departmental business officers and our new Human Resources office, explored opportunities for formal and informal initiatives to encourage staff development
- Continued to foster collaboration and communication between Human Resources, the Business Administration group and the Engagement & Development Network to share information and best practices

7. Resource Allocation

Our resources directly impact our ability to achieve the important and ambitious academic goals we have set in our Academic Plan. Over the past year, we effectively and strategically used our resources, including space, budget, infrastructure and personnel, to advance our excellence in research and innovation, support faculty and staff, and create an extraordinary learning environment for our students.

In 2014–2015, we maintained a strong financial position, with total revenue growing 7.5 per cent over the previous year, due primarily to increases in research funding, tuition and international student enrolment. Revenue growth, in conjunction with careful fiscal management and judicious budgeting, supported ongoing infrastructure upgrades and investments in strategic Faculty initiatives, and built financial reserves for future renewal and other key priorities.

The Dean's Strategic Fund (DSF) held its fifth annual call for proposals for projects that will have a broad impact within the Faculty, such as furthering our Academic Plan goals in developing multi-departmental and collaborative initiatives. From this call, we committed \$3.97 million for 13 initiatives, bringing total funding to \$18 million since the DSF was created in 2011. DSF projects funded in 2015 include:

- Engineering Education for Sustainable Cities in Africa, an initiative from the Centre for Global Engineering and the departments of Civil (CivE) and Mechanical & Industrial Engineering (MIE). This cross-disciplinary research program will focus on developing engineering education strategies that can lead to sustainable infrastructure for future global mega-cities, particularly for African cities that are expected to experience tremendous population growth in the coming decades.
- The Collaboratory for Advanced Learning and Innovation in Bioengineering Research and Education, from the Institute of Biomaterials and Biomedical Engineering (IBBME). This initiative will provide enhanced learning opportunities in synthetic biology, physiology and advanced functional imaging. In addition, there will be an expansion of the related IBBME laboratories and development of a suite of cross-departmental collaborative courses between U of T Engineering and the Faculty of Medicine.

We allocate part of the DSF to the Engineering Instructional Innovation Program (EIIP) to support the development of new teaching approaches and better curriculum to improve the student experience. In 2014–2015, we funded an additional three initiatives through this program, bringing the total number of EIIP initiatives to eleven:

- The University of Toronto Institute for Aerospace Studies (UTIAS) and MIE received funding to offer integrated and complementary courses to MEng students in both programs by renovating two classrooms — one at UTIAS’s Downsview location and one in the Mechanical Engineering Building on the downtown campus. The leading-edge tools and equipment will allow students to participate in lectures delivered from either location. A pilot graduate course designed specifically for “parallel classrooms” will also be developed with content from both fields.
- An initiative known as *Re-engineering Mathematics Education* will improve engineering education and re-energize engineering mathematics instruction.
- Funding was also awarded for development work to enhance instruction in thermodynamics, which will better connect theory with practice.

Previously funded initiatives also made excellent progress in 2014–2015. These include a project in Chemical Engineering & Applied Chemistry to develop collaborative skills in technical courses using team-based learning, and an initiative through Materials Science & Engineering to redesign the entire first-year materials program to improve the student experience through the creation of several types of reusable learning objects.

We made tremendous progress in 2015 toward our vision for the Centre for Engineering Innovation & Entrepreneurship (CEIE). Significant milestones included demolition of the existing structure on the site (February), rezoning by the City of Toronto (May), and tendering and awarding the construction contract (March and June). The commitment and generosity of our entire U of T Engineering community enabled us to break ground on June 24, 2015, at a celebratory event with more than 200 alumni, faculty, staff, students, industry partners and friends. Construction has progressed well over the summer and fall, and we are on track for this transformative new building to open in 2017.

We are maximizing our facilities through strategic renovations and innovative approaches to revitalizing existing spaces. We continue to test the pilot Technology Enhanced Active Learning (TEAL) room in the Sandford Fleming Building, which serves as a prototype for the active and collaborative learning spaces in the CEIE. We are testing different layouts and technologies and gathering feedback to determine the most effective design to ensure these unique rooms will encourage dynamic group work and successfully facilitate blended modalities of teaching and design. In addition, we are currently in discussion with Academic and Campus Events (ACE) to trade use of TEAL rooms in the CEIE for other classrooms located in U of T Engineering. CEIE is a Faculty of Applied Science & Engineering building and we will be able to optimize the use and capacity of all our classrooms by allowing ACE to use the CEIE TEAL rooms when they are not used by the

Faculty in exchange for the Faculty gaining space in current ACE rooms. This partnership will expand the options for our faculty and students and will increase the number of classrooms available to us.

While the CEIE is a key component in our strategy to alleviate our urgent space issues, we also continue to audit our existing facilities and infrastructure to ensure our faculty members can continue their innovative research and our students have access to the best laboratories, classrooms, club and study spaces. In 2014–2015, we made significant improvements to several facilities, including the installation of hallway study seating in the Bahen Centre, which accommodates 87 students. This seating gives Engineering students opportunities to study and complete assignments between classes and is part of our goal to continually improve the student experience. In the Galbraith Building, we completed the first and second phases of renovations to the Electrical Energy Systems Lab, with the design and replacement of the supporting high-voltage electrical infrastructure and stations. The third phase of the project is underway and will entail the purchase of equipment infrastructure and the development of new experimental systems to teach undergraduate and graduate courses that will focus on the creation of micro-grids, renewable energy and enabled smart grids. In summer 2015, our Human Resources team moved into newly renovated space in the Fields Institute to improve service delivery to the U of T Engineering community.

In 2014, the Ontario Centre for Characterization of Advanced Materials (OCCAM) opened to offer highly specialized tools to understand and manipulate matter at the atomic scale. The centre also emphasizes collaborative and multidisciplinary investigations and expects to facilitate more than 350 different research programs annually involving academic researchers and private companies. To support these programs, we renovated existing research labs to install electromagnetic shielding systems and a suite of electron microscopes. Other projects completed this past year included washroom renovations in the Galbraith Building to provide additional capacity and improve the distribution of men's and women's facilities, and completion of an electronic access control system for the Wallberg Building/D.L. Pratt Building complex to improve security for students, faculty and staff.

While we continue to be strategic and prudent in managing our resources, advancement remains a critical part of ensuring we can address both our academic and capital priorities. We had a highly successful fundraising year for philanthropic and research gifts in 2014–2015, with support from alumni, graduating students and other members of our vibrant community reaching \$34.9 million. Alumni around the world have generously supported the CEIE and we are working with many of our engineering Asia-Pacific alumni groups

toward ambitious fundraising goals. Together with gifts from industry partners, this support will enable us to set a new standard for engineering education and research. In addition to the CEIE, we attracted strong support for research, education and entrepreneurship across diverse disciplines, including major gifts for biomedical engineering and for an entrepreneurship incubator at UTIAS. With our 2014–2015 advancement results, we have raised more than \$152 million toward our campaign goal of \$200 million for Boundless: The Campaign for the University of Toronto. We will continue our efforts to seek new and repeat donations to fully offset the remaining CEIE mortgage financing by the time the building opens in 2017.

RESOURCE ALLOCATION: YEAR 4 PROGRESS HIGHLIGHTS

7.1 Maximize quality academic time and effectiveness by increasing engagement in high value activities that support students' academic experience, contribute to knowledge creation, and advance engineering research frontiers.

- Added two administrative directors to further the mandates of BioZone and the Centre for Water Innovation, and one administrator to support the Institute for Robotics and Mechatronics and the Toronto Institute of Advanced Manufacturing, all starting in summer 2015
- Lowered our undergraduate-to-graduate student ratio to 2.24 in 2014–2015, from 2.35 the previous year, marking progress toward our long-term goal of 1.5 to help optimize academic time and classroom resources
- Reviewed with our academic units the local workload policies in conjunction with the University's Workload Policy and Procedures for Faculty and Librarians (WLPP)

7.2 Place emphasis on Engineering's strategic research areas when considering faculty hires.

- Initiated an interdisciplinary academic search for three new faculty members, focusing on cross-disciplinarity, diversity, research and teaching excellence, after successfully hiring three new interdisciplinary cross-appointed faculty members in 2013–2014

7.3 Provide a supportive environment for faculty members through mechanisms such as start-up funding, teaching skills workshops, and assistance via Associate Chairs, Research to create successful research proposals.

- Held a lunch-time panel series for faculty on best practices in research, including a session on collaborative and partnership research
- Prepared junior faculty to apply for Early Research Awards (ERA) by hosting a panel called "Succeeding in the ERA" and initiating an internal expert review during the competition to critique each of the Faculty's applications

- Supported NSERC Strategic Partnership Grants (SPG) and Collaborative Research and Training Experience (CREATE) applications
- Focused on industry-sponsored research and matching funding for various granting agency competitions
- Provided support to Ontario Research Fund–Research Excellence (ORF-RE) team applications and worked with faculty to build industry consortia
- Worked with faculty, particularly junior faculty, through the Faculty’s Research Committee and Directors of Corporate Partnerships, to identify and pursue industry partners
- Continued to share best practices through the Research Committee to foster growth of Tri-Council sponsored research, which in turn affects the Faculty’s Canada Research Chair (CRC) allocation
- Initiated a year-long teaching and learning workshop series coordinated jointly by the office of the Vice-Dean, Undergraduate, the Teaching Methods and Resources Committee, and students in the Masters/PhD collaborative program in Engineering Education

7.4 Improve our chances of being awarded funding for capital projects by pre-planning for various opportunities consistent with our goals and suitable for external funding sources such as CFI, Ontario Ministry of Training, Colleges and Universities (MTCU) and other capital grants. Increase the quality and quantity of space particularly through fundraising for new and revitalized buildings.

- Received six CFI John R. Evans Leaders Fund grants for a total of over \$1 million
- Received two CFI Innovation Fund grants for a total of over \$3.3 million
- Increased Research Infrastructure Funds to \$17.3 million in 2013–2014 (up from \$5.9 million in 2012-2013)
- Raised almost \$80 million to date in support of the CEIE building

7.5 Enhance teaching and design facilities, upgrade undergraduate laboratory space, and make flexible space available for extra-curricular activities.

- Supported several new initiatives to upgrade facilities and equipment through the Dean’s Strategic Fund including:
 - renovation of the Unit Operations Laboratory in the Wallberg Building to create an additional 200 net assignable square metres (NASMs) of wet lab space and increase student capacity from 48 to 60;
 - Faculty-wide video conferencing facilities to develop three systems in each of the Wallberg, Bahen and the Mechanical Engineering buildings;
 - purchase of precision machining equipment for engineering capstone projects to give undergraduate and graduate students experience in the use of high-precision manufacturing equipment and metrology and improve the performance of the manufactured prototypes; and

- improvement of prototyping services to researchers and students through the Toronto Nanofabrication Centre.
- Continued to evaluate the renovated Sandford Fleming TEAL room to aid in the final design of the TEAL spaces in the CEIE

7.6 Provide reliable, accessible, effective computing services; create study spaces within and outside computer laboratories, library and classrooms so as to enhance interactive learning and socialization where today's student 'lives'.

- Added 87 student study spaces to the Bahen Centre inventory of hallway seating
- Currently installing another 63 student study spaces in the Bahen Centre and 20 spaces in the Wallberg Building
- Initiated renovation in the Lassonde Mining Building for a student study area and conferencing centre
- Completing an undergraduate teaching laboratory space audit, with the final report expected in December 2015

7.7 Encourage timely degree completion among doctoral stream students; increase research funding and graduate fellowships to support graduate students.

- Held time to graduation to an average of 5.3 years for PhD students and 2.0 years for MSc students
- Implemented a new software tracking system in ECE to record the progress of PhD students, which will also be available for use in other departments and institutes
- Continued to develop detailed data on time-to-completion, fast-tracking and scholarship success rates with the goal of using this data to identify and share best practices, as well as identify problems to be addressed
- Increased total graduate funding by 5.2% to \$42.8 million in 2013–2014, up from \$40.7 million in 2012–2013

7.8 Establish a strong Case for Support that addresses the Faculty's resource requirements and aligns the Faculty's critical need for improved space in the context of addressing educational and research priorities.

- Raised almost \$80 million to date in support of the CEIE building, the cornerstone of our Engineering campaign
- Designated nearly half of all funds raised in 2014–2015 to research, student experience and programs, and student scholarships and awards
- Relocated the Human Resources office to the Fields Institute to improve service delivery

7.9 Increase long-term philanthropic support by strengthening the culture of advancement within the Faculty.

- Conducted advancement stakeholder meetings in the departments of Chemical Engineering & Applied Chemistry, Civil Engineering and Mechanical & Industrial Engineering to facilitate philanthropy and alumni relations priorities
- Supported and actively worked throughout the year with each U of T Engineering department and institute advisory board
- Actively pursued opportunities with top corporate prospects to leverage partnerships and add value to research and technology development
- Carried out successful fundraising campaigns in Asia-Pacific for named rooms in the CEIE
- Partnered with the Engineering Society to launch Skule™ Alumni Outreach (SkuleAO), a student-run program to assist alumni who wish to support and enhance the experiences of current students
- Expanded engagement with current students — our future alumni — by creating a new alumni outreach director position on the Engineering Society, initiating the inaugural Engineering Society Reunion of current and past officers of the Engineering Society and increasing participation in Gratitude, which encourages graduating students to give back to future students

8. Conclusion

Through dedication and commitment, our U of T Engineering community has achieved tremendous progress in Year Four of our *Academic Plan 2011-2016*. We have already surpassed several of our ambitious goals, and set new ones to capture emerging priorities.

As we move forward into the final year of our Academic Plan, collectively we will continue to broaden our influence and outreach, enhance our international reputation, support our multidisciplinary and collaborative research and ensure we create new initiatives and opportunities for the best student experience possible.

Appendix D: 2016 Annual Report of Performance Indicators



ANNUAL REPORT 2016

PERFORMANCE INDICATORS



UNIVERSITY OF
TORONTO

Engineering



Pictured on the front cover (top to bottom):

Professor Craig Simmons is the Scientific Director of the Translational Biology and Engineering Program (TBEP). TBEP is the University of Toronto's component of the Ted Rogers Centre for Heart Research (TRCHR) and brings together faculty members and their students from U of T Dentistry, Engineering and Medicine. Together, these researchers are advancing heart research, diagnostics, and regeneration using a comprehensive approach that includes systems and developmental biology, technology innovation and clinical translation.

On May 13, 2016 more than 1,400 students and teachers from across the Greater Toronto Area converged on U of T Engineering for Innovate U. The one-day workshop was Canada's largest science, technology, engineering and math (STEM) event for children in Grades 3 to 8. Innovate U was run in partnership with Google Canada and Actua, a national STEM charity.

Two students from U of T Engineering work on the Formula SAE racing car. Students can choose from more than 90 engineering clubs and teams, from design and competition groups such as the Human-Powered Vehicle Team to cultural and arts groups such as Skule™ Orchestra, as well as national organizations such as Engineers Without Borders.

Currently under construction, the Centre for Engineering Innovation & Entrepreneurship (CEIE) will set a new standard for engineering education and research. When the CEIE opens in 2017, it will provide a new home for some of our world-leading institutes, such as the Centre for Global Engineering and the Institute for Sustainable Energy. Its design/meet rooms and fabrication facilities will enable students, faculty and industry partners to collaborate across disciplines on complex global challenges and launch new companies to bring their innovations to market.

Message from the Dean

I am delighted to present the *2016 Annual Report of Performance Indicators*.

Our Faculty's commitment to excellence relies on data-driven decision making. Our performance indicators and related metrics are powerful tools that enable us to assess progress, identify our strengths and challenges, set measurable goals and fine-tune our actions when required. They point us to new directions and priorities that will strengthen our position as the premier engineering school in Canada and one of the world's best. The data and highlights in this document demonstrate our tremendous achievements over the past 12 months — the final year of our *Academic Plan 2011–2016*.

We had much to celebrate in 2015–2016. Our outstanding undergraduate programs, unparalleled co-curricular opportunities and exceptional reputation, combined with strategic recruitment initiatives, enabled us to draw a record number of applications. Our 2015 entering undergraduate cohort included students who excel in academics as well as entrepreneurship, global engagement, community service, athletics and the arts. It was one of the most diverse first-year classes in our history: nearly one-third of students came from outside of Canada and 31.4 per cent were women. This figure was surpassed once again in 2016 with women comprising 39.2 per cent of the incoming cohort.

Our enhanced programming and world-renowned professors attract brilliant graduate students from across Canada and around the world. These students choose U of T Engineering for the opportunities to conduct innovative research, work with pioneers in our engineering fields and join a rich and diverse community. Over the past decade, we have increased the number of students in our PhD program by 58 per cent. Through the development of vibrant programs, including specializations in Sustainable Energy, Robotics & Mechatronics, and Engineering & Globalization, we have grown the number of full-time equivalent MEng students by 600 per cent.

Our exceptional researchers are addressing major global challenges, from improving human health to advancing sustainability and clean energy. In 2015–2016, a team of U of T Engineering researchers created a platform for growing human tissues outside the body that will enhance drug safety and could one day enable the repair of damaged organs with lab-grown replacements. Another team created a catalyst with record-setting efficiency that could improve the storage of renewable energy sources, such as solar and wind. We also played a key role in multidisciplinary research initiatives at the intersection of engineering, medicine and clinical practice that have the potential to revolutionize health care. As a result of our

collaborative approach and the depth and breadth of our expertise, we further strengthened our research support, including a record amount of Tri-Council funding and corresponding proportion of Canada Research Chairs.

We continue to earn recognition at the highest levels for our excellence in research and teaching. This past year, U of T Engineering faculty won more than 20 per cent of major national and international awards received by Canadian engineering professors, including the Killam Prize and honours from the Royal Society of Canada and the U.S. National Academy of Engineering. Our professors also received the Ontario Confederation of University Faculty Associations Teaching Award and a President's Teaching Award in recognition of remarkable innovations and commitment to education.

In 2015–2016, we have enhanced experiential learning opportunities that enable students to develop key competencies in engineering, leadership and global fluency. Whether they are designing the world's fastest bicycle or building a wind-powered irrigation system for farmers in Central America, our students are creating solutions with global impact. They are also launching startups with support from our rich ecosystem of entrepreneurship accelerators, including Start@UTIAS and The Entrepreneurship Hatchery. These formative experiences, combined with a strong technical foundation in engineering, prepare them to be the next generation of innovators, makers and leaders.

The Centre for Engineering Innovation & Entrepreneurship (CEIE) will be a vibrant hub that will set a new standard for engineering education and research when it opens in 2017. It will provide a new home for some of our world-leading institutes, such as the Centre for Global Engineering and the Institute for Sustainable Energy. Its design/meet rooms and fabrication facilities will enable students, professors and industry collaborators to work together across disciplines on complex global challenges and bring their innovations to market. In 2015–2016, the CEIE received new support from the U of T Engineering community and beyond, including a \$15 million investment from the Government of Ontario.

I am proud of our shared achievements and the bright future we are building together as we strengthen our leadership in engineering education and research. On behalf of the Faculty, I thank you and our entire community for your tremendous contributions and inspiring commitment to our unwavering pursuit of excellence.



Cristina Amon, Dean
September 2016

Faculty Leadership, 2015–2016

Dean

Cristina Amon

Vice-Dean, Graduate Studies

Markus Bussmann

Vice-Dean, Research

Ted Sargent

Vice-Dean, Undergraduate

Thomas Coyle

Associate Dean, Cross-Disciplinary Programs

Bryan Karney

Chair, First Year

Micah Stickel

**Director, University of Toronto
Institute for Aerospace Studies**

David Zingg

**Director, Institute of Biomaterials
& Biomedical Engineering**

Christopher Yip

**Chair, Department of Chemical Engineering
& Applied Chemistry**

Grant Allen

Chair, Department of Civil Engineering

Brent Sleep

**Chair, The Edward S. Rogers Sr. Department of
Electrical & Computer Engineering**

Farid Najm

Chair, Division of Engineering Science

Mark Kortschot

**Chair, Department of Materials
Science & Engineering**

Jun Nogami

**Chair, Department of Mechanical
& Industrial Engineering**

Jean Zu

Assistant Dean, Administration

Lisa Camilleri

Chief Financial Officer

Brian Coates

Executive Director, Advancement

Gillian Sneddon

Executive Director, Communications

Catherine Riddell

Faculty Registrar

Don MacMillan

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Selected Achievements Under the Academic Plan

The Faculty of Applied Science & Engineering's five-year *Academic Plan 2011–2016* provides the framework that guides our vision to be a leader among the world's best engineering schools. Approved by Faculty Council in October 2011, the Academic Plan was developed through a highly consultative planning process involving faculty, staff, students, alumni and University stakeholders.

In the final year of the Academic Plan, we have made tremendous progress in achieving, and in many cases exceeding, our ambitious goals in seven key areas: positioning; culture of excellence; educating future engineers; student experience; research foci; outreach, collaboration and influence; and resource allocation.

The full Academic Plan is available at: uoft.me/engacademicplan, and our Year Four: Progress and Achievements report is available at: uoft.me/yearfourprogress

Positioning

Our position as a leader among the top global engineering schools is strengthened by the compelling stories we publish about our advances in research and engineering education. Our communications strategies leverage high-quality printed materials, engaging websites and social media, and even public art. In 2015–2016, we enhanced all of these areas and won seven international awards for communications.

Progress Highlights

- Earned recognition as the premier engineering school in Canada and among the best in the world across all international rankings in 2015 — the only Canadian university to rank in the top 25 schools globally in the Shanghai Jiao Tong Academic Ranking of World Universities (ARWU) for Engineering/Technology and Computer Sciences, and the Times Higher Education (THE)–Elsevier World University Ranking for Engineering and Information Technology.
- Secured more than 3,400 media stories in the strategic priority areas of Bioengineering/Health, Sustainability, Information and Communication Technology, Engineering Education, and Entrepreneurship and Commercialization. Nearly 60 per cent of these stories appeared in international outlets.
- Created a 276-foot-long graffiti installation on the site of the Centre for Engineering Innovation & Entrepreneurship (CEIE) to inspire a public conversation about the contribution of engineering to society and the accomplishments of our Faculty. The accompanying CEIExSKAM media campaign garnered 12 media stories with 5.5 million impressions, 5,000 visitors at Scotiabank Nuit Blanche, more than 282,900 social media impressions and a Gold Quill Award of Excellence from the International Association of Business Communicators.
- Expanded user engagement with our social media channels: Facebook engagements grew 447 per cent and Twitter engagements grew by nearly 600 per cent over the previous year. In January 2016, we relaunched our Instagram channel with a new focus on engineering student life and our vibrant engineering community, doubling our followers to more than 1,200 by June 2016.
- Published 220 stories on U of T Engineering News, generating 199,555 page views, up 74 per cent from the prior year.

Culture of Excellence

We recruit from among the best and brightest students from Canada and around the world, and we continue our commitment to increasing diversity in all its forms within the engineering profession. Our standard of excellence in research and education is reflected in the calibre of our faculty, students and alumni and the recognition we consistently receive at the national and international levels.

Progress Highlights

- Earned 21 per cent of major national and international awards received by engineering professors in Canada – twice as many as any other Canadian engineering school – with U of T Engineering professors accounting for only 5.5 per cent of total engineering faculty members in Canada.
- Performed an internal review of the Cross-Disciplinary Programs Office, which coordinates undergraduate minors. The review indicated that the office is fulfilling its mandate and ensuring that students benefit from these unique programs.
- Conducted external reviews of UTIAS, EngSci and ChemE during 2015–2016, all of which spoke highly of the calibre of our programs and students, as well as the excellence and dedication of our faculty and staff.
- Hired nine outstanding women professors who embody our values of excellence in research and teaching, cross-disciplinary collaboration and diversity, with five accepting budgetary cross-appointments in two academic units.
- Implemented the second phase of our broad-based admissions system, which leverages a video profile and written essays and accounts for students' first choice of school as well as extra-curricular activities. Together, these measures provide a more comprehensive understanding of each applicant's candidacy than grades alone.
- Created the position of Director, Engineering Pathways and Indigenous Partnerships to coordinate Faculty-led outreach to increase participation and academic success of Indigenous students in Engineering.
- Created the Percy Edward Hart and Erwin Edward Hart Professorships from proceeds of a \$20-million endowment to accelerate the research and educational contributions of seven faculty members within the first 10 years of their careers and provide enhanced support for graduate students.

Educating Future Engineers

We continue to nurture the next generation of global engineering leaders by providing educational programs that are recognized for excellence around the world. In 2015–2016, we further enhanced our leading-edge offerings with new options that help students develop their competencies in high-demand sectors. We also strengthened our support for incoming students as they transition to the engineering academic environment.

Progress Highlights

- Launched a new Engineering Science major in Robotics Engineering, championed by several engineering departments and the Department of Computer Science. Student interest in this program has been tremendous, with 66 students entering this major in 2016–2017, double the size of the first cohort in 2015–2016.
- Welcomed the first undergraduate students into the new Nanoengineering minor, and the Engineering Communication certificate, as well as the new MEng emphasis in Advanced Manufacturing.
- Increased the proportion of our graduating class to complete a minor or certificate to 55 per cent, including 34 per cent who completed either a minor or certificate in Engineering Business.
- Created a new first-year course – APS100 Orientation to Engineering – which consists of lectures as well as tutorials led by upper-year undergraduate TAs, to help students transition into U of T Engineering.
- Increased the proportion of MEng students within overall professional master's enrolment to 54 per cent, surpassing our goal as set out in the Academic Plan.
- Doubled enrolment in the collaborative graduate program in Engineering Education, first launched in 2014, to 12 graduate students.
- Attracted five applications for every space in new Master of Engineering (MEng) in Biomedical Engineering program, set to launch in fall 2016. Eleven students were accepted, seven of whom are domestic.

Student Experience

Both inside and outside of class, U of T Engineering offers unparalleled opportunities for students to develop competencies in leadership, communication, multidisciplinary collaboration and cross-cultural fluency. Our innovative courses and internships provide valuable experience addressing major industrial challenges, while our co-curricular programs enable students to pursue their passions, including developing startup companies.

Progress Highlights

- Placed 790 students — the largest cohort yet — in Professional Experience Year (PEY) internships with leading companies, including 79 outside of Canada.
- Addressed industrial challenges for Bombardier, Defence Research & Development Canada, Astronauts for Hire and other organizations through the University of Toronto Institute for Multidisciplinary Design and Innovation (UT-IMDI), including through internships and the Multidisciplinary Capstone Project (MCP) course.
- Expanded the number of online courses to four: APS 160 Mechanics; APS 162 and 163 Calculus for Engineers; and APS 164H1 Introductory Chemistry from a Materials Perspective. We also offered a calculus “boot camp,” which gave entering students an opportunity to review key mathematical concepts and see how they are applied to university-level calculus in the summer before their first year.
- Increased first- to second-year retention rate to 96.8 per cent in 2015 — a record achievement. This accomplishment reflects the high calibre of our students and our robust programs that support student success.
- Launched a new Faculty-wide Summer Leadership Program through ILead, an eight-week course that provides summer research students with opportunities to better understand their strengths and values and gain new perspectives on engineering and its impact on society. ILead also added four new complementary studies courses in subjects from engineering leadership to positive psychology.
- Celebrated the launch of several companies that received support from one or both of our entrepreneurship accelerators, Start@UTIAS and The Entrepreneurship Hatchery. Kepler Communications, MedChart, Pillsy and TeleHex all received funding from the Ontario Centres of Excellence’s SmartStart Seed Fund. teaBOT, a purveyor of customized, robot-blended cups of tea, opened its sixth North American location in Los Angeles.
- Commissioned two decanal task forces: one to review academic and student advising and the other on student mental health strategies. We also created two new committees: one to serve as an inclusive forum for discussion of ideas to ensure a welcoming and supportive atmosphere for Indigenous students, faculty, staff and communities, and the other to review and help implement the University’s new policy on Information Security and the Protection of Digital Assets.

Research Foci

Our Faculty fosters world-leading, multidisciplinary research that addresses global challenges of the 21st century. We leverage our international reputation for excellence, cross-disciplinary collaboration and synergistic relationships with alumni, industry partners and governments to attract new support for research. Appropriate funding helps us to enhance the impact and reach of our innovations.

Progress Highlights

- Launched two new multidisciplinary research institutes: the Centre for Power & Information and the Centre for Aerial Robotics Research & Education.
- Enhanced our ability to attract major research awards by leveraging faculty experiences through panel discussions and an internal proposal review. One result was an increase in the success rate for Ontario Early Researcher Awards to 67 per cent in 2016 (up from 38 per cent in the previous competition). In 2015–2016 we also received two additional Strategic Project Grants, seven new or renewed Canada Research Chairs, and major awards from NSERC including the Brockhouse Prize and an E.W.R. Steacie Memorial Fellowship.
- Raised the level of Tri-Council support to \$31.8 million from \$29.1 million, bringing us close to our revised \$32 million goal.
- Developed policies and guidelines to standardize practices across the Faculty, including Canada Research Chair allowances, and indirect cost recovery for service contracts.

Outreach, Collaboration & Influence

Our collaborations and outreach activities help us leverage our global community of alumni and partners to attract stellar students, enhance the support for and impact of our research, and build capacity for the future.

Progress Highlights

- Hosted Innovate U, Canada's largest science, technology, engineering and math (STEM) event for children in Grades 3 to 8. This one-day workshop, held on May 13, 2016, was run in partnership with Google Canada and Actua. It attracted more than 1,400 students and teachers from across the GTA.
- Intensified our international student recruitment in the U.S., Latin America, and the Middle East; awarded international scholarships of full tuition to students from underrepresented countries (U.S., Bangladesh, Turkey, and New Zealand).
- Held the second annual Young Women in Engineering Symposium (YWIES) in October 2015, which attracted top female Grade 12 science students from across the Greater Toronto Area to learn more about engineering and meet our students, faculty and alumni.
- Formalized agreements with Shanghai Jiao Tong University and Tianjin University for incoming students (MAsc and fourth-year students, respectively) to obtain our MEng. We also expanded the number of partners in our international capstone design course to include Tsinghua University along with existing partners Peking University (PKU), the National University of Singapore (NUS) and the University of California, Irvine.
- Increased the number of students completing summer research abroad to 76 in 2016–2017 from 64 in 2015–2016, and the number of international Professional Experience Year internships to 79 from 61 in 2015–2016.
- Attracted \$29.3 million in philanthropic gifts in 2015–2016, bringing our fundraising for Boundless: The Campaign for the University of Toronto to \$180 million, or 90 per cent of our \$200-million goal.
- Rolled out the Graduway alumni network social media platform across three departments, with two more expected to launch in 2017. Graduway enhances our ability to connect with our global community of alumni and improves engagement, including mentorship and volunteer opportunities. It also provides us with key data on industry affiliations.
- Launched our first Spring Reunion Giving campaign in 2016, including both online and direct mail giving options.

Resource Allocation

Our resources have a direct impact on our ability to achieve the ambitious goals in our Academic Plan. In 2015–2016, we creatively and strategically leveraged our resources, including budget, space, infrastructure and personnel, to achieve our goals.

Progress Highlights

- Continued construction of the CEIE and established four multidisciplinary implementation groups to plan for the CEIE's new spaces and consult on key design decisions. These groups were composed of professors, students and staff from all departments, divisions and institutes and addressed four key aspects of the building: rapid prototyping and fabrication facilities, TEAL and design/meet rooms, research centres and student club space.
- Funded 15 projects through the Dean's Strategic Fund, including expansion of the MIE machine shop and growth of the Southern Ontario Centre for Atmospheric Aerosol Research (SOCAAR). We also initiated a call for proposals for the Dean's Infrastructure Improvement Fund.
- Completed the development of an Interdivisional Teaching Agreement with the Faculty of Arts & Science that enables our Faculties to work together more effectively, and have now moved into the implementation phase.
- Grew total revenue in 2015–2016 by 6.3 per cent over the previous year, driven by increased research funding and higher student enrolment, particularly among international students.
- Completed the \$10-million laboratory for the Translational Biology and Engineering Program (TBEP) in the MaRS Discovery District West Tower, part of the Ted Rogers Centre for Heart Research.
- Established a working group to review the Faculty's makerspaces. Its mandate includes identifying current capabilities and evaluating how they will be complemented by new spaces in the CEIE, as well as addressing supervision and safety to expand the use of existing makerspaces.

Comparison of U of T Engineering with Ontario and Canada, 2015–2016

The table below compares U of T Engineering metrics against those of engineering Faculties in Ontario and Canada for 2015–2016. Within Canada, we awarded 7.3 per cent of all undergraduate engineering degrees, 10.2 per cent of all engineering master’s degrees and 11.0 per cent of all engineering PhD degrees this past year.

Our internationally renowned scholars have received the single largest proportion of Natural Sciences and Engineering Research Council (NSERC) engineering funding in 2015–2016, despite the fact that they make up only 6.1 per cent of Canada’s tenured and tenure-stream engineering professors.

	U of T Engineering	Ontario	U of T % of Ontario	Canada	U of T % of Canada
Undergraduate					
Enrolment (FTE)	4,745	36,921	12.9%	80,708	5.9%
Degrees Awarded	1,035	6,465	16.0%	14,131	7.3%
% Women	22.8%	18.8%		18.8%	
Master's (MEng, MAsC and MHSc)					
Enrolment (FTE)	1,088	5,504	19.8%	13,481	8.1%
Degrees Awarded	631	3,057	20.6%	6,193	10.2%
% Women	26.0%	24.7%		24.5%	
Doctoral (PhD)					
Enrolment (FTE)	855	3,423	25.0%	9,104	9.4%
Degrees Awarded	152	619	24.6%	1,385	11.0%
% Women	29.6%	23.1%		22.0%	
Faculty					
Tenured and Tenure-Stream	226	1,566	14.4%	3,683	6.1%
Major Awards					
Major Awards Received	14	24	58.3%	67	20.9%
Research Funding					
NSERC Funding for Engineering	\$29.8M	\$122.6M	24.3%	\$292.7M	10.2%

Note: Unlike data contained in the rest of this report, enrolment (Full-time Equivalent, or FTE) and degrees awarded are based on the 2015 calendar year and come from Engineers Canada. Faculty data (tenured and tenure-stream) are based on November 2015 counts by Engineers Canada. Major awards are based on the 2015 calendar year and NSERC research funding is based on the 2015–2016 grant year (April to March).

Comparison of U of T Engineering with St. George Campus and University of Toronto, 2015–2016

The following chart compares U of T Engineering with the University of Toronto based on key metrics for 2015–2016. Since our activities are concentrated on the St. George campus, we also present our relative metrics where available.

	U of T Engineering	St. George Campus	Engineering % of Campus	University of Toronto	Engineering % of U of T
Student Enrolment					
Undergraduate	5,565	38,575	14.4%	64,635	8.6%
Professional Master's (MEng and MHSc)	815	7,249	11.2%	7,726	10.5%
Research Master's (MAsc)	563	2,760	20.4%	2,864	19.7%
Doctoral (PhD)	881	5,872	15.0%	6,171	14.3%
All Students	7,824	54,456	14.4%	81,396	9.6%
Degrees Awarded					
Undergraduate	1,050	7,765	13.5%	12,210	8.6%
Professional Master's (MEng and MHSc)	442	3,282	13.5%	3,565	12.4%
Research Master's (MAsc)	238	1,349	17.6%	1,401	17.0%
Doctoral (PhD)	145	828	17.5%	864	16.8%
Total Degrees	1,875	13,224	14.2%	18,040	10.4%
Faculty and Staff					
Professoriate	249			2,839	8.8%
Administrative and Technical Staff	312			6,620	4.7%
Research Funding					
Sponsored Research Funding	\$78.3M			\$420.0M	18.6%
Industry Research Funding	\$7.1M			\$16.8M	42.6%
Space					
Space (NASMs)	64,524	627,751	10.3%	828,067	7.8%
Revenue					
University-wide Costs	\$62.5M			\$501.3M	12.5%
Total Revenue	\$197.4M			\$1,817.0M	10.9%

Note: Student enrolment is shown as of November 1, 2015. Degrees awarded are based on the 2015–2016 academic year. Professoriate includes tenured, tenure-stream and teaching-stream faculty members. Administrative and technical staff include full- and part-time staff. Research funding is based on the 2014–2015 grant year (April to March). Space is measured in Net Assignable Square Metres (NASMs). Revenue is based on the 2015–2016 U of T fiscal year (May to April).

The Centre for Engineering Innovation & Entrepreneurship

The Centre for Engineering Innovation & Entrepreneurship (CEIE) will set a new standard for engineering education and research, strengthening our Faculty's position as the premier engineering school in Canada and one of the world's best. Located at the heart of U of T's St. George campus, the CEIE will inspire new levels of cross-disciplinary collaboration and experiential learning that will accelerate innovation and prepare the next generation of global engineering leaders to address the world's greatest challenges. Thanks to the remarkable commitment and vision of our U of T Engineering community, as well as funding from the Ontario government, the CEIE will open in 2017, launching an extraordinary new era for our Faculty.

“By incorporating innovation in engineering education and smart building design, the CEIE will be one of the finest research and teaching environments of any engineering school in the world.”

– **Meric S. Gertler**, President,
University of Toronto

Sustainability

The CEIE will boast innovative sustainable design features that will make it one of the most energy-efficient buildings at U of T. Illustrated in the Floor-by-Floor Tour, the skylights will draw daylight deep into the building, reducing the need for artificial lighting, and rooftop photovoltaic cells will harness the sun's energy to generate 70 kWh of electricity each year. Advanced air delivery systems (shown on the diagram with blue and red arrows) and passive solar shading will help reduce heating and cooling costs, and rainwater will be collected for landscape irrigation. The CEIE will meet or exceed many of the Tier 2 Toronto Green Standard performance measures for sustainable site and building design.

“This state-of-the-art, energy-efficient building will not only provide 10 per cent more space, but also offer exciting new opportunities for creative invention and a new level of interdisciplinary collaboration.”

– **Ron Venter**, Chair, CEIE Project Planning Committee, Professor Emeritus, Mechanical & Industrial Engineering and Clarice Chalmers Chair of Engineering Design

CEIE PROJECT MILESTONES

47–55 St. George Street selected as the site of the CEIE. Project Committee formed.

Boundless campaign launched for U of T Engineering

Project Planning Report finalized

Architects selected

MAR
2012

SEPT
2012

JAN
2013

APR
2013



Impact

“The CEIE will allow us to take the next leap forward in the way we drive innovation, foster entrepreneurship and cultivate global engineering leaders.”

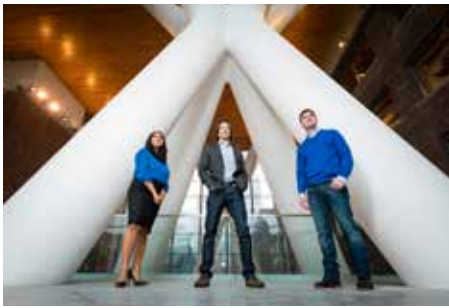
– **Cristina Amon**, Dean, Faculty of Applied Science & Engineering



Student Experience

The CEIE will enrich the student experience by creating dynamic, flexible environments that enhance collaboration and experiential learning, including:

- Technology Enhanced Active Learning (TEAL) rooms with configurable tables and chairs serviced by multiple flat-panel screens;
- design rooms and fabrication facilities that will enable students to turn their ideas into working prototypes;
- a 500-seat auditorium featuring small-group seating and highly interactive learning and communications technology; and
- dedicated space for student clubs.



Regional Hub

U of T Engineering has a long history of nurturing exceptional researchers, students, and alumni entrepreneurs and leaders whose success contributes to the regional marketplace and enhances job and wealth creation in Toronto. The CEIE will combine some of the University’s premier centres, institutes, incubators and industry partnership opportunities under one roof, providing our community with unparalleled resources to take ideas to market and strengthening Toronto’s standing as one of the top 10 cities in the world for startups.



Global Reach

The CEIE will house both established and recently launched multidisciplinary institutes and research centres that bring together some of the most innovative minds across the Faculty and the University to address the world’s greatest challenges, including sustainable energy, clean water and enabling technologies. The Faculty’s ability to attract top students from around the world is due in part to the way these centres improve lives through creative engineering solutions.

To learn more about the Centre for Engineering Innovation & Entrepreneurship, please visit: uoft.me/CEIE



Pilot TEAL room established in Sandford Fleming Building

Design review committee assessment began

Approval received from U of T’s Governing Council

SEPT
2013

FEB
2014

OCT
2014

Support

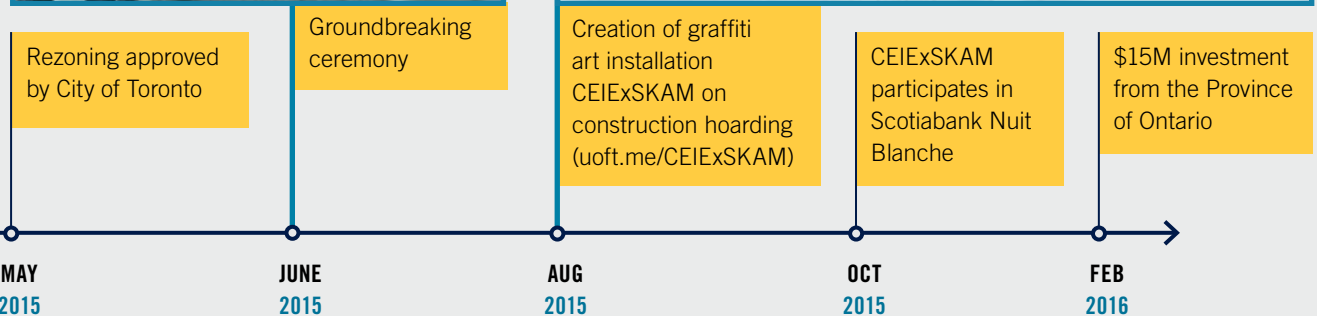
“The CEIE will transform our Faculty and will be an important legacy for future generations of engineers. This ambitious vision is coming to fruition thanks to the engagement, affinity and pride of our campaign donors, faculty, staff, students, alumni and friends, and the impeccable leadership of Dean Cristina Amon.”

– **George Myhal (IndE 7T8)**, Chair, U of T Engineering Campaign Executive Committee

The CEIE is an integral part of Boundless: The Campaign for the University of Toronto, which is raising \$2 billion for Canada’s leading research university. We have received more than \$26 million in philanthropic donations to support the CEIE, including \$1 million from undergraduates through the U of T Engineering Society. In addition, the Ontario government announced \$15 million in funding for the CEIE in the 2016 budget, recognizing the key role the CEIE will play in advancing economic growth and accelerating innovation in the province.

The Faculty extends special thanks to donors who have supported the CEIE with contributions of \$25,000 or more:

Anonymous (1)	Gooi Seong Heen	Walter Morris
Peter and Jocelyn Allen	Michael Goutama	George E. Myhal
Cristina Amon	Hatch	The Estate of James Norris
Stewart L. Blusson	Gerald and Geraldine Heffernan	Herbert Ross and Debra Pitman
Brookfield	Ian W. and Helen Hollingsworth	Gillian Sneddon
William P. Buckley	Claire M. C. Kennedy	Edward Swanston
Paul M. Cadario	Koh G. Yong	James C. Tai
Choong Kong Chang	Albert Lam	William and Kathleen Troost
Robert Conway Chen	Lee and Margaret Lau	University of Toronto Engineering Society
Water Chung-Wing Cheung	The Lee Foundation	Carol Mitchell and Richard Venn
Class of 5T3 Engineering	Ming Lim	Bert Wasmund
Sydney and Florence Cooper	Nick Lo	John H Weber
C. William Daniel	John Edgar McAllister	The Estate of Isabel Blake Winnett
Kwong Wah Er	Murray R. Metcalfe	Henry King-cheong Wu
Patrick Yuk-Bun Fung	Dusan Miklas	Philip L. K. Yeo
Gooi Seong Lim	Frank and Barbara Milligan	



Floor-by-Floor Tour

“This building will encourage informal and spontaneous interaction, for it is often through chance encounters that innovation occurs and entrepreneurial thinking flourishes.”

– Robert Davies, Principal, Montgomery Sisam Architects

Sixth Floor

- The Entrepreneurship Hatchery, U of T Engineering’s in-house startup incubator
- Suite for visiting alumni

Seventh Floor

- Centre for Global Engineering
- Institute for Leadership Education in Engineering
- Collaborative research space
- Project rooms

Eighth Floor

- Institute for Sustainable Energy
- Institute for Water Innovation
- Collaborative research space
- Open-air terrace facing front campus

Fifth Floor

- Base level of a dramatic four-storey atrium and event space
- Institute for Multidisciplinary Design & Innovation
- Institute for Robotics & Mechatronics
- Research laboratory for Partners for the Advancement of Collaborative Engineering Education

Third Floor

- TEAL rooms to encourage dynamic group work
- Design/meet rooms to support collaborative courses

Fourth Floor

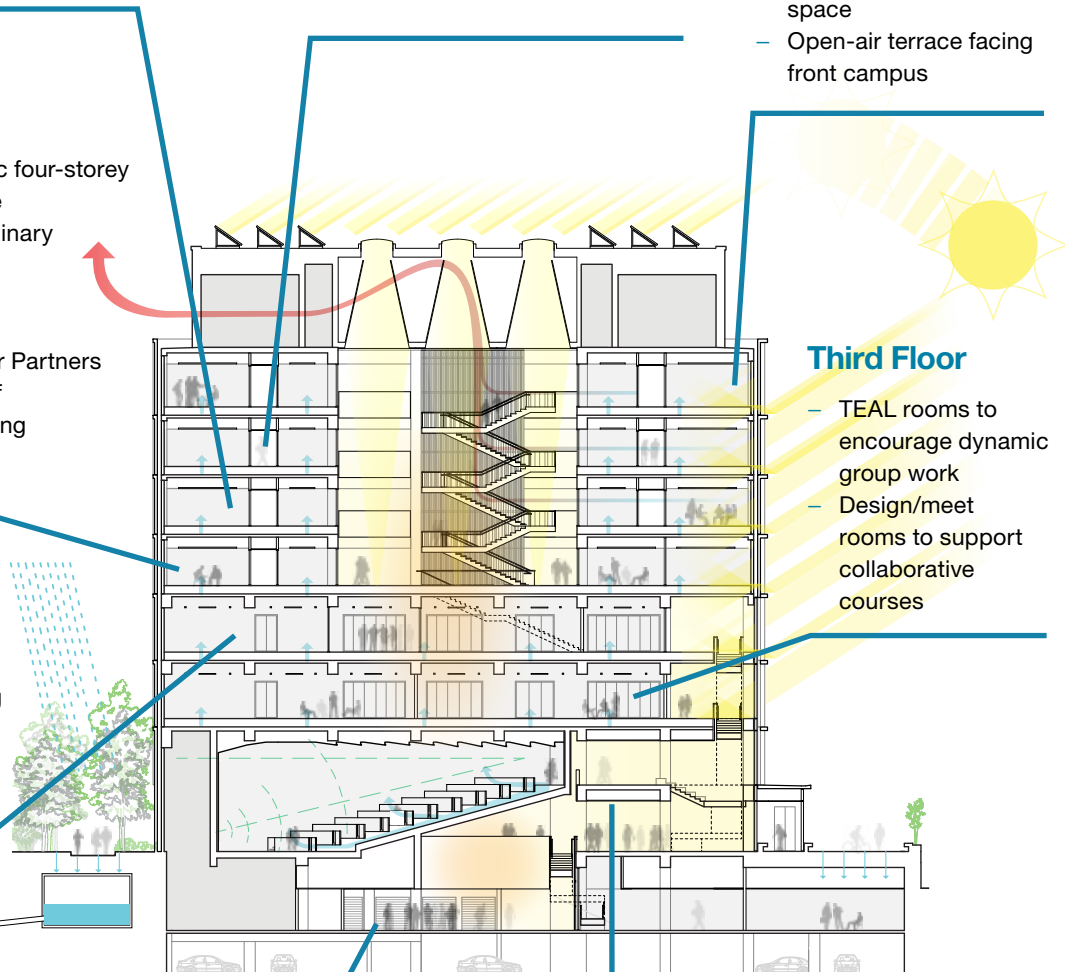
- Design/meet rooms for planning and executing group projects
- Fabrication facility and rapid prototyping room

First & Second Floors

- Grand hall and world-class event space
- Interactive 500-seat auditorium with a leading-edge data communications system, theatre-quality lighting and a stadium-style video wall

Lower Level

- Fabrication spaces, meeting rooms and storage for student clubs and teams
- Computer teaching laboratory
- Visualization facility with immersive screen technology



1

Our goal is to further strengthen our extraordinary programs, thereby advancing our standing as a global leader in engineering education and preparing our undergraduates to lead in a complex global engineering environment. We recruit outstanding students from around the world who excel not only academically, but also in diverse pursuits such as entrepreneurship, global citizenship, community service, athletics and the arts. These students choose U of T Engineering because of the excellence and breadth of our academic programs, our exceptional faculty members and the unparalleled co-curricular experiences we offer.

We received a record number of applications for our undergraduate programs in 2015 and selected one of the most accomplished entering classes in our history. For the second year, we used an enhanced broad-based admissions process that gives our admissions committee a more comprehensive understanding of each applicant's candidacy than one based on grades alone. This holistic picture allows us to recognize remarkable contributions both in and outside academic settings. We offer a range of resources to support student learning and well-being, and have struck two task forces to review and recommend improvements to mental health supports and to academic and student advising.

Our record of excellence, our inclusive environment and proactive recruitment strategies have made us a leader in advancing diversity among our students and in the engineering profession. In 2015–2016, our first-year class included the highest percentage of women in our Faculty's history. Our outstanding global reputation and recruitment strategies enable us to attract increasing numbers of international students, a group we are continuously working to further diversify. We are also intensifying efforts to improve access to engineering programs for Indigenous students and increase the number who apply to and enrol in our undergraduate programs.

We look forward to the opening of the Centre for Engineering Innovation & Entrepreneurship (CEIE) in 2017. The new Centre will enhance our undergraduate programming and student life by creating facilities that support innovative learning pedagogies, increase opportunities for experiential learning and offer purpose-built space for student clubs and teams.

Admissions and First-Year Students

Our undergraduate programs continue to attract top students from across Canada and around the world. A record 11,418 candidates applied for admission in 2015, an increase of four per cent from the previous year and nearly 80 per cent from a decade ago. Applications from international students grew by 17 per cent year over year and have nearly tripled over the past 10 years, demonstrating our growing global reputation and the success of our international recruitment strategy.

Figure 1.1a Applications, Offers, Registrations, Selectivity and Yield of First-Year Undergraduates, 2006 to 2015

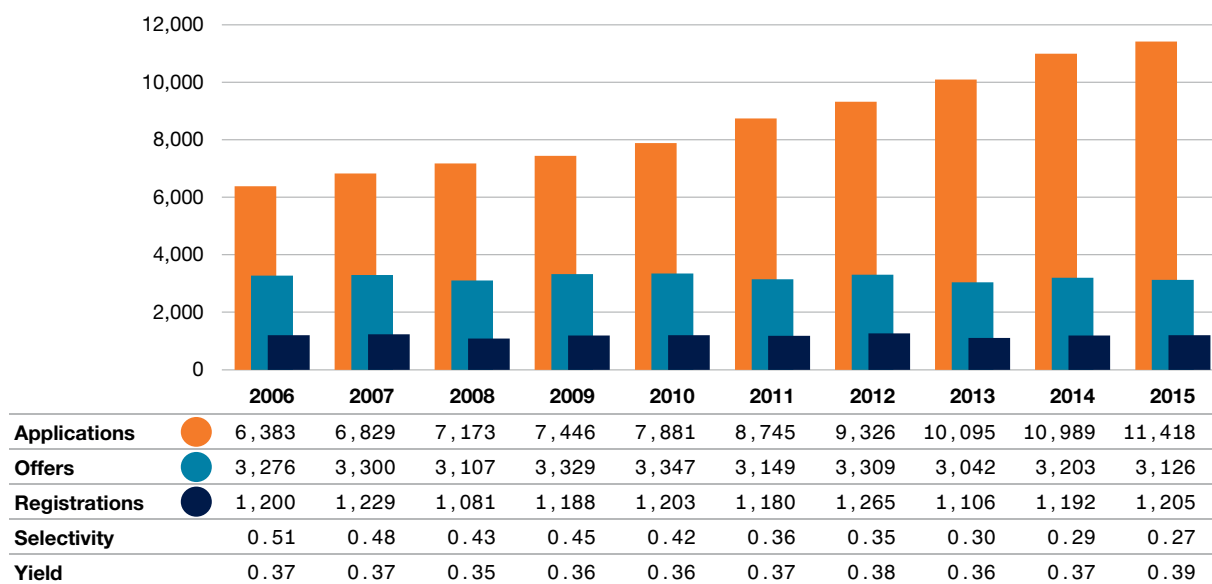
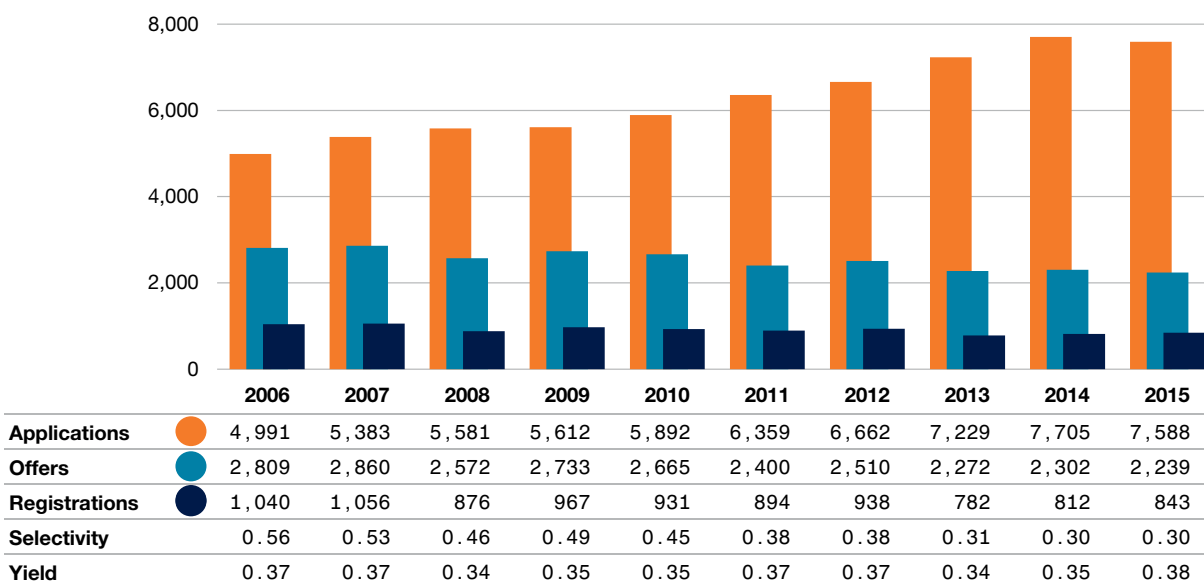


Figure 1.1b Applications, Offers, Registrations, Selectivity and Yield of Domestic First-Year Undergraduates, 2006 to 2015



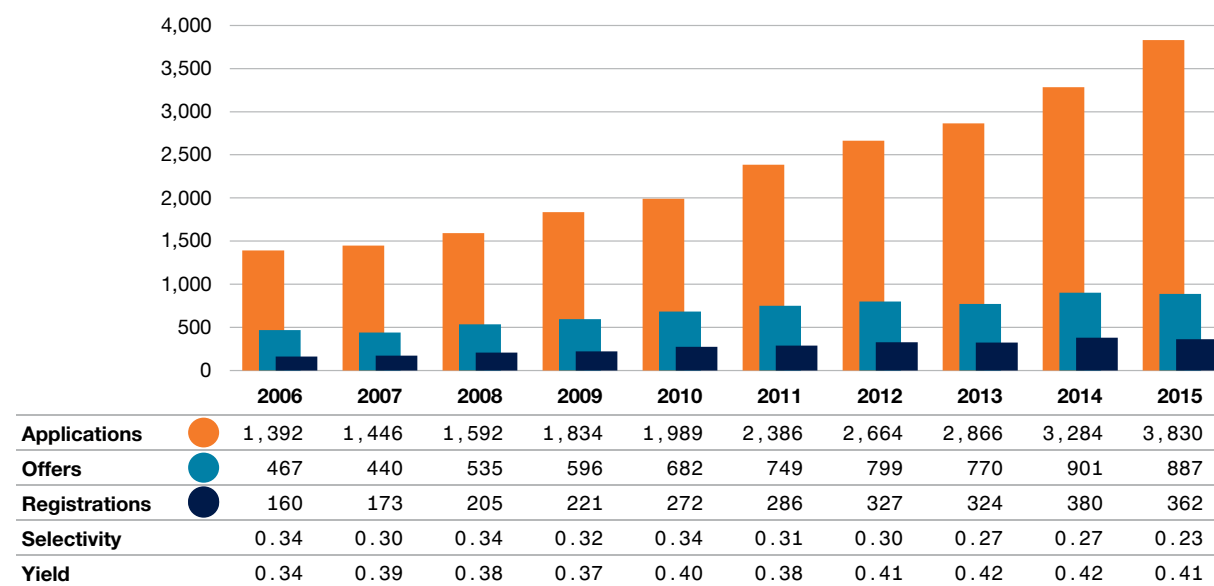
Data in this chapter are presented by academic year (September to August). Highlights are from July 2015 to June 2016.

Note 1.1a, b, c: Student counts are shown as of November 1. Applications and offers are for the fall admissions cycle. Selectivity = offers ÷ applications and represents the proportion of applicants who were offered admission. Yield = registration ÷ offers. Domestic students are defined as citizens (living in Canada or abroad) or permanent residents of Canada.

Strong demand for our programs enabled us once again to increase both our selectivity and the proportion of admitted students who accepted our offers. In 2015, we offered admission to only 27 per cent of applicants, with 39 per cent of admitted students ultimately enrolling. In making admissions decisions, we carefully consider candidates' academic records, as well as non-academic accomplishments such as co-curricular involvement and leadership experience. For the second year, we also assessed applications using an enhanced broad-based admissions process that employs videos and timed,

written responses to evaluate key engineering qualities, such as logical thinking, communication skills, adaptability and perseverance. This process gives us a more complete view of each applicant and enables us to select candidates who will best thrive in our enriched learning environment. To evaluate the effectiveness of this initiative, we are working with colleagues at the Ontario Institute for Studies in Education to correlate admissions scores with student success in the first year of studies.

Figure 1.1c Applications, Offers, Registrations, Selectivity and Yield of International First-Year Undergraduates, 2006 to 2015



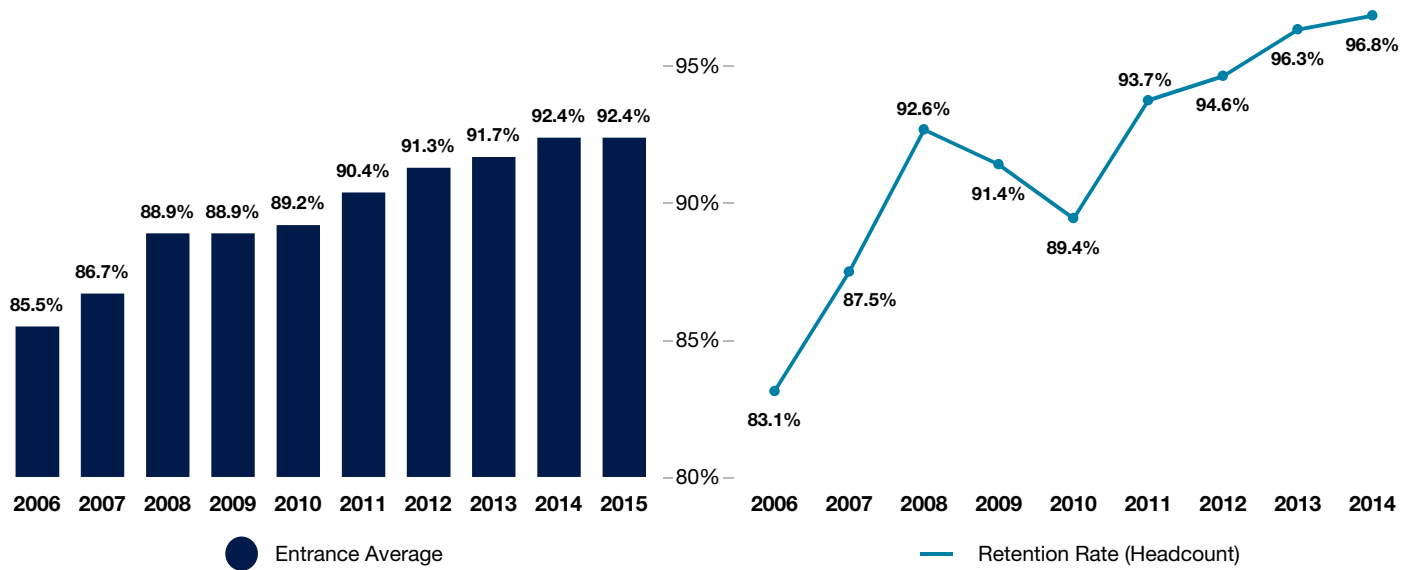
As a result of our strong global rankings, rigorous admissions process and targeted recruitment strategies, our 2015 entering class is one of the most accomplished in our history. The mean entering average of incoming Ontario secondary school students was 92.4 per cent, matching the previous year's record.

Our first-year class was also one of the most diverse in our history. Continuing pre-university outreach activities and targeted recruitment efforts, the percentage of women in our first-year class grew to a record 31.4 per cent. This is the second year in a row that women have comprised more than 30 per cent of our first-year students. International students continued to make up a significant proportion of our entering class, at 30 per cent, and the new International Scholar Award enhanced our ability to attract the

very best students from abroad. We also admitted 29 students into the International Foundations Program, which allows academically strong students who do not meet the University's minimum English proficiency requirements to receive a conditional offer of admission as non-degree students while they improve their English-language skills. *(For further discussion of our achievements in these areas, please see Chapter 9: International Initiatives and Chapter 10: Diversity.)*

Our first- to second-year retention rate increased to 96.8 per cent in 2015, a new high, due to the academic strength of our students and our robust programs that support their success. *For more details, please see "Enriching the Undergraduate Engineering Experience."*

Figure 1.2 Ontario Secondary School Averages of Incoming First-Year Undergraduates and Retention Rate Between First and Second Year, 2006 to 2015



We strengthened our recruitment activities to enhance our ability to attract the brightest students from around the world. For the 2016 admissions cycle, key initiatives included:

- **National Recruitment** — We doubled the number of school visits in the Greater Toronto Area to 60 schools from 30 in 2014–2015. The schools were selected on the basis of historic admission data, with an eye to our enrolment priorities. We also conducted recruitment activities in Ottawa, Montreal, Vancouver and Calgary. As a result of these efforts, we increased both our Ontario and our out-of-province applications by nine per cent compared with 2014–2015.
- **International Recruitment** — We conducted extensive recruitment activities including school visits, applicant events, information sessions, conference presentations, and science fair participation in 13 countries. These included both established and emerging markets in the U.S. (California), South Asia (India, Sri Lanka, Singapore, Malaysia), Latin America (Brazil, Ecuador, Colombia, Peru, Costa Rica, Panama), the Caribbean (Trinidad) and the Middle East (Dubai, Turkey). As a result of our activities, we increased international applications by nine per cent compared with 2014–2015.
- **Online Events** — We hosted 15 livestreamed events and live chats throughout the admissions cycle to answer applicants' questions, promote our March Break Applicant and Welcome to Engineering events, and help students who accepted our offers plan for their first year of engineering studies. These events were highly successful and reached a total audience of more than 2,000 students.
- **Redesigned Offer Package** — We redesigned our offer package to make it more visually attractive and increase the excitement among successful applicants to U of T Engineering. We also built a new microsite for admitted students to provide further information about our programs, student life and next steps.
- **Young Women in Engineering Symposium (October 2015)** — After the success of the inaugural Young Women in Engineering Symposium (YWIES) in 2014, we held the event again in 2015, inviting more than 100 top female Grade 12 science students from across the Greater Toronto Area. The event gave attendees an opportunity to learn more about engineering, participate in hands-on workshops and meet students, faculty and alumni. It also enabled us to connect with these students early in the 2016 admissions cycle. To build on this engagement, we piloted a mentorship program from February to April 2016 that connected YWIES participants with current female U of T Engineering students.
- **Reading Week Calling Campaign (February 2016)** — Current U of T Engineering students called nearly 3,000 applicants across Canada to answer their questions

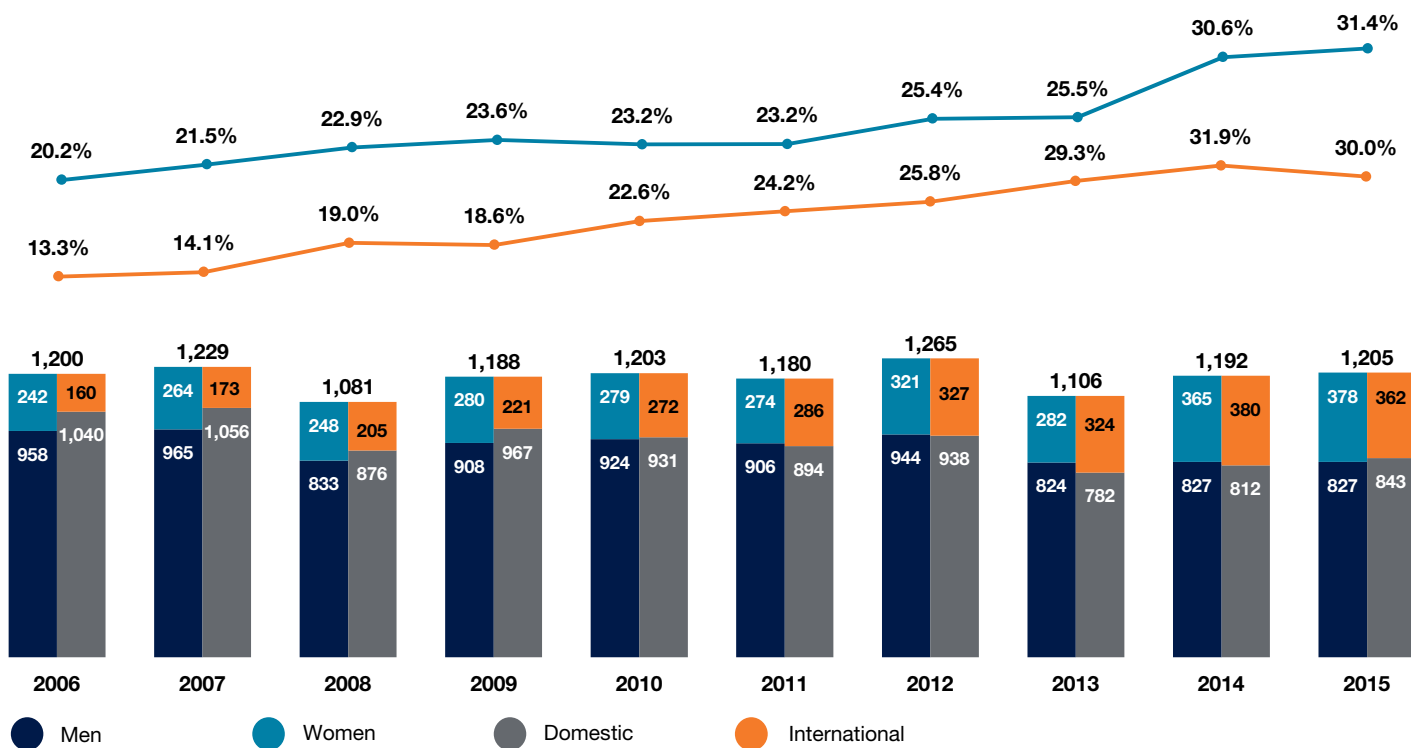
Note 1.2: Entrance average is calculated based on Ontario secondary school students. First- to second-year retention rate is indicated above year of first-year enrolment and is calculated as of November 1.

about our Engineering programs.

- **Alumnae Calling/Postcard Campaign (March/April 2016)** — This campaign connected more than 100 admitted female students across Canada and the United States with U of T Engineering alumnae who live in their regions.
- **March Break Applicant Event (March 2016)** — This invitation-only open house gave 600 applicants and their families an opportunity to learn more about the Faculty, specific programs, student life and our campus.
- **Girls' Leadership in Engineering Experience (GLEE) (May 2016)** — This annual, weekend-long program empowers and inspires women who have received offers of admission to our programs by connecting them with female faculty members, students and alumnae. Ninety-one per cent of the 87 students participating in GLEE accepted our offers of admission.
- **Welcome to Engineering (May 2016)** — This full-day event gave admitted students an opportunity to learn more about U of T Engineering before the final deadline for applicants to accept offers from Ontario universities. About 250 admitted students attended this event.

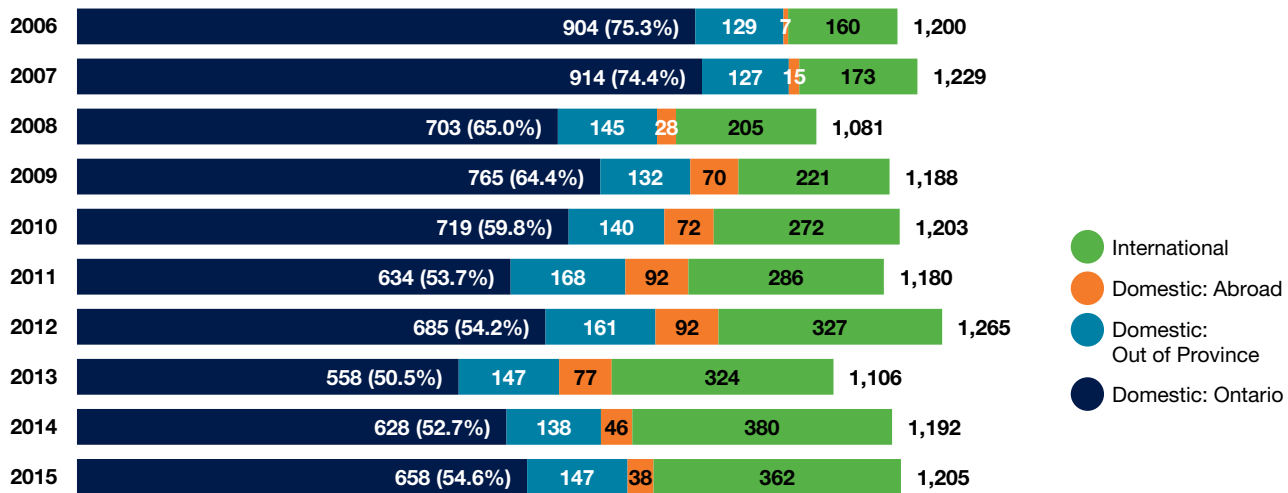
We are committed to addressing the Truth and Reconciliation Commission of Canada's call to eliminate educational gaps between Indigenous and non-Indigenous Canadians. In 2016, we created a new Director of Engineering Pathways and Indigenous Partnerships position to coordinate a Faculty-led outreach program to First Nations, Métis and Inuit communities, with the goal of increasing the rate of participation and academic success of Indigenous students in Engineering. The Director is also facilitating greater integration of outreach, recruitment and retention initiatives, both within the Faculty and across the University, that impact Indigenous engineering students. *(For more information on these initiatives, see Chapter 10: Diversity.)*

Figure 1.3 Incoming First-Year Undergraduates with Percentage of Women and International Students, 2006 to 2015



Note 1.3: Student counts are shown as of November 1. Domestic students are defined as citizens or permanent residents of Canada.

Figure 1.4 Incoming First-Year Domestic and International Undergraduates, 2006 to 2015



Enrolment

The proportion of women across our undergraduate population increased to 27.4 per cent in 2015–2016 as the number of female students in our entering class continues to grow. Nearly every undergraduate program is seeing gains in female students. With women comprising more than 30 per cent of our first-year class for the second year in a row, we expect our overall undergraduate cohort to surpass that threshold within a few years. We play an active role in a broad national coalition that aims to increase the percentage of newly licensed engineers who are women to at least 30 per cent by 2030.

We also saw continuing growth in the proportion of international students across our undergraduate programs after we surpassed our Academic Plan goal of 25 per cent in 2014–2015. International students now comprise 27.4 per cent of our undergraduates, enriching our student body with diverse perspectives and expanding our global U of T Engineering community.

Overall enrolment was strong across all our undergraduate programs, with increases in CompE, General First Year, ChemE, EngSci and IndE.

Note 1.4: Student counts are shown as of November 1. Domestic students are defined as citizens or permanent residents of Canada.

Figure 1.5a Undergraduate Enrolment with Proportion of Women and International Students, 2006–2007 to 2015–2016

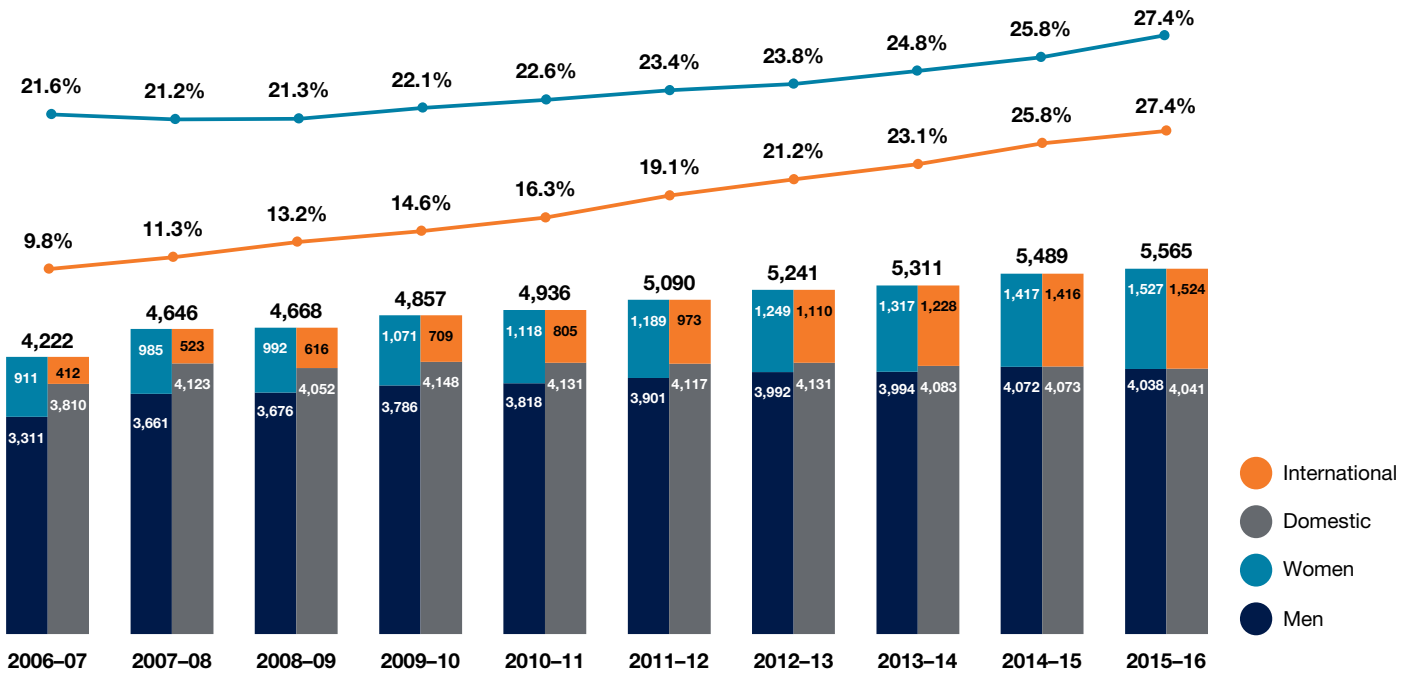
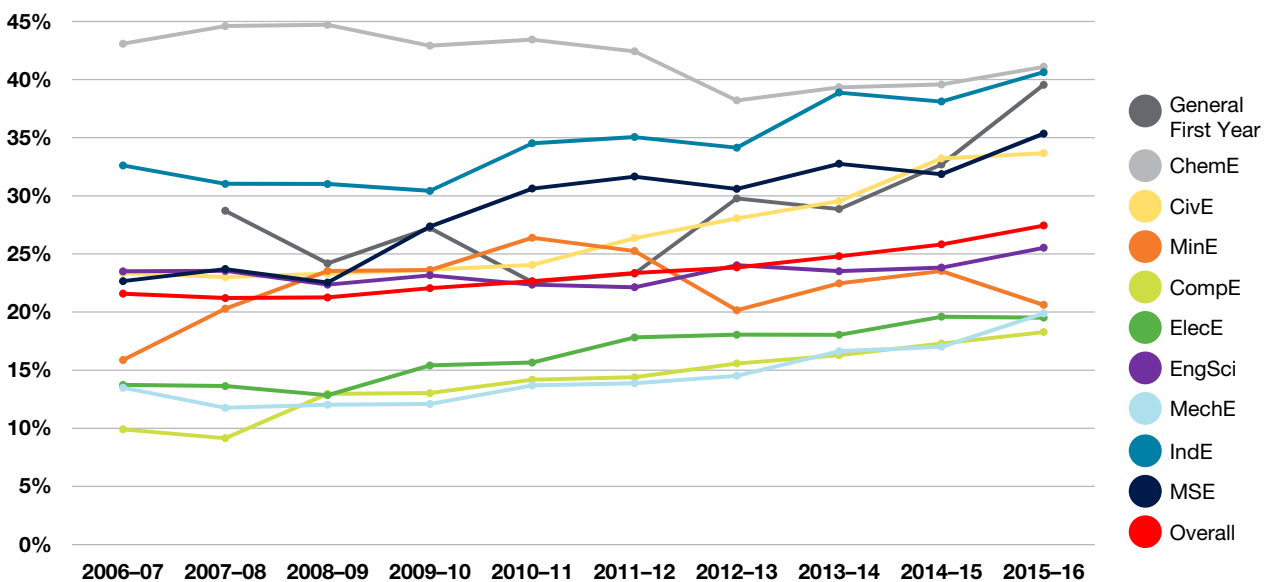
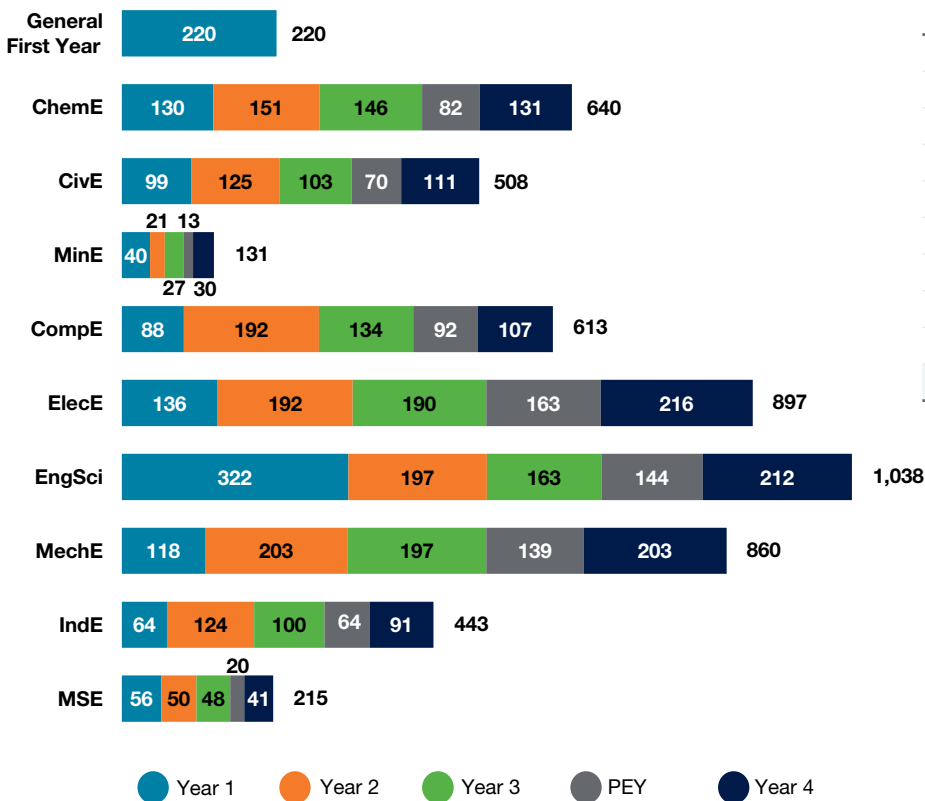


Figure 1.5b Women as a Proportion of Total Enrolment by Program, 2006–2007 to 2015–2016



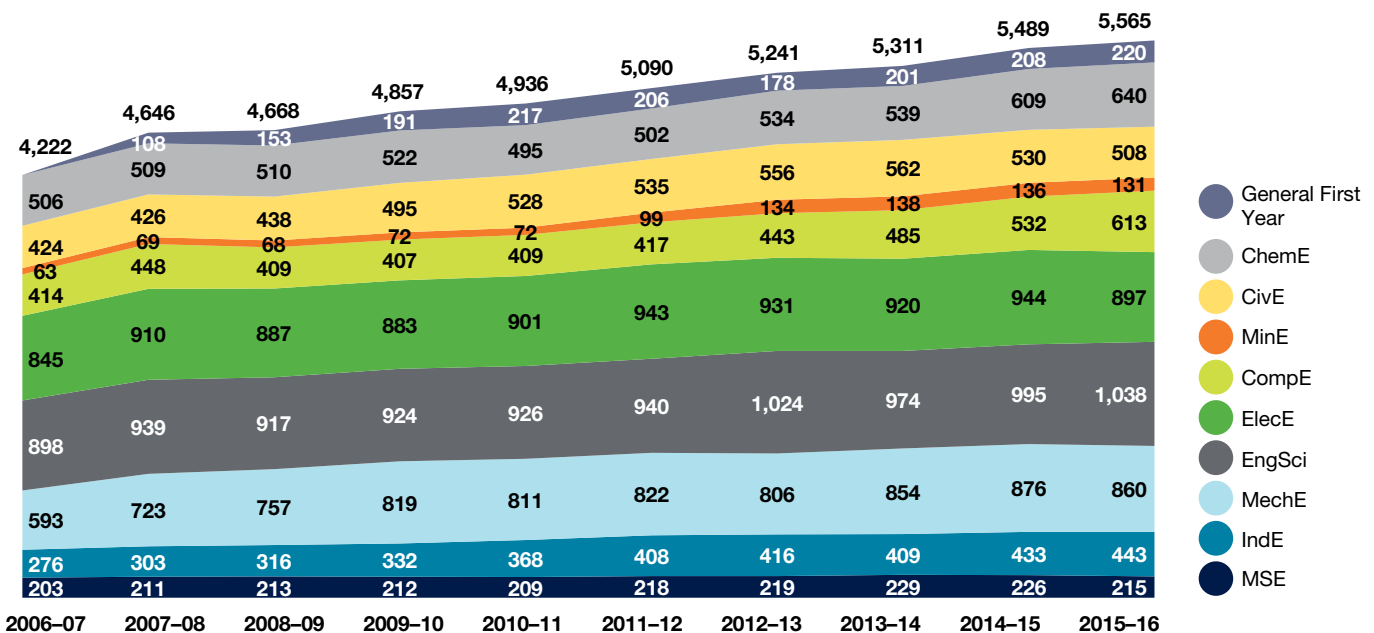
Note 1.5: Includes full- and part-time students and those on Professional Experience Year (PEY) internships. Does not count students with special (non-degree) status. Student counts shown as of November 1. Domestic students are defined as citizens or permanent residents of Canada. For more information about our international enrolment goal, please see Academic Plan, Chapter 4, Goal 12

Figure 1.6 Undergraduates by Program, Year of Study and Professional Experience Year (PEY), 2015–2016



Engineering Science Majors	Enrolment
Aerospace Engineering	51
Biomedical Systems Engineering	58
Electrical and Computer Engineering	99
Energy Systems Engineering	36
Infrastructure Engineering	29
Mathematics, Statistics and Finance	53
Nanoengineering	4
Engineering Physics	13
Robotics Engineering	32
Total	375

Figure 1.7 Undergraduates by Program, 2006–2007 to 2015–2016



Note 1.6: Student counts are shown as of November 1, 2015. Engineering Science Majors show only students in Year 3 and Year 4 and do not count students on PEY internships.

Note 1.7: Student counts are shown as of November 1.

Need-Based Funding

We remain committed to ensuring that students are able to enrol in our degree programs and complete their course of study regardless of financial means. We provide funding for undergraduate students through a variety of sources, including from individual donors and from the University of Toronto Advanced Planning for Students (UTAPS) program.

The number of undergraduate students receiving need-based awards in 2015–2016 was 1,627. The total amount of student

support increased to its highest-ever value of \$12 million. This funding is distributed relatively evenly across all four years of study.

The amounts shown in this chapter do not include merit-based scholarships or awards, or funding from provincial assistance programs such as the Ontario Student Assistance Program (OSAP).

Figure 1.8a Number of Awards Received by Cohort with Total Number of Undergraduate Need-Based Award Recipients, 2009–2010 to 2015–2016

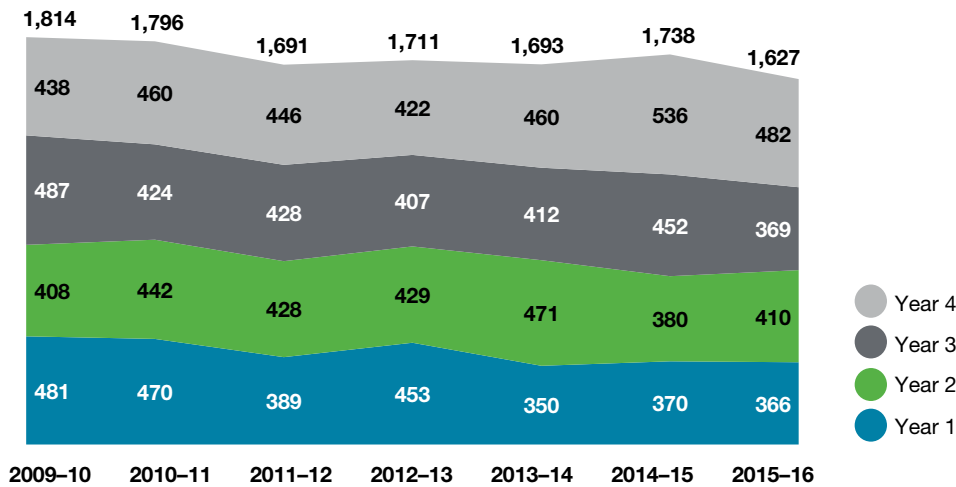
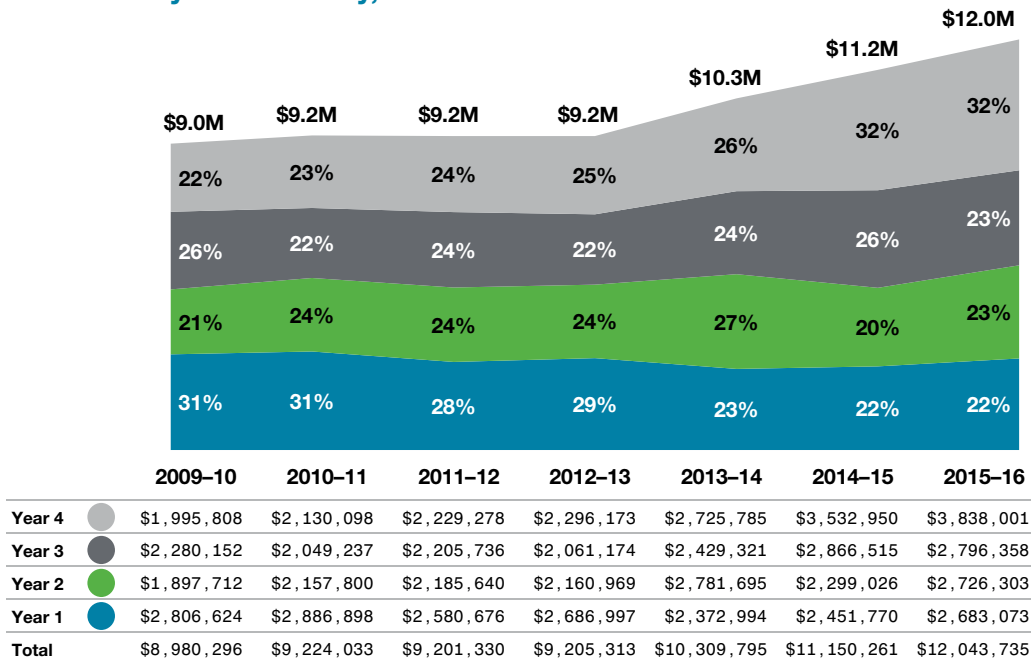


Figure 1.8b Total Value of Undergraduate Financial Assistance and Percentage Distributed by Year of Study, 2009–2010 to 2015–2016



Note 1.8a and 1.8b: Data for these figures were obtained from the new Student Accounts Reporting Cube. In previous Annual Reports, data was obtained from Faculty Registrar’s Office. For more information, see Data Sources.

Degrees Awarded

Students at U of T Engineering earn either a Bachelor of Applied Science (BASc) or Bachelor of Applied Science in Engineering Science (BASc EngSci). Both degrees can be completed in four years. However, many of our second- and third-year students choose to augment their degrees by

participating in our Professional Experience Year (PEY) internship program, which adds 12 to 16 months to their time-to-completion. *(For more information on PEY, please refer to Chapter 4: Cross-Faculty Education and Experiential Learning.)*

Figure 1.9a Undergraduate Degrees Awarded by Program, 2006–2007 to 2015–2016

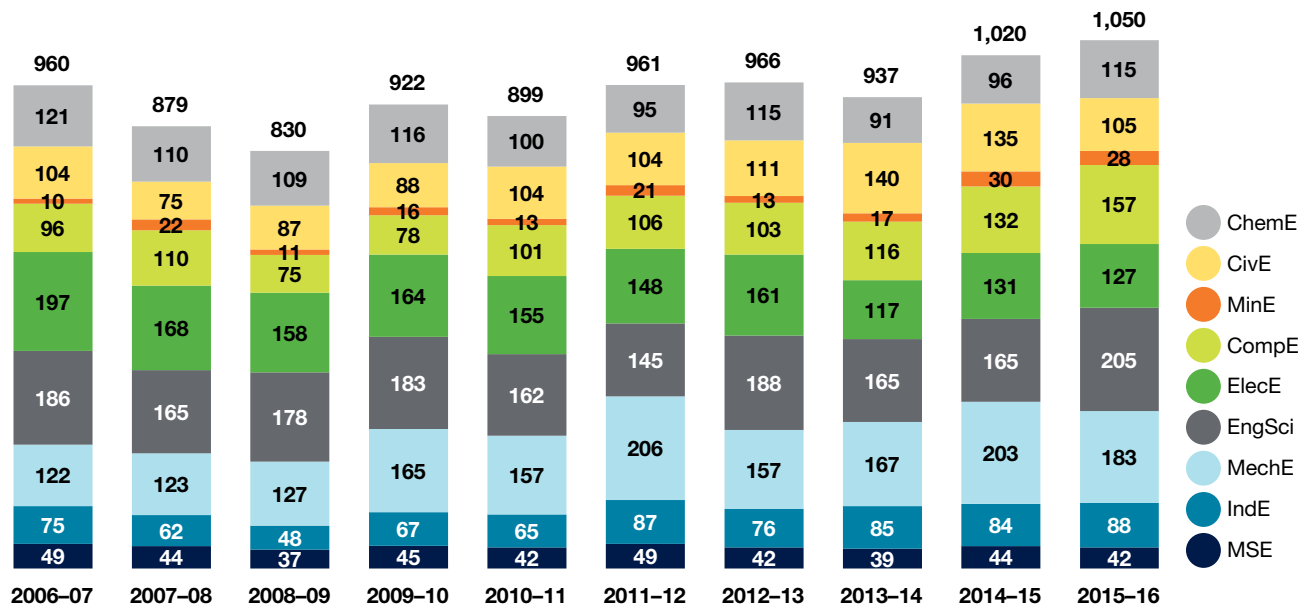
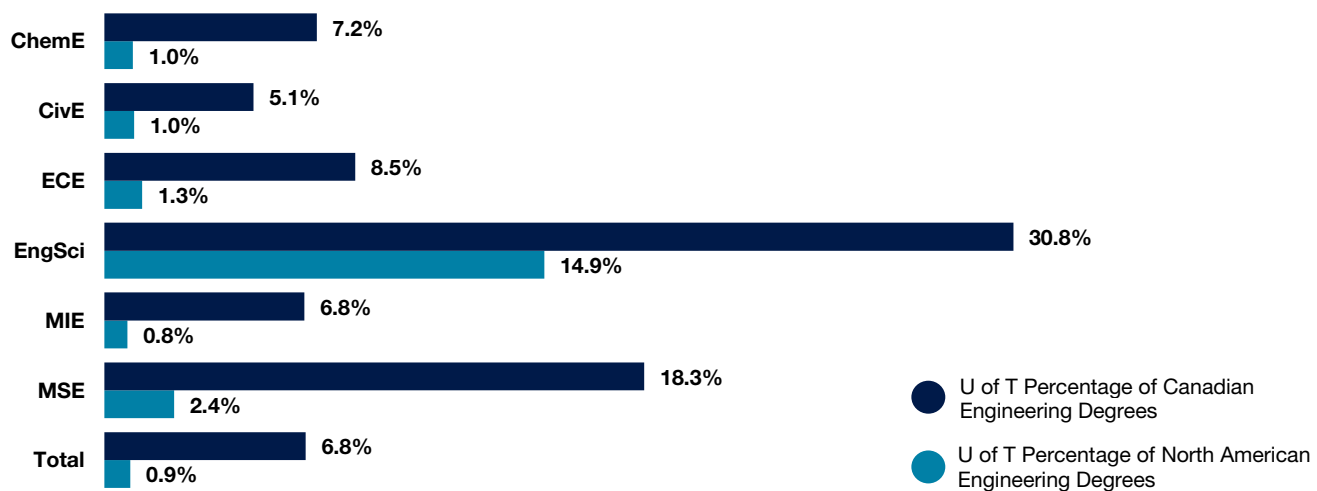


Figure 1.9b U of T Engineering Degrees Awarded by Academic Area Compared with Canadian and North American Degree Totals, 2014



Note 1.9a: Data reported by academic year (September to August).

Note 1.9b: Data sourced from reports produced by Engineers Canada and the American Society for Engineering Education. Total percentages represent all engineering degrees in North America, including those in fields that are not specifically identified at U of T.

Student-to-Faculty Ratios and Dean’s Honour List

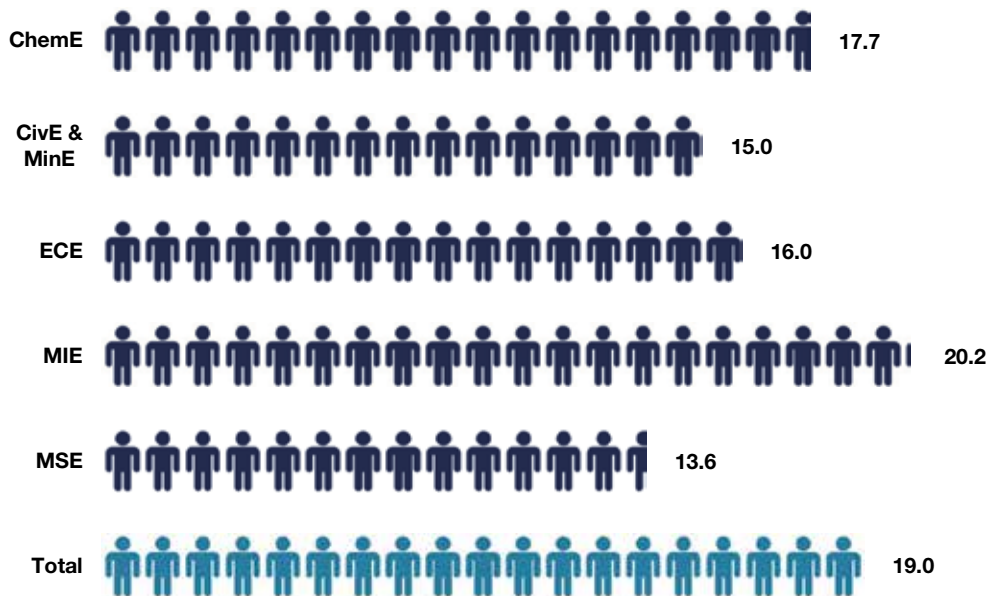
Figure 1.10 shows the number of undergraduates in each department relative to the number of teaching faculty in that department. Students in programs such as Engineering Science and General First Year that employ a cross-faculty teaching approach, students are included only in the “Total” bar.

In 2016, 39 per cent of graduating students achieved Honours or High Honours (Figure 1.11a). To graduate with Honours, a full-time student must achieve a cumulative average of higher than 79.5 per cent across second, third and fourth years and a weighted sessional fourth-year average of 74.5 per cent or higher. The

designation of High Honours, created in June 2015, distinguishes students who obtain a cumulative average of 87.5 per cent or higher and a weighted sessional fourth-year average of 82.5 per cent or higher. Both designations provide a measure of the outstanding achievement of our students.

The number of students who attained Dean’s Honour List standing in 2015–2016 also remained strong, reflecting the high calibre of our students and the many programs we offer to support students throughout all years of study.

Figure 1.10 Undergraduate Students per Faculty Member by Academic Area, 2015–2016



Note 1.10: Student and faculty counts are shown as of November 1, 2015. For full-time equivalency (FTE), each part-time student is counted as 0.3 FTE. Students with special (non-degree) status or on PEY internships are not included. Faculty counts include tenure-stream and teaching-stream faculty.

Figure 1.11a Number of Students and Percentage of Class Graduating with Honours, 2007 to 2016

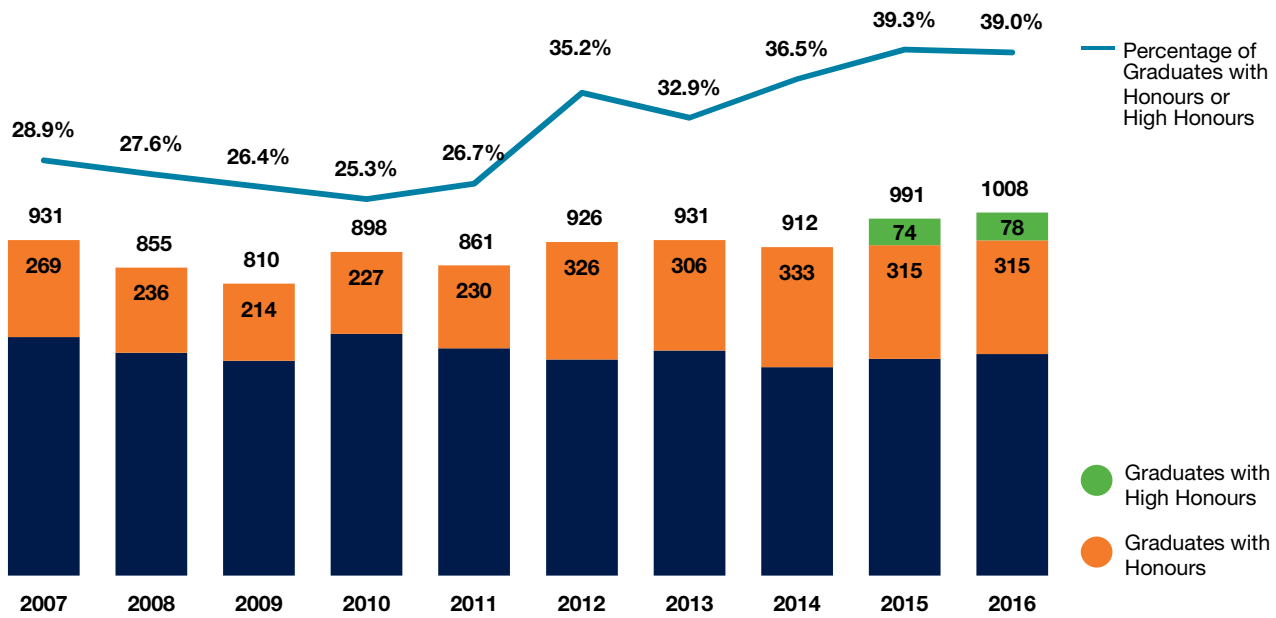
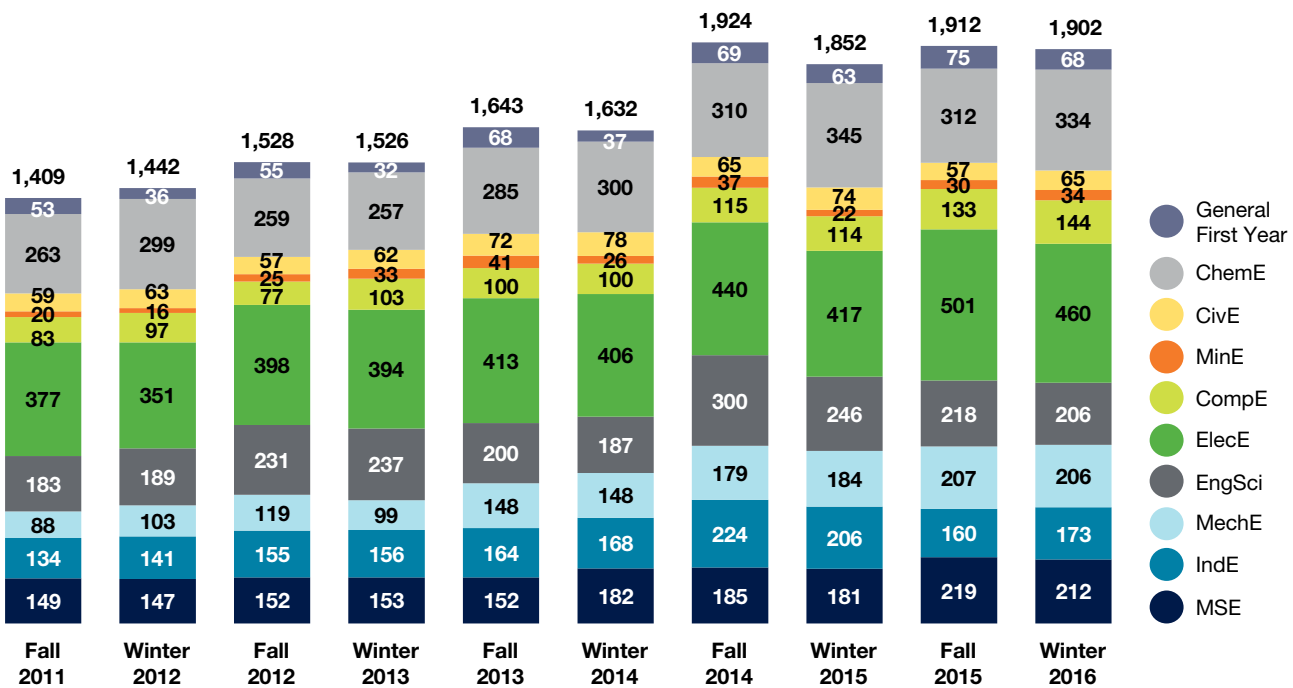


Figure 1.11b Number of Students on the Dean's Honour List by Term and Academic Area, Fall 2010 to Winter 2016



Note 1.11b: Honours standing is normally granted to students carrying a full academic load (2.5 credits per session, excluding extra courses) if the session is not being repeated. During fourth year, a student may reduce their course load in either semester (but not both) and still be eligible for Honours standing, provided the other conditions are met.

Enriching the Undergraduate Engineering Experience

At U of T Engineering, we offer our undergraduates an exceptional learning environment and an unparalleled student experience. Experiential learning, multidisciplinary collaboration, entrepreneurship and diverse opportunities to develop key technical and professional competencies are the pillars of our rich academic and co-curricular programs. *(See Appendix A for a complete list of student clubs and teams)*

We continually review and strengthen our programs to ensure our students graduate with the competencies they need to address the world's greatest challenges. In 2015–2016, we took significant steps to begin implementing the recommendations of the Core Curriculum Review Task Force to enhance the content and delivery of the first-year curriculum. In fall 2015, we introduced APS 100H1F Orientation to Engineering, a required course that is designed to help entering students in our Core 8 and General First Year programs transition to first-year engineering studies. Through six one-hour lectures, supplemented by 12 one-hour tutorials led by upper-year teaching assistants, the course covers key topics such as good study habits, time management and engineering ethics. Many of the lectures featured guest speakers, including current undergraduate and graduate students and alumni. Two staff members from our First Year Office delivered a presentation about this new course at the Annual Conference on The First-Year Experience in February 2016.

We also moved forward with the following recommendations from the task force:

- We implemented a numerical computation component in MAT 188 Linear Algebra by adding six two-hour labs that gave students an opportunity to learn MATLAB.
- We created a First Year Core 8 Curriculum Committee to help implement the task force's recommendations.
- We completed a curriculum-mapping exercise of our first-year program and began a search for a teaching-stream faculty position within the Faculty and the First Year Office that will be responsible for enhancing first-year course integration.
- Beginning in 2016–2017, we will introduce:
 - a new Engineering Chemistry and Materials Science course for General First Year and ECE students; and
 - a change in the programming language in one of our first-year programming courses that will provide a better introductory learning experience for students who will not take advanced programming courses.

We continued to pilot a Technology Enhanced Active Learning (TEAL) room in the Sandford Fleming Building

to inform and optimize the design of planned TEAL rooms in the CEIE. We also expanded the number of online courses we offer to four: APS 160 Mechanics; APS 162 and 163 Calculus for Engineers; and APS 164H1 Introductory Chemistry from a Materials Perspective. We continued to provide lecture capture for most first-year classes to enable students to review lecture material outside class.

Our commitment to student success starts before entering students begin their classes. As part of our First Year Foundations programs, we offer Success 101, a three-day academic skills mini-course, several times each summer to help new students prepare for their studies at U of T Engineering. It offers guidance on time management, effective note taking, classroom etiquette, different learning styles and effective classroom communication, as well as tips for students who are living in residence or commuting. First-year students can also take weeklong summer programs in engineering design and computer programming to enhance their competencies in these areas before they begin their studies.

In 2015, we offered a calculus “boot camp,” which gave entering students an opportunity to review key mathematical concepts and see how they are applied to university-level calculus. We continued to give entering students the opportunity to take APS 162 Calculus for Engineers as an online, for-credit course over the summer. We also offered a summer orientation program to help international students meet their classmates and get to know the campus and the city.

During their first year, students have access to diverse programs to support their learning. Embedded counsellors help identify students who may benefit from extra academic support, and we also offer Peer-Assisted Study Sessions run by highly successful upper-year students. The Transition Program allows first-year students who experience academic challenges to redistribute their course load, defer some courses to the summer session and repeat up to three fall courses in the winter term, enabling them to proceed to second year on schedule. We also held the third annual First Year Instructors Day in September 2015 to help ensure consistency in student experience and raise awareness among our instructors of supports that are available to first-year students.

Engineering students in all years can meet with a learning strategist at the University of Toronto Academic Success Centre to discover how they learn best and develop more effective study strategies. The Engineering Communication Program, which celebrated its 20th anniversary this year with a speaker series, helps undergraduates hone their communication skills and

provides assistance in preparing written assignments and presentations. We struck task forces on mental health and on academic and student advising to improve the experience of all our students in these important areas, and expect to have their recommendations in fall 2016.

Our Faculty is committed to supporting the next generation of makers and innovators through rich experiential learning opportunities. Starting in first year, all of our undergraduate students work in teams on open-ended design challenges through either Engineering Strategies & Practice or

Praxis courses. In upper years, students build on these experiences through either departmental capstone courses, programs offered by the University of Toronto Institute for Multidisciplinary Design and Innovation (UT-IMDI) — including APS 490 Multidisciplinary Capstone Project (MCP) and industry-sponsored projects — or PEY internships with leading companies around the world.

For further information about experiential learning and multidisciplinary collaboration, please see Chapter 4: Cross-Faculty Education and Experiential Learning.

Selected Undergraduate Highlights

Better Mop Design Wins Safety Award for U of T Engineering Students

In April 2016, third-year Engineering Science students Jeremy Wang, Shuyi Wu, Ryan Williams and Noah Yang (all EngSci 1T7 + PEY) won second prize in the 2016 Minerva Canada James Ham Safe Design Awards competition. They designed PowerWring, a small, simple device that attaches to the short handle of any mop wringer and multiplies the force of wringing by allowing the worker to leverage the much longer mop handle. The worker can stay upright while wringing the mop, and the force required of them is reduced by half or more. The product was developed as part of Praxis Engineering Design. As a result of support from The Entrepreneurship Hatchery, PowerWring has patents under review in Canada and the U.S.

Strong Finish for U of T Supermileage Team at Shell Eco-Marathon

The University of Toronto Supermileage Team delivered a strong second-place finish at the 2016 Shell Eco-Marathon Americas, held April 22-24 in Detroit, Michigan. Their vehicle, christened UT4, achieved a fuel efficiency of 1,005 kilometres per litre of gasoline, or 2,364 miles per gallon. It was bested only by the Alérion Supermileage team from Université Laval, which achieved 1,099 kilometres per litre (2,584 miles per gallon). The competition, held annually since 2007, featured 125 teams from the United States, Guatemala, Mexico, Canada, Brazil, Ecuador and Puerto Rico.

Bronze Medal Finish for Blue Sky Solar Racing at American Solar Challenge

In August 2016, U of T Engineering's Blue Sky Solar Racing team finished third at the American Solar Challenge. Horizon — Blue Sky's eighth-generation vehicle — zipped across the

finish line with a final time of 62 hours, 11 minutes and three seconds. The eight-day rally-style solar car race covers 1,975 miles (3,178 kilometres) through the eight American states. In October 2015, Horizon competed in the biennial World Solar Challenge in Australia, where it placed 12th in a field of 27 vehicles.

U of T Engineering Students Honoured with OPE Scholarships

In March 2016, the Ontario Professional Engineers Foundation for Education presented an admission scholarship and eight in-course scholarships totaling \$15,000 to students from U of T Engineering. The recipients were honoured for their participation in co-curricular activities while maintaining above average grades. They included: Chia Hang (Kevin) Chang (Year 3 ElecE), Lia Orders Codrington (Year 1 EngSci), Kun Yi Antonio Juan Ding (Year 3 ChemE), Haya Elaraby (Year 3 IndE), Savannah Forest (Year 4 CivE), Ran Hong (Year 3 MSE), Katherine Lonergan (Year 3 MechE), Connor Jackson Smith (Year 4 CompE + PEY), Paul Minkang Suk (Year 2 EngSci).

International Scholar Awards Draw Top Students

Tamara Abugharbieh (Year 1 EngSci) of Jordan and Katherine Bancroft (Year 1 General First Year) of Singapore were the first recipients of the International Scholar Awards, a new scholarship that enhances U of T Engineering's ability to attract top students from around the world. The award, which covers full tuition and is renewable for up to four years, recognizes students studying abroad who have exceptional marks, are involved in extra-curricular activities and want to use their engineering degrees to improve the world.

UnERD showcases innovations from undergraduate summer research

Projects on tissue engineering, cancer detection and algal biofuels took top prizes in August 2016 at the Undergraduate Engineering Research Day (UnERD). The annual event featured nearly 100 poster and podium presentations on a wide range of topics, from sustainable energy to biomedical engineering. This year's top presenters were Jasmine Quigley (Year 4 EngSci), Chris Zhang (Medical Biophysics) and Onasvi Kharsikar (Year 3 ChemE). Quigley and Zhang won an opportunity to publish their research in *STEM Fellowship Journal*, a peer-reviewed publication that aims to be a "showcase for original, interdisciplinary ideas and supports the inquiry-based approach of the Internet-educated generation."

Lassonde Mineral Engineering Team Wins World Mining Competition

A student team from the Lassonde Mineral Engineering Program won the fourth annual World Mining Competition, held from October 29 to November 1, 2015 at the University of Saskatchewan. Seung Young Baek (Year 4 MinE), Matthew Hart (Year 3 MinE), Daryl Li (Year 4 MinE) and Peter Miskiel (Year 4 MinE) placed first among 13 teams and 11 schools from Canada, Germany, India and the United Kingdom. The multidisciplinary competition challenges teams — generally composed of business, engineering and geology students — to solve a mining strategy case based on issues facing the international mining industry.

In 2015, the case focused on sustainability and required teams to act as consultants for a fictitious mining company seeking to acquire a junior exploration company that owns a lithium mine. The teams had 36 hours to create proposals that considered social, environmental, economic and political factors, which they presented to a panel of judges composed of accounting, human resources and government representatives, as well as mining executives.

Undergraduate Engineering Student Wins Aircraft Design Competition

In October 2015, Arthur Brown (Year 4 EngSci) took the top prize in the American Institute of Aeronautics and Astronautics Foundation's Undergraduate Individual Aircraft Design Competition. Brown's project, which took several months to complete, involved designing an unpiloted aircraft that could fly supersonically for 1,000 nautical miles or more, drop a payload of 4,000 pounds and then return to base. Brown is the first student from a Canadian university to win the international design challenge.

Canadian Engineering Memorial Foundation honours CivE student for mentorship of young women

In May 2016, Sara Maltese (Year 3 CivE) was awarded the Marie Carter Memorial Undergraduate Engineering Scholarship from the Canadian Engineering Memorial Foundation (CEMF). The award honours her work as an Ambassador for the WISE High School Outreach team, delivering engaging presentations about science and engineering to schools across the Greater Toronto Area. In 2014, Maltese helped organize a new outreach event called Take Your Kid to Skule™ day, inviting high school students to spend a day at U of T Engineering to learn more about the engineering profession and the programs offered by the Faculty. The Canadian Engineering Memorial Foundation is dedicated to attracting women to the engineering profession so they may fully contribute to the development of our society and in so doing, honour the memory of the 14 women from L'École Polytechnique who were killed in the shooting on December 6, 1989.

U of T Engineering Gains Two Schulich Scholars

Two first-year engineering students were among four entering U of T students who were honoured with prestigious Schulich Leader Scholarships in 2015. Christopher Choquette-Choo (Year 1 EngSci) and Daniel McInnis (Year 1 MechE) each received \$80,000 through the program, which was started in 2012 by business leader and philanthropist Seymour Schulich. The program awards 50 scholarships annually to top students across Canada who are pursuing undergraduate degrees in science, technology, engineering and math (STEM) and have demonstrated significant leadership qualities.

University of Toronto Aerospace Team Unveils its Latest Fleet

The University of Toronto Aerospace Team (UTAT) displayed its latest innovations to more than 200 people at the 2016 Aerospace Showcase, held in March 2016. The team's projects included a hybrid drone with both wings and rotors, a supersonic rocket powered by laughing gas and candle wax and a satellite smaller than a toaster that could carry microorganisms into orbit. UTAT has more than 100 members from the Faculties of Applied Science & Engineering, Arts & Science and Medicine, and is active in five areas: rocketry, aerial robotics, unpiloted aerial vehicles, space systems, and outreach and advancement.

Pre-University Engineering Outreach

Through the Engineering Student Outreach Office, we design and deliver a range of pre-university programs that engage students in Grades 3 to 12 in science, technology, engineering and math (STEM). The graduate and undergraduate students who deliver these programs serve as ambassadors for the Faculty while gaining invaluable experience in youth education and project management. We also bring together elementary and secondary school teachers to share innovative ways of bringing STEM to the classroom.

Every summer, our Da Vinci Engineering Enrichment Program (DEEP) Summer Academy draws extremely motivated high school students from around the world to week-long courses, where they explore a variety of engineering, business and science disciplines. We also offer March break and summer camps, Saturday programs and in-school workshops that inspire elementary school students to explore topics ranging from aerospace engineering to coding to regenerative medicine. We are particularly proud that our programs successfully connect girls and youth from underrepresented communities — including Indigenous youth —with STEM.

In 2015–2016, we reached more than 9,000 pre-university students through our outreach programs. *See Appendix B for a full list of these programs.*

Highlights of our outreach programs include:

- Innovate U, Canada's largest science, technology, engineering and math (STEM) event for children in Grades 3 to 8. This one-day workshop, held on May 13, 2016, was run in partnership with Google Canada and Actua, a national STEM charity. It attracted more than 1,400 students and teachers from across the GTA.
- Engineering for Educators, a day-long event held in November 2015 that brought together more than 40 science and math teachers from across the GTA for a series of interactive and collaborative workshops on teaching and learning STEM.
- Four full-day workshops in February 2016 that drew nearly 350 elementary-school teachers from the Toronto District School Board to learn how computer coding can help them teach everything from mathematics to literacy. Taught by U of T Engineering students, the workshops provided teachers with an introduction to Scratch, a visual coding tool created by the Lifelong Kindergarten Group at the Massachusetts Institute of Technology (MIT) Media Lab. Through a simple drag-and-drop interface, users can create animations, games and even program simple robots to perform tasks. Funding for the workshops came from Codemakers, a national program delivered by Actua, in partnership with Google.
- Visits to three California science fairs in March 2016 to engage with top Grade 10 and 11 students and offer scholarships to DEEP Summer Academy. These scholarships allow us to attract top students to DEEP and raise the profile of U of T Engineering in a key region.

In addition to activities organized by the Engineering Outreach Office, many of our students also lead activities for national STEM outreach organizations:

- In May 2016, graduate student Yonatan Lipsitz (IBBME PhD candidate) and a team of volunteers from across U of T partnered with Sandy Lake First Nation in Northern Ontario to deliver a series of workshops aimed at reducing the high rates of Type II diabetes in the community through Let's Talk Science, a national STEM charity.
- In July and August 2016, undergraduate student Rachel Mandel (Year 3 MIE) was one of 12 students from across Canada who were selected to deliver workshops through the National Indigenous Youth in STEM (InSTEM) program from Actua.

For more on these initiatives, see Chapter 10: Diversity.

2

Our extraordinary professors, outstanding research- and professional-stream graduate programs, and exceptional global reputation attracted a record number of graduate students in 2015–2016. Driven by strong demand for our Master of Engineering (MEng) program, particularly among international students, this rapid growth builds on our success in surpassing our Academic Plan goal of enrolling 2,000 graduate students by 2015, which we accomplished two years ahead of schedule. Our graduate students are uniquely positioned to take up leadership positions in both academia and industry, where they will drive innovation, apply engineering to new problems and address critical global challenges.

We strengthened our MEng offerings in fall 2015 by launching new emphases in Sustainable Energy and Advanced Manufacturing, and approved the creation of a new MEng in Biomedical Engineering, a one-year program focusing on medical device design that is welcoming its first cohort in fall 2016. Growth in our professional master's programs was particularly robust in 2015–2016, with applications from international students increasing by one-quarter compared with the previous year. Enrolment in the MEng and Master of Health Science (MHSc) programs now makes up more than half of full-time equivalent master's students, exceeding our Academic Plan goal of 50 per cent by 2015–2016.

Enrolment in our research-stream graduate programs held steady in 2015–2016 as we focused on attracting the very best domestic PhD candidates and encouraged MASc students to fast-track into the doctoral program. We actively recruited top students from across Canada through events such as Graduate Research Days and a nationwide recruitment tour held in partnership with a consortium of the country's best engineering schools. We continued to prepare PhD students for academic positions through the Prospective Professors in Training program, and are creating similar resources for developing competencies relevant to roles in industry and other non-academic settings.

Our PhD program continues to draw large numbers of applications from top international candidates. However, we have been able to accept a limited number of these applicants because the Ontario government did not provide funding to universities for international PhD students until recently. We are encouraged that the province opened the door in 2015 to providing grants to universities for a small number of international PhD students. We are optimistic this development will enable us to accept more extraordinary students from abroad and increase the already exceptional quality of our PhD cohort.

Enrolment

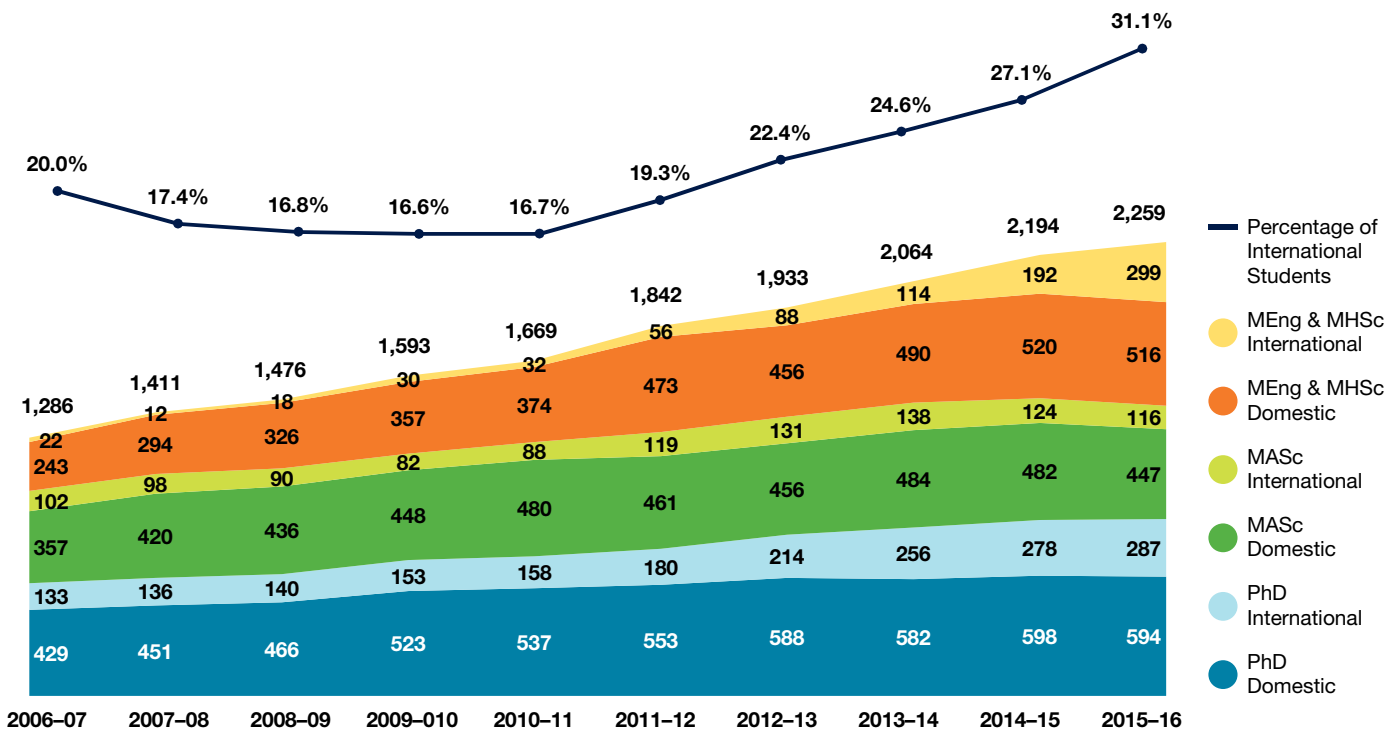
Our graduate enrolment increased in both size and diversity in 2015–2016 as our programs attracted top students from across Canada and around the world. A total of 2,259 students pursued graduate degrees at U of T Engineering, up three per cent from the previous year and 76 per cent from a decade ago, with enrolment growing across nearly every academic area. Over the past 10 years, we have increased the proportion of graduate students in our overall student body from 22.1 per cent to 31.5 per cent, bringing us closer to our Academic Plan goal of 40 per cent. This growth strengthens our position as a leader in research-based and professional graduate education while maintaining our standard of excellence in undergraduate engineering education.

The proportion of international graduate students jumped to 31.1 per cent from 27.1 per cent in 2014–2015, while the percentage of women increased slightly year over year to 27.1 per cent. We expect growth in female graduate enrolment to accelerate over the next five years as the number of women studying engineering at the undergraduate level continues to

grow. For the past two years, women have comprised nearly one-third of our entering undergraduate classes, expanding the future pool of potential female applicants for graduate studies.

The total number of students pursuing professional master’s degrees (MEng and MHSc) increased to 815 in 2015–2016, up 14 per cent from the previous year and more than triple the enrolment in these programs a decade ago. International students accounted for much of this year’s growth, comprising 37 per cent of professional master’s students, up from 27 per cent in 2014–2015 and only eight per cent in 2010–2011. As a result of this strong increase, the number of full-time equivalent professional master’s students has now surpassed the number of full-time equivalent MASc students, achieving the goal we set in our Academic Plan. We continue to enhance and broaden our MEng offerings, which enable practising engineers to gain specialized technical knowledge and develop leadership and other professional competencies that will advance their careers.

Figure 2.1a International and Domestic Graduate Students by Degree Type, with Percentage of International Students, 2006–2007 to 2015–2016



Data in this chapter are presented by academic year (September to August) unless otherwise noted. Highlights are from May 2015 to August 2016.

Note 2.1a: Student counts are shown as of November 1.

Figure 2.1b Graduate Students by Degree Type and Gender with Percentage of Women Students, 2006–2007 to 2015–2016

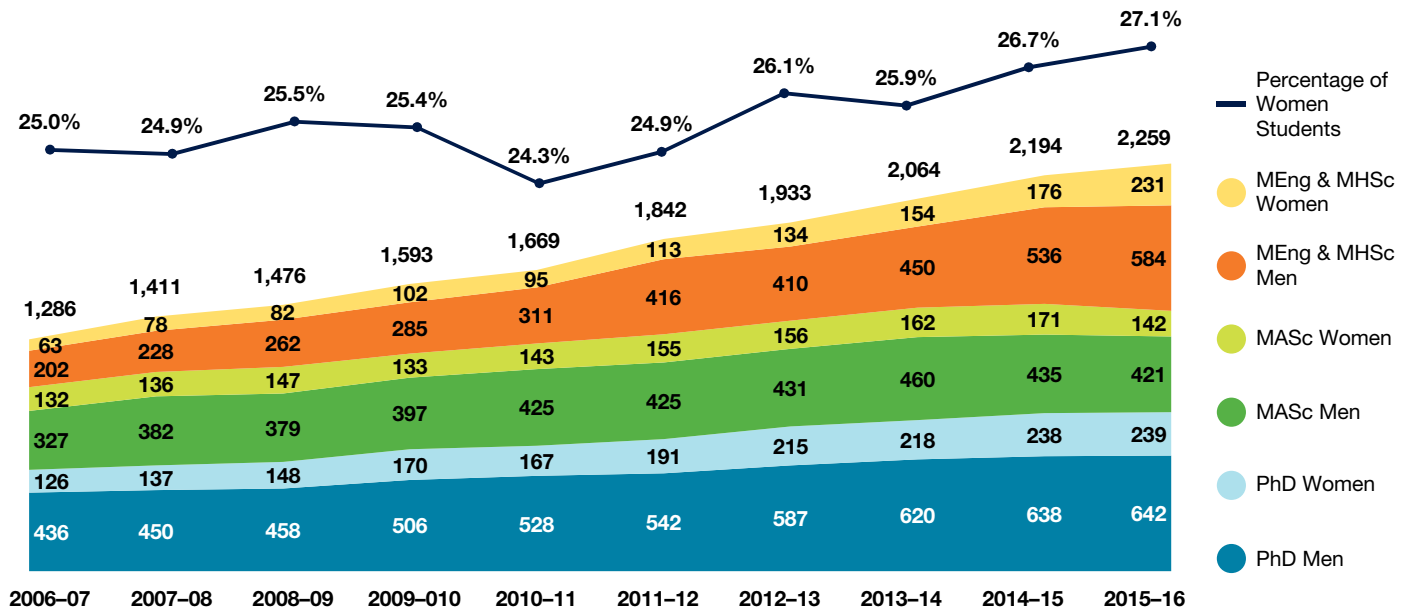


Figure 2.1c Graduate Student Enrolment by Full-Time Equivalent (FTE) and Headcount (HC) by Academic Area, 2006–2007 to 2015–2016

		UTIAS	IBBME	ChemE	CivE	ECE	MIE	MSE	Total
2006-2007	FTE	79.6	75.0	138.5	160.3	407.3	238.8	67.5	1,167.0
	HC	81	75	142	182	457	278	71	1,286
2007-2008	FTE	105.0	115.0	150.0	183.3	438.1	227.3	71.2	1,289.9
	HC	105	115	157	212	478	270	74	1,411
2008-2009	FTE	122.9	140.0	167.8	184.0	415.4	237.1	82.8	1,350.0
	HC	125	140	179	219	442	284	87	1,476
2009-2010	FTE	130.6	153.0	209.1	200.2	421.5	284.3	70.4	1,469.1
	HC	132	153	221	238	453	320	76	1,593
2010-2011	FTE	140.9	168.0	195.4	212.6	403.0	339.2	68.5	1,527.6
	HC	143	168	208	256	431	391	72	1,669
2011-2012	FTE	143.2	199.0	202.3	229.8	437.7	382.6	68.2	1,662.8
	HC	146	199	217	276	479	454	71	1,842
2012-2013	FTE	146.7	208.3	193.2	243.3	504.8	387.2	68.2	1,751.7
	HC	153	209	203	279	565	453	71	1,933
2013-2014	FTE	162.1	219.0	209.9	290.5	509.8	436.2	90.9	1,918.4
	HC	167	219	219	322	556	488	93	2,064
2014-2015	FTE	182.4	228.0	238.0	293.1	531.5	511.2	80.3	2,064.5
	HC	188	228	245	312	577	563	81	2,194
2015-2016	FTE	143.2	241.0	253.0	299.4	591.5	532.9	79.0	2,140.0
	HC	146	241	260	326	637	570	79	2,259

Note 2.1b: Student counts are shown as of November 1.

Note 2.1c: A difference between FTE and HC exists only when discussing part-time students. At U of T Engineering, MEng candidates are the only graduate students who can pursue their studies on a part-time basis.

Enrolment in our research-stream graduate programs remained stable in 2015–2016 as we continued to focus on the quality of our students. The number of PhD students increased slightly year-over-year, with enrolment growing by 27 per cent compared with five years ago, largely due to an increase in the number of international students, among whom demand for our programs is extremely high. MAsc enrolment has been flat over the same period, reflecting our practice of

encouraging these students to fast-track into doctoral studies to enhance the impact of their work, and the increasing attractiveness of the MEng.

The number of graduate students per faculty member increased in our professional stream, reflecting strong enrolment growth, and decreased slightly in our research-stream programs.

Figure 2.1d Comparison of MAsc and MEng/MHSc Full-Time Equivalent Enrolment Trends 2006–2007 to 2015–2016

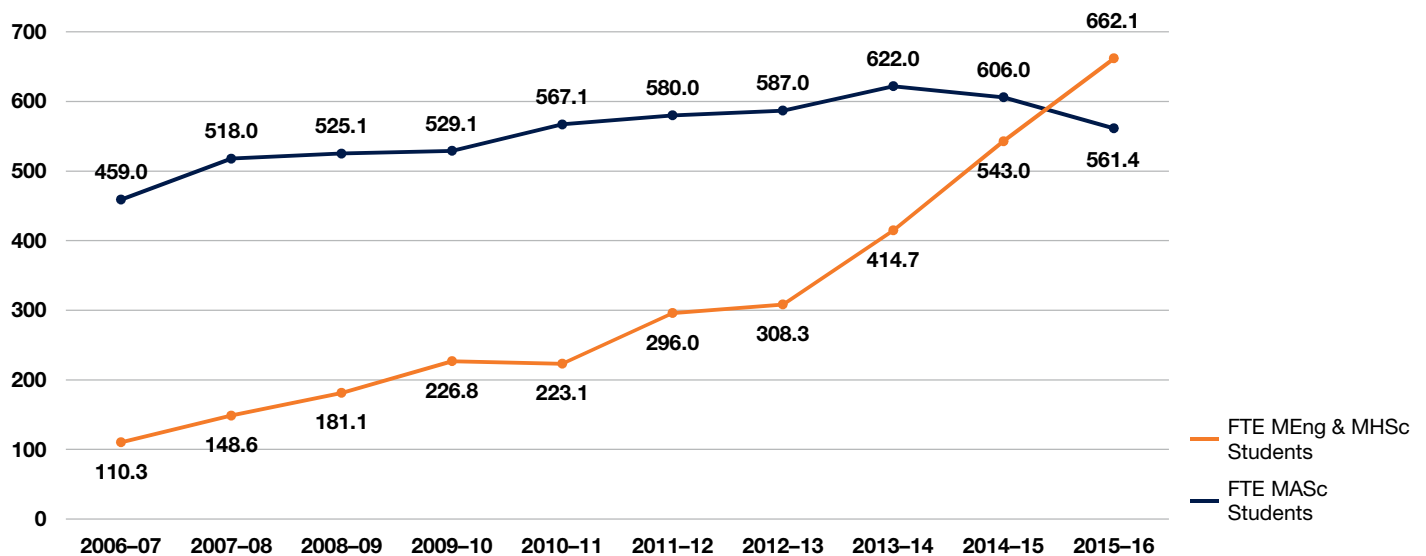
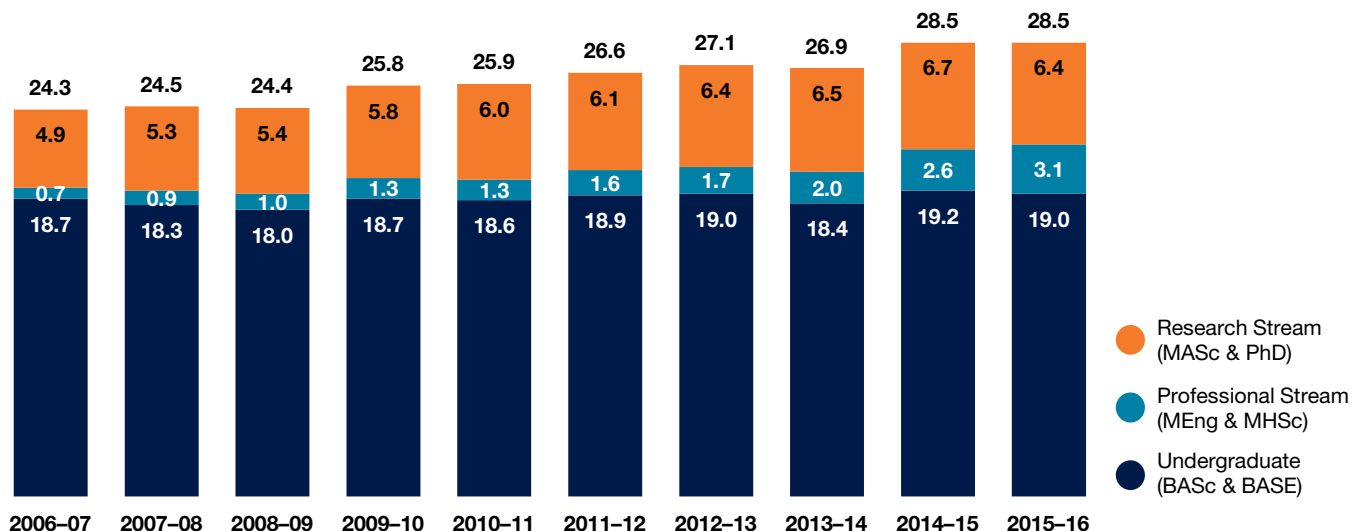


Figure 2.2a Undergraduate and Graduate Full-Time Equivalent Students per Faculty Member, 2006–2007 to 2015–2016



Note 2.2a: To allow more accurate comparisons, undergraduate FTEs are determined by counting each part-time student as 0.3 FTE.

Figure 2.2b Ratio of Undergraduate to Graduate Full-Time Equivalent Students, 2006–2007 to 2015–2016

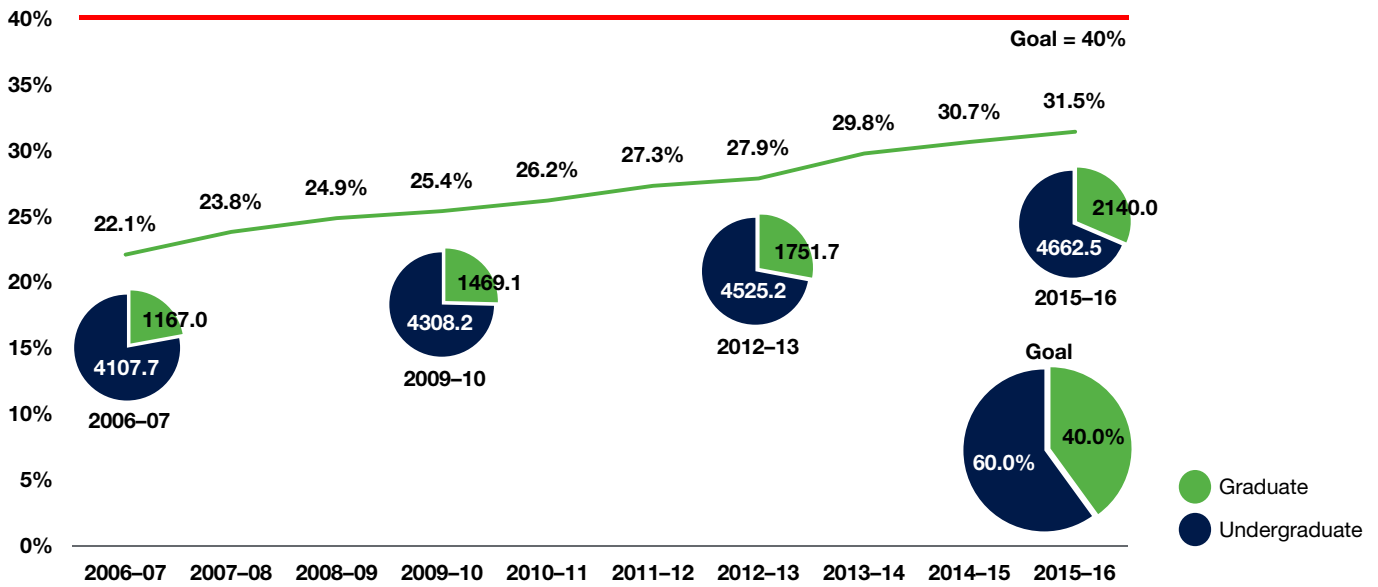
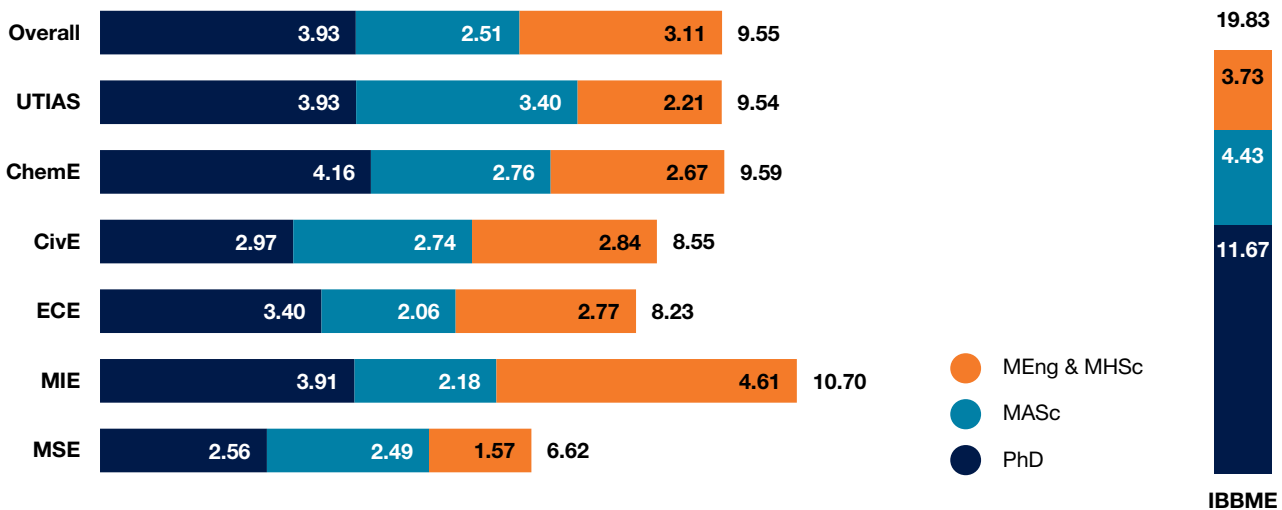


Figure 2.2c Full-Time Equivalent Graduate Students per Faculty Member by Academic Area and Degree Type, 2015–2016



Note 2.2b: Students on Professional Experience Year placements are not included in this count.

Note 2.2c: Some students in IBBME are supervised by faculty members from the Faculties of Medicine and Dentistry and affiliated hospitals, as well as from other departments within U of T Engineering. Because the ratio includes only faculty with a budgetary appointment in IBBME, comparisons with other Engineering departments are not possible. For that reason, this figure shows IBBME in a visually distinct way. In cases of inter-departmental supervision within the Faculty, PhD and MAsc students are assigned 100 per cent to their primary supervisors' department.

Admissions and Recruitment

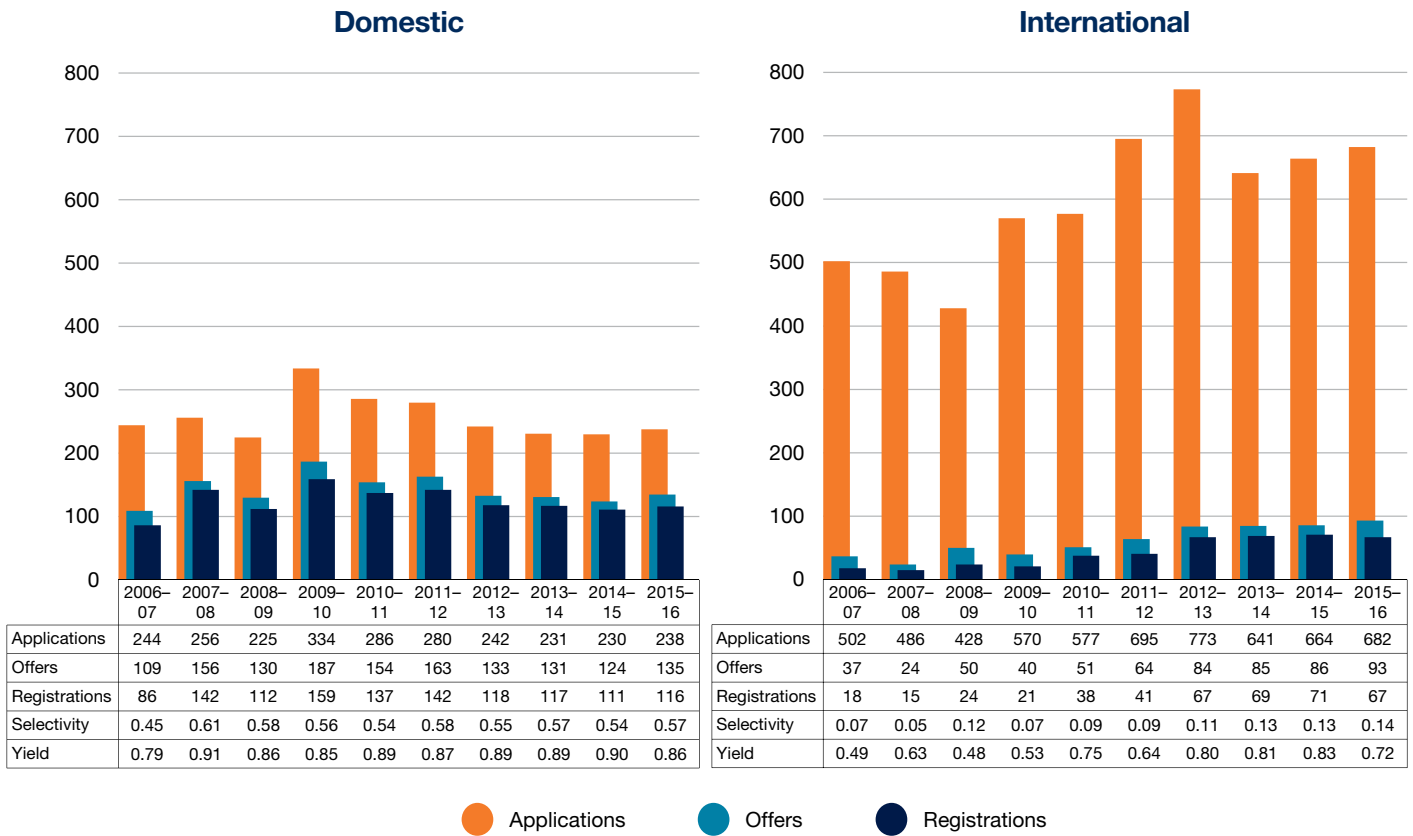
Applications to our graduate programs reflected growing demand for programs of study that offer advanced technical and professional competencies, as well as strong interest from international students.

We experienced robust growth in our MEng program, particularly among international students, as we enhanced and expanded our offerings. Applications from international candidates increased by 25 per cent compared with 2014–2015, and international students made up 41 per cent of new registrations, up from 37 per cent the previous year and 12 per cent a decade ago. Domestic applications increased by five per cent over the previous year.

Applications and enrolment in our research-stream MASc remained steady, as more students who do not foresee enrolling in a PhD program chose to pursue a MEng instead.

The total number of new students entering PhD programs this year was similar to the level of the last five years and the proportion of incoming international PhD students has remained steady between 35 and 40 per cent over that time. We are making progress in enabling talented researchers to maximize their contributions by increasing the number who fast-track from MASc programs into PhD programs, or who enter PhD programs directly after completing their undergraduate degrees.

Figure 2.3 Applications, Offers, Registrations, Selectivity and Yield of PhD Students, 2006–2007 to 2015–2016



Note 2.3: Student counts are shown as of November 1. Selectivity = offers ÷ applications and represents the proportion of applicants who were offered admission. Yield = registration ÷ offers. Domestic students are defined as citizens (living in Canada or abroad) or permanent residents of Canada. Students who have fast-tracked from MASc programs into PhD programs are counted in this figure as applications, offers and admissions. This is a change from previous annual reports.

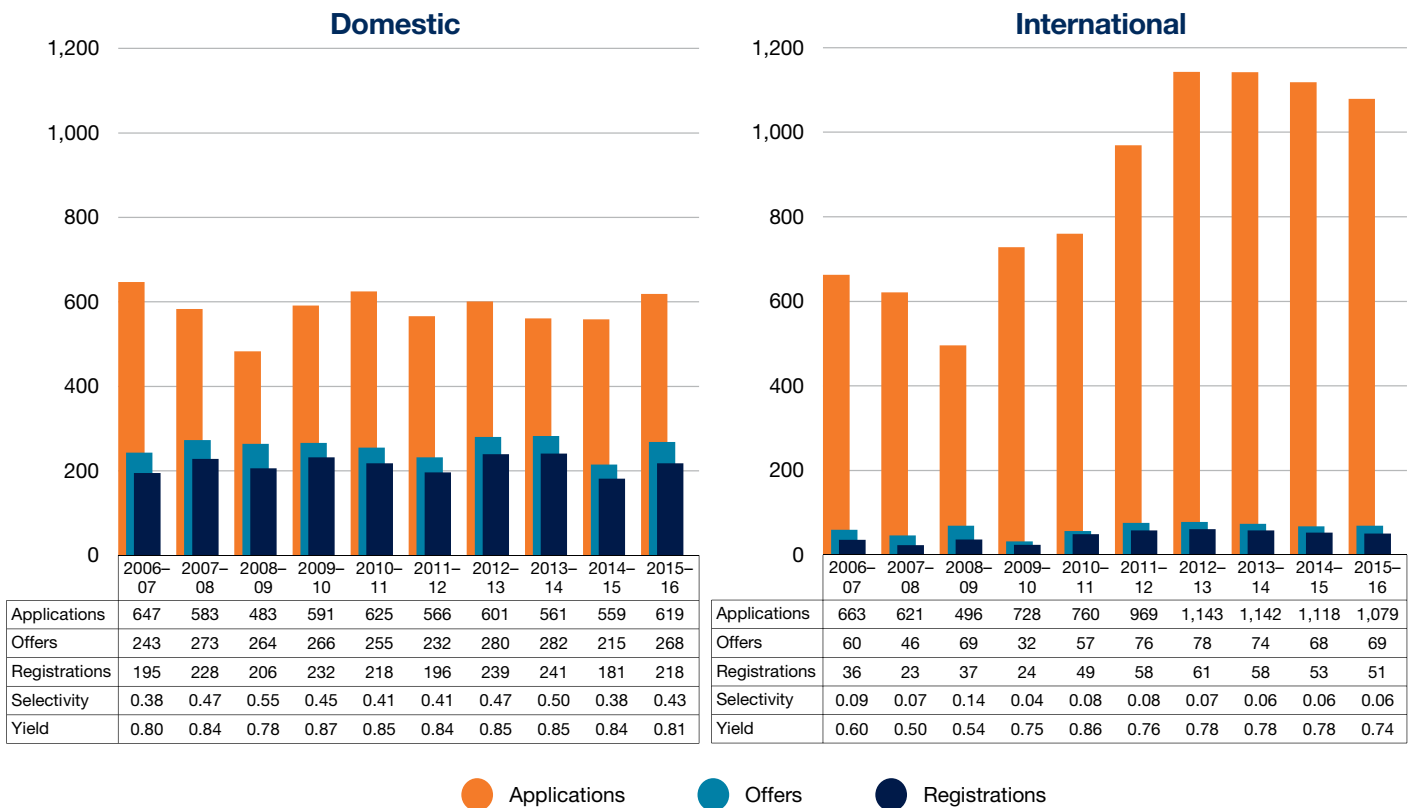
To encourage more domestic candidates to apply to our research-stream programs, we target top candidates from across Canada through a number of strategic initiatives:

- For the third year, we partnered with Canada’s top engineering schools through the Canadian Graduate Engineering Consortium to hold the U of T Graduate Engineering Fair and six similar events across the country in fall 2015. This initiative, which included stops at U of T, the University of Alberta, the University of Calgary, the University of British Columbia, Queen’s University, McGill University and the University of Waterloo, enabled us to reach more highly qualified students to promote the benefits of graduate education and the strengths of U of T Engineering.

- In February 2016, we hosted 127 top students from other Canadian universities at our second Graduate Research Days event. We provided opportunities for these students to learn more about our programs, discover the innovative research of our faculty members and graduate students and meet prospective supervisors.

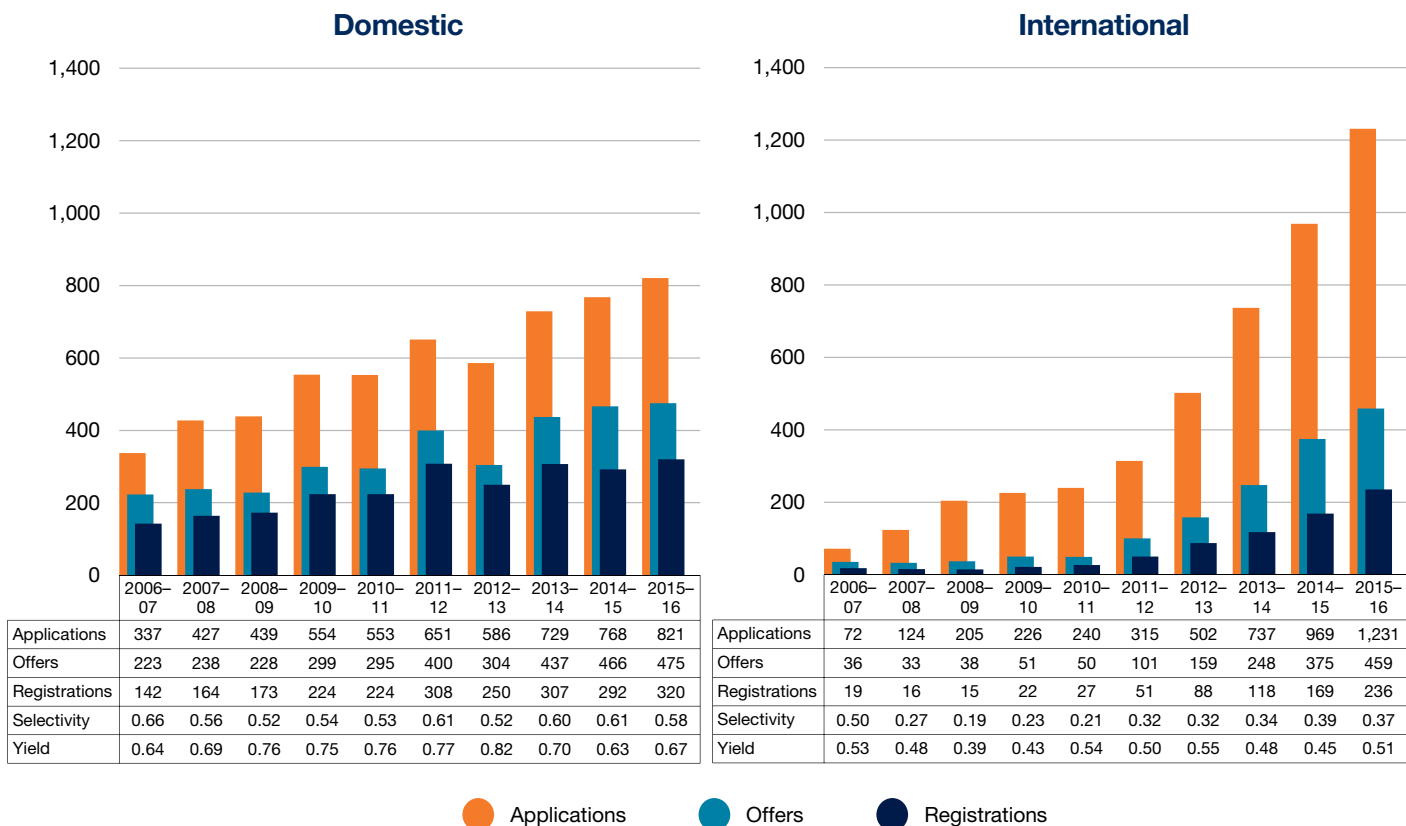
In addition to marketing our graduate programs in traditional print and online platforms, for the first time we also launched a graduate studies e-marketing campaign that used the web and social media to target engineering students across Canada. Our general graduate studies campaign ran from November 2015 to January 2016 and the MEng campaign from February to May 2016. We will evaluate the success of these campaigns after the 2016 recruitment cycle.

Figure 2.4 Applications, Offers, Registrations, Selectivity and Yield of MASc Students, 2006–2007 to 2015–2016



Note 2.4: Student counts are shown as of November 1. Selectivity = offers ÷ applications and represents the proportion of applicants who were offered admission. Yield = registration ÷ offers. Domestic students are defined as citizens (living in Canada or abroad) or permanent residents of Canada.

Figure 2.5 Applications, Offers, Registrations, Selectivity and Yield of MEng and MHSc Students, 2006–2007 to 2015–2016



Note 2.5: Student counts are shown as of November 1. Selectivity = offers ÷ applications and represents the proportion of applicants who were offered admission. Yield = registration ÷ offers. Domestic students are defined as citizens (living in Canada or abroad) or permanent residents of Canada.

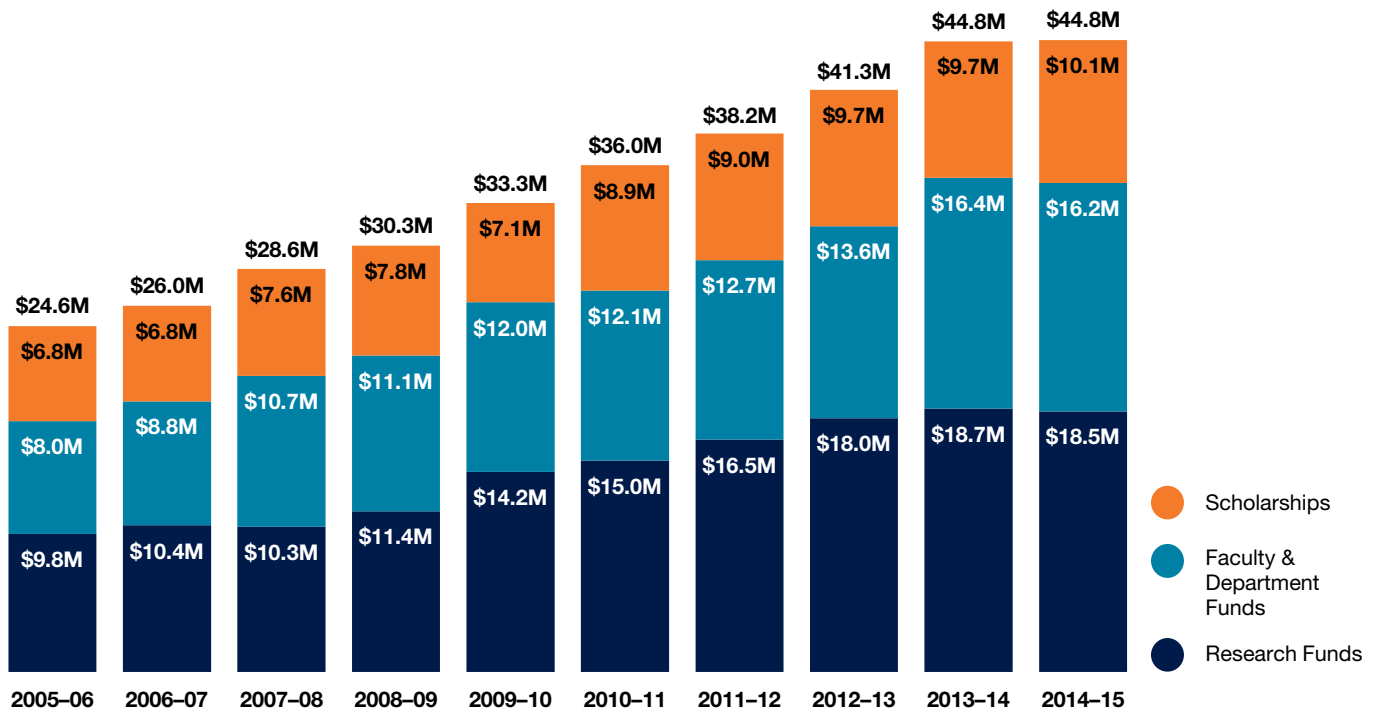
Funding

Overall graduate student funding for 2014–2015 remained level compared with 2013–2014 (Figure 2.6a). This was influenced by two factors: firstly, the total number of funded graduate students (MAsc and PhD) grew by only two per cent from 2013–2014 to 2014–2015. Secondly, a job action in the Winter 2015 term affected earnings for teaching assistants. Total scholarship funding increased by four per cent in 2014–2015 over 2013–2014. This includes the NSERC,

Ontario Graduate Scholarships (OGS) and other external scholarships shown in Figure 2.7a, plus a variety of other U of T scholarships.

With a slight decline in NSERC funding, more students are taking up OGS, as well as scholarships from other external sources, including the Canadian Institutes of Health Research (CIHR) and the Ontario Trillium Scholarships.

Figure 2.6a Graduate Student Funding by Category, 2005–2006 to 2014–2015



Note 2.6a: Data from 2009–2010 onward were obtained from the new Student Accounts Reporting Cube. Data for prior years (and for all years in previous annual reports) were obtained from the Graduate Student Income Reporting Cube. For more information, see Data Sources.

Figure 2.6b Graduate Student Funding by Category and Academic Area, 2014–2015

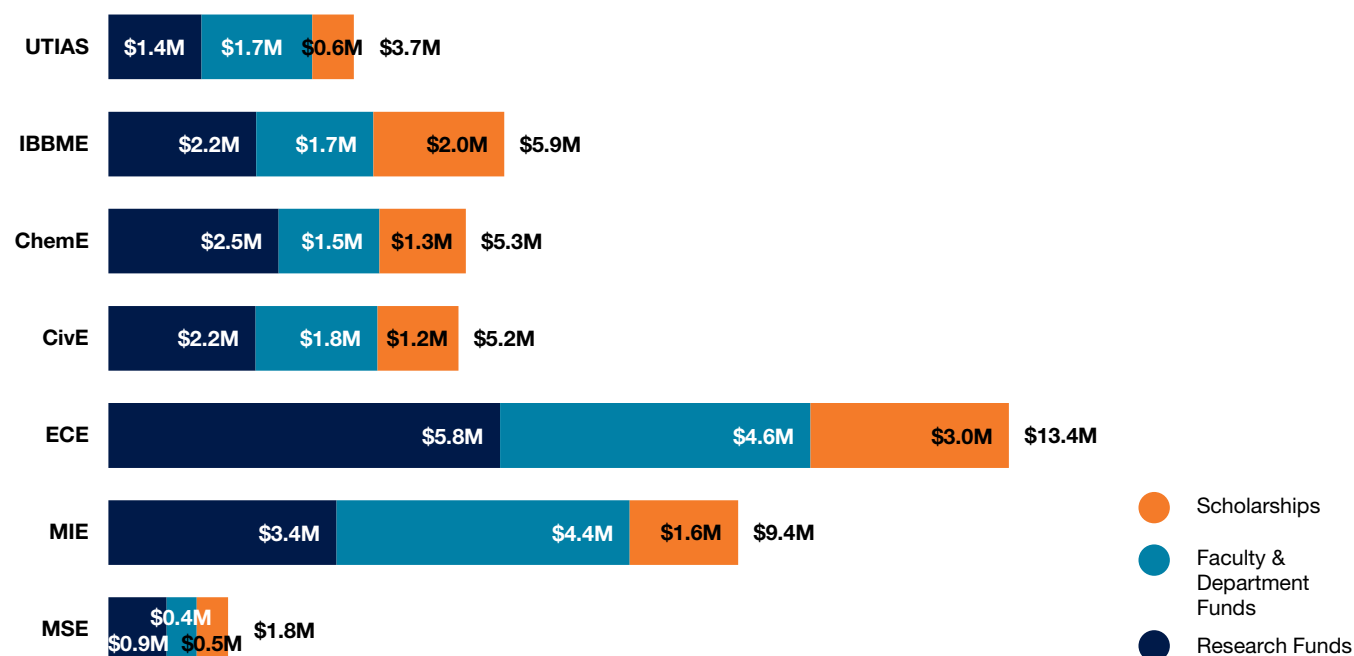


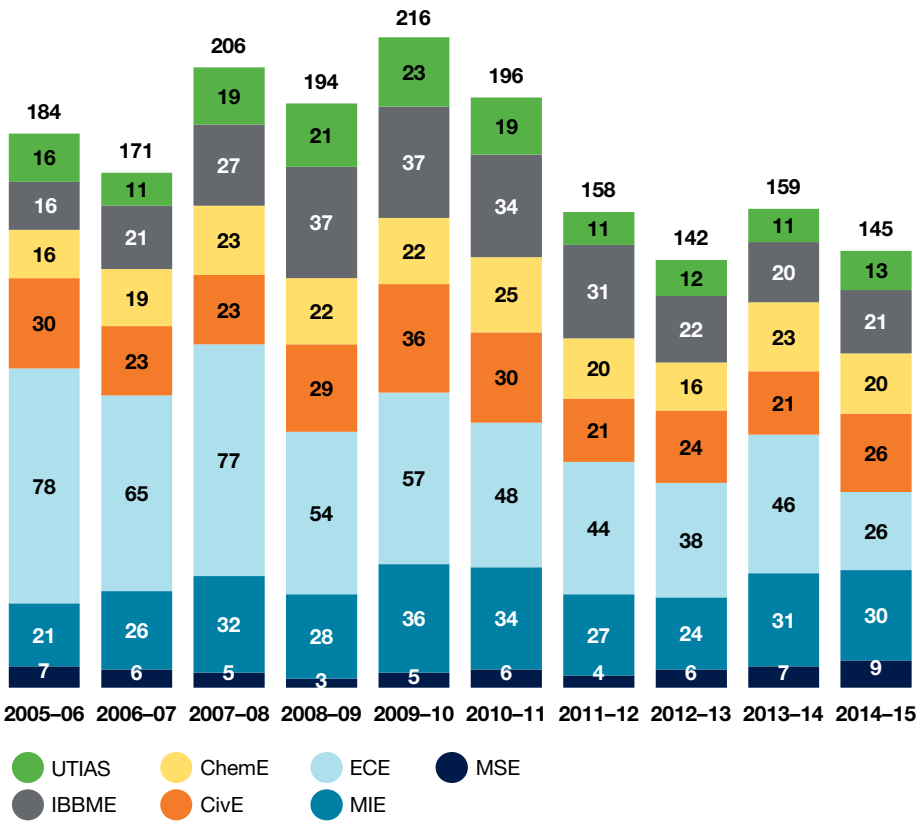
Figure 2.7a Total External Graduate Student Scholarships by Source, 2005–2006 to 2014–2015

	NSERC	OGS	External-Other	Total
2005–2006	\$3,400,236	\$1,106,665	\$23,500	\$4,530,401
2006–2007	\$3,228,150	\$1,088,332	\$31,100	\$4,347,582
2007–2008	\$3,827,494	\$930,000	\$68,167	\$4,825,661
2008–2009	\$3,737,157	\$868,332	\$111,770	\$4,717,259
2009–2010	\$4,393,513	\$853,334	\$203,167	\$5,450,014
2010–2011	\$4,396,617	\$1,036,675	\$179,580	\$5,612,872
2011–2012	\$3,765,883	\$1,593,328	\$256,860	\$5,616,071
2012–2013	\$3,374,183	\$1,583,333	\$285,501	\$5,243,017
2013–2014	\$3,759,671	\$1,236,666	\$582,170	\$5,578,507
2014–2015	\$3,458,779	\$1,333,336	\$877,587	\$5,669,702

Note 2.6b: Data were obtained from the new Student Accounts Reporting Cube. Data for previous annual reports were obtained from the Graduate Student Income Reporting Cube. For more information, see Data Sources.

Note 2.7a: Data from 2009–2010 onward were obtained from the new Student Accounts Reporting Cube. Data for prior years (and for all years in previous annual reports) were obtained from the Graduate Student Income Reporting Cube. For more information, see Data Sources.

Figure 2.7b Number of NSERC Graduate Student Award Recipients by Academic Area, 2005–2006 to 2014–2015



Note 2.7b: Data reported by academic year (September to August).

Graduate Studies Completion

From 2013 to 2016, the number of fast-tracking students has grown by about 20 per cent compared with the three years from 2010 to 2013 (Figure 2.8a). The direct-entry option has been used by relatively few students in the past, but last year the number of direct-entry PhD students more than tripled to 24. These changes emphasize the value of the engineering PhD as the best option for students interested in research. The average duration of degrees remains on par with previous years (Figure 2.9). *For complete information on time to completion for all academic areas, see Appendix C.*

Figure 2.8a Number of Students Fast-Tracked from MASc to PhD by Academic Area, 2006–2007 to 2015–2016

	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16
UTIAS	1	2	8	6	5	2	5	6	10	1
IBBME	2	8	4	12	8	5	9	9	11	15
ChemE	7	4	6	11	5	8	7	14	8	6
CivE	5	4	4	3	2	5	2	3	1	5
ECE	2	2	0	1	6	4	2	4	5	4
MIE	3	8	5	7	6	6	6	5	3	9
MSE	2	2	3	1	3	7	1	3	4	1
Total	22	30	30	41	35	37	32	44	42	41

Figure 2.8a Number of Direct-Entry PhD Students by Academic Area, 2008–2009 to 2015–2016

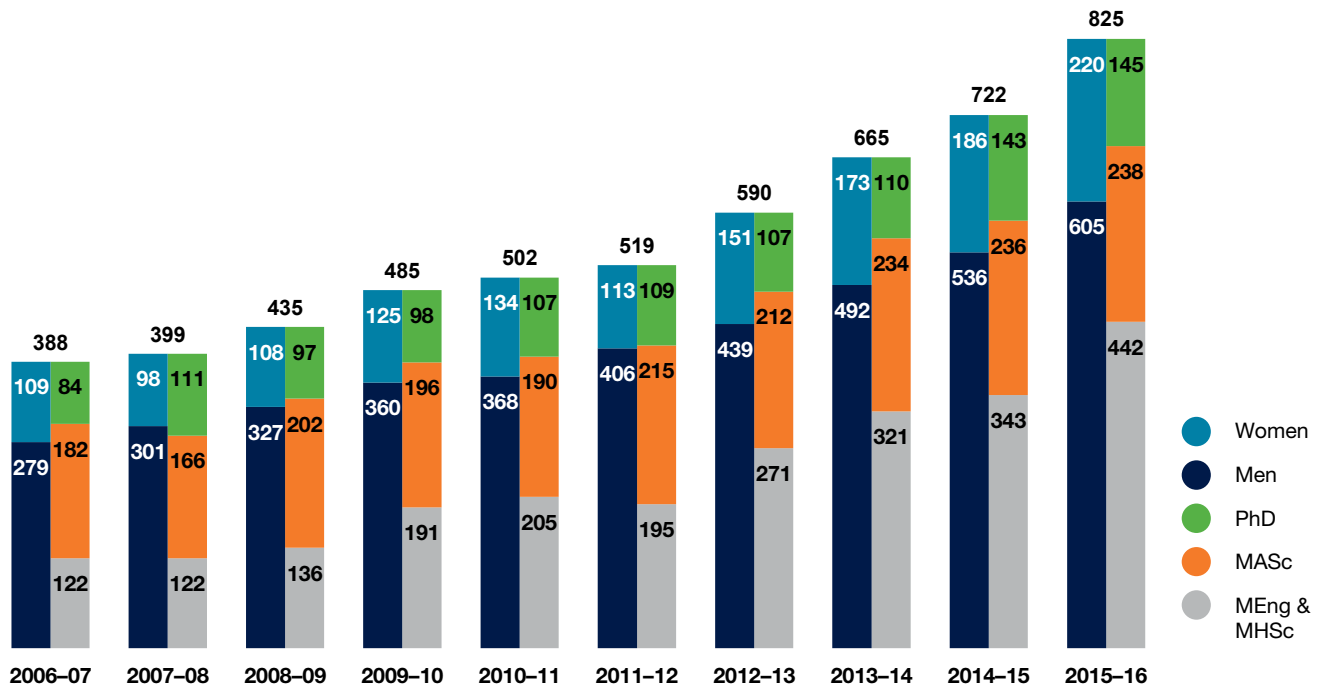
	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16
UTIAS								2
IBBME	2	6	6	8	7	7	3	10
ChemE			1	1	1			9
CivE			1	1				
ECE				1			2	3
MIE			1	1	3		2	
MSE		1		1				
Total	2	7	9	13	11	7	7	24

Note 2.8a and b: For counting purposes, the academic year is from May to April.

Figure 2.9 Time to Graduation for PhD, MASc, MEng and MHSc Students, 2006–2007 to 2015–2016

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
PhD	5.0	4.7	4.7	4.7	5.3	5.0	5.3	5.2	5.3	5.3
MASc	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
MEng & MHSc (FT)	1.0	1.0	1.0	1.0	1.0	1.0	1.3	1.0	1.0	1.0
MEng & MHSc (ExtFT)									1.3	1.7
MEng & MHSc (PT)	2.0	2.0	2.3	2.3	2.3	2.0	2.0	2.0	2.0	2.0

Figure 2.10 Graduate Degrees Awarded by Degree Type and Gender, 2006–2007 to 2015–2016



Enriching the Graduate Student Experience

We continually enhance our curricular and co-curricular offerings to ensure our graduate students receive the most rigorous and comprehensive preparation possible, whether they aspire to work in academia, industry or other fields.

Our innovative professional master's programs allow students to gain specialized technical knowledge and develop leadership and other professional competencies to advance their careers. MEng students apply through one of seven departments and can choose from among a growing number of optional emphases, including sustainable energy and advanced manufacturing. The most popular of these emphases

is the Entrepreneurship, Leadership, Innovation & Technology in Engineering (ELITE) Certificate, which enhances students' professional competencies with a range of courses on business, finance, leadership and management. In 2015–2016, we expanded our ELITE offering to include five new courses:

- APS 1028H Operations and Production Management for Manufacturing and Services;
- APS 1032 Introduction to Energy Project Management;
- APS 1033 Innovation via Imagineering;
- APS 1035 Taking a New Venture to Market; and
- APS 1036 Formative Experiential Entrepreneurial Learning.

Figure 2.11 ELITE Certificates Awarded, 2008–2009 to 2015–2016

	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16
AeroE		1	2		7	2	4	11
ChemE		2	12	11	17	8	20	20
CivE	3	11	13	11	9	12	12	25
ECE		3	3	3	22	32	22	14
MIE		7	19	20	26	36	39	50
MSE			1	1	4	6	11	5
Total	3	24	50	46	85	96	108	125

We also offer:

- Master of Health Science in Clinical Engineering through the Institute of Biomaterials & Biomedical Engineering;
- MEng in Cities Engineering and Management (MEng CEM), which provides graduates with a fundamental understanding of the complex and cross-disciplinary issues facing cities through a year of course work and a four-month internship with a municipal, university or corporate partner; and
- MEng in Biomedical Engineering, a one-year, full-time program focusing on biomedical devices. Students in this program, which begins in fall 2016, will take on an applied design challenge and meet the growing demands of this industry through a four-month internship.

We continue to enhance experiential learning and entrepreneurship opportunities for all of our graduate students. Co-curricular incubator programs such as Start@UTIAS and The Entrepreneurship Hatchery offer mentoring, expertise and other resources that help students launch startups and bring their innovations to market. The Multidisciplinary MEng Project, offered by the University of Toronto Institute for Multidisciplinary Design & Innovation (UT-IMDI), provides MEng students with the opportunity to apply their knowledge and skills in multidisciplinary teams to address technical research challenges proposed by industry partners. UT-IMDI also offers internships with industry partners for MEng students. MHSc candidates complete the equivalent of eight months of full-time work in internships in clinical engineering as a requirement of their program.

In the fall of 2014, we created the Collaborative Program in Engineering Education (EngEd) for master’s and doctoral students from either U of T Engineering or the Ontario Institute for Studies in Education (OISE) to join the small community of scholars immersed in research and learning at the nexus of education and engineering practice. The program is the first of its kind in Canada. In its second year, the enrolment grew from six to 12 students.

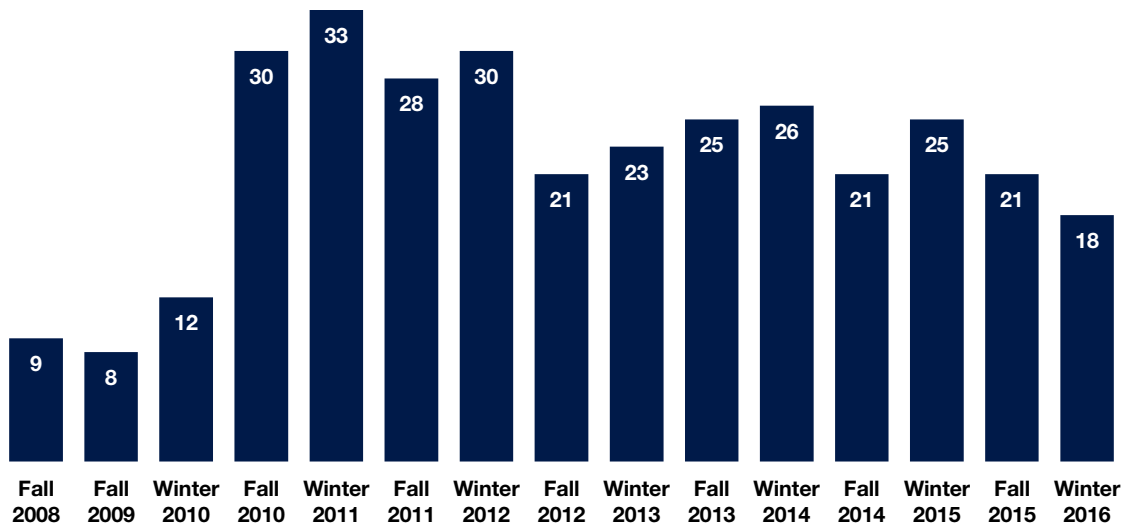
We also prepare PhD candidates to apply for — and be successful in — academic positions through the Prospective Professors in Training program. The program includes 13 core seminars on topics including preparing a resume, the interview process, classroom management and starting a research program. The program, which counts toward credits in the Graduate Professional Skills Program offered

by the University of Toronto School of Graduate Studies, also includes a full semester course, APS 1203 Teaching Engineering in Higher Education. We are developing a similar program to prepare PhD graduates who will work in industry and other settings.

Since 2008, we have partnered with Magna International to provide Magna employees with a specialized MEng curriculum, including a major technical project. The MEng program for the Stronach Centre for Innovation (MEng, SCFI) continues to show strong demand.

To read more about programs that enrich the graduate student experience, please see Chapter 4: Cross-Faculty Education and Experiential Learning.

Figure 2.12 MEng, SCFI Program Enrolment, Fall 2008 to Winter 2016



Selected Graduate Student Highlights

Graduate students compete at 2015 Pan Am Games

Two U of T Engineering graduate students made their mark at the 2015 Pan Am Games before a hometown crowd in Toronto. Sasha Gollish (CivE MEng 1T0, EngEd PhD Candidate) captured a bronze medal on the track in the women's 1,500 metres and was recognized in fall 2015 as one of the Top 8 Academic All-Canadians by Canadian Interuniversity Sport. Donna Vakalis (CivE PhD Candidate) came fourth in the modern pentathlon at the Pan Am Games, in the process securing a berth on the Canadian team at the 2016 Summer Olympics in Rio de Janeiro. Vakalis also competed at the 2012 London Olympics in modern pentathlon, which includes fencing, swimming, riding, running and shooting.

Using game theory to predict electricity demand

Joseph Dongchan Lee (EngSci 1T3 + PEY, ECE MASc 1T6) won the best paper award from the Institute of Electrical and Electronics Engineers (IEEE) 2015 Electrical Power and Energy Conference for research that could help utilities understand how electricity demand changes in response to real-time pricing. Using evolutionary game theory, Lee studied the effect of real-time pricing in electricity consumption patterns and proposed methods for system operators to reduce consumption during peak hours. Lee's current research focuses on automatic monitoring of power quality disturbances in smart grids to increase reliability and system awareness in existing power grids. Lee, a student of Professor Deepa Kundur (ECE), will begin doctoral studies at the Massachusetts Institute of Technology in fall 2016.

PhD candidate wins teaching excellence award

Mario Badr (ElecE 1T1, MASc 1T4) won a 2015 TA Teaching Excellence Award from the University of Toronto's Teaching Assistant Training Program (TATP). Badr, a PhD candidate in The Edward S. Rogers Sr. Department of Electrical & Computer Engineering, was one of just four recipients from among the more than 6,000 teaching assistants across the University. He has served as a teaching assistant for Engineering Strategies and Practice I & II, Computer Fundamentals, Computer Organization and Computer Architecture. The TATP Teaching Excellence Award was created in 2003 to recognize the outstanding contributions of teaching assistants at the University of Toronto.

3

U of T Engineering advances solutions to relevant global challenges through multidisciplinary research that accelerates innovation in areas ranging from sustainable energy to biomedical engineering. Working with colleagues and partners across the Faculty and the University, research hospitals affiliated with U of T and industry partners, our researchers create groundbreaking technologies that improve lives and drive economic growth.

Our Faculty leads a number of initiatives at the intersection of engineering, medicine and clinical practice that have the potential to revolutionize health care. In 2015–2016, U of T Engineering professors were appointed to direct Medicine by Design, a regenerative medicine initiative funded by the largest single grant in U of T's history, and the Translational Biology and Engineering Program, part of the new Ted Rogers Centre for Heart Research. Both enhance opportunities for U of T Engineering researchers to work closely with experts in other disciplines to advance health-related research and clinical innovations.

Within the Faculty, professors and graduate students across all departments and institutes bring together their expertise in multidisciplinary initiatives such as the Centre for Global Engineering and the Institute for Sustainable Energy. Both will become part of the new Centre for Engineering Innovation & Entrepreneurship when it opens in 2017.

Our multidisciplinary approach and the depth and breadth of our research drive our success in attracting research funding and chairs. We achieved a record \$31.8 million in Tri-Council funding in 2014–2015. In 2015–2016, we received seven new or renewed Canada Research Chairs, as well as two new Collaborative Research and Training Experience (CREATE) grants from the Natural Sciences and Engineering Research Council of Canada (NSERC).

We engage with more than 300 industry partners in sectors including communications, mining, automotive, health care, information technology and power generation, and leverage these relationships through programs ranging from NSERC's Collaborative Research and Development program to Strategic Partnership Grants and the Strategic Research Network program.

Selected Research Highlights

U of T Engineering Professors Lead Multidisciplinary Research Initiatives

Two U of T Engineering faculty members have been chosen to lead major multidisciplinary initiatives that are bringing together researchers and clinicians to advance innovations in health care.

In July 2015, Professor Craig Simmons (MIE, IBBME) became scientific director of the Translational Biology and Engineering Program (TBEP), which unites leading experts from the Faculties of Applied Science & Engineering, Medicine and Dentistry to enhance discoveries and accelerate new treatments for cardiovascular disease. TBEP is a key component of the Ted Rogers Centre for Heart Research, which was created in November 2014 as a result of an unprecedented \$130-million gift from the Rogers family. TBEP is advancing heart research, diagnostics, and regeneration using a comprehensive approach that includes systems and developmental biology, technology innovation and clinical translation. Simmons was named Distinguished Professor of Mechanobiology, beginning on July 1, 2016.

Professor Peter Zandstra (IBBME), Canada Research Chair in Stem Cell Bioengineering, was named executive director of Medicine by Design in January 2016. Medicine by Design is a leading regenerative medicine initiative at the University of Toronto that is designing and manufacturing cells, tissues and organs that can be used in research, drug discovery and clinical treatments. Supported primarily by a \$114-million federal grant from the Canada First Research Excellence Fund — the largest single research grant in U of T's history — Medicine by Design brings together more than 50 researchers and clinicians from the University and its affiliated hospitals to collaborate with academic partners, commercialization entities and the private sector. Grants are designed to support new ideas through to clinical trials and commercialization, with an initial round awarded to researchers at the Faculties of Applied Science & Engineering, Medicine, Arts & Science and Pharmacy, as well as Sunnybrook Health Sciences Centre, Mount Sinai Hospital, the Hospital for Sick Children and the University Health Network. The initiative also focuses on recruiting new faculty, enhancing training opportunities for graduate students and postdoctoral fellows, and creating new national and international partnerships in regenerative medicine. In May 2016, Zandstra received the rank of University Professor, an honour that recognizes pre-eminence in a particular field of knowledge.

Seeding New Partnerships

The Faculties of Applied Science & Engineering and Medicine have created EMHSeed, a seed funding program that supports collaborative research projects that bring together co-principal investigators from U of T Engineering, and either the Faculty of Medicine or an affiliated hospital. The program leverages the world-class expertise of U of T and the Toronto Academic Health Science Network, working at the convergence of engineering, medicine and health. It also promotes partnerships that include at least one early career (<10 years) co-principal investigator.

In an initial round of funding announced in March 2016, nine projects received seed grants. One of the successful projects — a collaboration between Professor Joyce Poon (ECE) and Professor Andres Lozano of the Division of Neurosurgery in the Faculty of Medicine — seeks to develop photonic technologies for targeted neuronal stimulation to improve the understanding and treatment of neurological and psychiatric disorders.

Two New CREATE Grants Strengthen Training in Research Commercialization and Entrepreneurship

Professor Peter Herman (ECE) and Professor Milica Radisic (IBBME, ChEM) will lead two new Collaborative Research and Training Experience (CREATE) grants from NSERC, received in April 2016. The goal of the grants — each of \$1.65 million over six years — is to train highly qualified students and postdoctoral fellows through innovative programs that encourage collaborative approaches and help new researchers transition into the workplace. Herman, his collaborators and students will build links between academia and photonics companies in order to commercialize discoveries they make in optics. Radisic and her collaborators will train students in biomedical entrepreneurship, including applying for patents, developing business plans and making fundraising pitches. These new team grants bring the number of active CREATE grants at U of T Engineering to eight.

Data in this chapter are presented for the 2014–2015 grant year (April to March). This is the most recent year for which complete data are available. Highlights are from the 2015–2016 academic year (September to August).

Six Engineering Innovations Get Boost from NSERC Strategic Partnership Grants

Six U of T Engineering researchers — four of them in their first decade as faculty members — received 2015 NSERC Strategic Partnership Grants worth a total of more than \$2.8 million. Funded projects include new technologies to extract valuable minerals from hazardous mine tailings, and systems to enable cities to repurpose storm water more effectively. The researchers are:

- Professor Mansoor Barati (MSE)
- Professor Aimy Bazylak (MIE)
- Professor Sean Hum (ECE)
- Professor Elodie Passeport (ChemE, CivE)
- Professor Ted Sargent (ECE)
- Professor Costas Sarris (ECE)

Strategic Partnerships Grants seek to increase research and training in targeted areas and enhance Canada's economy, society and environment within the coming decade. The six Engineering researchers were among 10 U of T professors to receive the grants this year.

Seven U of T Professors Receive New or Renewed Canada Research Chairs

In February 2016, seven U of T Engineering professors received significant federal support for their research with new or renewed Canada Research Chairs. The U of T Engineering chairholders are:

- Ya-Huei Cathy Chin (ChemE), Canada Research Chair in Advanced Catalysis for Sustainable Chemistry (Tier 2, new)
- Birsen Donmez (MIE), Canada Research Chair in Human Factors and Transportation (Tier 2, new)
- Andreas Mandelis (MIE), Canada Research Chair in Diffusion-Wave and Photoacoustic Sciences and Technologies (Tier 1, renewal)
- Prasanth Nair (UTIAS), Canada Research Chair in Computational Modelling and Design Under Uncertainty (Tier 2, renewal)
- Elodie Passeport (ChemE, CivE), Canada Research Chair in Environmental Engineering and Stable Isotopes (Tier 2, new)
- Matthew Roorda (CivE), Canada Research Chair in Freight Transportation and Logistics (Tier 2, new)
- David Sinton (MIE), Canada Research Chair in Microfluidics and Energy (Tier 1, new)

The seven engineering chairholders joined 27 others from Faculties across the University of Toronto who were announced at the same time. Launched in 2000, the Canada Research Chairs program is aimed at helping the country

attract and retain research leaders in engineering and natural sciences, health sciences, humanities and social sciences. Tier 1 Chairs have a seven-year term, and recognize outstanding researchers acknowledged by their peers as world leaders in their fields. Tier 2 Chairs are for exceptional emerging researchers and have a five-year term. As of April 2016, U of T Engineering held 31 Canada Research Chairs.

Researchers Create New Tool to Understand Cancer Growth

A team of U of T researchers has developed a way to grow cancer cells in the form of a rolled-up sheet that mimics the 3D environment of a tumour, yet can also be taken apart in seconds. The platform, described in a *Nature Materials* paper, has the potential to speed up the development of new drugs and therapies by offering insights into how cancer cells behave.

Professor Alison McGuigan (ChemE, IBBME) and graduate student Darren Rodenhizer (ChemE IT3, PhD candidate) impregnated a short strip of a porous, paper-like support material with collagen — a gel-like material found in the body — and cancer cells. They bathed it in a nutrient-rich culture solution for a day, allowing the cells to adjust to their new environment. Next, they rolled the strip around a metal core, forming an engineered tumour, and cultured it for a few more days before analyzing the behavior of the tumour cells.

The new technique accurately creates conditions that have proven difficult to replicate with traditional cell cultures in two-dimensional petri dishes. For example, cells near the centre have less access to oxygen and nutrients than those growing near the surface, just as they would in a real tumour. By providing a more realistic model for tumour growth, the device could accelerate the search for new treatments, including more effective drugs and personalized medicine.

“Person-on-a-Chip” Grows Realistic Human Tissues Outside Body

Researchers at U of T Engineering have developed a new way to grow realistic human tissues outside the body. Their “person-on-a-chip” technology, called *AngioChip*, is a powerful platform for discovering and testing new drugs, and could eventually be used to repair or replace damaged organs.

Professor Milica Radisic (IBBME, ChemE), postdoctoral fellow Boyang Zhang (IBBME IT6) and their collaborators created a fully three-dimensional structure with blood vessels and a lattice for other cells to attach and grow. Zhang built the scaffold out of POMaC, a polymer that

is both biodegradable and biocompatible. The scaffold is made from a series of thin layers, stamped with a pattern of channels that are each about 50 to 100 micrometres wide. The layers, which resemble computer microchips, are then stacked into a 3D structure of synthetic blood vessels and cross-linked using UV light. When the structure is finished, it is bathed in a liquid containing living cells, which quickly colonize the channels and begin growing just as they would in the human body.

The work, which was published in *Nature Materials*, was produced collaboratively with researchers from across U of T, including Professor Michael Sefton (ChemE, IBBME), Professor Aaron Wheeler (Chemistry, IBBME) and their research teams, as well as researchers from Toronto General Hospital and University Health Network.

Improving Defibrillator Access to Save Lives

U of T Engineering researchers have developed the first mathematical optimization approach to deploying automated external defibrillators (AEDs) that considers not only where the devices are located, but also when host buildings are open.

Christopher Sun (EngSci 1T3 + PEY, MIE PhD candidate), working with Professor Timothy Chan (MIE), director of the Centre for Healthcare Engineering, and collaborators at the Rescu program at St. Michael's Hospital, found that AED coverage diminished by more than eight per cent during the day, 28 per cent in the evening and 48 per cent at night, based on the opening hours of buildings where AEDs are placed. Many AEDs are located in office buildings, schools and recreation facilities, which are open for only a limited period each day.

The placement of AEDs in buildings with limited hours can have an impact on survival for those who suffer cardiac arrests. Over a period of roughly eight years, 2,440 out-of-hospital cardiac arrests occurred in Toronto. Of those that occurred near an AED, approximately one in five occurred when an AED was inaccessible. Previous research had examined where AEDs are placed, but had largely overlooked time factors.

The researchers found their new model provided the largest improvement in coverage during the night, when AED availability and survival are the lowest. The researchers hope their optimization model will help develop policies and guidelines for AED placements around the world, and ultimately save lives.

OCCAM Celebrates Official Opening

The Ontario Centre for the Characterization of Advanced Materials (OCCAM) — a \$20-million analytical laboratory at U of T Engineering — officially unveiled its latest capabilities in May 2016. Nearly 200 people attended the event, including faculty from across U of T as well as industry partners and representatives from the centre's funders: the Canada Foundation for Innovation, the Ontario Ministry of Research and Innovation, and Hitachi High Technologies Canada. The facility is a joint initiative between the Departments of Materials Science & Engineering and Chemical Engineering & Applied Chemistry. It contains leading-edge equipment for imaging, analyzing and manipulating materials with nanometre-scale precision. Insights gained using these advanced facilities will help researchers understand the natural world and design better devices, from dental implants to microchips, solar cells, aircraft and much more. OCCAM is based on a collaborative model; each year, researchers from across U of T and external industry partners bring hundreds of samples to OCCAM for analysis.

Research Funding and Partnerships

U of T Engineering attracted \$78.7 million in research funding in 2014–2015. Our success in this area over the past decade reflects the innovative and collaborative work our investigators are conducting, the strength of our industrial partnerships and more robust fundraising efforts. The Faculty is set for continued growth in research support in light of our recently created Medicine by Design and TBEP programs.

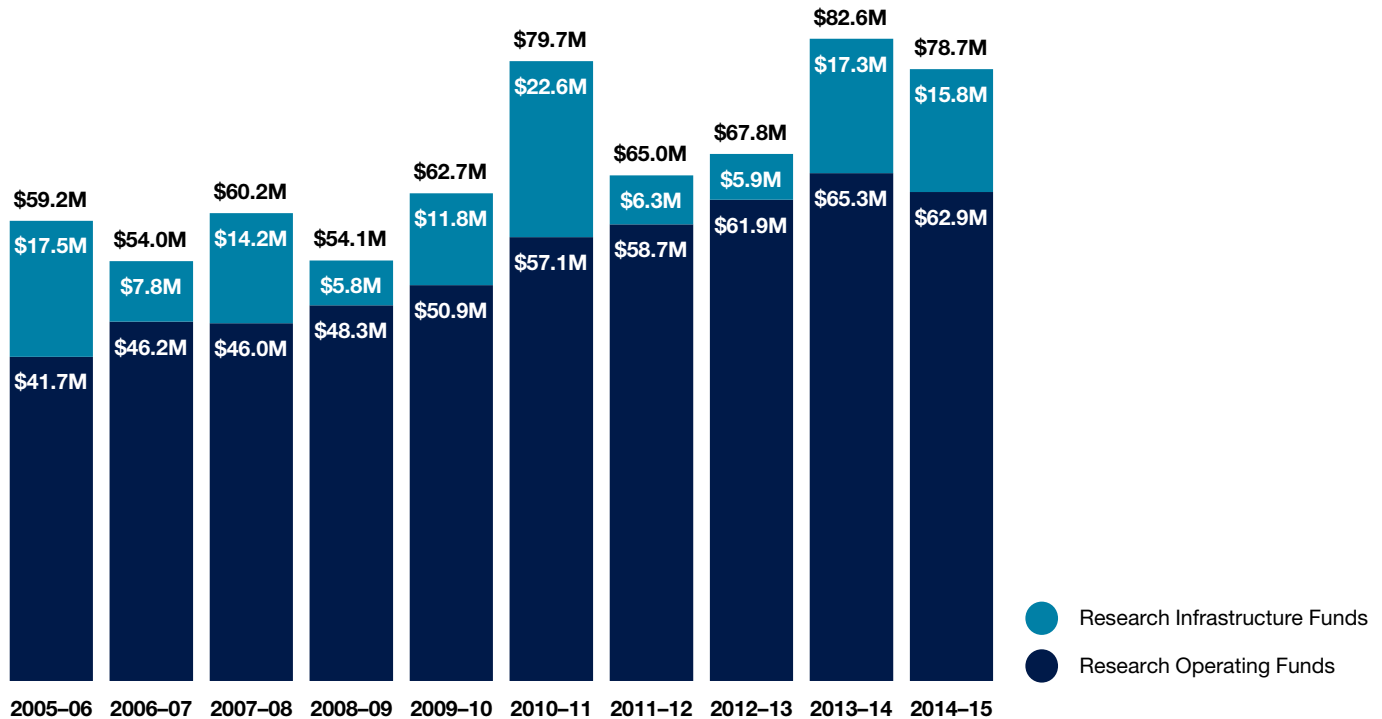
The Faculty achieved a record \$31.8 million in Tri-Council funding in 2014–2015, putting us in an excellent position to reach our goal of \$32 million by 2015–2016. We increased our goal after reaching our previous Academic Plan target of \$25 million in 2012–2013, three years earlier than originally targeted. The Tri-Council includes the Canadian Institutes of Health Research (CIHR), the Natural Sciences and Engineering Research Council of Canada (NSERC), the Social Sciences and Humanities Research Council (SSHRC), plus the Networks of Centres of Excellence (NCE).

Our researchers increased total NSERC support to the Faculty by nine per cent year-over-year to \$26.9 million. We also attracted a record amount of funding from CIHR as our Faculty gains increasing recognition for strength in fields such as biomedical engineering and health systems research. Developing additional funding sources is a key goal of our Academic Plan, and enables our excellence in collaborative and multidisciplinary research.

From 2010–2011 to 2014–2015, U of T’s five-year cumulative share of NSERC funding was 9.3 per cent, greater than any other Canadian university. The allocation of CRCs to U of T and its divisions is updated every two years and is based on its portion of national Tri-Council funding (including NCE).

On average, each faculty member received \$283,273 in annual research funding.

Figure 3.1a Breakdown of Research Infrastructure Funding vs. Research Operating Funding, 2005–2006 to 2014–2015



Note 3.1: The figures in this chapter report research funding the Faculty received in 2014–2015. Because it takes some time after the completion of a fiscal year for research funding data to become final, this is the most recent year for which data is available.

Figure 3.1b Canadian Institutes of Health Research (CIHR), Natural Sciences and Engineering Research Council of Canada (NSERC) and Networks of Centres of Excellence (NCE) Funding, 2005–2006 to 2014–2015

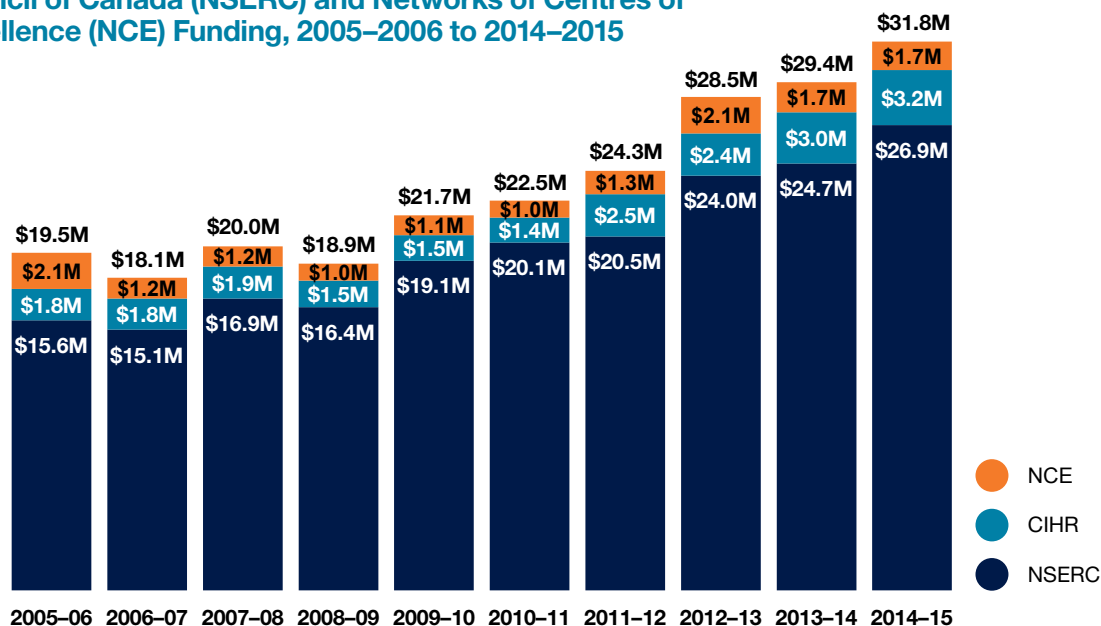
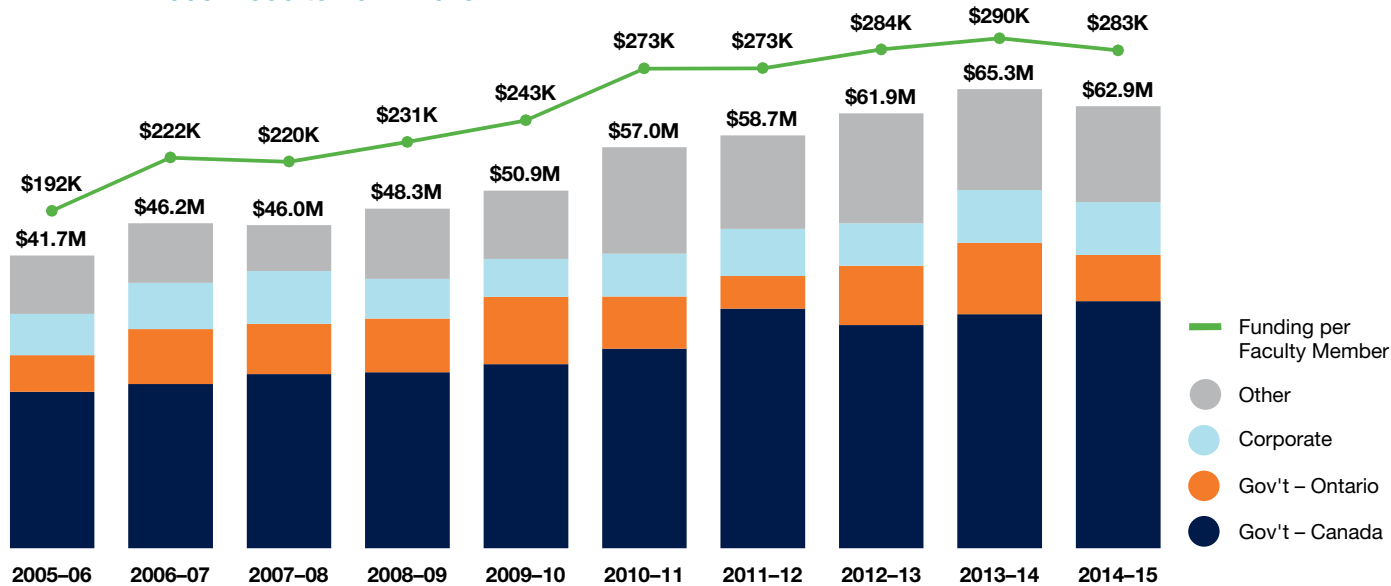


Figure 3.1c Research Operating Funding by Year, Source and Funding per Faculty Member, 2005–2006 to 2014–2015



	Funding per Faculty Member	Gov't - Canada	Gov't - Ontario	Corporate	Other	Total
2005-06	\$191,956	\$22,238,632	\$5,241,595	\$5,848,143	\$8,326,178	\$41,654,548
2006-07	\$222,300	\$23,357,386	\$7,817,967	\$6,583,699	\$8,479,398	\$46,238,450
2007-08	\$219,998	\$24,763,970	\$7,168,950	\$7,520,781	\$6,525,854	\$45,979,555
2008-09	\$231,217	\$25,043,728	\$7,618,346	\$5,666,153	\$9,996,059	\$48,324,286
2009-10	\$243,477	\$26,194,223	\$9,562,402	\$5,415,268	\$9,714,802	\$50,886,695
2010-11	\$272,965	\$28,404,920	\$7,395,585	\$6,096,677	\$15,152,585	\$57,049,767
2011-12	\$273,182	\$34,091,979	\$4,636,724	\$6,705,219	\$13,300,258	\$58,734,180
2012-13	\$283,808	\$31,751,929	\$8,425,047	\$6,062,015	\$15,631,214	\$61,870,205
2013-14	\$290,231	\$33,297,369	\$10,173,279	\$7,476,802	\$14,354,519	\$65,301,969
2014-15	\$283,273	\$35,137,026	\$6,594,253	\$7,504,880	\$13,650,347	\$62,886,506

The number of research chairs and grants the Faculty receives is one reflection of the exceptional calibre of our investigators and their work.

Our Faculty is home to 77 research chairs held by 69 individual chairholders. These chairs include Canada Research Chairs, endowed chairs, NSERC Industrial Research Chairs, U of T Distinguished Professors and University Professors. *For the full list, see Appendix D.*

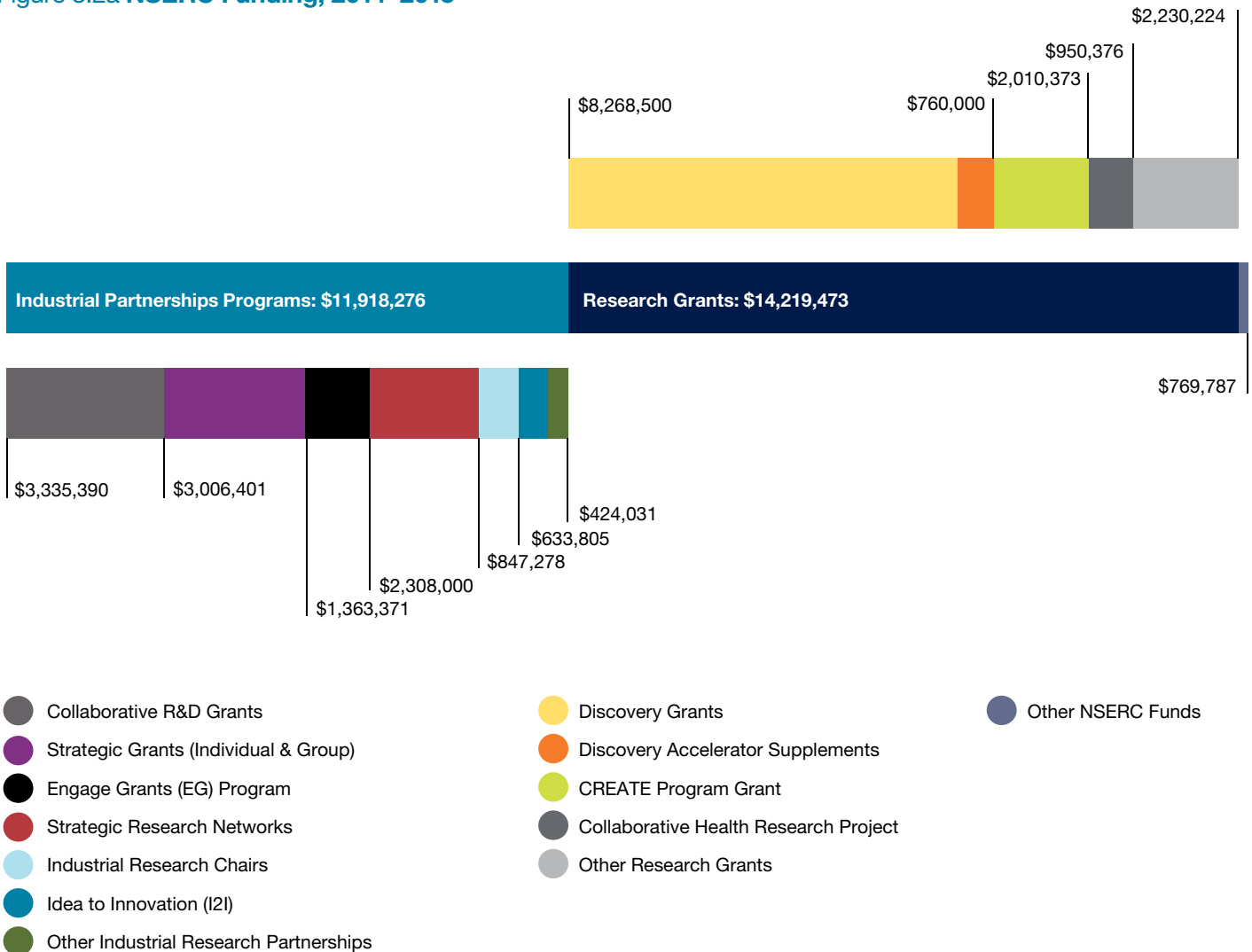
In 2015–2016, U of T Engineering led eight Collaborative Research and Training Experience (CREATE) grants, including two announced in April 2016. Each of these NSERC grants provides \$1.65 million in support over six years, and is aimed at training and mentoring highly qualified students in collaborative and integrative approaches.

Our success in leveraging industrial partnerships has played a key role in the growth we have achieved in NSERC

funding over the past decade. It made up 44 per cent of our NSERC funding in 2014–2015. The Faculty attracted six 2015 NSERC Strategic Partnership Grants (SPG) worth a total of \$2.8 million, and four of the six awards received by U of T Engineering went to researchers in their first decade as faculty members, including one that was awarded to a faculty member beginning her second year in the tenure stream. To strengthen our industry partnerships, we held workshops for faculty members on attracting industry partners and succeeding in the SPG competition.

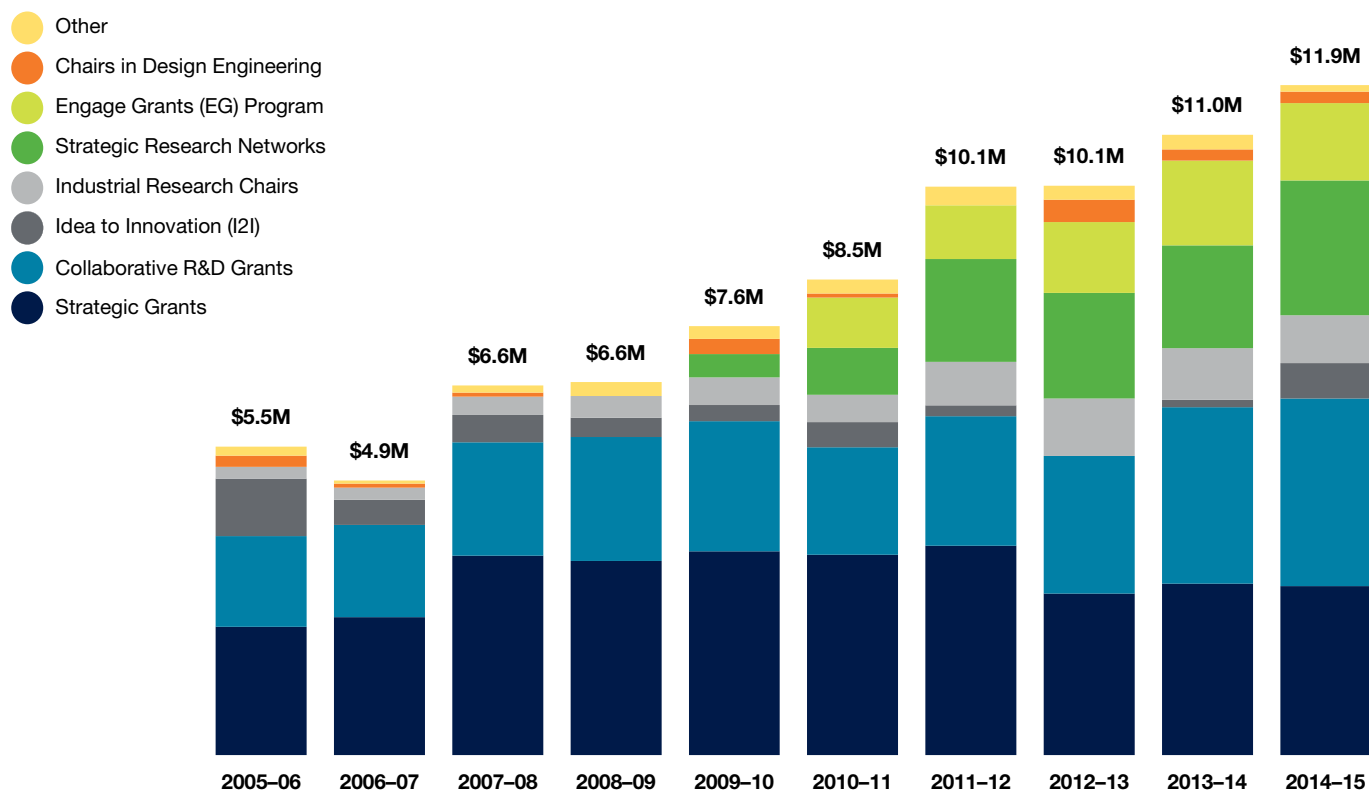
U of T Engineering collaborates in research with more than 300 industry partners, from large multinationals such as Apple, Intel and General Electric to local businesses such as the Greater Toronto Airports Authority (GTAA) and even U of T spinoffs such as Crowdmark. Our partners gain access to our world-class researchers, students and facilities, while the Faculty benefits from mentorship and employment opportunities for students and commercialization expertise.

Figure 3.2a NSERC Funding, 2014–2015



Note 3.2a: Data current as of May 2016 and based on grant year (April to March).

Figure 3.2b NSERC Industrial Partnership Funding by Program, 2005–2006 to 2014–2015



Other	\$163,537	\$55,267	\$130,000	\$247,392	\$230,000	\$251,770	\$328,780	\$246,790	\$258,882	\$119,531
Chairs in Design Engineering	\$195,437	\$69,076	\$69,076		\$267,173	\$69,076		\$400,000	\$200,000	\$200,000
Engage Grants (EG) Program						\$897,114	\$960,531	\$1,254,468	\$1,508,924	\$1,375,871
Strategic Research Networks					\$417,293	\$832,697	\$1,826,000	\$1,879,000	\$1,824,940	\$2,400,000
Industrial Research Chairs	\$211,000	\$216,000	\$329,834	\$390,667	\$493,197	\$485,711	\$773,964	\$1,025,031	\$918,349	\$847,278
Idea to Innovation (I2I)	\$1,023,640	\$449,032	\$483,200	\$339,200	\$287,417	\$448,612	\$195,000		\$133,750	\$633,805
Collaborative R&D Grants	\$1,612,412	\$1,637,132	\$2,015,904	\$2,203,103	\$2,313,127	\$1,909,431	\$2,301,643	\$2,445,232	\$3,137,628	\$3,335,390
Strategic Grants	\$2,282,310	\$2,457,079	\$3,549,374	\$3,457,330	\$3,625,317	\$3,567,277	\$3,725,049	\$2,875,127	\$3,050,492	\$3,006,401
Total	\$5,488,336	\$4,883,586	\$6,577,388	\$6,637,692	\$7,633,524	\$8,461,688	\$10,110,967	\$10,125,648	\$11,032,965	\$11,918,276

Figure 3.2c Industrial Partnerships as a Proportion of Total NSERC Funding, 2005–2006 to 2014–2015

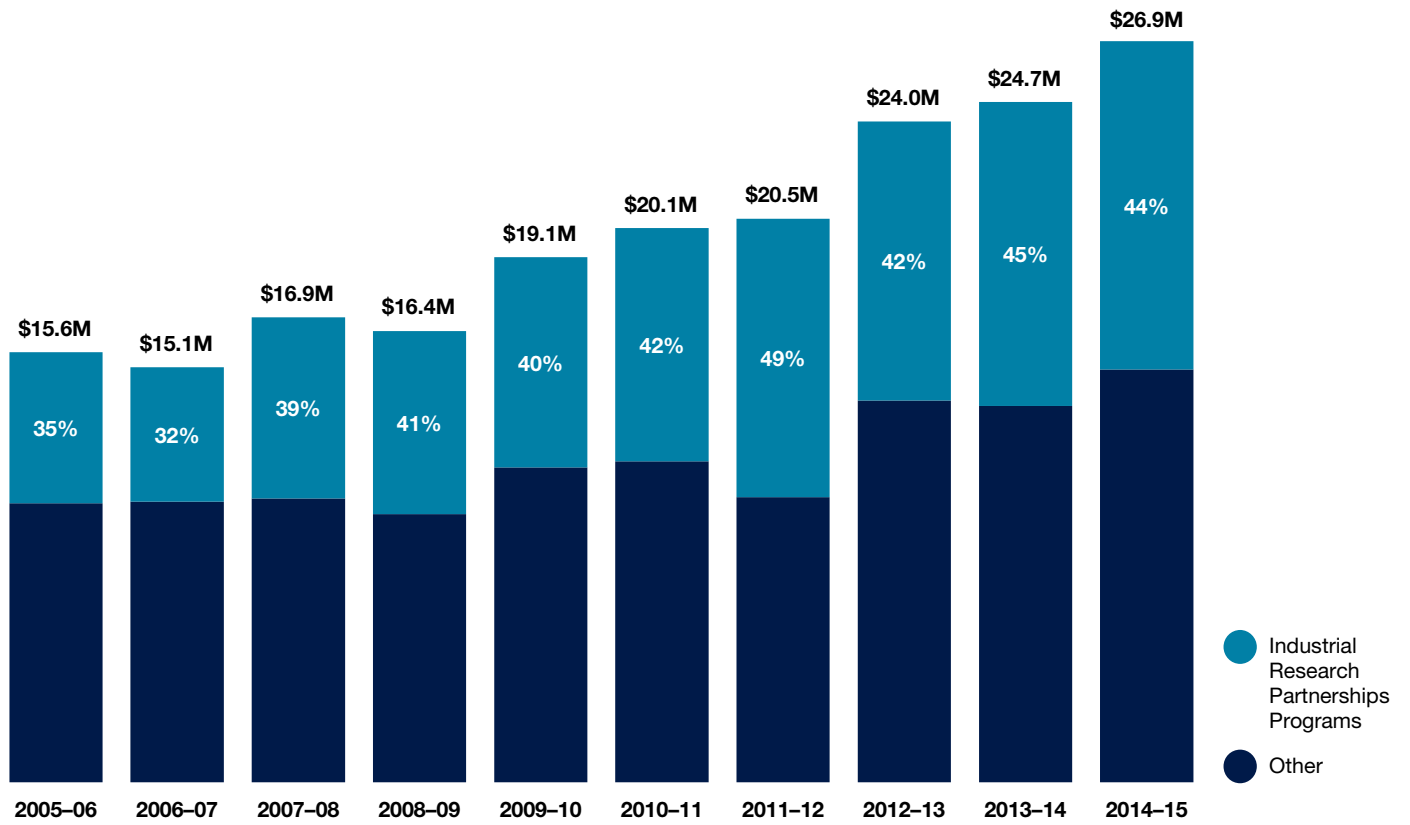


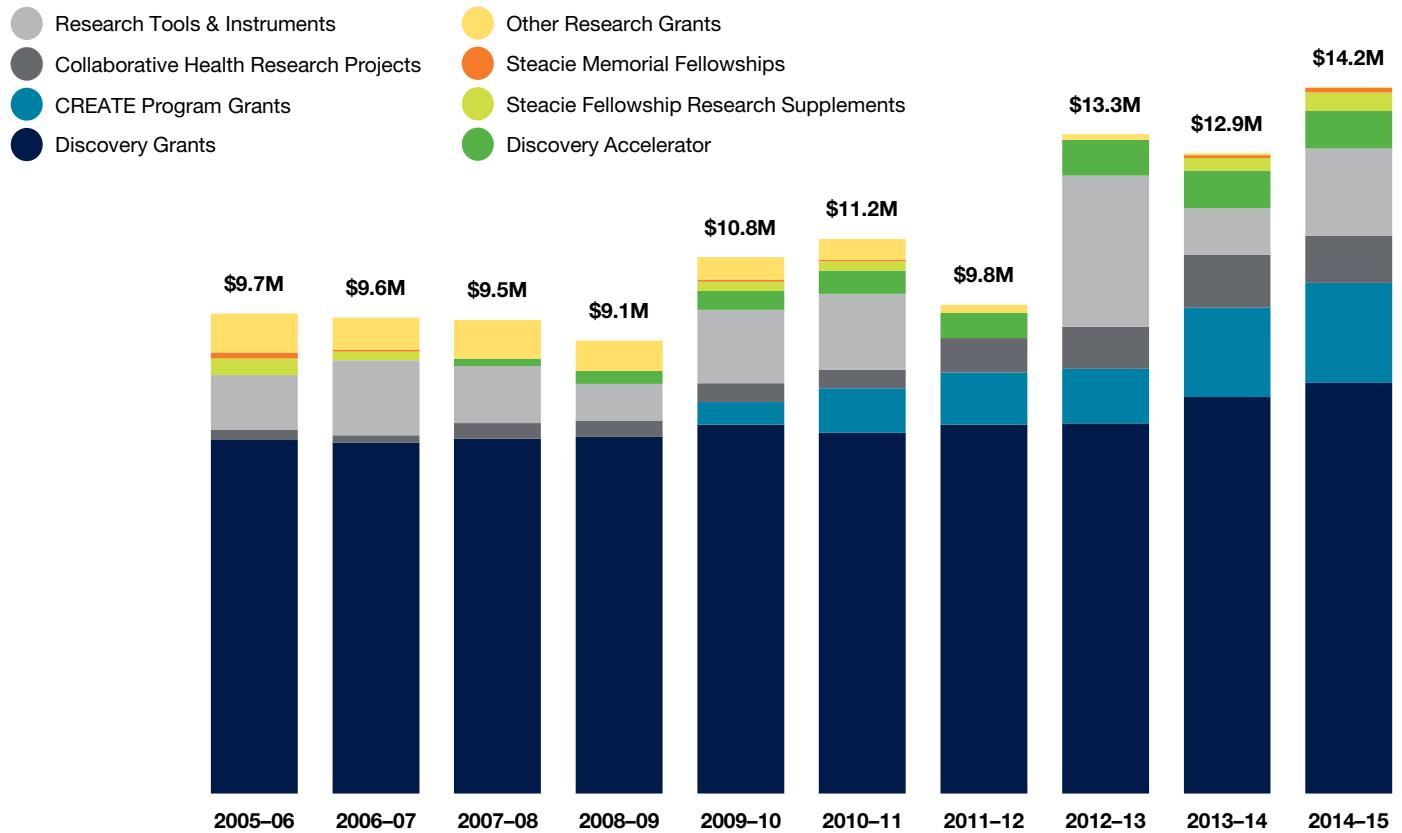
Figure 3.2d Industry Partners, 2015–2016

- ABB Group
- Advanced Measurement and Analysis Group Inc.
- Advanced Micro Devices Inc.
- Advanis
- Aerodyne
- AGFA
- Agnico-Eagle Mines Ltd.
- Airbus SAS
- AISC
- Alcan Aluminum International
- Alcohol Countermeasure Systems
- Altera Corp.
- AMAG Ltd.
- AMEC Foster Wheeler
- Americas Styrenics LLC
- Analog Devices Inc.
- Andec Manufacturing Ltd.
- Andritz Group
- Anemol Technologies Inc.
- Anglo Operations Ltd.
- Angstrom Engineering Inc.
- Antex Western
- Apotex Inc.
- Applanix
- Apple
- Aquafor Beech
- ArcelorMittal Dofasco
- Armacell
- Artium Technologies
- Arup Canada Inc.
- Asahi Glass Co. Ltd.
- Astronauts4Hire
- Atomic Energy of Canada Ltd.
- AUG Signals Ltd.
- Autodesk
- AV Nackawic Group
- Avalon Rare Metals
- Babcock & Wilcox Ltd.
- Barrick Gold Corp.
- Bell Canada
- Bell Helicopter Textron Inc.
- Bickell Foundation (J. P. Bickell)
- BiomeRenewables
- Bio-Rad Laboratories Canada Ltd.
- BlackBerry
- BLiNQ Inc.
- BMW
- Boeing
- Boise Cascade
- Bombardier Aerospace
- Bombardier Inc.
- Braskem
- Brican Automated Systems Inc.
- Brigham & Women’s Hospital
- Broadcom Corp.
- CAE
- CalEnergy Generation
- Calgon Carbon Corp.
- Cameco
- Canadian Automobile Association
- Canadian Institute of Steel Construction
- Canadian Nuclear Laboratories
- Canadian Nuclear Safety Commission
- Canadian Renewable Fuels Association
- Canadian Solar Inc.
- Candu Energy Inc.
- Candu Owners Group
- Candura Instruments
- CanSyn Chem Corp.
- Carbon Cure Technologies
- Cardinal Health
- Carter Holt Harvey Ltd.
- Cascades
- CD Nova
- Celestica
- CellScale Biomaterials Testing
- Celulose Nipo-Brasileira
- Cement Association of Canada
- Center for Automotive Materials and Manufacturing
- Centre Line Ltd.
- Christie Digital Systems Canada Inc.
- Chrysler Canada Inc.
- Ciena Canada Inc.
- Clearpath Robotics
- Clyde-Bergemann Inc.
- CMC Electronics
- Colibri Technologies
- COM DEV International Ltd.
- ConCast Pipe
- Connaught Foundation
- Coraltec Inc.
- Corix Water Systems Inc.
- Crosswing Inc.
- Crowdmark
- Cyberworks Robotics
- Cyclone Manufacturing
- Cytodiagnosics
- Daishowa-Marubeni International (DMI) Ltd. – Peace River Pulp Division
- Dana Canada Corp.
- Daniels Group
- Datatrends Research Corp.
- DCL International
- Defence Science & Technology Lab (U.K.)
- Dell
- Detour Gold Corp.
- Deveron
- Dionex
- Diros Technology Inc.
- Dongwon Technology Co. Ltd.
- Dr. Robot Inc.
- Droplet Measurement Technologies
- DSO National Laboratories
- DuPont Canada
- Eclipse Scientific Inc.
- Ecosynthetix
- Eco-Tec Inc.
- Eldorado Brasil
- Electrovaya Inc.
- Eli Lilly Research Laboratories
- Enbridge Gas Distribution Inc.
- Energent Inc.
- Engineering Services Inc.
- ENMAX Power Corporation
- Ensyn Technologies Inc.
- ERCO Worldwide
- Ericsson Canada Inc.
- ESG Solutions
- exactEarth Inc.
- Explora Foundation
- FedEx
- Fibria Celulose
- Finisar Corporation
- Flight Safety International
- Ford Motor Company (U.S.A.)
- Ford Motor Company of Canada
- FP Innovations
- Fuji Electric Co. Ltd.
- Fujitsu Laboratories Ltd.
- Fujitsu Labs of America Inc.
- G. S. Dunn Dry Mustard Millers
- G. Cinelli – Esperia Corporation
- GE Energy
- GE Global Research
- GE Zenon
- Gedex Inc.
- Gener8 Inc.
- General Dynamics Canada
- General Electric Canada
- General Electric Inc.
- General Motors of Canada Ltd.
- Genpak
- Geosyntec Consultants
- Gerdau Long Steel North America
- GlaxoSmithKline Inc.
- Goodrich
- Goodrich Landing Gear
- Grafoid Inc.
- Greencore Composites
- Groupe Mequaltech Inc.
- GTAA Toronto Pearson
- GVA Lighting
- Hamilton Professional Fire Fighters Association
- Hanwha Solar Canada
- Hard Rock Innovations Inc.
- Hatch Ltd.
- Hawker Siddeley Canada
- HDR Corp.
- Hitachi High-Technologies
- Holcim Inc.
- Honeywell
- Huawei Technologies Co. Ltd.
- Hunch Manifest Inc.
- Huron Digital Pathology
- Hydro One Networks
- Hydro Quebec
- Hyundai Motor Company
- IBI Group
- IBM Canada Ltd.
- IBM T. J. Watson Research Center

Note 3.2d: The list above includes companies from U of T’s Research Information System, along with collaborators that fund research through a number of industrial research consortia, including those associated with many of our Industrial Research Chairs. It does not include companies that hire our students through the Professional Experience Year, work with them on Multidisciplinary Capstone Projects, or provide philanthropic support.

- IGEN Technologies Inc.
- Imperial Oil Ltd.
- Indian Oil Company
- Industrial Thermo Polymers Ltd.
- Ingenia Polymers Corp.
- Inphi Corp.
- Institute for Energy Technology (Norway)
- Integran Technologies Inc.
- Intel Corp.
- International Paper Company
- Ionicon
- Ionics Mass Spectrometry Group Inc.
- IRISNDT Corp.
- Irving Pulp & Paper Ltd.
- ITS Electronics Inc.
- JDS Uniphase Inc.
- JNE Chemicals
- Johnson Matthey
- Kapik Integration
- Kasai Kogyo Co. Ltd.
- Kevin Quan Studios
- Kiln Flame Systems Ltd.
- Kimberly-Clark Corp.
- Kinectrics
- Kinetica Dynamics
- Klabin
- Krauss Maffei Corp.
- Kumho Petrochemical R & D Center
- LaFarge Canada
- Lallemand Inc.
- Lattice Semiconductor Ltd.
- LG Chem
- Litens Automotive Group
- Lubrizol
- Lumentra Inc.
- MacDonald, Dettwiler and Associates (MDA) Ltd.
- Magellan Aerospace
- Magna Closures
- Magna Exteriors and Interiors
- Magna International Inc.
- Magna Powertrain
- Manitoba Hydro
- Mantech Inc.
- Manulife Financial
- Marmak Information Technologies
- Materials & Manufacturing Ontario
- Maxim Integrated Products Inc.
- MeadWestvaco (MWV) Corp.
- Mercedes-Benz Canada Inc.
- Merrimack Pharmaceuticals Inc.
- Messier-Bugatti-Dowty
- Messier-Dowty Inc.
- Meta North Inc.
- Metso Pulp, Paper and Power
- Microbonds Inc.
- Micropilot
- Millipore
- Mitsubishi Rayon Co. Ltd.
- Moldflow Corp.
- Monaghan Biosciences Ltd.
- Mr. Robot Inc.
- Nanowave
- National Aeronautical Establishment (USA)
- NatureWorks LLC
- NCK Engineering
- Nestle Canada
- Newterra
- Nike Inc.
- Nordion International Inc.
- NUCAP Global
- Nuclear Waste Management Organization
- NXP Semiconductors Netherlands BV
- OCMR
- Olympus Canada
- OneChip Photonics Inc.
- Ontario Clean Water Agency
- Ontario Power Generation Inc.
- Ontario Renal Network
- Ontario Teachers Pension Plan
- Opal-RT Technologies Inc.
- Opus One Solutions Energy Corp.
- ORNGE Medical Transport
- Pall Corporation
- Perkin Elmer Canada
- Pfizer Inc. (New York)
- Plasco Energy Group
- Polaris Industries
- Polycon Industries
- Porewater Solutions
- POSCO Center
- Pratt & Whitney Canada Inc.
- PrecisionHawk
- Process Research Ortech Inc.
- Procter & Gamble
- Prothena Biosciences Inc.
- Purolator
- QD Solar Inc.
- Qualcomm Canada Inc.
- Qualcomm Technologies Inc.
- Quanser Inc.
- Quantum Dental Technologies (QDT) Inc.
- Questor Technologies Inc.
- Quorum Technologies Inc.
- RBC – Royal Bank of Canada
- RBC Capital Markets
- RBC Global Asset Management
- Regeneron Pharmaceuticals
- Research in Motion Ltd.
- Resonance Ltd.
- Resource Systems Group Inc.
- Robert Bosch Corp.
- Rockwell International
- Rocscience Inc.
- Rolls Royce Canada Ltd.
- Rosellini Scientific LLC
- RWDI
- Safety Power Inc.
- Safran Electronics Canada
- Samsung Advanced Institute of Technology
- Samsung Electronics
- Sanofi Pasteur
- Saudi Basic Industries Corp. (SABIC)
- Schlumberger Canada Ltd.
- Sealed Air Corp.
- Semiconductor Research Corp.
- Sendyne Corp.
- Sensor Technology Ltd.
- ShawCor
- Shinil Chemical Industry Co. Ltd.
- Side Effects Software
- Siemens ADGT
- Siltech Corp.
- Sinclair Interplanetary
- Sinclair Technologies Inc.
- Solantro Semiconductor Corp.
- Solar Ship Inc.
- Solvay Specialty Polymers
- Sony Corporation
- SPP Canada Aircraft Inc.
- St Mary's Cement Group
- Stackpole International
- Stantec Inc.
- Steel Structures Education Foundation
- StoraEnso
- Sulzer Metco
- Suncor Energy Inc.
- Sunwell Technologies
- Suzano Papel e Celulose
- Synbra
- Syncrude Canada Ltd.
- Tantalus Rare Earths AG
- Teck Resources Ltd.
- Teknion
- Teledyne ISCO
- TELUS
- TELUS Mobility
- Tembec Industries Inc.
- Tenova GoodFellow Inc.
- Tessonics Inc.
- Thales Canada Inc.
- The Iron Ore Company of Canada (IOC)
- The Miller Group
- Thermodyne Engineering
- ThermoFisher Scientific
- TMS Robotics & Academics
- Tolko Industries Ltd.
- Toronto Hydro
- Toshiba Corp.
- Tower Automotive
- Tower Solutions
- Toyota Collaborative Safety Research Center (CSRC)
- Toyota Technical Center USA Inc.
- TransCanada
- Tridel
- Trojan Technologies Inc.
- TSI Inc.
- Ultrasonix
- Uncharted Software Inc.
- Unisearch Associates
- US Steel Canada
- UTC Aerospace Systems
- VAC Aero International Inc.
- Vale Canada Ltd.
- Valmet Ltd.
- Van-Rob Kirchhoff Automotive
- Varilume Lighting Inc.
- Vicicog
- VisImage Systems Inc.
- Volkswagen Canada Inc.
- VTT Technical Research Centre of Finland
- Westport Innovations
- Whitemud Resources
- Wugang Canada Resources Investment Ltd.
- Wurth Elektronik eiSos GmbH & Co. KG
- Wuzhong Instrument Company
- Xilinx Inc.
- Xiphos Technologies Inc.
- Xstrata Nickel
- Xylitol Canada
- Zotefoams PLC

Figure 3.2e NSERC Research Grant Funding by Program, 2005–2006 to 2014–2015



Other Research Grants	\$778,537	\$653,000	\$781,400	\$607,950	\$462,319	\$422,583	\$162,000	\$111,000	\$40,000	\$15,000
Steacie Memorial Fellowships	\$120,000	\$30,000			\$30,000	\$30,000			\$60,000	\$90,000
Steacie Fellowship Research Supplements	\$336,477	\$179,250			\$187,500	\$187,500			\$250,000	\$375,000
Discovery Accelerator Supplements			\$144,000	\$264,000	\$383,999	\$464,000	\$504,000	\$720,000	\$760,000	\$760,000
Research Tools & Instruments	\$1,108,037	\$1,510,468	\$1,150,928	\$734,572	\$1,477,018	\$1,533,781		\$3,043,030	\$933,709	\$1,750,224
Collaborative Health Research Projects	\$197,752	\$151,355	\$311,245	\$326,169	\$378,774	\$366,899	\$696,536	\$846,731	\$1,064,880	\$950,376
CREATE Program Grants					\$450,000	\$900,000	\$1,050,000	\$1,096,000	\$1,797,084	\$2,010,373
Discovery Grants	\$7,119,011	\$7,057,674	\$7,145,644	\$7,183,551	\$7,429,093	\$7,261,603	\$7,425,475	\$7,452,942	\$7,984,878	\$8,268,500
Total	\$9,659,814	\$9,581,747	\$9,533,217	\$9,116,242	\$10,798,703	\$11,166,366	\$9,838,011	\$13,269,703	\$12,890,551	\$14,219,473

Figure 3.3a Canadian Peer Universities vs. University of Toronto Share of NSERC Funding for Engineering Cumulative Five-Year Share, 2010–2011 to 2014–2015

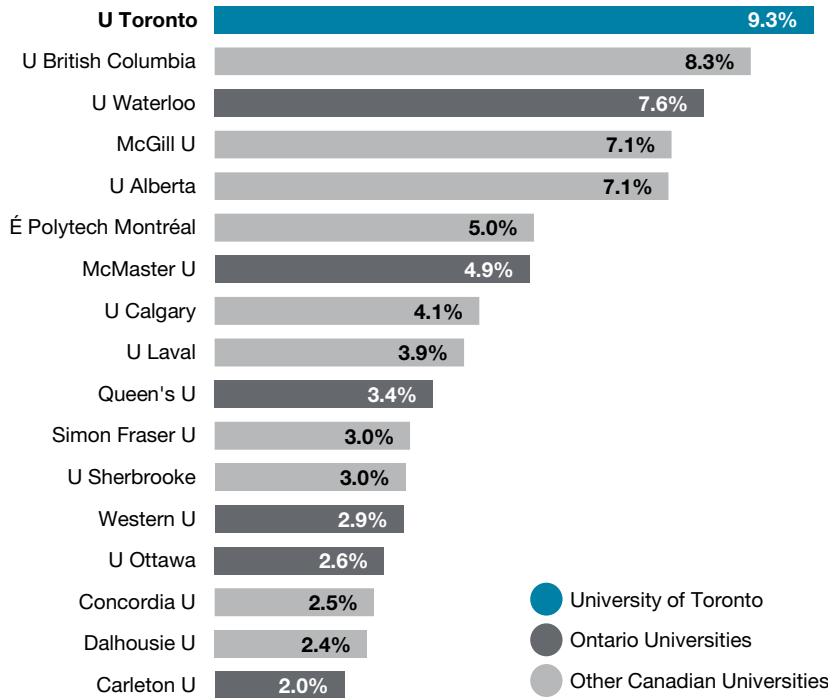


Figure 3.3b U of T Annual Share of NSERC Funding in Engineering, 2005–2006 to 2014–2015

Year	Share (%)
2005–06	9.1%
2006–07	9.0%
2007–08	9.2%
2008–09	8.5%
2009–10	9.4%
2010–11	9.0%
2011–12	9.5%
2012–13	9.0%
2013–14	9.6%
2014–15	9.5%

Figure 3.4a Engineering Invention Disclosures by Academic Area, 2011–2012 to 2015–2016

	2011–12	2012–13	2013–14	2014–15	2015–16	5-Yr Total
UTIAS	1.0	1.0	1.0		1.0	4.0
IBBME	14.0	8.2	5.9	6.5	8.0	42.6
ChemE	5.8	12.4	10.3	9.0	7.0	44.5
CivE	3.3	1.8	5.0	5.0	6.0	21.1
ECE	24.5	38.1	16.5	41.6	24.6	145.3
EngSci		0.5	1.2		1.0	2.7
MIE	20.7	13.1	9.5	18.8	16.8	78.9
MSE	3.0	4.0	2.5	1.5	1.3	12.3
Annual Total	72.3	79.1	51.9	82.4	65.7	351.4
University Annual Total	158.0	166.0	147.0	176.0	169.0	816.0
Engineering Percentage	46%	48%	35%	47%	39%	43%

U of T Engineering researchers applied for 32 patents in 2015–2016, representing more than 70 per cent of all patent applications across the entire University. Our Faculty also led the way in invention disclosures, accounting for 39 per cent of those made at U of T in 2015–2016 and 43 per cent of those made in the last five years. Within our Faculty, ECE accounted for 37 per cent of invention disclosures in 2015–2016, and MIE accounted for 26 per cent.

Note 3.3a and 3.3b: Data are from the NSERC advanced search website and are shown by NSERC’s fiscal year (April to March).

Figure 3.4b U of T Invention Disclosures by Faculty, 2015–2016

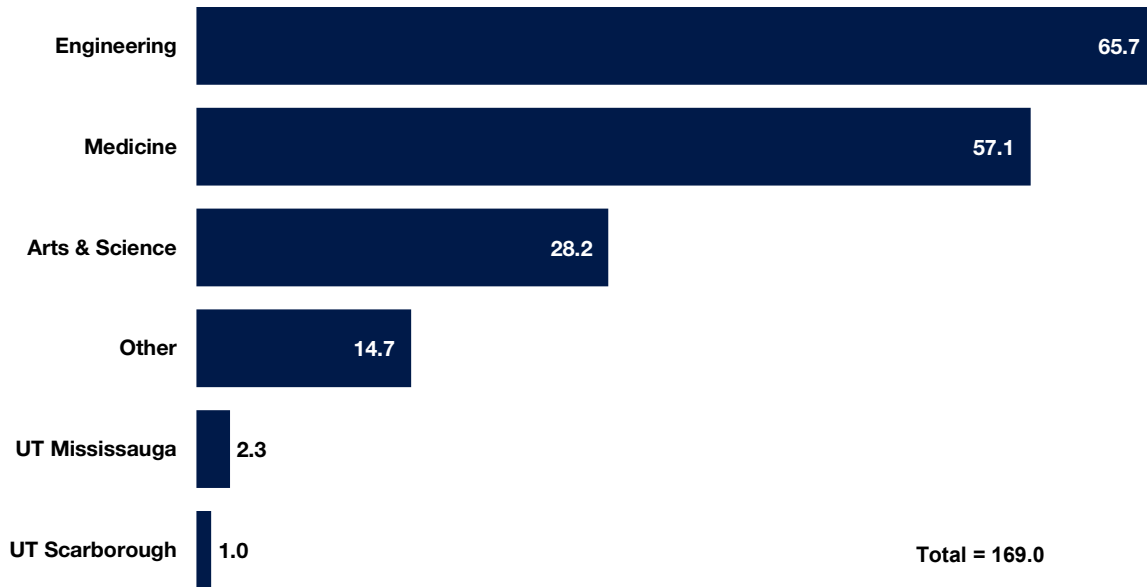
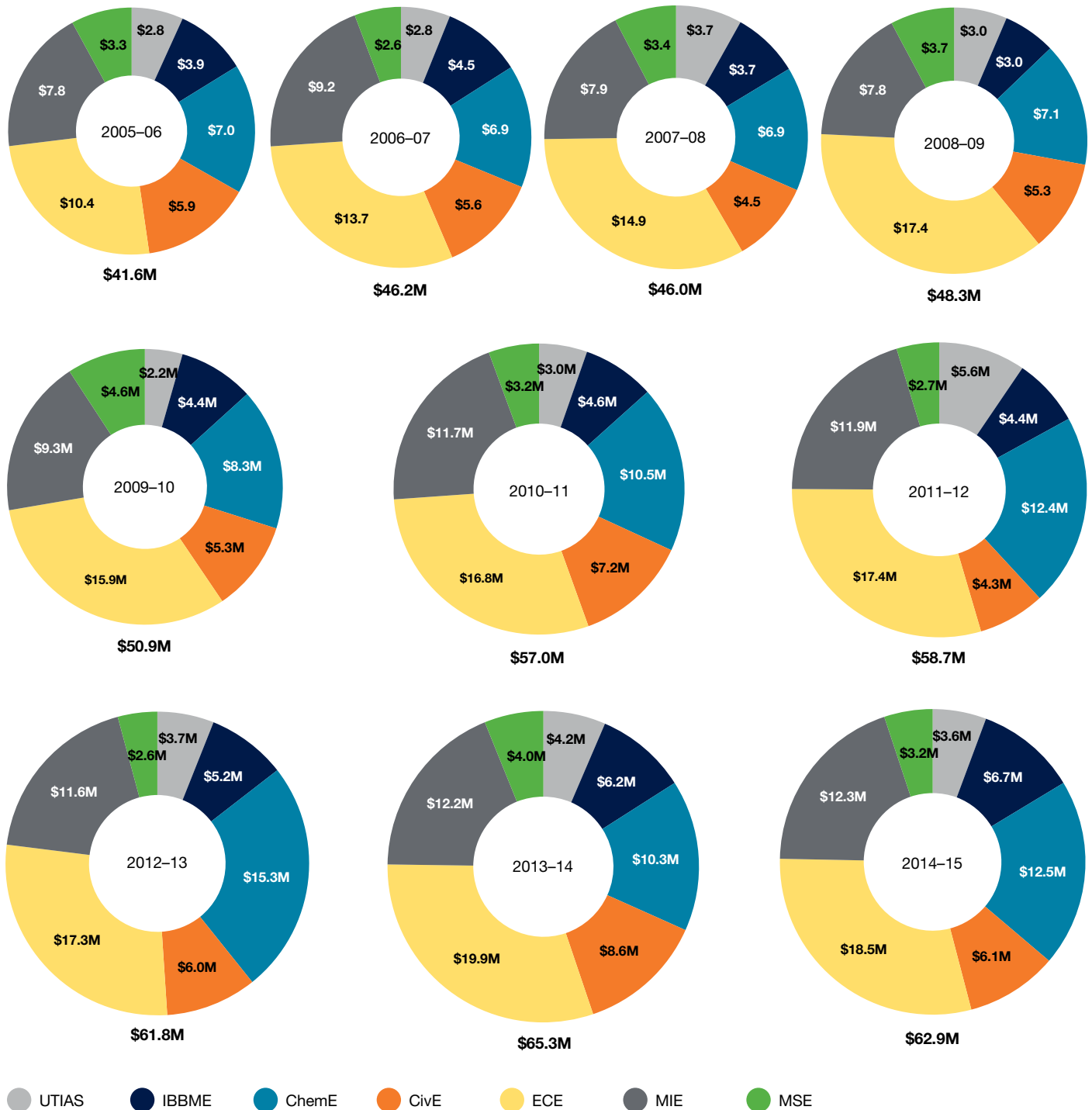


Figure 3.4c U of T Patent Applications by Faculty, 2015–2016



Figure 3.5 Distribution of Research Operating Funding by Academic Area, 2005–2006 to 2014–2015



Note 3.5: Totals include a small amount of additional funding not shown in the breakdown by academic areas. The research funding attributed to IBBME for 2014–15 represents 68 per cent of the total funding received by core professors in the Institute. Because of IBBME's cross-disciplinary structure, many of its faculty have their research funding processed through the Medicine or Dentistry Faculties. The figure above shows only the funding that comes through U of T Engineering and is presented by grant year (April to March).

4

U of T Engineering fosters the next generation of makers, creators and innovators by integrating unparalleled experiential and collaborative learning opportunities throughout our curricular and co-curricular programs. We equip our students with the technical, professional and entrepreneurial competencies to excel in a complex global environment.

Our diverse minors and certificates in subjects ranging from sustainable energy to engineering business enable undergraduates to customize their degrees and collaborate with students in other disciplines based on shared interests. Interest in our minors and certificates continues to grow and this year for the first time, more than half of the graduating class has completed at least one minor or certificate.

We embed engineering design, communication skills, teamwork and leadership in all years of our undergraduate curriculum. First-year design courses and fourth-year disciplinary and multidisciplinary capstone projects give students opportunities to work in teams on challenges brought by industry clients. The Engineering Communication Program enhances students' professional communication competencies through both standalone courses and integration with core curriculum, and the Institute for Leadership Education in Engineering (ILead) offers electives that students can apply to undergraduate minors or to the MEng Entrepreneurship, Leadership, Innovation & Technology in Engineering (ELITE) emphasis.

Our Professional Experience Year (PEY) internship program, the largest optional paid internship of its kind in Canada, gives undergraduates the opportunity to immerse themselves in engineering practice for 12 to 16 months. PEY internships enable students to apply what they have learned in their studies while strengthening their professional networks and career paths.

A rich suite of co-curricular activities also enables students to enhance and broaden their competencies. Our two in-house incubators, The Entrepreneurship Hatchery and Start@UTIAS, provide mentoring and resources to help students take their ideas from concept to startup. Several ILead co-curricular programs encourage students to explore and hone their leadership competencies and maximize their impact as engineers. Our students can choose from more than 80 clubs and teams to pursue their passions while fostering the tightly knit community for which U of T Engineering is known.

Undergraduate Engineering Minors and Certificates, Complementary Courses and Inter-Divisional Collaboration

We offer diverse minors and certificates that enable undergraduates to customize their degrees, complement their chosen engineering programs and collaborate with students in other disciplines based on shared interests. Programs include technical options such as minors in Nanoengineering and Robotics & Mechatronics, and multidisciplinary programs such as the Minor in Sustainable Energy and the Certificate in Global Engineering. We also offer a range of opportunities for students to hone their professional competencies in areas such as engineering business, engineering leadership and communication.

In 2015–2016, we offered the following minors and certificates:

Minors

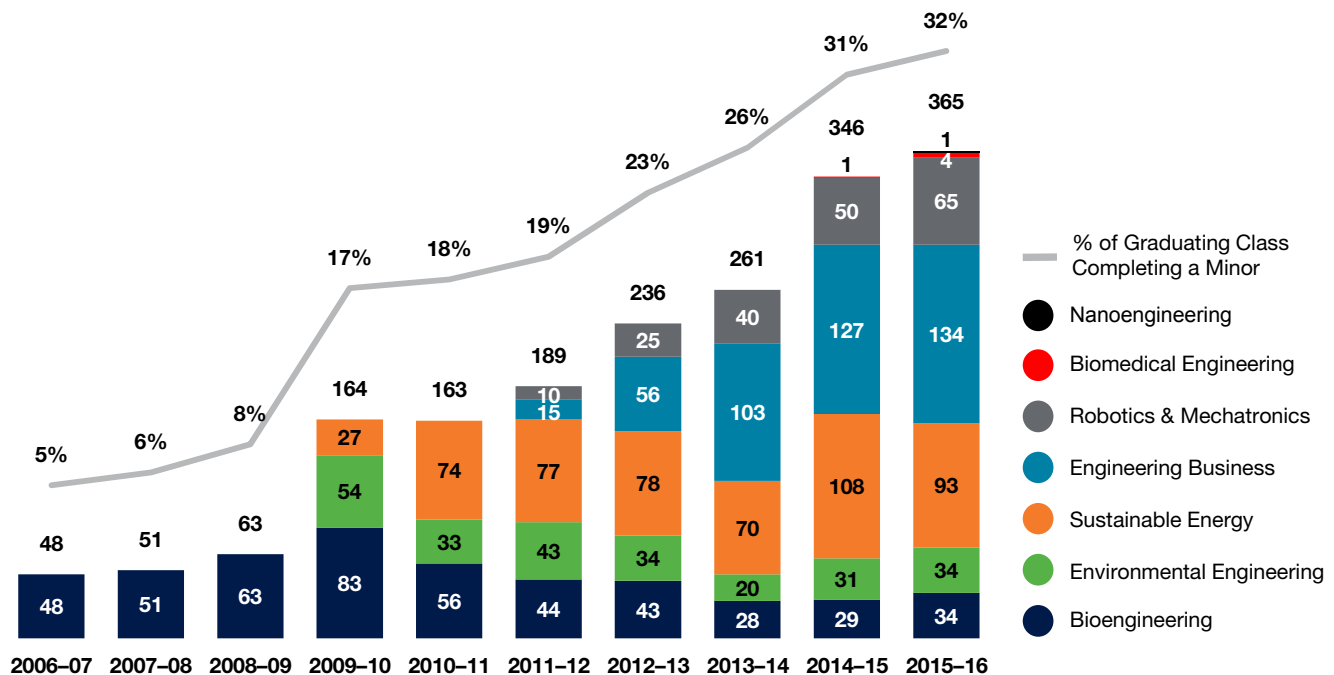
- Bioengineering
- Biomedical Engineering
- Engineering Business
- Environmental Engineering
- Nanoengineering (new in 2015)
- Robotics & Mechatronics
- Sustainable Energy

Certificates

- Communication (new in 2015)
- Engineering Business
- Engineering Leadership
- Entrepreneurship, Innovation & Small Business
- Global Engineering
- Mineral Resources
- Nuclear Engineering
- Renewable Resources Engineering

Students must complete six half courses to earn a minor, and three half courses for a certificate. We have raised the proportion of graduating undergraduate students who complete a minor from five per cent 10 years ago to nearly a third today. This year, for the first time more than half of the graduating class completed at least one minor or certificate. The Engineering Business minor and certificate have been particularly popular, with more than a third of students completing one or the other (Figure 4.1b).

Figure 4.1a Number of Students and Percentage of Graduating Class Completing an Engineering Minor, 2006–2007 to 2015–2016



Data and highlights in this chapter are presented for the period from August 2015 to July 2016.

Engineering students may also complete minors through the Faculty of Arts & Science in areas such as economics, sociology, languages, cinema studies, philosophy, history and music.

As part of the Faculty’s strategy to broaden students’ competencies and prepare them for leadership, in 2015–2016 we added four complementary studies courses through ILead:

- APS 343 Foundations of Engineering Leadership
- APS 444 Positive Psychology for Engineers
- APS 445 The Power of Story
- APS 446 Leadership in Project Management

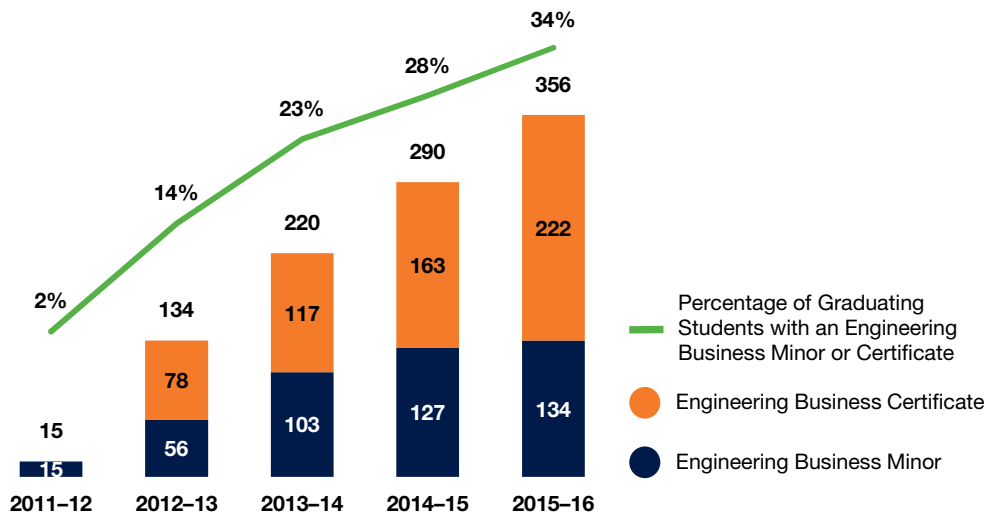
In 2016–2017, we will launch an additional course, APS 447 The Art of Ethical and Equitable Decision-Making.

We also introduced a new complementary studies elective – APS 120 Interdisciplinary Introduction to Sustainability – through the University Transition and Preparation Program (UT Prep). UT Prep is an eight-week summer preparatory program for students who have been admitted to U of T. The new course can be counted toward the Minor in Sustainable Energy.

Engineering Science students can customize their degrees by choosing from eight different majors in subjects from aerospace engineering to engineering physics. Our newest major in robotics engineering – launched in September 2015 – draws on expertise from electrical and computer engineering, computer science, mechanical engineering and aerospace studies, and was designed with a focus on perception, reasoning and acting as the three key functions of intelligent robots. Enrolment for 2016 has nearly doubled to 65 incoming third-year students.

We collaborate closely with other Faculties to broaden course options available to engineering students and to capitalize on research strengths across the University. In 2015, we signed an Interdivisional Teaching Agreement with the Faculty of Arts & Science that enables our Faculties to work together more effectively and guarantees a number of non-technical elective course slots for engineering students. We also strengthened interdisciplinary ties with the School of the Environment and the Department of Geography & Planning to enhance our Environmental Engineering Minor.

Figure 4.1b Students Graduating with an Engineering Business Minor or Certificate, 2011–2012 to 2015–2016



Undergraduate Design and Research Experiences

We embed engineering design throughout our undergraduate curriculum, enabling students in all years to experience the process of meeting a challenge, developing a solution and building and testing prototypes. The Centre for Engineering Innovation & Entrepreneurship (CEIE), which will include a 500-seat interactive auditorium, design/meet rooms, and rapid prototyping and fabrication facilities, will enhance design work across our programs. *(For more information about the CEIE, please see the introductory section of this report.)*

All undergraduates participate in engineering design courses in their first year. Engineering Science students take ESC 101 and 102 Praxis, and students in our General First Year and core programs take APS 111 and 112 Engineering Strategies and Practice. In both sets of courses, students learn the design process by addressing challenges proposed by industry and other clients while developing their competencies in teamwork, leadership and effective communication.

In 2015–2016, Praxis students were challenged to improve daily life in communities around the Greater Toronto Area. Designs presented in April 2016 at the Praxis showcase included:

- an accessible art station for children with fine-motor and cognitive delays;
- a mobile app that improves public engagement with the Allan Gardens Conservatory in downtown Toronto with a map to aid navigation and a virtual tour to help identify plants; and
- an improved drying system for rental skates at the Nathan Phillips Square skating rink outside Toronto's City Hall.

In their final year, all engineering students take on design challenges proposed by industry, other clients or themselves in capstone courses. Students may take discipline-specific capstone courses, including some that have an international focus. *(For more information, see Chapter 9: International Initiatives).*

Alternatively, they may enrol in APS 490 Multidisciplinary Capstone Project (MCP), which brings together undergraduate students from across the Faculty to work with leading companies and develop solutions to industry-proposed design challenges. Since the University of Toronto Institute for Multidisciplinary Design & Innovation (UT-IMDI) began offering the MCP course in 2012, 240 students from across all undergraduate programs have participated. In 2015–2016, 19 student teams worked with industry clients such as Astronauts for Hire, Bombardier, Defence Research & Development Canada, the Royal Bank of Canada and Sunnybrook Health Sciences Centre. Projects presented at the annual MCP Showcase in March 2016 included

an inexpensive, portable accessibility lift, microgravity experiments to improve astronaut training and student education, and a modernized approach to teaching land navigation courses in the Canadian Armed Forces.

MCP designs from previous years continue to make an impact. Xposure, an app that helps firefighters track hazards they come in contact with on the job, began in 2014–2015's MCP course as a project for the Hamilton Professional Firefighters Association. More than 50 Hamilton firefighters are now using the app, which was originally designed for iPhones and is now available for Android phones.

The Innovation, Hammers & Nails Initiative gives students at the Institute of Biomaterials & Biomedical Engineering (IBBME) the opportunity to design engineering solutions to challenges identified by clinicians, nurses, staff and fellows at the Hospital for Sick Children. Launched in fall 2015, this initiative is available to undergraduate and graduate students through a range of courses and degree programs, including BME 498 Biomedical Engineering Capstone Design and the MSc clinical internship. Projects included a 3D-printed eye for ophthalmology training and a wearable device to detect tripping hazards for elderly patients.

Undergraduates across all years have rich opportunities to engage in research that advances the frontiers of engineering, both within the Faculty and internationally. Through the Engineering Science Research Opportunities Program (ESROP), first- and second-year Engineering Science students work with faculty members each summer on research-based collaborations, exposing them early in their studies to the research process. Undergraduates across all programs who spent their summers working in laboratories at U of T Engineering presented their findings in August 2016 at the Undergraduate Engineering Research Day (UnERD). This annual event featured more than 100 poster and podium presentations on topics such as improving alternative energy production and preventing the formation of secondary organic aerosols, air pollutants that can cause health problems and impact climate change.

U of T Engineering students also have opportunities to conduct research abroad through programs administered by U of T's Centre for International Experience. Partner institutions include the National University of Singapore, Hong Kong University of Science & Technology and University of Stuttgart. Students in some programs have the option to receive degree credit for such exchanges through APS 299Y Summer Research Abroad. Engineering Science students who find their own research opportunities overseas can apply for an Exceptional Opportunities Award, which helps cover some of the costs associated with the placement. In 2015, students who received this

award conducted research at the Massachusetts Institute of Technology, Harvard University, the University of Michigan and the University of California, Berkeley, as well as the

German Aerospace Center and the Aldebaran AI Lab. (For more information on international opportunities for students, please see Chapter 9: International Initiatives.)

Figure 4.2a Undergraduate Participation in Summer Research Opportunities, 2010 to 2016

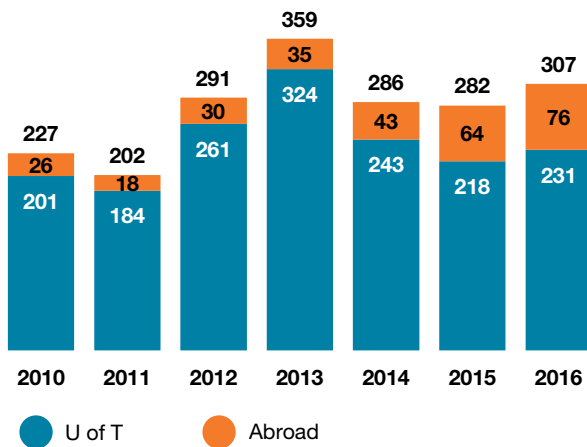


Figure 4.2b Undergraduate Participation in Summer Research Opportunities, by Academic Area, 2016

Research Participation:	U of T	Abroad	Total
ChemE	35	20	55
CivE & MinE	31	5	36
ECE	36	7	43
EngSci	70	38	108
MIE	38	5	43
MSE	16	1	17
Other (Non-Degree)	5	0	5
Total	231	76	307

Engineering Leadership

ILead provides transformative learning opportunities that prepare students to maximize their impact as engineers, innovators and leaders. In addition to curricular and co-curricular opportunities for students, ILead also conducts academic and industry-focused research and outreach to engineering leadership educators and engineering-intensive enterprises.

ILead offered five undergraduate and five graduate courses in 2015–2016, in areas ranging from leadership in project management to positive psychology for engineers. Our newest courses include:

- The Science of Emotional Intelligence and its Application to Leadership
- Engineering Careers – Theories and Strategies to Manage your Career for the Future

MEng students can count these courses toward the Entrepreneurship, Leadership, Innovation & Technology (ELITE) certificate, while undergraduate students can earn credits toward the Minor in Engineering Business or the Certificate in Engineering Leadership. Demand for these courses was strong; overall enrolment reached 512 students and many courses had significant waiting lists.

Engineering students also have opportunities to hone their leadership competencies in innovative co-curricular programs offered by ILead:

- Leadership Labs are highly experiential workshops ranging from evening sessions on project management, team conflict, public speaking, team culture, emotional intelligence and feedback to full-day labs on team skills and workplace readiness. In 2015–2016, ILead offered 25 co-curricular labs, and also delivered 17 labs as part of core courses. Students who attend four Leadership Labs are eligible for recognition on their Co-Curricular Records. Leadership Labs also provided work experience for five students, who were trained as co-facilitators.
- The Game challenges student teams to hone their leadership competencies by developing solutions to large-scale social problems. The program, which begins in September and culminates in a project showcase in March, attracted nine teams in 2015–2016. The \$5,000 top prize went to a team that developed an app to reduce food waste. A strategy to promote urban gardening took second prize, while a campaign against social media overuse came in third place.
- The ILead Summer Fellowship is a 16-week program for highly engaged engineering students who want to increase the impact of their student organization and their

leadership competencies. The program includes strategies for organizational development, peer learning and individual coaching.

- In summer 2016, ILead launched the Faculty-wide Summer Leadership Program. With the tagline ‘Engineer Your Future’, the eight-week course provides summer research students with opportunities to better understand their strengths and values, gain new perspectives on engineering and its impact on society, and be part of a vibrant and diverse community. It included field trips to the mechanical shops and subway control rooms of the Toronto Transit Commission (TTC) as well as a meeting with engineers from the City of Toronto.

Highlights from ILead’s academic and industry-focused research in 2015–2016 include:

- The Engineering Leadership Project II, a three-year study of engineers in the workplace. Co-sponsored by six companies,

the project asks questions such as: How do engineers lead? How do they learn to lead? How do they make the transition from school to work and from technical work to leadership work? Research results will inform curriculum in order to increase the workplace readiness of engineering students.

- The Team Effectiveness Learning System (TELS) is an online tool that enables students in large courses to get personalized feedback that can help them work more effectively in teams. Developed by Professor Patricia Sheridan (ILead) in work sponsored by the Higher Education Quality Council of Ontario, a plan for commercialization of TELS is being planned as a result of the tool’s success at U of T and interest from other universities.
- Case studies to present ethical and equity dilemmas that are relevant to engineering students. New pedagogy will frame discussion for active learning in a recently approved new course titled “The Art of Ethical and Equitable Decision Making in Engineering,” and in multiple other teaching opportunities.

Student Entrepreneurship

At U of T Engineering, we provide rich curricular and co-curricular opportunities for students to develop the technical and entrepreneurial competencies they need to take their ideas from concept to startup.

Curricular Programs

Undergraduates can complement their technical studies through our popular Engineering Business Minor or Certificate in Entrepreneurship, Innovation & Small Business. Through the Entrepreneurship, Leadership, Innovation & Technology in Engineering (ELITE) emphasis, MEng students can take courses that prepare them to lead in business and entrepreneurial activities.

Incubators

The Entrepreneurship Hatchery and Start@UTIAS, our two in-house incubators, provide mentoring, networking, seed funding and other resources to help our students develop and launch businesses. They also contribute to the larger ecosystem of entrepreneurship support across the University.

Start@UTIAS, established in 2014 with a \$1-million donation from entrepreneur Francis Shen (EngSci 8T1, UTIAS MAsc 8T3), provides UTIAS graduate students with mentoring, networking, seed funding and other resources

to translate the knowledge and competencies they have gained through their education into successful startups. Student teams are selected in December, work through two grant processes in March and June and present their pitches in September. Six teams pitched their business ideas in September 2015: 101 Sense, Diem Pouch, Kepler Communications, MedChart, MedTek Devices and teaBot. Seven teams are part of the 2015–2016 cohort.

The Hatchery, which will become an integral part of the CEIE when it opens in 2017, has launched 37 startups since 2013 and accepted 53 teams in its 2015–2016 cohort. The Hatchery promotes entrepreneurship through three distinct stages. In the first phase, students can attend a speaker series, weekly ideas market and events such as the Accelerator Weekend and the Hackathon. In the second stage, student teams develop business plans and apply for admission, with successful teams shifting their focus to developing a minimum viable product over the summer. The third stage begins with Hatchery Demo Day in September, when teams pitch their startups to investors and the University of Toronto community. From this stage, the Hatchery feeds the wider entrepreneurial ecosystem by launching teams into other accelerators and incubator programs in the community.

In January 2016, the four top teams from 2015 Hatchery Demo Day — three of which also participated in Start@UTIAS — received more than \$180,000 in grants from the

Ontario Centres of Excellence's SmartStart Seed Fund, which supports Ontario-based startups that are associated with campus-linked accelerators:

- **Diem Pouch** (\$30,000) has created a Bluetooth-enabled “smart pouch” that helps women remember to take birth control pills. It is improving basic features before beginning small-scale production for user testing and feedback. The company includes Valentin Peretroukhin (EngSci 1T3, UTIAS PhD candidate), Eric Ma (EngSci 1T3, IBBME MSc candidate), Tony Zhang (EngSci 1T3, UTIAS MSc candidate), Simon Bromberg (EngSci 1T3, IBBME MSc candidate), Sandra Fiset (MSc candidate) and Courtney Smith (MPH Epidemiology candidate).
- **Kepler Communications** (\$30,000) aims to improve communication in space by using small data-transmission satellites to build a space-based communications network that allows other satellites to transmit or receive data even when they are not near a ground station. It was one of nine companies selected to participate in winter 2016 in Techstars Seattle, a three-month technology accelerator that connects startups with training, mentors and funding to grow the businesses. The company includes engineering students Mina Mitry (EngSci 1T2, UTIAS MSc 1T4), Jeffrey Osborne (UTIAS PhD candidate), Wen Chen Chong (EngSci 1T3) and Mark Michael (ECE PhD candidate).
- **MedChart** (\$60,000) seeks to improve health care by centralizing patients' medical records from multiple health-care providers on a secure, cloud-accessible platform. In 2016, the company moved into space in the Banting & Best Centre for Innovation & Entrepreneurship, a U of T incubator, and partnered with the Techna Institute at the University Health Network. Founded by James Bateman (EngSci 1T3, ECE PhD candidate) and Derrick Chow (EngSci 1T3, UTIAS MSc candidate), it also secured an angel investment from Hero Ventures and expanded its team to seven people.
- **Telehex** (\$60,000) makes an all-in-one tool for adjusting the hexagonal-shaped sockets on most standard bicycles. The telescoping instrument automatically selects the correct size, making bike repairs faster and simpler. The company, started by Peter Wen (Year 3 MechE) has launched a Kickstarter campaign, and is developing the technical design, manufacturing and branding to start selling the product on a larger scale.

Alumni from previous incubator cohorts continue to innovate their products and develop their businesses. PheedLoop, an event and conference feedback app that was one of the top student startups at the Hatchery's 2014 Demo Day, was a finalist at the #IMEXpitch Technology Startup Competition in Las Vegas in October 2015. PheedLoop has also worked with Microsoft to power the event technology for its North American annual general meeting.

Heffernan Commercialization Fellowship

We support graduate student entrepreneurs through Heffernan Commercialization Fellowships, which provide \$17,000 per year for up to two years for MSc and PhD students or recent graduates to translate their research into working prototypes and bring their innovations to market. The fellowship, which was originally created in 1997 as the Heffernan/Co-Steel Innovation Post-Graduate Fellowship, was extended in 2013 with a gift of \$2.5 million from Gerald Heffernan (MMS 4T3).

In 2015–2016, the Heffernan Commercialization Fellowship went to Robert Brooks (MIE PhD 1T5). His company, SensOR Medical, has developed a force-sensing skin for endoscopic tools that helps surgeons better gauge how much force they are applying to tissues, reducing surgical complications from minimally invasive surgery. The fellowship will allow the company to conduct beta testing and develop manufacturing methods. The SensOR team, which also includes Justin Wee (ElecE 1T3, IBBME PhD candidate) and is advised by Thomas Looi (EngSci 0T0, UTIAS MSc 0T2, MBA 0T9, IBBME PhD candidate), has received a Banting & Best Centre for Innovation & Entrepreneurship Collaboration Fellowship and joined the Hatchery's 2016 cohort.

The Next 36

The Next 36 is a non-profit organization that seeks to increase Canada's economic prosperity by fast-tracking the development of Canada's most talented young entrepreneurs. Four U of T Engineering students and alumni are among 38 young innovators chosen to be part of The Next 36's 2016 cohort.

Nishant Samantray (MechE 1T5) is working on a startup called Tandem, which provides an online tool that integrates directly into developers' work flow, allowing them to make changes to their colleagues' code base in real time. Tandem received support from The Entrepreneurship Hatchery as part of the 2015 cohort.

Matthew Mazzuca (EngSci 1T6) is working on Mend, an app designed to ease the process of medical diagnosis. Users answer a series of questions to determine a pre-diagnosis, and are then able to book an appointment with a doctor.

Ashis Ghosh (MechE 1T5 + PEY) and **Karim Koreitem** (CompE 1T5 + PEY) met in U of T Engineering's Multidisciplinary Capstone Design course and quickly discovered a passion for entrepreneurship. They are working together on a startup that will leverage machine learning to provide simple solutions to data-rich problems.

Professional Experience

U of T Engineering offers undergraduate students rich opportunities to enhance their technical and professional competencies and gain significant work experience before they graduate through summer and year-long internships.

The Professional Experience Year (PEY) paid internship program is a key part of our Faculty's commitment to experiential learning. Through this optional program, students can work for leading companies worldwide after their second or third years of study. During this period, which lasts 12 to 16 months, they are full-time employees, with a competitive salary to match. PEY internships allow students to gain greater insights into workplace operations and make larger contributions than in the shorter co-op placements that many engineering schools offer. More than 70 per cent of PEY students who secure internships return to their studies with confirmed or tentative job offers in hand after they graduate.

In 2015–2016, a record 790 undergraduates — including 64 per cent of students from the previous year's third-year class — participated in the PEY internship program. The number who secured international placements increased to 79, from 61 in 2014–2015, as more students seek global engineering experience. More than 300 employers hired PEY students, ranging from startups such as EventMobi to large

multinational corporations such as Apple, Deloitte, IBM and Tesla Motors. The average annual salary for engineering PEY students in 2015 was \$50,000, with individual salaries ranging as high as \$104,000.

Students may also choose to participate in the Engineering Summer Internship Program (eSIP), a paid, four-month summer internship that is open to second- and third-year U of T Engineering undergraduates. Akin to a traditional co-op placement, the program provides students with work experience and prepares them to be competitive for future opportunities, including the PEY internship program. To enhance student success in the recruitment process, the program offers intensive and interactive development through a series of large- and small-group workshops and individual career counselling appointments. In summer 2016, 30 students secured eSIP opportunities with employers such as the Toronto Transit Commission, Geomechanica Inc., Amphenol Canada Corp., BlueCat, and Temporal Power Ltd.

The Engineering Career Centre provides workshops throughout the academic year to help PEY and eSIP students prepare their applications, succeed in job interviews and make a positive impact in the workplace.

Figure 4.3a PEY Internship Placements for Engineering Undergraduates with Percentage Participation from Previous Third-Year Class, 2006–2007 to 2015–2016

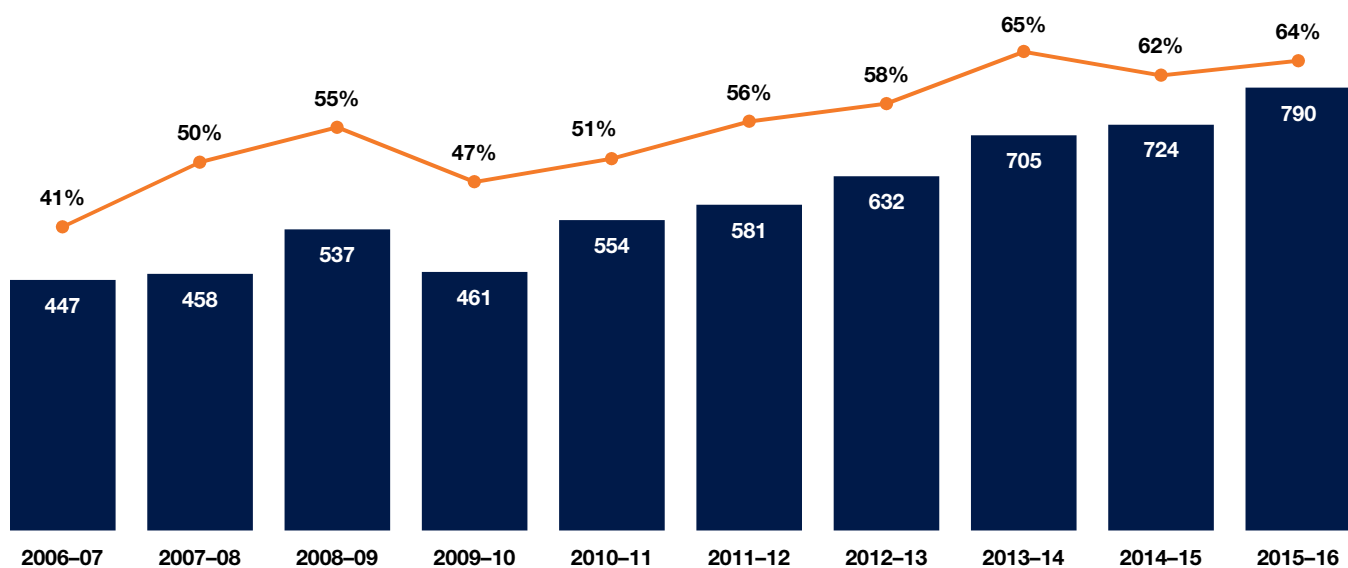


Figure 4.3b **Canadian and International PEY Internship Placements for Engineering Undergraduates, 2006–2007 to 2015–2016**

	Canadian Placements	U.S. Placements	Other International Placements	Total PEY Placements
2006–07	423	17	7	447
2007–08	427	23	8	458
2008–09	490	31	16	537
2009–10	426	24	11	461
2010–11	530	11	13	554
2011–12	547	26	8	581
2012–13	592	24	16	632
2013–14	644	36	25	705
2014–15	663	42	19	724
2015–16	711	50	29	790

Figure 4.3c **PEY Employers who Hired Engineering Students, 2009–2010 to 2015–2016**

	PEY Employers
2009–10	158
2010–11	185
2011–12	221
2012–13	241
2013–14	304
2014–15	317
2015–16	310

Engineering Communication

The Engineering Communication Program (ECP) is a leading hub for teaching, research and best practices in professional communication in engineering.

ECP is embedded in all years of our undergraduate programs, beginning with the first-year Praxis and Engineering Strategies and Practice courses. In upper years, ECP tailors its programs to the needs of each undergraduate program through standalone communication courses, portfolio classes and integration with the engineering design curriculum. It also coordinates the Certificate in Communication, which launched in 2015–2016 and graduated its first student in June 2016. The certificate leverages the suite of humanities and social sciences electives that have been offered by ECP faculty since 2008. In some departments, ECP faculty members train teaching assistants to give effective written and oral feedback, enhancing teaching excellence and the student experience.

ECP also offers individual tutoring to help undergraduates improve their writing and oral presentation skills in engineering courses, electives and other contexts such as job and graduate school applications. These tutoring sessions are held in person by appointment, during daily drop-in sessions or online. In 2015–2016, 833 students received communication support through this service.

ECP faculty members conduct research on engineering communication pedagogy and practice that enhances communication teaching throughout the Faculty and beyond. Areas of research include curriculum and program design, digital reusable learning objects, online teaching tools, information literacy and professional language development of multilingual students. In January 2016, ECP professor and founder Robert Irish published *Writing in Engineering: A Brief Guide*, which offers guidance on composing design reports, lab reports and other key engineering student assignments. To celebrate the program’s 20th anniversary, ECP also hosted a speaker series featuring leading experts in engineering communication from across North America. Topics included communication in project teams, integrating social context into education and the role of early diagnostic assessments in academic success.

ECP, which includes five faculty members and more than 35 sessional lecturers, writing instructors and teaching assistants, also gives students opportunities to explore creative writing through a series of workshops on topics ranging from poetry and literary non-fiction to science fiction and board game design.

Student Clubs and Teams

Our students nurture their passions and interests through more than 80 U of T Engineering student clubs and teams, ranging from the Skule™ Orchestra to the Blue Sky Solar Racing team, as well as hundreds of student activities across U of T. Students can document these activities in the U of T Co-Curricular Record, an official document that recognizes competencies gained through athletic teams, student government, cultural clubs, design teams and other campus organizations.

In 2015–2016, 104 undergraduate and graduate engineering student initiatives received \$249,266 through the Engineering Centralized Process for Student Initiative Funding. This process, which enables student groups to apply to various funding resources within the Faculty of Applied Science & Engineering in a single application, is widely seen among both funders and applicants as a significant improvement over past practices.

Please see Appendix A for a full list of student clubs and teams.

5

Our faculty members, staff and alumni continue to garner widespread recognition for outstanding achievements in research, teaching and community service. In 2015–2016, U of T Engineering received 21 per cent of major national and international awards won by engineering professors in this country – twice as many as any other Canadian school – with only 5.5 per cent of overall faculty members.

In the same period, U of T Engineering professors were recognized by their peers with distinguished awards from professional and technical societies. Dean Cristina Amon (MIE) received the Ontario Professional Engineers Awards Gold Medal, and Professor Andrew Goldenberg (MIE) received the A.G.L. McNaughton Gold Medal from the Institute of Electrical and Electronics Engineers Canada, both of which are the highest honours given out by the respective societies.

Early-career faculty members continued to win major international and national awards. Professor David Sinton (MIE) was inducted into the Royal Society of Canada College of New Scholars, Artists and Scientists in 2015 and received a 2016 NSERC Steacie Fellowship. Professor Warren Chan (IBBME) received the inaugural Kabiller Young Investigator Award from the International Institute for Nanotechnology. Professor Adam Steinberg (UTIAS) was the first recipient of the Hiroshi Tsuji Early Career Researcher Award.

Our faculty members continued to uphold their outstanding contributions to education. Professor Jonathan Rose (ECE) received the President's Teaching Award, the University of Toronto's highest award for teaching. Professor Greg Evans (ChemE) received an Ontario Confederation of University Faculty Associations Teaching Award. Professor Dawn Kilkenny (IBBME) garnered the Wighton Fellowship, a national award for excellence in laboratory teaching.

Senior faculty members garnered several highly distinguished awards. University Professor Molly Shoichet (ChemE, IBBME) was inducted into the U.S. National Academy of Engineering, one of two U of T professors who were among only four Canadians to be inducted in 2016. University Professor Ted Sargent (ECE) shared the prestigious NSERC Brockhouse Prize for Interdisciplinary Research. University Professor Michael Sefton (ChemE, IBBME) received the 2016 Terumo Global Science Prize, the first Canadian to receive this prize since its inception. Professor Elizabeth Edwards (ChemE) received a 2016 Killam Prize, among Canada's most distinguished research awards.

Staff members in several academic units were recognized for excellence in communications, design, events and publications by the Association of Marketing and Communication Professionals, the Council for Advancement and Support of Education and the International Association of Business Communicators.

Measuring Excellence

In the 2015 calendar year, U of T Engineering faculty members were recognized with 16 major awards and honours for excellence in research and teaching and contributions to the engineering profession. Fourteen of those awards were from prestigious national and international engineering bodies, twice as many as any other Canadian engineering school. That figure represented 21 per cent of all national and international awards received by engineering professors across Canada, even though our faculty members comprise only 5.5 per cent of engineering faculty members nationally.

Figure 5.1 Summary of Major International, National and Provincial Awards and Honours, 2006 to 2015

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
International										
AAAS Fellowships (Engineering Section)		2	4	4	6	5	3			1
MIT Top 35 Under 35			1				1			
U.S. National Academies*					1	1			1	
National										
3M Teaching Fellowship*		1								
Alan Blizzard Award		1							1	
Canadian Academy of Engineering Fellowships*	2	1	3	9	8	1	7	6	3	5
Engineering Institute of Canada Awards					1	2	1	2		1
Engineering Institute of Canada Fellowships	2	2	3	4	3	3	3	3	3	2
Engineers Canada Awards				1	3		1	1	1	1
Killam Prize*			1						1	
Killam Research Fellowships*			2		2					
Manning Innovation Award									1	
Royal Society of Canada Fellowships*	1	1	1	1	2	4	3		2	2
Royal Society of Canada College of New Scholars, Artists and Scientists									1	1
Steacie Fellowships*				1			2	1	1	1
Steacie Prize*							1			
Synergy Award for Innovation				1			1			
Provincial										
Ontario Professional Engineers Awards	1		3	4	4	5	3	2	2	1
OCUFA Teaching Award					1					1
Total	6	8	18	25	31	21	26	15	17	16

Data in this chapter are presented for the 2015 calendar year (January to December). Selected faculty, alumni and staff awards were received between summer 2015 and summer 2016.

Note 5.1: (*) denotes U of T performance indicator. Data shown are by calendar year (January to December) and include faculty award recipients only. Please see Appendix G to read descriptions of the listed awards and honours.

Figure 5.2a Number of Major National and International Awards Received by U of T Engineering Compared to Other Canadian Engineering Faculties, 2015

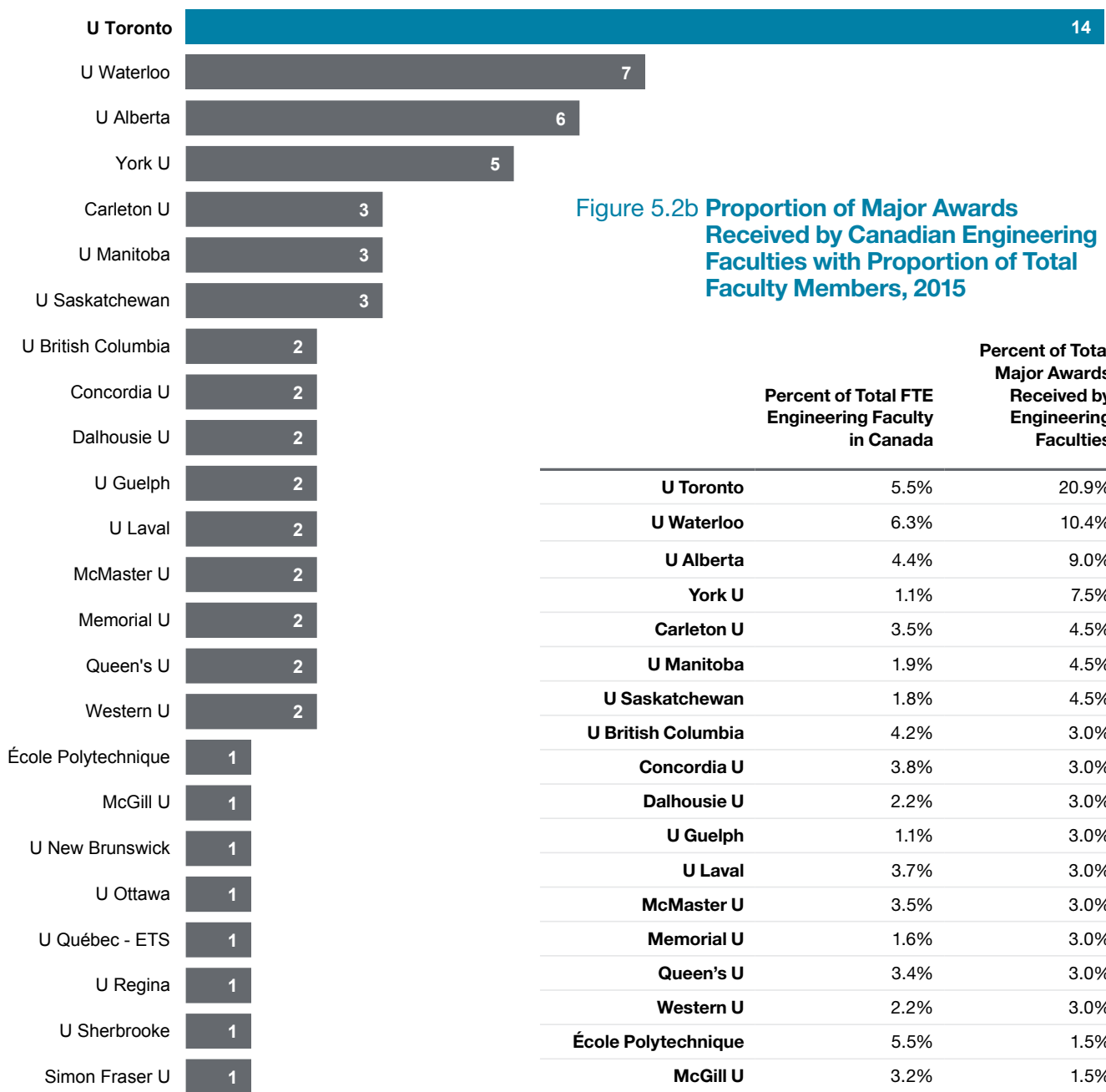
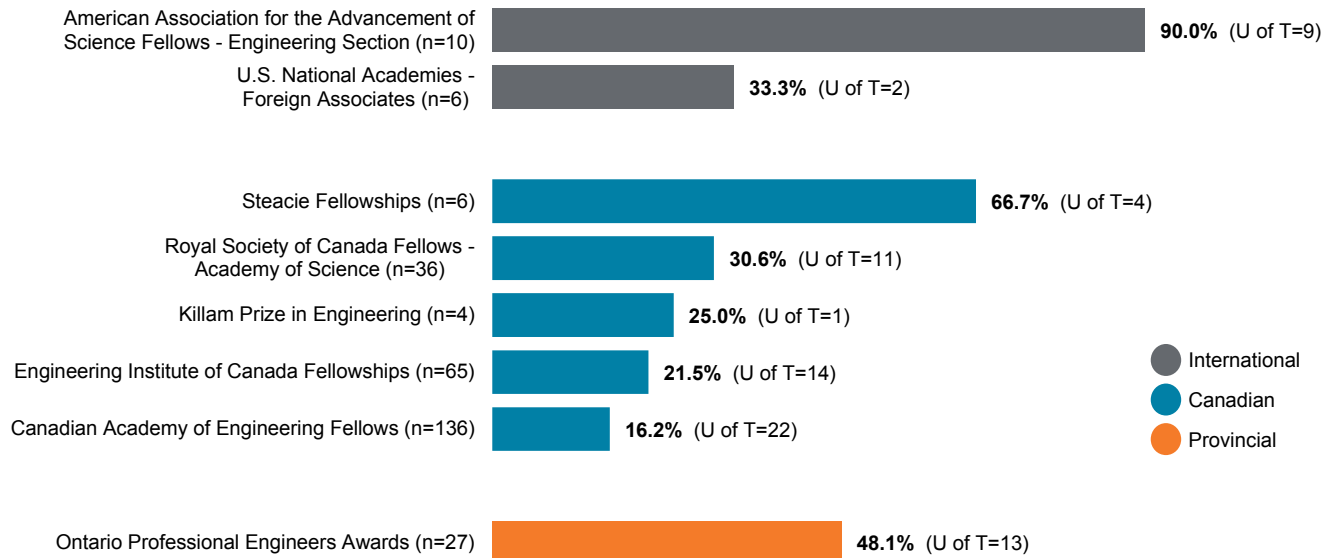


Figure 5.2b Proportion of Major Awards Received by Canadian Engineering Faculties with Proportion of Total Faculty Members, 2015

Faculty	Percent of Total FTE Engineering Faculty in Canada	Percent of Total Major Awards Received by Engineering Faculties
U Toronto	5.5%	20.9%
U Waterloo	6.3%	10.4%
U Alberta	4.4%	9.0%
York U	1.1%	7.5%
Carleton U	3.5%	4.5%
U Manitoba	1.9%	4.5%
U Saskatchewan	1.8%	4.5%
U British Columbia	4.2%	3.0%
Concordia U	3.8%	3.0%
Dalhousie U	2.2%	3.0%
U Guelph	1.1%	3.0%
U Laval	3.7%	3.0%
McMaster U	3.5%	3.0%
Memorial U	1.6%	3.0%
Queen's U	3.4%	3.0%
Western U	2.2%	3.0%
École Polytechnique	5.5%	1.5%
McGill U	3.2%	1.5%
U New Brunswick	1.6%	1.5%
U Ottawa	2.8%	1.5%
U Québec - ETS	7.9%	1.5%
U Regina	0.9%	1.5%
U Sherbrooke	5.0%	1.5%
Simon Fraser U	3.8%	1.5%

Note 5.2a and 5.2b: Data shown are by calendar year (January to December) and include faculty award recipients only. The following major awards are included: International — American Association for the Advancement of Science Fellowship (Engineering Section), MIT Top 35 under 35, U.S. National Academies; National — Alan Blizzard Award, Canadian Academy of Engineering Fellowship, Engineering Institute of Canada Award, Engineering Institute of Canada Fellowship, Engineers Canada Awards, Killam Prize (Engineering), Killam Research Fellowship, Manning Innovation Award, Royal Society of Canada Fellowship (Engineering/Physical Sciences), Royal Society of Canada College of New Scholars, Artists and Scientists, Steacie Fellowship, Steacie Prize and Synergy Awards for Innovation.

Figure 5.3 Number of Awards Received by U of T Engineering Faculty Compared to Other Canadian Engineering Faculties, 2011 to 2015



Selected Awards Received by Faculty Members and Alumni

The following is a selected list of awards U of T Engineering professors and alumni received between summer 2015 and summer 2016.

International

American Association for the Advancement of Science: *Fellow*

Greg Evans (ChemE)

American Concrete Institute: *Joe W. Kelly Award*

Frank Vecchio (CivE)

American Institute of Aeronautics and Astronautics: *Associate Fellow*

Kamran Behdinan (MIE)

American Society of Mechanical Engineers: *Fellow*

Kamran Behdinan (MIE)

Committee for the Status of Women in Computing Research: *Borg Early Career Award*

Natalie Enright Jerger (ECE)

The Combustion Institute and Elsevier: *Hiroshi Tsuji Early Career Researcher Award*

Adam Steinberg (UTIAS)

European Society for Biomaterials: *International Award*

Michael Sefton (ChemE, IBBME)

Institute for Operations Research and the Management Sciences: *Moving Spirit Award*

Dionne Aleman (MIE)

Institute of Electrical and Electronics Engineers: *Fellow*

Dimitrios Hatzinakos (ECE)

Institute of Electrical and Electronics

Engineers: *Robotics and Automation Award*

Raffaello D'Andrea (EngSci 9T1)

Institute of Materials, Minerals and Mining: *Fellow*

Paul Young (CivE)

International Academy of Food Science and Technology: *Lifetime Achievement Award*

Levente Diosady (ChemE)

International Institute for Nanotechnology: *Kabiller Young Investigator Award*

Warren Chan (IBBME)

Nanocem Research Network: *George C. Hoff Award for Concrete Technology*

Doug Hooton (CivE)

National Academy of Engineering (U.S.): *Foreign Member*

Molly Shoichet (ChemE, IBBME)

Réunion Internationale des Laboratoires et Experts des Matériaux: *Fellow*

Doug Hooton (CivE)

Terumo Foundation for Life Sciences and Arts: *Terumo Global Science Prize*

Michael Sefton (ChemE, IBBME)

Note 5.3: Data shown are by calendar year (January to December) and include faculty award recipients only.

National

Canadian Academy of Engineering: *Fellows*

Nazir Kherani (ECE, MSE)
Deepa Kundur (ECE)
Milica Radisic (IBBME, ChemE)
Murray Thomson (MIE)
Honghi Tran (ChemE)
William Breukelman (ChemE 5T5)
Elizabeth Croft (MIE PhD 9T5)
Samantha Espley (GEO 8T8)
John Gruzleski (PhD MMS 6T8)
Georges Kipouros (MAsc MMS 7T7, PhD 8T2)

Canadian Institute of Mining, Metallurgy and Petroleum: *Brimacombe Award*

Mansoor Barati (MSE)

Canadian Institute of Mining, Metallurgy and Petroleum: *Environmental Award*

Charles Jia (ChemE)

Canadian Society for Chemical Engineering: *Hatch Innovation Award*

Milica Radisic (IBBME, ChemE)

Canadian Society for Civil Engineering: *Fellow*

Jeff Packer (CivE)

Canadian Society for Civil Engineering: *Albert E. Berry Medal*

Robert Andrews (CivE)

Canadian Society for Civil Engineering: *Camille A. Dagenais Award*

Bryan Karney (CivE)

Canadian Society for Mechanical Engineering: *Fellow*

Lidan You (MIE)

Engineering Institute of Canada: *Fellow*

Kamran Behdinan (MIE)
Hugh Liu (UTIAS)
Heather MacLean (CivE)

Engineering Institute of Canada: *John B. Stirling Medal*

Marc Rosen (MechE 8T1, MAsc 8T3, PhD 8T7)

Engineering Institute of Canada: *Julian C. Smith Medal*

Doug Hooton (CivE)

Engineers Canada: *Meritorious Service Award for Community Service*

Marisa Sterling (ChemE 9T1)

Institute of Electrical and Electronics Engineers Canada: *A.G.L. McNaughton Gold Medal*

Andrew Goldenberg (MIE)

Killam Prize

Elizabeth Edwards (ChemE)

March of Dimes Canada: *Jonas Salk Pioneer Award*

Tom Chau (IBBME)

NSERC: *Brockhouse Prize for Interdisciplinary Research*

Ted Sargent (ECE)

NSERC: *E.W.R. Steacie Fellowship*

David Sinton (MIE)

Royal Canadian Institute: *Fleming Medal and Citation*

Molly Shoichet (ChemE, IBBME)

Royal Society of Canada: *Fellow*

Levente Diosady (ChemE)

Brendan Frey (ECE)

Royal Society of Canada: *Member, College of New Scholars, Artists and Scientists*

David Sinton (MIE)

Sandford Fleming Foundation: *Wighton Fellowship*

Dawn Kilkenny (IBBME)

Women's Executive Network:

Canada's Most Powerful Women Top 100

Siobhan Robinson (ChemE 0T9, MSE MAsc 1T0)

Jeanette Southwood (ChemE 8T6, MAsc 8T8)

Provincial

Ontario Professional Engineers Awards:

Gold Medal (2015)

Cristina Amon (MIE)

Ontario Confederation of University Faculty Associations:

OCUFA Teaching Award

Greg Evans (ChemE)

U of T

University Professor

Peter Zandstra (IBBME)

Distinguished Professor of Computational Aerodynamics and Sustainable Aviation

David Zingg (UTIAS)

Distinguished Professor of Mechanobiology

Craig Simmons (MIE, IBBME)

Distinguished Professor of Urban Systems Engineering

Mark Fox (MIE)

JJ Berry Smith Doctoral Supervision Award

David Zingg (UTIAS)

Massey College Senior Fellow

Grant Allen (ChemE)

President's Teaching Award

Jonathan Rose (ECE)

U of T Invention of the Year Award

Brendan Frey (ECE)

University Health Network Inventor of the Year Award

Milos Popovic (IBBME)

Selected Awards Received by Staff, April 2015 to April 2016

Association of Marketing & Communication Professionals

Hermes Creative Awards – Gold Winner:

Impact Magazine

Luke Ng (MSE)

Council for Advancement and Support of Education (CASE) District II (Middle Atlantic) Accolades Awards

Gold Award, Special Public Relations Projects

Category: *“Say Yes to Engineering” Campaign*

Engineering Strategic Communications, Engineering Recruitment and Engineering Outreach

Silver Award, Special Event (Individual Events)

Category: *CEIE Groundbreaking Event*

Engineering Strategic Communications and Engineering Advancement

International Association of Business Communicators

Gold Quill Excellence Award for Marketing, Advertising and Brand Communication:

CEIExSKAM – Centre for Engineering Innovation & Entrepreneurship Graffiti Installation

Engineering Strategic Communications and U of T Communications

Gold Quill Excellence Award for Publications:

2015 Annual Report of Performance Indicators

Engineering Strategic Communications and Office of the Dean

Gold Quill Merit Award for Marketing, Advertising and Brand Communications and Silver Leaf Award for Marketing Communication:

“Say Yes to U of T Engineering” Campaign

Engineering Strategic Communications, Engineering Student Recruitment & Retention and Engineering Student Outreach

Gold Quill Merit Award for Special Events and Silver Leaf Award for Special Events – External:

CEIE Groundbreaking Event

Engineering Strategic Communications, Engineering Advancement & Alumni Relations and U of T Advancement Communications

Not-for-Profit Communication Department of the Year

Engineering Strategic Communications and University of Toronto Communications

University of Toronto Engineering Faculty Awards

Each year, U of T Engineering recognizes the excellence of our staff and faculty through a number of awards for research, teaching, leadership and dedication to improving the student experience. This year's awards were presented at the Celebrating Engineering Excellence event held April 14, 2016.

Agnes Kaneko Citizenship Award

Presented to a staff member who has served with distinction and made contributions to the Faculty's mission above and beyond their job description over a long period of time. This award was established in memory of a dedicated Civil Engineering staff member.

2015–16: Matthew Chow (ECE)

2014–15: Belinda Li (ECE)

2013–14: Oscar del Rio (MIE)

2012–13: Mary Stathopoulos (ECE)

Harpreet Dhariwal Emerging Leader Award

Presented to a staff member who leads by example in their dedication to the Faculty's mission. Recipients are held in high regard by colleagues and demonstrate potential to assume more senior leadership roles within the Faculty. This award was renamed in memory of an esteemed staff member who received this honour in 2011–2012.

2015–16: Bruno Korst (ECE)

2014–15: Kelly Hayward (ECE)

2013–14: Luke Ng (MSE)

2012–13: Tom Nault (Office of the Registrar)

Influential Leader Award

Presented to a staff member who demonstrates exemplary support for the Faculty's education and research endeavours. Recipients inspire others to realize their potential through their significant and sustained contributions.

2015–16: Leslie Grife (First Year Office)
2014–15: Joe Baptista (MIE)
2013–14: Lisa Camilleri (Office of the Dean)
2012–13: Sandra Walker (IBBME)

Innovation Award

Presented to staff who, individually or as a team, address a problem creatively by developing a new technology or making significant improvements to an existing system or method.

2015–16: Roberta Baker, Raymond Cheah, Shilpa Gantotti and Catherine Riddell (Engineering Strategic Communications)
2014–15: Darlene Gorzo, Jaro Pristupa and Joe Wong (ECE)
2013–14: Tomas Bernreiter (MIE)
2012–13: Khuong Doan, Adam Fox, Linda Marsh, Sergei Metropolitanansky and Dan Pettigrew (Office of the Registrar)

McCharles Prize for Distinction in Early Career Research

The McCharles Prize was originally established in 1907 by Aeneas McCharles through a gift to the Faculty of Applied Science & Engineering at the University of Toronto. In 2007, the Faculty and the University re-established the McCharles Prize as an award for exceptional performance and distinction in early career research, typically on the part of a pre-tenure member of the Faculty of Applied Science & Engineering.

2015–16: Adam Steinberg (UTIAS)
2012–13: Joyce Poon (ECE)
2009–10: Craig Simmons (MIE, IBBME)
2007–08: Wei Yu (ECE)

Quality of Student Experience Award

Presented to a staff member who has made significant improvements to the quality of student experience.

2015–16: Carla Baptista (MIE)
2014–15: Mike Mehramiz (ECE)
2013–14: Susan Grant (ECE)
2012–13: Deborah Peart (ChemE, MIE)

Research Leader Award

Presented to a faculty member or team who has shown leadership in innovative, interdisciplinary and/or collaborative research initiatives that has enhanced the Faculty's research profile within the broader community.

2015–16: Alberto Leon-Garcia (ECE)
2014–15: Honghi Tran (ChemE)
2013–14: Javad Mostaghimi (MIE)
2012–13: Elizabeth Edwards, Radhakrishnan Mahadevan and Emma Master (ChemE)

Engineering Alumni Association Awards

The Engineering Alumni Association's annual awards honour graduates for outstanding contributions to U of T Engineering and to the profession. This year's awards will be conferred in November 2016.

L.E. (Ted) Jones Award of Distinction

Inspired by the contributions of Professor Emeritus L.E. (Ted) Jones, this award honours an alumnus/alumna for his or her support and dedication to U of T Engineering and its arts community.

2015–16: Xiao Fionna Gan (EngSci 1T6)
2014–15: Luca Casciato (MechE 1T5); Haruna Monri (CivE 1T5)
2013–14: Christopher Sun (EngSci 1T3 + PEY)
2012–13: Ryan Alafritz (IndE 1T2 + PEY); Thineshan Kathirchelvan (EngSci 1T2 + PEY)

7T6 Early Career Award

Presented to an alumnus/alumna 10 years after graduation who is distinguished in the profession and community.

2015–16: Gimmy Chu (ElecE 0T6)
2014–15: Stefanie Blain-Moraes (EngSci 0T5); Todd Reichert (EngSci 0T5)
2013–14: Mathew Szeto (CompE 0T4)
2012–13: Terrence Michael Branch (CompE 0T3)

2T5 Mid-Career Achievement Award

Presented to an alumnus/alumna 25 years after graduation who has earned respect within the profession and broader community, attained significant achievement and exhibits promise of further contributions.

2015–16: Raffaello D'Andrea (EngSci 9T1)
2014–15: Janet Elliot (EngSci 9T0); Suneet Tuli (CivE 9T0)
2013–14: Ted Maulucci (MechE 8T9)
2012–13: Samantha Espley (MinE 8T8)

Malcolm F. McGrath Alumni Achievement Award

Named in honour of Malcolm McGrath on his retirement as assistant dean, alumni liaison, this award recognizes contributions of personal service to the Faculty, University or to the greater community.

2015–16: Ross Pitman (GeoE 7T4)
2014–15: R. Christopher Hinde (CivE 5T0)
2013–14: Caprice Boisvert (MechE 9T3)
2012–13: Claire Kennedy (ChemE 8T9)

Engineering Alumni Hall of Distinction Award

The Hall of Distinction is an assembly of extraordinary alumni, selected by their peers for their lifelong accomplishments. These are graduates who have ultimately defined what is most exemplary in the engineering profession.

2015–16:
Paul Henderson (EngBus 5T7)
Ali Khademhosseini (ChemE 9T9, IBBME MASc 0T1)
Ronald Sidon (IndE 6T6)
John Weber (MechE 7T9)

2014–15:
William Breukelman (ChemE 5T5)
Jan Carr (ElecE 6T8)
Jay Cross (EngSci 7T5)
Emil Frind (CivE 6T6)

2013–14:
Prabha Kundur (ElecE MASc 6T5, ECE PhD 6T7)
Gerald Smith (MechE 8T7)
Som Seif (IndE 9T9)
William Troost (ChemE 6T7)

2012–13:
Anthony Lacavera (CompE 9T7)
Lee Lau (ElecE 7T7, ECE MEng 8T2)
Donald Sadoway (EngSci 7T2, MSE MASc 7T3, MSE PhD 7T7)
David Wilkinson (EngSci 7T2, MSE MASc 7T4)
Anna Dunets Wills (CivE 7T6)

Engineering Alumni Medal

As the Engineering Alumni Association's highest honour, this award is presented to an alumnus/alumna who has demonstrated superior accomplishment and serves as an outstanding role model for students.

2015–16: David Colcleugh (ChemE 5T9, MASc 6T0, PhD 6T2)
2014–15: Frank Dottori (ChemE 6T3)
2013–14: Arthur Slutsky (EngSci 7T0, MIE MASc 7T2)
2012–13: Paul Cadario (CivE 7T3)

Honorary Member – Engineering Alumni Association

2015: Ronald D. Venter (MIE)

6

We evaluate our excellence by diverse factors, including the exceptional calibre of applicants to our programs, growing recognition of our world-class research, and the large number of prestigious awards and honours our faculty receive. In a competitive global environment for higher education, rankings are another indicator of distinction. The international visibility resulting from our outstanding rankings enables us to attract top students, faculty and industry collaborators, strengthening our position as a leader in engineering education and research.

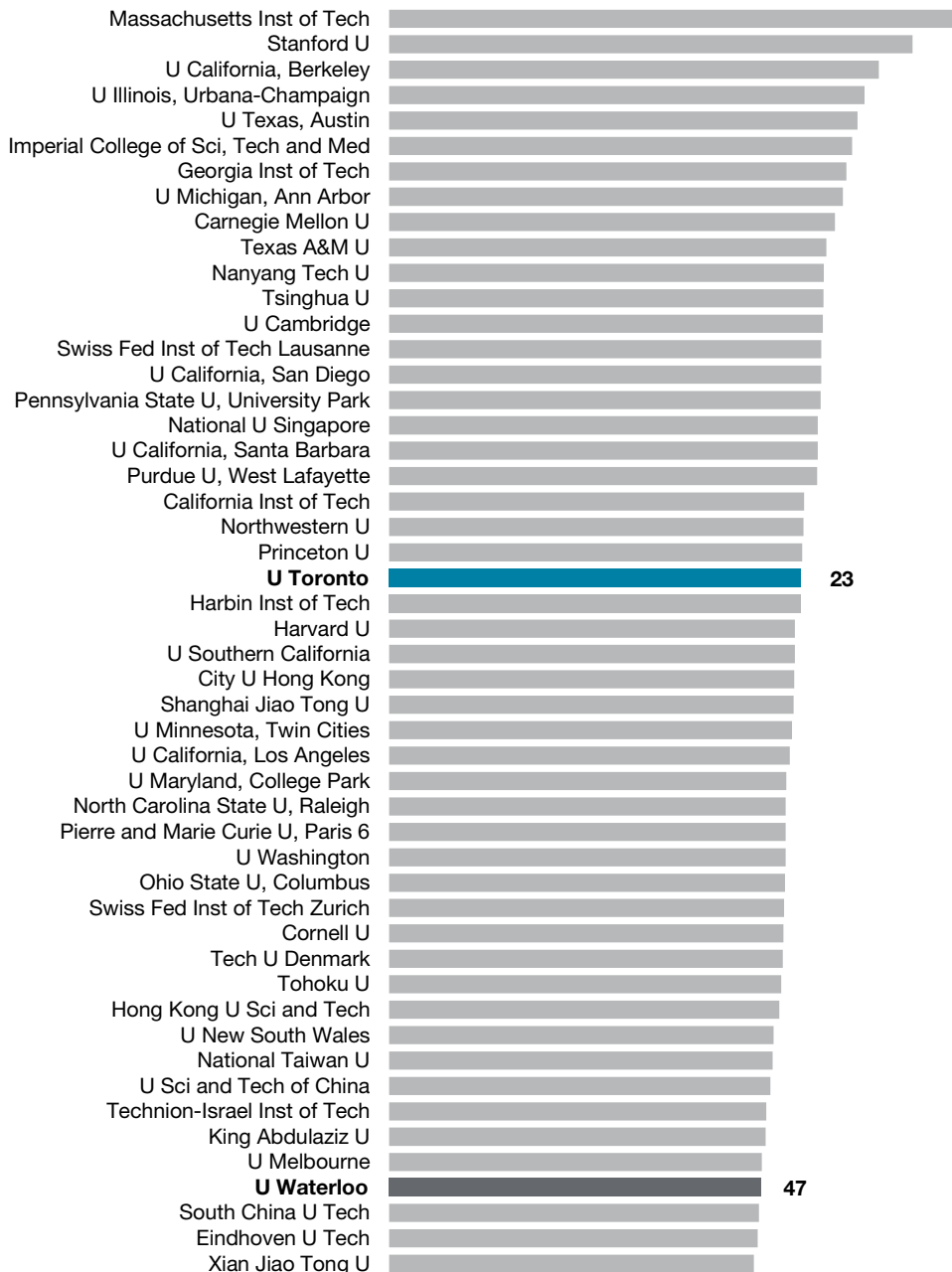
Our Faculty is the leading Canadian engineering school and among the best in the world across all international rankings. In 2015, U of T was the only Canadian university to rank in the top 25 schools globally in the Shanghai Jiao Tong Academic Ranking of World Universities (ARWU) for Engineering/Technology and Computer Sciences, and the Times Higher Education (THE)–Elsevier World University Ranking for Engineering and Information Technology. It was also the sole Canadian school in the top 50 in the QS World University Rankings for Engineering and Information Technology (QS) and the National Taiwan University (NTU) Performance Ranking of Engineering Papers. U of T Engineering distinguished itself as a North American leader by placing among the top 10 public universities — our closest peer institutions — in three of four rankings.

Subject rankings once again recognized the breadth and depth of our excellence. U of T Engineering placed first among Canadian universities in five out of six subjects in the QS ranking, and in four out of six subjects in the NTU, demonstrating our pre-eminence across diverse engineering fields.

Comprehensive University Rankings

Shanghai Jiao Tong Academic Ranking of World Universities (ARWU) for Engineering/Technology and Computer Sciences

Figure 6.1a ARWU Top 50 World Universities, 2015



U of T ranked among the premier universities worldwide in the 2015 Shanghai Jiao Tong Academic Ranking of World Universities (ARWU) for Engineering/Technology and Computer Science, advancing to 23rd globally, the highest of any Canadian university.

We were also the only Canadian school in the top 25. Among North American public universities, our closest peer institutions, U of T ranked 11th, and was one of only two Canadian universities in the top 25.

U of T led Canadian schools in highly cited research and articles in top journals, two of three indicators that constitute the ARWU's evaluation methodology.

The ARWU is the longest running of the global rankings. It has provided overall rankings since 2003 and engineering field rankings since 2007.

Data in this chapter include rankings published between August 2015 and July 2016.

Figure 6.1b ARWU Top North American Public Universities, 2015

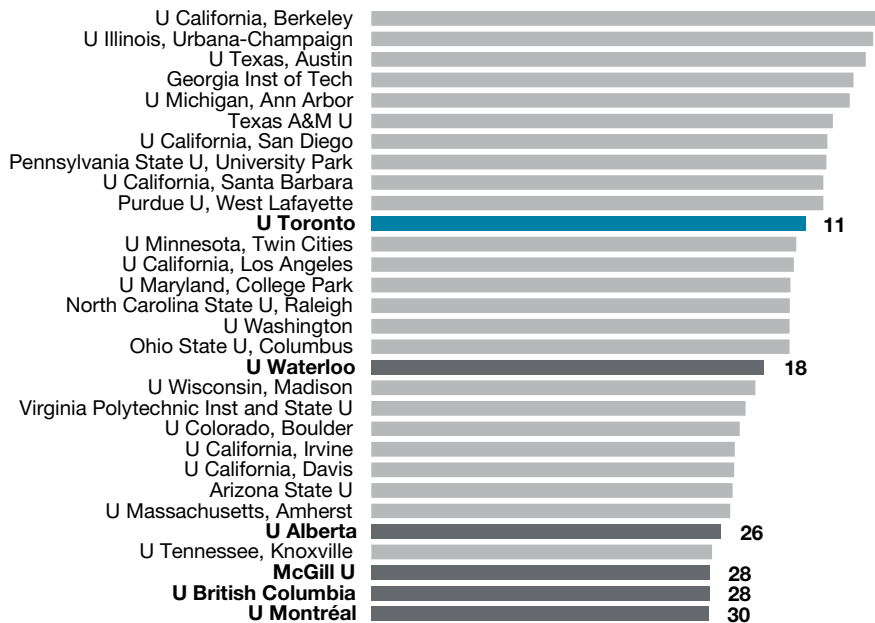
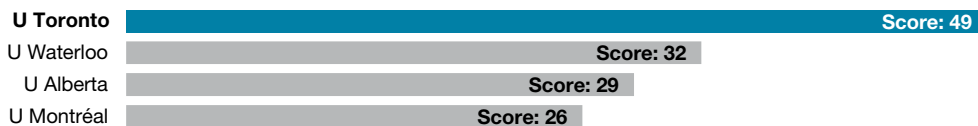


Figure 6.1c Canadian U15 Universities in ARWU Top 200, 2015



Figure 6.1d Scoring Analysis of Canadian U15 Universities in ARWU Top 100, 2015

Scoring on Highly Cited Research: (HiCi) Indicator



Scoring on Published Articles: (PUB) Indicator



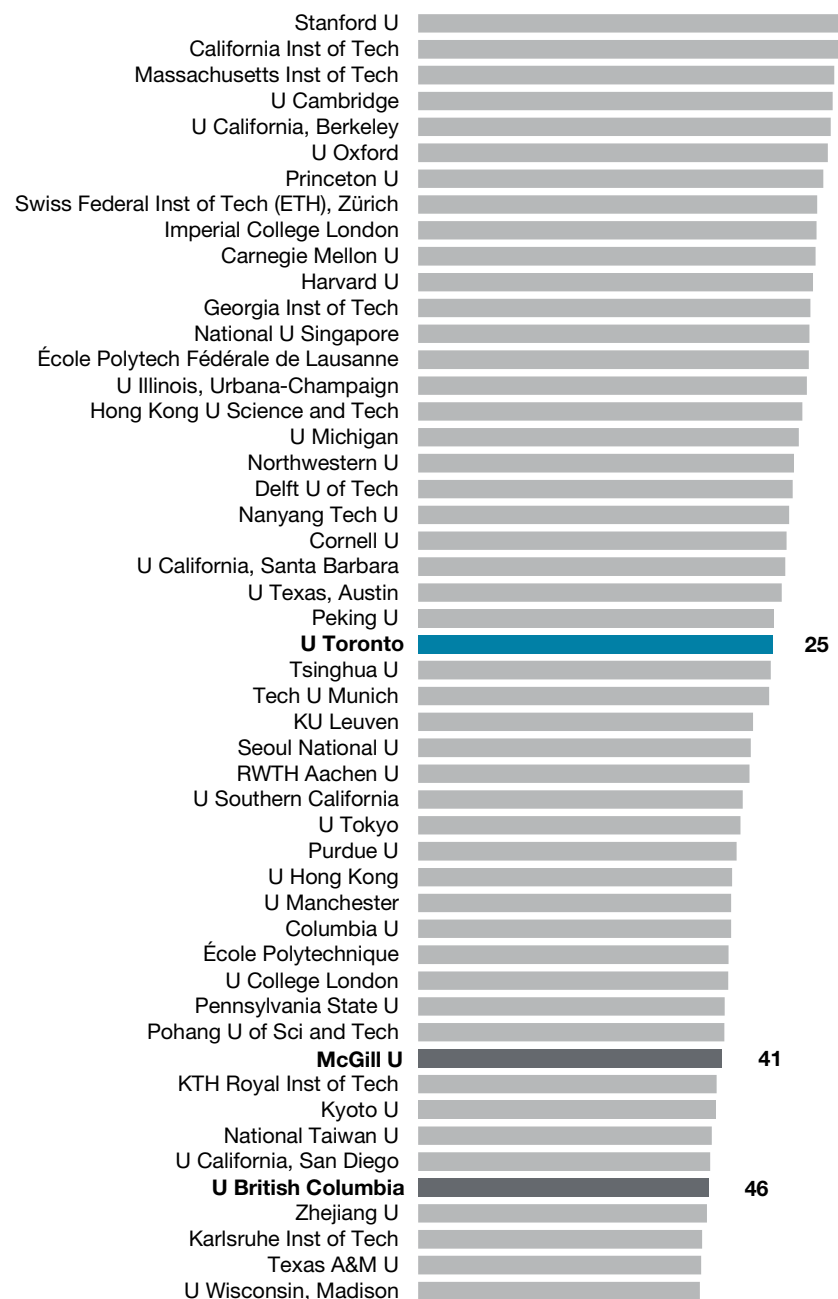
Scoring on Articles in Top Journals: (TOP) Indicator



Note 6.1d: In addition to HiCi, Pub and TOP, the ARWU uses a fourth indicator called Research Expenditures (FUND), which is used only for U.S. schools. Research funding mechanisms differ so significantly from country to country that all other international universities, including Canadian universities, are ranked using only the first three indicators.

Times Higher Education (THE)–Elsevier World University Ranking for Engineering and Information Technology

Figure 6.2a THE Top 50 World Universities, 2015



U of T was the top Canadian university in the Times Higher Education (THE)–Elsevier World University Ranking for Engineering and Information Technology, placing 25th overall and seventh among North American public universities. Only two other Canadian schools – McGill University and the University of British Columbia – placed among the top 50 universities in the world for these subjects.

THE is the second-longest running survey of its kind after the ARWU. What sets THE apart as an influential assessment of global, research-intensive universities is the breadth of its evaluation, which aims to measure institutions across all their core missions: teaching, research, knowledge transfer and international outlook. The THE ranking uses 13 performance indicators in five weighted categories:

- Teaching: the learning environment (30 per cent)
- Research: volume, income and reputation (30 per cent)
- Citations: research influence (30 per cent)
- International outlook: staff, students and research (7.5 per cent)
- Industry income and innovation (2.5 per cent)

Figure 6.2b THE Top North American Public Universities, 2015

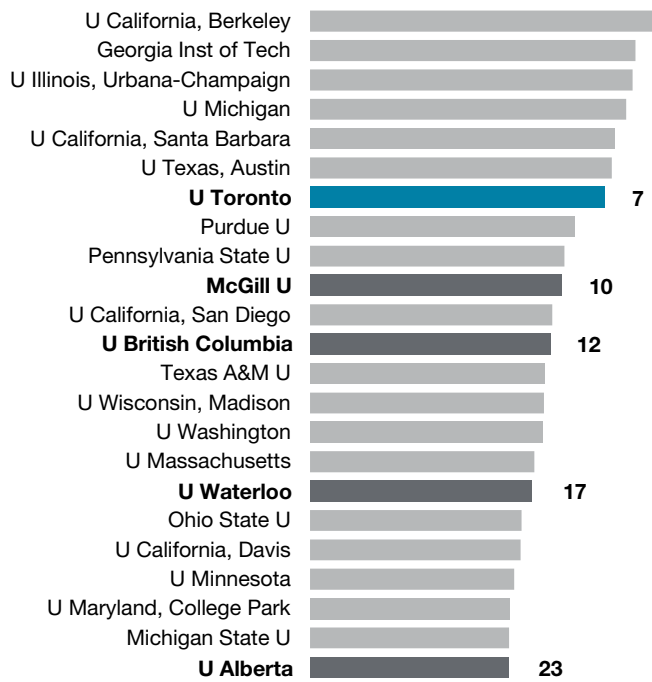


Figure 6.2c Canadian U15 Universities in THE Top 100, 2015



QS World University Rankings for Engineering and Information Technology

Figure 6.3a QS World University Rankings, Top 50 Universities for Engineering and Information Technology, 2015

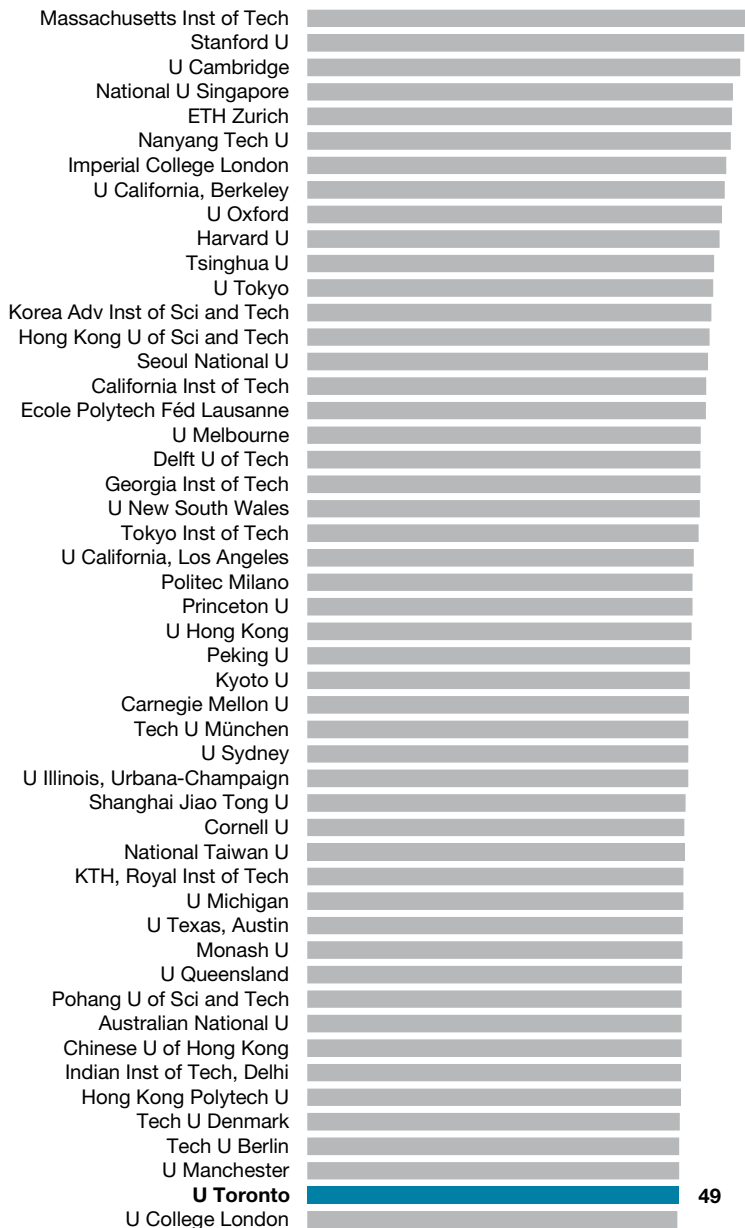


Figure 6.3c Canadian U15 in Top 200 from QS World University Rankings for Engineering and Information Technology, 2015

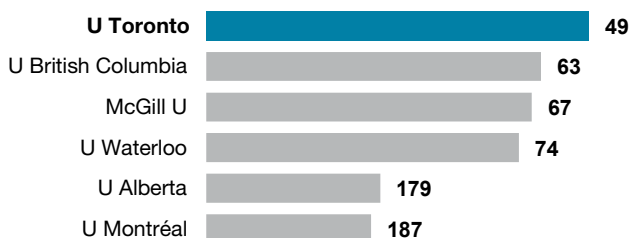
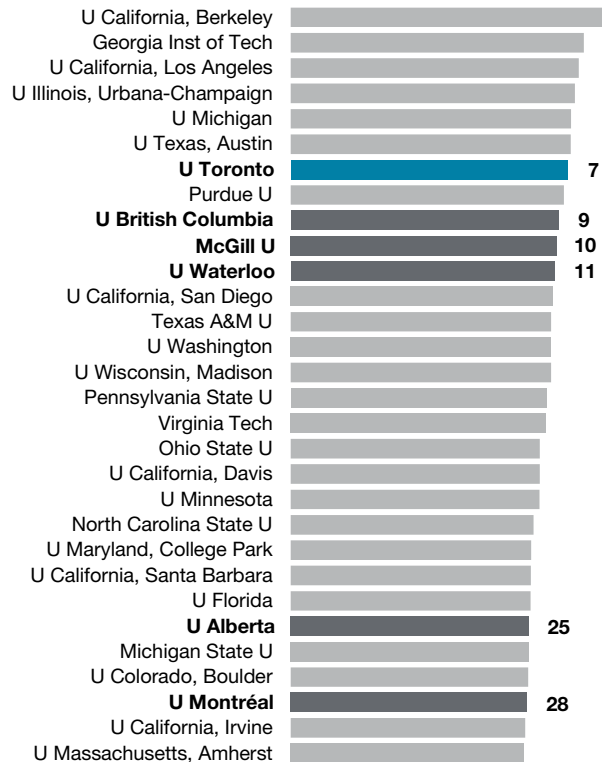


Figure 6.3b QS World University Rankings, Top North American Public Universities for Engineering and Information Technology, 2015

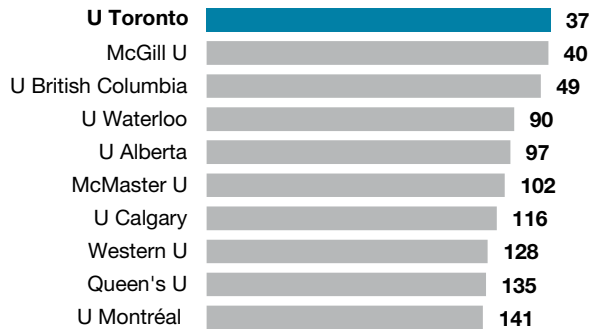


U of T Engineering, once again, outperformed all other Canadian universities in the QS World University Rankings for Engineering and Information Technology and was the only Canadian school in the top 50. We were also recognized as one of the premier North American public universities, placing seventh among these peer institutions. U of T ranked the highest of any Canadian engineering school in five out of six engineering and information technology subjects, demonstrating our broad strength.

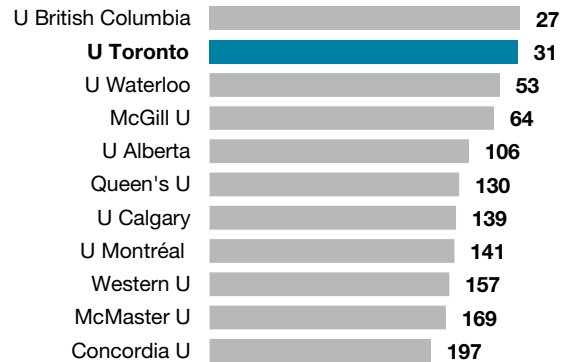
Despite our position in the QS ranking, U of T Engineering, like all Canadian U15 engineering schools in the top 200 globally, experienced volatility in the rankings. Several U15 schools that had placed within the top 200 in 2014 fell below this threshold in 2015. Nearly all of the top engineering programs at North American public universities also dropped in the global rankings, but within this subset there was a high degree of stability relative to one another. The subject-level rankings also remained stable year-over-year, especially among North American peer institutions.

Figure 6.3d Canadian Universities in QS by Subject, 2016

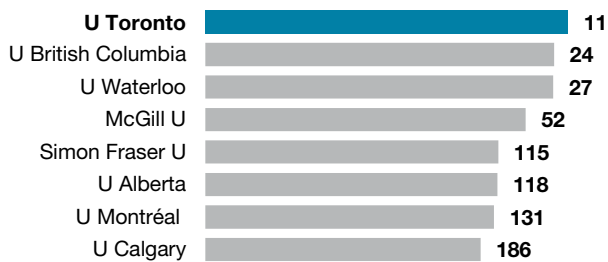
Chemical Engineering



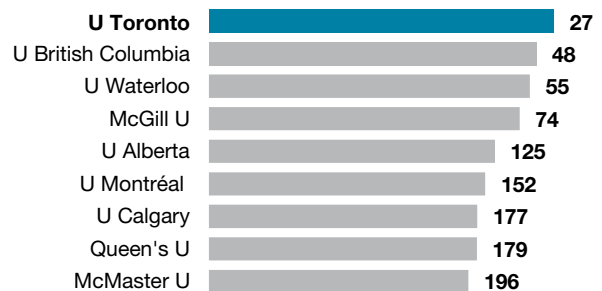
Civil & Structural Engineering



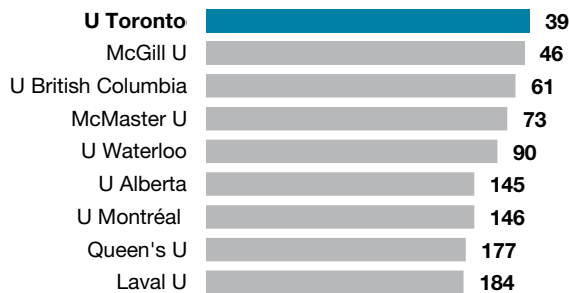
Computer Science & Information Systems



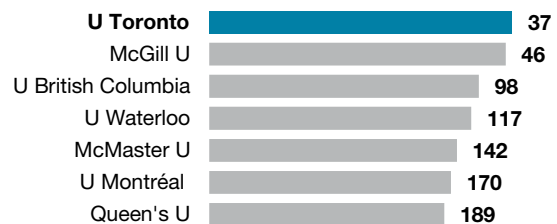
Electrical & Electronic Engineering



Materials Sciences



Mechanical, Aeronautical & Manufacturing Engineering



While QS has not communicated any changes in methodology in its Faculty-level rankings, the volatility noted above suggests a modification that may have had a regional impact. It is unclear if this has any relation to the major changes QS implemented in its 2015 ranking methodology that sought to both balance citation performance across all disciplines and adjust for regional variations globally. The changes negatively impacted the overall rankings of research-intensive universities with strengths in life sciences and medicine, including all Canadian universities of this type.

Although the QS Subject Rankings are dated 2016 and are announced in March, six months after the September release of the University and Field Rankings, they are based on the same data as the rankings shown above in Figures 6.3a through 6.3c. For further information about the methodological changes QS implemented in 2015, please see www.iu.qs.com/2015/09/methodology-refinements-explanations-by-martin-ince/.

National Taiwan University (NTU) Performance Ranking of Engineering Papers

U of T Engineering ranked 39th globally and first in Canada in the National Taiwan University Performance Ranking of Engineering Papers. It also placed in the top tier of North American public universities, in eighth place.

NTU uses the publication of engineering papers to identify and compare the top 200 universities in the world by subject. NTU's ranking is based on eight weighted criteria grouped into three broad categories:

Research Productivity

- Total number of articles published in the past 11 years (2004–14) [10 per cent]
- Total number of articles published in the most recent year reported (2014) [15 per cent]

Research Impact

- Total number of citations in the past 11 years (2004–14) [15 per cent]
- Total number of citations in the past two years (2013–14) [10 per cent]
- Average annual number of citations over the past 11 years (2004–14) [10 per cent]

Research Excellence

- H-index (measures productivity and impact of published work) of the past two years (2013–14) [10 per cent]
- Number of highly cited papers in the past 11 years (2004–14) [15 per cent]
- Number of papers published in high-impact journals in the current year (2014) [15 per cent]

Figure 6.4a NTU Top 50 World Universities, 2015

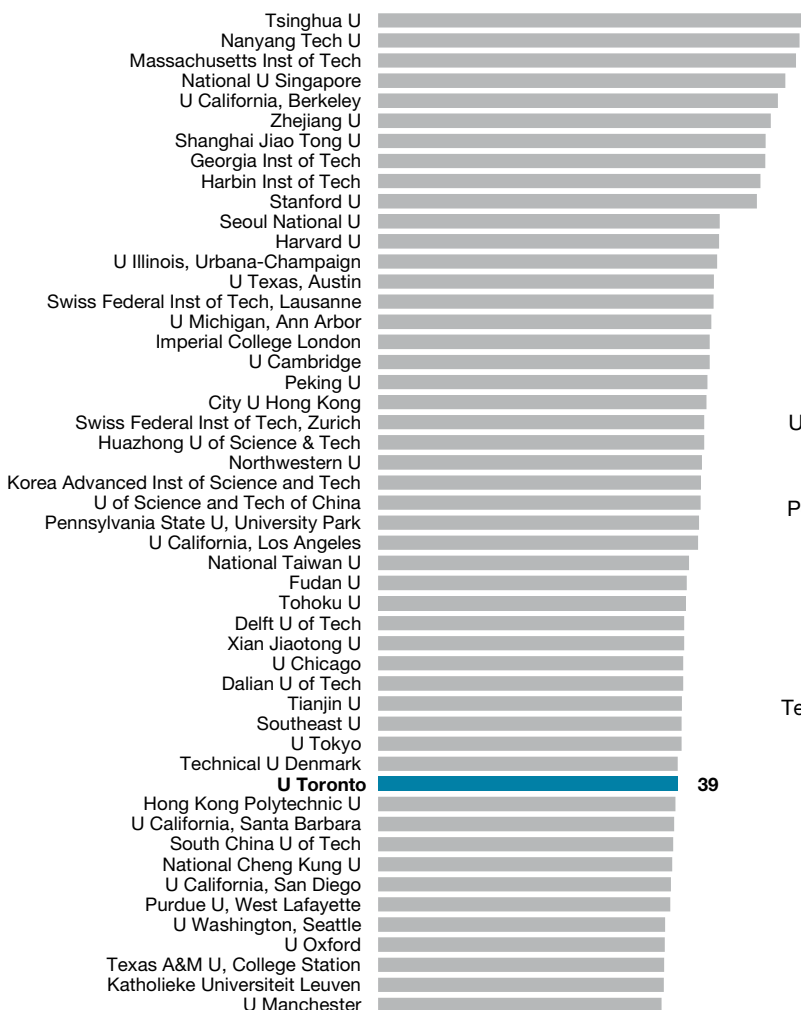
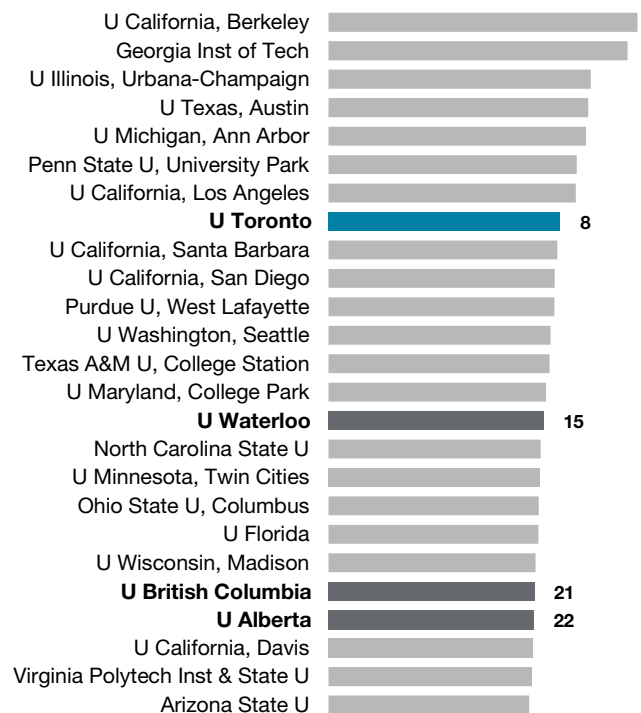


Figure 6.4b NTU Top North American Public Universities, 2015



U of T Engineering placed first among Canadian institutions in four out of six subjects in NTU's rankings of engineering and information technology subject areas. U of T's Civil and Electrical Engineering programs were particularly strong, respectively ranking 23rd and 26th globally.

Figure 6.4c Canadian U15 Universities in NTU Top 200, 2015

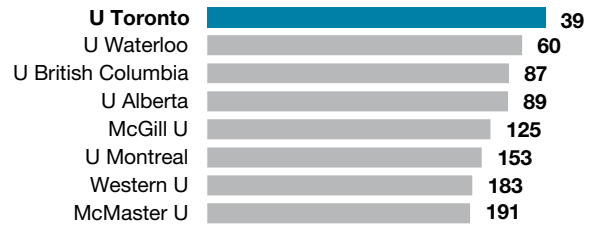
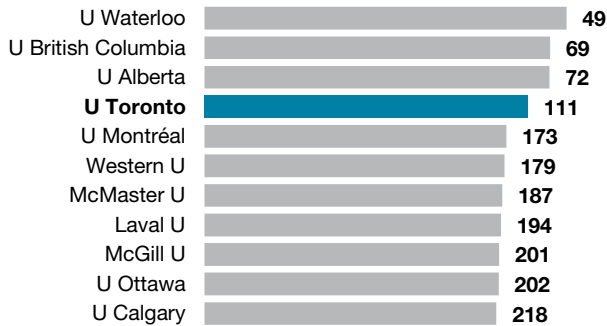
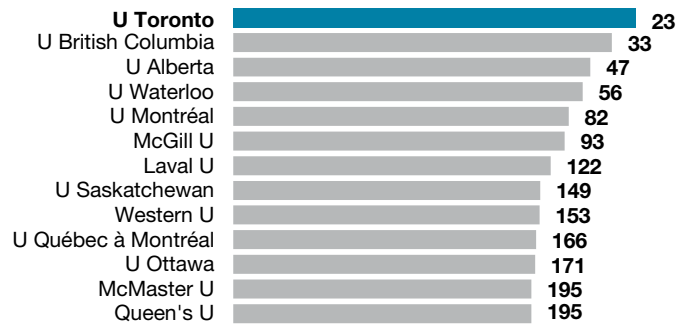


Figure 6.4d Canadian Universities in NTU by Subject, 2015

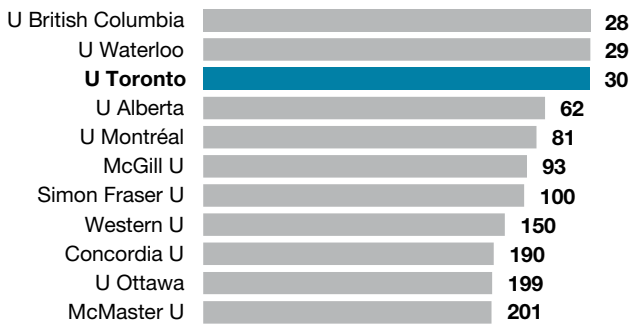
Chemical Engineering



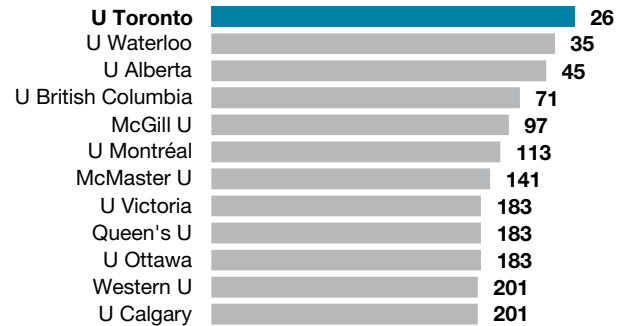
Civil Engineering



Computer Science



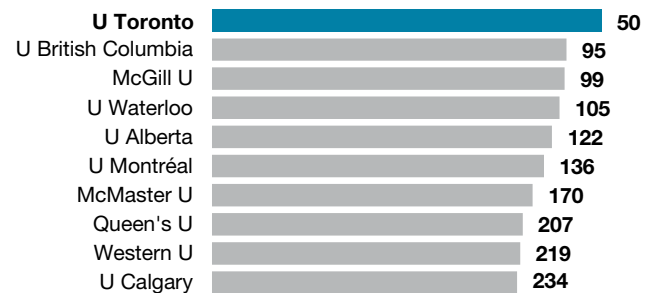
Electrical Engineering



Materials Science



Mechanical Engineering



Rankings Based on Publications and Citations

Figure 6.5a Number of Engineering Publications Indexed by Thomson Reuters for Association of American Universities (AAU) Public and Canadian Peer Institutions, 2010 to 2014

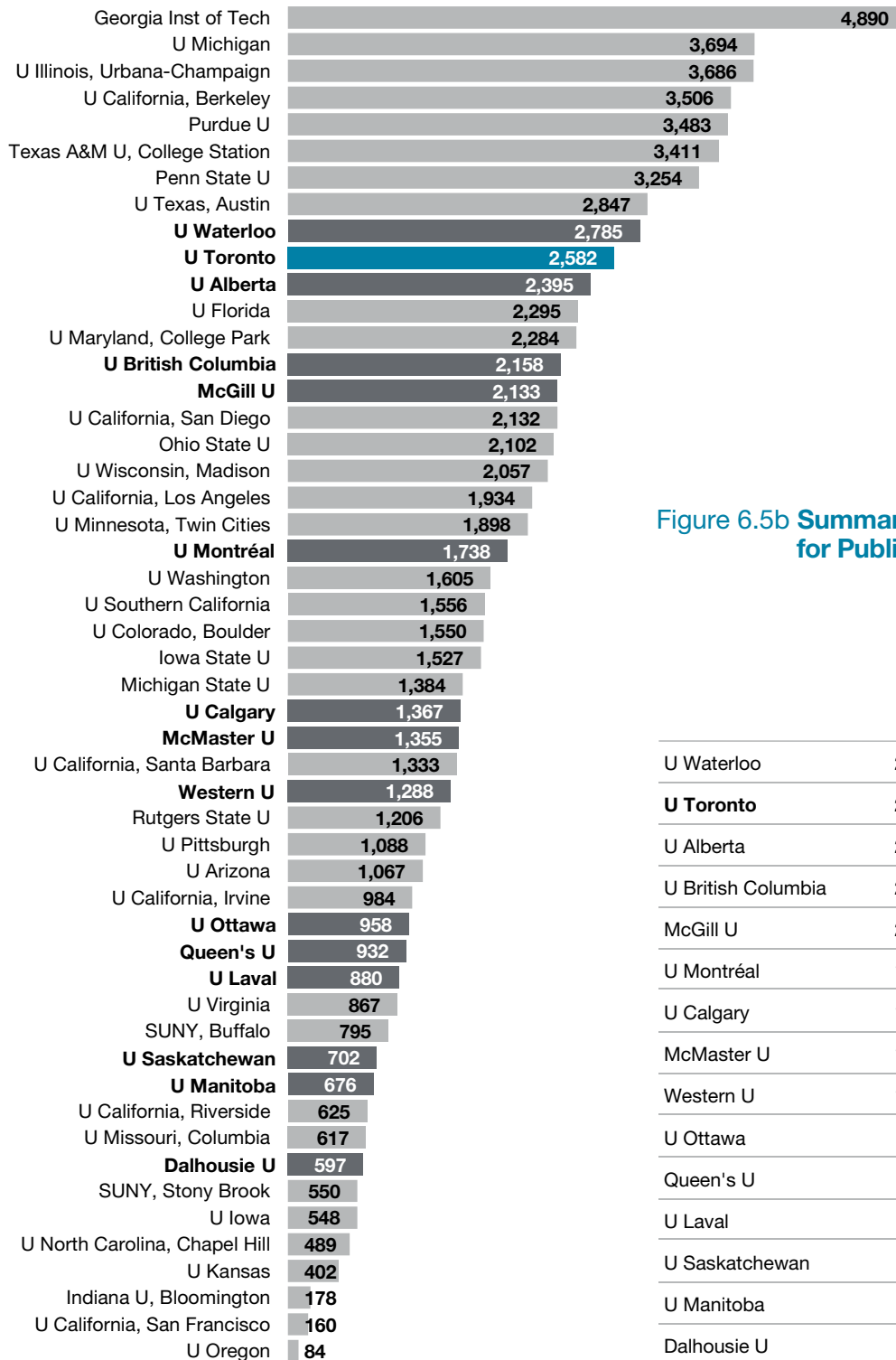


Figure 6.5b Summary of U15 Bibliometrics for Publications

	Publications	Faculty Count	Publications per Faculty	Rank on Pub per Faculty
U Waterloo	2,785	276	10.1	6
U Toronto	2,582	242	10.7	5
U Alberta	2,395	191	12.5	3
U British Columbia	2,158	184	11.8	4
McGill U	2,133	140	15.2	1
U Montréal	1,738	241	7.2	12
U Calgary	1,367	156	8.8	9
McMaster U	1,355	154	8.8	8
Western U	1,288	95	13.6	2
U Ottawa	958	121	7.9	11
Queen's U	932	149	6.3	13
U Laval	880	162	5.4	15
U Saskatchewan	702	78	9.0	7
U Manitoba	676	82	8.2	10
Dalhousie U	597	97	6.2	14

Note 6.5 and 6.6: Faculty counts are based on data from the Engineers Canada 2014 Resources Report Publication and citation data from Thomson Reuters InCities™, updated June 13, 2016.

Figure 6.6a Number of Engineering Citations Indexed by Thomson Reuters for Association of American Universities (AAU) Public and Canadian Peer Institutions, 2010 to 2014

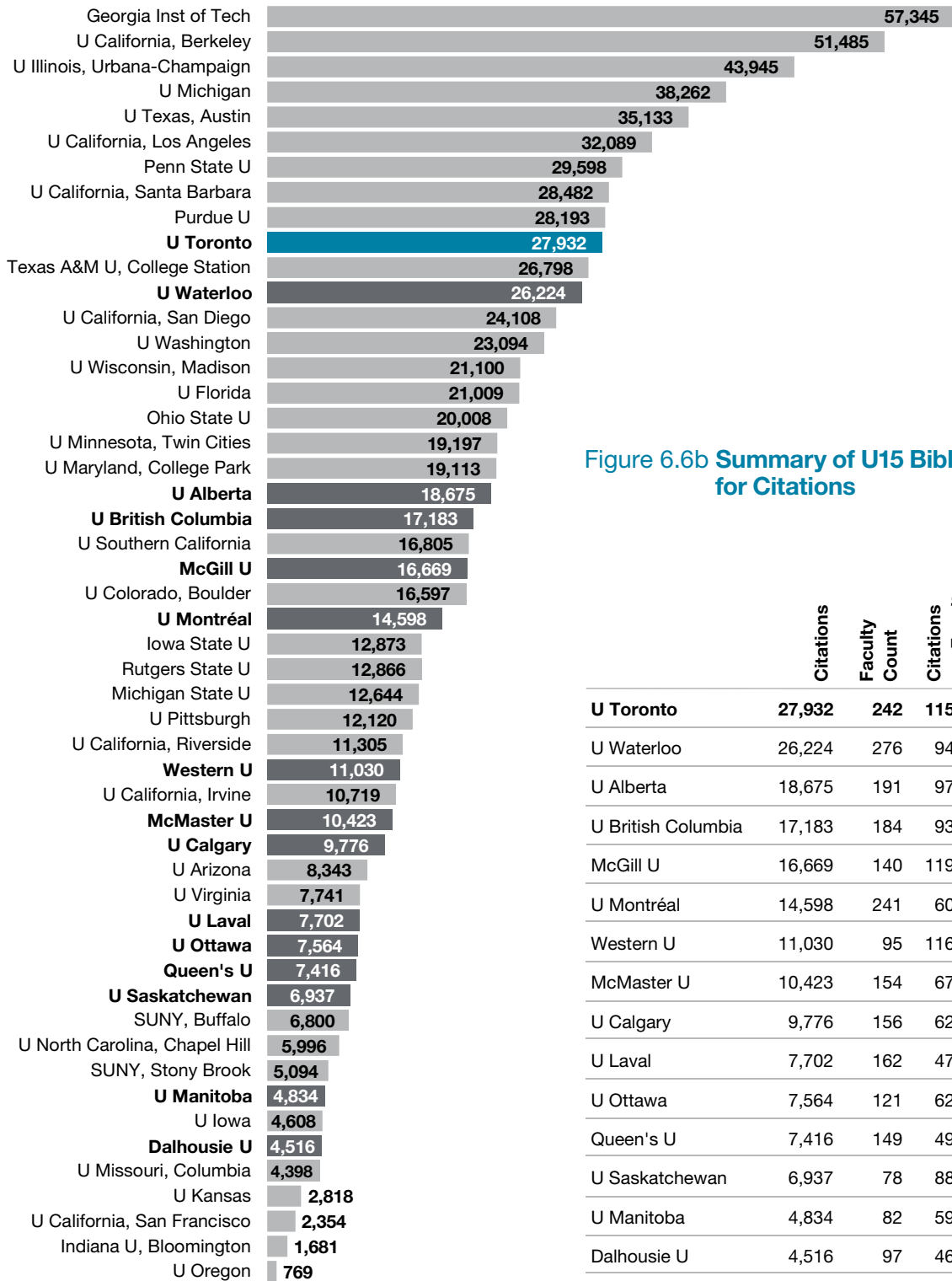


Figure 6.6b Summary of U15 Bibliometrics for Citations

	Citations	Faculty Count	Citations per Faculty	Rank on Citations per Faculty	Citations per Publication	Rank on Citations per Publication
U Toronto	27,932	242	115.4	3	10.8	1
U Waterloo	26,224	276	94.9	5	9.4	3
U Alberta	18,675	191	97.8	4	7.8	11
U British Columbia	17,183	184	93.6	6	8.0	7
McGill U	16,669	140	119.1	1	7.8	10
U Montréal	14,598	241	60.6	11	8.4	6
Western U	11,030	95	116.7	2	8.6	5
McMaster U	10,423	154	67.7	8	7.7	12
U Calgary	9,776	156	62.7	9	7.2	14
U Laval	7,702	162	47.5	14	8.8	4
U Ottawa	7,564	121	62.5	10	7.9	9
Queen's U	7,416	149	49.7	13	8.0	8
U Saskatchewan	6,937	78	88.8	7	9.9	2
U Manitoba	4,834	82	59.0	12	7.2	15
Dalhousie U	4,516	97	46.6	15	7.6	13

Summary of Ranking Results

U of T is the premier Canadian engineering school across all global rankings in 2015, and the only Canadian school in the top 25 in both the ARWU and THE. Among North American public universities, we ranked in the top 10 in three of the four ranking systems. Although no ranking can decisively illustrate a school's performance, our world-class rankings enhance our ability to attract top faculty, researchers and students from around the world.

Figure 6.7 Summary of University of Toronto Engineering Performance in World Rankings

Ranking Organization	Release Date	Canada	North American Public	World
Academic Ranking of World Universities for Engineering (ARWU) for Engineering / Technology and Computer Sciences	August 2015	1	11	23
ARWU Scoring Detail by Category	August 2015			
– Highly Cited (HiCi)		1	12	23
– Publications (PUB)		2	10	61
– Publications in Top Journals (TOP)		1	16	61
Times Higher Education (THE)–Elsevier World University Ranking for Engineering & Technology	October 2015	1	7	25
QS World University Rankings for Engineering and Technology	September 2015	1	7	49
QS World University Rankings by Subject	March 2016			
– Chemical Engineering		1	16	37
– Civil & Structural Engineering		2	9	31
– Electrical & Electronic Engineering		1	12	27
– Materials Science		1	16	39
– Mechanical, Aeronautical & Manufacturing Engineering		1	14	37
– Computer Science & Information Systems		1	7	11
National Taiwan University (NTU) Performance Ranking of Scientific Papers for World Universities by Subject	October 2015	1	8	39
NTU Performance Ranking by Subject	October 2015			
– Chemical Engineering		4	20	111
– Civil Engineering		1	7	23
– Electrical Engineering		1	8	26
– Materials Science		1	10	58
– Mechanical Engineering		1	12	50
– Computer Science		3	11	30

7

The philanthropic contributions of our global alumni community enable us to advance our research, enhance the student experience and strengthen our facilities. Many alumni volunteer their time to give guest lectures, contribute to advisory boards or mentor student startups, benefitting current students with access to their vast experience. Others provide gifts to support research, student activities or new infrastructure.

This year, generous donations by alumni enabled us to create new development opportunities for our early-career professors, as well as graduate and undergraduate students. With a transformational bequest from the estate of Erwin Edward Hart, we created the Percy Edward Hart and Erwin Edward Hart Professorships, which will support researchers in the first 10 years of their careers, as well as their graduate students.

In total, we attracted \$29.3 million in gifts through 2015–2016. This brings our fundraising for Boundless: The Campaign for the University of Toronto to \$180 million, which is 90 per cent of our \$200 million goal. The Centre for Engineering Innovation & Entrepreneurship (CEIE), a cornerstone of our Boundless campaign, received a \$15 million investment from the Ontario government as part of its innovation strategy in February 2016. When it opens in 2017, the CEIE will enable us to set a new standard for engineering education and research. We look forward to celebrating the half-way point of construction in fall 2016.

We continued our robust alumni engagement activities through regional events such as BizSkule, held in Toronto, Calgary and California's Silicon Valley, as well as the Alumni Mentorship Program and a communications campaign to promote volunteerism. We also enhanced our online engagement with alumni by rolling out Graduway, a powerful alumni social media platform, across several departments.

Philanthropic Support

In line with the Academic Plan, we have made significant progress in strengthening the philanthropic support that enables our faculty and students to innovate, share and advance engineering knowledge. In 2015–2016, we attracted a total of \$29.3 million from our U of T Engineering community, including \$23 million in philanthropic gifts and \$6.3 million in research support. Two exceptional bequests from the estates of Erwin Edward Hart (CivE 4T0) and William Dunbar (MechE 5T0) will provide support for early-career researchers, graduate students and undergraduate students.

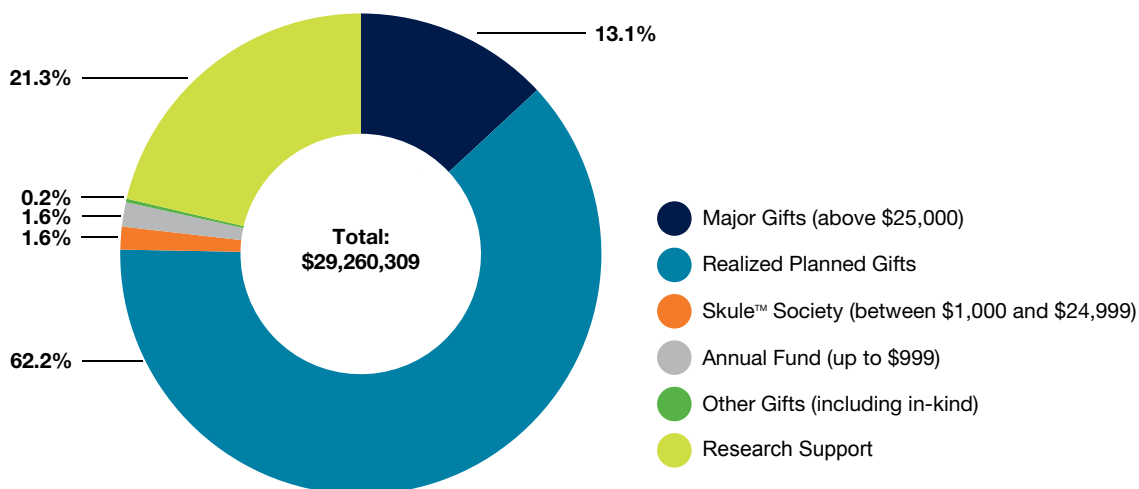
We have raised \$180 million toward Boundless: The Campaign for the University of Toronto. This represents 90 per cent of our campaign goal of \$200 million. We continue to attract new partners to the Centre for Engineering Innovation & Entrepreneurship (CEIE), the cornerstone of our Boundless campaign. In its February 2016 budget, the Ontario government announced a \$15 million investment in the CEIE as part of its innovation strategy. We also continue

to discuss prospective donor naming opportunities at a variety of levels, including the Student Lounge, the Fabrication Facility, the Institute for Robotics & Mechatronics, Research Space and the CEIE Tables & Benches campaign. Construction is progressing, and we are planning ways to celebrate the tremendous contributions of our U of T Engineering community to this project in fall 2016.

We launched our first Spring Reunion Giving campaign in 2016, providing returning alumni with a chance to give back to U of T Engineering either in person at the event, online or by mail.

We continued to engage our fourth-year undergraduate students through the Gratitude giving program. One-third of graduating students took part, with MinE and MSE both achieving 100 per cent participation rates. Gratitude offers graduating students, as well as faculty, staff, alumni and friends, an opportunity to give back to Skule™ and enhance the experiences of students who will follow them.

Figure 7.1a Advancement Results, 2015–2016



Data in this chapter are presented by fiscal year (May to April).

Note 7.1a, 7.1b and 7.1c: Data are shown by fiscal year (May to April).

Figure 7.1b Philanthropic Support, 2006–2007 to 2015–2016

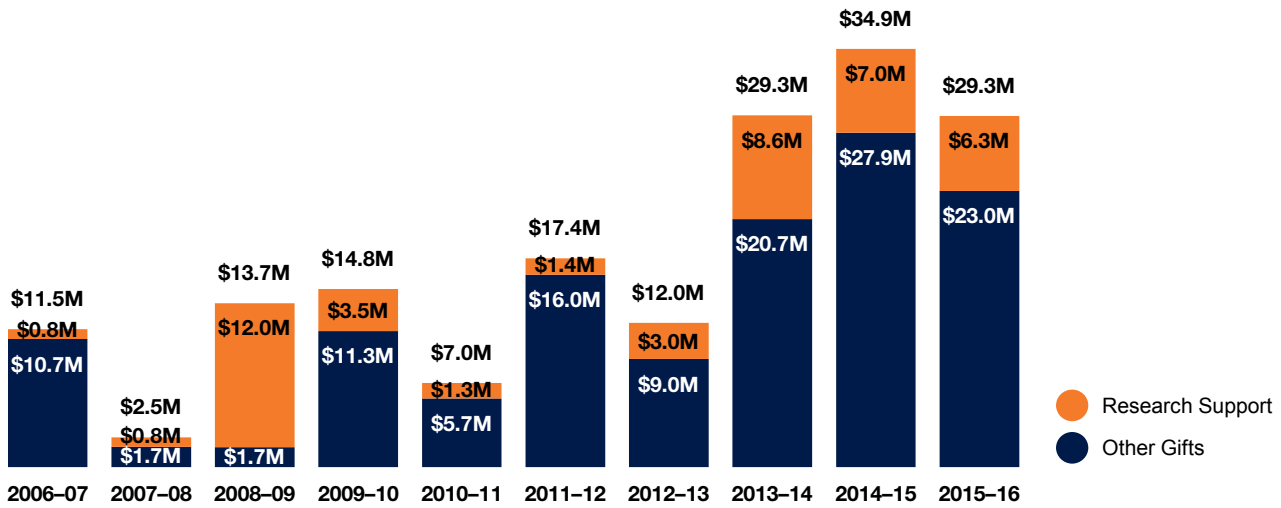


Figure 7.1c Gift Designation, 2015–2016

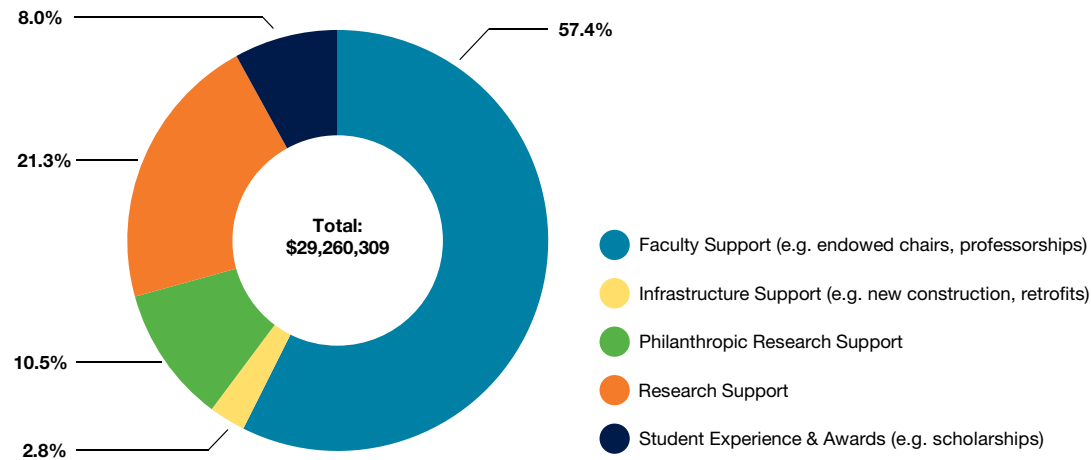
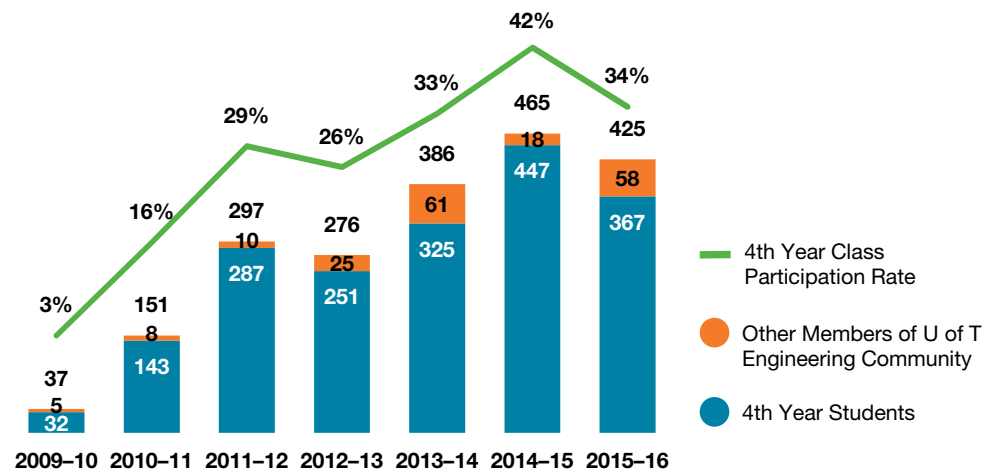


Figure 7.1d Gratitude Participation, 2009–2010 to 2015–2016



Initiatives and Projects

Social Media Engagement

We significantly expanded our presence on social media in 2015–2016 with the rollout of the Graduway alumni network platform across a number of departments. By combining the power of U of T Engineering's brand with the connectivity of social networks, Graduway enhances our ability to connect with our global community of alumni and facilitates further engagement through mentorship and volunteer opportunities. It also provides us with key data on industry affiliations, which in turn could increase opportunities for research collaborations. After successful beta-testing in EngSci, we introduced the platform in CivE, ChemE and MIE.

Alumni Events and Engagement

The cornerstone of our U of T Engineering community is our diverse and accomplished network of more than 48,000 alumni around the world. We invite them to see Skule™ not only as a place where they have earned a degree, but also as an ongoing resource for ideas, networking and partnerships. To nurture this engagement, we create opportunities for them to connect with faculty members, students, fellow alumni and industry partners, including learning events and volunteer opportunities. These activities strengthen our alumni network, cultivate new collaborations, highlight our commitment to excellence and encourage alumni to support our vision.

In 2015–2016, we held 84 networking and professional development events for alumni around the world. These events included:

- A Spring Reunion event for alumni who graduated between five and 15 years ago at the Steam Whistle Brewery. Nearly 200 young alumni attended the event, which included brewery tours and a presentation on identifying your online brand.
- The Engineering Society Heritage Awards Celebration, which included alumni who held leadership roles in the Engineering Society and current Engineering Society leaders. Approximately 150 people attended the event, including 52 alumni.
- Four BizSkule events in Toronto, Calgary and California's Silicon Valley on topics such as the future

Leadership Annual Giving, Class Giving and Special Projects

Annual gifts of between \$1,000 and \$25,000 enhance our research and educational programs in many ways, from improvements to laboratory facilities to scholarships and funds for student co-curricular activities. This year, a Leadership Annual Giving (LAG) Officer was hired to give special attention to this important class of donors. The role includes analyzing and improving current stewardship practices, and developing a Class Giving strategy to better promote and support peer-to-peer fundraising.

of health care, the new sharing economy and deep genomics. BizSkule showcases engineering leadership in business through keynote speakers and industry panellists ranging from startup founders to global executives.

We also continued to engage alumni in our recruitment and outreach programs. For example, we invited key alumni to serve as ambassadors in student recruitment campaigns in Vancouver, Palo Alto and San Francisco, and Hong Kong, and at post-offer receptions in Vancouver, Dubai and Singapore. These opportunities enable our alumni to share their Skule™ experiences with potential students and offer those students insights into the boundless opportunities that a U of T Engineering degree offers.

We also grew our Alumni Mentorship Program in 2015–2016, with 161 mentors and 280 mentees taking part — increases of 33 per cent and 16 per cent respectively over the previous year. This program, which is open to third- and fourth-year students (including students on PEY internships), fosters valuable relationships between Skule™ alumni and students. It also allows alumni to give back in a unique and rewarding way by sharing their knowledge and experience with students who are making important decisions about their engineering careers.

To increase awareness of the positive impact alumni volunteerism has on current students and faculty, we launched a communications campaign to promote

volunteer opportunities and highlight the benefits of giving back to U of T Engineering. The campaign included:

- A dedicated web page outlining volunteer opportunities;
- A five-part news series on alumni volunteers to mark National Volunteer Month (April 2016);
- A feature on seven engaged alumni volunteers; and
- An ad in *Skulematters* magazine.

Other key communications initiatives included:

- Redesigning our quarterly alumni e-newsletter, beginning with the fall 2015 issue. This resulted in a 37.3 per cent open rate, 15 percentage points higher than the industry benchmark, leading to an additional 1,100 alumni readers per issue over 2014–2015. The newsletter also achieved a 13.6 per cent click-through rate, 11 percentage points higher than the industry benchmark.
- Highlighting the accomplishments of engineering women in our community through our alumni magazine *Skulematters*. This issue demonstrates the myriad ways diversity enriches the engineering profession, drives

innovation and enhances the student experience. Alumni engagement with our website and social media channels (Twitter, Facebook and LinkedIn) increased across the board in 2015–2016 as we focused on creating relevant content. Highlights include:

- A total of 78 news stories were published and/or repurposed from the Faculty news website, 20 more than the year before, marking a 34 per cent increase in published content.
- Overall pageviews for the alumni website (alumni.engineering.utoronto.ca) increased by 24 per cent to 68,834 from 55,392 the previous year.
- Traffic to the alumni website from links shared on Facebook increased by 27 per cent (1,411 in 2014–2015 vs. 1,791 in 2015–2016).
- Traffic driven to the alumni site from links shared on Twitter increased by 48 per cent (215 in 2014–2015 vs. 318 in 2015–2016).
- Traffic to the alumni site from links shared on LinkedIn increased by 51 per cent (174 in 2014–2015 vs. 263 in 2015–2016).

Gift Highlights

Erwin Edward Hart – \$20 million

A historic \$20-million bequest from the estate of alumnus Erwin Edward Hart (CivE 4T0), announced in May 2016, enabled us to support early-career professors and provide enhanced opportunities for graduate students.

The income from the Hart Trust created the Percy Edward Hart and Erwin Edward Hart Professorships. Seven faculty members, each within the first 10 years of his/her academic career, received \$75,000 per year for three years for research and graduate student support. The recipients were nominated by their department or institute and demonstrated a high level of research excellence and exemplary graduate mentorship. The professorships will foster the next generation of engineering research leaders and educators, and enhance our ability to recruit top early-career educators and researchers from around the world.

The seven professors are:

- Natalie Enright Jerger (ECE) – Percy Edward Hart Professor in Electrical and Computer Engineering
- Tobin Filleter (MIE) – Erwin Edward Hart Professor in Mechanical and Industrial Engineering
- Philippe Lavoie (UTIAS) – Percy Edward Hart Professor in Aerospace Engineering
- Alison McGuigan (ChemE) – Erwin Edward Hart Professor in Chemical Engineering and Applied Chemistry
- Daman Panesar (CivE) – Erwin Edward Hart Professor in Civil Engineering
- Jonathan Rocheleau (IBBME) – Percy Edward Hart Professor in Biomaterial and Biomedical Engineering
- Chandra Veer Singh (MSE) – Erwin Edward Hart Professor in Materials Science and Engineering

Erwin Edward Hart, was a long-time employee of Massey-Ferguson Ltd. and served as the company's chief welding engineer. The professorships are named in honour of Hart and his late father, Percy Edward Hart.

William Dunbar – \$1.8 million

A bequest of \$1.8 million from the estate of William Dunbar (MechE 5T0) is funding new scholarships for mechanical engineering graduate students based on academic merit. Annual income from the endowment will support the William Dunbar Memorial Scholarships in Mechanical Engineering for graduate students.

Troost Family – \$1.1 million

Bill (ChemE 6T7) and Kathleen Troost enhanced their support for leadership education at U of T Engineering in 2015–2016 with a \$1 million gift for the Institute for Leadership Education in Engineering (ILead) to enrich co-curricular leadership training and \$125,000 for the Department of Chemical Engineering & Applied Chemistry's Leaders of Tomorrow Program. With these new gifts, the Troost family has contributed more than \$7 million to the Faculty, including a \$2-million gift to create new space for ILead in the Centre for Engineering Innovation & Entrepreneurship. Mr. Troost also generously contributes his expertise to the Faculty as a member of the boards of advisors of both ILead and the Department of Chemical Engineering & Applied Chemistry; and as a Professional Experience Year (PEY) internship employer through his company, Peel Plastic Products Ltd.

8

By communicating our strengths and accomplishments strategically and creatively through print, digital and earned media, we have strengthened our profile as a global leader in engineering education and research. Strategic communications support our efforts to attract the best students and faculty members from around the world, develop innovative partnerships and inspire our alumni and friends to deepen their engagement with U of T Engineering. The Faculty's communications efforts are carefully aligned with our Academic Plan and the University of Toronto's Three Priorities.

We leveraged our communications channels in new ways in 2015–2016. Over the summer and fall of 2015, we conceived, designed and unveiled Toronto's longest single graffiti installation on the construction hoarding surrounding the Centre for Engineering Innovation & Entrepreneurship. This innovative project allowed us to leverage our urban location to start a public conversation about the positive impact of engineering on society, as well as to celebrate the history and achievements of U of T Engineering. An accompanying media campaign received a Gold Quill Award of Excellence from the International Association of Business Communicators (IABC). In total, we earned more than a dozen communications awards in 2015–2016 and were named Not-for-Profit Communication Department of the Year by the IABC.

We refined our earned media outreach around the Faculty's strategic communications foci, with comprehensive coverage across these priority areas. The visibility of our world-class research was enhanced by content on our U of T Engineering News website and strong pickup in local, national and international outlets across print, online, broadcast and social media. Our renewed focus on social media has led to growing engagement across all channels, strengthening relationships with our vibrant community, particularly students and alumni.

Improving internal communications continues to be a priority. A communications workflow audit in fall 2015 has led to closer coordination among the more than 30 communicators who comprise the Engineering Communications Network. Engineering Strategic Communications is also working closely with colleagues at University of Toronto Communications and communications leaders across the University to strengthen consistency and collaboration in our storytelling.

Selected Communication Projects

CEIExSKAM Graffiti Mural

When the Faculty broke ground in June 2015 on the Centre for Engineering Innovation & Entrepreneurship (CEIE), the construction hoarding surrounding the site offered a unique opportunity to share the U of T Engineering story in an unconventional way. After broad consultation across the Faculty and among University leaders, we commissioned one of Toronto's best-known graffiti artists to produce a 276-foot-long street art installation to highlight our Faculty's history, the importance of engineering in society and the CEIE. The response was positive and measurable, and demonstrates the effectiveness of this campaign in shining a spotlight on the CEIE and our Faculty's world-leading education and research. Twelve stories about the mural appeared in regional media outlets, generating more than 5.5 million impressions. We also had significant online engagement, including 5,500 pageviews on related web stories and more than 1,125 pageviews on an online hub we created on the Faculty website. In addition, more than 5,000 people visited the mural during *Nuit Blanche*, a city-wide, all-night cultural festival held in October 2015. For more information on the art installation, visit uoft.me/CEIExSKAM.

Integrated Redesign of Offer Package and Admitted Students Website

Receiving an offer of admission to Canada's premier engineering school and one of the best in the world is a pivotal moment in an aspiring engineer's life. To reflect the significance of this accomplishment, we completely reimagined our offer package with the goal of reflecting the excellence of the U of T Engineering experience, while reducing printing and mailing costs.

The Engineering Strategic Communications and recruitment teams collaborated on this project, which integrated both print and digital media. We built and launched a new microsite targeted directly at applicants who had received offers of admission. The site presents reasons to choose U of T Engineering, and each proof point is accompanied by engaging video, photos, testimonials, statistics and details. It drew 2,101 unique visitors and more than 11,700 pageviews.

The printed offer package — a streamlined ensemble containing a personalized letter, informational brochure and a self-mailer envelope — pointed recipients to the microsite. All elements of the project contributed to a cohesive and inspiring piece that presents our Faculty to the world's best students.

Relaunch of the Faculty Homepage

In April 2016, we refreshed the Engineering homepage, our face to the world and the primary platform for information on our Faculty's world-leading education, research and innovation. The new homepage features a cleaner layout and more sophisticated look, prominent visibility for the latest U of T Engineering news, quick access to key facts and info, improved display on mobile devices and shorter loading times. We implemented these changes after carefully analyzing Google Analytics data from the previous 12 months to offer visitors a more efficient and impactful experience.

This enhancement followed the May 2015 launch of a major redesign of the Faculty's main website (www.engineering.utoronto.ca). The redesign included moving the site to the WordPress platform, enhancing search-engine optimization and meeting the highest web accessibility standards set out in both the World Wide Consortium Web Content Accessibility Guidelines and the Accessibility for Ontarians with Disabilities Act.

Enhanced Media Reporting

In April 2015, we formalized an agreement with Media Miser, a media reporting company, to track and evaluate the effectiveness of our earned media strategy, particularly as it connects to the Faculty's Academic Plan and the President's Three Priorities. This service collects all mentions of U of T Engineering in the news media across all platforms — print, online, television and radio — and records reach, value and geographical distribution. In 2015–2016, almost 60 per cent of earned media mentions appeared in international outlets. This widespread coverage underscores both the global impact of our activities, and our strong international reputation.

Strengthening Communications Coordination

The Engineering Strategic Communications team acts as a central hub for communicators working throughout the Faculty's departments, divisions and institutes. The team also works closely with the central University of Toronto Communications office. In 2015–2016 we continued to improve coordination within our Engineering Communications Network, increasing editorial meetings to every second week and closely collaborating on several Faculty-wide communications initiatives, including the design of new Advancement collateral. The Executive

Data and highlights in this chapter are presented by fiscal year (May to April).

Note: Impressions are an indicator of impact measured by the estimated number of people who may have interacted with a story, based on circulation (newspapers/magazine), viewers (TV), listeners (radio) and unique monthly visitors (online).

Director of Communications attended regular meetings of senior University communications leaders and the Vice-President, Communications to enhance information sharing and University-wide internal communications needs.

Student Communications

In November 2015, we conducted focus groups with engineering undergraduate students across all years to better understand how they consume e-communications received from staff and faculty. Feedback indicated that high email volume combined with messages that are information-dense or difficult to read leaves our students feeling frustrated

– not only because of the time they spend sifting through their inboxes, but that high-priority messages sometimes get lost in email bulk and go unread. First-year students were particularly overwhelmed by email volume.

To address this challenge, the Faculty developed an online resource that will help faculty and staff improve the quality of student-facing e-communications while decreasing volume. Through this resource, the Faculty also aims to increase awareness among staff and faculty of all the communication vehicles available to them beyond email. The Faculty plans to roll out the resource in fall 2016 and will measure its success in fall 2017.

Media Coverage

Between May 1, 2015 and April 30, 2016, the Faculty secured more than 3,400 earned media stories in the five priority areas identified in the Faculty's Academic Plan, almost 60 per cent of which appeared in international outlets. This coverage earned more than one billion impressions. This media coverage helps us connect to our global community, gives our Faculty a voice on key issues and enhances the reputation and awareness of U of T Engineering with target audiences, including prospective students and their parents, peer institutions, industry partners, policy makers, influencers and alumni.

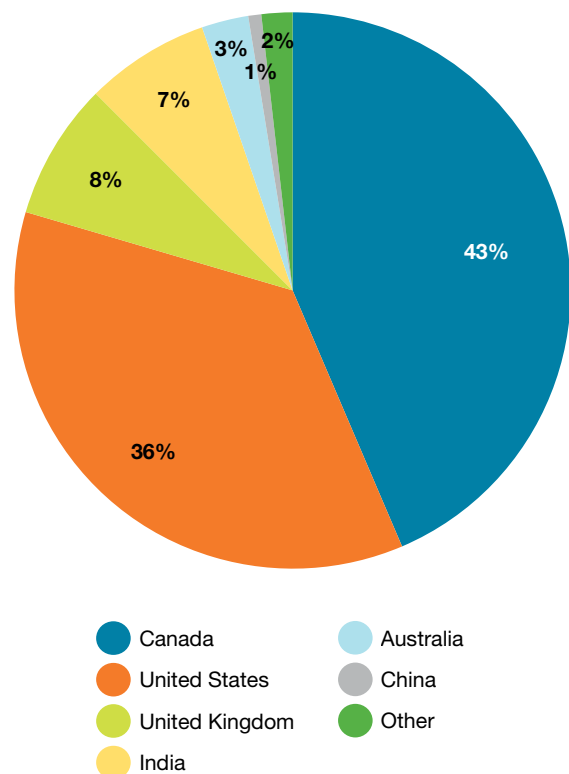
The following list includes selected highlights of our media coverage:

Bioengineering/Health

- New 'Tissue Velcro' could help repair damaged hearts (*Vice Motherboard, The Times of India, Gizmodo, Popular Science, New Scientist, Yahoo.ca, Gizmag, The Scientist*)
- A tumour you can unroll: Engineers create new technology for understanding cancer growth (*Vice Motherboard, Engadget, International Business Times, Tech Times, Phys.Org, BiotechDaily*)
- Discovery of 'slithering sperm' could improve infertility treatments (*Toronto Star, Gizmodo, Los Angeles Times, Daily Mail (UK), Popular Science, The Scientist*)
- Shape-shifting engineered nanoparticles for delivering cancer drugs to tumours (*Wired, Phys.Org, The Times of India, News-Medical.Net, Pharmaceutical Processing, Nanowerk, Science Codex, Nanotechnology Now*)

- U of T Engineering researchers create lab-grown heart and liver tissue for drug testing and more (*Toronto Star, CBC The National, CBC.ca, Yahoo! News, Gizmag, Ars Technica, Laboratory Equipment News*)

Figure 8.1a Proportion of U of T Engineering Media Stories by Outlet Location, 2015–2016



Note 8.1a: The impressions for one story may be included in the counts of multiple countries.

Sustainability

- Saving sunshine for a rainy day: New catalyst offers efficient storage of alternative energies (*The Globe and Mail, Western Daily Press, Nanowerk, Phys.org, Green Car Congress, ECNmag.com, Design News*)
- Interactive air pollution map for Pan Am Games developed by U of T Engineering researchers (*Metro, CBC Radio One, Urban Toronto, CTV News*)

Engineering Education

- World’s fastest bike created by U of T Engineering alumni and students (*Gizmodo, Popular Mechanics, Engadget, CBC.ca, Maxim, The Verge*)
- U of T Engineering hosts Canada’s largest STEM event to inspire 1,400 future innovators (*Huffington Post, CBC The National, CBC Metro Morning, Global News, Toronto Star*)
- First-year students in Engineering Science bring design solutions to challenges in Toronto communities (*Toronto Star, City News, 680 News Toronto*)

Entrepreneurship/Commercialization

- U of T Engineering startup applies the power of deep learning to genomics (*Washington Post, The Globe and Mail, Canadian Business, Business Insider, Popular Science*)
- teaBOT, startup launched out of Start@UTIAS accelerator program, expands across North America (*TechCrunch, The New Yorker, BetaKit, The Independent*)

Information & Communications Technology

- Thin, cheap antenna could bring the Internet to unconnected 3 billion (*Tech Times, Physics World*)
- ECE professor explains how his image-recognition research turned into a beauty product (*Washington Post, CTV News, TechCrunch, Toronto Star, Malay Mail Online*)

Figure 8.1b Proportion of U of T Engineering Impressions by Strategic Priority Area, 2015–2016

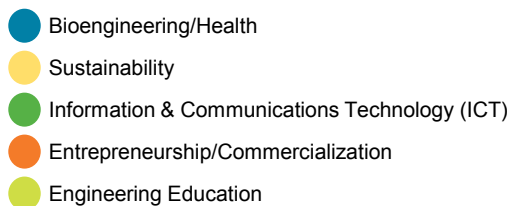
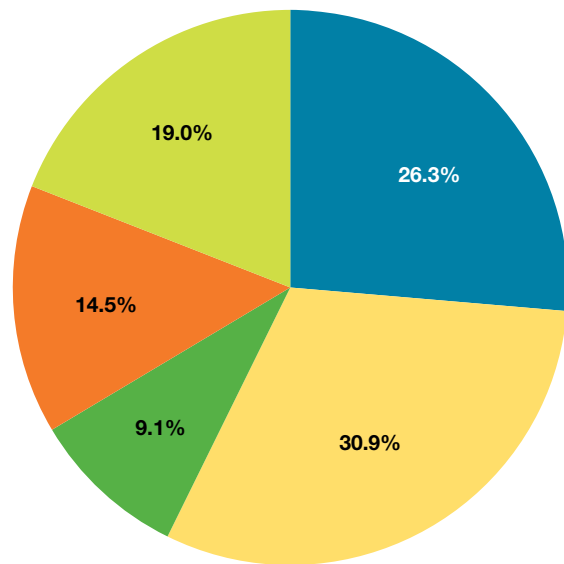
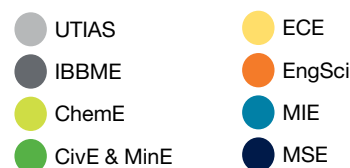
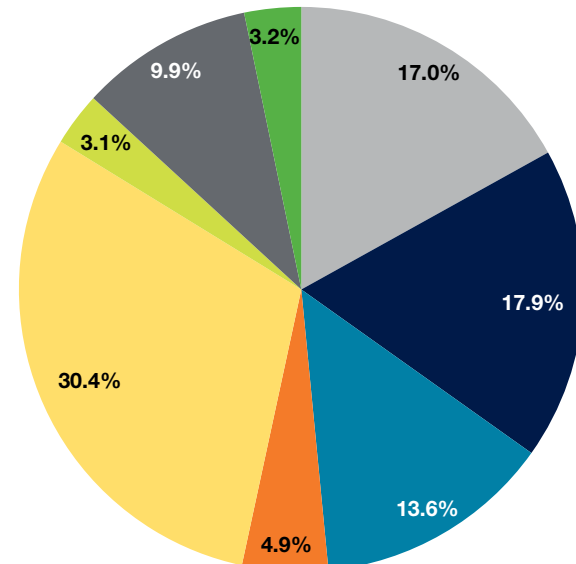


Figure 8.1c Proportion of U of T Engineering Impressions by Academic Area, 2015–2016



Note 8.1b and 8.1c: One media story can reference multiple strategic priority areas or academic areas. In those cases, the impressions are included in the counts for both areas. Fig 8.1b does not include an additional 0.2% of impressions that represented areas other than the ones shown here.

Engineering News at U of T

Since its launch in August 2014, the U of T Engineering News website (news.engineering.utoronto.ca) has become the go-to source for Faculty news. In 2015–2016, we published 220 stories on the site. With an emphasis on strategic storytelling that supports the Faculty’s priorities, these stories generated 199,555 pageviews, up 74 per cent from 2014–2015. The average time users spent on the page increased slightly, while our bounce rate decreased over the same period the previous year.

International interest in our stories continued to grow, with 35 per cent of pageviews on the U of T Engineering News site coming from outside Canada. More than 22,000 of those pageviews came from the United States, up more than 98 per cent from one year earlier. In 2015–2016, 20 per cent of total traffic originated outside of North America. Readership in India, a region we specifically targeted through proactive media and recruitment outreach, climbed more than 200 per cent over the previous year. We also saw significant gains among audiences in Russia, China, Australia, Japan and Malaysia.

Figure 8.2 Top Stories on the Engineering News and U of T News Websites, 2015–2016

Story Title	Date Posted	Pageviews		
		U of T Engineering News Site	U of T News Site	Total
U of T to transform regenerative medicine thanks to historic \$114-million federal grant	July 28, 2015	513	11,850	12,363
Prime Minister backs regenerative medicine at U of T Engineering	Jan. 14, 2016	997	9,335	10,332
Jonathan Sun: Engineer, architect, social media sensation	Feb. 21, 2016	4,814	3,359	8,173
Seven U of T engineers awarded Canada Research Chairs	Feb. 9, 2016	1,205	6,060	7,265
World’s fastest bike created by U of T Engineering alumni and students	Sept. 21, 2015	5,945	116	6,061
Hydrogels boost ability of stem cells to restore eyesight and heal brains	May 14, 2015	4,414	1,130	5,544
Shape-shifting engineered nanoparticles for delivering cancer drugs to tumours	Feb. 18, 2016	2,705	1,938	4,643
Grads to Watch: 16 global engineering leaders	June 12, 2015	4,470	-	4,470
Person-on-a-chip: U of T engineers create lab-grown heart and liver tissue for drug testing and more	Mar. 7, 2016	2,260	1,807	4,067
University of Toronto breaks ground on new Centre for Engineering Innovation & Entrepreneurship	June 24, 2015	3,662	-	3,662
Light up the night at U of T: Scotiabank Nuit Blanche	Sept. 30, 2015	209	3,114	3,323
Saving sunshine for a rainy day: New catalyst offers efficient storage of alternative energies	Mar. 24, 2016	1,096	1,748	2,844
Five U of T Engineering student startups to watch	May 27, 2015	2,782	-	2,782
NBA’s Ben Gordon signs on to U of T wearable tech sports coaching startup, Onyx Motion	July 8, 2015	269	2,049	2,318
Behind the scenes of Medicine By Design with Molly Shoichet and Peter Zandstra	July 28, 2015	1,111	1,099	2,210
A tumour you can unroll: Engineers create new technology for understanding cancer growth	Nov. 23, 2015	755	1,438	2,193
Thin, cheap antenna could help bring Internet to the unconnected 3 billion	Jan. 21, 2016	987	1,010	1,997
New ‘Tissue Velcro’ could help repair damaged hearts	Aug. 28, 2015	1,726	241	1,967
New U of T Engineering MOOC to teach 100,000 students how to build Swift-based iOS9 apps	Sept. 10 2015	621	1,201	1,822
Toronto’s longest single graffiti installation celebrates the Centre for Engineering Innovation & Entrepreneurship	Sept. 4, 2015	826	1,004	1,830
One U of T Engineering student’s passion for cycling becomes startup dream	Mar. 30, 2016	1,799	-	1,799
Godiva’s Hymn contest winners unveiled at Cannonball	Jan. 12, 2016	1,629	-	1,629
U of T grads in finals for Hult Prize — with talking stickers to boost literacy for impoverished children	Sept. 18, 2015	192	1,377	1,569
Designing across cultures: Engineering undergrads in China	Jan. 8, 2016	359	1,144	1,503
Five innovative ways the new CEIE will engineer tomorrow’s entrepreneurs	May 27, 2015	1,475	-	1,503
Flight MH370: Forensic engineering expert on the significance of debris	Aug. 4, 2015	176	1,220	1,396
Royal Society of Canada: Meet U of T’s newest Fellows	Sept. 10, 2015	158	1,153	1,311
15 U of T Engineering students honoured with 2016 Gordon Cressy Student Leadership Awards	Apr. 21, 2016	1,284	-	1,284
Winds of change: U of T engineers design windmills for Nicaragua	Jan. 26, 2016	1,012	254	1,266
Meet four international scholars from U of T Engineering	Dec. 17, 2015	1,245	-	1,245
U of T biomedical engineers may have solved the problem of protein binding	Mar. 17, 2016	78	1,108	1,186

Online Activity

Faculty Website

Since launching our new Faculty website (www.engineering.utoronto.ca) in May 2015 with continuous improvements in architecture and design, the average length of time users spend per page has climbed more than 38 per cent and the bounce rate has decreased by almost four per cent. This indicates that visitors to the new site are finding the information they seek more easily. Almost one-third of traffic to the Faculty site came from outside of Canada. The number of users accessing the site via mobile devices climbed slightly to 17.4 per cent from 16.8 the previous year, underscoring the importance of mobile compatibility across the entire suite of Engineering websites.

Recruitment and Admissions Websites

Our website is an important source of information for prospective students and their parents and families, a powerful tool in our recruitment strategy, and an opportunity to communicate our position as Canada's top engineering school and one of the best in the world. In 2015–2016, pageviews on our primary recruitment site, Discover Engineering (www.discover.engineering.utoronto.ca), rose by 28 per cent over 2014–2015. Our improved search-engine optimization delivered twice as much traffic from organic searches compared with the previous year. More than one-third of visits to Discover Engineering originated outside of Canada, with traffic from the United States growing by 52 per cent over the previous year.

We launched the “You Belong Here” microsite for admitted students on November 25, 2015. Since its launch, the site — which was marketed to admitted students in their offer packages and not indexed by Google — has received 9,100 unique pageviews from students in more 77 countries. Forty-three per cent of its traffic originates outside of Canada, with the majority coming from the United States, Russia, China, the United Arab Emirates and Japan. The site boasts a very low bounce rate of 35 per cent, which illustrates the quality, value and accessibility of its content.

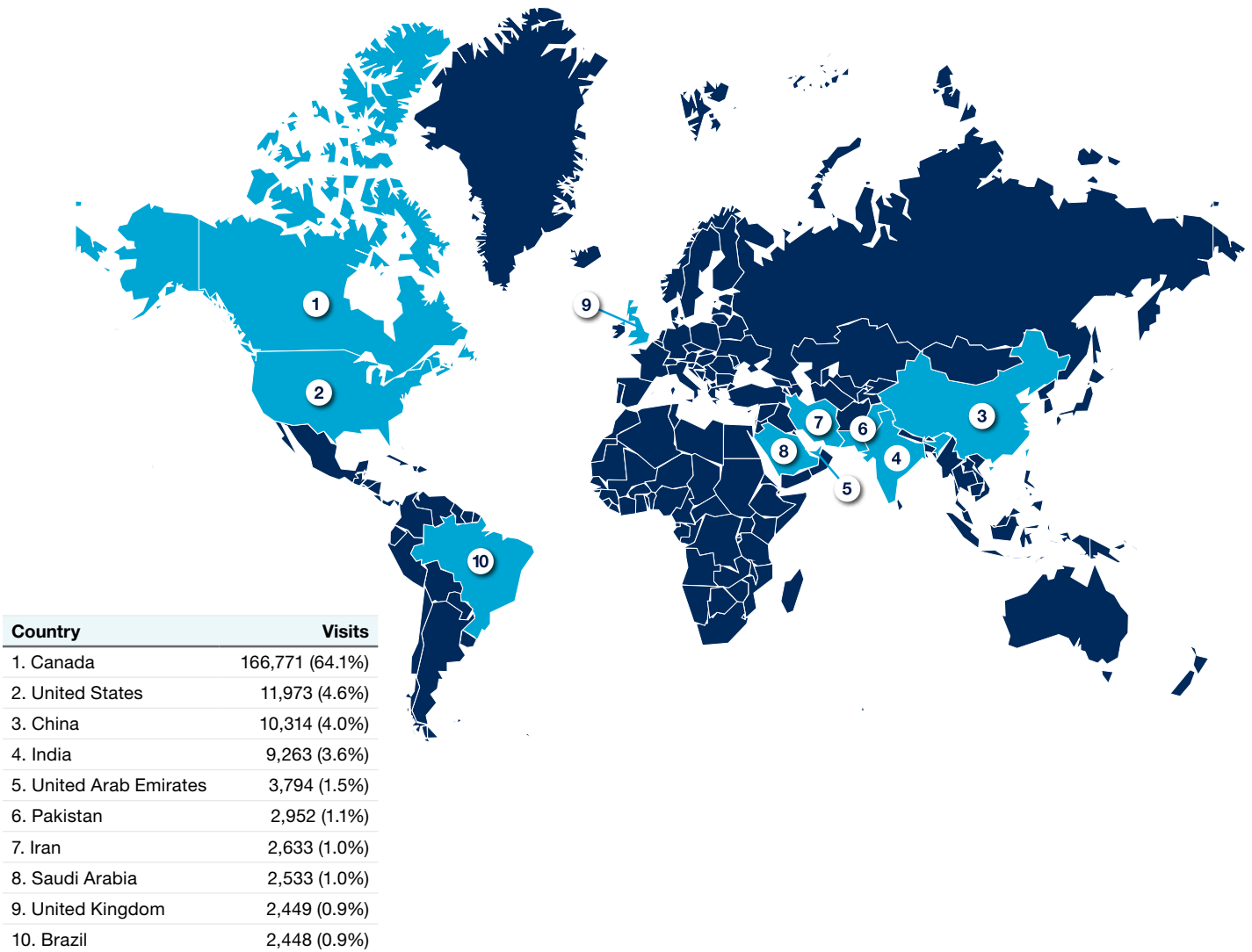
Figure 8.3a Summary of Analytics for Faculty and News Sites, 2015–2016

	Faculty Site	News Site
Pageviews	455,808	199,555
Unique visitors	156,698	104,255
Average number of pageviews per session	1.75	1.43
Average amount of time spent on site	2:33 min	0:59 min
Cities of origin	6,063	6,619
Countries of origin	193	192

Figure 8.3b Summary of Analytics for You Belong Here Microsite, Nov. 25, 2015 to April 30, 2016

	You Belong Here Microsite
Pageviews	11,714
Unique visitors	2,101
Average number of pageviews per session	3.12
Average amount of time spent on site	4:11 min
Cities of origin	507
Countries of origin	77

Figure 8.4 Visitors to Discover Engineering Site: Top 10 Countries, 2015–2016



Social Media

Engaging our key audiences through social media continues to be a priority for the Faculty. In 2015–2016, we expanded the reach of our social media channels, including Facebook and Twitter, and in January 2016 relaunched our Instagram channel with a new focus on engineering student life and our vibrant engineering community. Since this relaunch, we have seen a surge of engagement on Instagram, and have tripled our number of followers from 400 in January 2016 to more than 1,200 in June 2016.

We continue to refine our messaging and define our unique U of T Engineering voice across both Facebook and Twitter channels. This strategy has delivered demonstrable gains: between May 1, 2015 and April 30, 2016, Facebook impressions — a measure of reach — grew by 465 per cent, and engagements — an indicator of the value of the content to the audience — grew 447 per cent over the same period the previous year. We also increased the volume of our Twitter messaging by more than 77 per cent, and this grew our number of engagements by almost 600 per cent over 2014–2015.

Overall, U of T Engineering engaged with more than 6,800 unique users in 2015–2016, for a potential total reach of 3.8 million social media users who saw our U of T Engineering-related content.

9

From sustainable energy and clean water to public health and urban transportation, we are using our technical and problem-solving competencies to develop solutions to the world's most pressing challenges. At U of T Engineering, our outlook and impact are global, and we embed international perspectives in our research and our curricular and co-curricular programs. The Faculty's robust global engagement also strengthens U of T's international partnerships, one of the Three Priorities outlined by President Meric Gertler.

Our strong position in global rankings, the strength and breadth of our academic programs and our outstanding international reputation continue to draw exceptional international students who enrich our Faculty and deepen the engineering creative process with new ideas and perspectives. In 2015–2016, more than one-quarter of our undergraduate students and nearly one-third of our graduate students came from outside Canada. To enhance our ability to attract top international undergraduate students, in 2015 we introduced the U of T Engineering International Scholar Award, which covers the full cost of tuition and is renewable for four years. We are also diversifying our cohort of international students by increasing strategic recruitment in underrepresented regions such as South Asia, Latin America and the United States. We continued to welcome international students through targeted programs such as the International Foundations Program.

International educational exchanges, research programs and professional placements allow our students to gain cross-cultural fluency and experiences that enhance their understanding of complex global challenges. In 2015–2016, 89 students participated in outgoing exchanges to peer institutions such as the Massachusetts Institute of Technology, ETH-Zurich Swiss Federal Institute of Technology and National University of Singapore. Seventy-nine students gained invaluable international work experience by completing Professional Experience Year internship placements outside Canada. Many of our students also participated in international capstone courses and summer research opportunities that enhanced their abilities to work across borders and cultures.

Our multidisciplinary centres and institutes — such as the Centre for Global Engineering, the Institute for Sustainable Energy and the Institute for Water Innovation — bring together researchers from diverse disciplines to collaborate on projects that have the potential to improve the lives of people around the world, particularly in developing countries. These researchers and rich international opportunities become catalysts for global change.

International Students and Exchanges

We attract some of the finest students from around the world because of our excellent programs, extraordinary researchers, outstanding position in global rankings and location in one of the world's most vibrant, safe and diverse cities. In 2015–2016, international students made up 27.4 per cent of our undergraduate students, building on our success in meeting our Academic Plan goal of 25 per cent by 2015. The proportion of international graduate students also increased to 31.1 per cent.

To broaden the diversity of our international student population, we enhanced our recruitment efforts in 2015–2016 in key regions, including South Asia, Latin America and the United States. In addition to school visits, university fairs and guidance counsellor events, we also awarded scholarships to the 2016 DEEP Summer Academy to top entrants at three science fairs in northern California. We supplemented travel to these regions with digital outreach, including online chats, e-newsletters and “virtual visits” to STEM-focused high schools in California, Illinois, Massachusetts, North Carolina, New York and Texas.

Several targeted programs bring international students to the Faculty and enrich the diversity of our student population. We also offer numerous opportunities for our students to gain international experience.

Figure 9.1a Selected Opportunities for International Students to Study at U of T Engineering

Program	Description	2015–2016 U of T Engineering Participants
Ciência sem Fronteiras (CsF) (formerly Science without Borders)	Funded by the Government of Brazil and private industry, CsF sends Brazilian students abroad to study science, technology, engineering and mathematics. 2015–2016 was the final year of this program.	81 (Fall term) 56 (Winter term)
International Foundations Program (IFP)	IFP allows academically strong students who do not meet the University's minimum English proficiency requirements to receive a conditional offer of admission as non-degree students. After completing an intensive, eight-month English-language program as well as APS Engineering Strategies & Practice, these students continue in an engineering program.	25
Graduate International Foundations Program (G-IFP)	G-IFP is similar to IFP, but is aimed at graduate students. Upon completion of English classes and one ELITE course (APS 1012), they move into the MEng program in the winter term. 2015 was the final cohort for this program.	16
MasterCard Foundation Scholars Program (MFP)	MFP provides talented young people from economically disadvantaged communities, particularly in sub-Saharan Africa, with access to quality and relevant education.	18, including 9 first-year students

Data and highlights in this chapter are presented by academic year (September to August).

Figure 9.1b Selected Opportunities for U of T Engineering Students to Study or Work Abroad

Program	Description	2015–2016 U of T Engineering Participants
Professional Experience Year (PEY) Internship	PEY places second- and third-year students in 12- to 16-month internships with employers in Canada and abroad.	79 international placements (50 U.S. placements and 29 other international placements)
Summer Research Abroad, Structured Exchange Pathways and other exchange programs	Programs administered by U of T's Centre for International Experience or coordinated by the Faculty allow students to conduct research internships or pursue academic courses at partner institutions abroad.	89
Global Educational Exchange (Globex)	Globex brings professors and students from engineering schools around the world to Peking University in Beijing, China, each summer for a three-week program. The Department of Mechanical & Industrial Engineering became the first Canadian partner in 2012.	21
Exceptional Opportunities Award	The Exceptional Opportunities Award supports Engineering Science students who have secured summer research opportunities abroad apart from those arranged by the division or the Centre for International Experience.	4 awarded in summer 2016; host institutions included Carnegie Mellon University, National University of Singapore and Stanford University

International Scholar Award Attracts Top Students

Two students from Jordan and Singapore are the first recipients of the University of Toronto Engineering International Scholar Award, a new scholarship that enhances our ability to attract top students from around the world.

The award recognizes exceptional international students who are involved in extra-curricular activities and want to use their engineering careers to improve the world. It covers full tuition and is renewable for up to four years. Tamara Abugharbieh (Year 1 EngSci) and Katherine Bancroft (Year 1 General First Year) received the award in 2015–2016.

18 MasterCard Foundation Scholars Study at U of T Engineering

Nine MasterCard Foundation Scholars joined the entering class at U of T Engineering in 2015–2016, bringing the total number of scholarship recipients studying at the Faculty to 18. Through this program, the MasterCard Foundation has committed \$500 million over 10 years to provide disadvantaged students, primarily from sub-Saharan Africa, the opportunity to study at universities around the world. Students receive funding for tuition, books and living expenses, as well as support for internship, volunteer and social activities.

Selected International Education and Research Partnerships

International Partnerships

International agreements create academic pathways and partnerships that enhance our engagement with peer institutions around the world. Through these relationships, our students gain unique opportunities to increase their global fluency through summer research exchanges and cross-cultural engineering design projects, and by sharing classes with students from partner universities. International agreements also formalize and strengthen collaboration between our faculty members and researchers around the world. As of June 2016, our Faculty had 31 active international agreements, with access to other top institutions through University-wide partnerships.

In 2015–2016, U of T Engineering entered into new agreements on academic and research exchanges and student mobility with the following peer institutions:

- Centrale Supélec (France);
- Scuola Internazionale Superiore di Studi Avanzati (Italy);
- Tianjin University (China);
- Tongji University (China); and
- Yonsei University (South Korea).

In addition, agreements between UTIAS and Shanghai Jiao Tong University (SJTU) were finalized that will enable select SJTU students to complete a MEng at U of T, as well as a separate agreement for a joint placement PhD.

We have also begun the process of converting our expiring memorandum of understanding with South China University of Technology — which allowed its students to complete their final undergraduate year at U of T Engineering and gain conditional acceptance to our MEng program — to a dual degree program.

Improving Transportation at the World's Largest Gathering

Professor Amer Shalaby (CivE) is playing a key role in making the pilgrimage to Mecca safer for more than two million Muslims who gather there each year to perform the hajj, one of the five pillars of the faith.

Shalaby is working with authorities in Saudi Arabia on transportation studies to inform the development of infrastructure and crowd management systems. A main goal is to prevent deadly crowd crushes such as the one in September 2015 that killed more than 1,000 people, an estimate which may change pending an ongoing

investigation. With roughly 2.5 million pilgrims in attendance in recent years, the five-day hajj is considered to be the largest annual gathering of people in the world.

Shalaby, a member of the University of Toronto Transportation Research Institute (UTTRI), focuses on transportation infrastructure systems that can adapt to massive, sporadic population spikes, such as the hajj. He has served on the technical advisory panels of studies planning the shuttle bus system, pedestrian network and metro system in Mecca. He also serves on the international advisory panel for the Medina Mosque Expansion project, and helps guide the research program of the Transportation and Crowd Management Center of Research Excellence at Umm Al-Qura University in Mecca as a member of its advisory board and head of its International Scientific Committee.

His work has the potential to not only increase safety and efficiency during mass events, but also provide guidance on the unprecedented number of large-scale transportation projects that emerging countries are building to meet the demands of population growth and urbanization.

International Partnership Aims to Design the Next Generation of Aircraft Landing Gear

In April 2016, Professor Kamran Behdinan (MIE) was awarded a three-year NSERC Collaborative Research and Development to develop an integrated computational methodology for the design, testing and development of the next generation of landing gear.

Behdinan and his research group will work in partnership with SPP Canada Aircraft Inc. and its Japanese parent company, Sumitomo Precision Products Co., a world leader in the design of aircraft landing gear. The landing gear is essential to aircraft safety and relies on many complex and interdependent mechanical components: the retraction-extension mechanism, locking system, tires and 'shimmy damper' that controls the lateral vibration on landing all work together to prevent failure on landing.

Behdinan's group will conduct drop tests to validate impact measurements and simulate lateral vibrations of the landing gear when it hits the ground. Their results will inform new computational tools that will be used to optimize the cost and weight of landing gear, as well as to reduce noise pollution, all while maintaining the highest level of safety.

Saving Sunshine for a Rainy Day: New Catalyst Offers Efficient Storage of Alternative Energies

A multinational collaboration led by Professor Ted Sargent (ECE) has resulted in the most efficient catalyst for splitting water into hydrogen and oxygen. This process, which mimics that of plants during photosynthesis, allows the storage of electricity from intermittent sources, such as wind and solar, in chemical form.

The new catalyst is made of the abundant metals tungsten, iron and cobalt, making it much less costly to produce than state-of-the-art catalysts based on precious metals. It showed no signs of degradation over more than 500 hours of continuous activity, unlike other efficient but short-lived catalysts. Their work was published in the leading journal *Science*.

This research united engineers, chemists, materials scientists, mathematicians, physicists, and computer scientists across Canada, the United States and China. The team includes researchers at Stanford University, East China University of Science & Technology, Tianjin University, Brookhaven National Laboratory, the Canadian Light Source and the Beijing Synchrotron Radiation Facility.

Food & Nutrition Security Engineering Initiative

The Centre for Global Engineering (CGEN) is bringing together researchers from across the Faculty of Applied Science & Engineering in a multidisciplinary collaboration to address hunger and malnutrition, which affect billions of people around the world.

The Food & Nutrition Security Engineering Initiative (FaNSEI) seeks to leverage the Faculty's diverse expertise to advance engineering solutions to these issues.

Its multidisciplinary approach recognizes that food and nutrition are complex challenges that are often intertwined with other issues such as agricultural productivity, water availability, energy resources, food preservation, transport and storage — areas in which the Faculty has outstanding strengths.

The group has received seed funding from the Dean's Strategic Fund, which supports strategic collaborations that have a broad impact in the Faculty. FaNSEI members include CGEN Director Professor Yu-Ling Cheng (ChemE) and Associate Director Professor Amy Bilton (MIE), and Professors Edgar Acosta (ChemE), Stewart Aitchison (ECE), Timothy Chan (MIE), Levente Diosady (ChemE), Elizabeth Edwards (ChemE), Chi-Guhn Lee (MIE), Emma Master (ChemE) and Arun Ramchandran (ChemE).

The team has also partnered with U of T researchers outside engineering, including plant biologists and experts in food security and nutrition.

Improving Global Health Through Micronutrients

Researchers at U of T Engineering are fortifying universally consumed foods such as tea and salt with critical micronutrients to improve public health in the developing world. Micronutrients, such as iron, folic acid and vitamin B-12, are needed in only small quantities but are crucial for good health, particularly among women and babies.

Professor Levente Diosady (ChemE) and his team have created tiny edible particles that are rich in iron. The particles are mixed with traditional iodized salt to create double fortified salt (DFS). Diosady has teamed up with the Micronutrient Initiative to distribute DFS to more than five million children a day in India's Tamil Nadu province, with an initial trial showing a 35 per cent reduction in anemia within eight months. The project is expanding to the province of Uttar Pradesh, where it will be given to between 10 million and 20 million people.

Diosady is also working on incorporating folic acid and vitamin B-12 into salt, and iron into tea. Both salt and tea are consumed in predictable amounts in the developing world, regardless of economic status.

International Capstone Course Challenges Students to Design Across Cultures

More than a dozen U of T Engineering students and professors spent four days in China in November 2015 collaborating with colleagues from two universities on projects ranging from satellite design to assistive devices. The trip was part of the Department of Mechanical & Industrial Engineering's fourth-year international capstone course, which allows students to work collaboratively across continents and cultures on industry-sponsored engineering projects.

The course, which is celebrating its fifth anniversary, includes partnerships with Peking University (PKU) in Beijing, the National University of Singapore, the University of California, Irvine and, new this year, Beijing's Tsinghua University. Industrial partners in Canada or the partner country sponsor the projects.

The students, who conducted most of their work via e-mail and other online tools, met in Toronto in April 2016 to present their final designs.

Winds of Change Bring Water to Drought-Prone Area

Professor Amy Bilton (MIE) and her students have partnered with residents of Pedro Arauz, Nicaragua, to design and construct a water-pumping windmill, providing critical irrigation during the area's long dry season.

The project was part of a fourth-year capstone design course in the Department of Mechanical & Industrial Engineering. Over the last two years, three different teams of undergraduate students have worked closely with members of the community and Winds of Change — an initiative started by Canadians John Shoust and Rob Scott — to make the windmill a reality.

The area has plenty of groundwater and dug wells, but lacks the technology to pump the water efficiently. Hand pumps are not powerful enough to produce the thousands of gallons of water required for crop irrigation, while the use of diesel and electrical pumps is limited by a lack of infrastructure, high cost and difficulties with the importing of goods. By contrast, wind pumps can be built and maintained using locally available materials, and the climate in Nicaragua is windy enough to provide the required energy.

During the first two trips to Nicaragua, in fall 2014 and spring 2015, the teams took wind speed measurements, consulted extensively with community members about their resources and irrigation needs, designed the windmill and dug the foundation. In January 2016, Bilton and some of the students returned to Pedro Arauz and built the windmill out of wire, sheet metal and PVC piping in four and a half days.

10

Diversity deepens the engineering creative process, enriches the teaching and research environment, enhances the experiences of our students and enables accelerated innovation. As Canada's premier engineering school, we have a responsibility to lead in advancing diversity and we play a key role in enriching the engineering profession by ensuring candidates eligible for professional licensing better reflect the rich diversity of our society.

We have made excellent progress in recruiting female students to our undergraduate program, with women comprising more than 30 per cent of our first-year cohort — the highest proportion of any entering engineering class in Ontario — for the second year in a row. We expect the number of women in our graduating classes will continue to grow, expanding the number of potential female applicants to graduate programs and the number of women professional engineers. Our progress supports our commitment to a broader coalition that aims to increase the proportion of women to 30 per cent of all newly licensed engineers by 2030. Currently, fewer than 12 per cent of practising, licensed engineers in Canada are women.¹

Our commitment to diversity is also reflected in our faculty. In the past year we have hired 13 outstanding professors, nine of whom are women, whose areas of expertise span the breadth and depth of the profession, including research at the intersection of multiple disciplines that addresses the world's most pressing challenges.

The quality of our programs and our outstanding global rankings continue to attract top students from around the world. Diverse backgrounds and experiences enrich our learning and research environments and fortify our global alumni networks. To further increase the geographic and cultural mix among our international students, we enhanced strategic recruitment initiatives in key regions, including Latin America, South Asia, the Caribbean and the Middle East. We will continue to expand our activities in these areas.

We are also focusing our outreach and recruitment activities to encourage Indigenous students to engage in STEM subjects. We have created a new position to coordinate these initiatives and have struck a committee for discussion of ideas, information, and initiatives to ensure a welcoming and supportive atmosphere for Indigenous students, faculty, staff and communities, and to improve access to engineering education for Indigenous peoples.

¹ Engineers Canada, <https://www.engineerscanada.ca/diversity/women-in-engineering>

Diversity: Measures of Progress

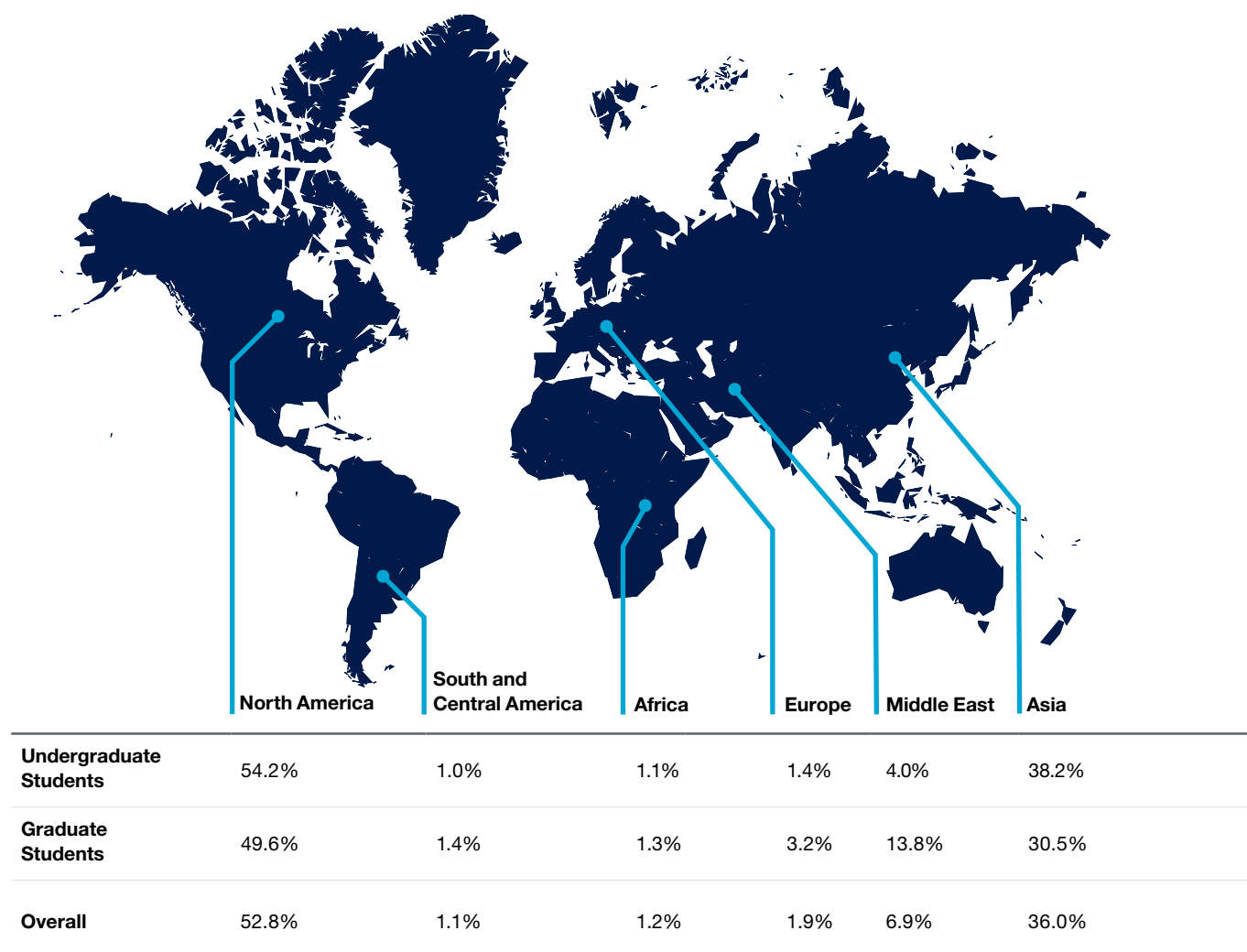
International Diversity

Our strong international reputation, excellent position in global rankings and vibrant alumni networks enable us to attract outstanding students from around the world. In 2015–2016, 25.8 per cent of our undergraduates were international students, in line with our Academic Plan goal of 25 per cent by 2015, with 30 per cent of our incoming students coming from outside Canada. Among our graduate students, 31.1 per cent are international students, up from 27.1 per cent the previous year. These

students enrich our community with different ideas and perspectives, enhance our student experience and broaden our global alumni community and networks.

To enhance diversity among our international students, we increased targeted recruitment initiatives in strategic regions, such as Latin America, South Asia, the United States and the Middle East. *(For more information about our international recruitment initiatives, please see Chapter 9: International Initiatives.)*

Figure 10.1 Continent of Origin: Undergraduate and Graduate Students, Fall 2015



Data and highlights in this chapter are from September 2015 to August 2016.

Note 10.1: Not shown—0.1% of undergraduate students and 0.2% of graduate students from Oceania, which includes Australia, New Zealand and other countries in the Pacific Ocean. Country of origin is derived from a combination of citizenship, location(s) of previous studies (e.g., elementary school, high school and university) and permanent address. This information does not indicate current Canadian immigration status, which is used to determine domestic/international student status for tuition and funding purposes.

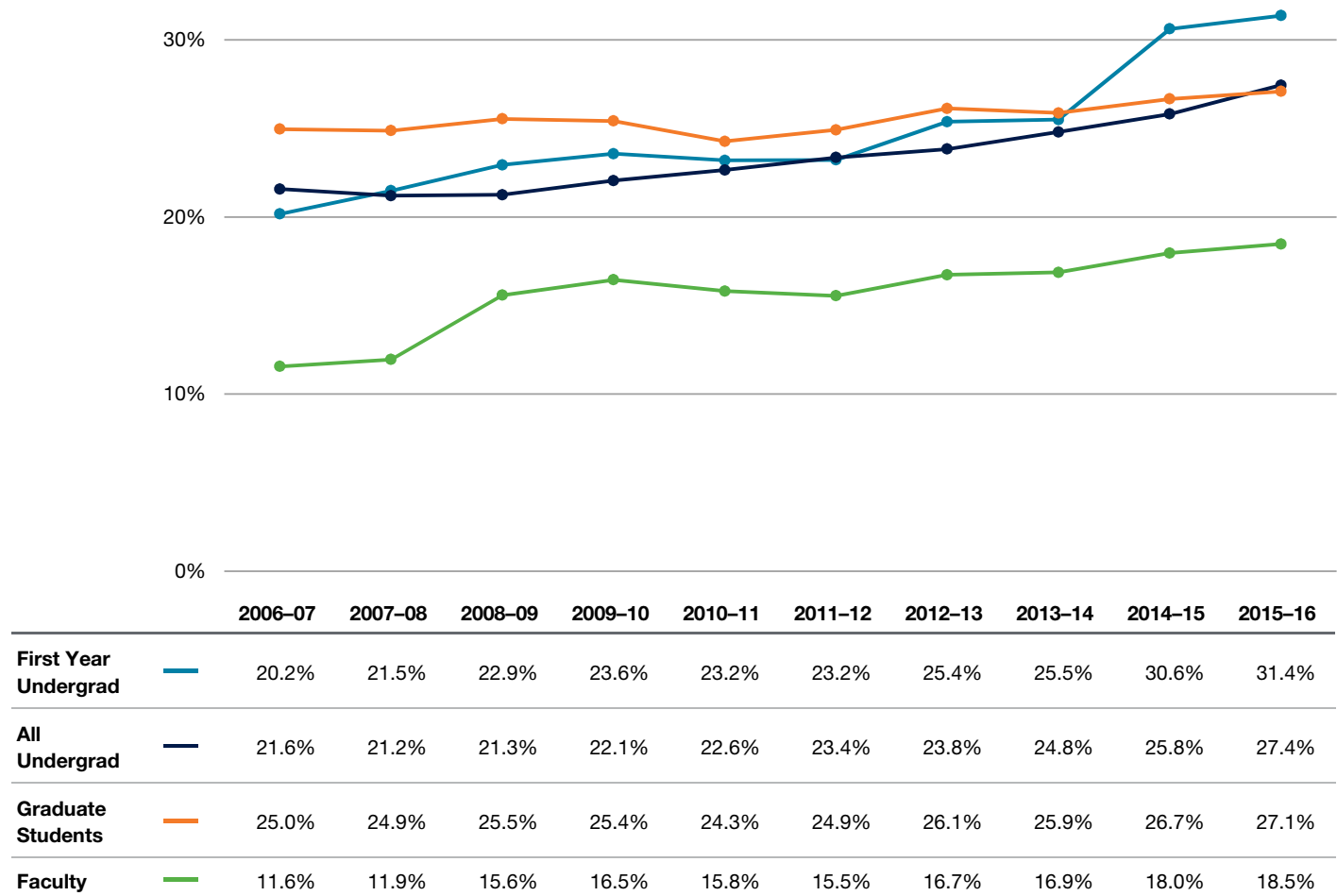
Outreach and Inclusivity

Through focused outreach and recruitment activities, we have continued to increase gender diversity in our student body. Women made up 31.4 per cent of entering first-year students in fall 2015, the second year in a row that women have comprised more than 30 per cent of our entering class. As a result of this progress in first-year enrolment, the proportion of women in our overall undergraduate population increased to 27.4 per cent, from 25.8 per cent in 2014–2015, and is on track to surpass 30 per cent within a few years. We are driving progress on increasing the percentage of newly licensed engineers who are women to 30 per cent by 2030. Currently, fewer than 12 per cent of practising, licensed engineers in Canada are women.¹

Our strategic recruitment initiatives seek to expand the pool of female applicants to our programs and increase the number of women who join U of T Engineering. In October

2015, we welcomed more than 70 top female Grade 12 students from the Toronto area at the second annual Young Women in Engineering Symposium (YWIES). This event gave invited students an opportunity to learn more about engineering, participate in experiential workshops and meet students, faculty and alumni, and enabled us to connect with these potential applicants early in the 2016 admissions cycle. We also piloted a mentorship program from February to April 2016 that connected YWIES participants with current U of T Engineering female students. In May 2016, we held our Girls' Leadership in Engineering Experience (GLEE), a weekend-long program for female students with offers of admission to U of T Engineering. GLEE inspires students to learn more about the contributions they can make as engineers and the unique opportunities our Faculty offers. This year, 91 per cent of the 87 students participating in GLEE accepted their offers of admission.

Figure 10.2 Percentage of Women Students and Faculty, 2006–2007 to 2015–2016



¹ Engineers Canada, <https://www.engineerscanada.ca/diversity/women-in-engineering>

Our robust outreach programs are a key aspect of our strategy to engage all students — including women and girls, black students, Indigenous youth and other underrepresented communities — in engineering activities, increasing their awareness of the profession and exposing them to inspiring role models. In 2015–2016, we reached more than 9,000 pre-university students through outreach programs such as:

- Da Vinci Engineering Enrichment Program (DEEP) Summer Academy, which provides motivated high school students from around the world the opportunity to engage in experiential learning activities in a variety of engineering, technology, business and science disciplines;
- Jr. DEEP and Girls' Jr. DEEP, summer day camps and Saturday programs that allow students in Grades 3 to 8 to explore engineering;
- Workshops such as Go Eng Girl and Go CODE Girl, which enable girls in middle and high school to explore engineering and computer coding;
- ENGage, a collaboration between U of T's Chapter of the National Society of Black Engineers and the Faculty of Applied Science & Engineering. ENGage highlights black role models, encourages literacy in science, technology, engineering and math (STEM) and promotes academic and social growth.

We are contributing to nationwide efforts to reduce the educational gaps between Indigenous and non-Indigenous Canadians. These efforts align with calls by the Truth and Reconciliation Commission of Canada. In 2016, we created a new position, Director of Engineering Pathways and Indigenous Partnerships. The Director will coordinate a Faculty-led outreach program to First Nations, Métis and Inuit communities, with the goal of increasing the rate of participation of Indigenous students in Engineering. The Director is also facilitating greater integration of existing outreach, recruitment and retention initiatives, both within the Faculty and across the University, that affect Indigenous engineering students.

We continue to raise awareness of LGBTQ perspectives and experiences in engineering. Members of the U of T Engineering community joined students, faculty and staff across the University in March 2016 to celebrate the 20th anniversary of the U of T Positive Space Committee with a panel discussion at Hart House. Founded in 1996, the Positive Space Committee promotes safe and inclusive spaces across the University for LGBTQ students, staff, faculty, alumni and allies. The most visible aspect of its work is the rainbow triangle stickers that are posted on doors and in offices across campus. Professor Peter Weiss of the Engineering Communication Program moderated the discussion. Ron Suprun (Year 3 IndE), the first non-binary person to take on the role of Godiva's Crown — a spirit

position within the Engineering Society that has historically been held by female students — was a member of the five-person panel.

Faculty, staff and students celebrated Pride Month on June 23, 2016 by assembling the pride flag out of 24 three-foot-wide balloons in the atrium of the Bahen Centre. The event was part of a University-wide challenge to #DisplayYourPride, and resulted in a spike of activity on social media, with more than 45,000 impressions across Facebook, Twitter and Instagram and an eight-fold increase in engagement with Facebook posts compared to the same week the previous year.

To ensure we have appropriate supports in place, the Community Affairs & Gender Issues Committee is developing a survey to inform these activities (see Next Steps).

New Faculty Members, 2016–2017

Our international reputation for excellence enables us to attract stellar faculty members from Canada and around the world. In anticipation of new space provided in the upcoming Centre for Engineering Innovation & Entrepreneurship (CEIE), in 2015–2016 we were able to hire a larger cohort of new professors than in most years. These 13 professors will take up their appointments on or before July 1, 2017. These new faculty members — five of whom have budgetary cross-appointments in more than one academic unit — enrich the multidisciplinary of our Faculty's research and educational programs.

Professor Fae Azhari (MIE, CivE) studied civil engineering at Iran's Isfahan University of Technology and the University of British Columbia before receiving her PhD from the University of California, Davis. She specializes in structural health monitoring of bridges, aircraft, wind turbines and other engineering systems to advance sustainable infrastructure management.

Professor Erin Bobicki (MSE, ChemE) completed her PhD at the University of Alberta, where she studied carbon sequestration, and spent two years working at Intel in Portland, Oregon. She aims to improve the sustainability of mining operations by developing enhanced techniques for mineral processing that reduce energy and water use, as well as the overall environmental impact.

Professor Merve Bodur (MIE) studied at Bogazici University in Turkey, as well as the University of Wisconsin–Madison, where she received her PhD. She conducted post-doctoral research at Georgia Institute of Technology. Her research focuses on new mathematical methods and big data analytics to optimize complex processes, including staffing, decision making and resource allocation.

Professor Jennifer Farmer (ChemE) is a teaching-stream faculty member who received her PhD in chemistry from York University. She will bring her expertise in synthetic and organometallic chemistry to undergraduate courses.

Professor Naomi Matsuura (MSE, IBBME) completed her PhD in the Department of Materials Science & Engineering at U of T and worked five years as a researcher at Sunnybrook Health Sciences Centre. Her research focuses on the application of nanotechnology, including injectable nanoparticles used as imaging agents, to the diagnosis and treatment of cancer.

Professor Alison Olechowski (MIE, ILead) completed her undergraduate studies at Queen's University and her PhD at the Massachusetts Institute of Technology (MIT). She uses a systems engineering approach to develop improved methods for corporate processes such as product development and risk management. As a teaching-stream faculty member, Professor Olechowski will share these useful tools with future engineers to enhance their leadership capabilities.

Professor Ira Daniel Posen (CivE) studied at Princeton University and Carnegie Mellon University, where he received his PhD in Engineering and Public Policy. He specializes in greenhouse gas emissions in the chemical industry, including assessing the effects of bio-based products using life-cycle analysis and examining the impact of renewable fuel standards on emissions.

Professor Shoshanna Saxe (CivE) studied at McGill University, MIT and the University of Cambridge, where she completed her PhD. She is an expert on public transit, in particular the impact of public infrastructure investments on society and the environment.

Professor Vahid Sarhangian (MIE) completed his PhD at U of T's Rotman School of Management and conducted postdoctoral research at Columbia Business School. He specializes in operations research, including optimizing the storage and delivery of blood products and other perishable commodities.

Professor Patricia Sheridan (ILead) received her PhD from the Collaborative Program in Engineering Education at U of T Engineering. She has developed novel tools to teach and evaluate team effectiveness and leadership competencies in undergraduate engineering courses.

Professor Hamid Timorabadi (ECE) completed his PhD in the Department of Electrical and Computer Engineering at U of T. He is a teaching-stream faculty member who specializes in lab-based courses relating to power electronics and computer organization.

Professor Marianne Touchie (CivE, MIE) completed her PhD in the Department of Civil Engineering at U of T and has worked for the Toronto Atmospheric Fund. Her research focuses on improving the energy performance and indoor environmental quality of existing buildings through comprehensive retrofits.

Professor Chirag Variawa (First Year Program) received his PhD from the Department of Mechanical & Industrial Engineering at U of T. He is a teaching-stream faculty member who applies artificial intelligence, computational linguistics, and neuroscience to improve the design of engineering learning environments.

Diversity in Engineering and Leadership

We have made significant progress since 2006, a time when our Faculty had no women in academic leadership positions. Today women engineers lead many of our academic units and our multidisciplinary research centres and institutes. They also hold senior leadership positions of significant responsibility at the University level.

Dean Cristina Amon (MIE) has led the Faculty of Applied Science & Engineering since 2006. She holds the Alumni Chair in Bioengineering and has been inducted into the Canadian Academy of Engineering, the Spanish Royal Academy, the Royal Society of Canada and the U.S. National Academy of Engineering. She has received the Achievement Award from the Society of Women Engineers, and in 2012 was among Canada's 25 Most Influential Women. In 2015 she received the Ontario Professional Engineers Gold Medal, the organization's highest honour.

Professor Aimy Bazylak (MIE) is the Canada Research Chair in Thermofluidics for Clean Energy and Director of the Institute for Sustainable Energy. This multidisciplinary institute brings together researchers, students, and educators from across the University, together with partners from industry and government, to increase energy efficiency and reduce the environmental impact of energy use and conversion.

Distinguished Professor Yu-Ling Cheng (ChemE) is Director of the Centre for Global Engineering. The Centre brings together researchers and students to tackle some of the world's most critical challenges, such as sanitation, alternative energy, drinking water and global health. Professor Cheng has also served as Chair of Engineering Science (2000–2005), Acting Chair of the Department of Chemical Engineering & Applied Chemistry (2006), Speaker of Faculty Council (2007–2010) and Acting Dean of the Faculty of Applied Science & Engineering (2012 and 2013).

Professor Elizabeth Edwards (ChemE) is the Canada Research Chair in Anaerobic Biotechnology. She heads both BioZone, a centre for applied bioengineering at U of T Engineering, and the Industrial Biocatalysis Network, which explores new methods of using enzymes to produce environmentally friendly chemicals, plastics and other products and includes researchers from the University of British Columbia, Concordia University and several industry partners.

Professor Deepa Kundur (ECE) is Director of the Centre for Power & Information and will become Chair of the Division of Engineering Science in January 2017. She is a leading expert on issues at the intersection of cybersecurity, signal processing and complex dynamical networks, including smart grid technologies that can increase the sustainability of our energy supply.

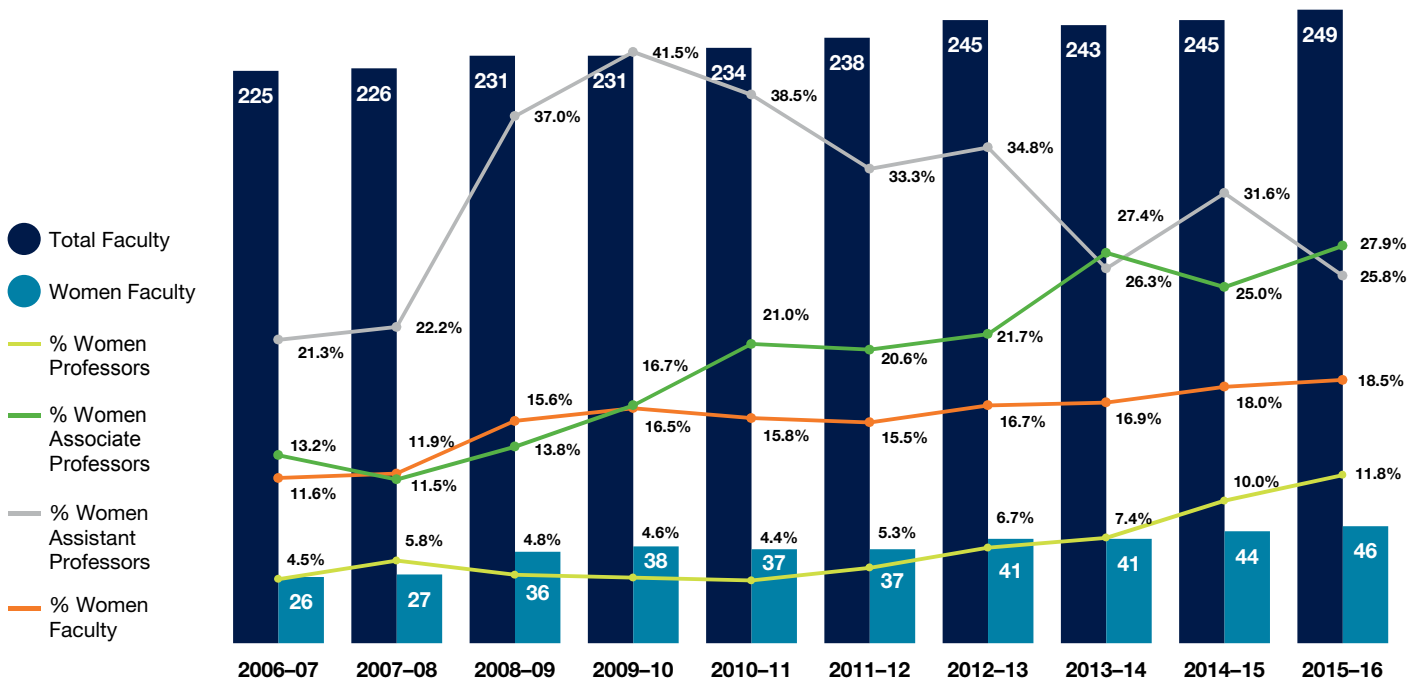
Professor Goldie Nejat (MIE) is the Canada Research Chair in Robots for Society and Director of the Institute for Robotics and Mechatronics, which is increasing cross-disciplinary research and commercialization in these fields.

Professor Susan McCahan (MIE), who served as Vice-Dean, Undergraduate (2011-2015) and Chair First Year (2006-2011), is now championing the University's efforts to reimagine undergraduate learning as Vice-Provost, Innovations in Undergraduate Education.

As U of T President Meric Gertler's Senior Advisor on Science and Engineering Engagement, **University Professor Molly Shoichet** (ChemE, IBBME) is raising public awareness of and engagement in STEM research at U of T. Her outstanding work in this area was recognized with the 2015 Fleming Medal and Citation from the Royal Canadian Institute.

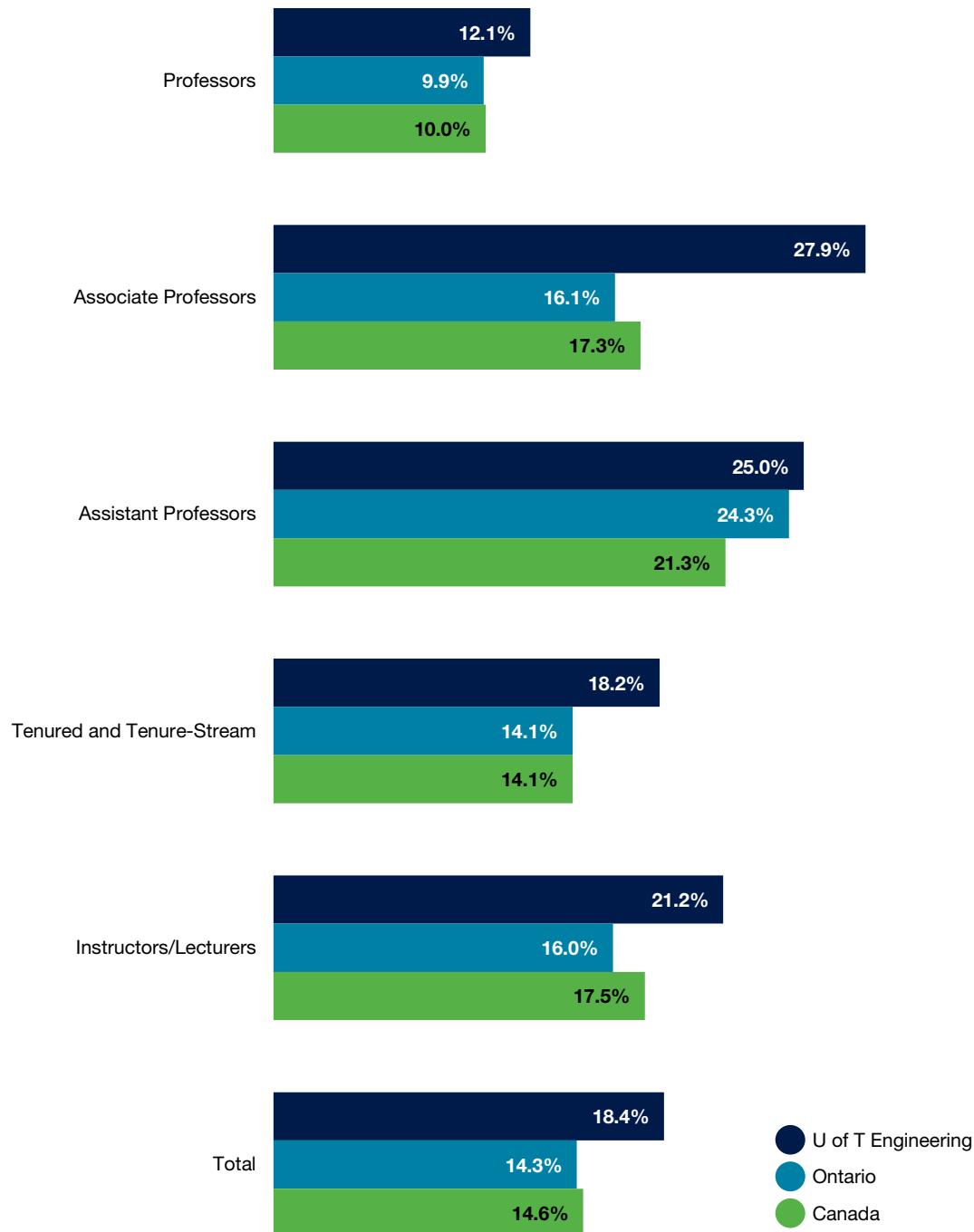
Professor Jean Zu (MIE) has served as the Chair of the Department of Mechanical & Industrial Engineering since 2009, having previously served as Associate Chair of Research. She was president of the Canadian Society for Mechanical Engineering from 2006–2008 and president of the Engineering Institute of Canada (EIC) from 2012–2014.

Figure 10.3 Total Number of Faculty with Percentage of Women, 2006–2007 to 2015–2016



Note 10.3: Data for this figure reflects faculty headcount as of July 1, 2016. Tenured, tenure-stream and teaching-stream professors are included.

Figure 10.4 Percentage of Women Faculty at U of T Engineering Compared with Women Faculty in Ontario and Canadian Engineering Faculties, November 2015



Next Steps

Diversity is a fundamental value of U of T Engineering, and we are committed to ensuring that the engineering profession reflects the population it serves. As a Faculty, we are developing a survey that will allow us to better understand the ethnicity, gender and sexual orientation, religion, age, disability, legal status and socio-economic background of our faculty, students and staff. The survey, designed by the Community Affairs & Gender Issues

Committee, will help us assess how Faculty policies and practices support all members of our community, and make appropriate changes to strengthen this support. Other universities, such as the University of California, Los Angeles, Texas A&M University and the University of Maryland, have used diversity climate surveys to develop and implement policies to enhance diversity among their students, faculty and staff.

Note 10.4: Data in this figure comes from Engineers Canada. Counts are based on full-time equivalent (FTE) faculty as of November 15, 2015.

Diversity: Selected Highlights

Engaging Indigenous Youth in STEM

In May 2016, a team of U of T volunteers — including engineering student Yonatan Lipsitz (IBBME PhD candidate) — partnered with Sandy Lake First Nation in Northern Ontario to deliver a series of workshops aimed at reducing the high rates of Type II diabetes in the community. Topics included healthy meal planning, food composition and local gardening. Both children and adults in the community also took part in science and engineering activities, including learning about the night sky in an astronomy workshop. The project has been running for five years and is delivered through Let's Talk Science, a national organization that connects graduate students and youth in science, technology, engineering and math (STEM) activities.

In summer 2016, Rachel Mandel (Year 3 MIE) was one of 12 students from across Canada who were selected to deliver science, technology, engineering and math (STEM) workshops through the National Indigenous Youth in STEM (InSTEM) program. Developed and run by Actua, a national STEM charity, InSTEM is a customized, community-based approach to engaging First Nations, Métis, and Inuit youth in locally and culturally relevant STEM education programs. Mandel and her teammates travelled more than 8,000 kilometres, visiting Indigenous communities in Nunavut — Igloolik, Arctic Bay, Kimmirut, Hall Beach, Cape Dorset and Resolute Bay — as well as the Six Nations of the Grand River in Ontario. The workshops covered a diverse range of topics, from Arctic ecology to computer programming to the use of unmanned aerial vehicles in the mining industry.

Infrastructure Engineering in Remote First Nations Communities in Ontario

Starting in fall 2016, MEng students will be offered a new course in Infrastructure Engineering in Remote First Nations Communities in Ontario. We also struck a committee that will serve as an inclusive forum for discussion to ensure a welcoming and supportive atmosphere for Indigenous students, faculty, staff and communities.

New Godiva's Hymn Verses Celebrate Diversity in Engineering

Women in leadership, the impact of engineering on the world and Skule™ spirit were the themes of three new verses that took the top prizes in the Godiva's Hymn contest, which were announced at Cannonball 1T6, held in January 2016. Organized by the Engineering Society, the contest challenged the U of T Engineering community to create lyrics to this traditional engineering song that better convey the diversity and vibrancy of engineering in the 21st century. Tania

Albarghouthi (Year 3 ECE) wrote the winning entry:

*I came across a girl whose skin was glazed a purple hue,
Her aura proud, her spirit loud, her words were strong and true,
She led a group of hundreds who were chanting far and near,
And in my mind, I had no doubts — she led the engineers!*

WISE Conference Highlights Professional and Personal Development

More than 250 delegates from universities across Ontario gathered in Toronto in January 2016 for the fourth annual Women in Science and Engineering (WISE) national conference. The program covered both professional and personal development topics, such as machine learning, how to land your dream job and finding the company culture that best fits your strengths. Guest speakers included leaders from companies ranging from startups such as NanoLeaf to multinational corporations such as IBM. U of T's WISE chapter was revitalized in 2012, with a mission to “support and empower women to achieve their full potential as engineers, scientists, and leaders.” In addition to the national conference, WISE also runs mentoring programs, networking events and community outreach initiatives.

U of T Engineering Observes Pink Shirt Day

Students, staff and faculty gathered in the Sandford Fleming atrium on Feb. 24, 2016 to observe Pink Shirt Day. The annual event, which aims to end bullying, started after students at a Nova Scotia high school wore pink shirts to support a boy who had been bullied for wearing a pink shirt. Members of the U of T Engineering community posted photos of themselves on social media using the hashtag #pinkskule.

U of T Joins Diversity Initiative

U of T Engineering has joined more than 90 North American engineering schools that are leading a transformative movement to increase diversity in engineering. In a letter shared in August 2015 by the White House in Washington D.C. as part of the its first Demo Day, U of T and peer institutions committed to recruit women and underrepresented minorities to its student bodies and as faculty members, as well as foster a culture of inclusivity in the engineering profession. Released as part of the American Society for Engineering Education's Year of Action in Diversity, the letter outlines four actions that each participating school has committed to implement, including developing a diversity plan and conducting pre-university outreach programs.

11

Strategic oversight of our physical and financial resources underpin our world-class research and educational programs. Total revenue in 2015–2016 grew by 6.3 per cent over the previous year, driven by higher international student enrolment, while our net revenue increased by 7.8 per cent. Growing revenue, combined with careful budgeting and fiscal management, enabled us to continue infrastructure upgrades as well as to invest in new initiatives and the further development of reserves for planned future priorities and contingencies.

The Dean’s Strategic Fund (DSF) provides seed funding for projects that advance the goals of the Academic Plan, but which may not otherwise get started. These include research collaborations that bring experts together across disciplines to address major societal challenges, as well as initiatives to enhance the student experience, from improvements to teaching labs and fabrication spaces to new experiential learning programs. In 2016, we committed \$7.2 million through the DSF for a number of initiatives that will be implemented over the next three years.

The Centre for Engineering Innovation & Entrepreneurship (CEIE), scheduled to open in 2017, is the most significant capital project the Faculty has undertaken in recent years. The CEIE will set a new standard for engineering education and research while providing a home for multidisciplinary research institutes such as the Centre for Global Engineering and the Institute for Sustainable Energy, and will contain Technology Enhanced Active Learning classrooms, prototyping and fabrication facilities, design/meet rooms and dedicated space for student clubs and teams. It will serve as a vibrant hub and enable us to drive innovation, facilitate entrepreneurial activities and cultivate global engineering leaders.

This year we completed the \$10-million laboratory for the Translational Biology and Engineering Program (TBEP) in the MaRS Discovery District West Tower. TBEP is part of the Ted Rogers Centre for Heart Research, and brings together faculty and students from U of T Engineering, Dentistry and Medicine to advance heart research, diagnostics, and regeneration using a comprehensive approach that includes systems and developmental biology, technology innovation and clinical translation.

We also created the Dean’s Infrastructure Improvement Fund, which enables upgrades to large-scale teaching and research laboratories and general facility renovations that further improve the experience of our students.

Total Revenue and Central Costs

The Faculty’s total revenue and associated costs are reflected in Figures 11.1 and 11.2. Revenue in 2015–2016 grew to \$210.1 million, an increase of 6.3 per cent over 2014–2015, with a compound annual growth rate of 6.5 per cent since 2006–2007.

Total central costs rose to \$94.0 million, a 4.6 per cent increase over 2014–2015, with a compound annual growth rate of 5.3 per cent since 2006–2007. Central costs are composed of the student aid levy, university fund contribution and university-wide costs, which experienced year-over-year increases of 3.4 per cent, 3.1 per cent and 5.2 per cent respectively (Figures 11.2 and 11.3).

The rise in our student aid levy is driven by our commitment to provide need-based assistance. U of T’s Student Access Guarantee makes this goal clear: “No student offered admission to a program at the University of Toronto should be unable to enter or complete the program due to lack of financial means.” Student aid ensures we continue to attract the very best students regardless of their financial situation.

University-wide costs, which include caretaking, utilities, human resources, student services, information technology, central library, advancement and research services, to name a few, also increased. Factors included: development of a new student information system; improved wireless access across campus; enhancement of central library collections; and repeated higher pension fund deficit obligations brought about by a volatile investment environment.

As a result, net revenue increased by 7.8 per cent to \$116.1 million year-over-year, with a compound annual growth rate of 7.6 per cent since 2006–2007.

Figure 11.1 Total Revenue, 2006–2007 to 2015–2016

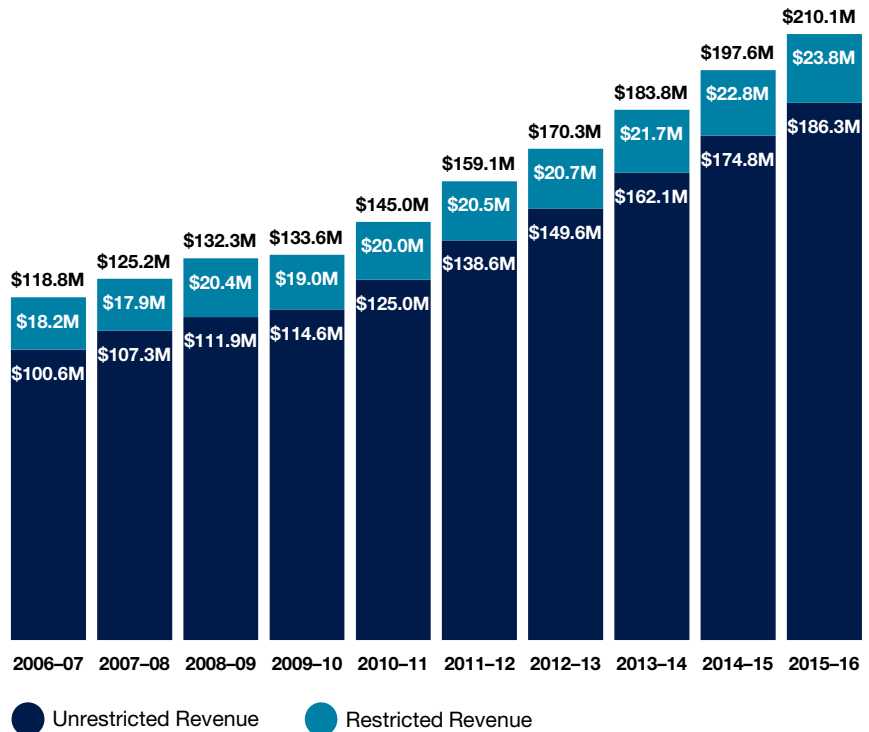
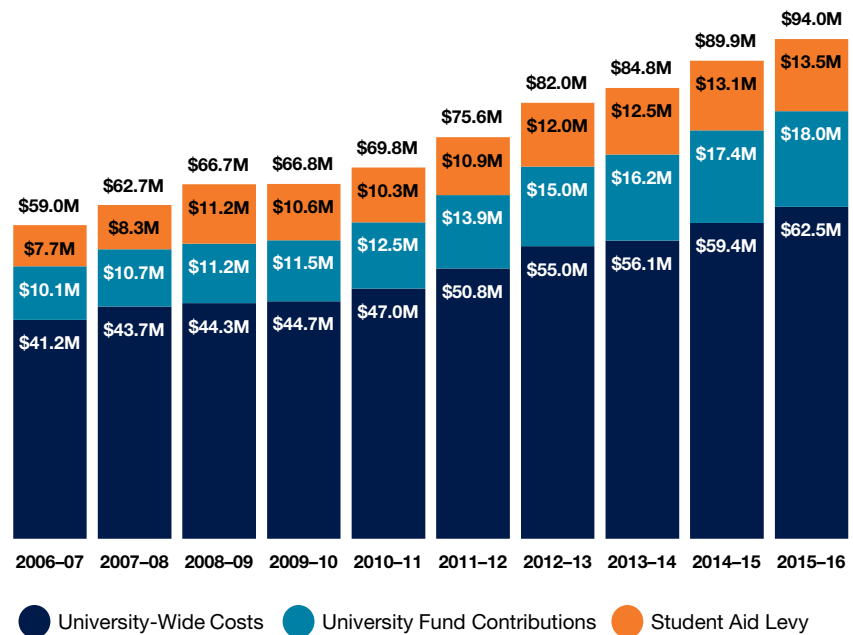


Figure 11.2 Total Central Costs, 2006–2007 to 2015–2016



Data in this chapter are presented by fiscal year (May to April). Selected projects were completed or begun between September 2015 and July 2016.

Figure 11.3 Budget Data, 2006–2007 to 2015–2016

	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16
Total Revenue	\$118,826,327	\$125,233,418	\$132,333,400	\$133,571,789	\$144,976,282	\$159,081,170	\$170,342,629	\$183,785,352	\$197,570,871	\$210,065,441
Unrestricted Revenue	\$100,663,690	\$107,347,671	\$111,937,605	\$114,602,697	\$124,966,518	\$138,597,605	\$149,615,656	\$162,048,175	\$174,819,446	\$186,298,686
Restricted Revenue	\$18,162,637	\$17,885,747	\$20,395,795	\$18,969,092	\$20,009,764	\$20,483,566	\$20,726,973	\$21,737,177	\$22,751,425	\$23,766,755
Total Central Costs	\$58,976,711	\$62,755,042	\$66,667,514	\$66,768,403	\$69,837,572	\$75,536,585	\$81,984,923	\$84,796,193	\$89,927,727	\$93,988,403
University-Wide Costs	\$41,180,986	\$43,698,011	\$44,307,203	\$44,693,620	\$47,027,056	\$50,817,454	\$55,028,273	\$56,089,556	\$59,390,462	\$62,461,112
University Fund Contributions	\$10,066,369	\$10,734,767	\$11,193,761	\$11,460,270	\$12,496,652	\$13,859,760	\$14,961,566	\$16,167,220	\$17,443,377	\$17,985,353
Student Aid Levy	\$7,729,356	\$8,322,264	\$11,166,550	\$10,614,513	\$10,313,864	\$10,859,371	\$11,995,084	\$12,539,417	\$13,093,888	\$13,541,938
Net Revenue	\$59,849,616	\$62,478,376	\$65,665,886	\$66,803,386	\$75,138,710	\$83,544,584	\$88,357,706	\$98,989,159	\$107,643,144	\$116,077,038

Budget Overview

Our revenue sources, attributed central costs and budget breakdown for 2015–2016 are shown in Figures 11.4, 11.5 and 11.6, respectively. Revenues are up 6.3 per cent year-over-year, driven by higher student enrolment, rising relative enrolments of international undergraduate students and annual tuition increases. Government grant revenues have remained relatively stagnant as the grant per domestic student has not changed for a number of years.

The ability to consistently grow net revenue at the Faculty level enables us to pursue renewal objectives, including major strategic initiatives such as the Centre for Engineering Innovation & Entrepreneurship (CEIE). Further prudent budgeting and fiscal management across the Faculty has allowed us to fund reserves to meet future commitments, upgrade existing classrooms and laboratories and invest in Dean’s Strategic Fund (DSF) initiatives.

Figure 11.4 Revenue Sources, 2015–2016

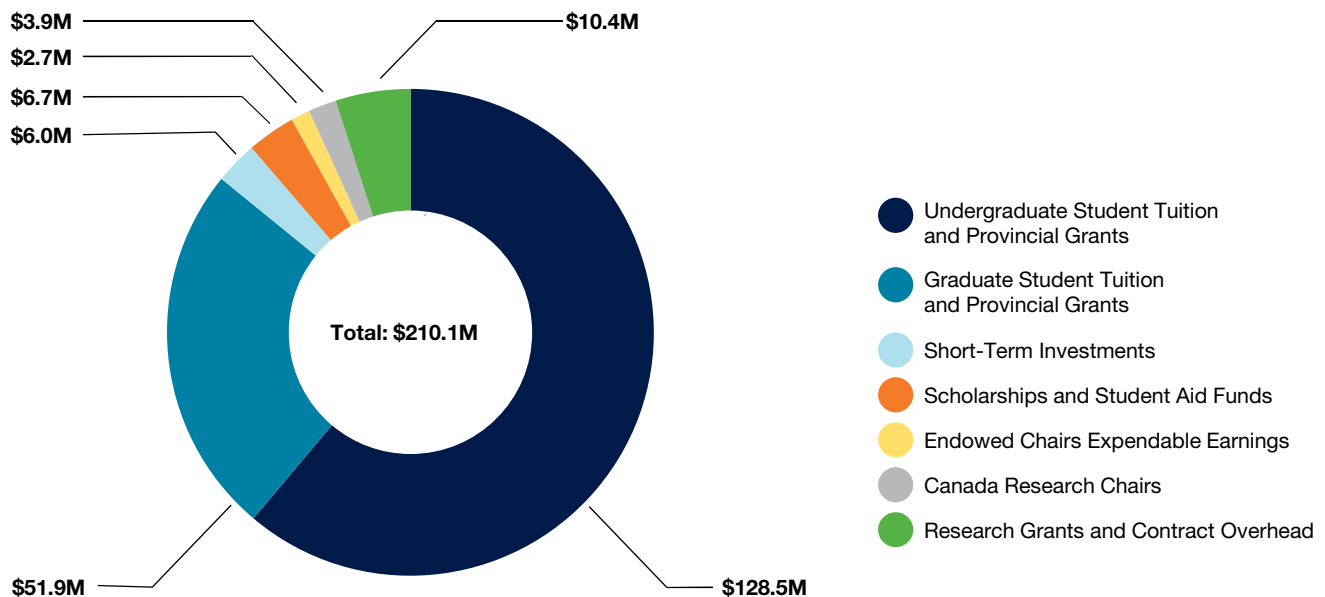


Figure 11.5 Revenue Distribution, 2015–2016

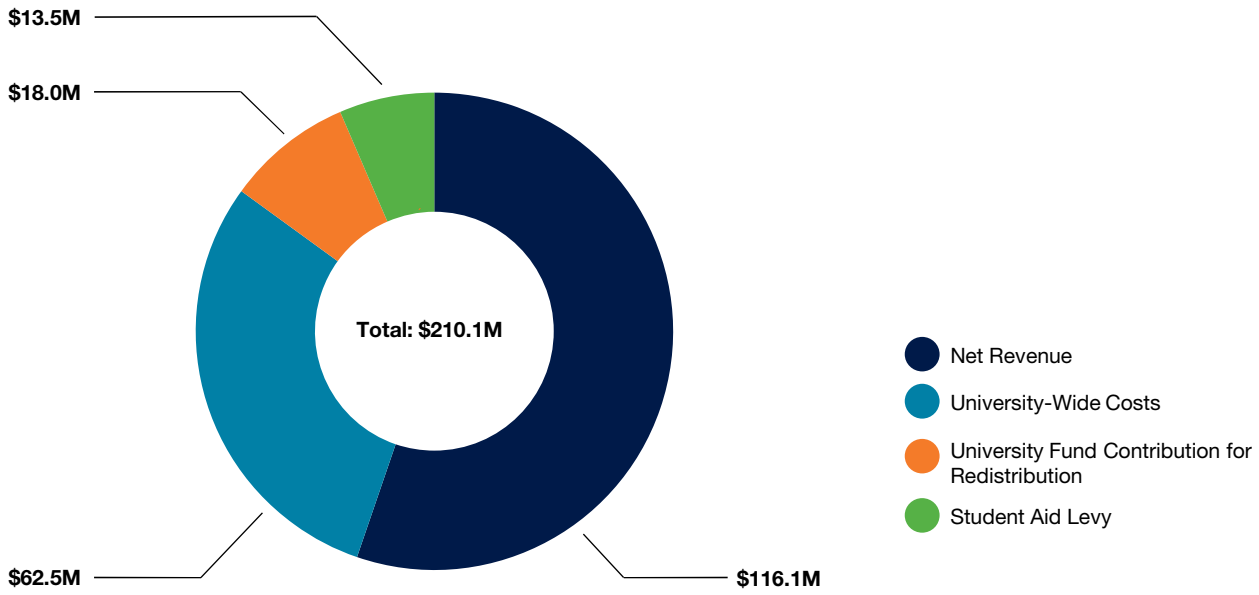
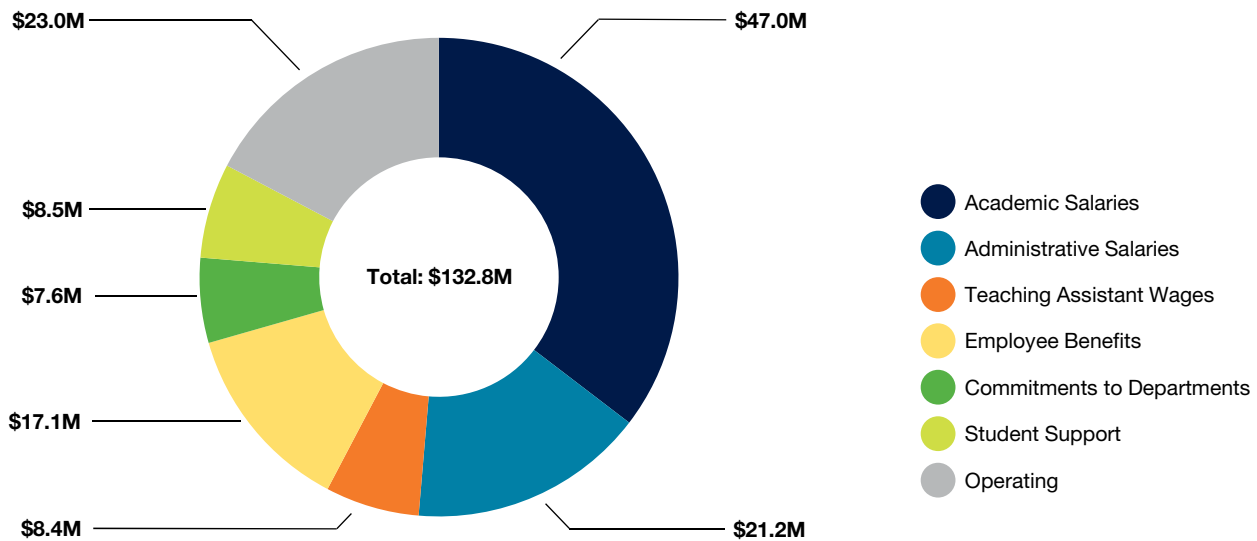


Figure 11.6 Total Operating Budget: Breakdown by Expense, 2015–2016 (net of central university costs)



Dean's Strategic Fund

The Dean's Strategic Fund (DSF) provides seed funding for initiatives that will have a broad impact within the Faculty.

In 2015–2016, the DSF committed \$7.2 million to support 15 new projects designed to further the goals of the Faculty's Academic Plan over the next three years. These projects included:

Public Health Diagnostics Initiative (PHDi)

This project will create a multidisciplinary and cross-Faculty network of investigators focused on creating low-cost, easy-to-use diagnostic systems to detect toxins, pathogens or pollutants in air, water and food. These systems are especially important in developing countries, where the inability to monitor safety leaves the general population at risk for illness or disease. The project brings together researchers from U of T Engineering, the Dalla Lana School of Public Health and the Canadian Center for World Hunger Research.

The Entrepreneurship Hatchery Phase 1 and 2

The Entrepreneurship Hatchery's mission is to provide resources to launch and support student startups within the Faculty of Applied Science & Engineering and the University of Toronto as a whole. This is done through workshops that promote entrepreneurship — including the weekly Idea Markets — and a four-month summer program where teams work to build a minimum viable product. Throughout the process, Hatchery teams receive advice from mentors on how to refine their business plans and pitch their ideas to potential clients and investors.

The DSF will support continued improvements to the existing model, as well as a new program dedicated to the incubation of graduate-level, research-driven startups. Called Hatchery Phase 2, the new program will support teams of graduate students and faculty for longer periods of time in order to help them successfully commercialize their engineering solutions.

Expansion of MIE Machine shop

U of T Engineering is home to more than 80 student clubs and design teams, as well as a variety of design courses, each of which could benefit from more space for fabrication. By expanding the MIE student machine shop in MC78 in terms of both its physical capacity and hours of operation, we enable it to be opened up to students from all departments.

Expansion of the physical resources includes an upgrade to the floor, refurbishment of a lathe, re-allotment of space to accommodate the increased student numbers and installation of new safety systems. Supervision of the additional students and opening on Saturdays will require a new professional machinist. The DSF will support these expenses for a three-year period, after which time an appropriate fee schedule will be developed for individual Engineering Departments and users to cover continued access.

Infrastructure and Facilities

Figure 11.7 Summary of Buildings Occupied by the Faculty of Applied Science & Engineering, 2015–2016

Code	Building	Office of the Dean	EngSci	UTIAS	ChemE	CivE & MinE	ECE	IBBME	MIE	MSE	Total NASMs
AS	Aerospace (Downsview)			5,294							5,294
BA	Bahen Centre	1,113	575		67		5,741		1,375		8,871
DC	CCBR				667			889			1,556
EA	Eng Annex	237					946		91		1,274
EL	Electrometal									149	149
FI	Fields Institute	340									340
GB	Galbraith	1,667				4,869	4,174				10,710
HA	Haultain				198	110			639	721	1,668
	MaRS West Tower						132	791	183		1,110
MB	Mining					1,205		1,379	1,885	830	5,299
MC	Mech Eng	63							5,391		5,454
PT	D.L. Pratt						1,330			1,491	2,821
RS	Rosebrugh							814	2,096		2,910
SF	Sandford Fleming	766		692		1,559	3,556				6,573
WB	Wallberg	375			8,135		130			1,327	9,967
RM	256 McCaul	528									528
	Total Area	5,089	575	5,986	9,067	7,743	16,013	3,873	11,660	4,518	64,524
											64,524 NASMs

Projects Completed — By Building

Bahen Centre

Student Study Seating

Building on the work completed in 2014–2015, we increased the available seating in the Bahen Centre where students can study and complete assignments between classes. The new seating can accommodate an additional 65 students and is part of our commitment to improve the student experience at U of T Engineering.

Fields Institute

Relocation of HR Group

To make more efficient use of space, we relocated the Faculty's human resources group to the Fields Institute, where it shares space with the Engineering Career Centre.

Galbraith Building

Building Accessibility and Elevators

To enhance the accessibility of our facilities, we installed lift systems at the main entrance steps of 35 St. George St. and from the main lobby to the first floor corridor near the Registrar's Office. Both passenger elevators were refurbished and modernized by Facilities & Services.

Electrical Energy Systems Lab

This renovation expands the range of courses the lab can support and improves student safety. We completed the second phase of construction, which involved replacing student test stations throughout the lab and running new wiring from each station to the electrical room through the existing floor trench/conduit system.

Nano for Energy Lab Renovation — Galbraith 445

This project creates a new research laboratory by converting a former undergraduate teaching laboratory to a clean, high-tech space. This involved installing four fume hoods, a wet bench and a dedicated HVAC system.

Haultain Building

Student Club Space Renovation

To provide student groups such as the Baja and Formula-SAE teams with improved space to design, build and test their vehicles, we upgraded room 102 in the Haultain Building. The upgrades included the removal of suspended ceiling, installation of new work benches & storage units, a new articulated-arm fume extraction canopy, a new chain hoist, repainting and floor refinishing.

Lassonde Mining Building

MIE Student Study/Conferencing Room

To create a new student study/conferencing facility, we renovated room 71 in the Lassonde Mining Building.

MaRS

Translational Biology & Engineering Program Lab

The Translational Biology & Engineering Program (TBEP) is part of the Ted Rogers Centre for Heart Research, and brings together leading experts in engineering and medicine to advance discoveries and accelerate new treatments for cardiovascular disease. We built a \$10 million central research lab and surrounding offices and meeting facilities on the 14th floor of MaRS Discovery District West Tower to house TBEP.

Mechanical Engineering Building

Student Machine Shop Expansion

The expansion of the student machine shop allows more students from across the entire Faculty to fabricate parts and prototypes, either for their courses or for student design clubs and teams. The expansion includes an upgrade to the floor, refurbishment of a lathe, re-allotment of space to accommodate the increased student numbers, and installation of new safety systems. We have hired additional staff to increase opening hours.

Wallberg Building

Chemical Engineering Operations Lab Renovations

To house additional experiments and improve safety, we renovated the two-level Operations Lab in rooms 25/125.

Video-Conferencing Pilot Project

To improve collaboration between our faculty members and collaborators, we installed a pilot video-conferencing system in room 407 for evaluation.

Projects Underway – By Building

Centre for Engineering Innovation & Entrepreneurship (CEIE)

Construction Progress

We have made significant progress on this new building since the official groundbreaking in June 2015. Workers have completed the bulk excavation and installed a de-watering system and connected temporary power. They have drilled 123 caissons down to the bedrock to create the building's foundation, and built a construction crane to enable the construction of upper layers. Construction of the concrete walls and columns for Lower Level II is underway. We have also begun the process of designing the interior, including furniture layout and selection, signage (wayfinding and donor recognition) and audio-visual systems. *For more information about the CEIE please see the introductory section.*

D.L. Pratt Building

Room 162 Lab Renovation

To accommodate new research equipment for several faculty in the area of extractive metallurgy, this MSE research lab space has been re-designed. Construction will start in the fall.

Galbraith Building

Room 412 Lab Renovation

We began the design phase for this project will convert a tutorial room into a wet research lab for water-related research in CivE.

Gull Lake

Bunkhouse Project

A new bunkhouse will accommodate 68 students. We have completed a design which can now be used to assist with fundraising for this CivE project.

Lassonde Mining Building

IBBME Undergraduate Teaching Lab Expansion

To enhance the student experience, we started the pre-design phase for a project that will convert room 322 in the Lassonde Mining Building from a research lab to an undergraduate teaching lab.

Office Renovations

This renovation of the first-floor, west-wing office area will accommodate additional graduate student offices for the Lassonde Mineral Engineering program. We began a schematic design for this project.

Mechanical Engineering Building

Lobby Renovations

This renovation will expand the lobby area of the Mechanical Engineering Building. We have initiated a feasibility study.

MC 402 Renovation

In summer 2016, we began renovations to create M-Space, a new instructional/fabrication facility.

University of Toronto Institute for Aerospace Studies

Gas Turbine Combustion Research Lab Renovation

This new research lab will be created in tandem with the associated combustion wind tunnel. We have begun preparing a design to send out to tender.

Room 194 Lecture Room

To improve research capabilities, we started the design of a small-scale visualization facility and lecture room for computational modelling.

Wallberg Building

Fume Hood Project

To improve sustainability, we initiated a feasibility study to optimize the energy efficiency of the fume hoods throughout the building.

Space Audits

We conduct regular audits to inform our infrastructure needs and the most efficient use of space. Over the past year, we made progress on the following audits and reports:

- A space audit of undergraduate teaching labs (Final report expected by December 2016)
- A report by the Working Group on makerspaces on the status of machine shops and other fabrications space within the Faculty (Final recommendations expected by November 2016)
- A safety audit of all common and study rooms
- A project planning report for the CivE space on the first-floor, west wing, in Lassonde Mining Building
- A project planning report for the Gull Lake Bunkhouse Project

LIFT Initiative

We also worked with other Faculties on the Lab Innovation for Toronto (LIFT) project, which funds infrastructure upgrades across the University. In July 2016, we received \$31.6 million to renovate 89 laboratory spaces, benefitting more than 330 professors, graduate students and undergraduate students.

Faculty of Applied Science & Engineering Academic Area Terms

Academic Area	For the purpose of this annual report, Academic Area refers to the following departments, divisions and institutes: UTIAS, IBBME, ChemE, CivE, ECE, EngSci, MIE and MSE. While General First Year is not an academic unit, it is also included as an academic area in specific contexts Chapter 1: Undergraduate Studies.
ChemE	Department of Chemical Engineering & Applied Chemistry Graduates who studied the discipline of Chemical Engineering are also designated as ChemE.
CivE	Department of Civil Engineering Graduates who studied the discipline of Civil Engineering are also designated as CivE.
CompE	Graduates of The Edward S. Rogers Sr. Department of Electrical & Computer Engineering (ECE) who studied the discipline of Computer Engineering.
ElecE	Graduates of The Edward S. Rogers Sr. Department of Electrical & Computer Engineering (ECE) who studied the discipline of Electrical Engineering.
ECE	The Edward S. Rogers Sr. Department of Electrical & Computer Engineering Graduates of Electrical Engineering are designated as ElecE; graduates of Computer Engineering are designated as CompE.
EngSci	Division of Engineering Science Graduates of this Division are also designated as EngSci.
IBBME	Institute of Biomaterials & Biomedical Engineering Graduates who studied the discipline of Biomedical Engineering are referred to as BioMedE.
IndE	Graduates of the Department of Mechanical & Industrial Engineering (MIE) who studied the discipline of Industrial Engineering.
MechE	Graduates of the Department of Mechanical & Industrial Engineering (MIE) who studied the discipline of Mechanical Engineering.
MIE	Department of Mechanical & Industrial Engineering Graduates of Mechanical Engineering are designated as MechE; graduates of Industrial Engineering are designated as IndE.
MinE	Graduates from the Department of Civil Engineering (CivE) who studied the discipline of Mineral Engineering.
MSE	Department of Materials Science & Engineering Graduates who studied the discipline of Materials Engineering are also designated as MSE.
General First Year	General first-year undergraduate studies in Engineering, formerly known as TrackOne. Upon successful completion of General First Year, students choose from one of the Engineering undergraduate programs, excluding Engineering Science.
UTIAS	University of Toronto Institute for Aerospace Studies Graduates who studied the discipline of Aerospace Engineering within this Institute are designated as AeroE.

Additional Terms

AAAS	American Association for the Advancement of Science	FTE	Full-time equivalent
AAU	Thomson Reuters Association of American Universities	GCC	Grand Challenges Canada
ARWU	Shanghai Jiao Tong Academic Ranking of World Universities	G-IFP	Graduate International Foundation Program
ASEE	American Society for Engineering Education	GLEE	Girls' Leadership in Engineering Experience
BASc	Bachelor of Applied Science	Gratitude	Fundraising campaign for students
BizSkule	Alumni speaker series	GTA	Greater Toronto Area
CCR	Co-Curricular Record	H-index	A measurement of both the productivity and impact of published work based on citations
CEIE	Centre for Engineering Innovation & Entrepreneurship	HC	Headcount, or number of degree-seeking students
CFI	Canada Foundation for Innovation	IEEE	Institute of Electrical and Electronics Engineers
CGEN	Centre for Global Engineering	IFP	International Foundation Program
CHE	Centre for Healthcare Engineering	ILead	Institute for Leadership Education in Engineering
CHRP	Collaborative Health Research Projects	IRC	Industrial Research Chair
CIE	Centre for International Experience	ISE	Institute for Sustainable Energy
CIHR	Canadian Institute of Health Research	MASc	Master of Applied Science
CRC	Canada Research Chair	MCP	Multidisciplinary Capstone Projects
CREATE	NSERC Collaborative Research and Training Experience	MEng	Master of Engineering
DEEP	Da Vinci Engineering Enrichment Program	MEngCEM	MEng in Cities Engineering & Management
DSF	Dean's Strategic Fund	MEng, SCFI	MEng program for the Stronach Centre for Innovation
ECN	Engineering Communications Network	MHSc	Master of Health Science (Clinical Engineering)
ECP	Engineering Communication Program	MFP	MasterCard Foundation Scholarship Program
EDU	Extra-Departmental Unit	MOOC	Massive Open Online Course
EIIP	Engineering Instructional Innovation Program	NASM	Net Assignable Square Metre
ELITE	Entrepreneurship, Leadership, Innovation & Technology in Engineering	NCE	Networks of Centres of Excellence
EngEd	Engineering Education, graduate-level programs	NSERC	Natural Sciences and Engineering Research Council of Canada
eSIP	Engineering Summer Internship Program	NTU	National Taiwan University
ESOO	Engineering Student Outreach Office	OCCAM	Ontario Centre for Characterization of Advanced Materials
ESROP	Engineering Science Research Opportunities Program	OGS	Ontario Graduate Scholarship

OISE	Ontario Institute for Studies in Education	TIAM	Toronto Institute for Advanced Manufacturing
ONWIE	Ontario Network of Women in Engineering	TRCHR	Ted Rogers Centre for Heart Research
ORF	Ontario Research Fund	Tri-Council	Canadian Institutes of Health Research (CIHR), Natural Sciences and Engineering Research Council of Canada (NSERC) and Social Sciences and Humanities Research Council (SSHRC)
OSAP	Ontario Student Assistance Program	U15	Group of 15 leading, research-intensive universities in Canada, including: University of Alberta, University of British Columbia, University of Calgary, Dalhousie University, Université Laval, University of Manitoba, McGill University, McMaster University, Université de Montréal, University of Ottawa, Queen's University, University of Saskatchewan, University of Toronto, University of Waterloo, Western University
PASS	Peer-Assisted Study Sessions	UnERD	Undergraduate Engineering Research Day
PEY	Professional Experience Year internship program	UT-IMDI	University of Toronto Institute for Multidisciplinary Design & Innovation
PhD	Doctor of Philosophy	UTAPS	University of Toronto Advanced Planning for Students
PPIT	Prospective Professors in Training Program	UTTRI	University of Toronto Transportation Research Institute
QS	QS World Rankings	WISE	Women in Science & Engineering
RENEW	Remediation Action Network	YWIES	Young Women in Engineering Symposium
SGS	University of Toronto School of Graduate Studies		
Skule™	Refers to the U of T Engineering community		
SSHRC	Social Sciences and Humanities Research Council		
STEM	Science, Technology, Engineering and Mathematics		
SwB	Science without Borders		
TBEP	Translational Biology and Engineering Program		
TEAL	Technology Enhanced Active Learning		
THE	Times Higher Education–Thomson Reuters World University Ranking		

Appendices

Appendix A: Student Clubs and Teams

Below is a list of Engineering student clubs and teams, which is referenced in *Chapter 1: Undergraduate Studies*. Beyond the groups presented here, our students also participate in clubs and teams across U of T.

Arts

- Appassionata Music Group
- Skule™ Arts Festival
- Skule™ Orchestra
- Skule™ Stage Band
- Tales of Harmonia
- U of T Music Clubs Initiative

Athletics

- Skule™ Badminton Club
- U of T Engineering Iron Dragons
- U of T Ironsports Club

Community

- Bridges to Prosperity
- Engineers Without Borders – U of T Chapter
- Engineering World Health – U of T
- Pakistan Development Foundation
- Power to Change U of T
- Promise to Future Generations
- Students Fighting Cancer
- Student Research Teams
- Suits U
- Tetra Society
- Toronto Students for the Advancement of Aerospace (TSAA)
- TrackOne Mentorship Program
- Women in Science and Engineering

Cultural

- Arabs in Engineering
- Bangladeshi Engineering Students' Association
- Chinese Engineering Students' Association
- Indian Engineering Students' Association
- Indian Students' Society
- Malaysian Student Association of University of Toronto
- Muslim Students Association
- U of T Engineering Chinese Club
- University of Toronto Ismaili Students Association (ISA)
- U of T Mandarin Chinese Christian Fellowship

Design & Competition

- Blue Sky Solar Racing
- Global Engineering Design Association
- Human-Powered Vehicle Design Team
- Mechatronics Design Association
- Multidisciplinary Analytical Kinesthetic Education
- Project Holodeck
- Robotics for Space Exploration
- Seismic Design Team
- Spark Design Club
- Supermileage Team
- University of Toronto Aerospace Team
- U of T Baja Team
- U of T Biomod Team
- U of T Concrete Canoe Team
- U of T Concrete Toboggan Team
- U of T Destination Imagination
- U of T Formula SAE Racing Team
- U of T Robotics Association
- U of T Space Design Contest
- U of T Steel Bridge Team

Hobby & Special Interest

- Hacker Academy
- LeadingGreen
- Peer Wellness Group
- Skule™ Dance Club
- Skule™'s Got Talent
- Skule™ Improv
- U of T Emergency First Responders
- U of T Engineering Photography Club
- U of T Engineering Toastmasters
- UTFOLD
- UTTTC (University of Toronto Table Tennis Club)
- U of T Smash
- Skule™ Dev

Professional Development & Industry

- ALChemE
- American Society of Mechanical Engineers
- ASHRAE U of T
- Biomedical Engineering Students Association
- Canadian Association of Food Engineers – University of Toronto
- Canadian Electrical Contractors Association
- Canadian Society for Chemical Engineering
- Canadian Society for Mechanical Engineering
- Canadian Institute of Mining, Metallurgy and Petroleum – University of Toronto Chapter
- Club for Undergraduate Biomedical Engineering
- Digital Trinity Labs
- Galbraith Society
- Institute of Electrical and Electronics Engineers University of Toronto Student Branch
- Institute of Industrial Engineers Chapter 0889
- Institute of Transportation Engineers
- Materials Industry Club
- MIE Mentorship Program
- MechEngage
- National Society of Black Engineers
- Nsight Mentorship
- Nspire Innovation Network
- Materials Industry Club
- Rational Capital Investment Fund
- Society of Petroleum Engineers at the University of Toronto
- Sustainable Engineers Association
- TechXplore
- U of T Business Association
- U of T Consulting Association
- University of Toronto Energy Network
- University of Toronto Engineering Finance Association
- University of Toronto Ontario Water Works Association-Student Chapter
- UT Industry Insights
- Water Environment Association of Ontario Student Chapter

Appendix B: Outreach Programs

Between July 2015 and June 2016, we offered the following pre-university outreach programs, reaching more than 9,000 students from across Ontario, Canada and the world.

Program	Date	Total # of Participants	Female	Male	Audience
DEEP Summer Academy	July 5-August 1, 2015	472	142	330	Grades 9-12
DEEP Leadership Camp	July 5-August 1, 2015	57	14	43	Grades 10-12
Girls' Jr. DEEP	July 6-10, 2015	74	74	0	Grades 3-8
ENGage	July 6-10, 2015	68	34	34	Grades 3-8
Jr. DEEP	July 13-August 21, 2015	759	246	513	Grades 3-8
Go ENG Girl	October 17, 2015	104	104	0	Grades 7-10
Girls' Jr. DEEP Saturday Fall	October 24-November 7, 2015	73	73	0	Grades 3-8
Jr. DEEP Saturday Fall	November 14-28, 2015	71	19	52	Grades 3-8
High School Saturdays Fall	November 14-28, 2015	75	32	43	Grades 9-11
Girls' Jr. DEEP Saturday Winter	January 16-30, 2016	72	72	0	Grades 3-8
Jr. DEEP Saturday Winter	February 6-27, 2016	72	14	58	Grades 3-8
High School Saturdays Winter	February 6-27, 2016	75	20	55	Grades 9-11
DEEP Leadership at March Break	March 14-18, 2016	24	7	17	Grades 10-11
Jr. DEEP at March Break	March 14-18, 2016	72	24	48	Grades 3-8
In-School and On-Campus Workshops	May 11-June 10, 2016	5,774	2,887	2,887	Grades 3-8
Innovate U	May 13, 2016	1,400	700	700	Grades 3-8
Skule™ Kids	May 28, 2016	36	12	24	Grades 1-8
Total		9,242	4,462	4,780	

Appendix C: Time to Completion for Graduate Students

The following figures indicate the median time to completion for graduating cohorts in each master's and doctoral degree program by academic area for the past decade. Time to completion represents the number of years between a student's initial enrolment in a graduate program and meeting all the requirements for graduation. The data includes only terms in which a student is registered, excluding leaves, lapses and (in most cases) the term in which convocation occurs. Where a student is fast-tracked from the MASc into a PhD, the total time for both programs is counted. Distinguishing full-time (FT), extended full-time (ExtFT) and part-time (PT) MEng students provides greater clarity.

Figure C.1 **University of Toronto Institute for Aerospace Studies**
Time to Completion for Graduate Students, 2006–2007 to 2015–2016

	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16
PhD	4.5	5.2	5.3	6.0	7.0	4.7	5.3	5.3	5.7	6.3
MASc	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.0	2.0
MEng (FT)	1.3		1.3	1.2	1.3	1.3	1.0	1.0	1.0	1.0
MEng (Ext FT)									1.7	1.7
MEng (PT)	1.7	1.7	1.0	1.8			1.7	1.3	2.0	2.3

Figure C.2 **Institute of Biomaterials & Biomedical Engineering**
Time to Completion for Graduate Students, 2006–2007 to 2015–2016

	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16
PhD	5.2	3.3	4.3	4.3	6.0	5.7	5.0	5.0	6.0	5.7
MASc	2.3	2.0	2.2	2.0	2.0	2.0	2.0	2.0	2.3	2.0
MHSc (FT)	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

Figure C.3 **Department of Chemical Engineering & Applied Chemistry**
Time to Completion for Graduate Students, 2006–2007 to 2015–2016

	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16
PhD	5.7	4.7	5.0	5.3	6.0	5.3	5.2	5.5	5.7	5.7
MASc	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.3
MEng (FT)	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
MEng (Ext FT)									1.5	1.7
MEng (PT)	3.3	2.0	3.7	2.2	1.8	1.3	2.0	2.0	1.8	1.5

**Figure C.4 Department of Civil Engineering
Time to Completion for Graduate Students, 2006–2007 to 2015–2016**

	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16
PhD	4.8	4.7	5.0	5.0	5.3	5.3	5.3	5.0	5.3	5.3
MASc	2.3	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
MEng (FT)	1.3	1.0	1.0	1.0	1.3	1.0	1.0	1.0	1.0	1.0
MEng (Ext FT)									1.3	1.7
MEng (PT)	1.8	1.7	1.7	2.0	2.3	1.8	2.0	2.0	1.7	2.0
MEngCEM (FT)									1.3	1.3

**Figure C.5 The Edward S. Rogers Sr. Department of Electrical & Computer Engineering
Time to Completion for Graduate Students, 2006–2007 to 2015–2016**

	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16
PhD	5.3	4.7	4.7	4.7	5.0	5.2	5.5	5.3	5.0	5.0
MASc	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.3	2.0
MEng (FT)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
MEng (Ext FT)									1.3	1.3
MEng (PT)	2.0	2.0	2.0	3.0	2.7	2.0	2.2	2.0	2.0	2.0

**Figure C.6 Department of Mechanical & Industrial Engineering
Time to Completion for Graduate Students, 2006–2007 to 2015–2016**

	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16
PhD	4.5	4.7	4.7	4.0	4.7	5.0	5.7	5.0	4.8	5.0
MASc	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
MEng (FT)	1.0	1.3	1.0	1.3	1.0	1.3	1.0	1.0	1.0	1.0
MEng (Ext FT)									1.7	1.7
MEng (PT)	2.0	2.3	2.3	2.3	2.0	2.0	2.0	2.0	2.0	1.7
MEngDM (PT)	2.7	2.2	3.3	2.7	2.3	2.7	2.5	2.7	2.3	3.5

**Figure C.7 Department of Materials Science & Engineering
Time to Completion for Graduate Students, 2006–2007 to 2015–2016**

	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16
PhD	5.8	5.3	4.0	5.3	6.0	6.3	5.7	4.7	5.3	5.5
MASc	2.0	2.0	1.7	2.0	2.0	2.0	2.0	2.3	2.0	2.0
MEng (FT)			1.5	1.7		0.8	1.0	1.0	1.0	1.0
MEng (Ext FT)									1.3	1.7
MEng (PT)	2.7		1.3	2.0	2.3	2.3	2.0	2.7	2.8	

Note: Based on Ontario Council of Graduate Studies (OCGS) data from ROSI. Data reflects median values based on the total number of terms in which a student is registered.

Appendix D: Research Chairs

Our Faculty is home to 77 research chairs held by 69 individual chairholders. The following list reflects five types of Chairs:

- **Canada Research Chair (CRC):** The Canadian Government invests \$300M per year in two types of CRCs: 1) Tier 1 – renewable chair held for seven years; and 2) Tier 2 – held for five years and is eligible for renewal once.
- **Endowed Chair:** Fixed-term chairs created through donor support. Holders are of high distinction and typically tenured faculty.
- **Industrial Research Chair:** Jointly funded by NSERC and industry to help universities build on existing strengths or develop research capacity in areas of interest to industry.
- **U of T Distinguished Professor:** Designed to advance and recognize faculty with highly distinguished accomplishments. This Chair is limited to no more than three per cent of tenured faculty.
- **University Professor:** The highest possible rank at U of T. This title is awarded to a maximum of two per cent of tenured U of T faculty.

Figure D.1 Research Chairs, 2015–2016

Title	Chairholder	Sponsor	Tier	Dep't
Alumni Chair in Bioengineering	Cristina Amon	Endowed		MIE
Bahen/Tanenbaum Chair in Civil Engineering	Jeffrey Packer	Endowed		CivE
Bahen/Tanenbaum Chair in Civil Engineering	Michael Collins	Endowed		CivE
Bell Canada Chair in Multimedia	Kostas Plataniotis	Endowed		ECE
Bell University Labs Chair in Computer Engineering	Baochun Li	Endowed		ECE
Canada Research Chair in Advanced Catalysis for Sustainable Chemistry	Cathy Chin	NSERC	Tier 2	ChemE
Canada Research Chair in Anaerobic Biotechnology	Elizabeth Edwards	NSERC	Tier 1	ChemE
Canada Research Chair in Autonomous Space Robotics	Timothy Barfoot	NSERC	Tier 2	UTIAS
Canada Research Chair of Biotechnology	Warren Chan	NSERC	Tier 2	IBBME
Canada Research Chair in Cellular Hybrid Materials	Glenn Hibbard	NSERC	Tier 2	MSE
Canada Research Chair in Computational Modelling and Design Optimization Under Uncertainty	Prasanth Nair	NSERC	Tier 2	UTIAS
Canada Research Chair in Diffusion-Wave Sciences and Technologies	Andreas Mandelis	NSERC	Tier 1	MIE
Canada Research Chair in Environmental Engineering and Stable Isotopes	Elodie Passeport	NSERC	Tier 2	ChemE, CivE
Canada Research Chair in Freight Transportation and Logistics	Matthew Roorda	NSERC	Tier 2	CivE
Canada Research Chair in Fuel Cell Materials and Manufacturing	Olivera Kesler	NSERC	Tier 2	MIE
Canada Research Chair in Functional Cardiovascular Tissue Engineering	Milica Radisic	NSERC	Tier 2	IBBME, ChemE
Canada Research Chair in Human Factors and Transportation	Birsen Donmez	NSERC	Tier 2	MIE
Canada Research Chair in Information Processing and Machine Learning	Brendan Frey	NSERC	Tier 1	ECE
Canada Research Chair in Information Theory and Wireless Communications	Wei Yu	NSERC	Tier 1	ECE
Canada Research Chair in Integrated Photonic Devices	Joyce Poon	NSERC	Tier 2	ECE
Canada Research Chair in Micro and Nano Engineering Systems	Yu Sun	NSERC	Tier 2	MIE
Canada Research Chair in Microfluidics and Energy	David Sinton	NSERC	Tier 1	MIE
Canada Research Chair in Modelling of Electrical Interconnects	Piero Triverio	NSERC	Tier 2	ECE
Canada Research Chair in Nano- and Micro-Structured Electromagnetic Materials and Applications	George Eleftheriades	NSERC	Tier 1	ECE
Canada Research Chair in Nanotechnology	Ted Sargent	NSERC	Tier 1	ECE
Canada Research Chair in Network Information Theory	Ashish Khisti	NSERC	Tier 2	ECE
Canada Research Chair in Novel Optimization and Analytics in Health	Timothy Chan	NSERC	Tier 2	MIE
Canada Research Chair in Organic Optoelectronics	Zheng-Hong Liu	NSERC	Tier 1	MSE
Canada Research Chair in Robots for Society	Goldie Nejat	NSERC	Tier 2	MIE
Canada Research Chair in Secure and Reliable Computer Systems	David Lie	NSERC	Tier 2	ECE
Canada Research Chair in Seismic Resilience of Infrastructure	Constantin Christopoulos	NSERC	Tier 2	CivE
Canada Research Chair in Stem Cell Bioengineering	Peter Zandstra	NSERC	Tier 1	IBBME

Title	Chairholder	Sponsor	Tier	Dep't
Canada Research Chair in Thermofluidics for Clean Energy	Aimy Bazylak	NSERC	Tier 2	MIE
Canada Research Chair in Tissue Engineering	Molly Shoichet	NSERC	Tier 1	ChemE, IBBME
Celestica Chair in Materials for Microelectronics	Doug Perovic	Endowed		MSE
Chair in Information Engineering	Joseph Paradi	Endowed		MIE
Clarice Chalmers Chair of Engineering Design	Greg Jamieson	Endowed		MIE
Dusan and Anne Miklas Chair in Engineering Design	Paul Chow	Endowed		ECE
Edward S. Rogers Sr. Chair in Engineering	Brendan Frey	Endowed		ECE
Eugene V. Polistuk Chair in Electromagnetic Design	Costas Sarris	Endowed		ECE
Frank Dottori Chair in Pulp and Paper Engineering	Honghi Tran	Endowed		ChemE
Foundation CMG Industrial Research Chair in Fundamental Petroleum Rock Physics and Rock Mechanics	Giovanni Grasselli	Foundation CMG		CivE
Gerald R. Heffernan Chair in Materials Processing	Mansoor Barati	Endowed		MSE
J. Armand Bombardier Foundation Chair in Aerospace Flight	David Zingg	Endowed		UTIAS
L. Lau Chair in Electrical and Computer Engineering	Reza Iravani	Endowed		ECE
Michael E. Charles Chair in Chemical Engineering	Michael Sefton	Endowed		ChemE, IBBME
Nortel Institute Chair in Emerging Technology	J. Stewart Aitchison	Endowed		ECE
Nortel Institute Chair in Network Architecture and Services	Jörg Liebeherr	Endowed		ECE
NSERC Chair in Multidisciplinary Engineering Design	Kamran Behdinan	NSERC		MIE
NSERC Industrial Research Chair in Source Water Quality Monitoring and Advanced/Emerging Technologies for Drinking Water Treatment	Robert Andrews	NSERC		CivE
NSERC Industrial Research Chair in Technologies for Drinking Water Treatment	Ron Hofmann	NSERC		CivE
NSERC/Altera Industrial Research Chair in Programmable Silicon	Vaughn Betz	NSERC/Altera		ECE
NSERC/Cement Association of Canada Industrial Research Chair in Concrete Durability and Sustainability	Doug Hooton	NSERC/CAC		CivE
NSERC/P&WC Industrial Research Chair in Aviation Gas Turbine Combustion/Emissions Research and Design System Optimization	Sam Sampath	NSERC/P&WC		UTIAS
NSERC/UNENE Industrial Research Chair in Corrosion Control and Materials Performance in Nuclear Power Systems	Roger Newman	NSERC/UNENE		ChemE
Pierre Lassonde Chair in Mining Engineering	John Hadjigeorgiou	Endowed		CivE
Robert M. Smith Chair in Geotechnical Mine Design and Analysis	Murray Grabinsky	Endowed		CivE
Skoll Chair in Computer Networks and Enterprise Innovation	Elvino Sousa	Endowed		ECE
Skoll Chair in Software Engineering	Jason Anderson	Endowed		ECE
Stanley Ho Professorship in Microelectronics	Sorin Voinigescu	Endowed		ECE
The Stanley L. Meek Chair in Advanced Nanotechnology	Harry Ruda	Endowed		MSE
U of T Distinguished Professor in Application Platforms and Smart Infrastructure	Alberto Leon-Garcia			ECE
U of T Distinguished Professor in Global Engineering	Yu-Ling Cheng			ChemE
U of T Distinguished Professor in Plasma Engineering	Javad Mostaghimi			MIE
U of T Distinguished Professor of Digital Communications	Frank Kshischang			ECE
U of T Distinguished Professor of Microcellular Engineered Plastics	Chul Park			MIE
U of T Distinguished Professor of Urban Systems Engineering	Mark Fox			MIE
U of T Distinguished Professor of Mechanobiology	Craig Simmons			MIE, IBBME
U of T Distinguished Professor of Computational Aerodynamics and Sustainable Aviation	David Zingg			UTIAS
University Professor	Michael Collins			CivE
University Professor	Edward Sargent			ECE
University Professor	Michael Sefton			ChemE
University Professor	Molly Shoichet			ChemE, IBBME
Velma M. Rogers Graham Chair in Engineering	George Eleftheriades	Endowed		ECE
W. M. Keck Chair in Engineering Rock Mechanics	John Harrison	Endowed		CivE
Wallace G. Chalmers Chair of Engineering Design	Axel Guenther	Endowed		MIE

Appendix E: Research Funding by Academic Area

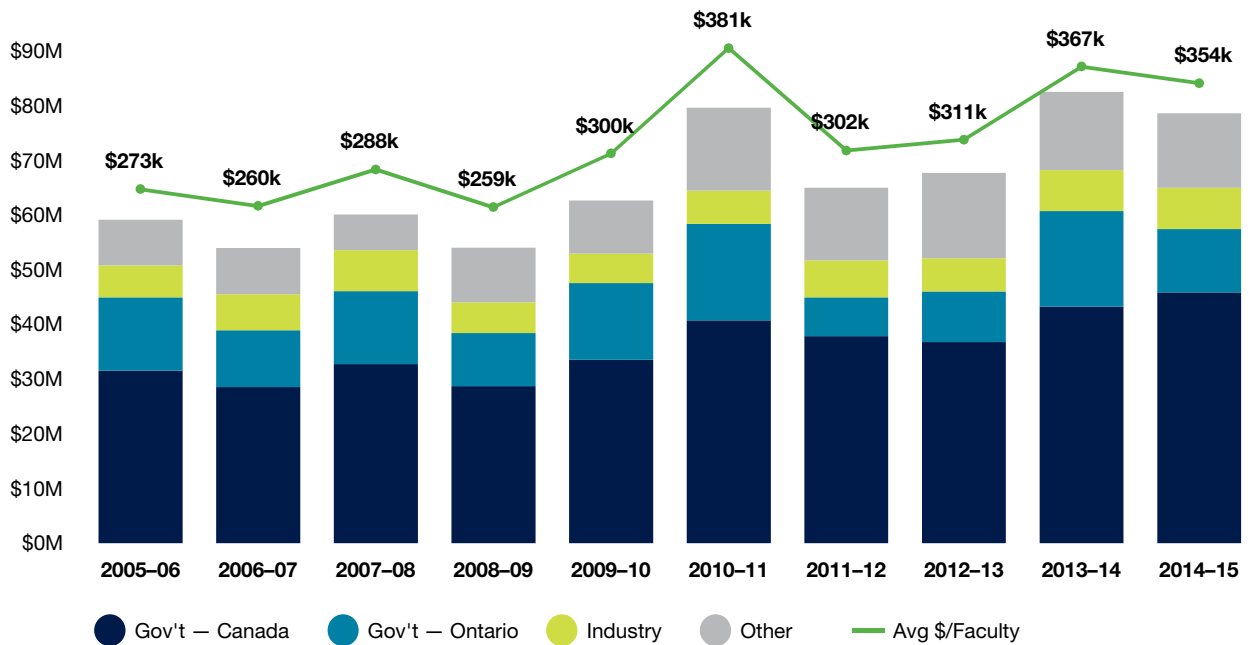
Figure E.1 shows our Faculty's total research funding, including operating and infrastructure.

Figures E.2 to E.8 in this appendix show research operating funding by department and institute over the last decade. This data excludes funding received under the following research infrastructure programs:

- Canada Foundation for Innovation (except the CFI Career Award)
- NSERC Research Tools & Instruments program for Faculty
- Ontario Innovation Trust
- Ontario Research Fund – Research Infrastructure

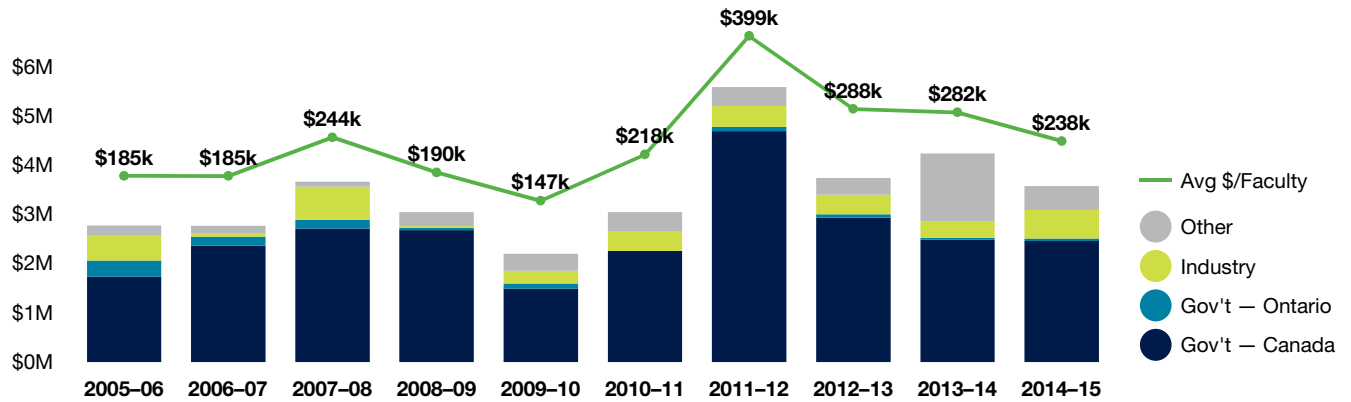
Data is based on grant years (April to March). For example, 2012–13 represents the granting cycle starting in April 2012 and ending in March 2013.

Figure E.1 University of Toronto Faculty of Applied Science & Engineering Total Research Funding by Source and Average Funding per Faculty Member, 2005–2006 to 2014–2015



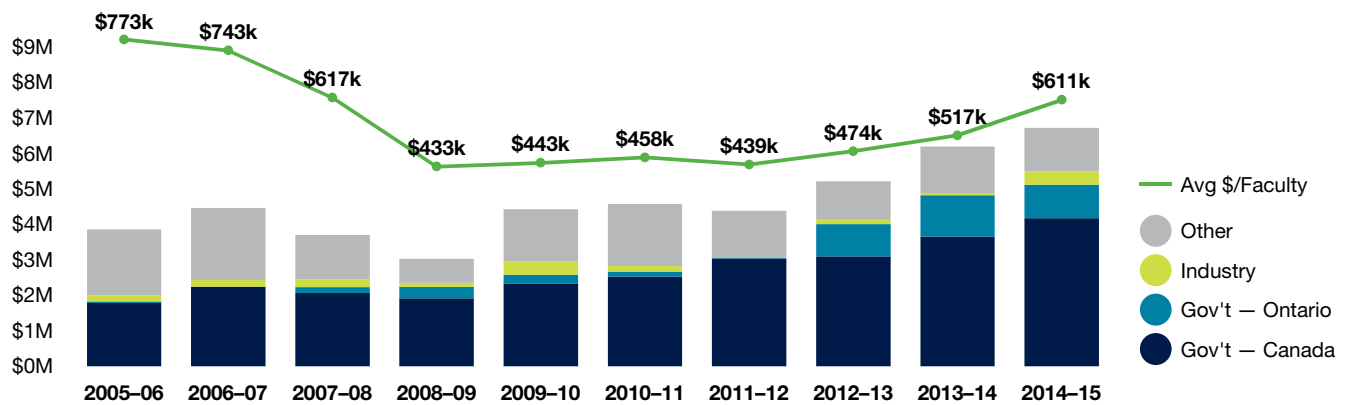
	Gov't – Canada	Gov't – Ontario	Corporate	Other	Total	Avg \$/Faculty
2005–06	\$31,573,788	\$13,410,788	\$5,848,143	\$8,326,178	\$59,158,897	\$272,622
2006–07	\$28,602,598	\$10,360,149	\$6,583,699	\$8,479,398	\$54,025,844	\$259,740
2007–08	\$32,801,606	\$13,319,325	\$7,520,781	\$6,525,854	\$60,167,566	\$287,883
2008–09	\$28,775,192	\$9,661,808	\$5,666,153	\$9,996,059	\$54,099,212	\$258,848
2009–10	\$33,558,391	\$14,040,322	\$5,415,268	\$9,714,802	\$62,728,783	\$300,138
2010–11	\$40,769,149	\$17,676,249	\$6,096,677	\$15,152,585	\$79,694,660	\$381,314
2011–12	\$37,892,435	\$7,125,567	\$6,705,219	\$13,300,258	\$65,023,479	\$302,435
2012–13	\$36,843,730	\$9,221,859	\$6,062,015	\$15,631,214	\$67,758,818	\$310,820
2013–14	\$43,270,328	\$17,498,586	\$7,476,802	\$14,354,519	\$82,600,235	\$367,112
2014–15	\$45,887,056	\$11,616,389	\$7,504,880	\$13,650,347	\$78,658,672	\$354,318

Figure E.2 University of Toronto Institute for Aerospace Studies Research Operating Funding by Source and Average Funding per Faculty Member, 2005–2006 to 2014–2015



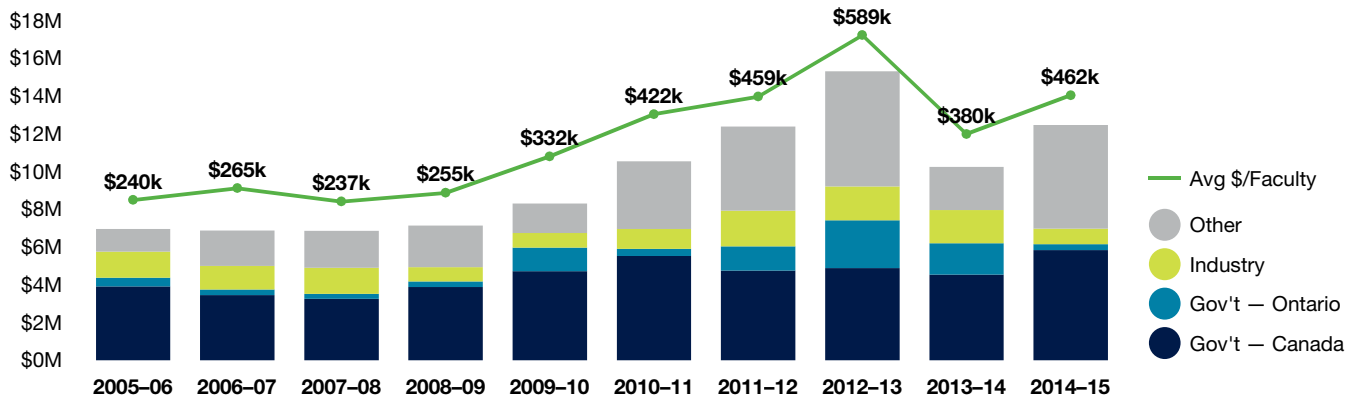
	Gov't – Canada	Gov't – Ontario	Corporate	Other	Total	Avg \$/Faculty
2005–06	\$1,737,031	\$329,500	\$499,365	\$210,069	\$2,775,965	\$185,064
2006–07	\$2,365,513	\$185,000	\$60,000	\$161,533	\$2,772,046	\$184,803
2007–08	\$2,712,542	\$175,000	\$679,227	\$96,167	\$3,662,936	\$244,196
2008–09	\$2,682,272	\$45,000	\$35,500	\$282,968	\$3,045,740	\$190,359
2009–10	\$1,486,735	\$107,333	\$259,200	\$349,358	\$2,202,626	\$146,842
2010–11	\$2,261,742		\$390,200	\$396,936	\$3,048,878	\$217,777
2011–12	\$4,692,109	\$89,356	\$420,400	\$386,989	\$5,588,854	\$399,204
2012–13	\$2,931,459	\$72,605	\$397,116	\$337,560	\$3,738,740	\$287,595
2013–14	\$2,486,418	\$35,708	\$342,400	\$1,372,126	\$4,236,652	\$282,443
2014–15	\$2,458,871	\$50,000	\$584,609	\$481,988	\$3,575,468	\$238,365

Figure E.3 Institute of Biomaterials & Biomedical Engineering Research Operating Funding by Source and Average Funding per Faculty Member, 2005–2006 to 2014–2015



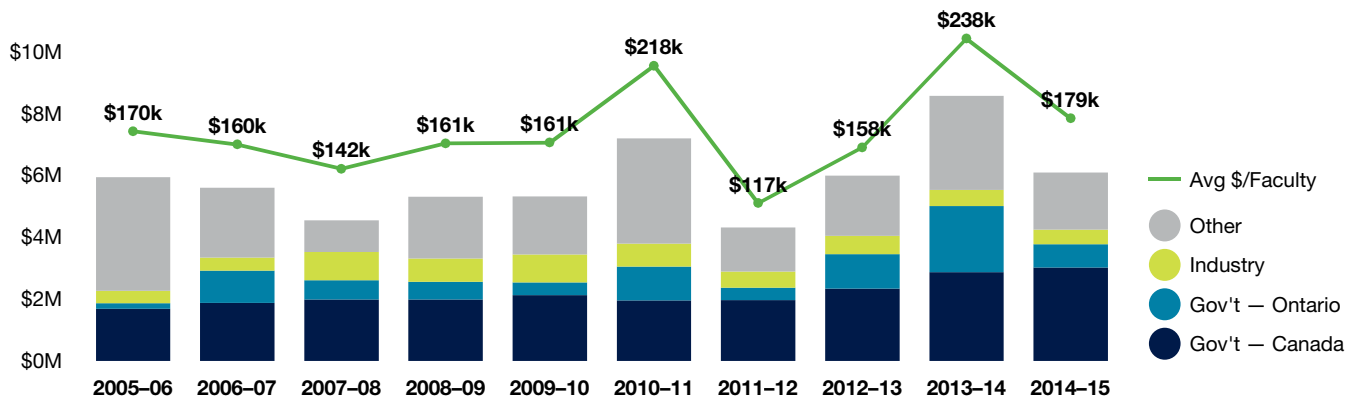
	Gov't – Canada	Gov't – Ontario	Corporate	Other	Total	Avg \$/Faculty
2005–06	\$1,782,028	\$48,666	\$176,220	\$1,857,110	\$3,864,024	\$772,805
2006–07	\$2,243,946	\$1,333	\$186,904	\$2,027,941	\$4,460,124	\$743,354
2007–08	\$2,065,500	\$165,515	\$222,300	\$1,251,056	\$3,704,371	\$617,395
2008–09	\$1,919,671	\$317,147	\$117,411	\$678,498	\$3,032,727	\$433,247
2009–10	\$2,337,302	\$242,228	\$375,037	\$1,476,045	\$4,430,612	\$443,061
2010–11	\$2,527,234	\$142,383	\$160,634	\$1,748,787	\$4,579,038	\$457,904
2011–12	\$3,040,869	\$13,500		\$1,330,768	\$4,385,137	\$438,514
2012–13	\$3,098,604	\$908,607	\$121,090	\$1,088,556	\$5,216,857	\$474,260
2013–14	\$3,659,531	\$1,158,809	\$48,000	\$1,331,805	\$6,198,145	\$516,512
2014–15	\$4,177,002	\$943,878	\$371,689	\$1,231,847	\$6,724,416	\$611,311

Figure E.4 Department of Chemical Engineering & Applied Chemistry Research Operating Funding by Source and Average Funding per Faculty Member, 2005–2006 to 2014–2015



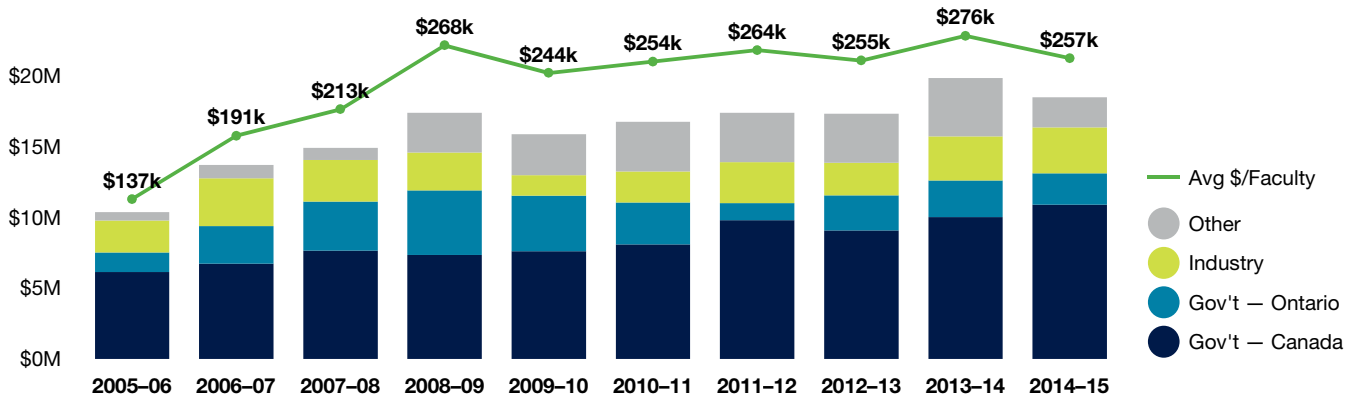
	Gov't – Canada	Gov't – Ontario	Corporate	Other	Total	Avg \$/Faculty
2005–06	\$3,914,479	\$465,999	\$1,379,766	\$1,195,334	\$6,955,578	\$239,848
2006–07	\$3,460,090	\$290,203	\$1,261,279	\$1,875,921	\$6,887,493	\$264,904
2007–08	\$3,267,829	\$261,610	\$1,368,550	\$1,961,293	\$6,859,282	\$236,527
2008–09	\$3,883,714	\$299,378	\$757,256	\$2,202,402	\$7,142,750	\$255,098
2009–10	\$4,717,078	\$1,257,813	\$781,842	\$1,554,321	\$8,311,054	\$332,442
2010–11	\$5,525,910	\$388,844	\$1,052,026	\$3,581,019	\$10,547,799	\$421,912
2011–12	\$4,759,256	\$1,283,137	\$1,897,761	\$4,450,643	\$12,390,797	\$458,918
2012–13	\$4,897,371	\$2,528,978	\$1,783,746	\$6,111,048	\$15,321,143	\$589,275
2013–14	\$4,551,511	\$1,652,628	\$1,761,315	\$2,285,459	\$10,250,913	\$379,663
2014–15	\$5,849,595	\$309,298	\$828,124	\$5,485,081	\$12,472,098	\$461,930

Figure E.5 Department of Civil Engineering Research Operating Funding by Source and Average Funding per Faculty Member, 2005–2006 to 2014–2015



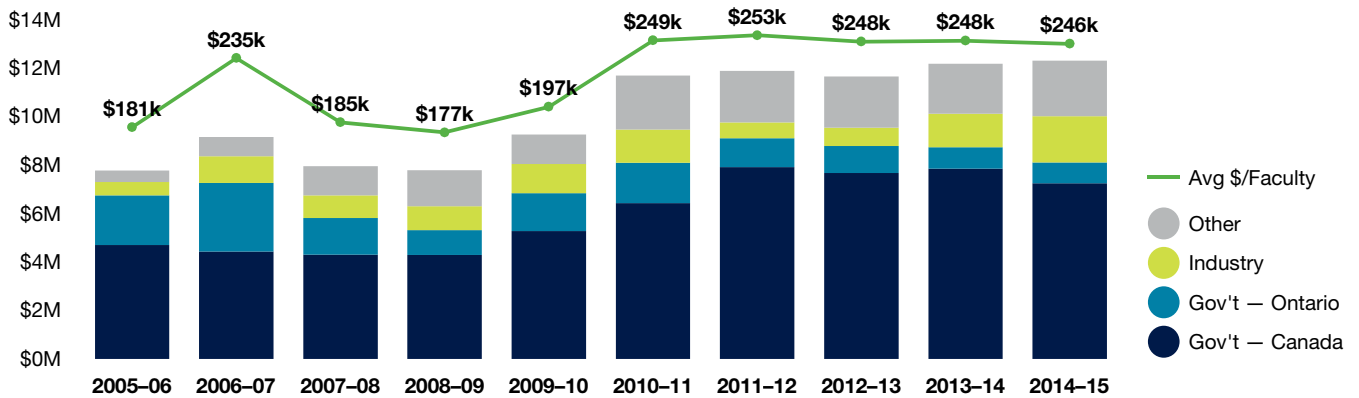
	Gov't – Canada	Gov't – Ontario	Corporate	Other	Total	Avg \$/Faculty
2005–06	\$1,685,873	\$182,459	\$404,084	\$3,668,571	\$5,940,987	\$169,742
2006–07	\$1,879,079	\$1,040,229	\$421,708	\$2,261,010	\$5,602,026	\$160,058
2007–08	\$1,990,013	\$622,300	\$910,734	\$1,023,094	\$4,546,141	\$142,067
2008–09	\$1,990,579	\$572,670	\$755,982	\$1,988,916	\$5,308,147	\$160,853
2009–10	\$2,129,407	\$412,542	\$906,466	\$1,879,277	\$5,327,692	\$161,445
2010–11	\$1,956,171	\$1,097,073	\$747,127	\$3,399,792	\$7,200,163	\$218,187
2011–12	\$1,971,794	\$402,645	\$515,359	\$1,428,083	\$4,317,881	\$116,699
2012–13	\$2,338,881	\$1,121,004	\$586,088	\$1,952,886	\$5,998,859	\$157,865
2013–14	\$2,872,286	\$2,136,572	\$528,078	\$3,041,895	\$8,578,831	\$238,301
2014–15	\$3,019,037	\$762,246	\$468,645	\$1,847,498	\$6,097,426	\$179,336

Figure E.6 The Edward S. Rogers Sr. Department of Electrical & Computer Engineering Research Operating Funding by Source and Average Funding per Faculty Member, 2005–2006 to 2014–2015



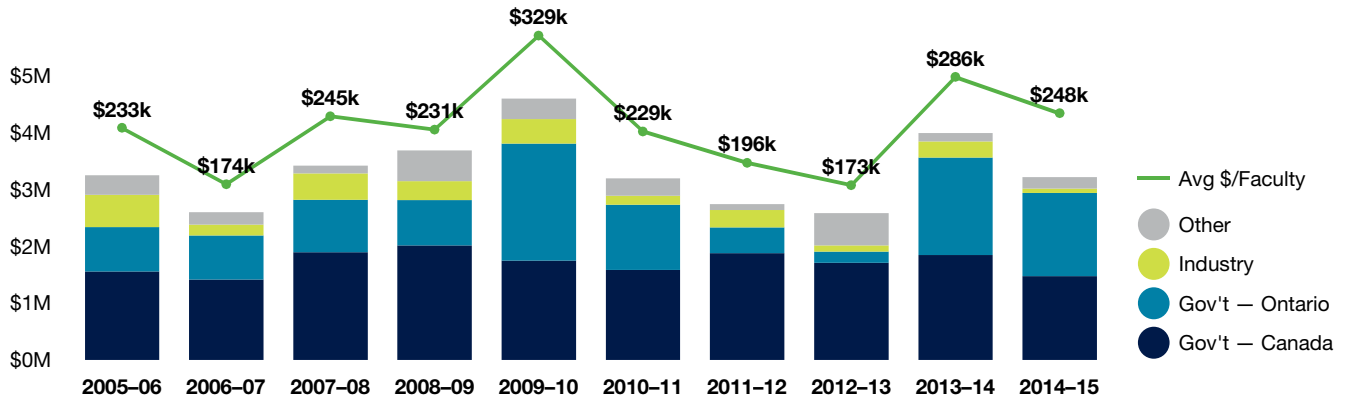
	Gov't – Canada	Gov't – Ontario	Corporate	Other	Total	Avg \$/Faculty
2005–06	\$6,154,141	\$1,378,334	\$2,266,096	\$575,955	\$10,374,526	\$136,507
2006–07	\$6,739,878	\$2,660,526	\$3,363,559	\$957,306	\$13,721,269	\$190,573
2007–08	\$7,654,810	\$3,470,568	\$2,950,516	\$853,280	\$14,929,174	\$213,274
2008–09	\$7,354,769	\$4,551,690	\$2,684,325	\$2,815,615	\$17,406,399	\$267,791
2009–10	\$7,620,706	\$3,923,865	\$1,456,958	\$2,878,488	\$15,880,017	\$244,308
2010–11	\$8,089,058	\$2,962,550	\$2,213,062	\$3,491,863	\$16,756,533	\$253,887
2011–12	\$9,804,328	\$1,205,388	\$2,910,981	\$3,484,571	\$17,405,268	\$263,716
2012–13	\$9,081,379	\$2,481,833	\$2,305,784	\$3,465,717	\$17,334,713	\$254,922
2013–14	\$10,032,197	\$2,592,751	\$3,117,251	\$4,122,724	\$19,864,923	\$275,902
2014–15	\$10,913,574	\$2,204,063	\$3,260,799	\$2,115,017	\$18,493,453	\$256,854

Figure E.7 Department of Mechanical & Industrial Engineering Research Operating Funding by Source and Average Funding per Faculty Member, 2005–2006 to 2014–2015



	Gov't – Canada	Gov't – Ontario	Corporate	Other	Total	Avg \$/Faculty
2005–06	\$4,703,394	\$2,042,264	\$555,242	\$473,811	\$7,774,711	\$180,807
2006–07	\$4,425,552	\$2,833,485	\$1,095,225	\$804,332	\$9,158,594	\$234,836
2007–08	\$4,297,733	\$1,519,533	\$924,880	\$1,200,988	\$7,943,134	\$184,724
2008–09	\$4,289,293	\$1,027,566	\$976,457	\$1,486,804	\$7,780,120	\$176,821
2009–10	\$5,276,172	\$1,558,727	\$1,203,710	\$1,211,942	\$9,250,551	\$196,820
2010–11	\$6,432,136	\$1,653,762	\$1,375,128	\$2,224,992	\$11,686,018	\$248,639
2011–12	\$7,912,011	\$1,188,878	\$657,854	\$2,114,359	\$11,873,102	\$252,619
2012–13	\$7,663,486	\$1,115,661	\$757,191	\$2,105,840	\$11,642,178	\$247,706
2013–14	\$7,844,628	\$879,834	\$1,393,542	\$2,050,835	\$12,168,839	\$248,344
2014–15	\$7,239,600	\$860,477	\$1,911,014	\$2,288,560	\$12,299,651	\$245,993

Figure E.8 Department of Materials Science & Engineering Research Operating Funding by Source and Average Funding per Faculty Member, 2005–2006 to 2014–2015



	Gov't – Canada	Gov't – Ontario	Corporate	Other	Total	Avg \$/Faculty
2005–06	\$1,561,749	\$783,577	\$567,370	\$345,328	\$3,258,024	\$232,716
2006–07	\$1,417,224	\$777,970	\$195,024	\$216,848	\$2,607,066	\$173,804
2007–08	\$1,898,382	\$927,585	\$464,574	\$138,250	\$3,428,791	\$244,914
2008–09	\$2,020,903	\$796,601	\$339,222	\$539,173	\$3,695,899	\$230,994
2009–10	\$1,754,687	\$2,059,894	\$432,055	\$364,545	\$4,611,181	\$329,370
2010–11	\$1,587,169	\$1,150,973	\$158,500	\$309,101	\$3,205,743	\$228,982
2011–12	\$1,886,112	\$453,820	\$302,864	\$104,500	\$2,747,296	\$196,235
2012–13	\$1,715,249	\$196,359	\$111,000	\$569,275	\$2,591,883	\$172,792
2013–14	\$1,850,798	\$1,716,977	\$286,216	\$149,675	\$4,003,666	\$285,976
2014–15	\$1,479,347	\$1,464,291	\$80,000	\$200,356	\$3,223,994	\$248,000

Appendix F: Spinoff Companies

Est.	Company Name	Engineering Affiliation	Department
2015	Appulse Inc. (formerly ICE3 Power Technologies Inc.)	Aleksander Prodic	ECE
2015	Deep Genomics Inc.	Brendan Frey	ECE
2015	Enhanced Biomodulation Technologies Inc.	Paul Yoo	IBBME
2015	ExCellThera Inc.	Peter Zandstra	IBBME
2015	Onyx Motion Inc.	Marissa Wu	IBBME
2015	Tara Biosystems, Inc.	Milica Radisic	IBBME, ChemE
2014	Arrowonics Inc.	Hugh Liu	UTIAS
2014	Enceladeus Imaging	Steve Mann	ECE
2014	IQBiomedical	David Sinton	MIE
2014	Pragmatek Transport Innovations, Inc.	Baher Abdulhai	CivE
2014	QD Solar Inc.	Sjoerd Hoogland and Ted Sargent	ECE
2014	Sonas Systems Inc.	Joyce Poon	ECE
2014	SpineSonics Medical Inc.	Richard Cobbold	IBBME
2014	Toronto Nano Instrumentation Inc. (TNi Inc.)	Yu Sun	MIE
2014	XCellPure Inc.	Milica Radisic	IBBME, ChemE
2014	XTouch Inc.	Parham Aarabi	ECE
2013	CoursePeer	Hadi Aladdin	ECE
2013	eQOL Inc.	Binh Nguyen	ECE
2013	Kydo Engineering	John Ruggieri	ChemE
2013	Whirlscape Inc.	Will Walmsley	MIE
2012	Kinetica Dynamics Inc.	Constantin Christopoulos	CivE
2012	MyTrak Health Systems	Sean Doherty	CivE
2012	OTI Lumionics Inc.	Zheng-Hong Lu	MSE
2012	XTT	Parham Aarabi	ECE
2011	Aereus Technologies Inc. (formerly Aereus Wood)	Javad Mostaghimi	MIE
2011	Bionym Inc.	Karl Martin	ECE
2011	Filaser Inc.	Peter Herman	ECE
2011	Luminautics Inc. (formerly Ensi Solutions)	Graham Murdoch	MSE
2011	Nymi (Formerly Bionym Inc.)	Karl Martin	ECE
2011	Ojiton Inc.	Tom Chau	IBBME
2011	PRISED Solar Inc.	Wahid Shams-Kolahi	ECE
2011	RenWave	Mohamed Kamh	ECE
2011	Sense Intelligent	Brian Hu	ECE
2011	Xagenic Canada Inc.	Ted Sargent	ECE
2010	Arda Power Inc.	Peter Lehn	ECE
2010	FOTA Technologies	Tony Chan Carusone	ECE
2009	Chip Care Corp.	J. Stewart Aitchison	ECE
2009	Cytodiagnosics	Warren Chan	IBBME
2009	Peraso Technologies Inc.	Sorin Voinigescu	ECE
2008	Ablazeon Inc.	Javad Mostaghimi	MIE
2008	Arch Power Inc.	Mohammad (Reza) Iravani	ECE
2008	AXAL Inc.	Milos Popovic and Egor Sanin	IBBME
2008	Incise Photonics Inc.	Peter Herman	ECE
2008	Quantum Dental Technologies	Andreas Mandelis	MIE
2008	Simple Systems Inc.	Milos Popovic, Aleksandar Prodic and Armen Baronijan	ECE, IBBME
2007	002122461 Ontario Inc.	Harry Ruda	MSE
2007	Cast Connex Corp.	Jeffrey Packer and Constantin Christopoulos	CivE
2007	Elastin Specialties	Kimberly Woodhouse	ChemE
2007	Inometrix Inc.	Michael Galle	ECE
2007	Modiface Inc.	Parham Aarabi	ECE
2007	Neurochip Inc.	Berj Bardakjian	IBBME
2007	Viewgenie Inc.	Parham Aarabi	ECE
2006	Anviv Mechatronics Inc. (AMI)	Andrew Goldenberg	MIE
2006	InVisage Technologies Inc.	Ted Sargent	ECE
2006	Metabacus	Jianwen Zhu	ECE

2006	Vennsa Technologies Inc.	Andreas Veneris and Sean Safarpour	ECE
2005	Greencore Composites	Mohini Sain	Forestry, ChemE
2004	Field Metrica Inc. (FMI)	Tim DeMonte, Richard Yoon	IBBME
2004	Tissue Regeneration Therapeutics Inc. (TRT)	J.E. Davies	IBBME
2003	1484667 Ontario Inc.	Brad Saville	ChemE
2003	ArchES Computing Systems Corp.	Paul Chow	ECE
2003	Norel Optronics Inc.	Zheng-Hong Lu	MSE
2003	Vocalage Inc.	Mark Chignell	MIE
2002	Information Intelligence Corporation (IIC)	Burhan Turksen	MIE
2002	MatRegen Corp.	Molly Shoichet	IBBME, ChemE
2002	OMDEC Inc.	Andrew K.S. Jardine	MIE
2002	SiREM	Elizabeth Edwards	ChemE
2001	Fox-Tek	Rod Tennyson	UTIAS
2001	Insception Biosciences	Peter Zandstra	IBBME
2001	Interface Biologics	Paul Santerre	IBBME
2000	Biox Corporation	David Boocock	ChemE
2000	Photo-Thermal Diagnostics Inc.	Andreas Mandelis	MIE
2000	Simulent Inc.	Javad Mostaghimi	MIE
2000	Virtek Engineering Science Inc.	Andrew Goldenberg	MIE
1999	Accelight Networks Inc.	Alberto Leon-Garcia and Paul Chow	ECE
1999	em2 Inc.	J.E. Davies	IBBME
1999	Soma Networks	Michael Stumm and Martin Snelgrove	ECE
1999	Vivosonic Inc.	Yuri Sokolov and Hans Kunov	IBBME
1998	1208211 Ontario Ltd. (affiliate: Regen StaRR)	Robert Pilliar, Rita Kandel and Marc Grynpas	IBBME
1998	BANAK Inc.	Andrew K.S. Jardine	MIE
1998	BoneTec Corp. (now owned by subsidiary of TRT)	J.E. Davies and Molly Shoichet	IBBME
1998	Right Track CAD Corp.	Jonathan Rose	ECE
1998	SMT HyrdaSil	Rod Tennyson	UTIAS
1998	Snowbush Microelectronics	Kenneth Martin and David Johns	ECE
1997	Rimon Therapeutics	Michael Sefton	IBBME, ChemE
1996	OANDA Corp.	Michael Stumm	ECE
1996	Rocscience Inc.	John Curran	CivE
1995	Amilog Systems		MIE
1995	Electrobiologies	Paul Madsen	IBBME
1995	Hydrogenics Corp.		MIE
1995	Tribokinetics Inc.	Raymond Woodhams	ChemE
1994	Key Lime Co.	Honghi Tran	ChemE
1994	Trantek Power		ECE
1993	Electro Photonics	Raymond Measures	UTIAS
1993	Liquid Metal Sonics Ltd.		MSE
1993	SAFE Nozzle Group	Honghi Tran	ChemE
1993	SmartSpeaker Corp.	Anees Munshi	ECE
1992	Condata Technologies Ltd.		ECE
1992	Gao Research & Consulting Ltd.	Frank Gao	ECE
1992	Novator Systems Ltd.	Mark Fox	MIE
1992	Paul Madsen Medical Devices	Hans Kunov	IBBME
1992	PolyPhalt Inc.	Raymond Woodhams	ChemE
1991	Advent Process Engineering Inc.		MSE
1991	LinShin Canada Inc.		IBBME
1991	Minnovex	Glenn Dobby	MSE
1991	Redrock Solvers Inc.	Michael Carter	MIE
1990	Fibre Metrics	Dale Hogg	UTIAS
1989	Apollo Environmental Systems Corp.	John Harbinson	ChemE
1989	Integrity Testing Laboratory Inc. (ITL)		UTIAS
1989	Translucent Technologies	Paul Milgram	MIE
1989	Xiris Automation Inc.	Cameron Serles	MIE
1988	Advanced Materials Technologies	Steven Thorpe	MSE
1988	Food BioTek Corp.	Leon Rubin	ChemE
1988	HydraTek and Associates Inc.	Bryan Karney and (since 2006) Fabian Papa	CivE

Appendix G: Descriptions of Major Awards

Chapter 5: Awards and Honours summarizes the international, national and provincial awards our faculty and alumni received. Below are descriptions of some of those awards and honours.

International

American Association for the Advancement of Science (AAAAS) Fellowship – Engineering Section

Recognition of extraordinary achievements across disciplines by a member whose efforts on behalf of the advancement of science or its applications are scientifically or socially distinguished. The AAAS is the world's largest general scientific society.

MIT Top 35 Under 35

Awarded to world's top 35 young innovators under the age of 35 by *MIT Technology Review* magazine.

U.S. National Academies

The National Academies serve (collectively) as the scientific national academy for the United States.

National

3M Teaching Fellowship

Canada's highest teaching award in recognition of educational excellence and leadership.

Alan Blizzard Award

Recognition for exemplary collaboration in university teaching as it enhances student learning.

Canadian Academy of Engineering (CAE) Fellowship

Recognition for distinguished achievements and career-long service to the engineering profession.

Engineering Institute of Canada (EIC) Fellowship

Recognition for exceptional contributions to engineering in Canada and for service to the profession and to society.

Engineering Institute of Canada (EIC) Awards

Recognition of outstanding engineers for exemplary contributions to engineering achievement in Canada and the world.

Engineers Canada Awards

Recognition of outstanding Canadian engineers, teams of engineers, engineering projects and engineering students.

Killam Prize

Awarded to distinguished Canadian scholars conducting research in one of five fields of study, including engineering, by the Canada Council for the Arts.

Killam Research Fellowship

Awarded to an established scholar who has demonstrated outstanding research ability and has published research results in substantial publications in their field by the Canada Council for the Arts.

Manning Innovation Award

Recognition of Canadian innovators who are improving the lives of Canadians and others around the world through their commercialized innovations.

Royal Society of Canada (RSC) Fellowship

Highest Canadian honour a scholar can achieve in the arts, humanities and sciences.

Royal Society of Canada (RSC) College of New Scholars, Artists and Scientists

Members are Canadian scholars who, at an early stage in their career, have demonstrated a high level of achievement and excellence.

Steacie Fellowship

Awarded to enhance the career development of outstanding and highly promising scientists and engineers by the Natural Sciences and Engineering Research Council (NSERC).

Steacie Prize

Awarded to a scientist or engineer 40 years of age or less for outstanding scientific research carried out in Canada.

Synergy Award for Innovation

Recognition for university-industry collaboration that stands as a model of effective partnership.

Provincial

Ontario Professional Engineers Awards

Awarded to Professional Engineers Ontario members who have contributed substantially to the advancement of the engineering profession in any of its branches.

Ontario Confederation of University Faculty Associations (OCUFA) Teaching Award

Recognition of individuals with exceptional contributions to the higher education community in Ontario, including teaching philosophy, curriculum development and research on university teaching.

Appendix H: Academic Staff by Academic Area

The figures in Appendix H show the composition of our academic staff from 2006–2007 to 2015–2016. Figures H.1a and H.1b provide a Faculty overview and H.2 to H.8 present a detailed analysis by academic area.

Figure H.1a Total Academic Staff by Academic Area, 2006–2007 to 2015–2016

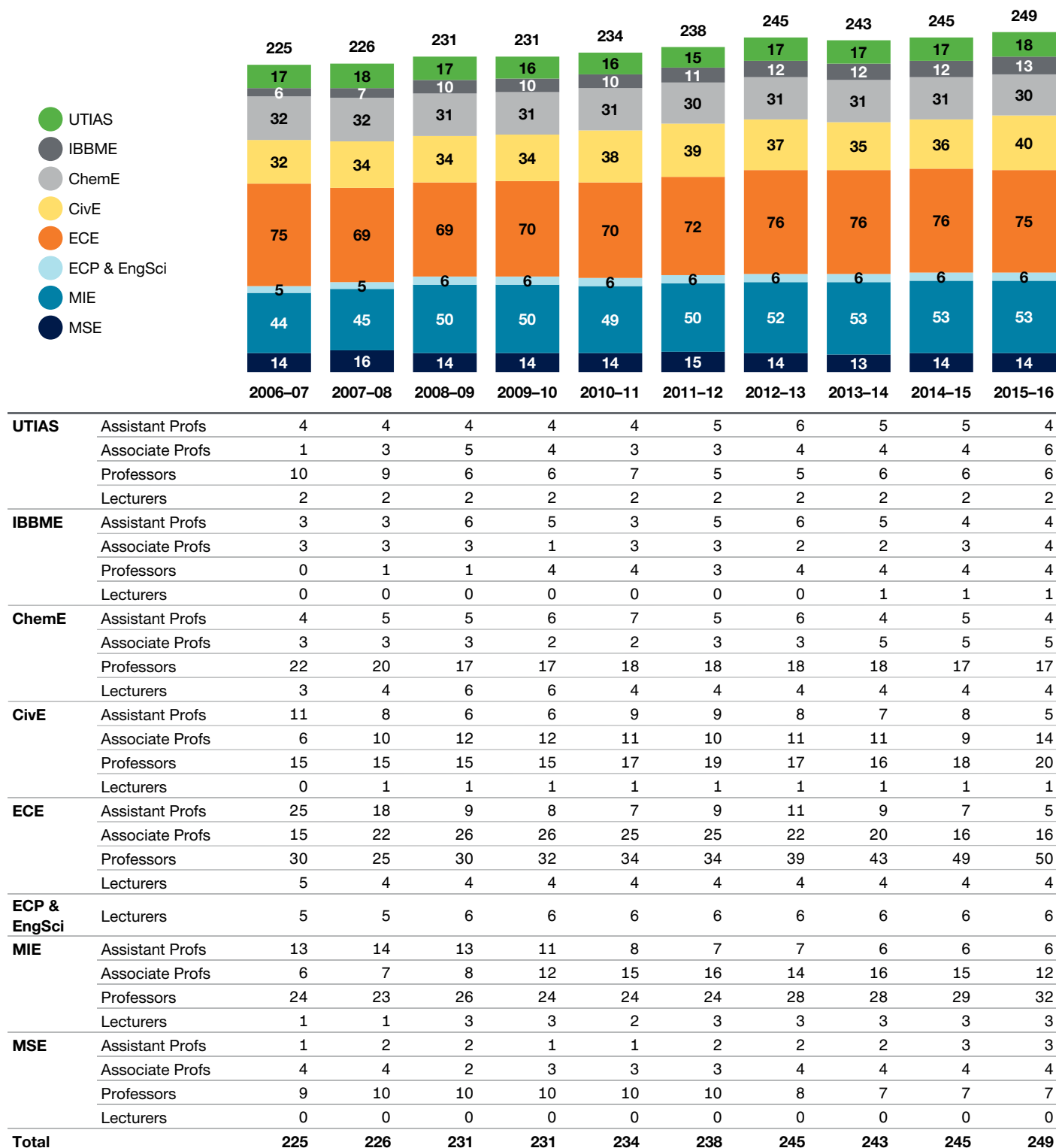


Figure H.1b University of Toronto Faculty of Applied Science & Engineering Total Academic Staff by Position with Percentage of Women, 2006–2007 to 2015–2016

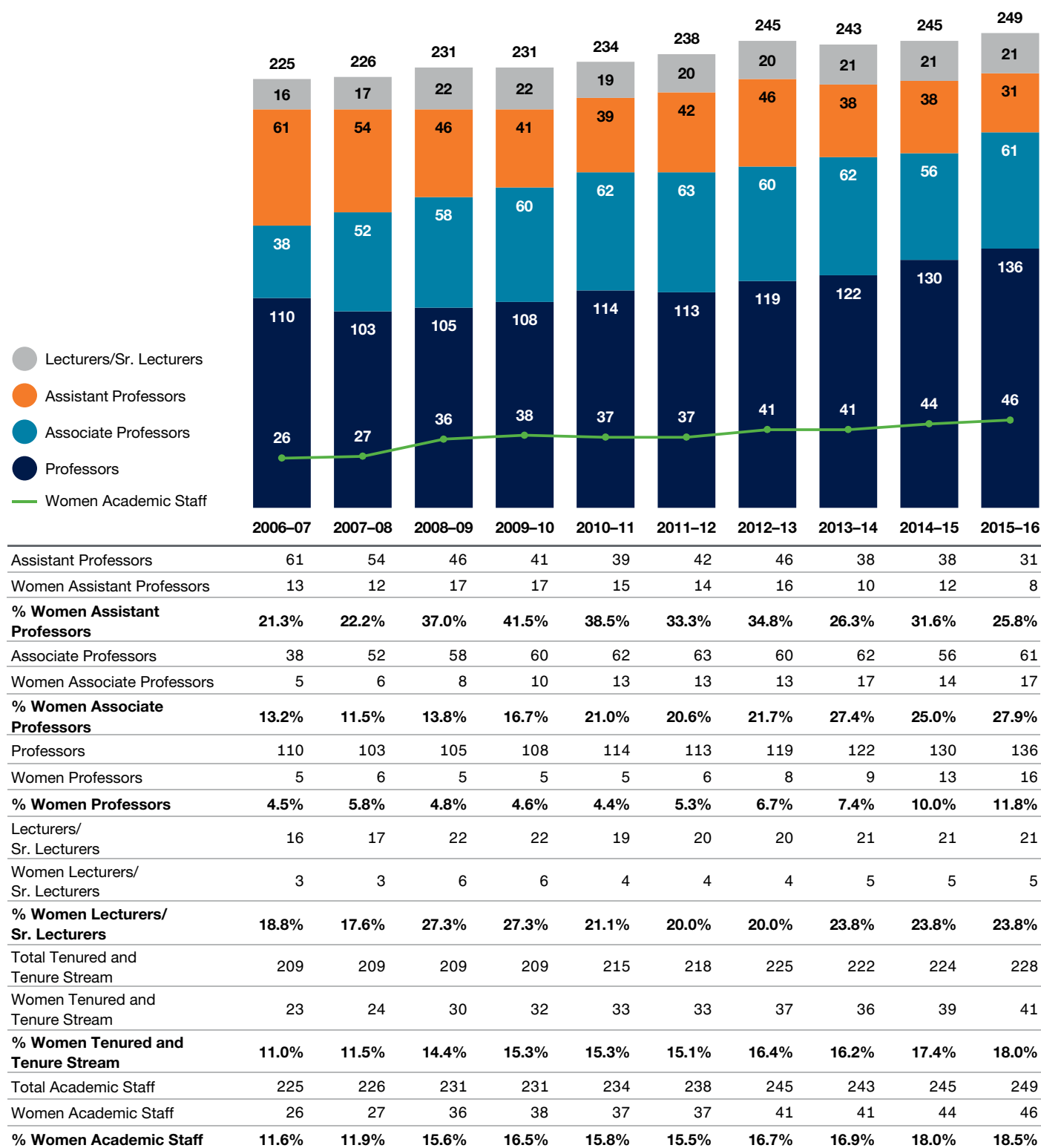
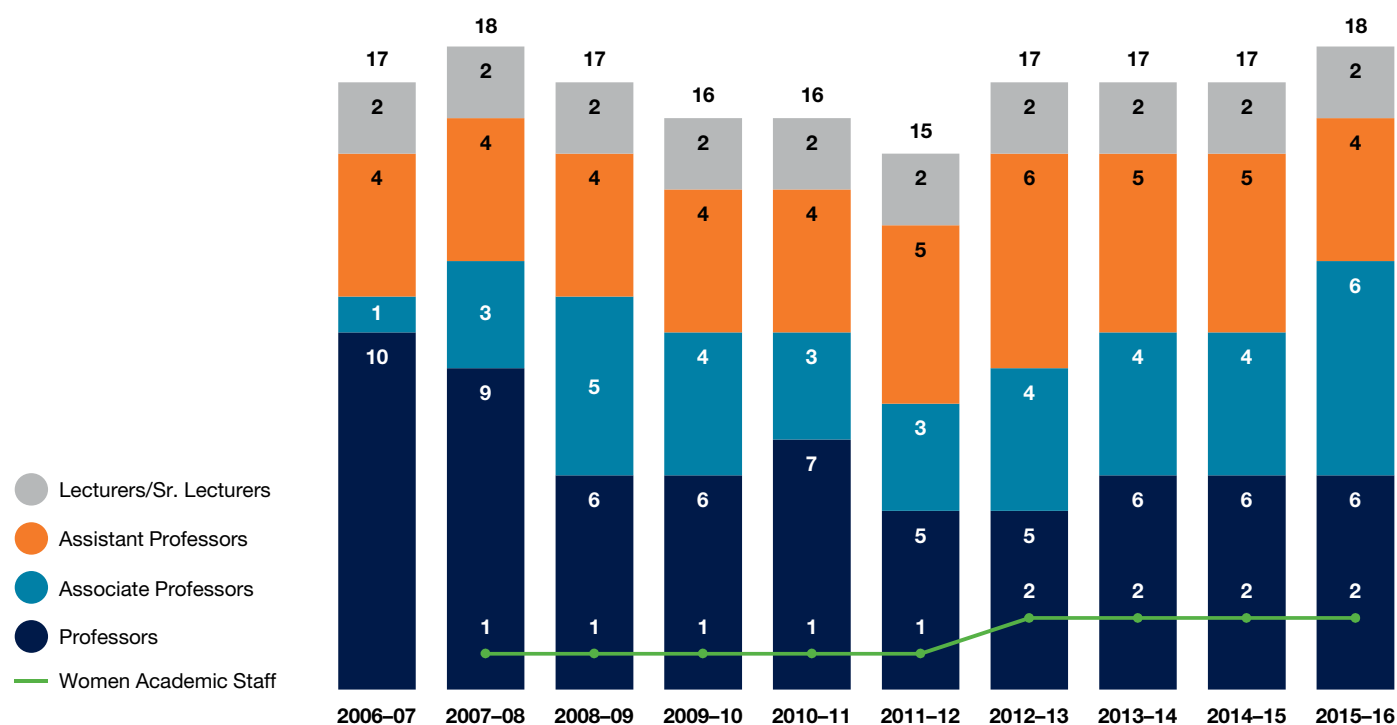


Figure H.2 University of Toronto Institute for Aerospace Studies:
Academic Staff by Position with Percentage of Women, 2006–2007 to 2015–2016



	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Assistant Professors	4	4	4	4	4	5	6	5	5	4
Women Assistant Professors	0	1	1	1	1	1	2	2	2	1
% Women Assistant Professors	0.0%	25.0%	25.0%	25.0%	25.0%	20.0%	33.3%	40.0%	40.0%	25.0%
Associate Professors	1	3	5	4	3	3	4	4	4	6
Women Associate Professors	0	0	0	0	0	0	0	0	0	1
% Women Associate Professors	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	16.7%
Professors	10	9	6	6	7	5	5	6	6	6
Women Professors	0	0	0	0	0	0	0	0	0	0
% Women Professors	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Lecturers/ Sr. Lecturers	2	2	2	2	2	2	2	2	2	2
Women Lecturers/ Sr. Lecturers	0	0	0	0	0	0	0	0	0	0
% Women Lecturers/ Sr. Lecturers	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total Tenured and Tenure Stream	15	16	15	14	14	13	15	15	15	16
Women Tenured and Tenure Stream	0	1	1	1	1	1	2	2	2	2
% Women Tenured and Tenure Stream	0.0%	6.3%	6.7%	7.1%	7.1%	7.7%	13.3%	13.3%	13.3%	12.5%
Total Academic Staff	17	18	17	16	16	15	17	17	17	18
Women Academic Staff	0	1	1	1	1	1	2	2	2	2
% Women Academic Staff	0.0%	5.6%	5.9%	6.3%	6.3%	6.7%	11.8%	11.8%	11.8%	11.1%

Figure H.3 Institute of Biomaterials & Biomedical Engineering:
Academic Staff by Position with Percentage of Women, 2006–2007 to 2015–2016

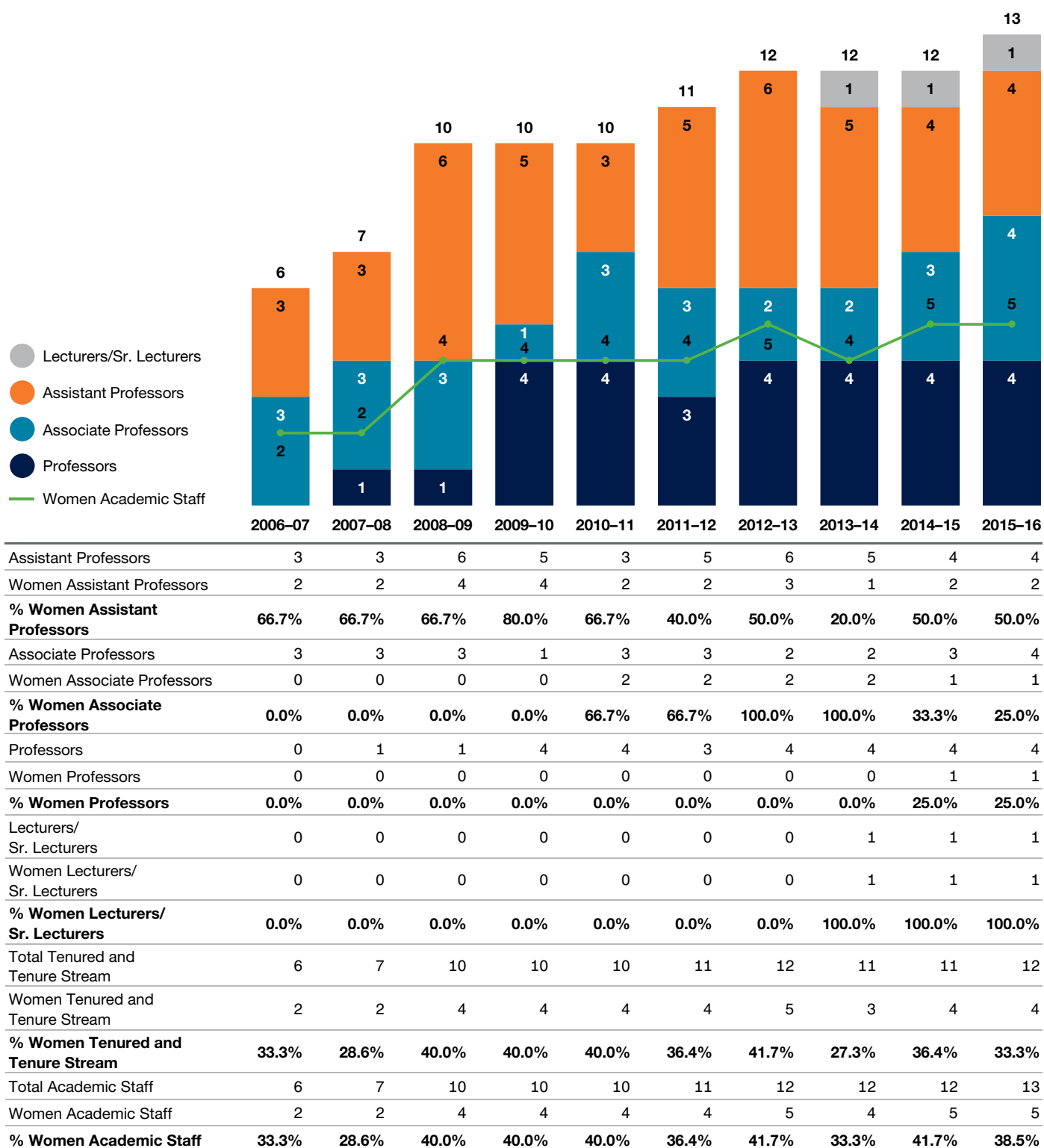
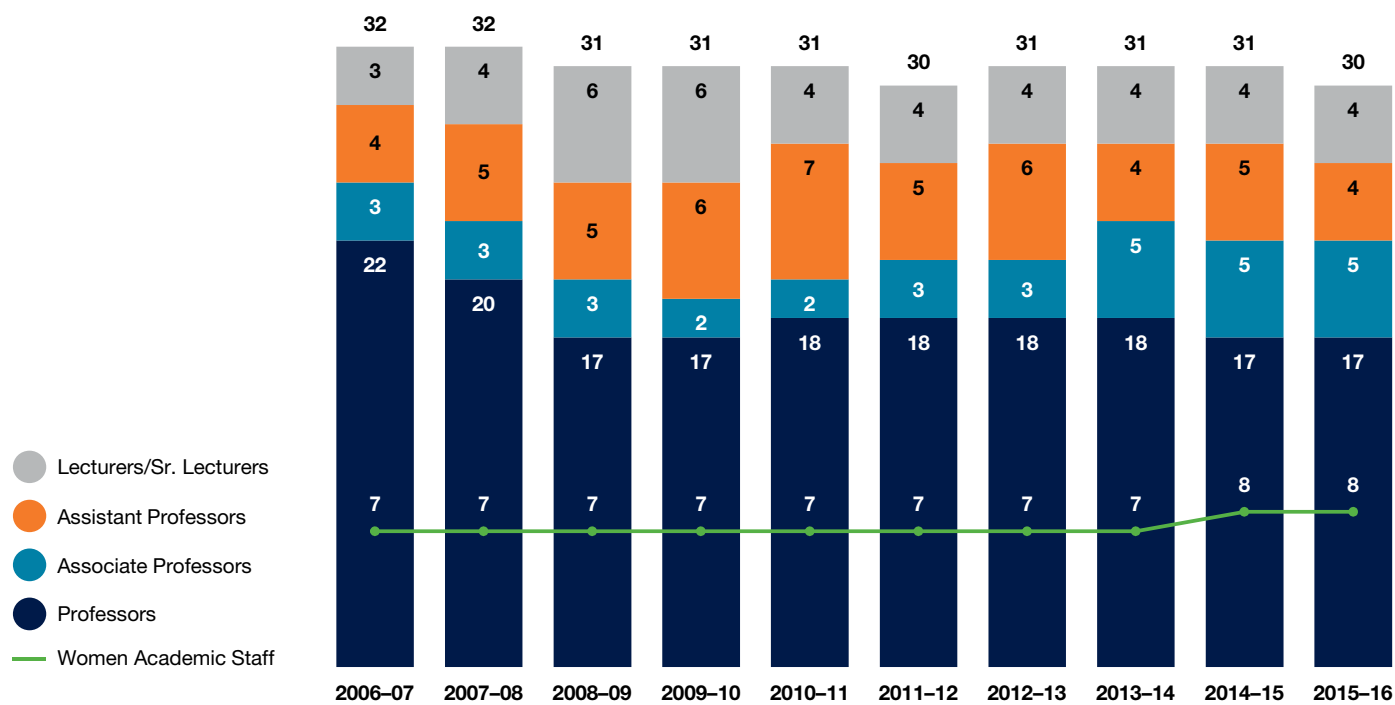


Figure H.4 Department of Chemical Engineering & Applied Chemistry:
Academic Staff by Position with Percentage of Women, 2006–2007 to 2015–2016



	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Assistant Professors	4	5	5	6	7	5	6	4	5	4
Women Assistant Professors	2	2	2	2	3	2	2	2	3	2
% Women Assistant Professors	50.0%	40.0%	40.0%	33.3%	42.9%	40.0%	33.3%	50.0%	60.0%	50.0%
Associate Professors	3	3	3	2	2	3	3	5	5	5
Women Associate Professors	1	0	0	0	0	1	1	1	1	2
% Women Associate Professors	33.3%	0.0%	0.0%	0.0%	0.0%	33.3%	33.3%	20.0%	20.0%	40.0%
Professors	22	20	17	17	18	18	18	18	17	17
Women Professors	3	4	3	3	3	3	3	3	3	3
% Women Professors	13.6%	20.0%	17.6%	17.6%	16.7%	16.7%	16.7%	16.7%	17.6%	17.6%
Lecturers/ Sr. Lecturers	3	4	6	6	4	4	4	4	4	4
Women Lecturers/ Sr. Lecturers	1	1	2	2	1	1	1	1	1	1
% Women Lecturers/ Sr. Lecturers	33.3%	25.0%	33.3%	33.3%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%
Total Tenured and Tenure Stream	29	28	25	25	27	26	27	27	27	26
Women Tenured and Tenure Stream	6	6	5	5	6	6	6	6	7	7
% Women Tenured and Tenure Stream	20.7%	21.4%	20.0%	20.0%	22.2%	23.1%	22.2%	22.2%	25.9%	26.9%
Total Academic Staff	32	32	31	31	31	30	31	31	31	30
Women Academic Staff	7	7	7	7	7	7	7	7	8	8
% Women Academic Staff	21.9%	21.9%	22.6%	22.6%	22.6%	23.3%	22.6%	22.6%	25.8%	26.7%

Figure H.5 Department of Civil Engineering:
Academic Staff by Position with Percentage of Women, 2006–2007 to 2015–2016

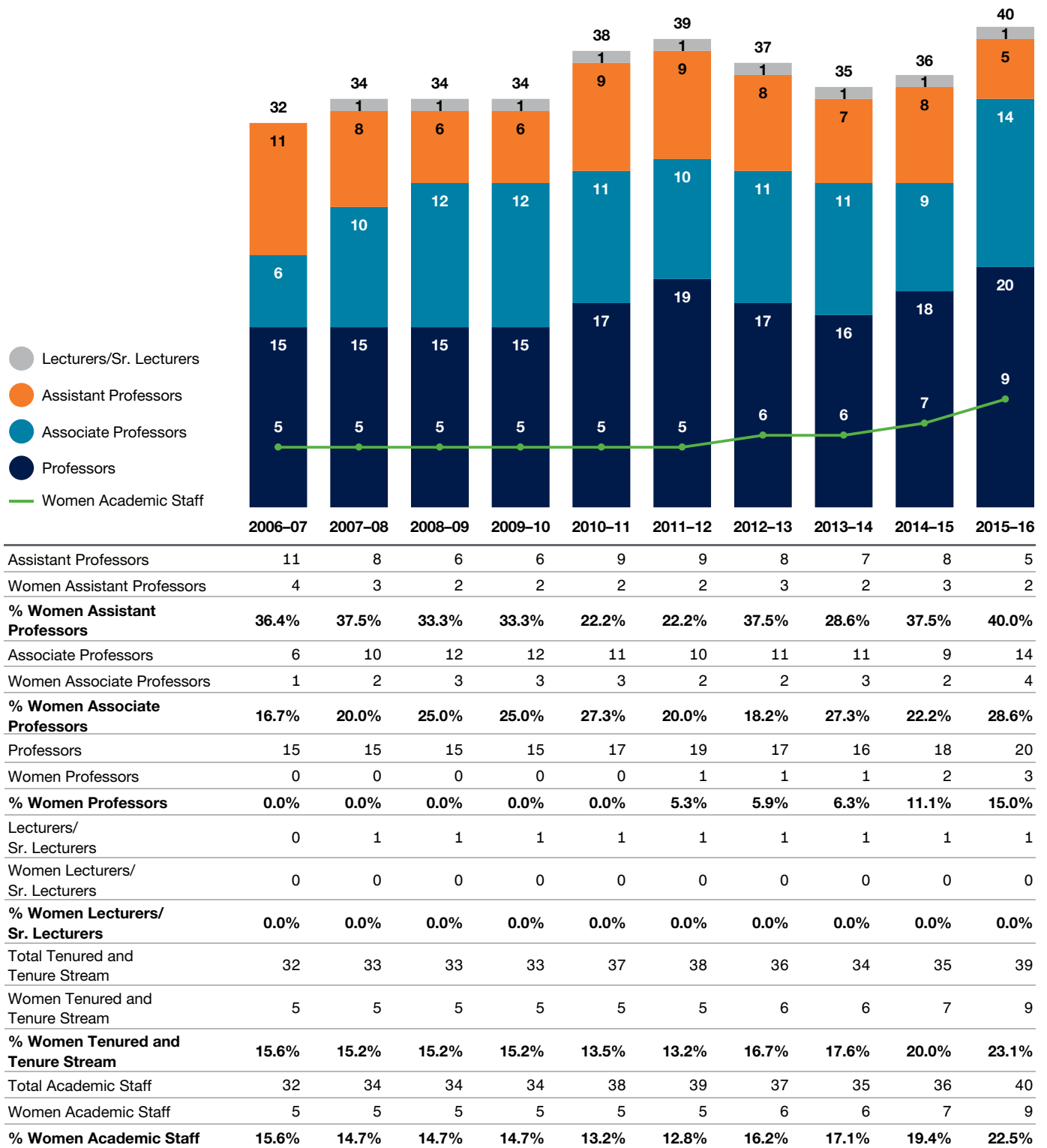
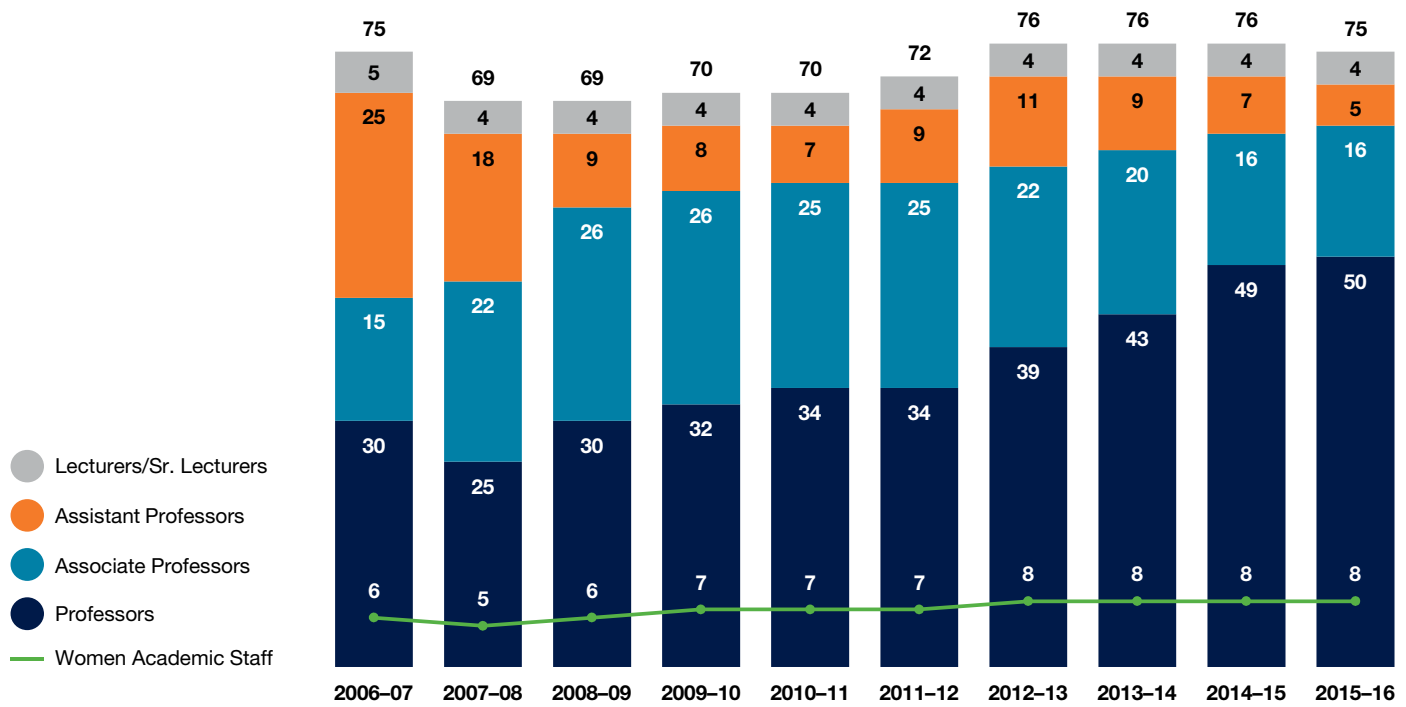
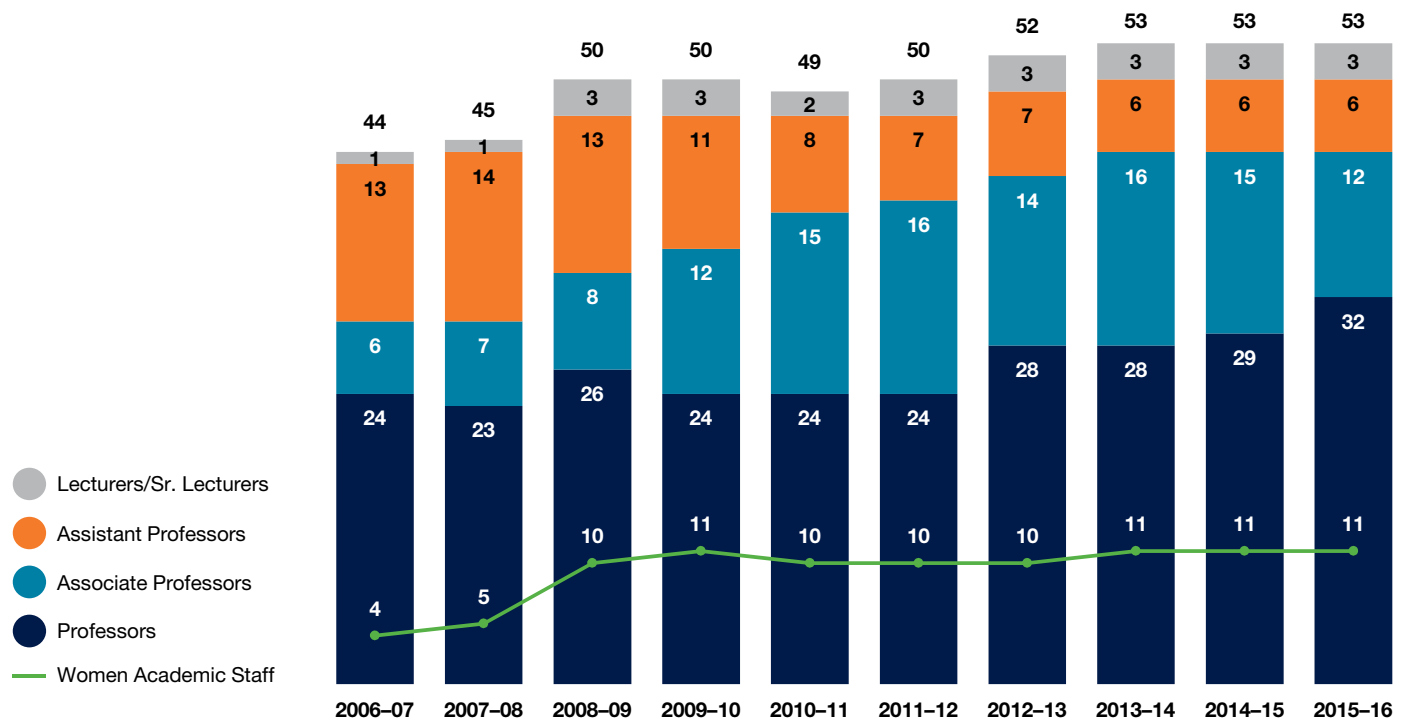


Figure H.6 The Edward S. Rogers Sr. Department of Electrical & Computer Engineering: Academic Staff by Position with Percentage of Women, 2006–2007 to 2015–2016



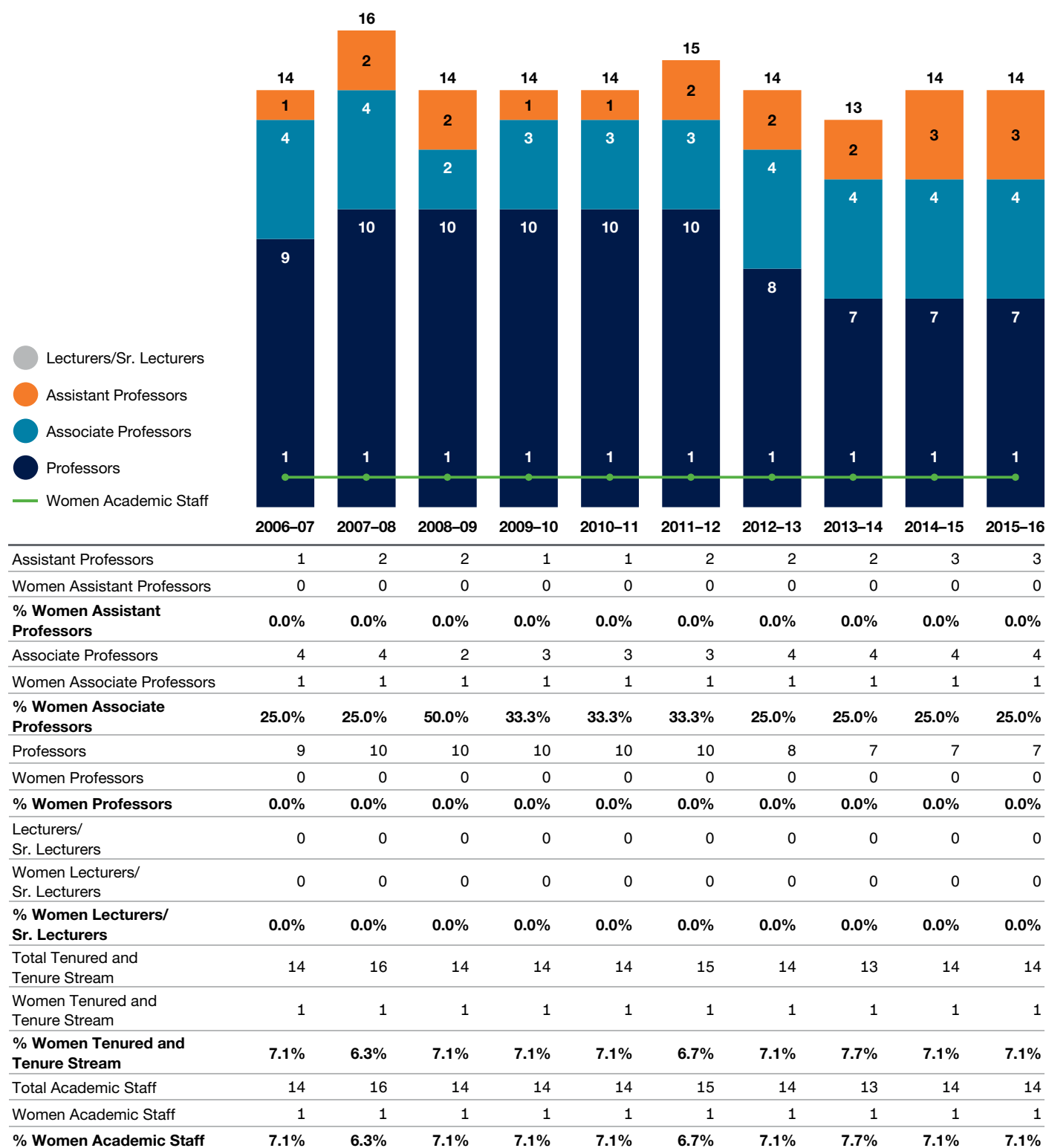
Assistant Professors	25	18	9	8	7	9	11	9	7	5
Women Assistant Professors	5	3	2	2	2	2	2	1	0	0
% Women Assistant Professors	20.0%	16.7%	22.2%	25.0%	28.6%	22.2%	18.2%	11.1%	0.0%	0.0%
Associate Professors	15	22	26	26	25	25	22	20	16	16
Women Associate Professors	0	1	3	4	4	4	4	4	4	3
% Women Associate Professors	0.0%	4.5%	11.5%	15.4%	16.0%	16.0%	18.2%	20.0%	25.0%	18.8%
Professors	30	25	30	32	34	34	39	43	49	50
Women Professors	0	0	0	0	0	0	1	2	3	4
% Women Professors	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.6%	4.7%	6.1%	8.0%
Lecturers/ Sr. Lecturers	5	4	4	4	4	4	4	4	4	4
Women Lecturers/ Sr. Lecturers	1	1	1	1	1	1	1	1	1	1
% Women Lecturers/ Sr. Lecturers	20.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%
Total Tenured and Tenure Stream	70	65	65	66	66	68	72	72	72	71
Women Tenured and Tenure Stream	5	4	5	6	6	6	7	7	7	7
% Women Tenured and Tenure Stream	7.1%	6.2%	7.7%	9.1%	9.1%	8.8%	9.7%	9.7%	9.7%	9.9%
Total Academic Staff	75	69	69	70	70	72	76	76	76	75
Women Academic Staff	6	5	6	7	7	7	8	8	8	8
% Women Academic Staff	8.0%	7.2%	8.7%	10.0%	10.0%	9.7%	10.5%	10.5%	10.5%	10.7%

Figure H.7 Department of Mechanical & Industrial Engineering:
Academic Staff by Position with Percentage of Women, 2006–2007 to 2015–2016



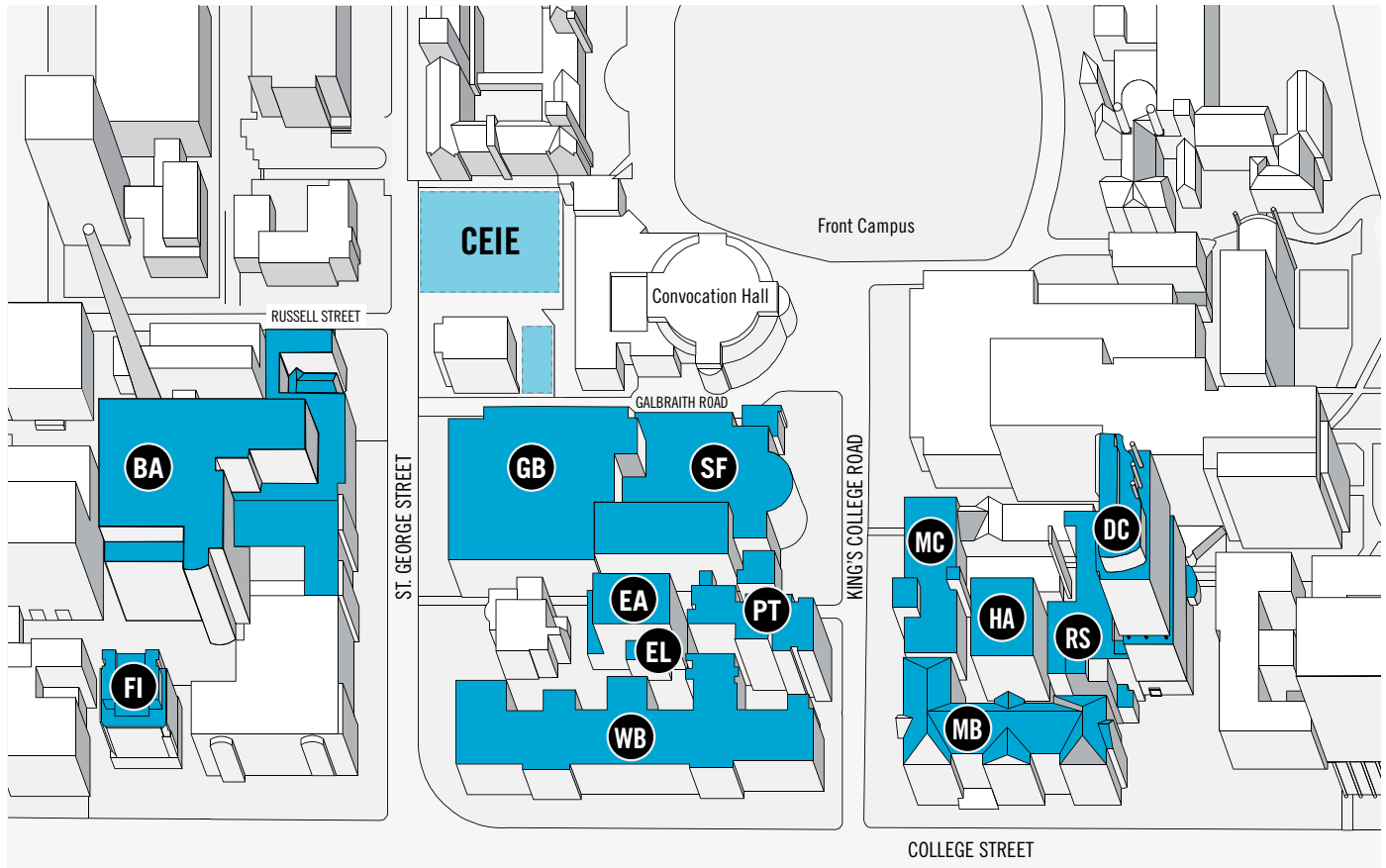
Assistant Professors	13	14	13	11	8	7	7	6	6	6
Women Assistant Professors	0	1	5	6	5	5	4	2	2	1
% Women Assistant Professors	0.0%	7.1%	38.5%	54.5%	62.5%	71.4%	57.1%	33.3%	33.3%	16.7%
Associate Professors	6	7	8	12	15	16	14	16	15	12
Women Associate Professors	2	2	2	2	3	3	3	6	5	5
% Women Associate Professors	33.3%	28.6%	25.0%	16.7%	20.0%	18.8%	21.4%	37.5%	33.3%	41.7%
Professors	24	23	26	24	24	24	28	28	29	32
Women Professors	2	2	2	2	2	2	3	3	4	5
% Women Professors	8.3%	8.7%	7.7%	8.3%	8.3%	8.3%	10.7%	10.7%	13.8%	15.6%
Lecturers/ Sr. Lecturers	1	1	3	3	2	3	3	3	3	3
Women Lecturers/ Sr. Lecturers	0	0	1	1	0	0	0	0	0	0
% Women Lecturers/ Sr. Lecturers	0.0%	0.0%	33.3%	33.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total Tenured and Tenure Stream	43	44	47	47	47	47	49	50	50	50
Women Tenured and Tenure Stream	4	5	9	10	10	10	10	11	11	11
% Women Tenured and Tenure Stream	9.3%	11.4%	19.1%	21.3%	21.3%	21.3%	20.4%	22.0%	22.0%	22.0%
Total Academic Staff	44	45	50	50	49	50	52	53	53	53
Women Academic Staff	4	5	10	11	10	10	10	11	11	11
% Women Academic Staff	9.1%	11.1%	20.0%	22.0%	20.4%	20.0%	19.2%	20.8%	20.8%	20.8%

Figure H.8 Department of Materials Science & Engineering:
Academic Staff by Position with Percentage of Women, 2006–2007 to 2015–2016



Appendix I: The Engineering Precinct

The map below highlights buildings on the St. George campus that form the Engineering precinct. Most of our buildings reside on the southern-most part of campus. Along with UTIAS in Downsview, our offices at 256 McCaul Street, 704 Spadina Ave and the West Tower of MaRS Discovery District, these buildings house our students, faculty, staff, research and teaching spaces. For details on the buildings we occupy, please see *Chapter 11: Financial and Physical Resources*.



BA	Bahen Centre for Information Technology	PT	D.L. Pratt Building
DC	Donnelly Centre for Cellular and Biomolecular Research (CCBR)	RS	Rosebrugh Building
EA	Engineering Annex / Electro-Metallurgy Lab Building (South Side)	SF	Sandford Fleming Building
EL	Electrometallurgy Lab	WB	Wallberg Building
FI	Fields Institute	-	256 McCaul Street [not pictured]
GB	Galbraith Building	-	704 Spadina Avenue [not pictured]
HA	Haultain Building	-	MaRS Discover District West Tower [not pictured]
MB	Lassonde Mining Building	-	UTIAS (Downsview) [not pictured]
MC	Mechanical Engineering Building	CEIE	Centre for Engineering Innovation & Entrepreneurship (coming in 2017)

This section indicates the sources for data and information presented throughout this report. Sources are organized in order of appearance by figure number and title.

Figure Data Source

Faculty Leadership, 2015–2016

Information provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering. A current organizational chart is also available online at www.engineering.utoronto.ca/About/deans_office/Academic_Administrative_Leadership.htm

Comparison of U of T Engineering with Ontario and Canada, 2015–2016

Enrolment, degrees granted and faculty data are based on the 2015 calendar year and come from the National Council of Deans of Engineering and Applied Science (NCDEAS) 2015 Resources Report, prepared by Engineers Canada and circulated to Canadian engineering deans in July 2016. Undergraduate enrolment figures exclude non-degree students and those doing a Professional Experience Year (PEY). Full-time equivalent (FTE) enrolment statistics represent averages that take into account all three terms of the year (winter, summer and fall). Undergraduate FTE shows the three-term total divided by two; Graduate FTE shows the three-term total divided by three. Research funding data comes from the Natural Sciences and Engineering Research Council (NSERC) search engine (www.nserc-crsng.gc.ca/ase-oro/index_eng.asp) with the following parameters: Selection Committees = Discovery Grants + Research Partnerships (excl CRCs & NCEs); Research Subjects = all engineering-related; Universities only; Fiscal Year = 2015–2016 (April to March). Major awards data comes from the Director, Awards and Honours, Faculty of Applied Science & Engineering, based on press releases and websites of individual awards for the 2015–2016 grant year (April to March).

Comparison of U of T Engineering with St. George Campus and University of Toronto, 2015–2016

All student enrolment statistics are based on headcount for Fall 2015 from the U of T Enrolment Reporting Cube (St. George and U of T statistics do not include Toronto School of Theology). All degrees awarded statistics come from ROSI and reflect September 2015 to June 2016 dates (St. George and U of T statistics do not include Toronto School of Theology). All sponsored-research funding statistics come from the U of T Research Reporting Cube, based on 2014–2015 grant year and exclude partner hospitals; includes all program types; data current as of May 2016. Engineering academic staff statistics provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering (based on HRIS and published lists of faculty members). Engineering administrative and technical staff statistic from 2015 Resources Survey prepared by Engineers Canada for NCDEAS (based on calendar year). U of T academic and administrative staff statistics come from U of T Facts and Figures 2015. Engineering total revenue provided by Chief Financial Officer, Faculty of Applied Science & Engineering. U of T total revenue provided by the Office of the Vice-Provost, Planning & Budget. Engineering space statistic from U of T Office of Space Management data, January 2016. U of T and St. George space statistics from U of T Facts and Figures 2015, which is available online at: https://www.utoronto.ca/sites/default/files/Facts_Figures_2015_online_entire_book.pdf

Chapter 1: Undergraduate Studies

1.1a Applications, Offers, Registrations, Selectivity and Yield of First-Year Undergraduates, 2005 to 2014

All years data for applications and offers are based on annual Admissions Committee reports to Faculty Council (November), counting new admissions only, FT and PT, all years of study. Excludes students with special status. Registrations only are from U of T Undergraduate Enrolment Reporting Cube. Cube Parameters: Faculty = Faculty of Applied Science & Engineering, All Fall Terms for 2006–2015, Degree Type = Undergraduate; Stage of Study (SESLEV) = Year 1, New Intake (NEWINTK) = Yes, Measure = Headcount.

1.1b Applications, Offers, Registrations, Selectivity and Yield of International First-Year Undergraduates, 2006 to 2015

All years data for applications and offers are based on annual Admissions Committee reports to Faculty Council (November), counting new admissions only, FT and PT, all years of study. Excludes students with special status. Registrations only are from U of T Undergraduate Enrolment Reporting Cube. Cube Parameters: Faculty = Faculty of Applied Science & Engineering, All Fall Terms for 2006–2015, Degree Type = Undergraduate; Stage of Study (SESLEV) = Year 1, New Intake (NEWINTK) = Yes, Domestic / International (DOM_INTL) = International; Measure = Headcount.

-
- 1.1c Applications, Offers, Registrations, Selectivity and Yield of International First-Year Undergraduates, 2006 to 2015**
All years data for applications and offers are based on annual Admissions Committee reports to Faculty Council (November), counting new admissions only, FT and PT, all years of study. Excludes students with special status. Registrations only are from U of T Undergraduate Enrolment Reporting Cube. Cube Parameters: Faculty = Faculty of Applied Science & Engineering, All Fall Terms for 2006–2015, Degree Type = Undergraduate; Stage of Study (SESLEV) = Year 1, New Intake (NEWINTK) = Yes, Domestic / International (DOM_INTL) = International; Measure = Headcount.
-
- 1.2 Ontario Secondary School Averages of Incoming First-Year Undergraduates and Retention Rate Between First and Second Year, 2006 to 2015**
Averages of incoming first-year students from Admissions Committee Report to Faculty Council (November). Retention rates based on Undergraduate Enrolment Projections, published by the U of T Planning and Budget Office, October 2015 and January 2016.
-
- 1.3 Incoming First-Year Undergraduates with Percentage of Women and International Students, 2006 to 2015**
Headcount from U of T Undergraduate Enrolment Cube. Excludes students with special status. Cube Parameters: All Fall Terms for 2006–2015; Degree Type = Undergraduate; New Intake (NEWINTK) = Yes; Measure = Headcount; [Gender] and [DOM_INTL] parameters used to calculate percentages of women and international students, respectively.
-
- 1.4 Incoming First-Year Domestic and International Undergraduates, 2006 to 2015**
Headcount from University of Toronto Enrolment Master Files, the source of U of T Reporting Cube. Includes new and returning students. Excludes students with special status. Cube Parameters: All Fall Terms for 2006–2015; Stage of Study (SESLEV) = Year 1; New Intake (NEWINTK) = Yes; Degree Type = Undergraduate; Measure = Headcount
-
- 1.5a Undergraduate Enrolment with Proportion of Women and International Students, 2006–2007 to 2015–2016**
Headcount from U of T Undergraduate Enrolment Reporting Cube. Excludes students with special status. Cube Parameters: All Fall Terms for 2006–2015; Degree Type = Undergraduate; Measure = Headcount; [Gender] and [DOM_INTL] parameters used to calculate percentages of women and international students, respectively.
-
- 1.5b Women as a Proportion of Total Enrolment by Program, 2006–2007 to 2015–2016**
Headcount from U of T Undergraduate Enrolment Reporting Cube. Excludes students with special status. Cube Parameters: Fall Terms for 2006–2015; Degree Type = Undergraduate; Gender = Female; Departments based on [Programs] field
-
- 1.6 Undergraduates by Program, Year of Study and Professional Experience Year (PEY), 2015–2016**
Headcount from U of T Undergraduate Enrolment Reporting Cube. Includes full-time students, part-time students and students on PEY internship. Excludes students with special status. Cube Parameters: Years 1–4; Fall 2015; Departments based on [Programs] field; Degree Type = Undergraduate.
-
- 1.7 Undergraduates by Program, 2006–2007 to 2015–2016**
Headcount from U of T Undergraduate Enrolment Reporting Cube. Includes full-time students, part-time students and students on PEY internship. Excludes students with special status. Cube Parameters: All Fall Terms for 2006–2015; Years 1–4 (SESLEV); Degree Type = Undergraduate; Measure = Headcount; Departments based on [Programs] field.
-
- 1.8a Number of Awards Received by Cohort with Total Number of Undergraduate Need-Based Award Recipients, 2009–2010 to 2015–2016**
Award data from U of T Student Accounts Cube. Parameters: Transaction Type = Income / Awards – Undergrad; Need-based; Level of Instruction = Undergrad; Enrolment Status = All (e.g. FINCA, CANG, etc.); Year of Study = 1-4 (exclude any N/A); Sessions: include most recent (current) academic year (even without Summer; summer = mostly CIE exchange funding); Measure = Dollar amount
-
- 1.8b Total Value of Undergraduate Need-Based Awards and Percentage Distributed by Year of Study, 2009–2010 to 2015–2016**
Award data from U of T Student Accounts Cube. Parameters: Transaction Type = Income / Awards – Undergrad; Need-based; Level of Instruction = Undergrad; Enrolment Status = All (e.g. FINCA, CANG, etc.); Year of Study = 1-4 (exclude any N/A); Sessions: include most recent (current) academic year (even without Summer; summer = mostly CIE exchange funding); Measure = Distinct student count
-

1.9a Undergraduate Degrees Awarded by Program, 2006–2007 to 2015–2016

All data from ROSI download: 5EA (Graduated Students); Faculty = Faculty of Applied Science & Engineering.

1.9b U of T Engineering Degrees Awarded by Academic Area Compared with Canadian, and North American Degree Totals, 2014

U of T and Canadian statistics are based on the 2014 calendar year and come from Engineers Canada Report of Enrolment & Degrees Granted (*Canadian Engineers for Tomorrow, Trends in Engineering Enrolment and Degrees Awarded 2010-2014*), released November 2015, and available online at: <https://www.engineerscanada.ca/sites/default/files/EnrolmentReport2014-e-r2.pdf>. American statistics used to calculate North American percentages are based on the 2014–2015 academic year and come from the 2015 American Society of Engineering Educators (ASEE) Report, available online at: www.asee.org/papers-and-publications/publications/college-profiles

1.10 Undergraduate Students per Faculty Member by Academic Area, 2015–2016

Number of undergraduates from U of T Undergraduate Enrolment Reporting Cube. Excludes students on PEY internship and students with special status. Cube Parameters: Fall 2015, Degree Type = Undergraduate; AssocOrg = blank (to exclude PEYs); Measure = Headcount. Faculty Total does not include teaching done for Engineering by extra-divisional units (especially Arts & Science departments). Results are not adjusted for departmental contributions to shared first-year curriculum, Engineering Science or Engineering minors. Faculty counts provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering and used on a slip-year basis: totals from July 2015 are used to compare with 2015-16 student counts. Calculation includes tenured / tenure-stream and lecturers / teaching stream faculty.

1.11a Number of Students and Percentage of Class Graduating with Honours, 2007 to 2016

Data provided by the Office of the Faculty Registrar, Faculty of Applied Science & Engineering.

1.11b Number of Students on the Dean's Honour List by Term and Academic Area, 2011–2012 to 2015–2016

Statistics provided by Assistant Director, Engineering Career Centre, Faculty of Applied Science & Engineering.

Text Pre-University Engineering Outreach

Information and statistics provided by the Associate Director, Engineering Student Outreach Office, Faculty of Applied Science & Engineering.

Chapter 2: Graduate Studies

2.1a International and Domestic Graduate Students by Degree Type with Percentage of International Students, 2006–2007 to 2015–2016

Enrolment counts are from U of T Graduate Enrolment Reporting Cube. Excludes special status students. Cube Parameters: All Fall Terms for 2006–2015, Measure = Headcount. [DOM_INTL] parameter used to calculate percentage of international students.

2.1b Graduate Students by Degree Type and Gender with Percentage of Women Students, 2006–2007 to 2015–2016

Enrolment counts are from U of T Graduate Enrolment Reporting Cube. Excludes special status students. Cube Parameters: All Fall Terms for 2006–2015; Measure = Headcount. Gender parameter used to calculate percentage of women.

2.1c Graduate Student Enrolment by Full-Time Equivalent (FTE) and Headcount (HC) by Academic Area, 2006–2007 to 2015–2016

Enrolment counts are from U of T Graduate Enrolment Reporting Cube. Excludes special status students. Cube Parameters: Measure = Headcount or Total FTE (UAR). Headcounts are reported for all fall terms from 2006–2015. FTEs are counted by academic year as reported in the cube (May to April).

2.1d Comparison of MAsc and MEng/MHSc Full-Time Equivalent Enrolment Trends 2006–2007 to 2015–2016

Enrolment counts are from U of T Graduate Enrolment Reporting Cube. Excludes special status students. Cube Parameters: All Fall Terms for 2006–2015; Measure = Total FTE (UAR).

-
- 2.2a Undergraduate and Graduate Full-Time Equivalent Students per Faculty Member, 2006–2007 to 2015–2016**
Number of FTE undergraduates from U of T Undergraduate Enrolment Reporting Cube. Excludes students on PEY internship and students with special status. Cube Parameters: Fall terms 2006–2015; AssocOrg = blank (to exclude PEY); Degree Type = Undergraduate; Measure = Headcount. To calculate Undergraduate FTEs, part-time students are counted as 0.3 FTE. Number of FTE graduate students from U of T Graduate Enrolment Reporting Cube. Cube Parameters: Fall terms 2006–2015; Measure = Total FTE (UAR); excludes students with special status. Number of faculty included in the calculation provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering and used on a slip-year basis: totals from July 2015 are used to compare with 2015-16 student counts. Graduate ratios include only tenured and tenure-stream faculty; Undergraduate ratios also include lecturers / teaching stream faculty.
-
- 2.2b Ratio of Undergraduate to Graduate Full-Time Equivalent Students, 2006–2007 to 2015–2016**
Number of FTE undergraduates from U of T Undergraduate Enrolment Reporting Cube. Excludes students on PEY internship and students with special status. Cube Parameters: Fall terms 2006–2015; AssocOrg = blank (to exclude PEY); Degree Type = Undergraduate; Measure = Headcount. To calculate Undergraduate FTEs, part-time students are counted as 0.3 FTE. Number of FTE graduate students from U of T Graduate Enrolment Reporting Cube. Cube Parameters: Fall terms 2006–2015; Measure = Total FTE (UAR); Includes all degree types but excludes students with special status.
-
- 2.2c Full-Time Equivalent Graduate Students per Faculty Member by Academic Area and Degree Type, 2015–2016**
Number of FTE graduate students from U of T Graduate Enrolment Reporting Cube. Cube Parameters: Fall 2015; Measure = Total FTE (UAR). Includes all degree types but excludes students with special status. The number of graduate students per department is adjusted as per the budget calculation for inter-departmental graduate student supervision. Faculty counts are provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering, and are used on a slip-year basis: totals from July 2015 are used to compare with 2015-16 student counts. Includes tenured and tenure-stream faculty only.
-
- 2.3 Applications, Offers, Registrations, Selectivity and Yield of PhD Students, 2006–2007 to 2015–2016**
All data from ROSI download: 4BEG (Admissions Statistics). Students who have fast-tracked from MASc programs into PhD programs are calculated separately (see Fig. 2.8a) but have been included in this figure as applications, offers and admissions in order to more accurately reflect total PhD student intake. This is a change from previous annual reports.
-
- 2.4 Applications, Offers, Registrations, Selectivity and Yield of MASc Students, 2006–2007 to 2015–2016**
All data from ROSI download: 4BEG (Admissions Statistics)
-
- 2.5 Applications, Offers, Registrations, Selectivity and Yield of MEng and MHSc Students, 2006–2007 to 2015–2016**
All data from ROSI download: 4BEG (Admissions Statistics).
-
- 2.6a Graduate Student Funding by Category, 2005–2006 to 2014–2015**
Data from 2009–2010 onward were obtained from the new Student Accounts Reporting Cube. Parameters: include Awards-Grad, Stipend, UT Employment; exclude Awards-Undergrad, Waiver. Data for prior years (and for all years in previous annual reports) were obtained from the Graduate Student Income Reporting Cube. Parameters: include funding from all sources except work-study employment income. Student funding reported by academic year (September to August).
-
- 2.6b Graduate Student Funding by Category and Academic Area, 2014–2015**
Data from 2009–2010 onward were obtained from the new Student Accounts Reporting Cube. Parameters: include Awards-Grad, Stipend, UT Employment; exclude Awards-Undergrad, Waiver. Data for prior years (and for all years in previous annual reports) were obtained from the Graduate Student Income Reporting Cube. Parameters: include funding from all sources except work-study employment income. Student funding reported by academic year (September to August).
-
- 2.7a Total External Graduate Student Scholarships by Source, 2005–2006 to 2014–2015**
Data from 2009–2010 onward were obtained from the new Student Accounts Reporting Cube. Parameters: Transaction Type = Income / Awards – Grad; Award Income Source = External. Data for prior years (and for all years in previous annual reports) were obtained from the Graduate Student Income Reporting Cube. Parameters: Award Income only. Student funding reported by academic year (September to August).
-
- 2.7b Number of NSERC Graduate Student Award Recipients by Academic Area, 2005–2006 to 2014–2015**
Data from 2009–2010 onward were obtained from the new Student Accounts Reporting Cube. Parameters: Transaction Type = Income / Awards – Grad; Award Income Source = Federal – Natural Sciences and Engineering Research Council. Data for prior years (and for all years in previous annual reports) were obtained from the Graduate Student Income Reporting Cube. Parameters: Award Income only. Source = Federal – Natural Sciences and Engineering Research Council. Measure = Student Count. Student funding reported by academic year (September to August).
-

2.8a Number of Students Fast-Tracked from MASc to PhD by Academic Area, 2006–2007 to 2015–2016
All data from ROSI download: 4FF (Student Registrations). Fast-tracked students are identified by POST codes that end in 'PHD U' and are counted when prior session POST code was a master's degree (MASc or MEng). To reflect fast-tracking practice, an academic year is considered to be Summer-Fall-Winter (May to April).

2.8b Number of Direct-Entry PhD Students by Academic Area, 2008–2009 to 2015–2016
All data from ROSI download: 4FF (Student Registrations). Include all PhD students where prior session POST code was blank or AE NDEGP (recently-complete UGrad). Reported by academic year defined as Summer-Fall-Winter (May to April).

2.9 Time to Graduation for PhD, MASc, MEng and MHSc Graduate Students, 2006–2007 to 2015–2016
All data from ROSI download: 4BEA (Years to Graduate), originally created for Ontario Council of Graduate Studies (OCGS) reporting purposes. The data reflects median values based on the total number of terms in which a student is registered. Leaves, lapses and (in most cases) the term in which the convocation occurs are excluded. Where a student is fast-tracked from the MASc into a PhD, the total time for both programs is counted. Full-time, extended full-time and part-time MEng students are distinguished for greater clarity and accuracy.

2.10 Graduate Degrees Awarded by Degree Type and Gender, 2006–2007 to 2015–2016
All data from ROSI download: 5EA (Graduated Students); Faculty = Faculty of Applied Science & Engineering.

Text Enriching the Graduate Student Experience
Information provided by the Vice-Dean Graduate Studies, Faculty of Applied Science & Engineering.

2.11 ELITE Certificates Awarded, 2008–2009 to 2015–2016
ELITE eligibility based on year of graduation and successful completion of a minimum of 4 ELITE-designated courses. Eligibility criteria and course listing provided by the Vice-Dean Graduate Studies, Faculty of Applied Science & Engineering.

2.12 MEng, SCFI Program Enrolment, Fall 2008 to Winter 2016
Information provided by the Graduate Program Administrator, Department of Mechanical & Industrial Engineering.

Chapter 3: Research

Text Selected Research Highlights for 2015–2016
Information provided by Vice-Dean Research, Faculty of Applied Science & Engineering.

3.1a Breakdown of Research Infrastructure Funding vs. Research Operating Funding, 2005–2006 to 2014–2015
Data from the U of T Research Reporting Cube. Current as of May 2016. Organized by grant year (e.g., 2014–2015 = April 2014 to March 2015 = Grant Year 2015). Infrastructure funding includes the Canada Foundation for Innovation (except the CFI Career Award), the Ontario Research Fund (ORF) and the NSERC Research Tools and Instruments (RTI) Program.

3.1b Canadian Institutes of Health Research (CIHR), Natural Sciences and Engineering Research Council of Canada (NSERC) and Networks of Centres of Excellence (NCE) Funding, 2005–2006 to 2014–2015
Data from the U of T Research Reporting Cube. Current as of May 2016. Organized by grant year (e.g., 2014–2015 = April 2014 to March 2015 = Grant Year 2015).

3.1c Research Operating Funding by Year, Source and Funding per Faculty Member, 2005–2006 to 2014–2015
Data is from the U of T Research Reporting Cube, current as of May 2016, and is organized by grant year (e.g., 2014–2015 = April 2014 to March 2015 = Grant Year 2015). Research Operating Funding excludes the following infrastructure programs: Canada Foundation for Innovation (except the CFI Career Award), the Ontario Innovation Trust, the Ontario Research Fund (ORF) – Research Infrastructure and the NSERC Research Tools and Instruments (RTI) Program. Faculty data is provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering, and here includes tenured and tenure-stream faculty only, as reported each July. Faculty counts are used on a slip-year basis: e.g. those reported in July 2014 (for academic year 2013-14) are linked to Grant Year 2015 (Apr 2014 - Mar 2015).

3.2a NSERC Funding, 2014–2015
Data from the U of T Research Reporting Cube. Current as of May 2016. Organized by grant year (e.g., 2014–2015 = April 2014 to March 2015 = Grant Year 2015). Sponsor = Three Councils / Natural Sciences & Engineering. Year = 2015.

-
- 3.2b NSERC Industrial Partnership Funding by Program, 2005–2006 to 2014–2015**
Data from the U of T Research Reporting Cube. Current as of May 2016. Organized by grant year (e.g., 2014–2015 = April 2014 to March 2015 = Grant Year 2015). Sponsor = Three Councils / Natural Sciences & Engineering / Research Partnerships Programs
-
- 3.2c Industrial Partnerships as a Proportion of Total NSERC Funding, 2005–2006 to 2014–2015**
Data from the U of T Research Reporting Cube. Current as of May 2016. Organized by grant year (e.g., 2014–2015 = April 2014 to March 2015 = Grant Year 2015). Sponsor = Three Councils / Natural Sciences & Engineering.
-
- 3.2d Industry Partners, 2015–2016**
Data from the U of T Research Reporting Cube. Current as of May 2016. Organized by grant year (e.g., 2014–2015 = April 2014 to March 2015 = Grant Year 2015). Sponsor = Corporate. Additional information gathered from selected websites (e.g. those of Industrial Research Chairs and major research consortia) and provided by individual departments within the Faculty of Applied Science & Engineering.
-
- 3.2e NSERC Research Grant Funding by Program, 2005–2006 to 2014–2015**
Data from the U of T Research Reporting Cube. Current as of May 2016. Organized by grant year (e.g., 2014–2015 = April 2014 to March 2015 = Grant Year 2015). Sponsor = Three Councils / Natural Sciences & Engineering / Research Grants & Scholarships (Faculty)
-
- 3.3a Canadian Peer Universities vs. University of Toronto Share of NSERC Funding for Engineering Cumulative Five-Year Share, 2010–2011 to 2014–2015**
All data from NSERC Award Search Engine: www.nserc-crsng.gc.ca/ase-oro/index_eng.asp. Based on Selection Committees for Discovery and Partnership Programs, but not Scholarships and Fellowships. Organized by grant year. Excludes Canada Research Chairs and Networks of Centres of Excellence and does not include Indirect Costs of Research. Organized by grant year (e.g., 2014–2015 = April 2014 to March 2015 = Grant Year 2015).
-
- 3.3b U of T Annual Share of NSERC Funding in Engineering, 2005–2006 to 2014–2015**
All data from NSERC Award Search Engine: www.nserc-crsng.gc.ca/ase-oro/index_eng.asp. Based on Selection Committees for Discovery and Partnership Programs, but not Scholarships and Fellowships. Organized by grant year. Excludes Canada Research Chairs and Networks of Centres of Excellence and does not include Indirect Costs of Research. Organized by grant year (e.g., 2014–2015 = April 2014 to March 2015 = Grant Year 2015).
-
- 3.4a Engineering Invention Disclosures by Academic Area, 2011–2012 to 2015–2016**
Report of U of T Commercialization Indicators, Annual Supplement for FY2016, provided by the Office of the Vice President, Research. Data current as of May 1, 2016.
-
- 3.4b U of T Invention Disclosures by Faculty, 2015–2016**
Report of U of T Commercialization Indicators, Annual Supplement for FY2016, provided by the Office of the Vice President, Research. Data current as of May 1, 2016.
-
- 3.4c U of T Patent Applications by Faculty, 2015–2016**
Report of U of T Commercialization Indicators, Annual Supplement for FY2016, provided by the Office of the Vice President, Research. Data current as of May 1, 2016.
-
- 3.5 Distribution of Research Operating Funding by Academic Area, 2005–2006 to 2014–2015**
Data from the U of T Research Reporting Cube. Current as of May 2016. Organized by grant year (e.g., 2014–2015 = April 2014 to March 2015 = Grant Year 2015). Research Operating Funding excludes the following infrastructure programs: Canada Foundation for Innovation (except the CFI Career Award), the Ontario Innovation Trust, the Ontario Research Fund (ORF) – Research Infrastructure and the NSERC Research Tools and Instruments (RTI) Program.

Chapter 4: Cross-Faculty Education and Experiential Learning

- Text Undergraduate Engineering Minors and Certificates**
Information provided by the Cross-Disciplinary Programs Office, Faculty of Applied Science & Engineering.
-
- 4.1a Number of Students and Percentage of Graduating Class Completing an Engineering Minor, 2006–2007 to 2015–2016**
Information provided by the Cross-Disciplinary Programs Office, Faculty of Applied Science & Engineering.
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- 4.1b Students Graduating with an Engineering Business Minor or Certificate, 2011–2012 to 2015–2016**
Information provided by the Cross-Disciplinary Programs Office, Faculty of Applied Science & Engineering.
-
- 4.2a Undergraduate Participation in Summer Research Opportunities, 2010 to 2016**
Information regarding Canadian placements provided by each department and division within the Faculty of Applied Science & Engineering. International placement statistics provided by the University of Toronto's Centre for International Experience.
-
- 4.2b Undergraduate Participation in Summer Research Opportunities by Academic Area, 2016**
Information regarding Canadian placements provided by each department and division within the Faculty of Applied Science & Engineering. International placement statistics provided by the University of Toronto's Centre for International Experience.
-
- 4.3a PEY Internship Placements for Engineering Undergraduates with Percentage Participation from Previous Third-Year Class, 2006–2007 to 2015–2016**
Statistics provided by the Assistant Director, Engineering Career Centre, Faculty of Applied Science & Engineering.
-
- 4.3b Canadian and International PEY Internship Placements for Engineering Undergraduates, 2006–2007 to 2015–2016**
Statistics provided by the Assistant Director, Engineering Career Centre, Faculty of Applied Science & Engineering.
-
- 4.3c PEY Employers who Hired Engineering Students, 2009–2010 to 2015–2016**
Statistics provided by the Assistant Director, Engineering Career Centre, Faculty of Applied Science & Engineering.
-
- Text Engineering Communications**
Information provided by the Director, Engineering Communications Program.

Chapter 5: Awards and Honours

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- 5.1 Summary of Major International, National and Provincial Awards and Honours, 2006 to 2015**
Information provided by the Director, Awards and Honours, Faculty of Applied Science & Engineering.
-
- 5.2a Number of Major National and International Awards Received by U of T Engineering Compared to Other Canadian Engineering Faculties, 2015**
Information provided by the Director, Awards and Honours, Faculty of Applied Science & Engineering.
-
- 5.2b Proportion of Major Awards Received by Canadian Engineering Faculties with Proportion of Total Faculty Members, 2015**
Information provided by the Director, Awards and Honours, Faculty of Applied Science & Engineering. Faculty FTEs are based on the National Council of Deans of Engineering and Applied Science (NCDEAS) 2015 Resources Report prepared by Engineers Canada and circulated to Canadian engineering deans in July 2016.
-
- 5.3 Number of Awards Received by U of T Engineering Faculty Compared to Other Canadian Engineering Faculties, 2011 to 2015**
Information provided by the Director, Awards and Honours, Faculty of Applied Science & Engineering.
-
- Text Selected Awards Received by Faculty Members and Alumni**
Information provided by the Director, Awards and Honours, Faculty of Applied Science & Engineering.
-
- Text Selected Awards Received by Staff, April 2015 to April 2016**
Information provided by the Director, Awards and Honours, Faculty of Applied Science & Engineering.
-
- Text University of Toronto Engineering Faculty Awards**
Information provided by the Director, Awards and Honours, Faculty of Applied Science & Engineering.
-
- Text Engineering Alumni Association Awards**
Information provided by the Office of Advancement and Alumni Relations, Faculty of Applied Science & Engineering.
-

Shanghai Jiao Tong Academic Ranking of World Universities (ARWU) for Engineering/Technology and Computer Sciences

6.1a ARWU Top 50 World Universities, 2015
Data from ARWU website: www.shanghairanking.com/FieldENG2015.html.

6.1b ARWU Top North American Public Universities, 2015
Data from ARWU website: www.shanghairanking.com/FieldENG2015.html.

6.1c Canadian U15 Universities in ARWU Top 200, 2015
Data from ARWU website: www.shanghairanking.com/FieldENG2015.html.

6.1d Scoring Analysis of Canadian U15 Universities in ARWU Top 100, 2015
Data from ARWU website: www.shanghairanking.com/FieldENG2015.html.

Times Higher Education (THE)–Elsevier World University Ranking for Engineering and Information Technology

6.2a THE Top 50 World Universities, 2015
Data from THE World University Ranking website: www.timeshighereducation.co.uk/world-university-rankings/2015-16/subject-ranking/subject/engineering-and-IT

6.2b THE Top North American Public Universities, 2015
Data from THE World University Ranking website: www.timeshighereducation.co.uk/world-university-rankings/2015-16/subject-ranking/subject/engineering-and-IT

6.2c Canadian U15 Universities in THE Top 100, 2015
Data from THE World University Ranking website: www.timeshighereducation.co.uk/world-university-rankings/2015-16/subject-ranking/subject/engineering-and-IT

QS World University Rankings for Engineering and Information Technology

6.3a QS Top 50 World Universities, 2015
Data from QS World University Ranking website: www.topuniversities.com/university-rankings/faculty-rankings/engineering-and-technology/2015

6.3b QS Top North American Public Universities, 2015
Data from QS World University Ranking website: www.topuniversities.com/university-rankings/faculty-rankings/engineering-and-technology/2015

6.3c Canadian U15 Universities in QS Top 200, 2015
Data from QS World University Ranking website: www.topuniversities.com/university-rankings/faculty-rankings/engineering-and-technology/2015

6.3d Canadian Universities in QS by Subject, 2016
Data from QS World University Ranking website: www.topuniversities.com/subject-rankings/2016

National Taiwan University (NTU) Performance Ranking of Engineering Papers

6.4a NTU Top 50 World Universities, 2015
Data from National Taiwan University Performance Ranking of Scientific Papers for World Universities 2015 website: <http://nturanking.lis.ntu.edu.tw/DataPage/TOP300.aspx?query=Engineering&y=2015>. Data compiled from Thomson Reuters' science citation indexes.

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- 6.4b NTU Top North American Public Universities, 2015**
Data from National Taiwan University Performance Ranking of Scientific Papers for World Universities 2015 website: <http://nturanking.lis.ntu.edu.tw/DataPage/TOP300.aspx?query=Engineering&y=2015>. Data compiled from Thomson Reuters' science citation indexes.
-
- 6.4c Canadian U15 Universities in NTU Top 200, 2015**
Data from National Taiwan University Performance Ranking of Scientific Papers for World Universities 2015 website: <http://nturanking.lis.ntu.edu.tw/DataPage/TOP300.aspx?query=Engineering&y=2015>. Data compiled from Thomson Reuters' science citation indexes.
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- 6.4d Canadian Universities in NTU by Subject, 2015**
Data from National Taiwan University Performance Ranking of Scientific Papers for World Universities 2015 website: <http://nturanking.lis.ntu.edu.tw/DataPage/TOP300.aspx?query=Engineering&y=2015>. Data compiled from Thomson Reuters' science citation indexes.
-

Rankings Based on Publications and Citations / Summary of Ranking Results

- 6.5a Number of Engineering Publications Indexed by Thomson Reuters for Association of American Universities (AAU) Public and Canadian Peer Institutions, 2010 to 2014**
Data from Thomson Reuters University Science Indicators 2014 Standard Edition, covering 2010 to 2014. Includes public peer institutions in Canada (U15) and U.S. (AAU plus University of California at San Francisco).
-
- 6.5b Summary of U15 Bibliometrics for Publications**
Data from Thomson Reuters University Science Indicators 2014 Standard Edition, covering 2010 to 2014. Includes public peer institutions in Canada (U15) and U.S. (AAU plus University of California at San Francisco). Faculty counts for analysis of U15 publications per faculty member are from the Engineers Canada 2014 Resources Report.
-
- 6.6a Number of Engineering Citations Indexed by Thomson Reuters for Association of American Universities (AAU) Public and Canadian Peer Institutions, 2010 to 2014**
Data from Thomson Reuters University Science Indicators 2014 Standard Edition, covering 2010 to 2014. Includes public peer institutions in Canada (U15) and U.S. (AAU plus University of California at San Francisco).
-
- 6.6b Summary of U15 Bibliometrics for Citations**
Data from Thomson Reuters University Science Indicators 2014 Standard Edition, covering 2010 to 2014. Includes public peer institutions in Canada (U15) and U.S. (AAU plus University of California at San Francisco). Faculty counts for analysis of U15 citations per faculty member are from the Engineers Canada 2014 Resources Report.
-
- 6.7 Summary of University of Toronto Engineering Performance in World Rankings**
Compiled from other figures in this chapter.
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Chapter 7: Advancement

- 7.1a Advancement Results, 2015–2016**
Statistics provided by the Office of Advancement and Alumni Relations, Faculty of Applied Science & Engineering.
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- 7.1b Philanthropic Support, 2006–2007 to 2015–2016**
Statistics provided by the Office of Advancement and Alumni Relations, Faculty of Applied Science & Engineering.
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- 7.1c Gift Designations, 2015–2016**
Statistics provided by the Office of Advancement and Alumni Relations, Faculty of Applied Science & Engineering.
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- 7.1d Gratitude Participation, 2009–2010 to 2015–2016**
Statistics provided by the Office of Advancement and Alumni Relations, Faculty of Applied Science & Engineering.
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Text **Initiatives and Projects, 2015–2016**
Information provided by the Office of Advancement and Alumni Relations, Faculty of Applied Science & Engineering.

Text **Alumni Events and Engagement**
Statistics provided by the Office of Advancement and Alumni Relations, Faculty of Applied Science & Engineering.

Text **Gift Highlights, 2015–2016**
Information provided by the Office of Advancement and Alumni Relations, Faculty of Applied Science & Engineering.

Chapter 8: Communications

Text **Media Coverage**
Information provided by Engineering Strategic Communications, Faculty of Applied Science & Engineering.

8.1a **Proportion of U of T Engineering Media Stories by Outlet Location, 2015–2016**
Statistics provided by University of Toronto Strategic Communications. Data represents information collected between May 2015 and April 2016.

8.1b **Proportion of U of T Engineering Impressions by Strategic Priority Area, 2015–2016**
Statistics provided by University of Toronto Strategic Communications. Data represents information collected between May 2015 and April 2016.

8.1c **Proportion of U of T Engineering Impressions by Academic Area, 2015–2016**
Statistics provided by University of Toronto Strategic Communications. Data represents information collected between May 2015 and April 2016.

8.2 **Top Stories on the Engineering News and U of T News Websites, 2015–2016**
Statistics provided by University of Toronto Strategic Communications. Data represents information collected between May 2015 and April 2016.

Text **Online Activity**
Information provided by Engineering Strategic Communications, Faculty of Applied Science & Engineering.

8.3a **Summary of Analytics for Faculty and News Sites, 2015–2016**
Websites: engineering.utoronto.ca and news.engineering.utoronto.ca. Website statistics sourced from Google Analytics.

8.3b **Summary of Analytics for You Belong Here Microsite, Nov. 25, 2015 to April 30, 2016**
Website: www.admit.engineering.utoronto.ca/next-steps. Website statistics sourced from Google Analytics.

8.4 **Visitors to discover.engineering.utoronto.ca: Top 10 Countries, 2015–2016**
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9.1a **Selected Opportunities for International Students to Study at U of T Engineering**
Information provided by the Director, Centre for International Experience, University of Toronto.

9.1b **Selected Opportunities for U of T Engineering Students to Study or Work Abroad**
Information provided by the Director, Centre for International Experience, University of Toronto.

Text **Selected International Educational and Research Partnerships**
Information taken from *The Engineering Newsletter*, Faculty of Applied Science & Engineering.

Text **Selected Highlights**
Information taken from *The Engineering Newsletter*, Faculty of Applied Science & Engineering.

Chapter 10: Diversity

- 10.1 Continent of Origin: Undergraduate and Graduate Students, Fall 2015**
Student counts from U of T Enrolment Reporting Cube. Excludes students with special status. Cube Parameters: Year = Fall 2015; Degree Type = Undergraduate or one of 3 Graduate programs; Measure = Headcount; Calculations based on Continent/Country of Citizenship (CUNCIT) parameter.
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- 10.2 Percentage of Women Students and Faculty, 2006–2007 to 2015–2016**
Graduate, undergraduate and first-year headcount from U of T Enrolment Reporting Cube. Enrolment excludes students with special status. Number of faculty provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering.
-
- Text New Faculty Members, 2016–2017**
Information provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering.
-
- 10.3 Total Number of Faculty with Percentage of Women, 2006–2007 or 2015–2016**
Information provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering.
-
- 10.4 Percentage of Women Faculty at U of T Engineering compared with Women Faculty in Ontario and Canadian Engineering Faculties, 2015–2016**
Information from 2015 Resources Survey prepared by Engineers Canada for the National Council of Deans of Engineering and Applied Science. Data represents November 15, 2015 counts.

Chapter 11: Financial and Physical Resources

- 11.1 Total Revenue, 2006–2007 to 2015–2016**
Information provided by Chief Financial Officer, Faculty of Applied Science & Engineering.
-
- 11.2 Total Central Costs, 2006–2007 to 2015–2016**
Information provided by Chief Financial Officer, Faculty of Applied Science & Engineering.
-
- 11.3 Budget Data, 2006–2007 to 2015–2016**
Information provided by Chief Financial Officer, Faculty of Applied Science & Engineering.
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- 11.4 Revenue Sources, 2015–2016**
Information provided by Chief Financial Officer, Faculty of Applied Science & Engineering.
-
- 11.5 Revenue Distribution, 2006–2007 to 2015–2016**
Information provided by Chief Financial Officer, Faculty of Applied Science & Engineering.
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- 11.6 Total Operating Budget: Breakdown by Expense, 2015–2016 (net of central university costs)**
Information provided by Chief Financial Officer, Faculty of Applied Science & Engineering.
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- Text Dean's Strategic Fund**
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- 11.7 Summary of Buildings Occupied by the Faculty of Applied Science & Engineering, 2015–2016**
Data provided by Director, Facilities & Infrastructure Planning, Faculty of Applied Science & Engineering.
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- Text Projects Completed – By Building**
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-
- Text Projects Underway – By Building**
Information provided by Director, Facilities & Infrastructure Planning, Faculty of Applied Science & Engineering.
-

Appendices

A Engineering Student Clubs and Teams

Information from the Engineering Society: www.skule.ca.

B Outreach Programs

Information provided by Engineering Student Outreach Office, Faculty of Applied Science & Engineering.

C Time to Completion for Graduate Students

All data from ROSI 4BEA downloads (Years to Graduate), originally created for Ontario Council of Graduate Studies (OCGS) reporting purposes. The data reflects median values based on the total number of terms in which a student is registered. Leaves, lapses and (in most cases) the term in which the convocation occurs are excluded. Where a student is fast-tracked from the MAsc into a PhD, the total time for both programs is counted. Full-time, extended full-time and part-time MEng students are distinguished for greater clarity and accuracy.

D Research Chairs

Chairholders are reported as of the HR turnover date at the end of the reporting cycle, in this case, July 1, 2015, except in cases where new allocations (e.g., CRCs) have not yet been made public. List compiled from the following sources:

- Canada Research Chairs website: www.chairs-chaires.gc.ca/home-accueil-eng.aspx
- Industrial Research Chairs website: www.nserc-crsng.gc.ca/Professors-Professeurs/CFS-PCP/IRC-PCI_eng.asp
- Office of Advancement, Faculty of Applied Science & Engineering
- Office of the Vice-Dean, Research, Faculty of Applied Science & Engineering
- Assistant Dean, Administration, Faculty of Applied Science & Engineering
- Distinguished Professors and University Professors from the Office of the Vice-President & Provost websites: www.provost.utoronto.ca/awards/Distinguished_Professors.htm and www.provost.utoronto.ca/Awards/uprofessors.htm

Chairholders are reported as of the HR turnover date at the end of the reporting cycle, in this case, July 1, 2016, except in cases where new allocations (e.g. CRCs) have not yet been made public.

E Research Funding by Academic Area

Data is from the U of T Research Reporting Cube, current as of May 2016, and is organized by grant year (e.g., 2014–2015 = April 2014 to March 2015 = Grant Year 2015). Research Operating Funding excludes the following infrastructure programs: Canada Foundation for Innovation (except the CFI Career Award), the Ontario Innovation Trust, the Ontario Research Fund (ORF) – Research Infrastructure and the NSERC Research Tools and Instruments (RTI) Program. Faculty data is provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering, and here includes tenured and tenure-stream faculty only, as reported each July. Faculty counts are used on a slip-year basis: e.g. those reported in July 2014 (for academic year 2013-14) are linked to Grant Year 2015 (Apr 2014 - Mar 2015).

F Spinoff Companies

Report of U of T Commercialization Indicators, Annual Supplement for FY2016, provided by the Office of the Vice President, Research. Data current as of May 1, 2016.

G Descriptions of Major Awards

Information from the Director, Awards and Honours, Faculty of Applied Science & Engineering.

H Academic Staff by Academic Area

Information provided by the Assistant Dean, Administration, Faculty of Applied Science & Engineering. Women academic staff include all ranks of professor plus lecturers/senior lecturers.

I The Engineering Precinct

Information from Office of Space Management. Visit map.utoronto.ca for a full campus map.

We wish to acknowledge this land on which the University of Toronto operates. For thousands of years it has been the traditional land of the Huron-Wendat, the Seneca, and most recently, the Mississaugas of the Credit River. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.



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FOREST
STEWARDSHIP
COUNCIL

Appendix E: National Survey of Student Engagement (NSSE) 2014 Summary

List of Peer Institutions in the National Survey of Student Engagement (NSSE)

Ontario Peer Institutions

Algoma University
Brock University
Carleton University
Dominican University College
Lakehead University
Laurentian University
McMaster University
Nipissing University
OCAD University
Queen's University
Saint Paul University
Royal Military College of Canada
Ryerson University
Trent University
University of Guelph
University of Ontario Institute of Technology
University of Ottawa
University of Waterloo
University of Windsor
Western University
Wilfrid Laurier University
York University

U15 Peer Institutions

University of Alberta
University of British Columbia
University of Calgary
Dalhousie University
Université Laval
University of Manitoba
McGill University
McMaster University
Université de Montréal
University of Ottawa
Queen's University
University of Saskatchewan
University of Waterloo
Western University

Selected U.S. Peer Institutions

Florida State University

University of Georgia

University of Illinois at Urbana-Champaign

University of Maryland

University of Washington-Seattle

University of Wisconsin-Madison

Results of the National Survey of Student Engagement 2014



UNIVERSITY OF
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Presentation to
The Faculty of Applied Science & Engineering
May 20, 2015

About the Survey



National Survey of Student Engagement

- Our 5th set of NSSE results – 2004, 2006, 2008, 2011, 2014
- NSSE developed by a research team at Indiana University-Bloomington and launched in 2000
- Used to measure the extent to which students engage in effective educational practices that are empirically linked with learning as opposed to how “satisfied” they are
- 2014: 1.8M first-year and senior students from 713 institutions in US and Canada were invited to participate
- 473,633 respondents in total, of whom 114,511 were from 70 Canadian institutions (22 from Ontario)



What is Student Engagement?

- What **students** do – how they spend their time and energy, what they feel they have gained from classes and interactions with faculty, students and staff.
- What **institutions** do -- using effective educational practices to encourage students to do the right things
- Measures effective educational engagement in practices linked to learning, personal development and other designated outcomes (persistence, graduation)



Our NSSE Comparators

- **U15 (Canadian Peers):**
 - Dalhousie, McGill, McMaster, Queen's, Ottawa, Université de Montréal, Laval, Alberta, UBC, Calgary, Manitoba, Saskatchewan, Waterloo, Western
- **Ontario:**
 - ALL 22 universities across Ontario
- **US Peers:**
 - Florida State, University of Georgia, University of Illinois at Urbana-Champaign, University of Maryland, University of Washington-Seattle, University of Wisconsin-Madison



U of T respondents: **9,969** first and senior year students from

- Architecture, Landscape & Design*
- Arts & Science
- **Applied Science and Engineering**
(n = 1,078)
- Kinesiology & Physical Education
- Music
- University of Toronto Mississauga
- University of Toronto Scarborough
- Nursing (senior)*



NSSE 2014 Respondent Characteristics

The overall U of T response rate was better than our NSSE comparators

	APSC		UofT		U15	
Response Rate	FY	SR	FY	SR	FY	SR
Overall	38.7%		34.5%		31.7%	
By Class	42.9%	35.8%	34.0%	35.0%	32.3%	31.0%
Sample size	1,139	1,643	15,525	13,283	72,560	67,637
Number of respondents	490	588	5,285	4,684	23,466	20,993

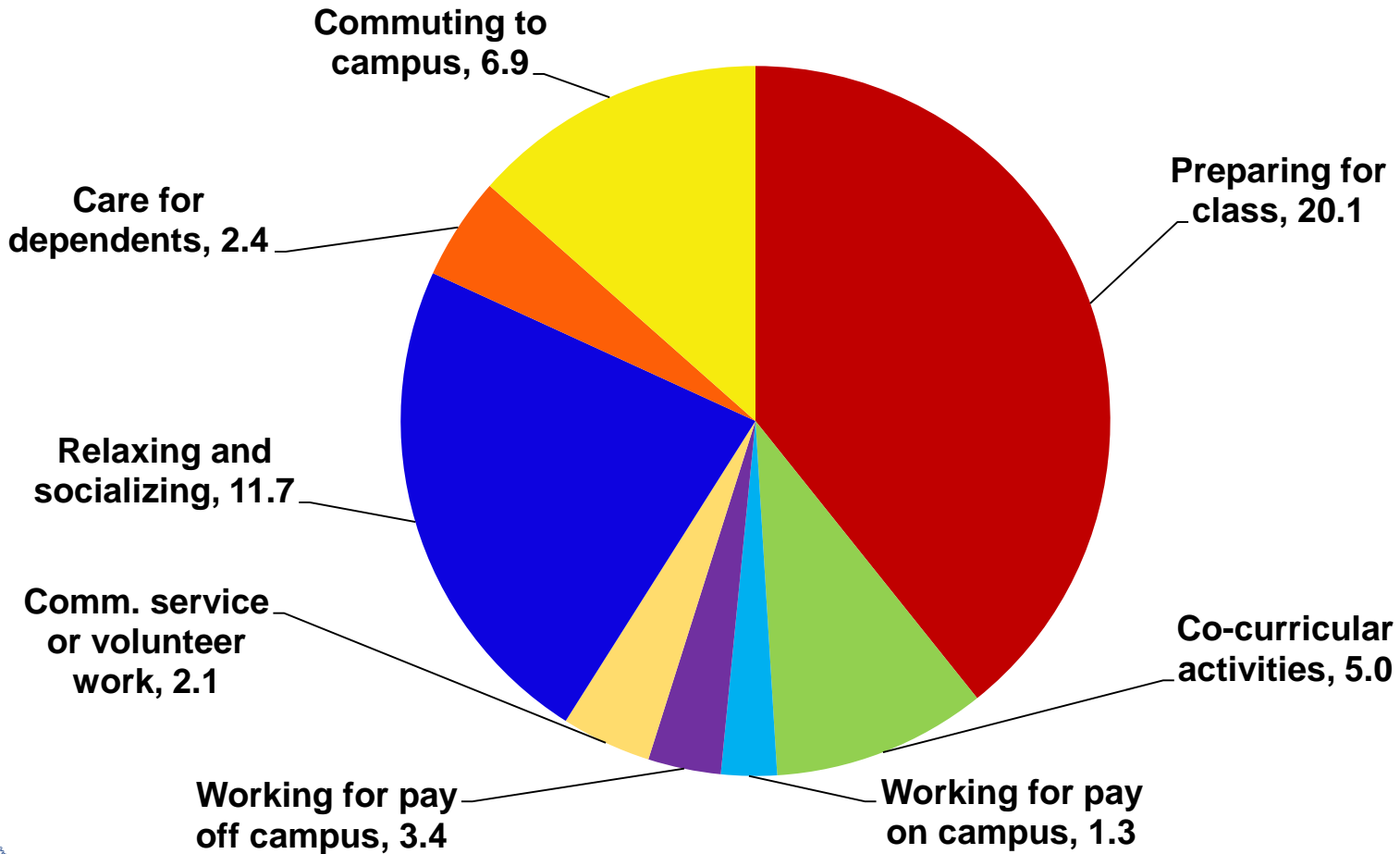
Demographic Information

	Canadian Citizen		Gender		Lives in Residence		Lives with Parents*	
	FY	SR	FY	SY	FY	SR	FY	SR
APSC	54%	73%	M – 71% F – 27%	M – 67% F – 31%	51%	5%	71%	46%
UofT	70%	83%	M – 44% F – 55%	M – 42% F – 56%	35%	5%	74%	56%
U15	77%**	88%**	M-72%** F-27%**	M-72%** F-26%**	39%	6%	n/a	n/a

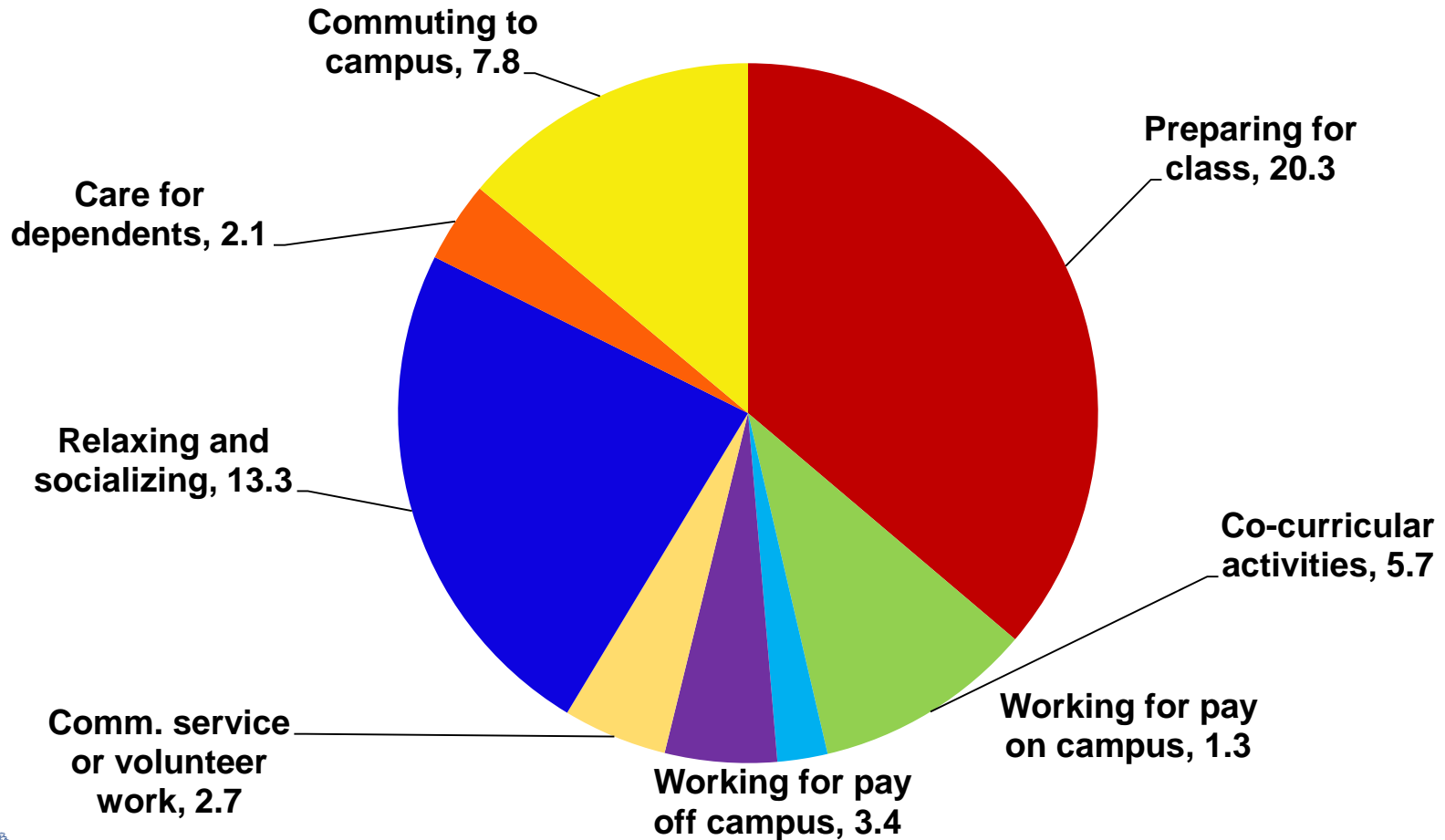
*From the respondents who indicated that they live off-campus; not all Ontario Universities asked this question

** U15 Engineering Schools ONLY

How first-year APSC students spend their time (hours/week)



How senior-year APSC students spend their time (hours/week)



Changes to NSSE in 2013



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Rationale for Change (2013)

- *Develop new measures related to effective teaching and learning*
- *Refine existing measures and scales*
- *Improve the clarity and applicability of survey language, and*
- *Update terminology to reflect current educational contexts*



Former Benchmarks

(2004, 2006, 2008, 2011)

- *Level of Academic Challenge*
- *Active and Collaborative Learning*
- *Enriching Educational Experiences*
- *Student-Faculty Interaction*
- *Supportive Campus Environment*

Themes & Engagement Indicators

(2014)

- **Academic Challenge THEME**

- Higher-Order Learning
- Reflective & Integrative Learning
- Learning Strategies
- Quantitative Reasoning

- **Learning with Peers THEME**

- Collaborative Learning
- Discussions with Diverse Others

- **Experiences with Faculty THEME**

- Student-Faculty Interaction
- Effective Teaching Practices

- **Campus Environment THEME**

- Quality of Interactions
- Supportive Environment



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THEME: Academic Challenge

Engagement Indicators:

- Higher-Order Learning
- Reflective & Integrative Learning
- Learning Strategies
- Quantitative Reasoning

Engagement Indicator: Higher-Order Learning

Questions:

- Applied facts, theories, or methods to practical problems or new situation
- Analyzed an idea, experience, or line of reasoning in depth by examining its parts
- Evaluated a point of view, decision, or information source
- Formed a new idea or understanding from various pieces of information

Engagement Indicator: Reflective & Integrative Learning

Questions:

- Combined ideas from different courses when completing assignments
- Connected your learning to societal problems or issues Included diverse perspectives (political, religious, racial/ethnic, gender, etc.) in course discussions or assignments
- Examined the strengths and weaknesses of your own views on a topic or issue
- Tried to better understand someone else's views by imagining how an issue looks from his or her perspective
- Learned something that changed the way you understand an issue or concept
- Connected ideas from your courses to your prior experiences and knowledge



Engagement Indicator: Learning Strategies

Questions:

- Identified key information from reading assignments
- Reviewed your notes after class
- Summarized what you learned in class or from course materials



Engagement Indicator: Quantitative Reasoning

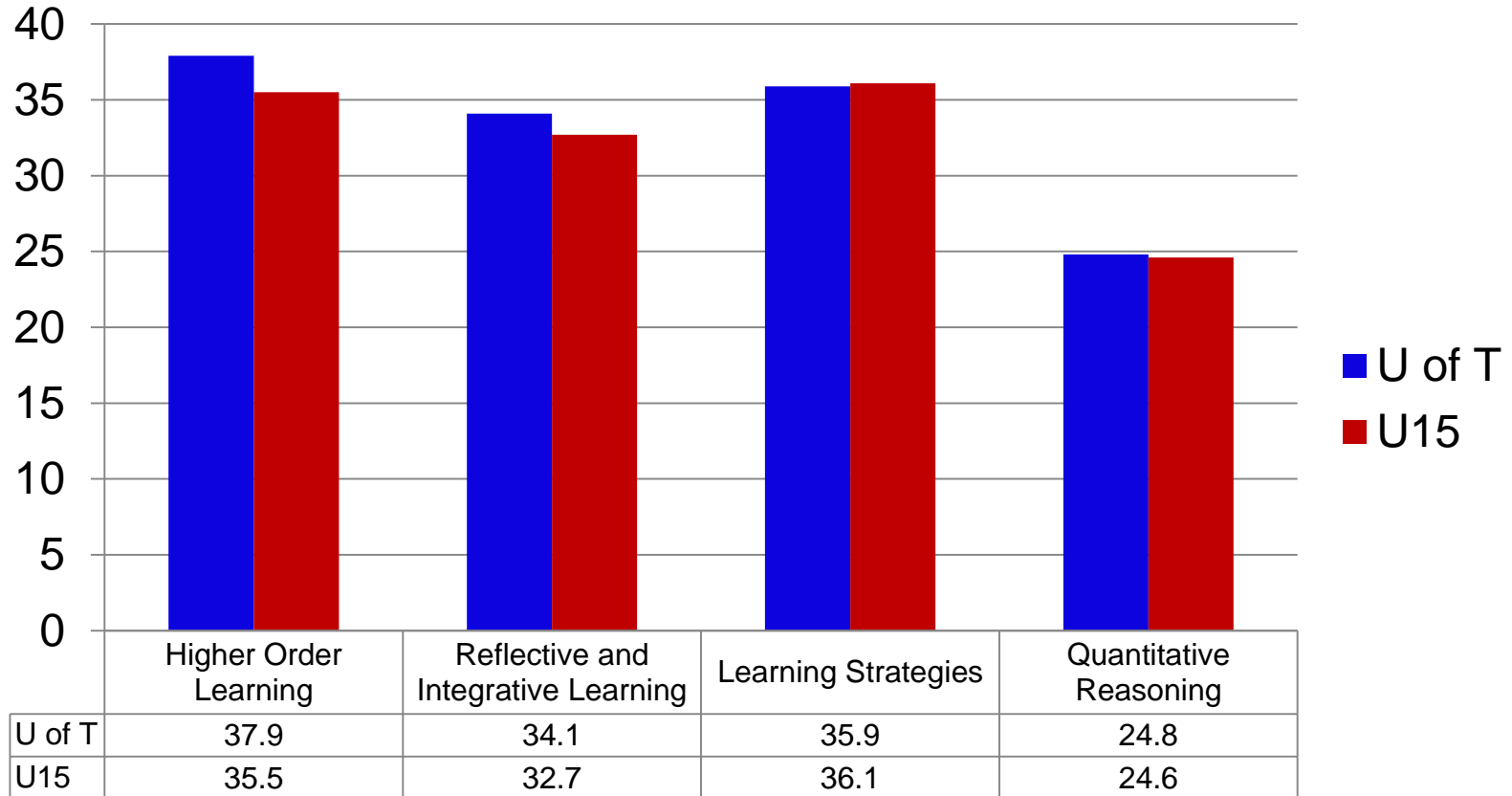
Questions:

- Reached conclusions based on your own analysis of numerical information (numbers, graphs, statistics, etc.)
- Used numerical information to examine a real-world problem or issue (unemployment, climate change, public health, etc.)
- Evaluated what others have concluded from numerical information



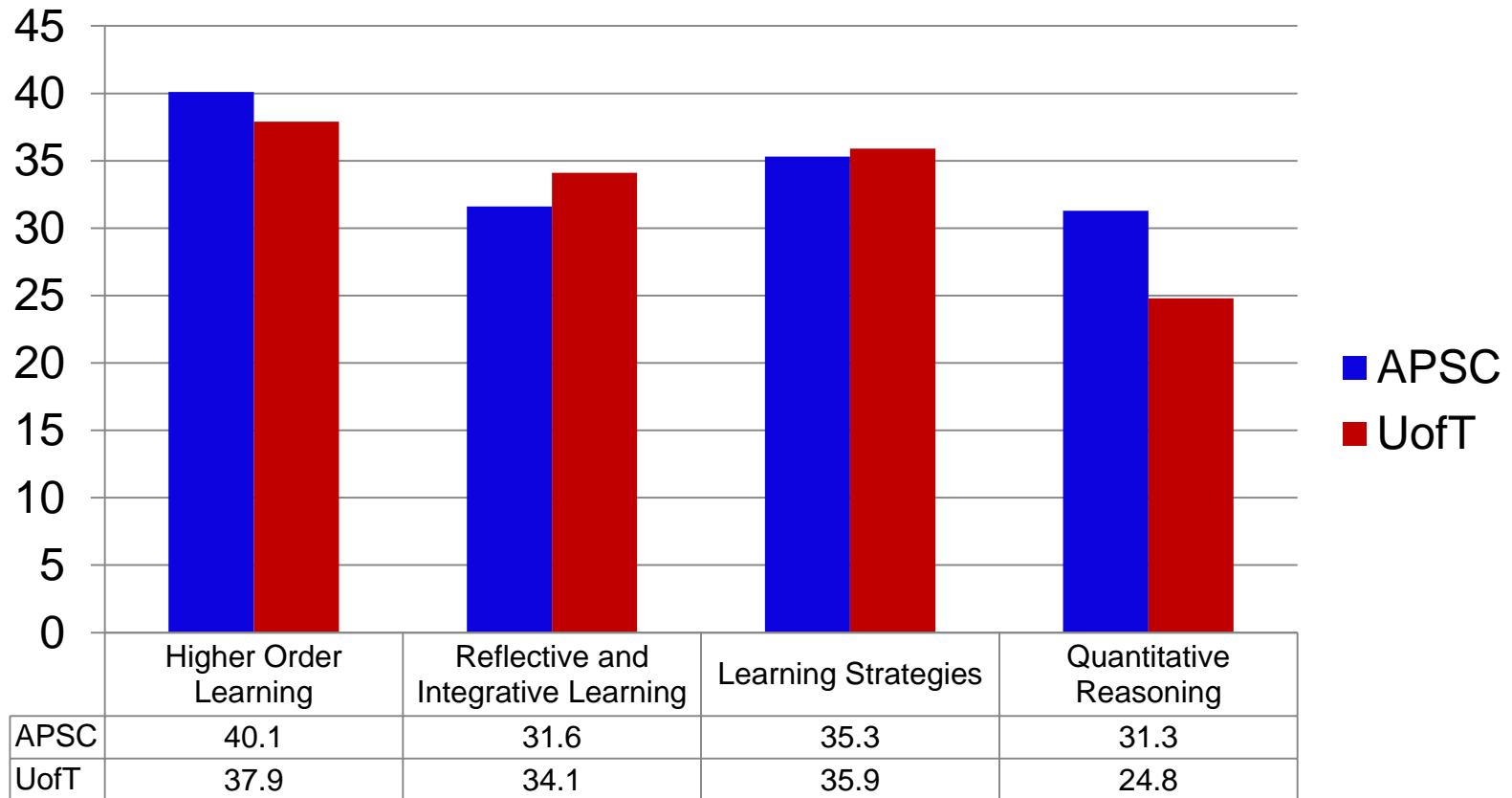
Academic Challenge - First Year

U of T and U15

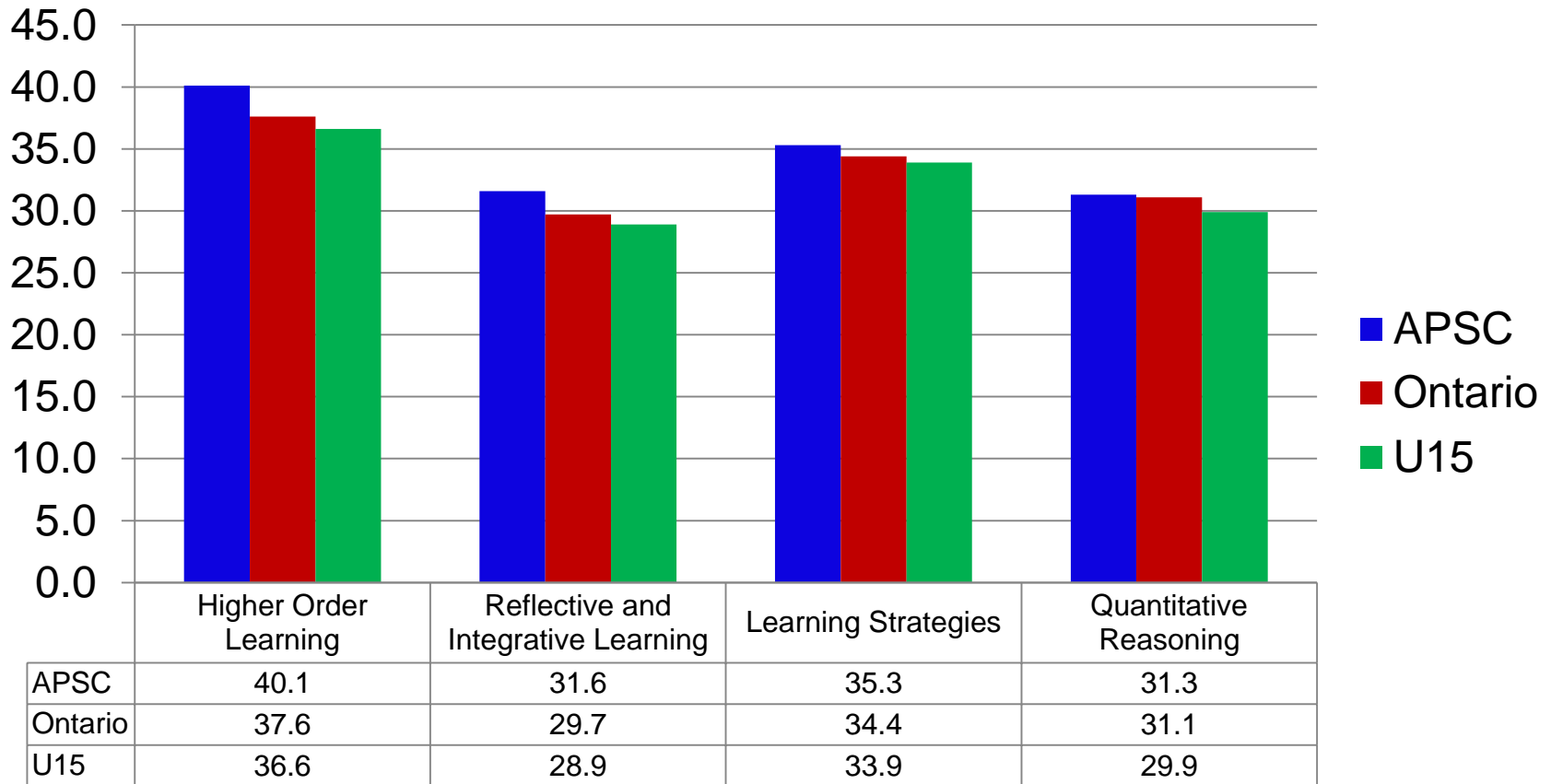


Academic Challenge - First Year

Faculty of Applied Science & Engineering

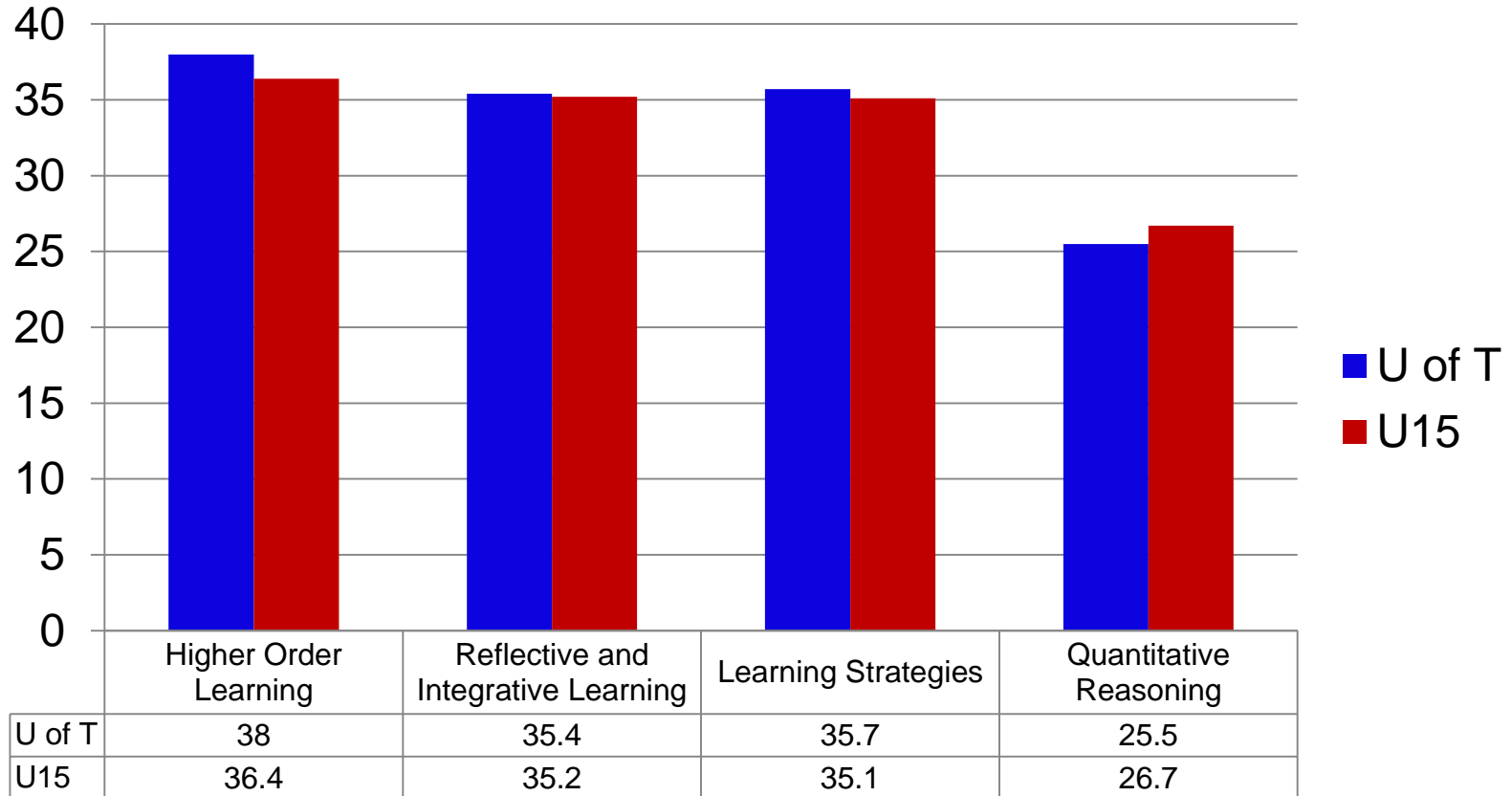


Academic Challenge - First Year Engineering Comparators Groups



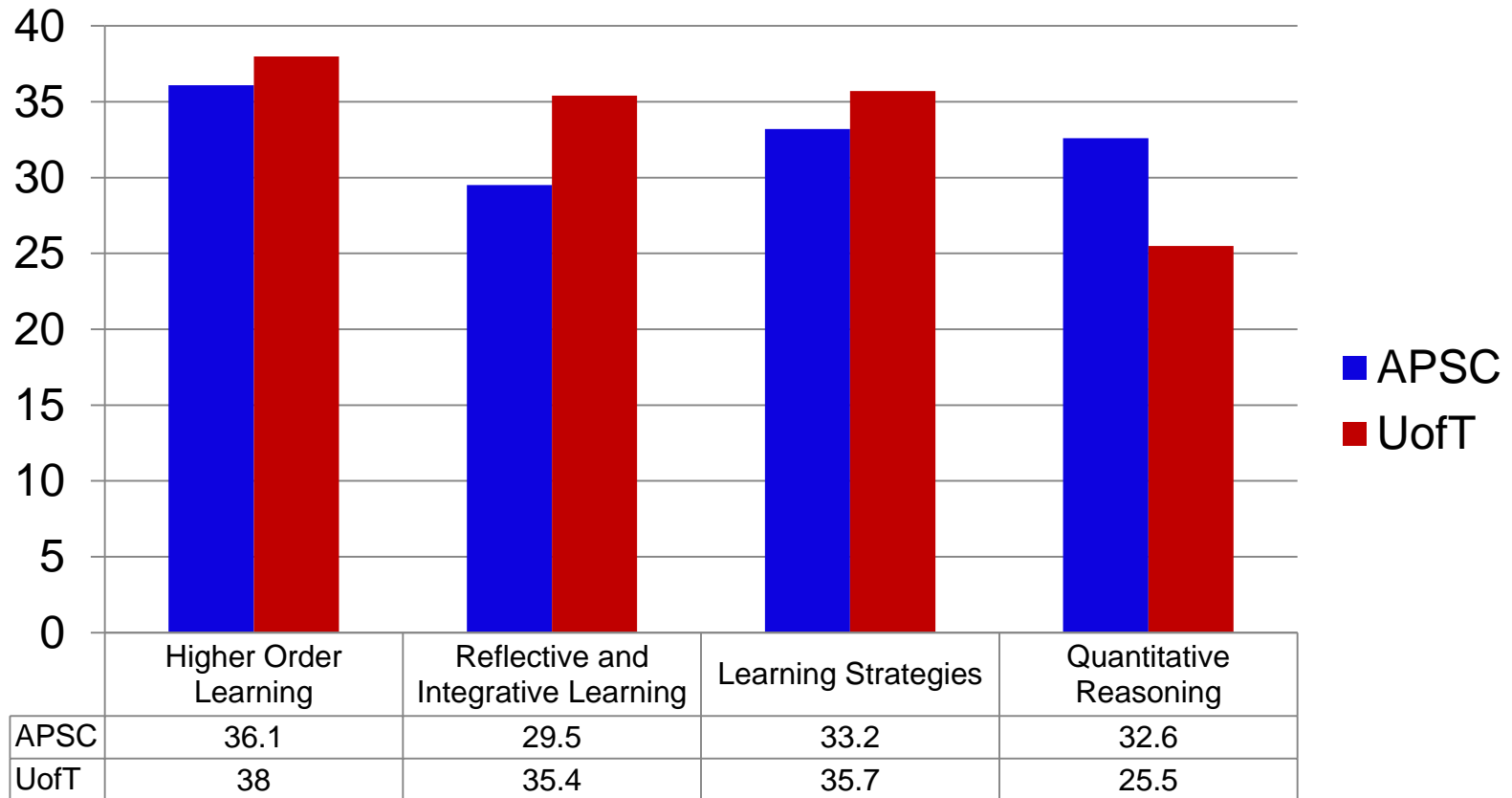
Academic Challenge - Senior Year

U of T and U15

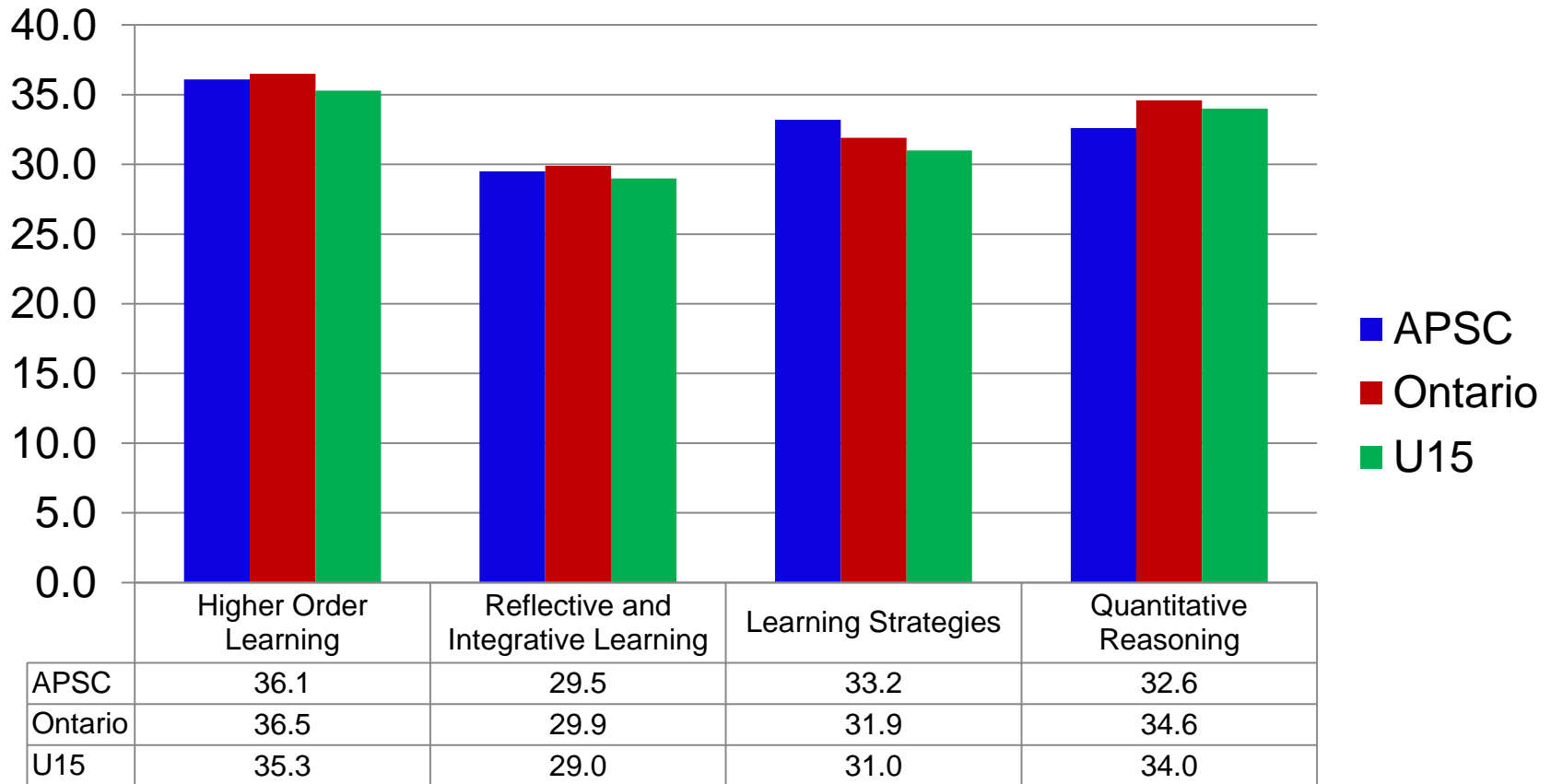


Academic Challenge - Senior Year

Faculty of Applied Science & Engineering



Academic Challenge - Senior Year Engineering Comparators Groups



THEME: Learning with Peers

Engagement Indicators:

- Collaborative Learning
- Discussions with Diverse Others

Engagement Indicator: Collaborative Learning

Questions:

- Asked another student to help you understand course material
- Explained course material to one or more students
- Prepared for exams by discussing or working through course material with other students
- Worked with other students on course projects or assignments



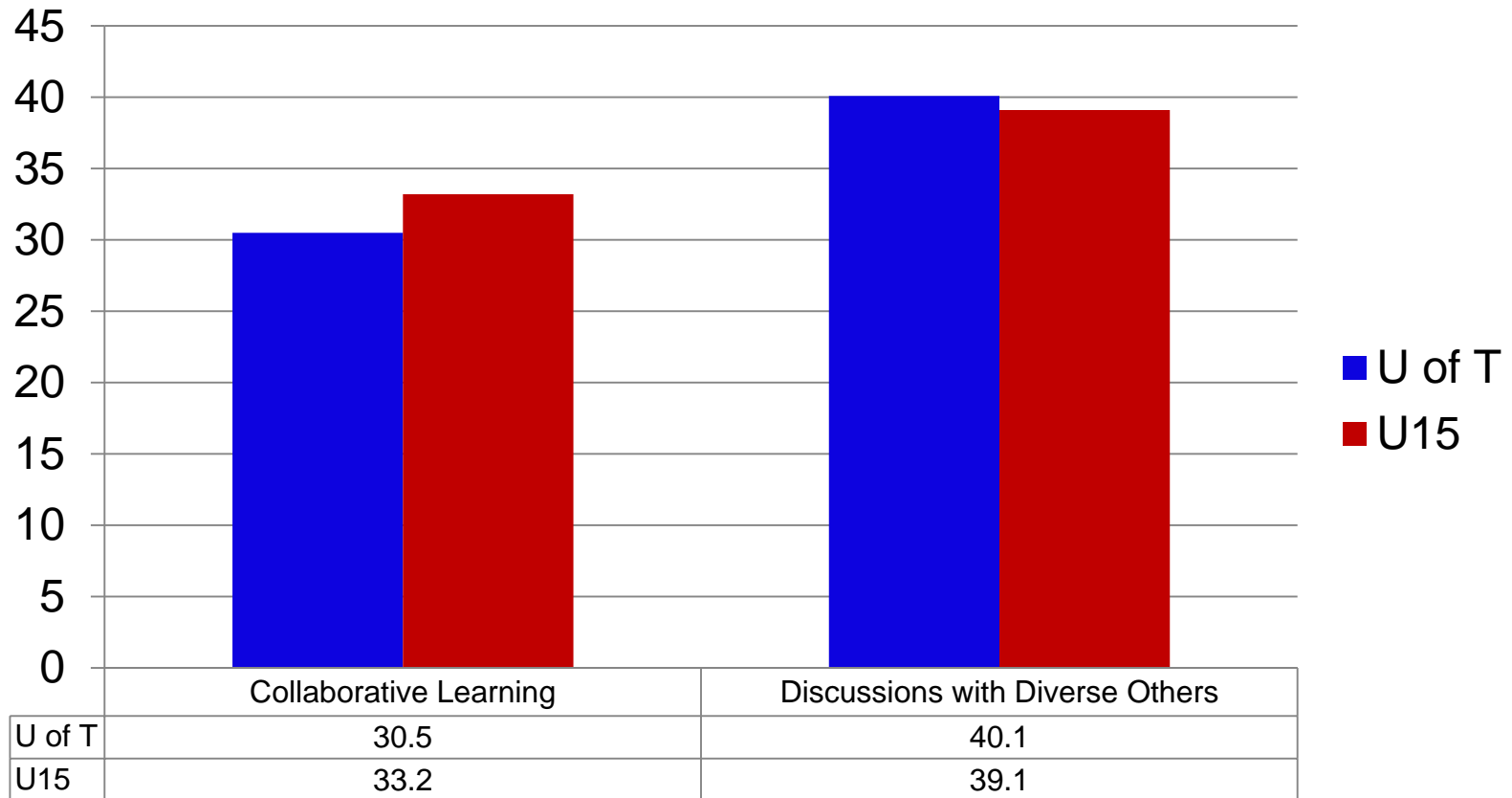
Engagement Indicator: Discussions with Diverse Others

Questions:

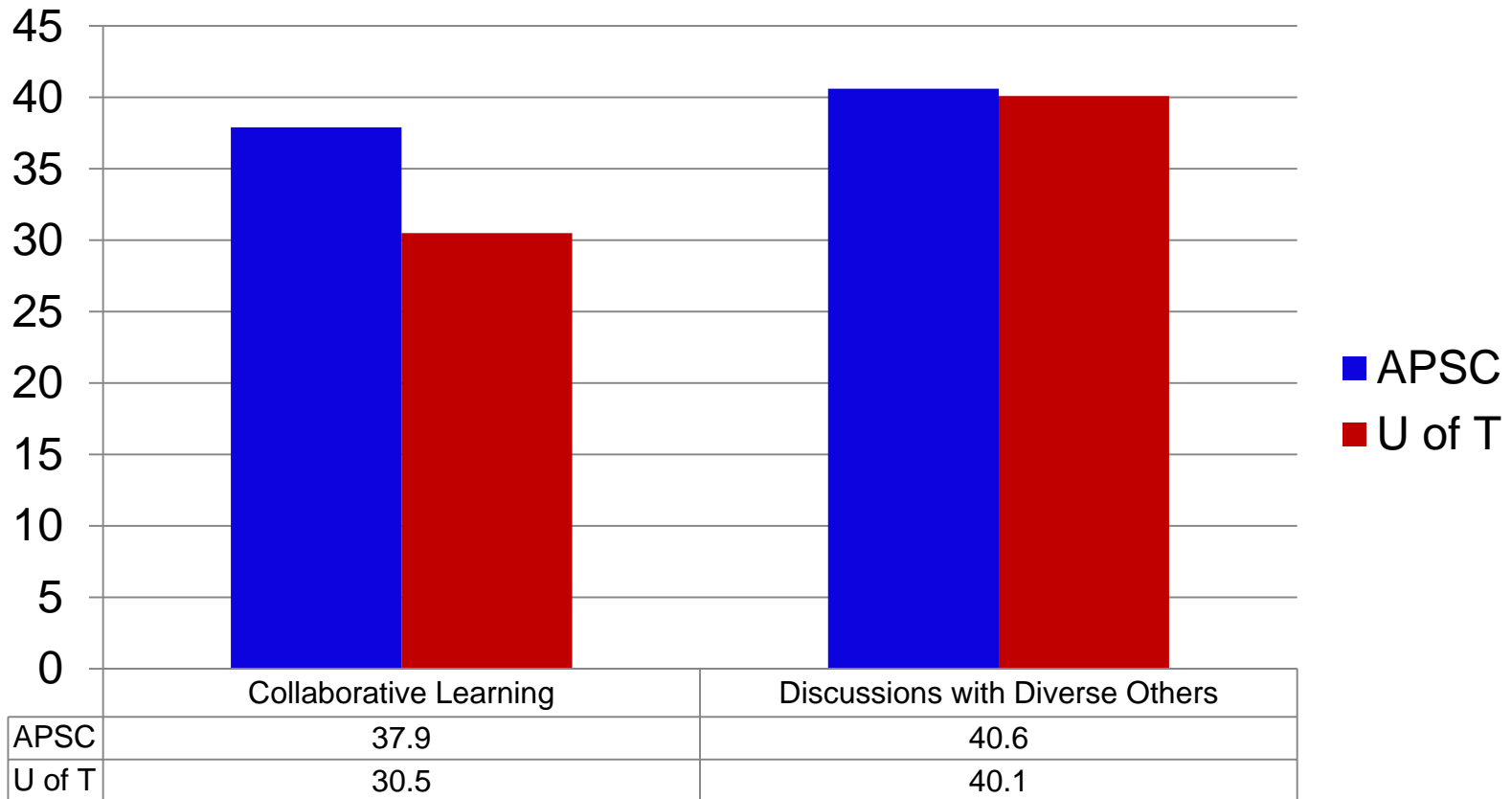
- People from a race or ethnicity other than your own
- People from an economic background other than your own
- People with religious beliefs other than your own
- People with political views other than your own



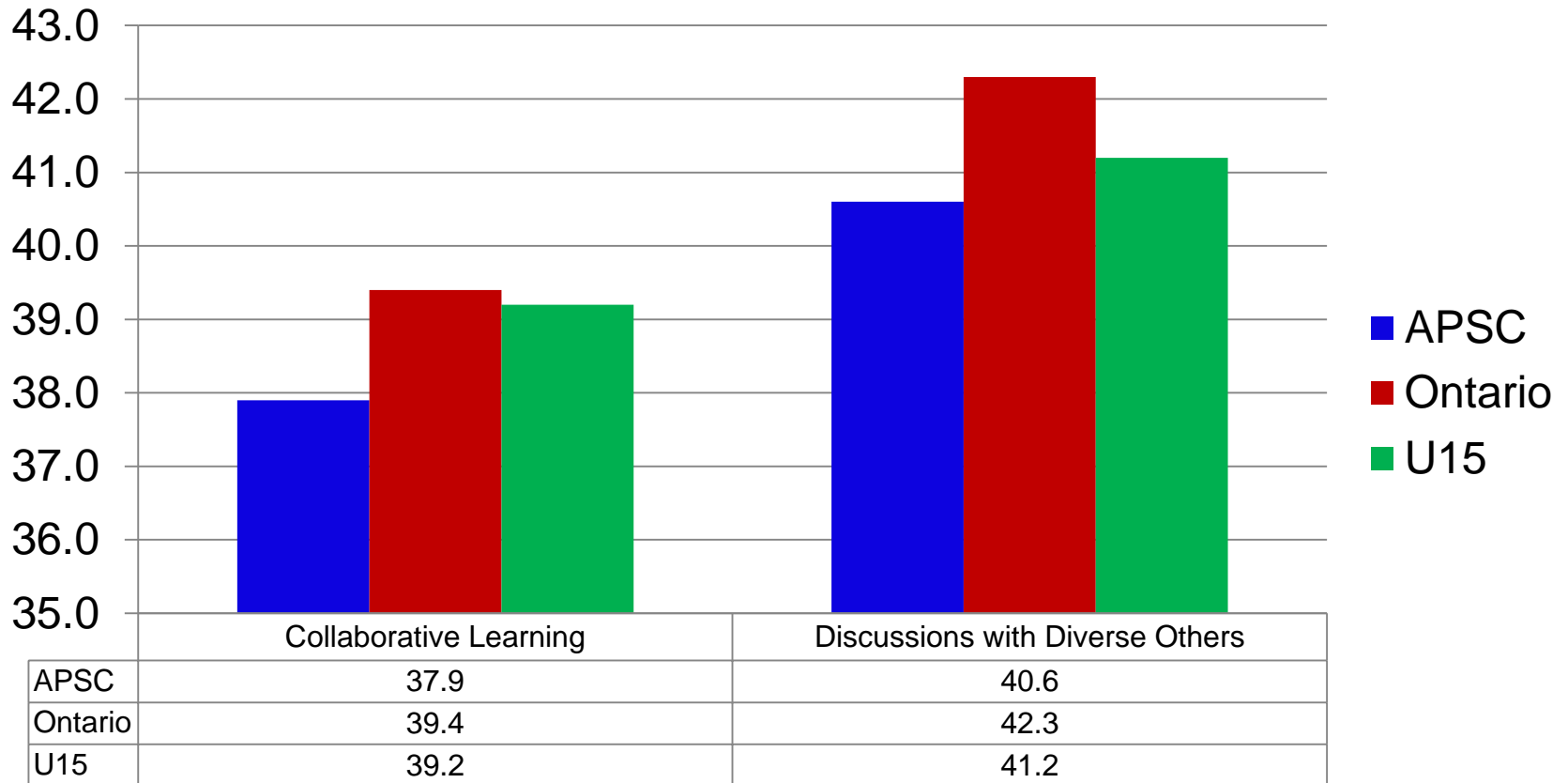
Learning With Peers - First Year U of T and U15



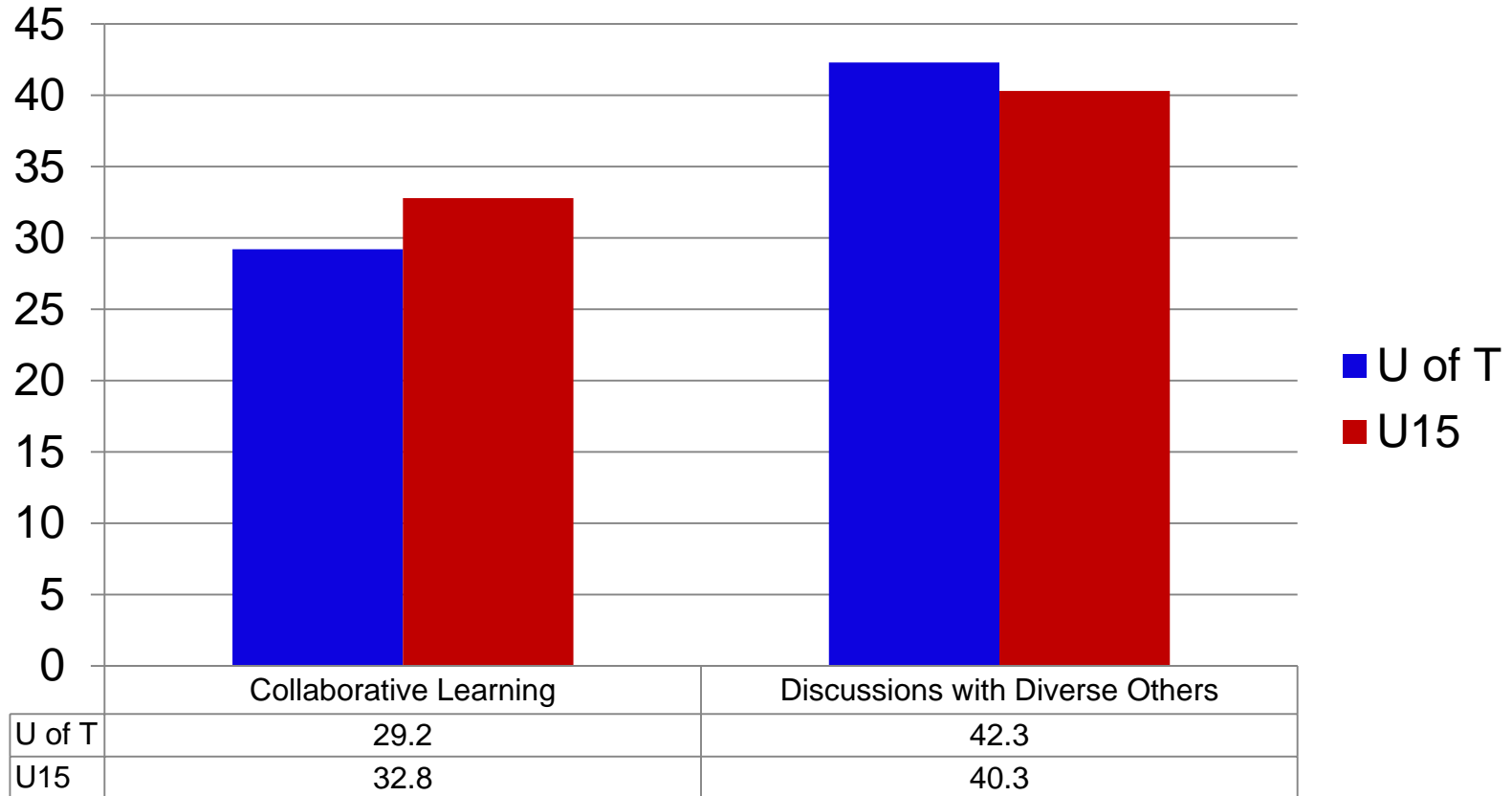
Learning With Peers - First Year Faculty of Applied Science & Engineering



Learning With Peers - First Year Engineering Comparator Groups

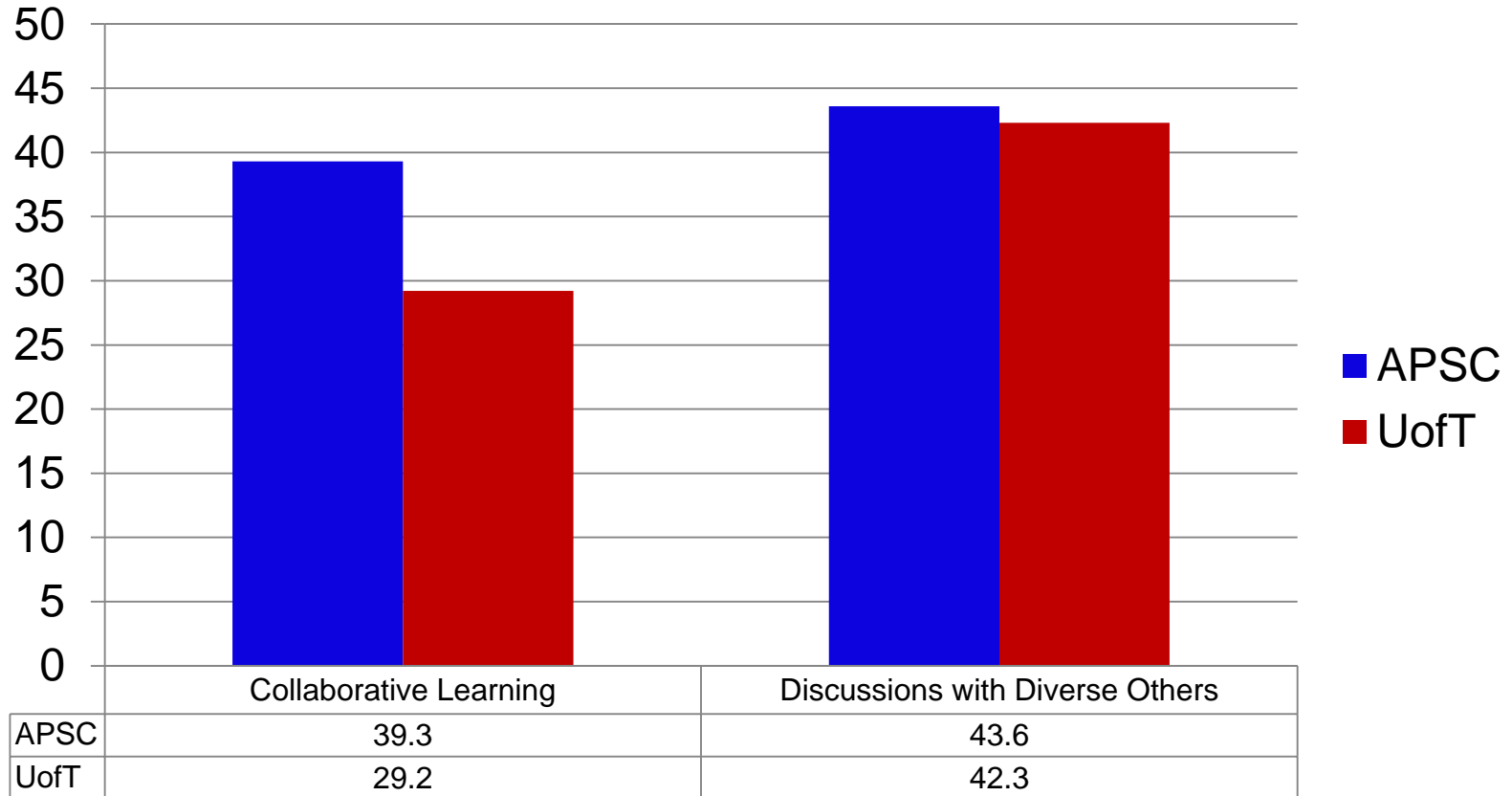


Learning With Peers - Senior Year U of T and U15

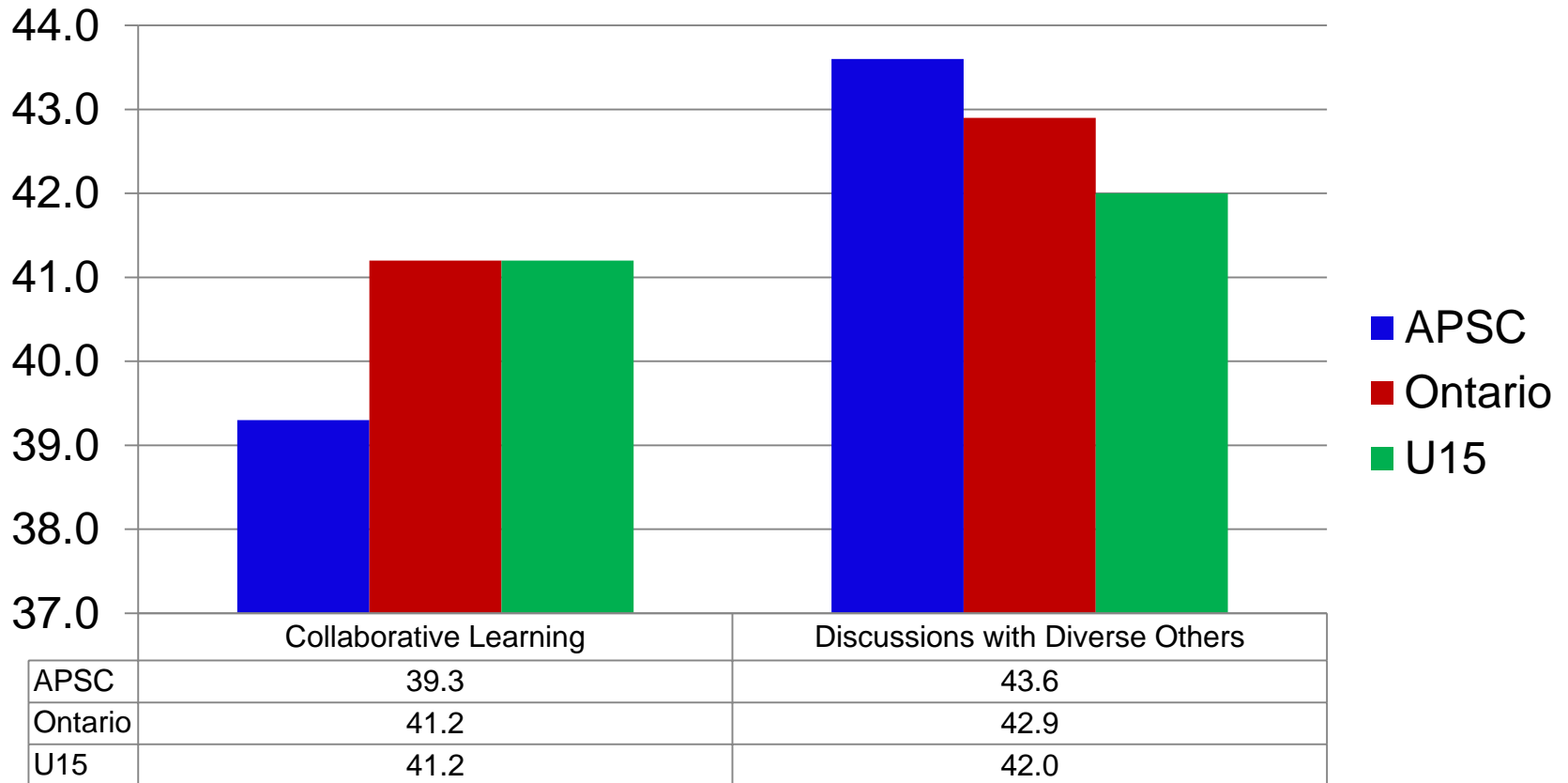


Learning With Peers - Senior Year

Faculty of Applied Science & Engineering



Learning With Peers - Senior Year Engineering Comparator Groups



THEME: Experiences with Faculty

Engagement Indicators:

- Student-Faculty Interactions
- Effective Teaching Practices

Engagement Indicator: Student-Faculty Interactions

Questions:

- Talked about career plans with a faculty member
- Worked with faculty on activities other than coursework (committees, student groups, etc.)
- Discussed course topics, ideas, or concepts with a faculty member outside of class
- Discussed your academic performance with a faculty member

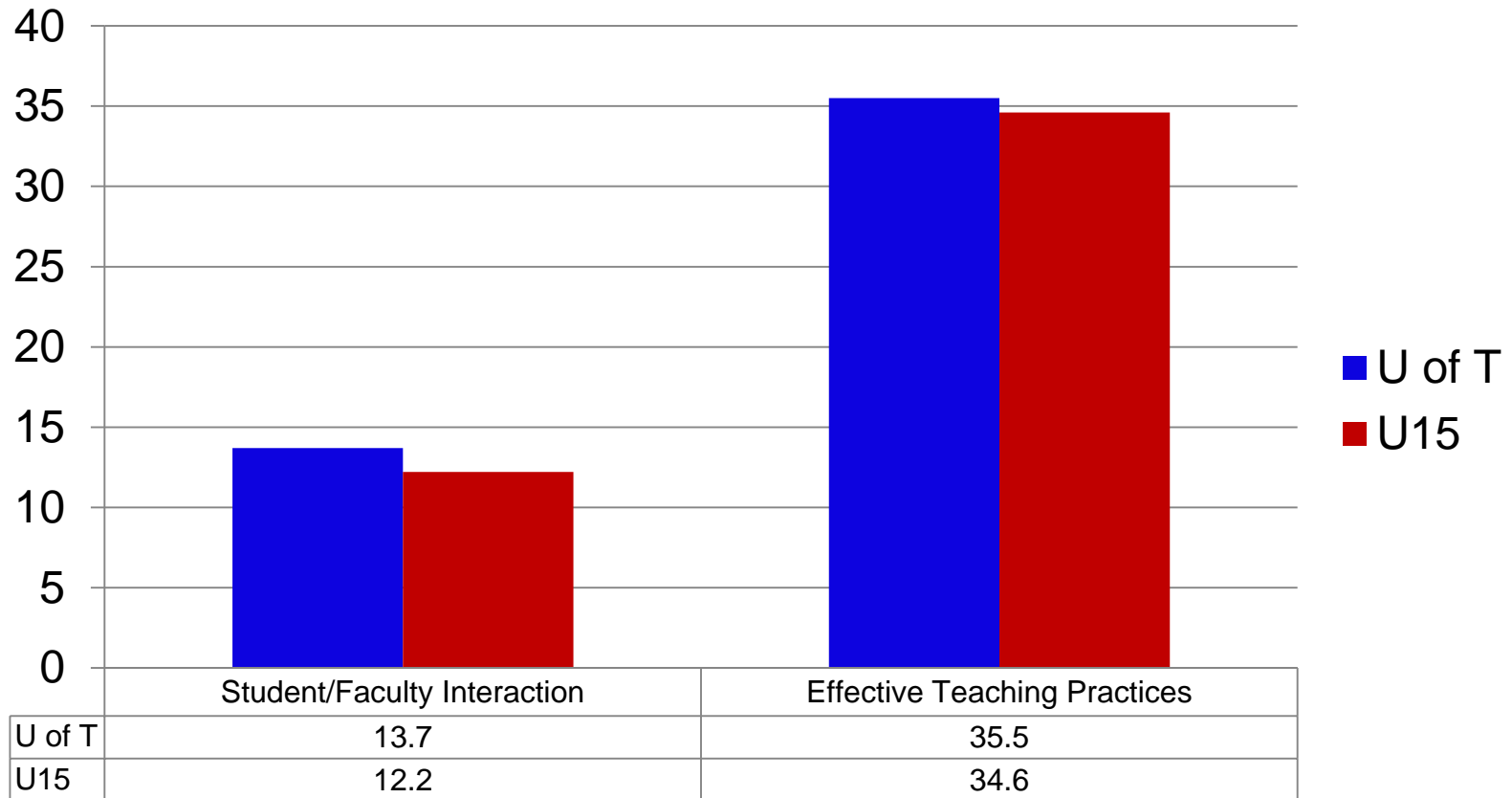


Engagement Indicator: Effective Teaching Practices

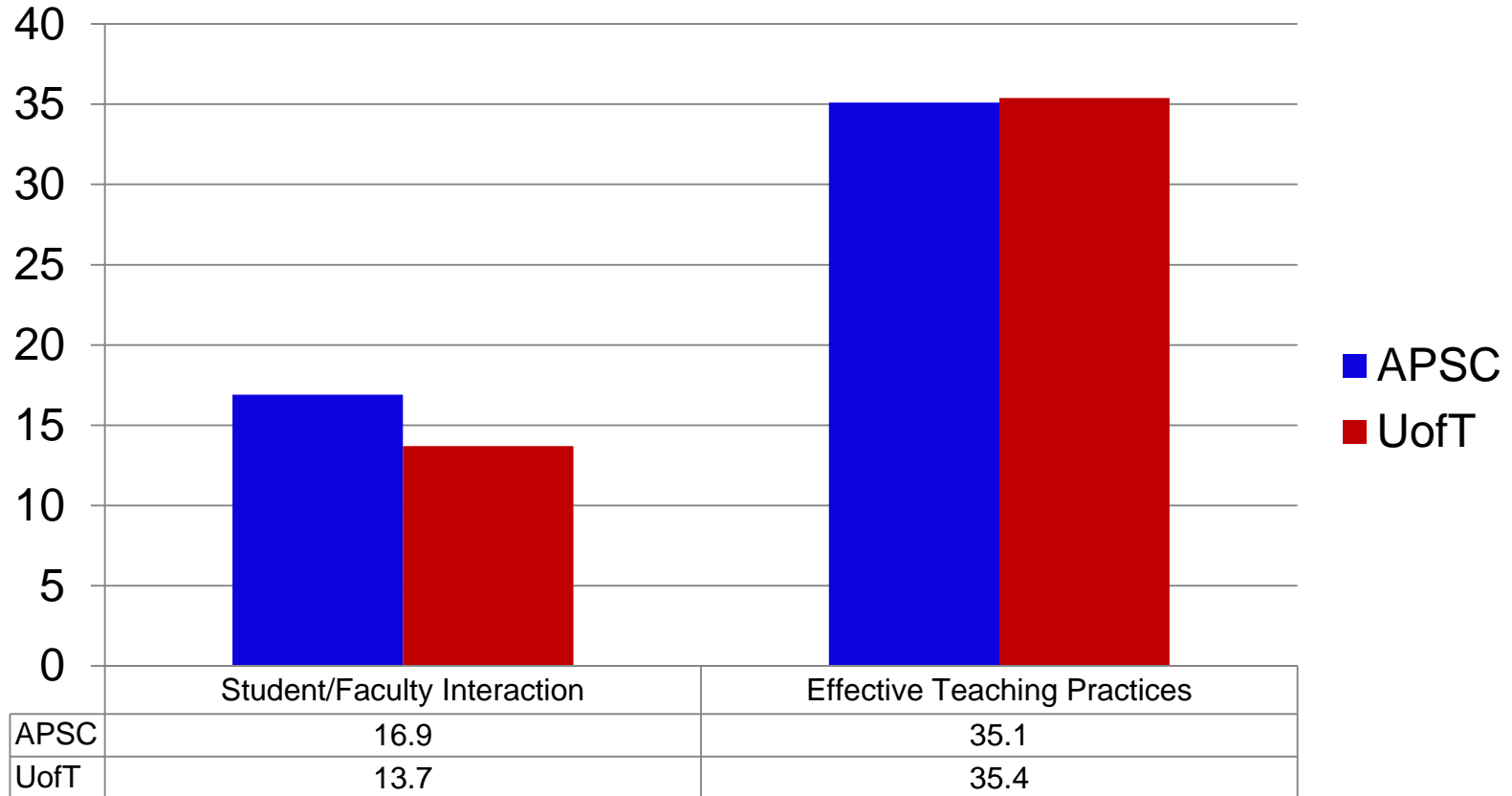
Questions:

- Clearly explained course goals and requirements
- Taught course sessions in an organized way
- Used examples or illustrations to explain difficult points
- Provided feedback on a draft or work in progress
- Provided prompt and detailed feedback on tests or completed assignments

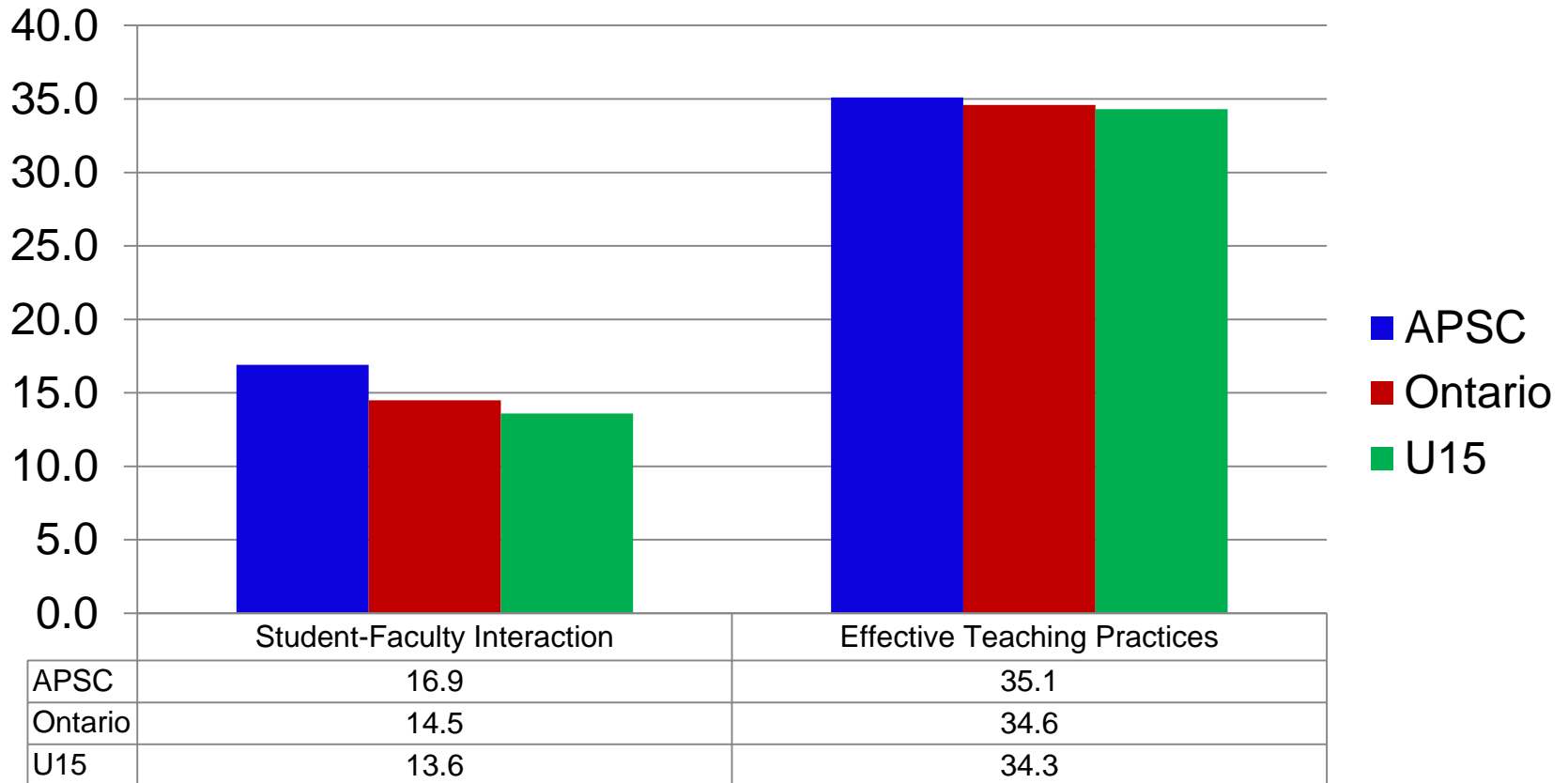
Experiences with Faculty - First Year U of T and U15



Experiences with Faculty - First Year Faculty of Applied Science & Engineering

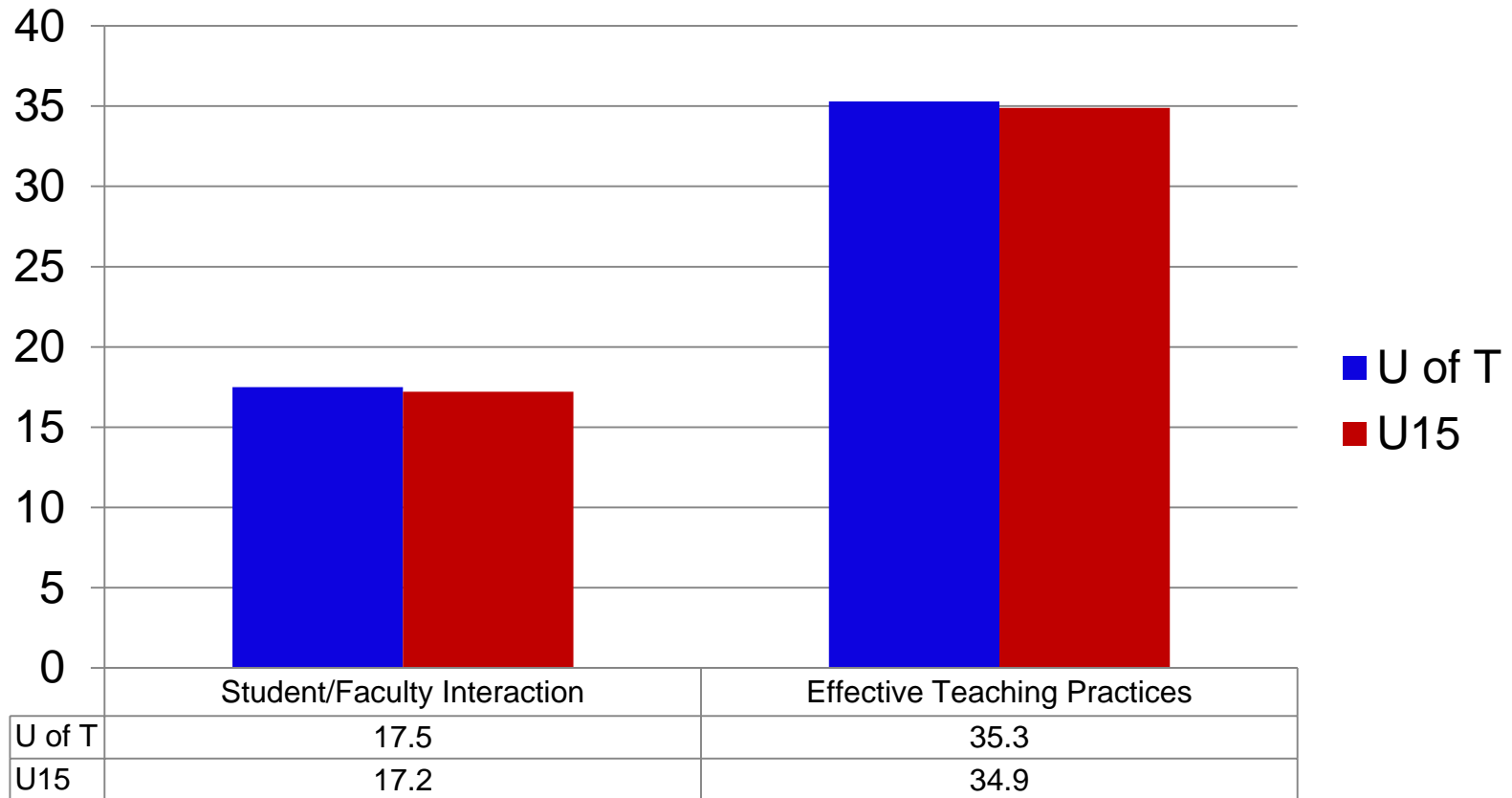


Experiences with Faculty - First Year Engineering Comparator Groups

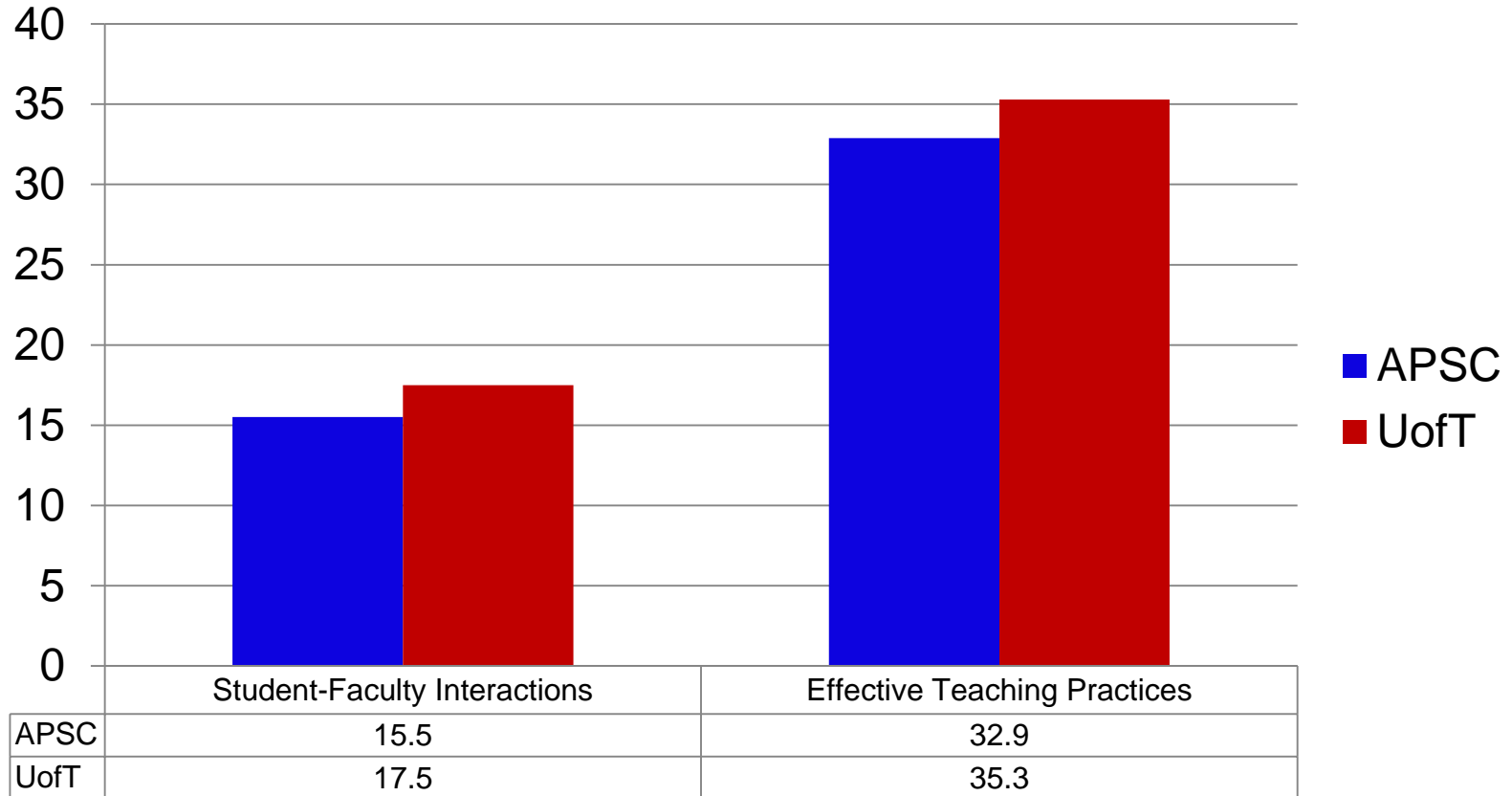


Experiences with Faculty - Senior Year

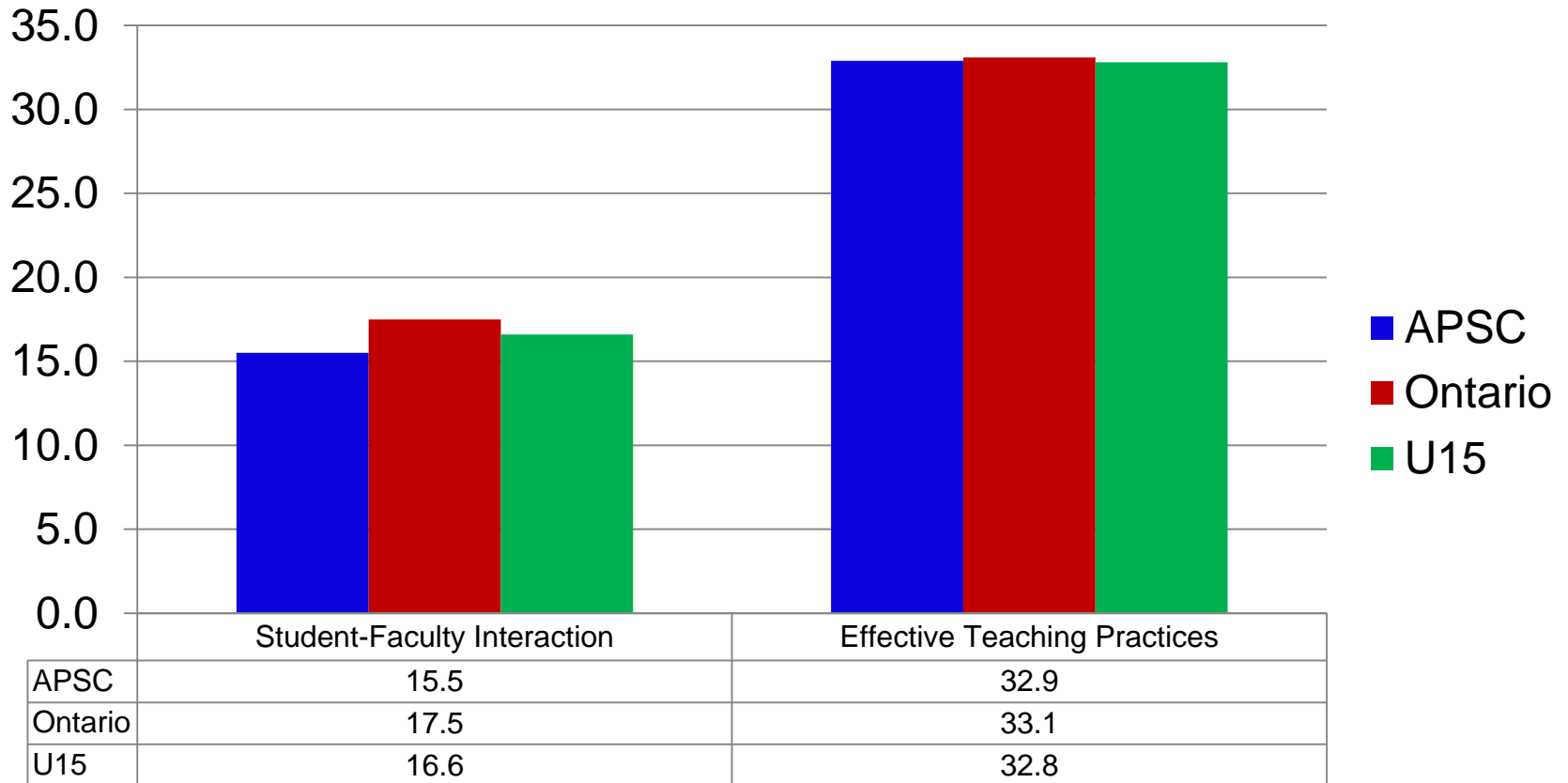
U of T and U15



Experiences with Faculty - Senior Year Faculty of Applied Science & Engineering



Experiences with Faculty - Senior Year Engineering Comparator Groups



THEME: Campus Environment

Engagement Indicators:

- Quality of Interactions
- Supportive Environment

Engagement Indicator: Quality of Interactions

Questions:

- Students
- Academic Advisors
- Faculty
- Student services staff (career services, student activities, housing, etc.)
- Other administrative staff and offices (registrar, financial aid, etc.)

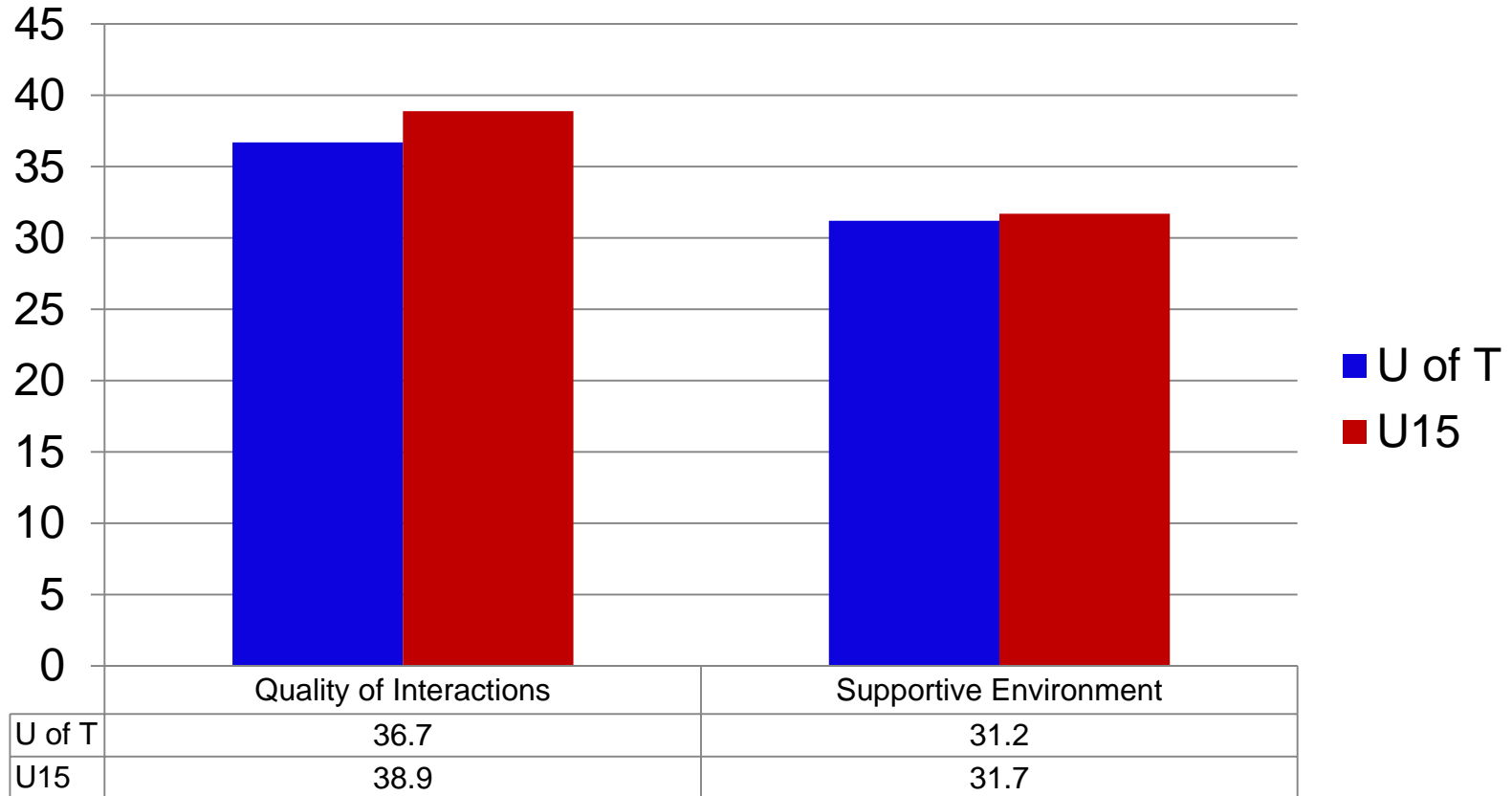
Engagement Indicator: Supportive Environment

Questions:

- Provided support to help students succeed academically using learning support services (tutoring services, writing centre, etc.)
- Encouraged contact among students from different backgrounds (social, racial/ethnic, religious, etc.)
- Provided opportunities to be involved socially
- Provided support for your overall well-being (recreation, health care, counselling, etc.)
- Helped you manage your non-academic responsibilities (work, family, etc.)
- Attended campus activities and events (performing arts, athletic events, etc.)
- Attended events that address important social, economic, or political issues

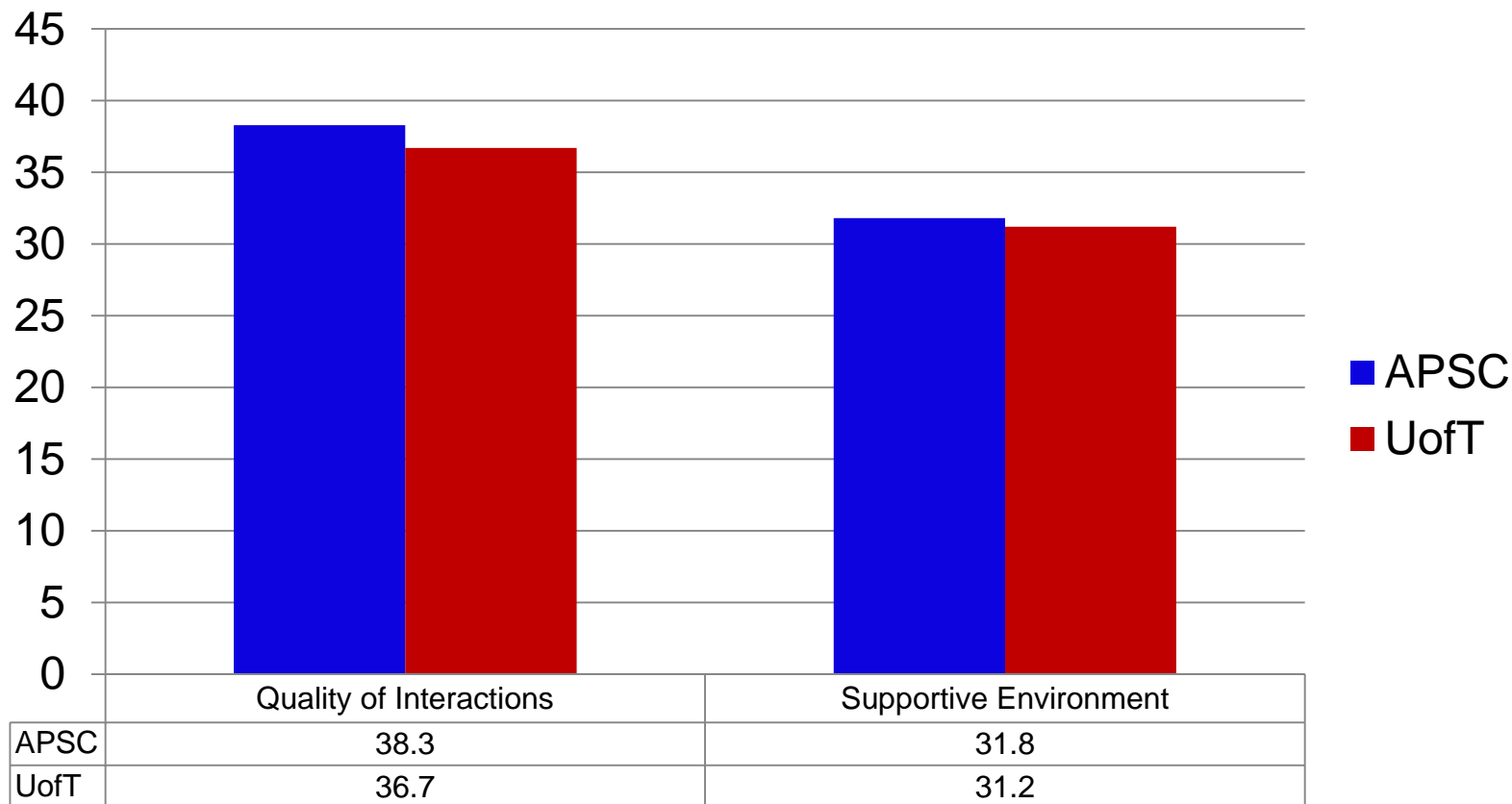


Campus Environment - First Year U of T and U15

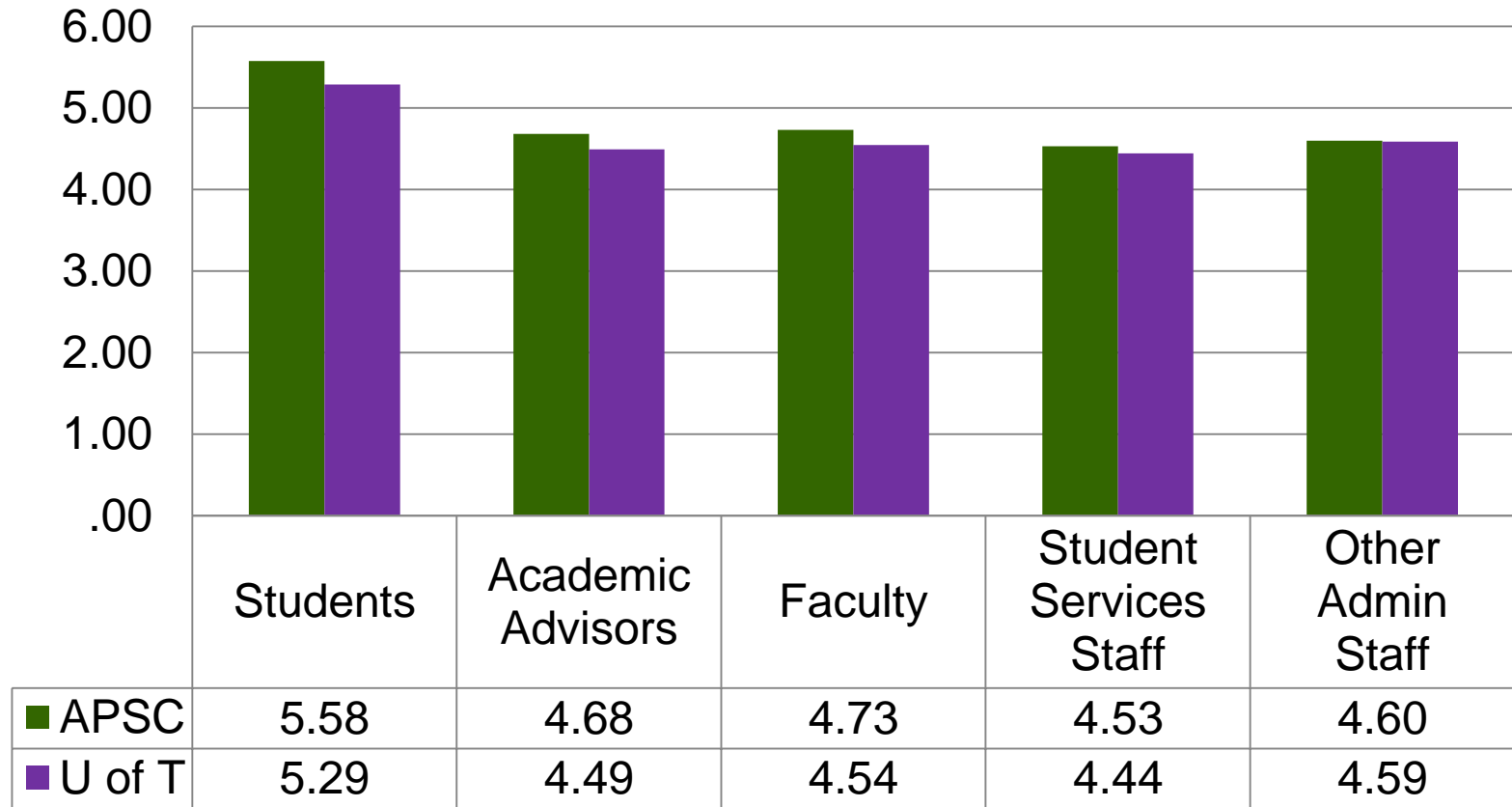


Campus Environment - First Year

Faculty of Applied Science & Engineering

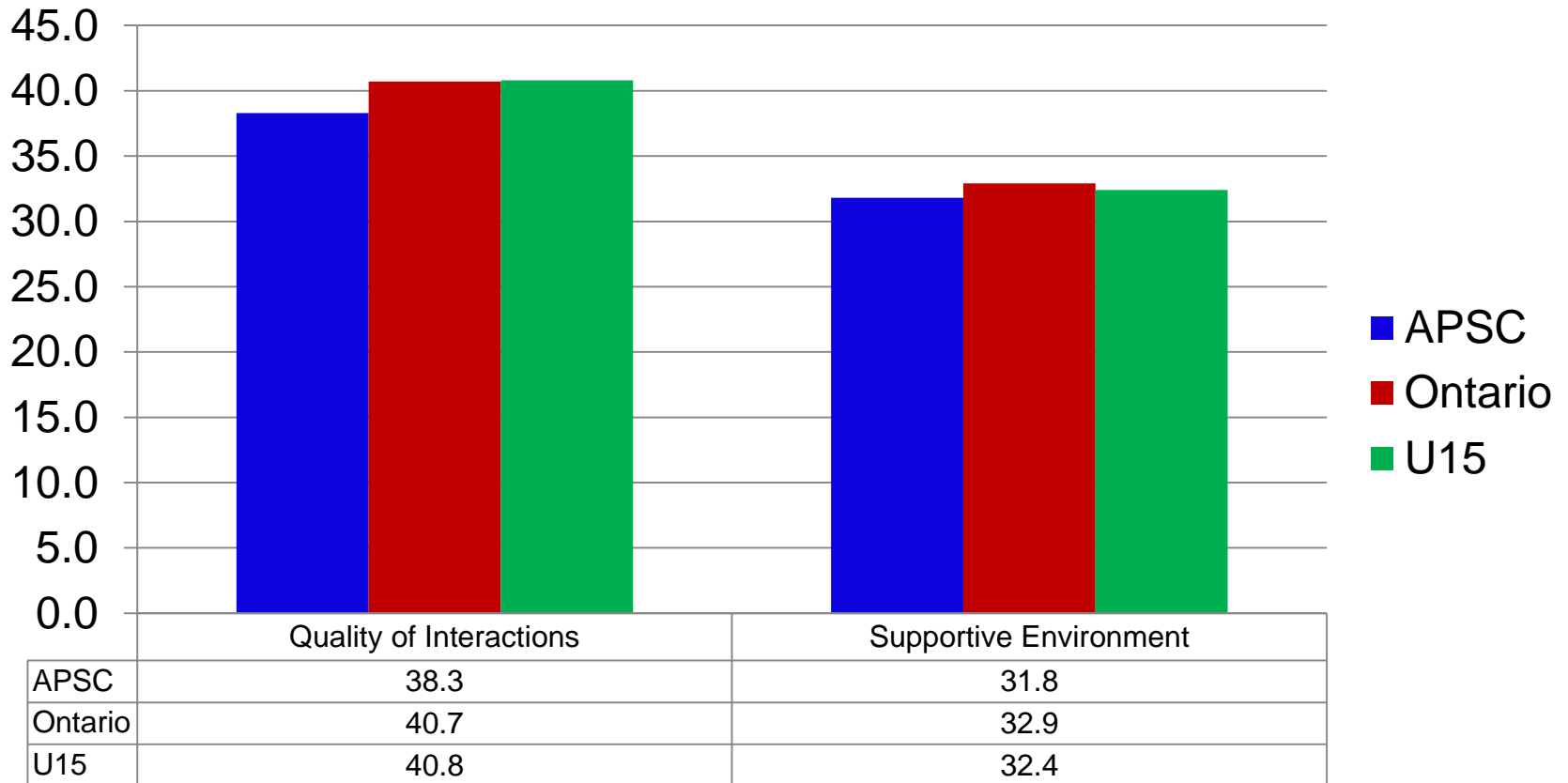


Quality of Relationship with: Overall Means - First Year



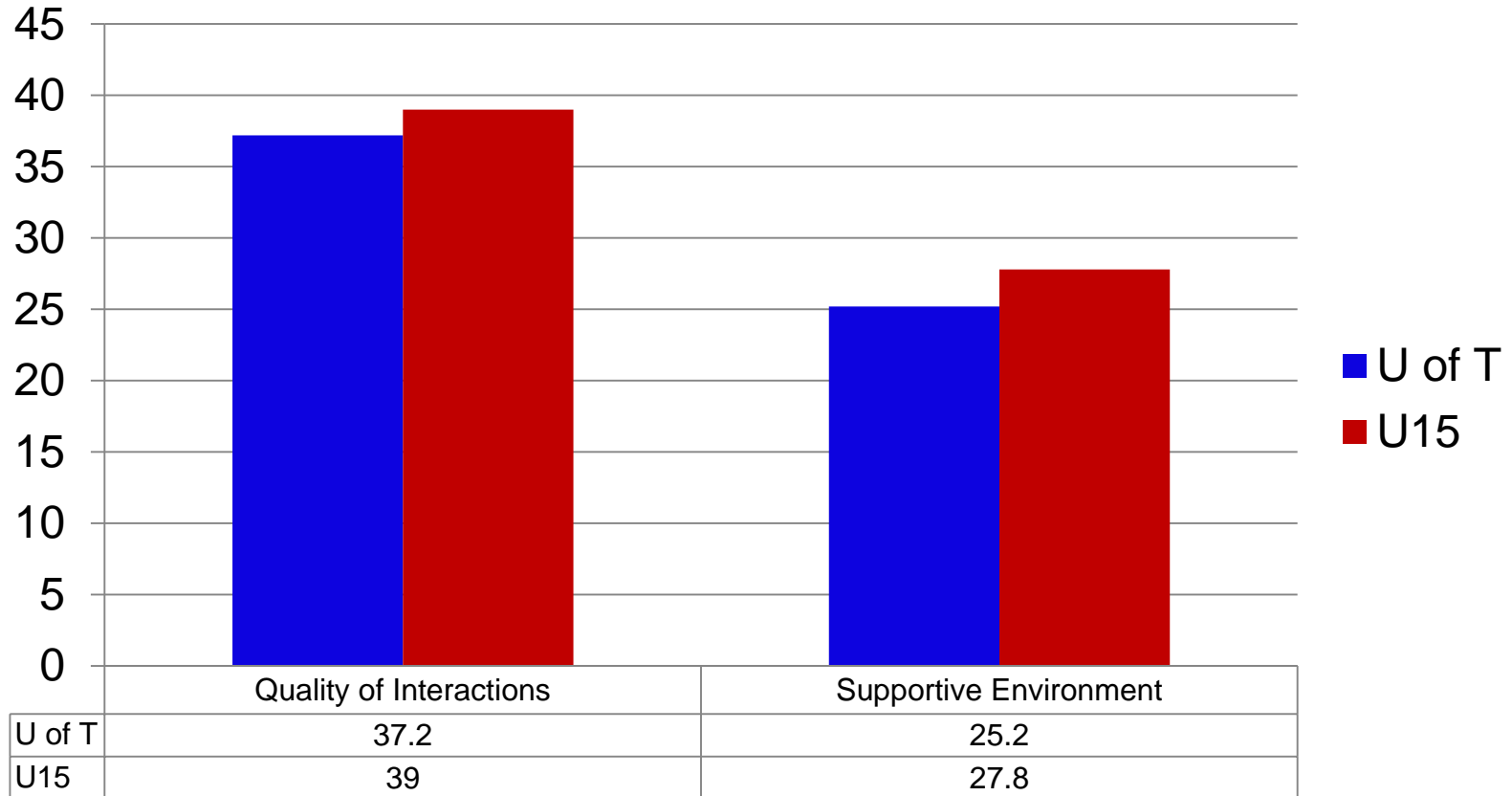
1 = Unhelpful, inconsiderate, rigid
7 = Helpful, considerate, flexible

Campus Environment - First Year Engineering Comparator Groups

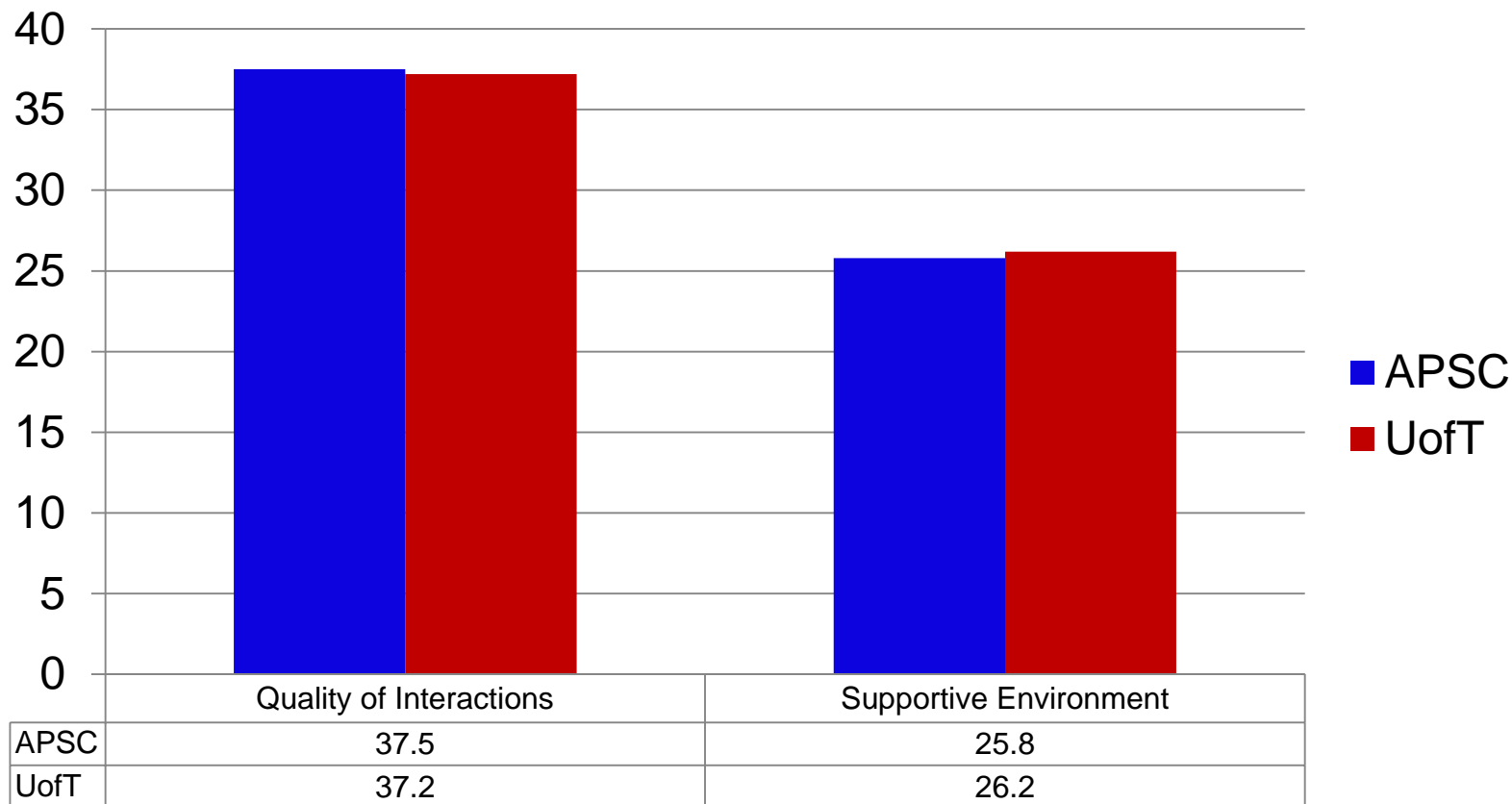


Campus Environment - Senior Year

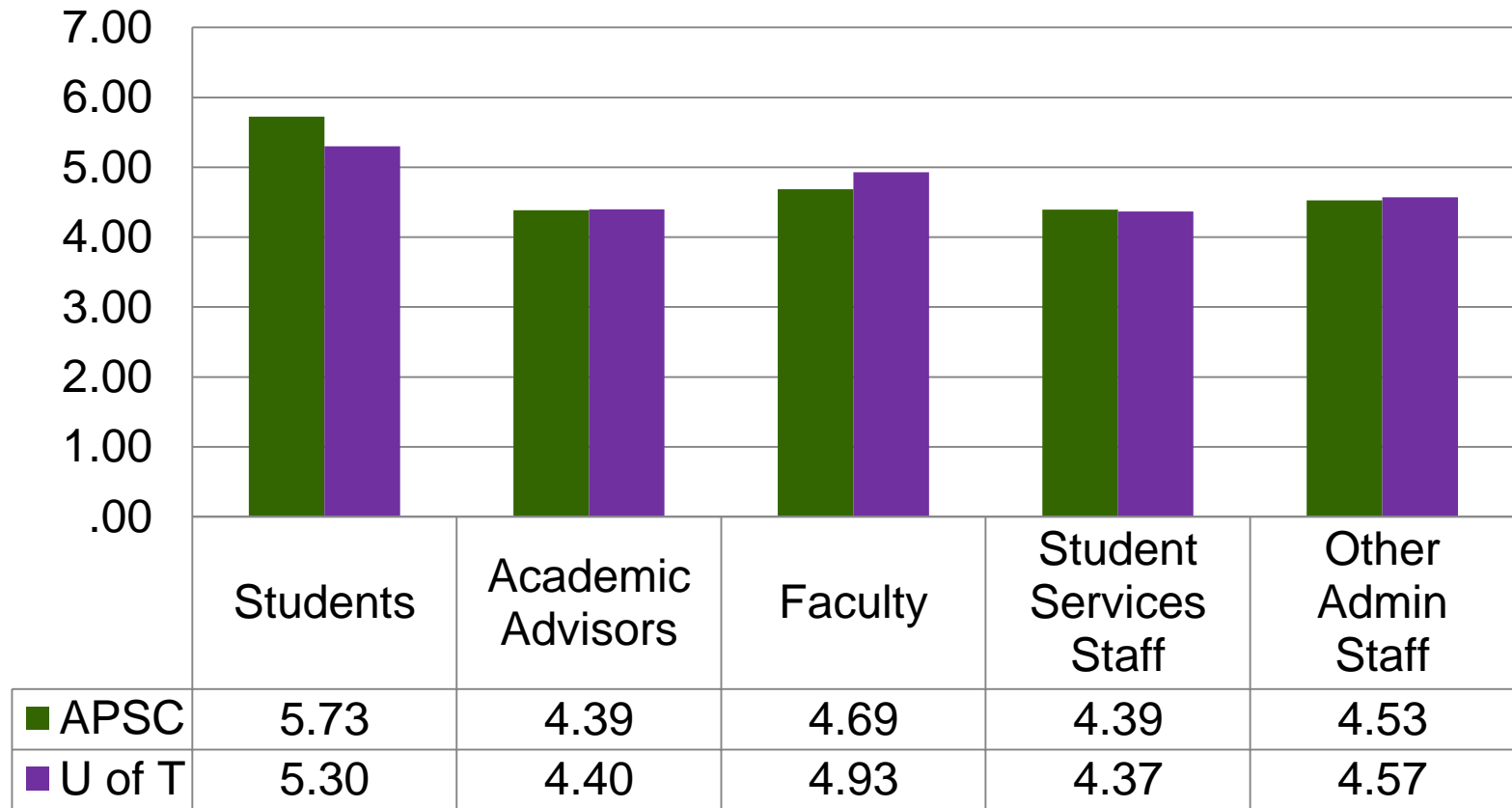
U of T and U15



Campus Environment - Senior Year Faculty of Applied Science & Engineering



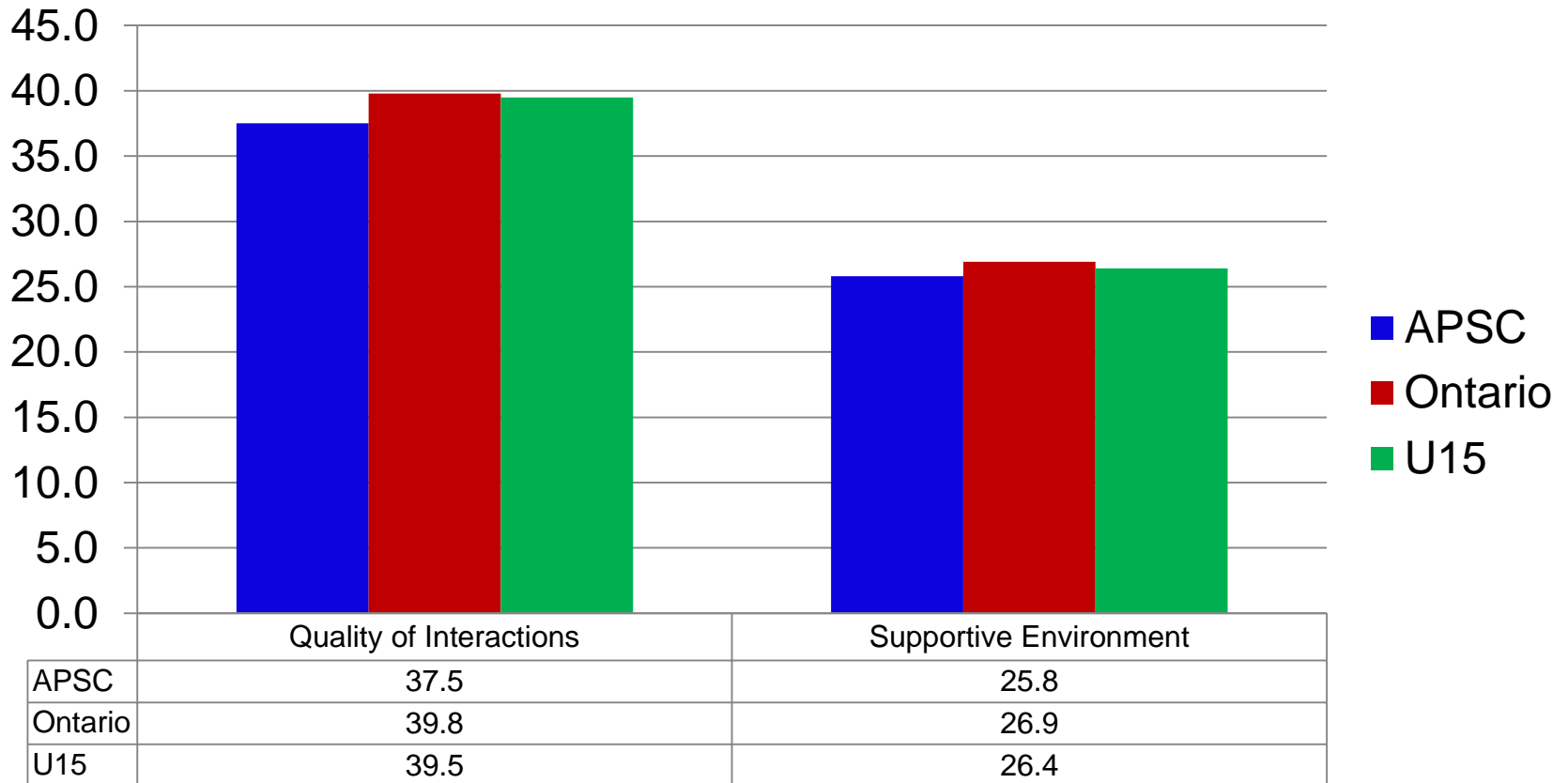
Quality of Relationship with: Overall Means - Senior Year



1 = Unhelpful, inconsiderate, rigid
7 = Helpful, considerate, flexible



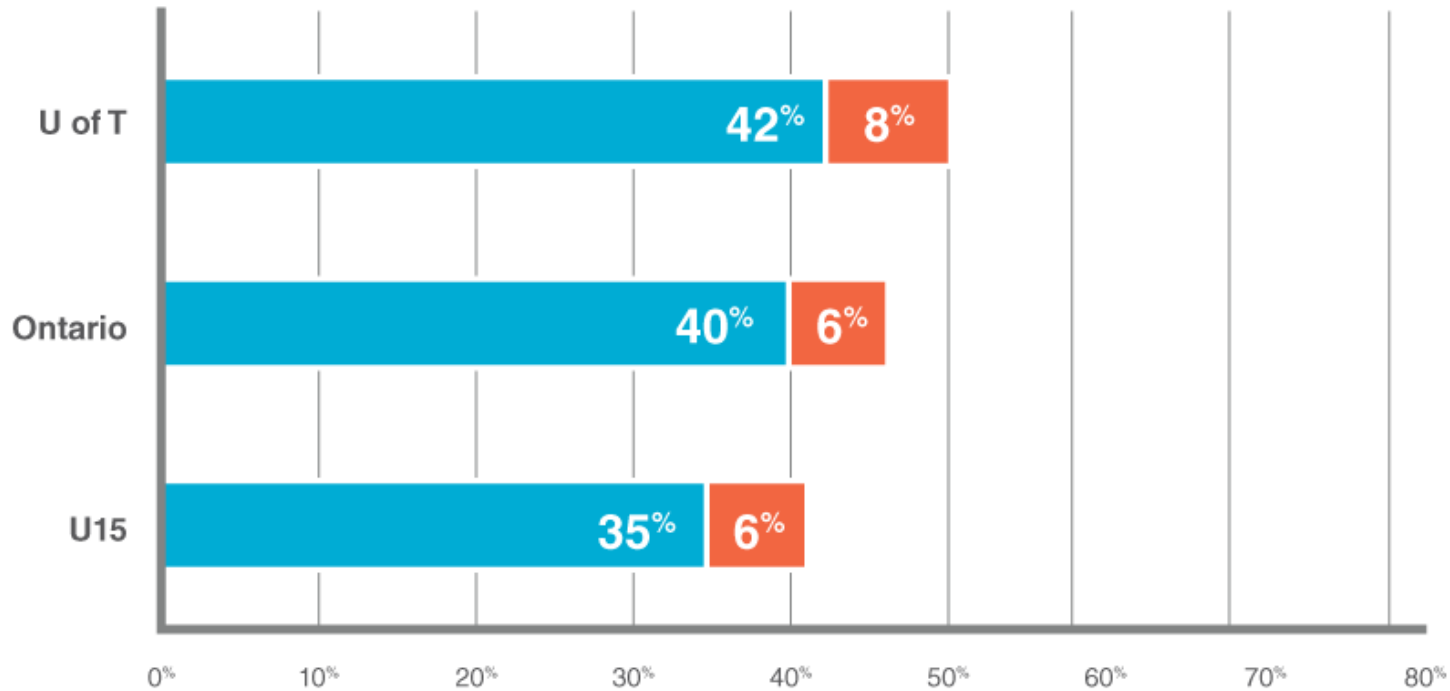
Campus Environment - Senior Year Engineering Comparator Groups



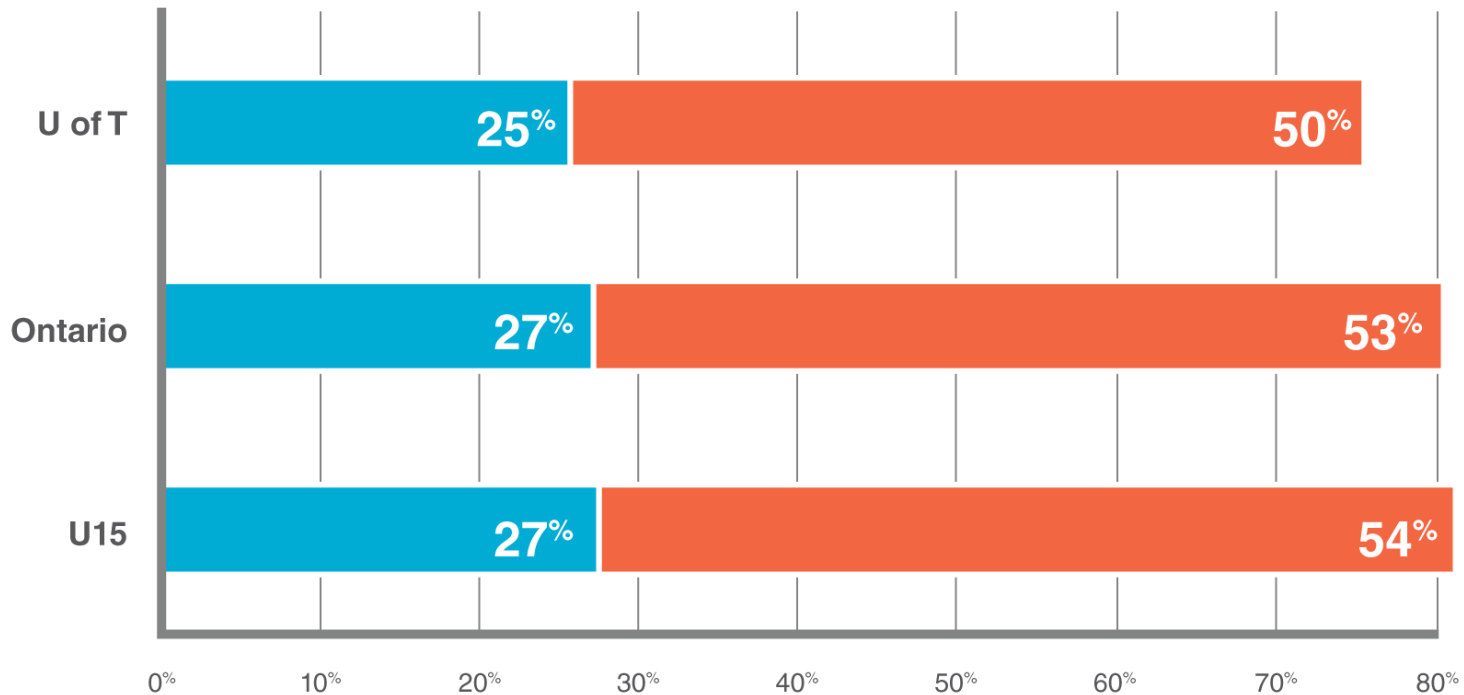
High-Impact Practices

- Learning community or some other formal program where groups of students take two or more classes together
- Courses that included a community-based project (i.e., service-learning)
- Work with a faculty member on a research project Internship, co-op, field experience, student teaching, or clinical placement
- Study abroad
- Culminating senior year experience (capstone course, senior project or thesis, comprehensive exam, portfolio, etc.)

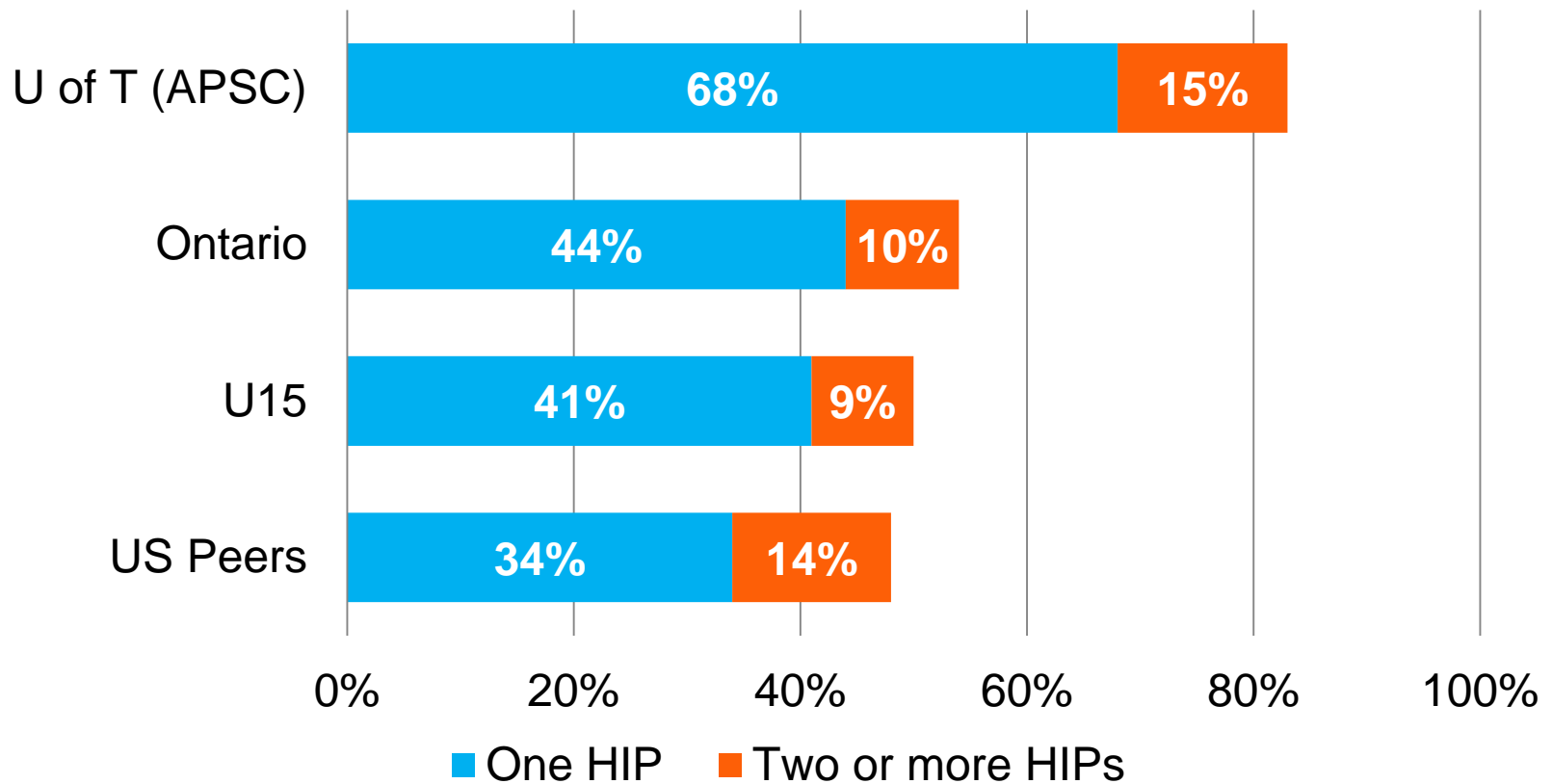
High-Impact Practices (HIP) First Year



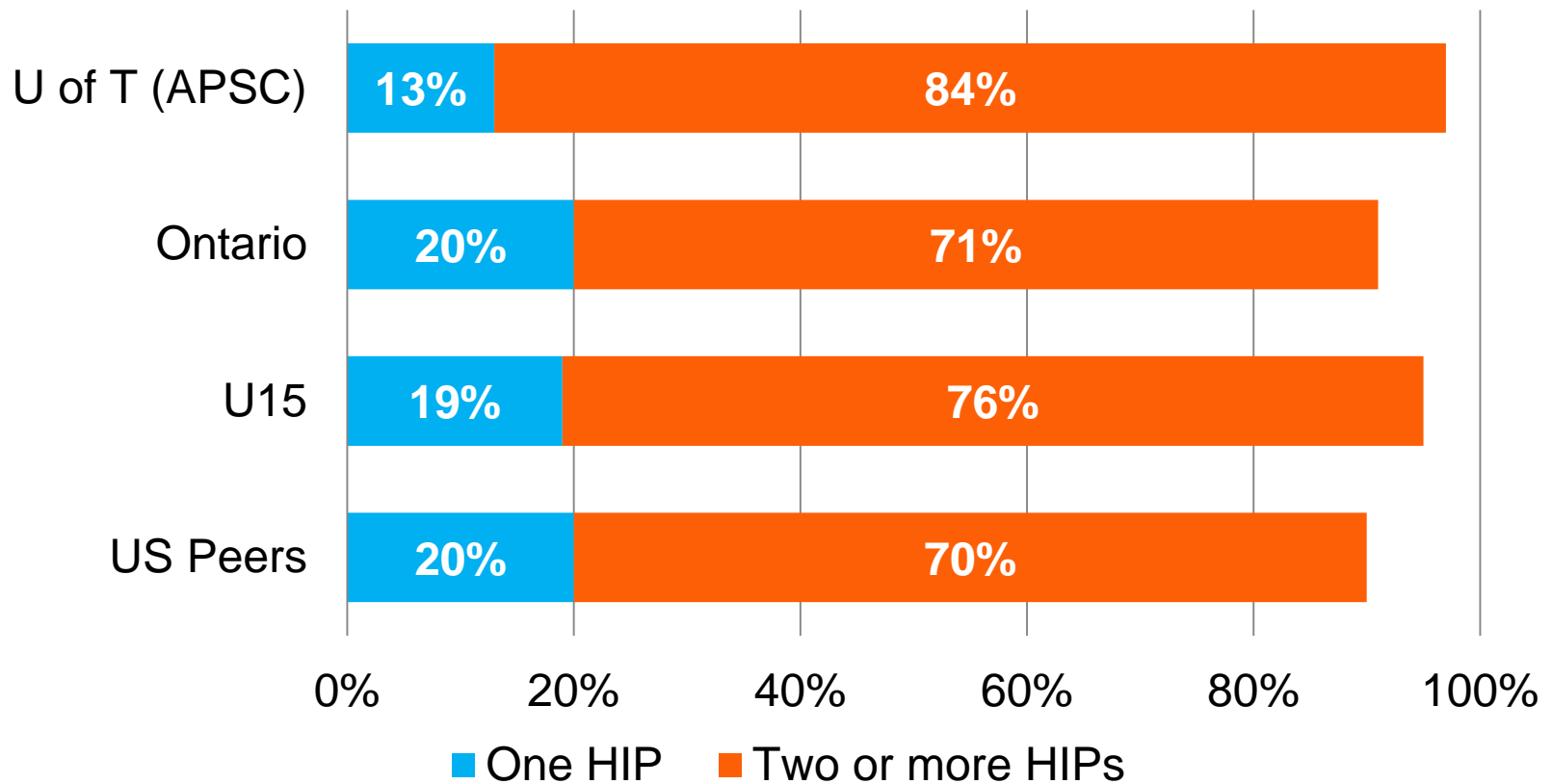
High-Impact Practices (HIP) Senior Year



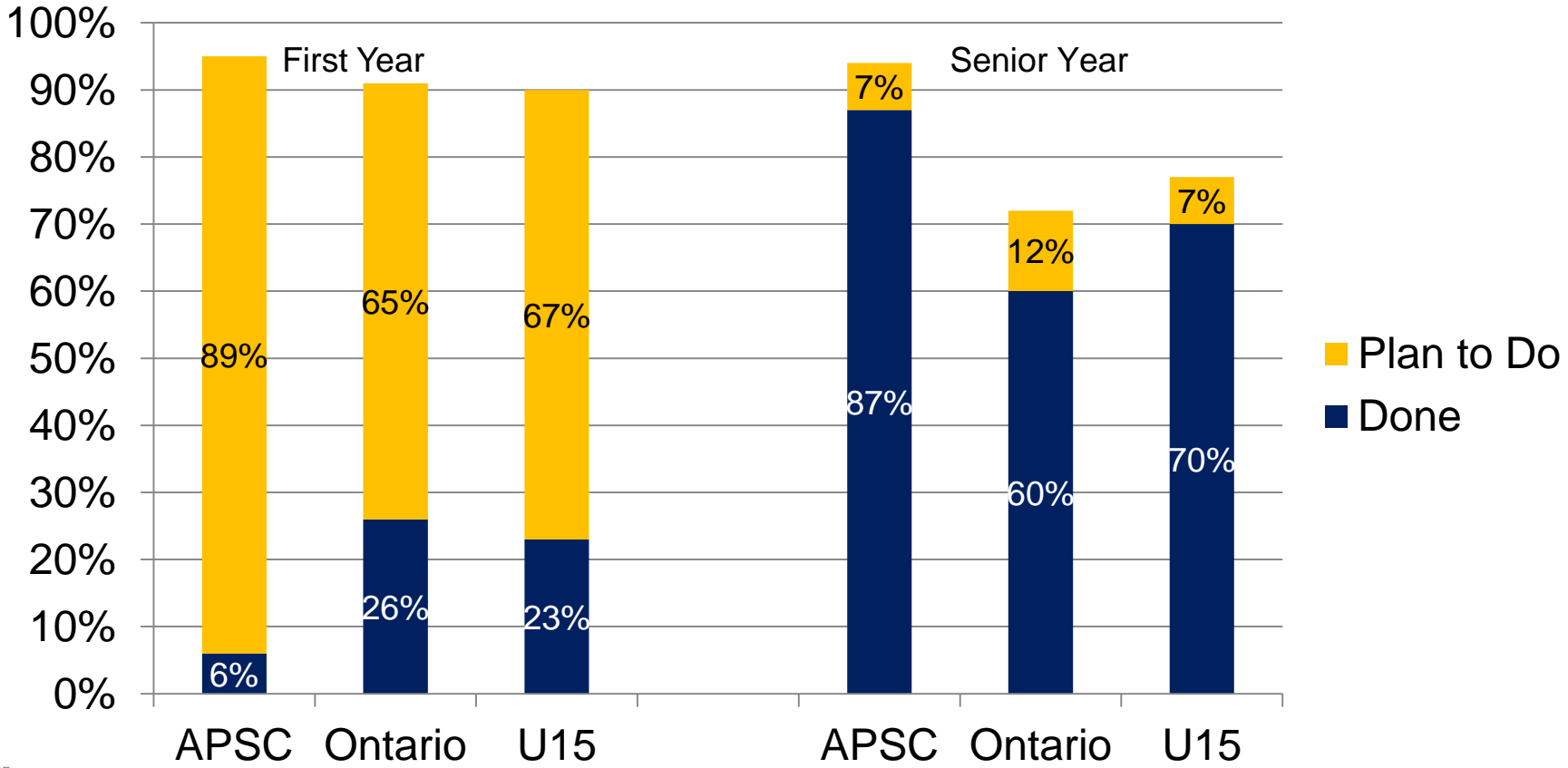
High-Impact Practices (HIP) – First Year Faculty of Applied Science & Engineering



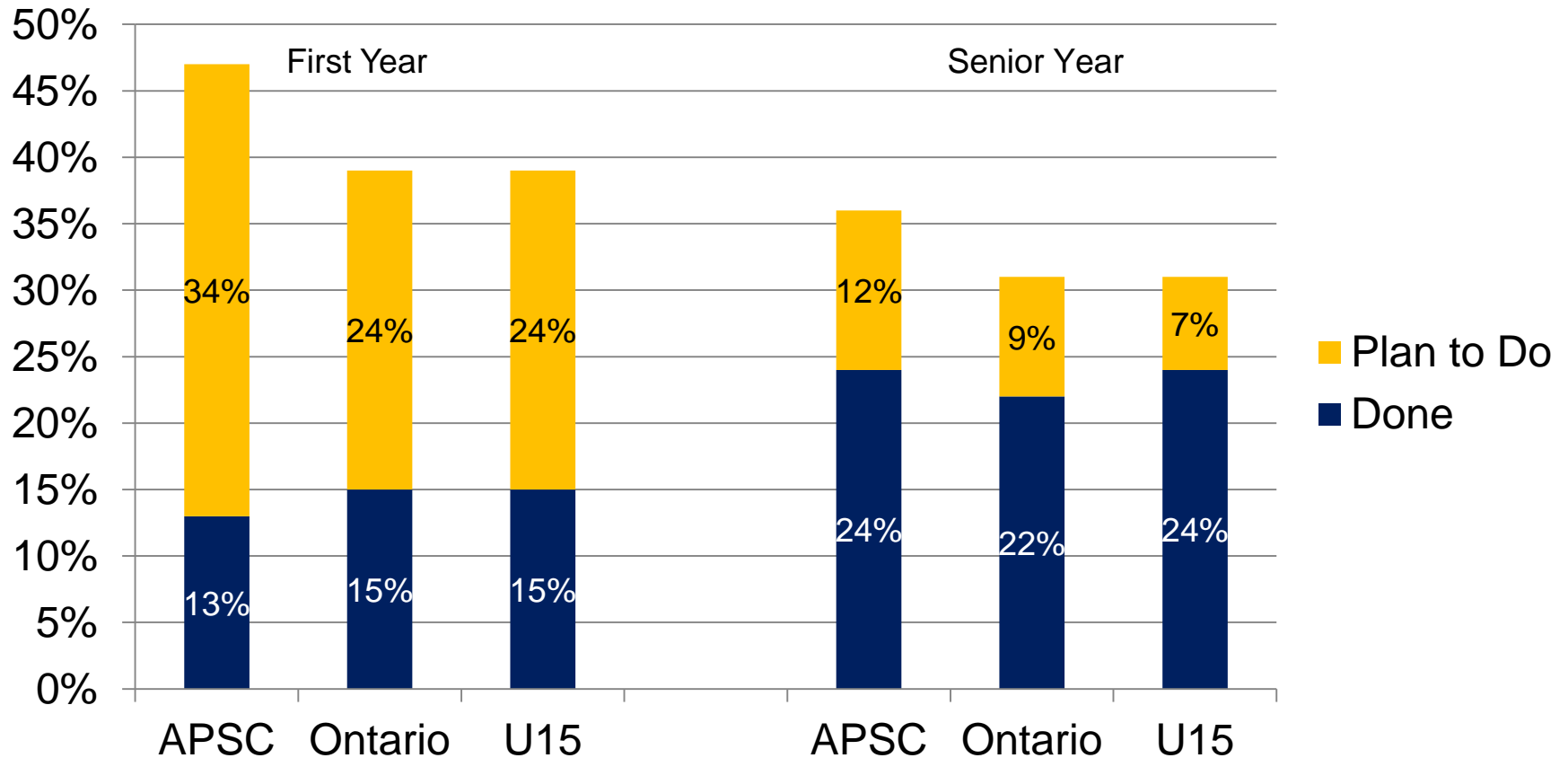
High-Impact Practices (HIP) – Senior Year Faculty of Applied Science & Engineering



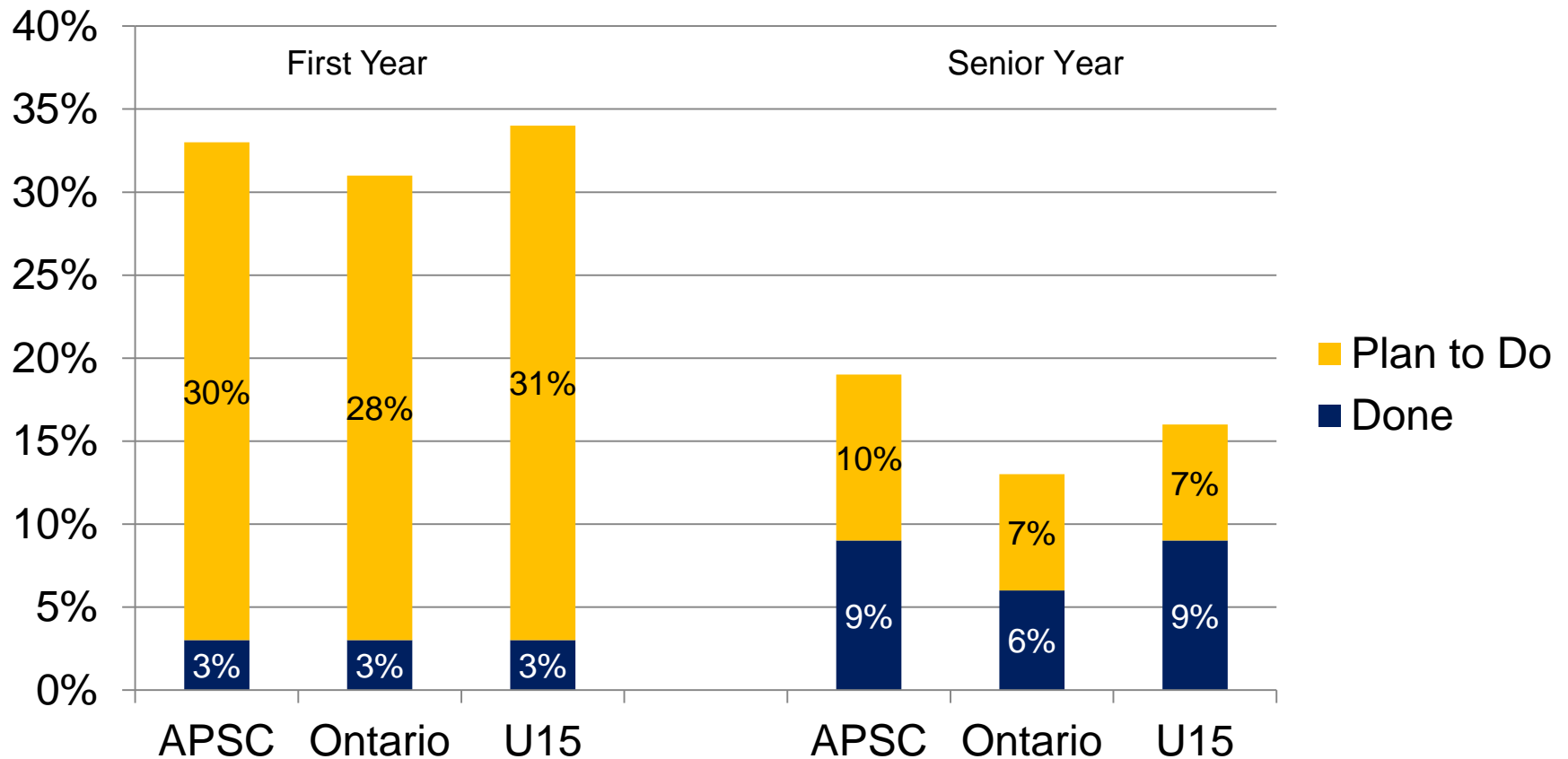
Internships, Co-ops, Field Work, Etc. Engineering Comparator Groups



Learning Communities Engineering Comparator Groups

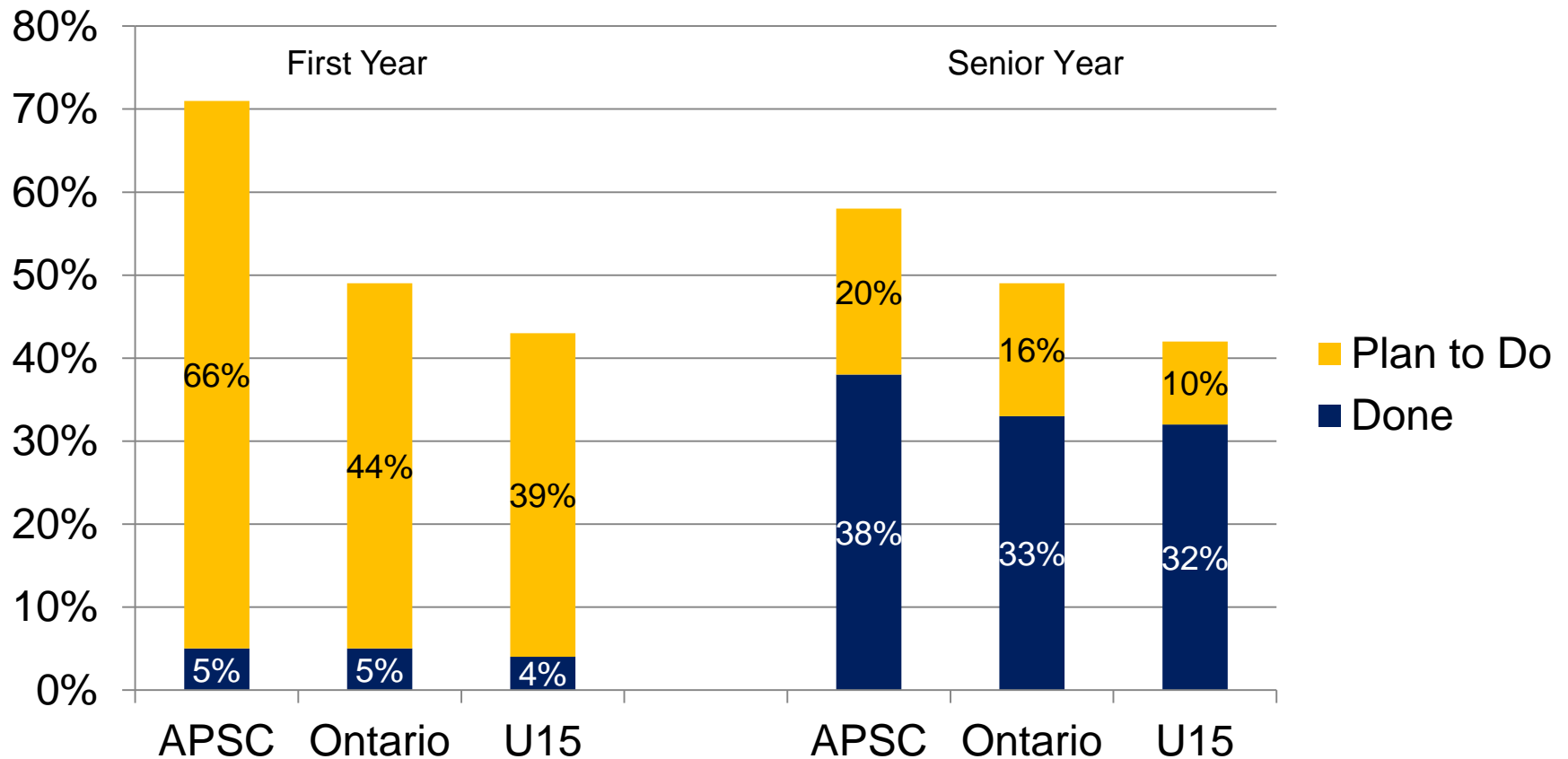


Study Abroad Engineering Comparator Groups

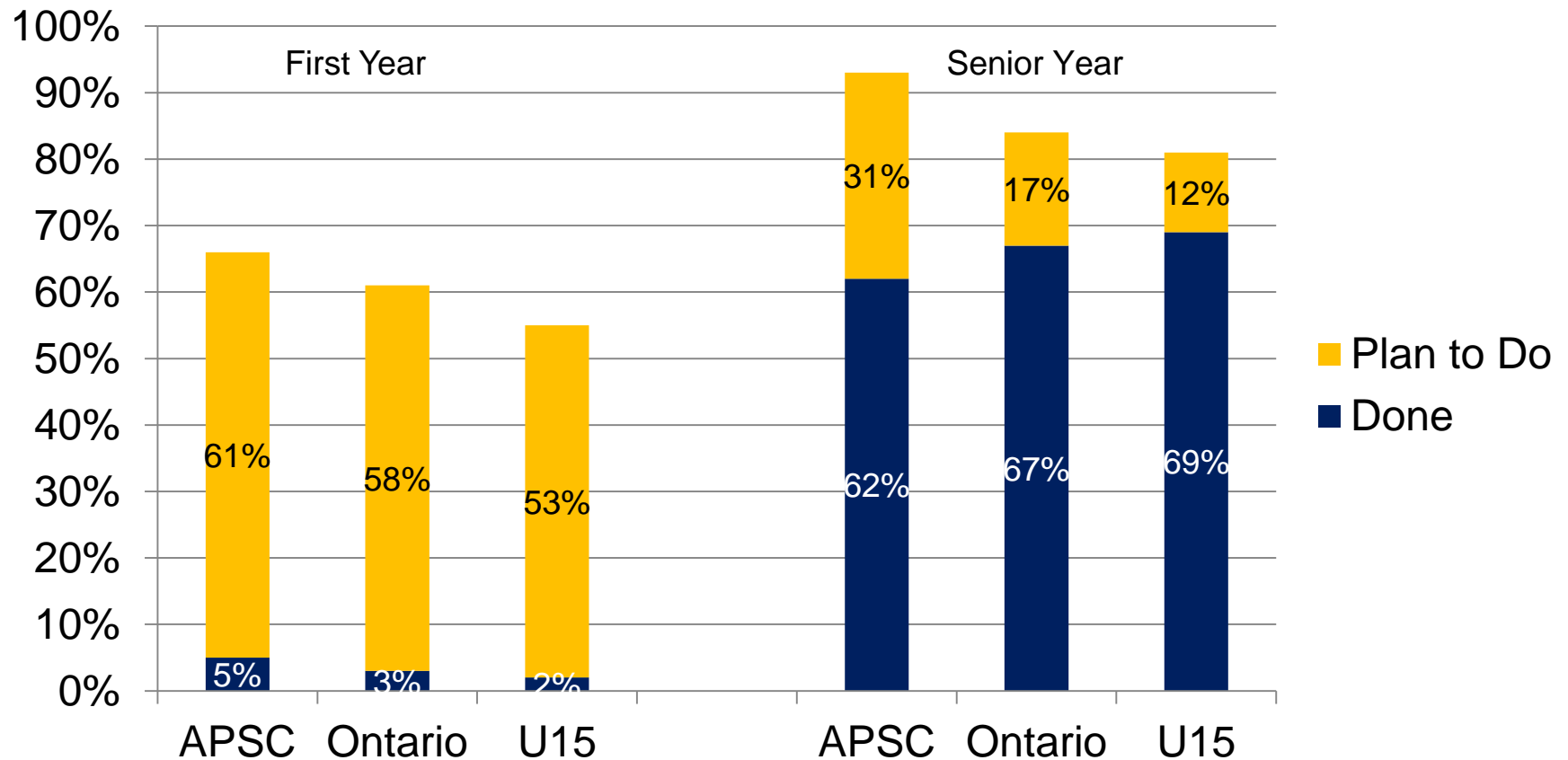


Research Project with Faculty Member

Engineering Comparator Groups



Culminating Senior Year Project Engineering Comparator Groups



**What do students in The Faculty of
Applied Science & Engineering
think should be addressed inside the
classroom?**



First Year APSC Students

1. Improving the quality of teaching assistants (45.3%)
2. Improving the quality of course instruction by professors (29.9%)
3. Ensuring a better fit between course content, assignments and tests/exams (29.0%)
4. Improving the quality of classrooms or lecture halls (21.2%)
5. Reducing class size overall (18.1%)
6. Increasing opportunities to learn more about global issues (8.6%)
7. Increasing the number or variety of course offerings in your major (8.1%)
8. Improving the quality of labs (7.5 %)
9. Providing more current/relevant courses and curriculum (6.0%)
10. Changing the mix of lectures, seminars, tutorials and labs (4.9%)
11. Increasing the number or variety of course offerings outside your major (4.9%)
12. Improving student access to information technology (4.4%)



Senior Year APSC Students

- 1. Improving the quality of course instruction by professors (37.4%)**
- 2. Ensuring a better fit between course content, assignments and tests/exams (28.4%)**
- 3. Improving the quality of teaching assistants (20.9%)**
4. Increasing the number or variety of course offerings in your major (19.4%)
5. Improving the quality of classrooms or lecture halls (16.7%)
6. Providing more current/relevant courses and curriculum (15.8%)
7. Reducing class size overall (13.5%)
8. Improving the quality of labs (12.2%)
9. Increasing opportunities to learn more about global issues (9.4%)
10. Increasing the number or variety of course offerings outside your major (5.5%)
11. Improving student access to information technology (4.3%)
12. Changing the mix of lectures, seminars, tutorials and labs (2.8%)

**What do students in The Faculty of
Applied Science & Engineering
think should be addressed outside of
the classroom?**



First Year APSC Students

- 1. Providing students with more opportunities to undertake research with Faculty (43.5%)**
- 2. Improving the quality/availability of study spaces (33.5%)**
- 3. Increasing contact with professors outside of class (32.2%)**
- 4./5. Working to provide a better social environment for students (22.8%)**
- 4./5. Expanding and/or improving the quality of academic support services (22.8%)**
- 6. Expanding and/or improving the quality of personal support services (11.6%)**
- 7. Increasing opportunities for international experiences (10.9%)**
- 8. Improving library services (2.6%)**
- 9. Improving the library collection (2.2%)**



Senior Year APSC Students

- 1. Improving the quality/availability of study spaces (43.7%)**
- 2. Providing students with more opportunities to undertake research with Faculty (39.9%)**
- 3. Increasing contact with professors outside of class (25.2%)**
- 4. Working to provide a better social environment for students (21.4%)**
- 5. Expanding and/or improving the quality of academic support services (21.1%)**
6. Increasing opportunities for international experiences (15.4%)
7. Expanding and/or improving the quality of personal support services (10.9%)
8. Improving library services (3.5%)
9. Improving the library collection (1.5%)





UNIVERSITY OF
TORONTO

Appendix F: Online Courses

Appendix F - Online courses, modules and MOOCs

<http://edtech.engineering.utoronto.ca/projects>

Current projects:

Course Code	Course Name	Course Type
APS162	Calculus for Engineers I	Online Course
APS163	Calculus for Engineers II	Online Course
	Cognitive Psychology for Engineering	Modules
	Electromagnetics and Circuits	Modules
	Engineering and Computer Science Library Series	Module
	Ethics for Engineers - English	Modules
	Ethics for Engineers – French	Modules
	Introductory Chemistry from a Materials Perspective	Online Course
APS160	Mechanics	Online Course
	Our Energetic Earth	MOOC
	Principles of Engineering Drawings	Modules
	Project Management	Online Course
	Project Management	Modules
	Engineering Communications Program – Undergraduate Thesis Writing	Modules
APS1005	Operations Research	Online Course
MIE515	Alternate Energy Systems	Online Course
	Wind, Waves, and Tides	MOOC
APS1012	Management of Innovation in Engineering	Online Course
	iOS Development	MOOC Specialization

Appendix G: Sample Course Evaluation Form

Format for Core and Faculty Student Evaluation of Teaching in Courses Questions

Office of the Registrar

Faculty of Applied Science & Engineering
35 St. George Street,
Toronto, ON M5S 1A4
Canada

Print this page

Notes:

Administrative Responsibility	Questions	Details
<p>Core institutional questions (8)</p>	<p>1. I found the course intellectually stimulating.</p> <p>2. The course provided me with a deeper understanding of the subject matter.</p> <p>3. The instructor created a course atmosphere that was conducive to my learning.</p> <p>4. Course projects, assignments, tests and/or exams improved my understanding of the course material.</p> <p>5. Course projects, assignments, tests and/or exams provided opportunity for me to demonstrate an understanding of the course material.</p> <p>Scale (Questions 1--5): Not at all >> Somewhat >> Moderately >> Mostly >> A great deal</p> <p>6. Overall, the quality of my learning experience in this course was: Scale: Poor >> Fair >> Good >> Very good >> Excellent</p> <p>7. Please comment on the overall quality of instruction in this course. Open--ended.</p> <p>8. Please comment on any assistance that was available to support your learning in the course. Open-ended.</p>	<p>Included in all U of T forms</p>
	<p>9. The course helped me improve my ability to formulate, analyze and solve problems.</p> <p>10. The instructor related course concepts</p>	

<p>Faculty of Applied Science & Engineering Questions (7)</p>	<p>to practical applications and/or current research.</p> <p>11. The course expanded my understanding of the ethical and environmental issues concerning engineering in society.</p> <p>12. The instructor explained how the course concepts related to other courses.</p> <p>13. The feedback I received on tests, assignments, labs, and/or projects provided guidance to improve my understanding of course materials.</p> <p>14. The instructor explained what students are expected to learn in the course. Scale (Questions 9-14): Not at all >> Somewhat >> Moderately >> Mostly >> A great deal</p> <p>15. What is your overall rating of the instructor as a teacher? Scale (Question 15): Poor >> Fair >> Good >> Very good >> Excellent</p>	<p>To be included on all Faculty of Applied Science & Engineering forms</p>
<p>Faculty-level questions (depending on type of course, as identified by the instructor) (1 to 2)</p>	<p>Lecture-based courses:</p> <p>16. The instructor used appropriate means to deliver the material in a clear and organized manner.</p> <p>Project-based courses:</p> <p>16. The course encouraged innovation in the project.</p> <p>17. The course provided opportunities to improve communication skills.</p> <p>Laboratory-only courses:</p> <p>16. The laboratory enhanced my understanding of science and/or engineering concepts.</p> <p>Scale: Not at all >> Somewhat >> Moderately >> Mostly >> A great deal</p>	
<p>Department-level / Instructor Questions (3 to 4)</p>	<p>Department-level and instructor questions can be introduced as long as the total number of questions is 20 or less.</p>	<p>Questions (quantitative/ qualitative) may be drawn from the central question bank.</p>

Appendix H: Library Report

**University of Toronto Libraries Report for
Faculty of Applied Science and Engineering, 2016**

Context: The University of Toronto Library (UTL) system is the largest academic library in Canada and is currently ranked 4th among academic research libraries in North America, behind Harvard, Yale and Columbia.¹ The research and special collections, together with the campus and college libraries comprise over 12 million print volumes, 5.6 million microform volumes, more than 17,000 journal subscriptions, in addition to a rich collection of manuscripts, films, and cartographic materials. The system provides access to more than 1.9 million electronic books, journals, and primary source materials and increasingly supports access via personal handheld devices.² There are numerous collection strengths in a wide range of disciplines reflecting the breadth of research and instructional programs at the University. The University of Toronto Library system has an annual acquisition budget of \$31 million. The strong collections, facilities and staff expertise attract unique donations of books and manuscripts from around the world, which in turn draw scholars for research and graduate work.

Major North American Research Libraries ³					
	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
ARL RANK	UNIVERSITY	UNIVERSITY	UNIVERSITY	UNIVERSITY	UNIVERSITY
1	Harvard	Harvard	Harvard	Harvard	Harvard
2	Yale	Yale	Yale	Yale	Yale
3	Toronto (3rd)	Toronto (3rd)	Toronto (3rd)	Toronto (3rd)	Columbia
4	Michigan	Columbia	Columbia	Columbia	Toronto (4th)
5	Columbia	Michigan	Michigan	Michigan	Michigan

Top 5 Canadian Universities in the ARL Ranking of Major North American Research Libraries					
	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
	RANK/ UNIVERSITY	RANK/UNIVERSITY	RANK/UNIVERSITY	RANK/UNIVERSITY	RANK/UNIVERSITY
	3/Toronto	3/Toronto	3/Toronto	3/Toronto	4/Toronto
	11/Alberta	10/British Columbia	18/Alberta	22/British Columbia	27/Alberta
	16/British Columbia	15/Alberta	24/British Columbia	26/Alberta	31/British Columbia
	32/Montreal	18/McGill	30/McGill	35/McGill	43/McGill
	38/McGill	32/Montreal	35/Montreal	36/Montreal	49/Calgary

Space and Access Services: The Library system provides individual and group study spaces for both undergraduates and graduates in the 10 central and 23 divisional libraries on the St. George, Mississauga, Scarborough and Downsview campuses. The Engineering & Computer Science Library provides 317 seats for study and research. Study space and computer facilities are available twenty-four hours, five days per week at one location, Robarts Library. Web-based services and electronic materials are accessible at all times from campus or remote locations, through the U of T based Scholars Portal and other leading edge digital services.

¹ Chronicle of Higher Education, "Library Investment Index at University Research Libraries, 2014 – 2015." In the Almanac of Higher Education, 2016. http://www.chronicle.com/interactives/almanac-2016?cid=cp51#id=65_416

² Figures as of 2014 taken from UTL's 2015 Annual Report and 2013-2014 annual statistics. https://oneresearch.library.utoronto.ca/sites/default/files/annual_reports/annualreport-2015.pdf and <https://oneresearch.library.utoronto.ca/annual-statistics/2013-2014>

³ Association of Research Libraries Statistics, 2014-15 <http://www.arlstatistics.org/analytics>

Instruction & Research Support: The Library plays an important role in the linking of teaching and research in the University. To this end, information literacy instruction is offered to all engineering students to assist them in developing the ability to gather, evaluate and interpret information. These services are aligned with the Association of College and Research Libraries (ACRL) Association of College and Research Libraries (ACRL) Framework for Information Literacy for Higher Education.⁴

Program Specific Instruction: Instruction occurs at a variety of levels for engineering and is provided by the faculty liaison librarians for those programs. The Engineering & Computer Science Library offers course specific instructional support to faculty and has provided support in the past to courses including BME1450, BME221, BME479, ESC101 Praxis, MSE390, APS490, CHE499, and MIE315. The Engineering & Computer Science Library also offers open instruction workshops on topics such as advanced engineering research, metrics, publishing pointers, and citation management.

The Library, through its liaison librarians, customizes feeds of library resources. These appear prominently in Portal/Blackboard course pages. The Library maintains online subject guides for aerospace engineering, biomaterials and biomedical engineering, chemical engineering, civil engineering, electrical and computer engineering, mechanical and industrial engineering, metallurgy and materials science, mining and materials engineering, as well as standards and codes and patents.

Collections: The largest collections of materials relevant to engineering are located in the Engineering & Computer Science Library, with some materials relevant to aerospace engineering held at the University of Toronto Institute for Aerospace Studies (UTIAS) Library at Downsview. The Gerstein Science Information Centre and other science libraries provide additional materials.

Collections are purchased in all formats to meet the variety of preferences and styles of current students and faculty. Special collections such as standards and codes are purchased online where possible, and the Library currently maintains subscriptions to all available current and historical standards from IEEE through its IEEE Explore online subscription, and all available current and historical standards from ASHRAE, ASME, CSA, CGSB, IEC, ISO, NFPA and UL through its Techstreet online subscription. The University of Toronto Library is committed to collecting both print and electronic materials in support of all engineering programs at the University.

Journals: The Library subscribes to electronic copies of all of the top 25 journals listed in Journal Citation Reports (JCR)⁵ in subject categories chemical, civil, electrical and electronic and environmental engineering, and in multidisciplinary material sciences, energy and fuels, and mechanics. The Library maintains subscriptions to the majority of the top 25 journals listed in JCR in the remaining subject categories relevant to Faculty of Applied Science and Engineering programs, and these are available to students and faculty in electronic format:

⁴ Association of College & Research Libraries. Framework for Information Literacy for Higher Education. ACRL, 2016. http://www.ala.org/acrl/sites/ala.org/acrl/files/content/issues/infolit/Framework_ILHE.pdf

⁵ 2014 Journal Citation Reports® (Thomson Reuters, 2014)

Category	subscriptions to JCR top 25
BIOTECHNOLOGY & APPLIED MICROBIOLOGY	23
CHEMISTRY, APPLIED	23
COMPUTER SCIENCE, SOFTWARE ENGINEERING	24
CONSTRUCTION & BUILDING TECHNOLOGY	24
ENGINEERING, AEROSPACE	18
ENGINEERING, BIOMEDICAL	23
ENGINEERING, GEOLOGICAL	22
ENGINEERING, INDUSTRIAL	21
ENGINEERING, MANUFACTURING	21
ENGINEERING, MECHANICAL	23
ENGINEERING, MULTIDISCIPLINARY	18
ENVIRONMENTAL SCIENCES	24
ERGONOMICS*	15
FOOD SCIENCE & TECHNOLOGY	24
MATERIALS SCIENCE, BIOMATERIALS	23
METALLURGY & METALLURGICAL ENGINEERING	20
MINING & MINERAL PROCESSING**	16
NANOSCIENCE & NANOTECHNOLOGY	22
POLYMER SCIENCE	24
ROBOTICS***	19
TELECOMMUNICATIONS	24
TRANSPORTATION	20
TRANSPORTATION SCIENCE & TECHNOLOGY	19

*category contains 15 journals in total

**category contains 20 journals in total

***category contains 23 journals total

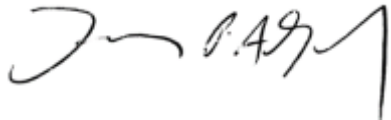
Monographs: The University of Toronto Library maintains comprehensive book approval plans with 53 book dealers and vendors worldwide. These plans ensure that the Library receives academic monographs from publishers all over the world in an efficient manner. For engineering, monographs are purchased in electronic form where possible. The Library currently receives all current e-books directly from the following publishers: Springer, Elsevier, Wiley, Taylor & Francis. The Library also maintains a subscription to a number of subject areas of the Knovel engineering e-book collection.

Preservation, Digitization, and Open Access: The University of Toronto Library supports open access to scholarly communication through its institutional research repository (known as T-Space), its open journal and open conference services, and subscriptions to open access publications. In addition to acquiring materials in support of engineering, the Library has, in cooperation with the Internet Archive, digitized its monograph holdings published before 1923. These books are available without charge to anyone with access to the Internet through the Scholar's Portal e-Book platform.

Key Databases: *Compendex, Scopus, Web of Science, IEEE Xplore, Techstreet, ACM Digital Library, GeoRef, GeoBase, Paper Village, SciFinder Scholar and Reaxys.*

Prepared by: Cristina Sewerin, Acting Head, Engineering & Computer Science Library, May 25, 2016. Updated with revised charts by Rita Vine, Head, Faculty & Student Engagement, September 29, 2016

Submitted by: Larry Alford, Chief Librarian, University of Toronto Libraries, September 30, 2016.

A handwritten signature in black ink, appearing to read "Larry Alford". The signature is stylized and cursive, with a large initial "L" and "A".

Appendix I: Engineering Computing Facility (ECF) Report

Engineering Computing Facility

ECF's primary mandate is to supply and support a computing infrastructure to assist in the delivery of the curriculum to the Faculty's more than 6,600 undergraduate and MEng students as well as more than 1,600 MASc and PhD students. Student accounts are generated automatically after they are invited to join the program and remain active until they are no longer with the Faculty. MASc and PhD students are also given access to ECF if their course work requires access to specific software.

By adopting a five-year hardware renewal cycle for lab PCs, ECF is able to keep pace with the demands of modern software packages, providing the students and faculty with an up-to-date computing environment.

ECF provides a variety of computing services for teaching and research within Engineering, as well as offering support for departmental computers and computer communication throughout the Faculty. Every undergraduate student in the Faculty is entitled to an ECF account, and relatively few constraints are placed on the usage of the system. The intention is to have the computing system used as often as the student requires it in his or her studies, just as one might use a library or other communal resource.

There are two major components to ECF: general Linux services and a Microsoft Windows environment. The general-purpose Linux machines consist of 183 Faculty PCs and a remote access multiprocessor running Red Hat Linux distributed through 3 labs in the Sandford Fleming building. The Windows environment is composed of Faculty and Departmental labs with approximately 800 PCs, running Windows 7, distributed through 20 labs in 8 buildings plus a remote lab at UTIAS, as well as remote access multiprocessor servers. All these systems are interconnected with Ethernet, and share files (using NFS/CIFS). They are also connected to the campus backbone network, and to the Internet. This provides email and file transfer capabilities, and access to remote sites, such as supercomputer facilities.

ECF Labs and remote access systems are available 24/7/365. The remote access environment allows users to connect from anywhere on the Internet and work as if they were sitting in a Faculty lab. Users can work from the comfort of their home, running expensive applications on ECF computers, accessing their ECF files and printers as well as their own home printer.

Choice of software is determined by the professor with assistance from ECF staff when necessary. Software costs are covered initially by the Department but later by ECF if the application is used across multiple disciplines. A list of available software is given at the end of this document. There are some cases where legacy software will not run under the Windows 7 operating system, so these applications are run in a virtual environment.

Faculty, staff and students are given free access to a wide variety of Microsoft software through the Microsoft Imagine program. Access is determined on a term-by-term basis and expires when the faculty/staff/student is no longer with the Faculty. The Faculty is also a member of Partners for the Advancement of Collaborative Engineering Education, PACE, giving ECF free access to a set of expensive software packages. Free student versions of Autodesk software are also available for download.

ECF supports an email system for all its users. The mail server also supports a number of Email lists available for communicating with specific student groups. Lists are updated daily from registration data and give staff the ability to target students in specific courses, departments, years of study, course options etc.

ECF supports a number of web related services. All ECF computer accounts are entitled to a personal ECF website which can be used to support course activity as well as host student specific information. This server is also used to host some administrative and departmental sites where specific services are required which are not supported by the Faculty CMS. Another webserver is used to supply a number of online services in support of ECF such as password changes, access to Email, print history/quota, front end to the ECF remote access systems, student account administration as well as systems status for network switches and machine room temperatures.

Students and staff can access the labs by swiping their University TCard. A card reader is placed at each ECF lab door. Student card access is given automatically when they register with the Faculty and is removed when they are no longer registered or if a lab is closed for service or holidays. The same Tcard can be used to access the buildings after hours, providing a safe environment for students to work late at night. The ECF office suite, all ECF labs and the buildings they reside in are wheelchair accessible.

Students are given a print quota each term based on their specific course load. Students are sent a warning email as they approach their limit or exceed it. They will not be prevented from printing but will be required to pay for excess printing at the end of term. Each lab has at least one high-speed laser printer and all are capable of duplex printing. A separate student services area, located in the ECF office suite, supplies document scanners and a colour printer. This area also hosts three Windows PCs and one Linux PC where students can demonstrate their problems to ECF staff. Computing resources and print quota are adjusted on an individual basis to accommodate any special needs students.

ECF has three computer systems administrators for Windows and two for Linux systems as well as a lab technician to service lab PCs and printers. The business officer is also the initial point of contact regarding problems with ECF systems and directs students to systems staff when necessary.

Software Available

- Adobe Acrobat 11 Pro and Adobe Reader X
- Altair HyperWorks 13.0
- Altera Quartus 16.0 light edition
- AMPL
- ANSYS 16 64 bit
- ArcGIS Desktop 10.4
- Age/Con
- Aspen Engineering V 9.5
- Autodesk 2016
- Bloodshed Dev-C++
- Bridge Point
- BRugs
- CATIA 5
- CES Edupack 2015
- Codeblocks
- CogLab
- IBM ILOG: CPLEX Optimization Studio (64 bits) 12.5.1
- Dynamic C++
- ECLIPSE
- Environment Canada Data Explorer
- EPA SWMM 5.0
- Fact Sage 6.4
- Geovia Gems 6.7
- Geovia Whittle 4.5.5
- Google Sketchup 8
- Google Sketchup 2015
- Gurobi 6.5
- HEC-RAS 4.1.0
- HOT2000
- HTRI X Changer Suit Educational
- InfraRecorder CD Burner Software
- INRO Emme 4.0.6
- LAMMPS
- MapTek Vulcan 9.1.4 64 bit
- Matlab R2016a 64 bit
- Microsoft Excel 2016
- Microsoft Office Access Professional 2016
- Microsoft Office Tools
- Microsoft Office Visio Professional 64 bit
- Microsoft
- PhotoDraw V2
- Microsoft PowerPoint Professional 2016
- Microsoft Project Professional 2016
- Microsoft Publisher
- Microsoft Visual InterDev
- Microsoft Visual Studio 2010
- Microsoft Word Professional 2016
- MINITAB 16
- MS Visual Basic
- MS Visual C++
- MS Visual Studio Express 2010
- MSC Adams 2013 64 bit
- Nitica
- OLI systems (ESP 9.0 Anayzer 9.0)
- Open Bugs
- Orest
- Palisade Decision Tools 7.0
- Processing Modflow
- Perdec
- Protege
- Prover9 and Mace4
- Pspice 9.1 Student Version
- Putty
- Python 3.1
- R
- RETScreen
- Rocscience Software suit
- Runge Software
- SAP 2000 14
- S-Frame Software Suit
- SBEDS
- Screen Pass Admin Tool 6.0
- Screen Share
- Silverlight
- SIMUL8 2016
- SolidWorks 2015 64 bit
- SolverStudio
- SSH
- Statfit
- TaskArchitect
- Talpac
- Vesta
- Vico software
- West Point Bridge Builder
- WollFram CDF Player Plugin
- Working model 2D 5.0

Appendix J: Graduate Degree Requirements, Curriculum Areas and Research Themes

Appendix J1: Graduate Degree Requirements

The degree requirements for the research stream degrees (MAsc and PhD) and the professional stream (MEng and MHSc) differ primarily in the nature of the required number of courses and in the required thesis for doctoral stream students. The professional stream students take significantly more classes than those in the research stream; the courses provide the MEng/MHSc students with exposure to a broad range of material to enhance their industry experience. The research stream students, on the other hand, take fewer and more focused courses which naturally lead into either a research-based project for the MAsc or the doctoral thesis, which is supervised by a faculty member, or co-supervised for collaborative programs.

The course requirements for the various degree programs are tabulated by graduate unit in [Table J1.1](#). In most departments, a portion of the MEng course requirements can be met by doing an independent project, but this is optional. The number of courses that can be covered by the project is also given in [Table J1.1](#) (indicated in parentheses). MEng programs also have requirements for the ratio of technical to non-technical courses, and the number of technical courses that are taken in the home department. For example, in Chemical Engineering and Applied Chemistry (CHE), a minimum of 6 of the 10 courses must be technical and 3 must be in CHE. A maximum of 3 may be non-technical and a maximum of 3 can be 500-level courses (undergraduate courses open to graduate students that are either technical or non-technical). In Civil and Mineral Engineering, 6 of the 10 courses must be taken in the home department with a maximum of 4 outside of the department and two may be taken outside of the U of T as a visiting student at another institution.

Table J1.1 Graduate Course Requirements, by Degree Program

Graduate Unit	Half-Course Requirements		
	MEng/MHSc (Project)	MAsc	PhD (With Masters/Direct Entry or Transfer)
AER	10 (1)	5	4/7
IBBME	7 (internship/thesis)	4	2/6
CHE	10 (3)	3	4/6
CIV	10 (1 or 2)	5	4/9
ECE	9 (3)	5	5/8
MIE	10 (3)	4	5/7
MSE	10 (3)	4	4/7

Appendix J2: Description of Degree Program Curriculum Areas or Research Themes

University of Toronto Institute for Aerospace Studies (AER) - 2016

- Aircraft Flight
- Aerodynamics, Fluid Dynamics, and Propulsion
- Structures, Design and Optimization
- Space Systems Engineering
- Engineering Physics

Institute of Biomaterials and Biomedical Engineering (IBBME) - 2016

- Biomaterials, Tissue Engineering and Regenerative Medicine
- Engineering in a Clinical Setting
- Nanotechnology, Molecular Imaging and Systems Biology
- Neural, Sensory Systems & Rehabilitation

Chemical Engineering & Applied Chemistry (CHE) - 2016

- Bioprocess Engineering
- Sustainable Energy
- Surface and Interface Engineering
- Pulp and Paper
- Informatics
- Chemical and Materials Process Engineering
- Environmental Science and Engineering
- Biomolecular and Biomedical Engineering

Civil Engineering (CIV) - 2016

- Building Engineering
- Environmental Engineering
- Structural Engineering
- Transportation Engineering and Planning
- Mining and Geomechanics

Electrical and Computing Engineering (ECE) - 2016

- Biomedical Engineering
- Communications
- Computer Engineering
- Electromagnetics
- Electronics
- Energy Systems
- Photonics
- Systems Control

Materials Science and Engineering (MSE) - 2016

- Advanced Coating Technologies and Ceramics
- Biomaterials and Biotechnology
- Composites, Polymers and Hybrid Materials
- Computational Materials Engineering
- Electronic Materials and Systems
- Energy Devices, Systems and Technologies
- Materials Fracture and Failure
- Materials Processing and Modelling
- Nanomaterials and Nanotechnology

Mechanical and Industrial Engineering (MIE) - 2016

- Applied Mechanics and Design
- Advanced Manufacturing and Materials Engineering
- Biomedical Engineering
- Energy and Environmental Engineering
- Human Factors/Ergonomics
- Information Engineering
- Operations Research
- Robotics, Mechatronics and Instrumentation
- Thermal and Fluid Sciences Engineering

Appendix K: Research Centres and Institutes

Appendix K: U of T Engineering Research Centres and Institutes

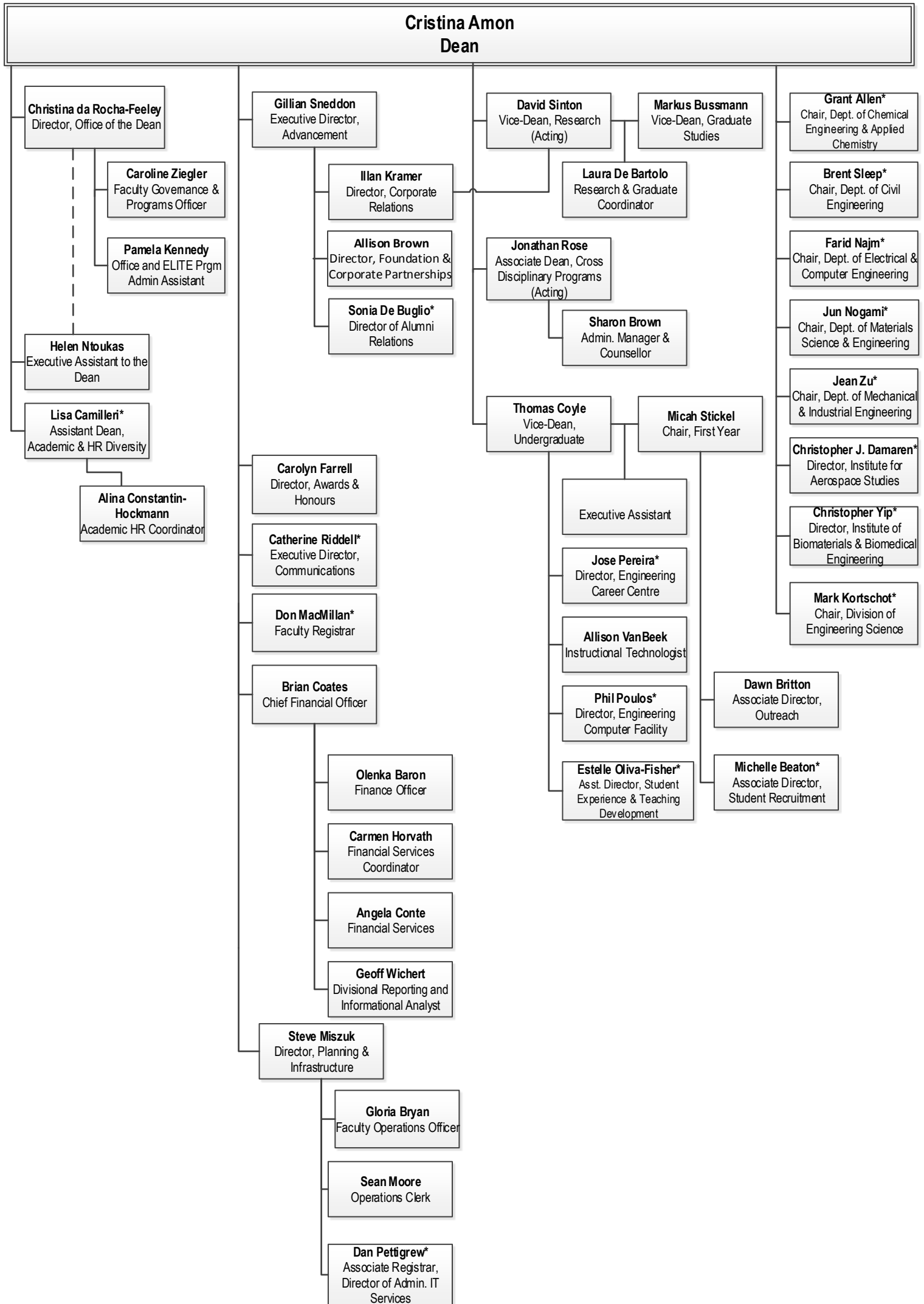
U of T is home to 26 multidisciplinary research centres and institutes that bring together world-leading expertise from across our Faculty. The complete list is below. Note the list does not include the Institute of Biomaterials & Biomedical Engineering (IBBME), the University of Toronto Institute for Aerospace Studies (UTIAS) or the Division of Engineering Science (EngSci) as these function as autonomous academic areas.

Research Centre/Institute	Chair or Director	Website
BioZone	Elizabeth Edwards	http://www.biozone.utoronto.ca/
Centre for Advanced Coating Technologies (CACT)	Javad Mostaghimi	http://www.mie.utoronto.ca/labs/cact/
Center for Advanced Diffusion-Wave and Photoacoustic Technologies (CADIPT)	Andreas Mandelis	https://cadipt.mie.utoronto.ca/
Centre for Advanced Nanotechnology	Harry Ruda	http://sites.utoronto.ca/ecan/
Centre for Aerial Robotics Research and Education (CARRE)	Hugh Liu	http://www.utias.utoronto.ca/aerial-robotics/
Centre for Healthcare Engineering (CHE)	Timothy Chan	http://che.utoronto.ca/
Centre for Global Engineering (CGEN)	Yu-Ling Cheng	http://cgen.utoronto.ca/
Centre for Maintenance Optimization & Reliability Engineering (C-MORE)	Mike Kim	http://cmore.mie.utoronto.ca/
Centre for Management of Technology and Entrepreneurship (CMTE)	Joseph Paradi	http://www.cmte.utoronto.ca/
Centre for Power and Information (CPI)	Deepa Kundur	https://www.ece.utoronto.ca/research/centres/cpi/
Centre for Research in Sustainable Aviation (CRSA)	Olivera Kesler	http://www.utias.utoronto.ca/sustainable-aviation/
Centre for the Resilience of Critical Infrastructure (CRCI)	Jeffrey Packer	http://www.crci.utoronto.ca/
Identity, Privacy and Security Institute (IPSI)	Dimitros Hatzinakos	http://www.ipsi.utoronto.ca/
Institute for Leadership Education in Engineering (ILead)	Doug Reeve	http://ilead.engineering.utoronto.ca/
Institute for Robotics and Mechatronics (IRM)	Goldie Nejat	http://irm.utoronto.ca/

Institute for Sustainable Energy	Aimy Bazylak	http://energy.utoronto.ca/
Institute for Water Innovation (IWI)	Vladimiro Papangelakis	http://water.utoronto.ca/
Lassonde Institute of Mining	John Hadjigeorgiou	http://lassondeinstitute.utoronto.ca/
Ontario Centre for the Characterization of Advanced Materials (OCCAM)	Charles Mims/Doug Perovic	http://occam.utoronto.ca/
Pulp and Paper Centres (PPC)	Honghi Tran	http://www.pulpandpaper.utoronto.ca/
Southern Ontario Centre for Atmospheric Aerosol Research (SOCAAR)	Greg Evans	http://www.socaar.utoronto.ca/
Toronto Institute for Advanced Manufacturing (TIAM)	Hani Naguib	http://tiam.engineering.utoronto.ca/
Toronto Intelligent Transportation Systems (ITS) Centre and Testbed	Baher Abdulhai	http://civil.engineering.utoronto.ca/research/transportation/
Toronto Nanofabrication Centre	Wai Tung Ng	http://tnfc.utoronto.ca/
University of Toronto Institute for Multidisciplinary Design & Innovation (UT-IMDI)	Kamran Behdinan	http://imdi.mie.utoronto.ca/
University of Toronto Transportation Research Institute (UTTRI)	Eric Miller	http://uttri.utoronto.ca/

Appendix L: U of T Engineering Organizational Chart 2016

Faculty of Applied Science & Engineering Organizational Chart



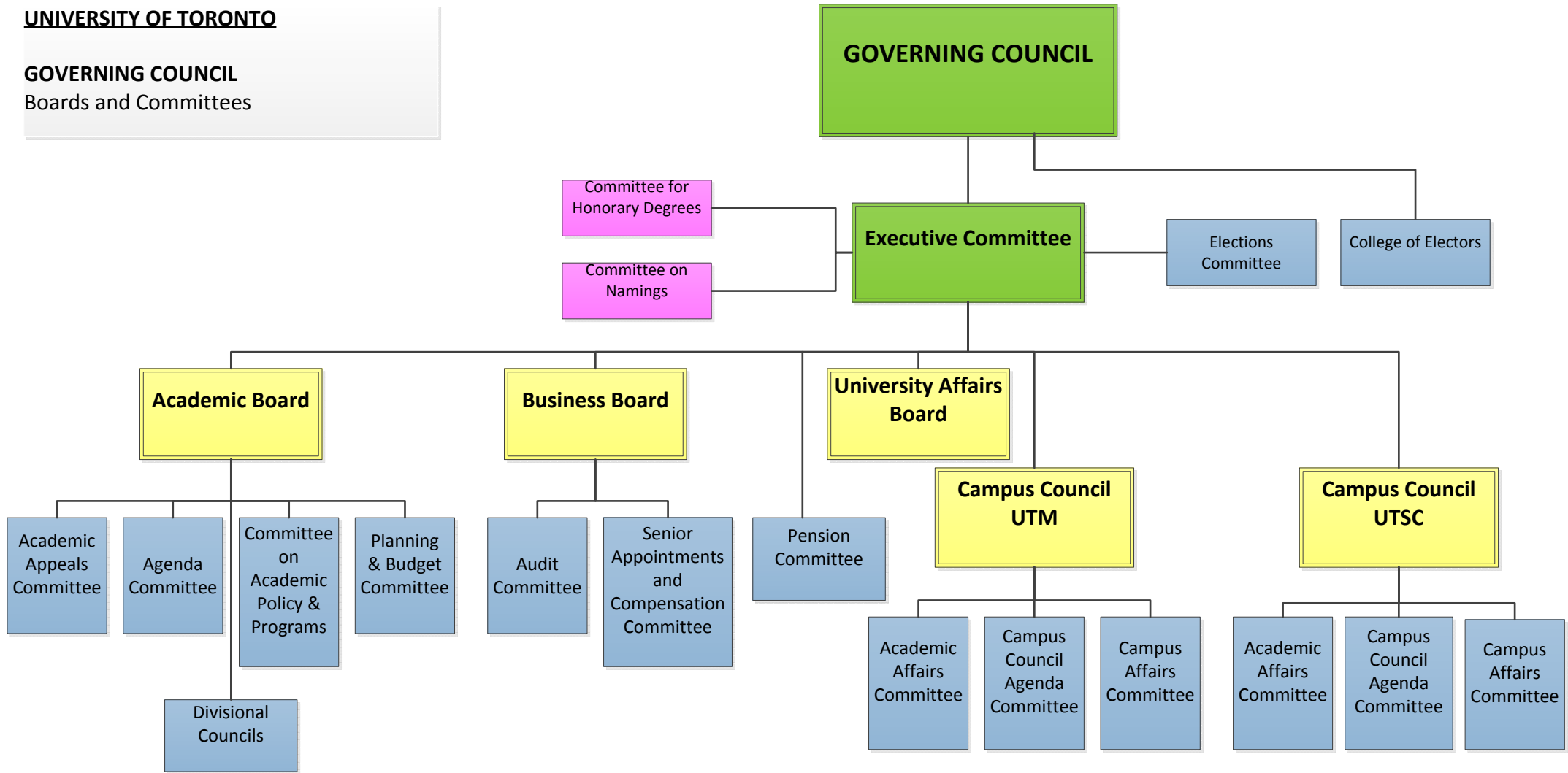
*Further Levels of organization exist beyond scope of this document

Appendix M: Governing Council

UNIVERSITY OF TORONTO

GOVERNING COUNCIL

Boards and Committees



The Governing Council of the University of Toronto
Membership Listed by Estate
2016-2017

Ex Officio

The Honourable Michael H. Wilson (Chancellor)

Professor Meric S. Gertler (President)

Administrative Staff

Mr. P.C. Choo

Ms Catherine Riddell

Alumni

Mr. Harvey T. Botting

Mr. David N. Bowden

Mr. Gary D. Goldberg

Mr. Nykolaj F. Kuryluk

Mr. Andrew Szende

Mr. W. Keith Thomas

Mr. Bruce Winter

Ms Samra Zafar

Government Appointee

Ms Shirley Hoy (Chair)

Ms Jane Pepino (Vice-Chair)

Mr. Preet Banerjee

Dr. Catherine Bragg

Mr. Jeff P. Collins

Ms Janet Lynne Ecker

Mrs. Zabeen Hirji

Mr. Brian K. Johnston

Ms Claire M.C. Kennedy

Mr. R. Mark Krembil

Mr. Brian D. Lawson

The Governing Council of the University of Toronto
Membership Listed by Estate
2016-2017

Government Appointee

Mr. John Paul Morgan

Ms Melinda M. Rogers

Mr. Mark Henry Rowswell

Mr. Howard L. Shearer

Mr. John Switzer

Full-time Undergraduate Student

Mr. Mohammad Amin

Mr. Aidan H. Fishman

Mr. Jorge May

Mr. Bingchen (Tony) Shan

Graduate Student

Ms Christine Moon

Mr. David Alex I. Nyikos

Part-time Undergraduate Student

Ms Susan Froom

- TBA

Presidential Appointee

Professor Bruce Kidd

Professor Cheryl Regehr

Teaching Staff

Dr. Avrum I. Gotlieb

Professor Hugh P. Gunz

Professor Paul Kingston

Professor Ernest W.N. Lam

The Governing Council of the University of Toronto
Membership Listed by Estate
2016-2017

Teaching Staff

Professor Mark Lautens

Professor Jan K. Mahrt-Smith

Professor Andrea M. Sass-Kortsak

Professor Elizabeth M. Smyth

Professor Salvatore M. Spadafora

Professor Janice Gross Stein

Professor Nicholas Terpstra

Professor Steven J. Thorpe

Appendix N: Catalogue of Priorities



UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Catalogue of Advancement Priorities

Updated: September 1, 2010

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Enriching Student Experience

Globalization

Research and Academic Priorities

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Energy, Environment & Sustainability
Information Communications & Technology
Nanoengineering

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Section 1.0 - Executive Summary

Engineers play a fundamental role in advancing human development. Globalization is linking people and economies across geographic space and time in ways they have never been linked before. In the face of this new reality, there is a need to develop a new educational paradigm that prepares engineers to work across cultures and disciplines in an unprecedented collaborative manner. With its depth of research and international perspective, the Faculty of Applied Science and Engineering at the University of Toronto will nurture a new generation of engineers – technically strong and globally adept – to address some of the most pressing and complex issues of our time.

This document outlines the Faculty of Applied Science and Engineering's philanthropic plan to financially support the following efforts:

1. Attract and engage a diverse, talented and creative body of undergraduate students in a manner that prepares them to assume leadership positions in the global economy;
2. Be a magnet for the best and the brightest engineering undergraduate and graduate students from around the world whose contributions will further strengthen our diversity and global perspective;
3. Recruit and retain an internationally renowned faculty, characterized by the quality of their teaching, the significance of their research, and caliber of the honours and funding they secure;
4. Be recognized internationally for the intellectual innovation, collaborative approach, and creativity of our educational and research programs, specifically in the areas of bioengineering, nanoengineering, energy and sustainability, and information communications and technology;
5. Create new and enhance existing facilities that reflects the aspirations and quality of our students and faculty.

Building for our Future

Attracting and empowering the finest faculty, staff, and students depends on the Faculty's ability to provide an environment that fosters creativity and inspires twenty-first-Century learning and discovery.

Success in our mission requires the eminent minds to undertake these endeavours. Endowing chairs within the four key areas of research will be a first step in securing our place among the world's leading research centres and providing our students with faculty mentors. Scholarships are also fundamental to our ability to attract the most talented students from Canada around the world.

Finally, our success in pursuing new areas of engineering innovation has created the need for specialized work areas, more laboratories and new kinds of classrooms. Our historic buildings, designed for the academic needs of the nineteenth century, need to be updated to accommodate contemporary learning technology and multi-disciplinary research that will assist faculty bring whole new dimensions of sight and sound to their lessons and research. Most of our academic buildings need to be designed to move students and faculty out of their disciplinary silos and into common areas that encourage collaboration. New buildings and the thoughtful renovation of our cherished spaces will also provide faculty, undergraduate and graduate students with powerful incentives to choose the University of Toronto.

SECTION 2.0 - OVERVIEW

During the Campaign, the Faculty witnessed tremendous success, raising approximately \$125 million against a target of \$65 million, which translated in \$245 million with matching funds from government and the corporate sector. Since the Campaign, the Faculty has raised over \$27 million.

In 2004, the Faculty produced a Strategic Plan for the period 2004-2010. Shortly thereafter, the Departments, Institutes and Divisions within the Faculty were asked to submit their fundraising priorities to the Advancement office for compilation in a Catalogue of Funding Priorities. The resulting document, produced in February 2005, was the last approved list of Faculty priorities on record.

Since the creation of this document, the environment has changed and the Catalogue of Funding Priorities requires updating to align with the current academic mission of the Faculty. During a Faculty Retreat in the fall of 2007, the Faculty under the leadership of the newly appointed Dean identified specific research intensive themes and strategic directions that serve as the foundation for its academic priorities.

Beginning in FY 2008/2009, the Faculty of Applied Science and Engineering's advancement priorities will be focused on the following six primary areas:

- Student Experience
- Globalization
- Bioengineering
- Energy, Environment and Sustainability
- Information Communications and Technology
- Nanoengineering

Highlights of the Faculty of Applied Science and Engineering

- Among the top ten engineering schools in the world and number one in Canada as determined by the Times Higher Education-QS World University Ranking and the U.S. News & World Report.
- Home to over to 4,500 undergraduate and 1,500 graduate students.
- Boasts a community of close to 40,000 living alumni who can found in manufacturing, transportation, the resource industry, biotechnology, communications, law, finance and the healthcare system, to name a few.
- Our faculty received, in the 2007-2008 academic year, over \$60 million in research funding – a record year and received over 138 awards for our teaching and research excellence.

A Note About Capital Projects

The capital project values were provided by the Chairs associated with the specific projects. The Mining Building Attic and the Structural Testing Facility have undergone Governing Council Approval. Several projects have more thorough estimates, which have been developed as part of a grant application. Others are simply estimates based on similar projects. All will go through the proper process. This includes assessing the full cost of the project, approvals from all boards and committees, as well as DUA approval for naming and recognition opportunities.

Section 3.0 - Enriching the Student Experience

A university education is a life-changing opportunity that provides unlimited exposure to intellectual discovery and opportunity for personal growth. University of Toronto Applied Science and Engineering graduates are sought after and renowned for their solid technical skills. The Faculty is committed to providing a learning environment that will foster creativity, independent thinking, collaboration, and personal development.

TRANSFORMATIONAL OPPORTUNITIES

Naming of the Faculty of Applied Science and Engineering

\$100 million endowment

The Faculty of Applied Science and Engineering is considered one of the top Engineering schools in the world. In 2008 we were ranked No. 1 in Canada and No. 10 in the world (Times Higher Education QS/US New and World Report), up from 11th in 2007. Funds associated for the naming would be used for capital and operational improvements across the Faculty, the establishment of special initiatives, professorships and student scholarships.

Naming of Departments, Divisions and Institutes

\$25 million endowment each

The Faculty is home to five Departments (Chemical Engineering, Civil Engineering, the Edward S. Rogers Sr. Department of Electrical and Computer Engineering, Materials Science & Engineering, and Mechanical & Industrial Engineering), two Divisions (Engineering Science, and Environmental Engineering and Energy Systems), and two Institutes (Institute of Biomaterials & Biomedical Engineering and Institute for Aerospace Studies). With the exception of the Edward S. Rogers Sr. Department of Electrical and Computer Engineering and the Lassonde Institute, all of these units are available to be named. Funds from such namings will support capital and operational improvements, establishment of new programs, professorships and student scholarships for the respective units.

Centre of Innovation for Sustainability

\$40 million

The proposed new building is intended to address a wide range of issues the Space Committee brought to light during its review. From much-needed student club spaces to new laboratories and from research centres to swing space that will facilitate other upgrades across all Engineering buildings, the proposed building is a key component to the Faculty's master plan for redeveloped Engineering facilities.

SCHOLARSHIPS, AWARDS, AND FELLOWSHIPS

Undergraduate, Academic-Merit Based Scholarships

\$10 million endowment or min. \$2,000 annual/student

To attract the very best students from across Canada and around the world, the Faculty is seeking private support for student aid. Merit based scholarships can be awarded based on academic excellence, outstanding leadership skills or to students from groups that are under-represented in the Faculty. Scholarships can also be directed within any of the Faculty's nine undergraduate programs.

Graduate Scholarships & Awards

\$10 million endowment or \$10,000 annual/student

Top quality of graduate students is critical to the success of the research enterprise within the Faculty. Recruiting and retaining outstanding graduate students is challenging, especially when competing with top engineering schools around the world. These scholarships will provide the funding packages required to attract the best and the brightest graduate students to the Faculty.

Undergraduate Research Fellowships

\$2 million endowment or \$5,000 annual/student

Through this program, undergraduate students from all engineering disciplines will have an opportunity to join established research groups led by faculty at the University of Toronto and other leading research institutions. This experience enables students to gain an understanding of the research process and provide them with hands-on experience during their undergraduate years. It also enables them to take part in vibrant research activities that have impact in our society.

Women in Engineering Admission Scholarships

\$1.5 million endowment or \$5,000 annual/student

Application of female students to engineering has decreased in recent years. Scholarships offer great incentives for young women to study at the leading Engineering School in Canada and mentor with top female engineers – over the last two years over 50% of the new hires at the Faculty have been females. Such an environment would empower young women to choose a professional career in engineering, thereby enriching our school and our profession.

Engineering Leaders of Tomorrow Awards

\$125,000 endowed or \$5,000 annual/student

The Awards would recognize current undergraduate and graduate students who have shown the potential to become outstanding leaders. This potential may be demonstrated in a number of ways, including participation in student councils or clubs, community organizations, cultural groups, athletics or through volunteering or community work. Recipients should have the ability to inspire others to action and to excellence.

CHAIRS

Chair in Engineering Entrepreneurship (to be approved)

\$3 million endowment or \$1 expendable (over 5 years)

A position will be responsible with the coordination of entrepreneurial activities as related to the Engineering Entrepreneurship Program and the Student Business Venture Fund. They will provide leadership and guidance in the development of the various initiatives.

Chair in Engineering Leadership Development

\$3 million endowment or \$1 expendable (over 5 years)

The Chair would support an Engineering Leadership Development Professor who would serve as an instructor of APS501: Leadership and Leading in Groups and Organizations and contribute to other courses including APS111/112: Engineering Strategies and Practice. The Chair will also provide pedagogical and curriculum support to the Engineering Leaders of Tomorrow program. The Chair holder may be a senior executive from the business world who holds the position on a partial appointment basis.

CAPITAL PROJECTS

Materials Science and Engineering First Year Laboratories

\$2 million capital

A recent external review of the Materials Science & Engineering Department highlighted the unfortunate state of the first year laboratories. There is a pressing need to renovate and upgrade existing undergraduate laboratory space to accommodate the growing number of students and to offer hands-on labs, which would significantly enhance the learning experience. Renovations would include replacement of lab benching and fixtures, new finishes, flooring and lighting. These labs are used by all first year students and include several laboratories in the Wallberg Building (WB41-52 and PT 66, 67, 67A, 162.)

Space for Engineering Entrepreneurship (to be approved)

\$2 million capital

The development of new ventures requires an environment that fosters collaboration and encourages the creation and exchange of innovative ideas. The Faculty seeks to create a space that incorporates meeting spaces for students, a central location to share information, and a place for faculty and alumni advisors to work with students to translate their ideas into prototypes and concrete business plans. Given our global community, the space must involve 21st century technology, enabling students to communicate across distance and time zones.

Student Business Venture Fund (to be approved)

\$2 million endowed or expendable

Students, whether graduate or undergraduate, will have the opportunity to submit proposals for funding. The submission must involve a viable proposal for a technology related start up. A committee, involving alumni, faculty and industry will judge an annual competition. The amount of the award will depend on the proposal and a range must be determined in advance. This program would be supervised by a faculty member, appointed by the Dean.

Structural Testing Laboratories

\$1 million capital

This project involves the expansion of the Structural Testing Laboratories located in the Sandford Fleming and Galbraith buildings. It will be completed by February 2009. When completed, this project will boast equipment, unique to Toronto and Canada, and will re-establish its position as a leading testing laboratory in North America.

Student Club Spaces

\$500,000 capital

Student clubs are excellent ways for students to enhance their experience at Skule™, broaden their technical knowledge and learn valuable teamwork and communication skills. Skule™ clubs includes our award winning Formula SAE Team – First Place winners in the Formula Student Racing Competition in the UK – Concrete Canoe, Skule™ Nite, Blue Sky Solar Race Team and many others. To date, these clubs have worked in a variety of ill-suite rooms that were made available on a temporary basis to the design teams. A dedicated facility, equipped with the proper tools, machinery and supplies would enrich the experience for our students. At the moment, these clubs are housed in Haultain and the Engineering Annex, as well as temporary spaces at 245 College Street. These spaces are not ones where the Faculty wants to invest in renovation. The goal would be to locate these clubs in one space, but a space has yet to be identified.

Undergraduate Laboratories

\$500,000 capital per space

In order to enhance student experience and attract world-class students to the Faculty, there is a constant need to create, renew and upgrade our existing teaching and research facilities and computer laboratories. By preserving, upgrading and equipping laboratories, the Faculty will provide the environment and tools required for our researchers, teachers and students to excel. The Faculty is in the process of assessing the quality of the spaces within the various buildings it occupies. This assessment will help determine the sequence of upgrades required and the specific funding requirements for each space.

Undergraduate Study Rooms

\$300,000 capital per space

The Faculty is home to over 4,500 undergraduate students and there is an urgent need for space in which students can study and work in teams. A number of Departments, particularly the Edward S. Rogers Sr. Department of Electrical and Computer Engineering and Materials Science and Engineering need a room designated for these purposes The Faculty is in the process of assessing the

quality of the spaces within the various buildings it occupies. This assessment will help determine the sequence of upgrades required and the specific funding requirements for each space.

Department Seminar/Graduate Classroom

\$250,000 capital per space

One of the Faculty's strategic priorities is to increase the number of graduate students in the coming years. This decision impacts the need for classrooms designated for graduate seminars and courses. At present, many Departments only have a conference room for meetings. Space is required to conduct graduate courses, special seminars and group activities.

PROGRAMS

Engineering Entrepreneurship Program Director's Opportunities Fund (to be approved)

\$5 million endowed

Gifts to the Opportunity Fund enable the Program to respond to pressing student and faculty needs and to support innovative programs in engineering entrepreneurship. The Fund will also provide resources to hire staff in support of the Program. Providing maximum flexibility, the Opportunity Fund ensures that the Program can engage in topical issues while embracing an extraordinary vision.

Engineering Leaders of Tomorrow

\$1 million expendable (over 5 years)

The goal of this faculty-wide program is to provide an engineering education that is a lifelong foundation for transformational leaders and outstanding citizens. This program aims to develop skills and abilities among students that go beyond the technical skills. Funds will be used to support the program's annual operation that includes a wide-variety of programming, such as lectures, seminars, and workshops.

Sponsorship for Student Teams, Clubs or Competition

\$1 million expendable (over 5 years)

Many current clubs and teams (Solar Car, Mechatronics Club, Robotics Club, National Society for Black Engineers, Formula SAE, Electrical Vehicle Club, Eco CAR, etc.) operate under a scattered set of funding. An endowment would provide sustainable funding to support clubs and teams that are at the heart of the student experience at the Faculty of Applied Science and Engineering.

Student Development Initiatives

\$100,000 expendable (over 5 years)

The transition into a university environment can be challenging for some students. The Faculty of Applied Science and Engineering wants to ensure that all students have access to valuable programs that will help them achieve success in their academic careers. Some of these programs connect upper year students with first year students or facilitate mentorship with faculty members. Other programs coordinate study groups run by upper year students for younger peers, helping them adjust to the university environment.

Section 4.0 – Globalization

Today's engineers are faced with enormously complex problems and extraordinary opportunities. Globalization of the workplace, rapid engineering advances, cross-border migrations and new approaches to problem-solving are challenging engineers in ways that were unheard of when Skule was first established in 1873.

Solving the world's imminent problems requires leadership. New and evolving technologies often have powerful national and international consequences. Inter-disciplinary and global work teams are increasingly becoming commonplace. To be successful in this environment, engineers must not only obtain strong engineering foundations, they must also develop a broad and international perspective. Their training must involve cross-cultural experiences, collaborations with a variety of disciplines – within and beyond engineering – and a solid foundation of technical skills to analyze problems, implement solutions, and most importantly, create innovative technologies. Along with these skills, they must also possess a comprehensive ethical perspective and a deep commitment to the common good.

Our engineering graduates will have to compete and collaborate with engineers across the world. The diversity amongst the student body is part of the unique character of the Faculty and the University. The Faculty plans to build on this distinct quality by further internationalizing our community through engaging international exchanges with other universities, exposing our students to visiting scholars from around the globe, and providing international work experience.

CHAIRS & FACULTY EXCELLENCE

Chair in Globalization

\$3 million endowed or \$1 million expendable (over 5 years)

The process of incorporating the theme of globalization into the curriculum will require leadership and a champion. This Professor will lead the development of specialized courses and complementary study courses, as well as incorporate global sustainability through the technical curriculum.

Visiting Professors

\$1 million endowed or \$500,000 expendable (over 5 years)

To strengthen the internationalization of the educational experience for engineering students, the Faculty welcomes educators from abroad. The objective is to enable distinguished academics to spend between three months to one year at the University of Toronto, primarily to enhance the skills of academic staff, our students and facilitate an exchange of ideas.

Visiting Scholars

\$250,000 endowed or \$10,000 expendable

This program will provide an opportunity for an internationally renowned researcher to visit the Faculty. The scholar will provide lectures to the academic community and perhaps the general public. It will also be an opportunity for students to hear from a renowned researcher, exposing them to a wider range of ideas and perspectives.

SCHOLARSHIPS, AWARDS, AND FELLOWSHIPS

International Travel Awards

\$1.5 million endowment or up to \$5,000 annual/student

The purpose of the award is to give deserving undergraduate students the opportunity to broaden their international horizons while they hone their technical skills. It will enable undergraduate students the opportunity to participate in international study or work experience by assisting with travel or educational expenses while participating in the international experience.

PROGRAMS

Director's Opportunity Fund for Centre for Global Engineering

\$5 million endowed

The Centre will harness the Faculty's activities on global engineering, particularly in the area of international development. Key activities and goals of the Centre will include training engineers in

global engineering approaches and the design of appropriate and sustainable technologies, serving as a resource in the development of a global perspective in the Faculty's academic and research program, acting as a focal point of some of the outreach and communications for a variety of programs and serving as a prominent example of how engineers address the world's most pressing problems.

International Exchange Program

\$500,000 expendable (over 5 years)

This program will leverage the successful record of the Faculty's Professional Experience Year (PEY), enhancing it with an increase in international PEY placements. Many of today's leading companies greatly value international experience. Our students, after completing this program, will gain unique and valuable experience.

International Summit on Urban/Global Sustainability

\$150,000 expendable

The Faculty's Department of Civil Engineering will host a summit every 3-4 years, inviting experts from around the globe to discuss the most pressing issues concerning the world's urban centres. The summit would put the international spotlight on the University and Canada as taking the lead in this critical area. Each summit could focus on a specific problem, resulting in a published Summit Manuscript that captures the flow of thought and inspiration from international perspectives.

Outreach Programs to Underrepresented Communities (to be approved)

\$250,000 expendable (over 5 years)

At all levels, U of T Engineering embodies diversity, from the student body to the faculty and staff, to the academic administration. In recent years, there has been a concerted effort to sponsor activities and initiatives aimed at expanding our breadth of cultural and geographic backgrounds. Indeed, diversity at U of T Engineering is a hallmark and metric of its academic excellence. One of the ways we continue to foster diversity is through community enrichment programs run through our Outreach Office. Programs such as DEEP and Jr. DEEP, Skule™Sisters and the Saturday Science and Engineering Academy present a unique, fun-filled view of math and science to young people with the purpose of sparking the crucial, early curiosity that can lead to a lifelong passion for engineering.

Section 5.0 - Research Priorities

Research at the Faculty of Applied Science and Engineering at the University of Toronto will strengthen Canada's ability to compete in the global economy that increasingly relies on new ideas, new processes and new technologies. We are connecting the brightest minds from a myriad of engineering disciplines and from all points of the world to address issues that concern a global society. The Faculty of Applied Science and Engineering will draw upon its resources, talent and creativity to build engineering programs that continue to stand among the best in the world.

Success in this pursuit will depend largely on our ability to attract brilliant and creative people and provide them with an environment that leads to innovation and discovery. To that end, the Faculty has identified four areas where we can capitalize on our existing strengths and play key leadership roles in a manner that will be truly transformational in nature. The following areas are:

- Bioengineering
- Energy, Environment & Sustainability
- Information Communications & Technology
- Nanoengineering

Research Opportunities Fund

\$5 million endowment

This endowed fund will give researchers access to short-term funding to pursue a variety of research opportunities. The funds could be used for travel, proposal development, matching funds, or other activities that advance innovative research at the Faculty of Applied Science and Engineering.

Section 5.01 - Bioengineering

The Faculty is uniquely positioned to harness the power of engineering approaches to diagnose, treat and prevent disease. Located in the heart of downtown Toronto, adjacent to its largest research hospitals and in partnership with other University of Toronto Faculties, our researchers are applying the tools of engineering to the disciplines of biology, medicine and healthcare.

CHAIRS

Chair in Biomedical Engineering (to be approved)

\$3 million endowed or \$1 million expendable (over 5 years)

Organs engineered from stem cells, medical imaging devices, biosensors and drug delivery systems are among the innovative and life-saving solutions that arise from applying engineering principles to medical problems. Biomedical engineering is one of the fastest growing occupations. A chair at U of T would build on the Faculty's existing expertise and leadership in the field.

Chair in Healthcare Engineering

\$3 million endowed or \$1 million expendable (over 5 years)

The potential for increased efficiency in the delivery of healthcare services, and corresponding reduction of costs, is enormous. Healthcare engineering seeks to replace silos with a broad system view and coordinate people, departments, and institutions to make optimal use of limited resources and taxpayer dollars. Furthermore, research in this area will improve the safety, quality, efficiency, and cost of medical diagnostic and treatment protocols and devices. This research will not only transform the present state of healthcare operations, but also educate professionals to sustain it.

Chair in Mechatronics

\$3 million endowed or \$1 million expendable (over 5 years)

The fields of mechanical engineering and electrical engineering have grown closer together over the past few decades as mechanical and electrical components are increasingly integrated together into engineering systems. The Faculty has experienced rapid growth in this area, after initiating an undergraduate mechatronics option in the late 1990's. Research in this field of mechatronics has many applications to the biomedical and sustainable energy fields.

Chair in Microfluidics

\$3 million endowed or \$1 million expendable (over 5 years)

Microfluidics has facilitated major biochemical application advancements in point-of-care diagnostics, and drug discovery. There are numerous potential applications in biotechnology, pharmaceuticals, the life sciences, public health, and agriculture. Microfluidic lab-on-a-chip (LOC) technologies represent a revolution in laboratory experimentation, bringing the benefits of miniaturization, integration, and automation to many research-based industries.

Chair in Molecular Imaging

\$3 million endowed or \$1 million expendable (over 5 years)

Using processes such as spectroscopy and microscopy, researchers at the Faculty enable us to see biological and chemical processes that occur at the molecular level. By seeing things at these tiny sizes (a molecule is about 100,000 times smaller than a strand of hair) offers science the next step - to be able to manipulate atoms and molecules to make stronger materials or control the pathways of disease. This research may ultimately help address how the body responds to new drugs and therapies.

Chair in Pediatric Rehabilitation Engineering

\$3 million endowed or \$1 million expendable (over 5 years)

Children with disabilities and their parents face extraordinary challenges. Children whose disabilities prevent them from speaking or moving, make everyday a guessing game as parents try to decipher their needs. Researchers at the Faculty are training a computer chip to decode a child's brain signals and breathing patterns, allowing them to activate electronic speech or household devices simply by thinking about them or taking a deep breath.

Chairs in Stem Cell Bioengineering

\$3 million or \$1 million expendable (over 5 years) each

The Faculty is home to world leaders in stem cell bioengineering. This emerging field aims to heal or regenerate damaged or nonfunctioning organs and tissues by applying bioengineering to stem cell research. Results from this research could lead to new techniques for stem cell therapies, including tissue and cellular engineering, gene therapy, and organ transplantation.

Chair in Tissue Engineering

\$3 million endowed or \$1 million expendable (over 5 years)

The Faculty is home to internationally recognized leaders in tissue engineering. Our engineers envision a world where transplant patients do not wait for a donor or where burn victims leave the hospital without disfiguring scars. They use innovative technology to engineer implant materials that can grow, reshape, or change their function as the body requires. These materials sense their surroundings, respond in an appropriate fashion and provide the basis for regeneration.

Section 5.02 - Energy, Environment & Sustainability

Developing sustainable energy systems is a global challenge faced by all nations and their responses to this challenge will determine in large part their economic and political future. Our planet has finite resources, and its growing population currently consumes them at a rate that cannot be sustained. Widely reported warnings have emphasized the need to develop new sources of energy and prevent or reverse the degradation of the environment.

All modern innovations, including nanoengineering, bioengineering, and cyber technology offer promising approaches to address these critical issues. University of Toronto Engineers are developing practical, sustainable solutions that fit the environment, its people and the culture as well. Great opportunities reside within the Faculty that will set itself apart from others in Canada and position itself among the leaders in the world.

CHAIRS

Chair in Bioprocessing

\$3 million endowed or \$1 million expendable (over 5 years)

The Faculty currently has four professors working in the area of utilizing micro-organisms to degrade pollutants in soils, air and water. The research is multi-disciplinary, drawing on the fields of chemical/biochemical engineering, microbiology, proteomics and genomics. The next generation of

these technologies can provide new solutions to environmental biotransformation, production of biofuels, and new bioproducts.

Chair in Green Engine Technologies for Future Aircraft (to be approved)

\$3 million endowed or \$1 million expendable (over 5 years)

The current contribution from civil aviation is estimated at roughly 5% of all man-made greenhouse gas emissions. The international aviation community is committed to reducing the total carbon dioxide emissions from aviation by 50% by 2050. Achieving this target will require substantial investment in new technologies for low-emissions engines and biofuels. Research undertaken by the Chair in Sustainable Flight will be directed toward the development of new technologies for future aircraft engines, including biofuels, to reduce the contribution of aviation to climate change.

Chair in Power Systems (formerly Energy Systems)

\$3 million endowed or \$1 million expendable (over 5 years)

The existing electric power systems were designed, constructed, maintained, and largely operated based on technology and demands in the 1950s to the 1970s. The last fifteen years have brought about major changes in the electric power industry, such as market liberalization and re-regulation; the legacy issues, policy and regulatory constraints, and potential economical ramifications have largely prevented evolution of the electric power systems to be responsive to the existing energy and climate change needs.

Chair in Robotics (to be approved)

\$3 million endowed or \$1 million expendable (over 5 years)

Description pending

Chair in Sustainable Energy

\$3 million endowed or \$1 million expendable (over 5 years)

Our planet is in need of clean and renewable sources of energy such as wind, solar, geothermal, and tidal. Truly sustainable development, however, will require clever integration of renewable energy technologies into existing infrastructure, along with vastly improved efficiencies in non-renewable energy use. The Faculty has considerable expertise and strength in this area, but it is spread out among several departments. An endowed chair could help to build a more structured and collaborative structure to our work.

Chair in Sustainable Energy in Chemical Processing

\$3 million endowed or \$1 million expendable (over 5 years)

With depleting global energy and material supplies and increased concerns regarding global warming, there are enormous opportunities in manufacturing industries to minimize energy consumption and to re-use and recover energy and chemical resources within industrial processes. The Faculty has internationally renowned engineers working in areas of chemical and energy recovery in various industries.

Chair in Sustainable Flight

\$3 million endowed or \$1 million expendable (over 5 years)

The current contribution from civil aviation is estimated at roughly 3.5% of all man-made greenhouse gas emissions with an impact two to four times greater as a result of the altitude at which aircraft emissions occur. Research undertaken by the Chair in Sustainable Flight will be directed toward reducing the contribution of aviation to climate change.

Chair in Urban Sustainability

\$3 million endowed or \$1 million expendable (over 5 years)

In twenty-first-Century North America, not only open space but also other issues of sustainability – such as potable water and carbon footprints – have become crucial elements in the quality of life in

the city and surrounding environment. This chair would undertake research focusing on the pressing issues concerning our urban centres.

CAPITAL PROJECTS

Experimental Facilities for Research in Sustainable Flight

\$3 million capital

Two particular experimental facilities would have a great impact on our sustainable flight research initiative are a major wind tunnel facility for studying ultra-low-drag aircraft concepts, including active flow control and a gas turbine engine/combustion facility for studying low-emissions high-efficiency engine concepts, to be located in the current machine shop at UTIAS (Downsview). This would involve the subdivision of the current machine shop to create a gas turbine/high pressure facility as well as a new building or addition of approximately 3,000 sq ft to house a new wind tunnel. The construction of the wind tunnel would be dependent on the results of a current CFI proposal.

BioZone

\$1 million capital

Through this transformation gift, the research and office spaces for BioZone will be established. Plans call for the centre to be located on the third floor of the Wallberg Building. This space requires significant renovation to best serve the aims of BioZone and its users. In addition, new research equipment is needed to build critical experimental and analytical infrastructure.

Gull Lake Camp Sustainable Development

\$1 million capital or \$100,000 annually

Survey Camp at Gull Lake is a remote-site course for Civil Engineering undergraduate students. It is unique among engineering schools in Canada and continues to play an important role in fulfilling the need for practical studies. The property at Gull Lake is currently underutilized and the buildings on the property are in need of major renovations. The Faculty is exploring options to ensure that it remains an integral part of the curriculum, including developing a conference and research facilities for energy and building technologies. At minimum, the annual maintenance cost would be approximately \$100,000. The Faculty is in the process of assembling more detailed plans for the development of the Gull Lake site.

Sustainable Flight Technology Demonstrator

\$1 million capital

As part of the Sustainable Flight Initiative, the Faculty plans to undertake the development of an unmanned aerial vehicle (UAV) as a test bed for the new concepts and ideas under development for aircraft with reduced environmental impact. Applications of this research could lead to a highly modular solar powered UAV that will enable practical demonstration of many of the new technologies we have currently under development. Funds would be used to purchase research equipment and renovate space to accommodate the demonstrator.

PROGRAMS

Centre for Sustainable Energy Director's Opportunity Fund (to be approved)

\$5 million endowed

The field of sustainable energy research is ever changing and quickly evolving. A Director's Opportunity Fund will serve to address a broad range of opportunities that arise. This Fund will support a variety of activities, such as provide seed funds for new collaborations and high-impact, high risk projects, leverage grants from other sources, enable graduate and undergraduate students to participate in international conferences, and many other opportunities critical to advancing the Faculty's research efforts in the area of sustainable energy.

Section 5.03 - Information Communications and Technology

Information technology, the convergence of computing and communications technologies has had an enormous impact on all aspects of life in the developed world. It will have even more impact in both the developed and developing world in the 21st century. The internet and information technologies have infiltrated nearly every aspect of today's life. Powered by the unprecedented and continuing advances in microelectronics and photonics, the power and capacity of our expanding information infrastructure has risen exponentially while simultaneously becoming more affordable. At least for the foreseeable future, the exponential pace of technology improvement is likely to continue. With national economy, education, national security and safety critically depending on a networked information infrastructure, securing information and information infrastructures has become a key challenge.

CHAIRS

Chair in Broadband Networks

\$3 million endowed or \$1 million expendable (over 5 years)

Demand for services like video on demand, 3G wireless services and web 2.0 applications has continued to grow since the telecom bubble burst in 2001, to the point where networks are reaching their capacity limits. Building on existing research strengths in the Faculty in both hardware (photonics, electronics and EM) and networks (communications and engineering), the Chair in Broadband Networks will develop the next generation of communications systems. This research is highly relevant to the Canadian telecommunications sector and the chair holder will actively engage with industrial partners.

Chair in Information Infrastructure (to be approved)

\$3 million endowed or \$1 million expendable (over 5 years)

The demand for professionals that combine expertise in process design and management, project management and systems integration is needed more than ever. Information infrastructure encompasses all of the distributed functions, data, and resources within an enterprise. It supports seamless software systems integration through the deployment of technologies such as web services, database design, and ontologies.

Chair in Information Security

\$3 million endowed or \$1 million expendable (over 5 years)

The world has witnessed unprecedented interest and activity in safety and security technologies. The emergence of secure electronic transactions, biometric passports, smart access cards, and electronic surveillance are indicators of the growing security trends. The new challenges and trends have fostered the emergence of Information Security as a new field of study that explores the interaction between human behaviour and security technologies and policies.

Chair in Mechatronics

\$3 million endowed or \$1 million expendable (over 5 years)

The fields of mechanical engineering and electrical engineering have grown closer together over the past few decades, as mechanical and electrical components are increasingly integrated together into engineering systems. The Faculty has experienced rapid growth in this area, after initiating an undergraduate mechatronics option in the late 1990's. Research in the field of mechatronics has many applications to the biomedical and sustainable energy fields.

Chair in Software Systems

\$3 million endowed or \$1 million expendable (over 5 years)

Software and software systems lie at the root of all important enterprise and within every existing technological device we make use of today. The creation of software is an extraordinary complex process that is becoming ever more complex as the world interconnects itself through networks. As we ask thousands of computers to support every human activity, it is essential to have academic research in this field.

Chair in Nanoelectrical Engineering

\$3 million endowed or \$1 million expendable (over 5 years)

Microelectronics is at the heart of the current information technology revolution. With increasing demand to process or transmit more information, there is a possibility that current microelectronic technologies will fail. Radical new ways of making and connecting high-speed electronic devices are required. Exotic devices such as nanoscale transistors based on semiconductor nanowires, carbon nanotubes, or graphene may address the first issue, while shifting from electrical to optical routing may address the second. This chair will transition the University of Toronto Engineering from a leader in the microelectronics of the past to the leader of the nanoelectronics of the future.

Section 5.04 - Nanoengineering

As a result of recent advances, we now have the opportunity to approach the ultimate limit of engineering at the atomic scale – indeed to manipulate atoms and molecules. This growing field of nanoscale, quantum science and engineering will be one of the defining new technologies of the century. The Faculty established Canada's first centre for nanoengineering research. In 2001, we were the first to offer an undergraduate nanoengineering option in the world. Although this area of study is at its infancy, nanoengineering research has the possibility of threading into every avenue from telecommunications, to material, to biomedical devices. The Faculty had the foresight to pursue nanoengineering at the earliest stages. With our existing strengths and tremendous potential, our engineers will catapult the University as a premier research institution.

CHAIRS

Chair in Bionanotechnology

\$3 million endowed or \$1 million expendable (over 5 years)

One area of research focus at the Faculty is bionanotechnology. Several engineers are using quantum dots to target a disease site and light it up. This technology would make it possible to detect, target and kill cancer cells. Beyond cancer, researchers are also exploring whether the dots could be used to detect pathogens such as malaria and HIV and we estimate that these quantum dots could be lighting up human disease within five to ten years.

Junior Chair in Advanced Materials

\$1.5 million endowment or \$500,000 expendable (over 5 years)

The field of advanced materials is one of the fastest areas of growth and potential in technology and industry, and Canada's ability to remain innovative in this field will have a direct correlation with its ability to continue to compete globally in a number of important industries. The Chair in Advanced Materials will concentrate on finding innovative solutions to the challenges associated with materials engineering and design at the micro- and nanostructural scale with emphasis on alternative energy technologies.

CAPITAL PROJECTS

Nanoengineering Laboratory

\$500,000 capital

The primary objective of the Nanoengineering Option (introduced in 2001) is to realize an undergraduate program that will blend all three enabling technologies into one educational

experience. The Faculty will enhance our undergraduate facilities to enable synthesis and processing of nanomaterials and provide a range of tools to probe their mechanical, thermal, electrical, optical, magnetic and environmental properties. These labs are crucial for support of the Nanoengineering Option

Section 6.0 – Projects in Progress

Prior to the Faculty Retreat in the fall of 2007, a number of projects had already been underway and reflects the previous priorities. Several donors have already committed to these projects and funds are in the process of being raised.

Lassonde Institute

\$21 million (\$13 million in capital and \$8 million in endowment)

The keys to continuing productive and sustainable mining in Canada and around the world are highly trained personnel and revolutionary technology and processes designed to lower production costs while meeting environmental challenges. The expansion of the Lassonde Institute will provide the space and infrastructure to educate highly qualified personnel for the industry by accommodating more than 100 graduate students and post-doctoral researchers within five years – a critical mass of industry leaders who will make a difference on a global scale. It will also help attract the best international students to study and conduct research in our collaborative, interdisciplinary research centre.