Waterloo Engineering
Strategic Plan
2011-2018
Building on Excellence

Final Report 2017/18
February 2019
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I. Executive Summary

In November 2010, the Faculty of Engineering initiated a comprehensive planning exercise that resulted in our second strategic plan. Published in May 2012, Vision 2015: Building on Excellence presented a set of goals and strategies aimed at achieving our aspiration to be a truly world-class school of engineering. With the publication of the University of Waterloo strategic plan in 2013, engineering extended our plan timeline to align more closely with the university, releasing last year’s progress report on what is now an extended Waterloo Engineering Strategic Plan 2011-2018.

Over the six-year period of Vision 2015+, Engineering deployed significant efforts and resources to implement the Plan. The focused endeavour led to significant year-over-year achievements that culminated in two historic milestones celebrated on the 29th of October 2018. First, the official opening of our new seven-storey Engineering 7 (E7) building, the last of the three buildings envisioned in Engineering’s first and current strategic plans. The building was needed to house two undergraduate growth initiatives – the new biomedical engineering program and doubling of the mechatronics engineering program in 2014 – and to address severe space shortages due to our rising graduate enrolment. Second, the closing of our “Educating the Engineer of the Future” fundraising campaign which raised $100M, far surpassing our $70M goal.

A key element of planning in the Faculty of Engineering is our commitment to an annual assessment of our current status and a progress report on our plan. This annual review process provides an opportunity to critically examine our plans and to make changes in direction if needed. This report, which covers the academic year 2017/18, is the fifth and final outcome of process for our current strategic plan. Sections II.A-K summarize our progress at the faculty level and Section II.L includes a summary of each academic unit’s progress report. Section III presents high-level key metrics and performance indicators used to assess our progress, supported further by the detailed data in the appendices.

Compared to 2016/17, our faculty and staff complements remained relatively consistent. Of the 318 faculty, 18.1% (16.6% excluding Architecture) are female. Comparatively, NCDEAS – Engineers Canada reported that the percentage of female faculty in Canadian Engineering departments is 14.8% as of 2017; thus indicating that Waterloo Engineering remains well above the average. The staff complement increased by 8 positions compared to the prior year, maintaining a faculty to staff ratio of approximately 1.3:1. We remain slightly below our hiring plan targets for both groups due to vacancies resulting from retirements and resignations for which searches are underway or expected shortly.

Enrolment in our undergraduate programs again reached an all-time high with 7,845 students, 28.6% of which are female. We continue to attract large numbers of very high-quality applicants: In 2017, 88% of entering students had a final high school average of 90% or higher, an affirmation of the exceptional students we continue to attract to our renowned undergraduate program. Co-operative education remains a cornerstone of the undergraduate program; in 2017, Waterloo Engineering students completed a record 8,826 co-op work terms, earning over $120M and achieving a 98.6% employment rate. Waterloo Engineering continues to foster an experiential learning environment, with continual efforts to enhance the undergraduate student experience. The Sedra Student Design Centre (SDC) continues to see a high level of participation, where over 20 different student teams are officially registered, and hundreds of students access available resources each term. All teams ultimately aim to design solutions to societal challenges, such as WATonomous, a student team working to develop an autonomous car capable of navigating an urban course. WATonomous won multiple awards and placed amongst the top teams in the world overall at the AutoDrive Challenge in 2018.

Enrolment in our graduate programs likewise surpassed record numbers with 2,079 students, 29.2% of which are female. PhD students received an average funding support of $42,373, an increase of nearly 4% compared to the prior year. Research Masters students received an average funding support of $29,336, a slight decrease from the prior year. Waterloo Engineering also launched in December 2017 the 100 New Awards and Fellowships initiative to attract the top domestic students to our research program. The launch of these awards was very successful and has already resulted in the recruitment of 23 exceptional, fully-funded graduate students under the Engineering Excellence Fellowship program. Externally funded fellowships from Ripple and the provincial Advanced Manufacturing Consortium initiative also expanded opportunities for high quality graduate recruitment. During the period, considerable progress was made in administrative processes and efforts towards increasing graduate student intake. The primary administrative accomplishment relates to decreasing the decision making timeline of applications.
In the 2017/18 fiscal year, the Faculty of Engineering earned $72.85M in research funding, the highest level ever. More than one third of this funding came from various Federal Tri-Council programs, while infrastructure project awards from the Canada Foundation for Innovation for infrastructure projects were also major contributors. Other indicators of research excellence and productivity, including research chairs and bibliometric data, continue to confirm our research strength. In terms of honours and recognition, three ECE faculty members were named Fellows of the Royal Society of Canada, the nation’s highest academic honour. Prof. Keith Hipel received the RSC Centenary and Miroslaw Romanowski Medals, while Prof. Zhongwei Chen received the RSC Rutherford Memorial Medal. Another six were appointed to the Royal Society of Canada College for New Scholars, Artists and Scientists. The Faculty secured a Canada 150 Research Chair, held by Prof. Kerstin Dautenhahn, in the area of Intelligent Robotics. Engineering was also successful with its Phase 1 Canada Excellence Research Chair application in Human-Centred Robotics and Machine Intelligence, one of only 11 selected nationally for Phase 2. Eleven new Canada Research Chairs were awarded to Engineering in 2017/18.

In 2017/18, engineering instructors continued to engage in development opportunities provided and promoted by our teaching portfolio. To enhance teaching assistant development, the Teaching office offered the TA training workshop, ExpecTAtions in April 2017 and December 2017, with over 350 total participants. Key priorities for the teaching portfolio include supporting the nomination of deserving engineering instructors for teaching honours and planning for the successful transition to a new student course evaluation instrument and an online delivery system. Gordon Stubley, Associate Dean, Teaching, was awarded the 3M National Teaching Fellowship in 2017. The Engineering Ideas Clinic™ moved into its 10,000 sq. ft. facility in E7, and continues to provide exciting opportunities for students to undertake problem solving in a hands-on setting. The students thrive in the Clinic’s reflective learning environment where there are intense activities to strengthen communications, team-work, judgement, and the understanding and importance of context. Over 3,000 unique students from 11 programs participated in at least one Ideas Clinic activity, which included the inaugural EngCon, a wide-ranging engineering convention that allowed senior students, alumni, industry, and instructors to meet and share ideas, and Design Days, focused 2-days events where students work in teams to solve complex, discipline-specific problems which are integrated with core class learning.

The Waterloo Engineering outreach program continued to be in high demand during 2017/2018. In the current period, there was an increased interest in our high school summer program. It is noted that the program appeals to students outside the KW region; many who attend are often from outside Ontario and Canada. The outreach office continues its focused work aimed at increasing the number of women in engineering at Waterloo. The number of female undergraduate students in Engineering programs has increased by 116% since 2009. In order to provide a welcoming and nurturing environment to incoming undergraduate female engineering students, the Women in Engineering Living Learning Community was launched in 2017. Following its inaugural success, the Living Learning Community will be available again in 2018. We also continue to work closely with social psychologists in the Faculty of Arts to ensure we understand best practises around some of the psychological aspects that may affect our female and male engineering students.

Waterloo Engineering continues to strategically enhance the internationalization efforts across the Faculty. The number of international students in both graduate and undergraduate program increased. With the growing number of international students, support systems and engagement efforts have been developed to enhance their campus experiences. Our efforts to increase international opportunities for undergraduate students have proven successful. The number of co-operative education work terms filled outside of Canada increased to a record high of 1,623 placements. It is also notable that international collaboration involved in the scholarly output of our researchers continued to increase on all measures.

The Faculty of Engineering remains committed to its strategic goals for nurturing entrepreneurship among our students, faculty and staff. Waterloo Engineering continues to promote a problem-solving culture that ensures Waterloo-led innovation will continue to thrive in the future. To date, over 650 start-ups have been identified with Waterloo Engineering students, researchers or alumni as founders. We awarded $87K to our entrepreneurial students in 2017/18 through the Norman Esch Entrepreneurship Awards for Capstone Design. The $50K Palihapitiya/Lau Venture Creation Fund was also awarded to a group pursuing their capstone project after graduation. In 2017/18, 53 students from 12 different engineering programs participated in the Bridging Entrepreneurs to Students (BETS) program. Participating students received one week of workplace skills training and worked working in three 5 week placements with start-ups in the Waterloo Region and the Greater Toronto Area.
Of course our strategic plan cannot be successfully implemented without the required resources. Although space constraints remain a significant impediment to our strategic development, improvements were made in the current year, with 523 additional net assignable sq. m. (nasms) added to our holdings. In all, Waterloo Engineering has increased its main campus space holdings by over 26% since 2011, and added over 11,000 nasms with the opening of Engineering 7. Engineering Computing continues to implement the schedule of updates outlined in our information technology plan and to seek ways to improve processes and enhance efficiency. The Faculty of Engineering advancement unit’s strong teamwork was instrumental to securing philanthropic support for the faculty’s strategic priorities. In November 2015, we launched the Educating the Engineer of the Future campaign with ground-breaking of Engineering 7. While the fundraising goal was $70M from private sector sources, Engineering eventually raised $100M by the end of 2018. The success of the campaign speaks to the generosity of our supporters and meaningfulness of the project. Increasing media interest, best-in-class marketing communications and the development of a strong brand continue to enhance Waterloo Engineering’s reputation locally and around the world.

As the founding faculty of the University of Waterloo, Engineering together with the institution celebrated its 60th anniversary in 2017. It is evident that the success of the Vision 2015+ Strategic Plan will shape the Faculty for the next 60 years. The construction of world class infrastructure, the introduction of new undergraduate initiatives, the persistent high priority on graduate studies, and our commitment to nurturing entrepreneurship will be vital to lifting the Faculty to even higher heights. Engineering secured over $400M ($310M in research and $100M in philanthropic) in strategic resources to support the Plan’s goals. This would not have been possible if not for the collective leadership of the Faculty, the hard work and dedication of our faculty members and staff, the deep trust we have established with our external partners and the drive of our extraordinary students who continually inspire us to run harder. These ideals will become both the foundation and pillars of Engineering as we develop our next Plan, Vision 2025, in the months to come.
Summary of Current Faculty Goals

Goal A1: Increase the Faculty Complement Strategically
Goal A2: Increase the Staff Complement to Appropriate Levels
Goal A3: Establish a Culture of Service Excellence
Goal A4: Improve Internal Communications
Goal A5: Recognize and Promote Faculty and Staff Excellence
Goal A6: Support the Career-Long Development of Faculty and Staff
Goal A7: Fully Engage All Faculty Members
Goal B1: Make Moderate and Strategic Increases to Undergraduate Intake Targets
Goal B2: Enhance the Undergraduate Academic Program
Goal B3: Support the Retention of Undergraduate Students
Goal B4: Improve the Undergraduate Student Experience
Goal B5: Improve Undergraduate Studies Operations and Processes
Goal B6: Increase the Number of Co-op Jobs
Goal B7: Provide Unemployed First Work Term Students a Meaningful Experience
Goal B8: Support the Successful Implementation of WatPD-Engineering
Goal B9: Ensure the Ongoing Accreditation of all Engineering Programs
Goal C1: Strategically Increase Graduate Enrolment
Goal C2: Improve Graduate Operations and Service
Goal C3: Improve the Graduate Program
Goal C4: Enhance the Graduate Student Experience
Goal D1: Increase Research Funding
Goal D2: Establish a Shared Commitment to Research Excellence
Goal D3: Eliminate Barriers to Research Success
Goal D4: Celebrate Research Excellence
Goal D5: Strategically Identify and Assess Research Strengths
Goal E1: Enhance Support for Teaching at the Faculty Level
Goal E2: Contribute to the Development of Faculty Members and TAs as Teachers
Goal E3: Affirm the Importance of Teaching
Goal E4: Support Teaching Innovations and Strategies for Integrating Learning
Goal F1: Expand the Scope of Waterloo Engineering Outreach Programs
Goal F2: Enhance the Waterloo Engineering Community through Participation in Outreach
Goal F3: Increase the Participation of Women in Engineering at Waterloo
Goal F4: Build an Inclusive Atmosphere within Waterloo Engineering
Goal G1: Consolidate and Expand Internationalization Efforts within the Faculty of Engineering
Goal G2: Increase International Undergraduate Enrolments
Goal G3: Increase International Experience Opportunities for Undergraduates
Goal G4: Increase International Graduate Studies and Research Collaborations
Goal H1: Provide Academic Programming to Support Student Interest and Development in Entrepreneurship
Goal H2: Develop Extra-curricular Initiatives to Support and Encourage Entrepreneurial Students and Projects
Goal H3: Develop New Spaces and Infrastructure to Support Entrepreneurship and Innovation
Goal I1: Maintain a Current Comprehensive Space Plan for the Faculty
Goal I2: Create the Space Required to Meet Operational and Strategic Needs
Goal I3: Harmonize All Aspects of Safety within the Faculty of Engineering
Goal J1: Ensure a Quality Computing Environment
Goal J2: Enhance Support to Computing Clients
Goal J3: Support Improvements to Operational Efficiency and Innovation in Service Delivery
Goal K1: Secure the Philanthropic Support Required for our Priority Initiatives
Goal K2: Enhance the Faculty’s Reputation as a Global Leader in Engineering Research and Education
Aspiration

Waterloo Engineering aspires to be a truly world-class school of engineering. The programs we offer, the students we graduate, and the solutions we develop will be sought after by outstanding students, employers, employees and partners.

Waterloo Engineering will be:

- the top choice of outstanding high school students from Canada and abroad who are seeking a challenging academic program of the highest quality, fully integrated with real-world experience;
- in demand by excellent students, both domestic and international, seeking high-calibre graduate education and by working engineers seeking professional upgrading opportunities;
- the destination of choice among Canadian and global employers seeking co-op students or graduates at all levels for full-time employment;
- sought after by outstanding engineering faculty looking for a rewarding career that supports teaching and research excellence; and
- the top choice of industry, government and community partners seeking to connect with outstanding researchers, students, entrepreneurs and innovators to solve local, national and global challenges.

Key Priorities

- Attracting, engaging, and retaining outstanding people: undergraduate students, graduate students, faculty and staff
- Committing to excellence in academic programs and services
- Undertaking high-impact research, both within and across the disciplines and spanning the theoretical to the practical
- Building connections and promoting collaboration
- Fostering innovation and entrepreneurship
- Providing the world-class facilities required to support excellence in education and research

Alignment with the University of Waterloo Strategic Plan

The University of Waterloo published its strategic plan *A Distinguished Past – A Distinctive Future* in fall 2013. The Waterloo Engineering strategic plan aspiration, key priorities, goals and strategies are entirely consistent with the directions set out in the University of Waterloo strategic plan. Table 1 below summarizes how the Waterloo Engineering strategic plan goals, summarized above, align with the University of Waterloo strategic plan goals.

*Table 1: Alignment of Waterloo Engineering and University of Waterloo Strategic Plan Goals*

<table>
<thead>
<tr>
<th>University of Waterloo Strategic Plan Goal</th>
<th>Supporting Waterloo Engineering Strategic Plan Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiential education for all</td>
<td>B6, B7, B8, I2</td>
</tr>
<tr>
<td>Uniquely entrepreneurial university</td>
<td>H1, H2, H3, I2</td>
</tr>
<tr>
<td>Transformational research</td>
<td>A1, A7, D1, D2, D3, D4, D5, G4</td>
</tr>
<tr>
<td>Outstanding academic programming</td>
<td>A1, A7, B1, B2, B3, B5, B9, C1, C3, E1, E2, E3, E4, G1, G3, G4, H1, I2, J1</td>
</tr>
<tr>
<td>Global prominence &amp; internationalization</td>
<td>G1, G2, G3, G4</td>
</tr>
<tr>
<td>Vibrant student experience</td>
<td>A1, A2, A3, B4, B5, C2, C4, F2, G3, H2, I2, I3, J1, J2, J3</td>
</tr>
<tr>
<td>Robust employer-employee relationship</td>
<td>A1, A2, A3, A4, A5, A6, D4, E2, F2, I2, J1, J2, J3</td>
</tr>
<tr>
<td>Sound value system</td>
<td>F1, F2, F3, F4</td>
</tr>
</tbody>
</table>
Table 2: Key Metrics: Current Values and Change from the Strategic Plan Baseline (2010/11)

<table>
<thead>
<tr>
<th>Key Metric</th>
<th>2017/18</th>
<th>% Change from Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty</td>
<td>318</td>
<td>17.2%</td>
</tr>
<tr>
<td>Staff</td>
<td>241</td>
<td>24.1%</td>
</tr>
<tr>
<td>Undergraduate Students (FTE)</td>
<td>6281</td>
<td>25.0%</td>
</tr>
<tr>
<td>Undergraduate Students (head count)</td>
<td>7845</td>
<td>23.6%</td>
</tr>
<tr>
<td>International Undergraduate Students</td>
<td>1056</td>
<td>128.6%</td>
</tr>
<tr>
<td>Female Undergraduate Students</td>
<td>2244</td>
<td>87.5%</td>
</tr>
<tr>
<td>Undergraduate Degrees Granted</td>
<td>1269</td>
<td>38.2%</td>
</tr>
<tr>
<td>Graduate Students (FTE)</td>
<td>1664</td>
<td>9.6%</td>
</tr>
<tr>
<td>Graduate Students (head count)</td>
<td>2079</td>
<td>12.7%</td>
</tr>
<tr>
<td>International Graduate Students</td>
<td>1081</td>
<td>72.7%</td>
</tr>
<tr>
<td>Female Graduate Students</td>
<td>606</td>
<td>37.4%</td>
</tr>
<tr>
<td>Research Graduate Students</td>
<td>1428</td>
<td>14.2%</td>
</tr>
<tr>
<td>Graduate Degrees Granted</td>
<td>624</td>
<td>8.9%</td>
</tr>
<tr>
<td>PhD Degrees Granted</td>
<td>127</td>
<td>35.1%</td>
</tr>
<tr>
<td>Sponsored Research Funds ($Ms)</td>
<td>$72.5</td>
<td>20.0%</td>
</tr>
<tr>
<td>Alumni</td>
<td>44,647</td>
<td>35.2%</td>
</tr>
<tr>
<td>Main Campus Space Holdings (nasm)</td>
<td>61,119</td>
<td>26.7%</td>
</tr>
</tbody>
</table>

Table 3: Key Performance Indicators: Current Values and Change from the Strategic Plan Baseline (2010/11)

<table>
<thead>
<tr>
<th>Key Performance Indicator</th>
<th>2017/18</th>
<th>% Change from Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female Faculty/Total Faculty</td>
<td>18.1%</td>
<td>29.1%</td>
</tr>
<tr>
<td>Faculty/Staff</td>
<td>1.32</td>
<td>-5.7%</td>
</tr>
<tr>
<td>Undergraduate Students/Faculty</td>
<td>19.4</td>
<td>9.5%</td>
</tr>
<tr>
<td>International Undergraduates/Total Undergraduates</td>
<td>13.5%</td>
<td>84.4%</td>
</tr>
<tr>
<td>Female Undergraduates/Total Undergraduates</td>
<td>28.6%</td>
<td>51.3%</td>
</tr>
<tr>
<td>Undergraduate Degrees Granted/Faculty</td>
<td>3.9</td>
<td>11.4%</td>
</tr>
<tr>
<td>Graduate Students/Faculty</td>
<td>5.8</td>
<td>-4.4%</td>
</tr>
<tr>
<td>Research Graduate Students/Faculty</td>
<td>4.4</td>
<td>-2.0%</td>
</tr>
<tr>
<td>International Graduate Students/Total Graduate Students</td>
<td>52.0%</td>
<td>53.4%</td>
</tr>
<tr>
<td>Female Graduate Students/Total Graduate Students</td>
<td>29.2%</td>
<td>22.0%</td>
</tr>
<tr>
<td>Graduate Degrees Granted/Faculty</td>
<td>2.2</td>
<td>-4.8%</td>
</tr>
<tr>
<td>PhD Degrees Granted/Faculty</td>
<td>0.4</td>
<td>10.0%</td>
</tr>
<tr>
<td>Graduate Students/Total Students</td>
<td>22.0%</td>
<td>-4.3%</td>
</tr>
<tr>
<td>Sponsored Research Funds/Faculty</td>
<td>$256,302</td>
<td>8.5%</td>
</tr>
<tr>
<td>Main Campus Space Holdings/FTE Student (nasm)</td>
<td>7.7</td>
<td>-1.0%</td>
</tr>
</tbody>
</table>

See IV. for explanatory notes on the data included in the tables above. For further details and an expanded set of metrics and indicators, please refer to III. of this report.
### Waterloo Engineering in Context

**Table 4: Waterloo Engineering in the Institutional Context, 2017/18**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Share of University of Waterloo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate Students</td>
<td>23.6%</td>
</tr>
<tr>
<td>International Undergraduate Students</td>
<td>16.8%</td>
</tr>
<tr>
<td>Female Undergraduate Students</td>
<td>14.3%</td>
</tr>
<tr>
<td>Undergraduate Degrees Granted</td>
<td>20.6%</td>
</tr>
<tr>
<td>Graduate Students</td>
<td>35.5%</td>
</tr>
<tr>
<td>PhD Students</td>
<td>36.7%</td>
</tr>
<tr>
<td>International Graduate Students</td>
<td>50.8%</td>
</tr>
<tr>
<td>Female Graduate Students</td>
<td>23.5%</td>
</tr>
<tr>
<td>Graduate Degrees Granted</td>
<td>31.4%</td>
</tr>
<tr>
<td>PhD Degrees Granted</td>
<td>40.8%</td>
</tr>
<tr>
<td>Regular Faculty Members</td>
<td>25.2%</td>
</tr>
<tr>
<td>Sponsored Research Funds</td>
<td>32.3%</td>
</tr>
<tr>
<td>Alumni</td>
<td>22.6%</td>
</tr>
</tbody>
</table>

**Table 5: Waterloo Engineering in the Provincial and National Contexts, 2017**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Share of Ontario</th>
<th>Share of Canada</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate Students</td>
<td>16.1%</td>
<td>7.3%</td>
</tr>
<tr>
<td>International Undergraduate Students</td>
<td>14.0%</td>
<td>6.0%</td>
</tr>
<tr>
<td>Female Undergraduate Students</td>
<td>18.6%</td>
<td>8.0%</td>
</tr>
<tr>
<td>Undergraduate Degrees Granted</td>
<td>16.9%</td>
<td>7.9%</td>
</tr>
<tr>
<td>Graduate Students</td>
<td>13.5%</td>
<td>5.4%</td>
</tr>
<tr>
<td>PhD Students</td>
<td>17.9%</td>
<td>6.3%</td>
</tr>
<tr>
<td>International Graduate Students</td>
<td>16.0%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Female Graduate Students</td>
<td>13.8%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Graduate Degrees Granted</td>
<td>13.4%</td>
<td>6.8%</td>
</tr>
<tr>
<td>PhD Degrees Granted</td>
<td>16.0%</td>
<td>7.7%</td>
</tr>
<tr>
<td>Total Faculty</td>
<td>17.0%</td>
<td>6.8%</td>
</tr>
<tr>
<td>Female Faculty</td>
<td>18.4%</td>
<td>7.4%</td>
</tr>
</tbody>
</table>

**Table 6: University of Waterloo in International University Rankings of the Engineering Discipline, 2017**

<table>
<thead>
<tr>
<th>Ranking Agency</th>
<th>World Rank</th>
<th>Canadian Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Ranking of World Universities (Shanghai Rankings)</td>
<td>51-75</td>
<td>2</td>
</tr>
<tr>
<td>QS World University Rankings</td>
<td>70</td>
<td>2</td>
</tr>
<tr>
<td>Taiwan Rankings</td>
<td>69</td>
<td>2</td>
</tr>
<tr>
<td>Times Higher Education World University Rankings</td>
<td>83</td>
<td>4</td>
</tr>
<tr>
<td>US News and World Report Best Global Universities</td>
<td>51</td>
<td>1</td>
</tr>
</tbody>
</table>

1 Beginning in 2016, Times Higher Education subject rankings for engineering and technology exclude computer science, an area in which many of our engineering researchers publish.
Table 7: University of Waterloo in International Entrepreneurial University Rankings, 2017

<table>
<thead>
<tr>
<th>Ranking Agency</th>
<th>World Rank</th>
<th>Canadian Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>PitchBook Top Universities: Unicorns (Top Undergraduate)(^2)</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>PitchBook Top Universities for VC-backed Entrepreneurs (Top 50 Undergraduate Program)</td>
<td>20</td>
<td>1</td>
</tr>
</tbody>
</table>

\(^2\) Pitchbook ranked undergraduate founders of unicorns. Unicorns are companies that have achieved private valuation of $1 billion or more.
II. Strategic Plan Progress Report

A. Faculty and Staff

Since 2011, our regular faculty complement has grown by 17% and our staff complement has grown by 23%. Section III of this report provides further details about our faculty and staff complements, and their growth over the past 10 years.

We continue making progress on our strategic faculty and staff goals, though we are still below target due to vacancies resulting from resignations and retirements. Hiring remains a priority as we roll out our new programs in Biomedical and Architectural Engineering, and continue with the expansion of Mechatronics Engineering.

Goal A1: Increase the Faculty Complement Strategically

- As of May 1, 2018, our faculty complement was at 92% of target, consistent with the year prior. Actual complement increased by 5 FTEs while the target increased, year-over-year, by 6 FTEs. Additional hires are being prioritized in the coming year to ensure emerging program development needs are met.

**Figure 1: Faculty Complement Plan Performance to Target**

**Figure 2: Faculty Complement Plan Performance to Target, % Women**

Fill all open faculty positions and establish new positions in strategic areas

- In 2017/18, 14 full-time equivalent (FTE) new faculty members joined the Faculty of Engineering, and 9 positions were vacated due to retirements, resignations or contract completion, resulting in a net increase of 5 full-time equivalent faculty members year-over-year. Not captured in this count is one position that has been filled but had a start date after May 1, 2018.

- Searches for 31 Mission Critical positions were initiated in 2017/18. 21 more positions are planned but not yet in search.

- Chemical Engineering, Management Sciences, Mechanical and Mechatronics Engineering, and Systems Design Engineering were responsible for the bulk of faculty hires. The most active of these areas for hiring in 2017/18 were the Mechatronics Engineering and Biomedical Engineering programs, both of which continue to work toward their planned complement.
The proportion of female faculty members was at 18.1%, slightly below the target of 18.4%.

Recruit and hire outstanding faculty

- Faculty hiring continues to remain an important priority and focus for the Faculty of Engineering with the continued expansion of Biomedical Engineering, Mechatronics Engineering and Architectural Engineering.
- Additional hires are expected in the upcoming years to fill positions vacated through retirements, given that 37% of the current faculty complement is over the age of 55.
- The Faculty of Engineering continues to demonstrate commitment to investing the time required to hire an excellent candidate for every faculty position opening as evidenced by the increasing diversity in the schools where our faculty members have earned their PhDs.

Goal A2: Increase the Staff Complement to Appropriate Levels

- As of May 1, 2018, our staff complement reached 97% of target. This is up 2% from the same time last year. Staff hiring to meet target goals continues to be a priority.
- In 2017/18, the staff target increased by 4 FTEs year-over-year due to undergraduate expansion.

Figure 3: Staff Complement Plan Performance to Target

Add staff positions at appropriate levels to manage workload and support strategic initiatives

- In 2017/18, 30 staff positions were filled. 10 of these positions were new and 20 were replacements. Waterloo Engineering will continue to focus on strategic hiring to ensure staff complement is appropriate.
- The active hiring areas for new staff positions in 2017/18 were:
  - Mechanical & Mechatronics Engineering: 3
  - Civil & Environment Engineering: 1
  - Engineering Undergraduate Office: 1
  - Engineering Research Office: 1
  - Engineering Graduate Office: 1
  - IDEAS Clinic: 1
  - Outreach: 1
  - Advancement: 1

Goal A3: Establish a Culture of Service Excellence

Provide staff development opportunities related to client service

- The annual staff conference (April 5-6, 2018) organized by the University’s Organizational & Human Development (OHD) office offered excellent programming again on topics including Pursuit of Excellence, Campus Collaboration Tool, Lean Thinking for Higher Education, Creating Inclusive Co-operative Education Workplaces and A Fresh New Approach to Productivity. The two-day event helped develop personal and professional growth, and nurture a robust, vibrant and engaging community.
The staff conference was attended by 67 staff members from the Faculty of Engineering, which represents 28% of the full-time staff complement.

Although Management Development Day was not offered in 2017/18, 23 staff members attended three lean workshops (Lean in High Ed Workshop, Lean Process Improvement and Lean Kanban Workshop). These workshops helped enhance coordination of workflow and increase productivity.

Recognize and reward excellence in client service

- The recipients of the 2017/18 staff excellence awards were announced at the staff and faculty awards dinner held in January 2018. They are Fernando Rivero Hernandez (Electrical and Computer Engineering) and Shirley Springall (Civil and Environmental Engineering).

Goal A4: Improve Internal Communications

Establish an internal communications framework and tools to best meet faculty and staff needs

- Details about efforts to improve internal communications are outlined in Section II.K of this report.

Goal A5: Recognize and Promote Faculty and Staff Excellence

Increase nominations to internal and external awards and honours

- The Faculty of Engineering Honours and Awards Committee continues to regularly solicit and support nominations for deserving faculty members to prestigious national and international awards. Please see Section II.D. of this report for more details.
- The Associate Dean, Teaching portfolio provides expertise and support specific teaching awards for our outstanding instructors. Please see Section II.E of this report for more details.

Goal A6: Support the Career-Long Development of Faculty and Staff

Identify and promote development opportunities for faculty and staff

- Staff in the Faculty of Engineering registered for 115 courses through Organizational and Human Development (OHD) in 2017/18.
- The largest enrolment was for OHD courses in Personality Dimensions (16), Exceptional Services (14), Principles of Inclusivity (14) and Principles of Leaderships (13).
- Additional, role-specific professional development activities took place within various units to strengthen the skill set and capabilities of our staff. For example, a number of our Advancement staff attended webinars and/or conferences related to fundraising, donor relations, and best practices.

Goal A7: Fully Engage All Faculty Members

Promote a holistic and integrated view of teaching and research

- In 2017/18, we continued to review the summary data from the 2016/17 faculty merit reports as planned and gained valuable insights about the data reported, with respect to variability in reporting practices between and within departments.

Maintain the engagement and contributions of all members of our highly capable professoriate

- While no specific progress was made on this strategy in 2017/18, it remains a priority for future.

B. Undergraduate Studies

Waterloo Engineering’s undergraduate enrolment has increased by about 20% over the plan period. Over the same time, the number of female students has increased by more than 70% and the number of international students has increased by more than 75%. We continue to attract large numbers of very high-quality applicants: of the new first-year students registered in the Faculty of Engineering in fall 2017, 88% had incoming high school averages of 90% or higher and 44% per cent had averages of at least 95%. Looking forward to the 2018 admission cycle, over 12,000 applications were received for our engineering programs, an increase of about 1% over the previous year. To help us identify the best possible future students from within this exceptionally high-quality applicant pool, Waterloo Engineering continues to use the Kira Talent video admissions platform as one of our admissions tools.
Goal B1: Make Moderate and Strategic Increases to Undergraduate Intake Targets

- Our overall undergraduate intake targets for fall 2017 admissions were met, with the number of admitted international students slightly above target.

- Note that the apparent reduction in target in 2016 relates to an adjustment made to account for students admitted to the BASE program. These students do not appear in first-year Engineering intake counts (because they are not yet technically enrolled in Engineering), but do enrol in first-year Engineering classes as continuing students in their second year, which can confuse student counts.

Figure 4: Undergraduate Intake Plan Performance to Target

Figure 5: Undergraduate International Intake Plan Performance to Target

Expand high-demand interdisciplinary undergraduate education

- Fall 2017 marked a third very successful intake into the new Biomedical Engineering program and the Mechatronics Engineering program expansion. Applications to both programs remain very high, and we do not anticipate any challenges filling both with high-quality students as intake targets reach steady state.

- A new program in Architectural Engineering was developed and approved by the Faculty of Engineering and UW Senate. The first student intake was in fall 2018.

- The engineering undergraduate recruitment staff continue to work to attract excellent students to all of our undergraduate programs. Recruitment initiative highlights from this year included:
  - Continued growth in our Engineering Ambassador team to 159;
  - Over 600 groups were provided faculty-specific tours in the 2016-2017 recruitment cycle;
  - Over 150 trained faculty members actively volunteered for undergraduate recruitment events;
  - 25,000 participants pre-registered to attend the Fall and March Break Open Houses.

Enhance the international student applicant pool

- Fall 2017 saw a continued focus on US recruitment, highlighted by attendance at 3 STEM-oriented fairs in New York, Silicon Valley, and Houston. We also continued our partnership with Raise.Me, promoting “micro-scholarships” to prospective applicants.
- The Faculty will aim to continue diversifying recruitment efforts, with due consideration for activities being undertaken by the Faculty of Mathematics and Marketing & Undergraduate Recruitment.

Review and revise mechanisms to identify the best possible future students from our strong applicant pool

- The Kira Talent video admissions platform, used in the 2017 admissions cycle, will again be a component of the admission process this year to help identify the best possible future students. Applicants to all undergraduate programs except Architecture (which already interviews applicants) are invited to complete an online video exercise through the Kira Talent platform, which is a proven product already in use to assess applicants to other programs at Waterloo and peer institutions, as well as specific scholarship applicants within Waterloo Engineering.

Goal B2: Enhance the Undergraduate Academic Program

Redesign and modernize the lab experience

- Significant improvements in laboratory experiences are outlined in the various academic unit summaries. Refer to Section II.L of this report for more detail.

Ensure a modern, high-quality learning environment

- $8.5M has been invested through the Vision 2015 Undergraduate Laboratory Enhancement Initiative to ensure modern, contemporary lab facilities and equipment.

- Investments were made to prepare studio space for the new Architectural Engineering program.

Goal B3: Support the Retention of Undergraduate Students

Enhance first-year student success

- The English Language Proficiency Exam (ELPE) is being phased out by 2019 and is being replaced by at least one communication course for each student. Initiatives are now implemented in the Software, Mechanical, and Civil Engineering programs, and other departments will have plans in place by fall 2019. The Associate Dean, Undergraduate Studies will continue to work with the English and Speech Communications departments to monitor communication course delivery.

- WEEF TAs continue to be trained and managed by the four engineering instructional support tutors and two first-year associate directors. The WEEF TAs also receive supplemental training from the Centre for Career Action to support resume critiques for first year students in preparation for work term job applications.

- Supported learning groups (SLG) for CHE 102 were shown to be useful and are now part of PHYS 115 and CIVE 105. Students whose midterm grades are less than 50% are strongly encouraged to attend SLGs.

- The Associate Dean continues to work with the Faculties of Science and Mathematics to provide continuity of good course instructors. Work is ongoing with Mathematics to modify the delivery of Math 115 to enhance first-year student success. Instead of offering three hours of lecture (course instructors) and two hours of tutorial (TAs), in the coming year one of the tutorials will be offered by the course instructor.

- All departments continue to pay special attention to first-year students, with promising results. The first-year failure rate had fallen for several years and has now leveled out at less than 5%. The average grade is also steadying at approximately 77%, the highest since we began keeping records (2001).

- Feedback from the First-Year Office indicates that students from departments with dedicated first-year support instructors are in general more engaged with first-year and are more inclined to reach out for help when in difficulty. Four departments (CEE, ECE, MME and MSCI) have designated an instructor to fill such a role.

Support student success at all levels

- Work to increase flexibility in promotion rules, including partial-load upper-year promotion rules, is ongoing. As a result of ongoing discussions with departments at the Faculty Operations Committee, rule changes have been introduced to allow upper year students to drop one elective course (technical or a CSE) per term with the approval of their academic advisor. Currently, we have about 40 students on reduced load in first year and two to three students on reduced load in upper years.
Goal B4: Improve the Undergraduate Student Experience

Improve service and communications

- The Engineering Undergraduate Office (EUGO) continues to be available to clients over lunch hour.
- Counselling Services and the Engineering Society (EngSoc) have continued holding informal discussion group over lunch hour.
- EngSoc and Counselling Services have continued to collaborate on MATES (Mentor Assistance Through Education and Support), a counselling-based peer support program in the Faculty. It was launched in Fall 2017, and also offers counselling services over the lunch hour.

Develop an annual student engagement survey

- As part of the Faculty’s strategic planning activities, a wide-ranging student survey was conducted in winter 2018. Nearly 1,300 undergraduate students, or 16.3% of the student body participated in the survey, the results from which will help inform future priorities for the Faculty.
- It is anticipated that the survey will be repeated in 2019 or 2020.

Enhance first-year student transition experience

- First-year transition remains a major focus of the Engineering Student Relations Officer. As the orientation advisor for Engineering and Architecture, the SRO was heavily involved in the process to review orientation and implement the new orientation schedule in fall 2016. Led by an external facilitator and involving key partners in orientation, additional reviews of the new orientation schedule were completed in January 2017 and in January 2018. Further enhancements to orientation programming and events are planned for 2018.
- The university’s new student transition experience continued to evolve this past year, with Faculty 101 Days. A new student transition team in Engineering (including the SRO, an Associate Director of First Year, and the Faculty Relations Manager for Engineering from the university’s Student Success Office) reviewed the existing program from 2017 and worked to make enhancements for 2018.

Provide support for students engaged in campus life and co-curricular experiences

- Waterloo Engineering proudly hosted the Great Northern Concrete Toboggan Race, the Canadian National Concrete Canoe Competition and the Canadian National Steel Bridge Competition in 2017, with financial and staffing resources provided to ensure the success of these events.
- The Dean of Engineering provided $155,000 to support student teams and initiatives in 2017/18.

Goal B5: Improve Undergraduate Studies Operation and Processes

Develop enhanced opportunities for undergraduate students

- The multidisciplinary capstone courses GENE 482 and GENE 483 were offered for a fourth year, facilitating interdisciplinary fourth-year design projects.
- Chemical Engineering has added three specializations (chemical process modelling, optimization and control; materials and manufacturing processes; and energy and environmental systems and processes), while Biomedical Engineering is developing plans to add two specializations in sports engineering and neural engineering respectively.
- The Faculties of Engineering and Mathematics worked together to introduce a new option in artificial intelligence which has generated a lot of interest from students.

Enhance undergraduate processes

- The EUGO has moved to expanded and modernized facilities in E2. The new facilities accommodate nearly all of our staff and provide additional room for our growing team of Engineering counsellors.
- The EUGO continues to work with Engineering Computing to automate the student ranking process. The first phase of this project has been implemented, and rankings are now made available to students on the web via a secure log in procedure. Efforts to further automate the process and integrate with the Registrar’s Office continue.
Co-operative Education

The co-op program continues to be a highly successful defining feature of Waterloo Engineering. Employment rates continue to be high. This success can be partially attributed to growth in the number of international jobs and a strong job market. Continued efforts are required to develop jobs for the first work term and to accommodate growth in the Faculty with the introduction of Architecture Engineering and Biomedical Engineering, and the expansion of Mechatronics Engineering. The implementation of the new employment administration system for co-op jobs, WaterlooWorks, has provided new opportunities for analysis, many of which remain to be exploited. The WatPD Engineering program continues to have high completion rates and is increasing its offering of elective courses.

Goal B6: Increase the Number of Co-op Jobs

Implement a program-focused initiative to assist in job development
- CE (formerly the co-op portion of CECA) continues to monitor jobs available to students in various programs, so to address areas with a low job/student ratio.

Develop additional international work term opportunities
- The number of international co-op jobs in 2017 has exceeded target for the sixth consecutive year, with a majority taking place in the US. The development of jobs outside of North America remains a challenge, though many students have achieved success securing employment abroad via individual networking.

Figure 6: Performance to Target, International Co-op Work Terms

Launch a research co-op program
- A framework for the co-op research certificate has been developed, and will be launched in September 2018.

Goal B7: Provide Unemployed First Work Term Students a Meaningful Experience

Develop a program to enhance the employability of unemployed first work term students during their next work term
- The Bridging Entrepreneurs to Students (BETS), launched in 2014, continues to offer opportunities for 20-30 students from all Engineering programs each term. Students receive one week of workplace skills training and then work 3-5 week placements with various start-ups in the Waterloo Region and the Greater Toronto Area.

Goal B8: Support the Successful Implementation of WatPD-Engineering

Ensure sufficient selection of current WatPD courses for engineering students
- Currently there are ten elective WatPD courses including:
  - PD 3: Communication
  - PD 4: Teamwork
  - PD 5: Project Management
  - PD 6: Problem Solving
- PD 7: Conflict Resolution
- PD 8: Intercultural Skills
- PD 9: Ethical Decision Making
- PD 12: Learning and Reflection in the Workplace
- PD 22: Professionalism and Ethics in Engineering Practice, which aims to prepare students for the Professional Engineers Ontario’s Professional Practice Exam

- PD 13: Research in the Workplace, is a new course under development, with a first offering anticipated in 2019.
- PD 21: Developing Effective Plans, a core PD course for Engineering students, was updated in 2016/2017.

Establish a framework to assess the WatPD-Engineering program’s effectiveness

- The WatPD Engineering curriculum committee has initiated a program review (collected and analyzed student feedback, prepared recommendations), and is in the process of implementing the recommendations.

Student communication

- WatPD has reviewed its existing practices and is currently implementing new ways of communicating with students.

Accreditation

Goal B9: Ensure the Ongoing Accreditation of all Engineering Programs

Implement a system of outcomes assessment for all programs

- All thirteen programs have made significant progress in the development of graduate attributes (GA) and continual improvement (CI) processes (e.g. curriculum maps, data collection and analysis, program improvement, etc.). Nearly all programs have clear processes and mechanisms for conducting and reporting GA/CI. Processes for CI remain at an early stage.
- For 2018/19, there was focus on preparation for the CEAB accreditation visit for Biomedical Engineering, and the renewal of CEAB accreditation of twelve other Engineering programs in November 2019.

Increase the proportion of eligible faculty members who are licensed professional engineers

- The fraction of faculty that are either registered or have applied for professional registration decreased slightly compared to 2017 and remains below the target value. Efforts to encourage and assist faculty with registration continue.

Figure 7: Regular Faculty Registered & Applied for PEng Performance to Target, over time
C. Graduate Studies

Progress was made on increasing graduate enrolment. Overall FTE enrolment in all Engineering graduate programs increased by 10% in 2017/18 relative to the year prior. Overall intake in 2017 was at 109% of target, a 20% increase relative to 2016. The proportion of graduate student population that is female increased to 28.6%, the highest value in at least the past 13 years.

Demand for professional programs continued to increase: the number of applications increased by 60% relative to 2016, and intake increased by 51%. Enrolment in Professional Masters programs is now 30% of total graduate enrolment (by headcount), up from 25% in 2016.

Two proposed new graduate programs, a collaborative program in Data Analytics (DA) and a graduate program in Biomedical Engineering (BME), were not implemented as expected. Interest in implementing the DA program has waned due to a number of challenges, while the BME program, led by SYDE, has been delayed due to a shift in focus toward AI.

Graduate Studies continues to work toward:

- Strategically growing graduate enrolment with specific focus on (i) meeting domestic intake targets, and (ii) attracting and recruiting top quality applicants (domestic and international);
- Identifying opportunities for a larger amount of experiential learning/co-op in graduate programs;
- Enhancing quality of graduate programs by (i) developing Specializations for professional programs, and (ii) expanding on Pathways for PhD programs.

**Goal C1: Strategically Increase Graduate Enrolment**

- In 2017, we successfully met and exceeded overall graduate student intake targets, with final intake at 109% of target (130 FTE above target), nearly 20% higher than in 2016.

- Performance to target was not uniform across degree types or across domestic versus international students:
  - PhD intake was 101% of target, representing an increase of 13% compared to 2016;
  - MASc/MArch intake was 95% of target, representing an decrease of 21% compared to 2016;
  - Professional Masters intake was 128% of target, representing an increase of 51% compared to 2016.

- 40% of overall intake consisted of domestic students in 2017, down from 43% in 2016. Overall, domestic student intake was only 84% of target, though this still represents an increase of 10% compared to 2016.
Figure 9: Graduate Intake Plan Performance to Target

Figure 10: Graduate Intake Plan Performance to Target: PhD

Figure 11: Graduate Intake Plan Performance to Target: Research Master

Figure 12: Graduate Intake Plan Performance to Target: Professional Master

Strategic Plan Progress Report: 2017/18
Introduce new graduate programs in areas of strength

- Interest in the proposed collaborative program in Data Analytics has waned, largely because of concerns that (i) the program would provide only a small number of net new graduate students; (ii) the structure of collaborative programs is administratively burdensome; (iii) there is a lack of clarity of the revenue implications for departments for graduate growth; and (iv) focus has shifted toward the development of Specializations for MEng programs.

- In 2017, efforts were made to improve the attractiveness of MEng/MMSc program offerings by recognizing the completion of a series of courses in an area of specialization via Type 2 Graduate Diploma. However, the Ministry changed their criteria for these types of programs, and several such program proposals were denied. As a result, the University created a campus-wide definition for graduate specializations, and efforts are currently underway to modify previous proposals to fit these criteria.

- The graduate program in BME has not yet moved to the phase of approvals. This effort, being led by SYDE, has been delayed as SYDE attempts to develop a Specialization in Artificial Intelligence (AI) for their MEng program and, possibly, a stand-alone AI MEng program.

Enhance the professional master’s program

- Demand for admission into professional programs increased by almost 60% relative to 2016, while intake increased by 51% relative to 2016.

- All departments are now accepting international students into their professional programs.

- MME and CEE now require GRE score for those applicants to the MEng program who completed their previous degree outside of Canada or the USA. The use of GRE scores will assist in the evaluation of applicants in the admission process.

- Program requirements have been modified in several departments, with core courses now required in CHE, MSci MMSc, and SYDE.

Develop and implement a strategic recruitment plan for graduate studies

- A comprehensive scholarship/funding strategy for attracting top domestic students was developed and implemented. Evidence to date suggest that efforts to attract undergraduate students from other top engineering schools in Canada to apply to graduate programs in Engineering at Waterloo are having a positive impact.

- A plan outlining strategic recruitment activities for the 2018/19 cycle has been jointly developed with the Strategic Graduate Enrolment Manager and the Graduate Recruitment Officer.

Explore the opportunity to incorporate co-op into new or existing graduate programs

- No specific progress has occurred in Engineering on developing a comprehensive plan to incorporate co-op at the graduate level, but this remains a significant opportunity for the Faculty. The University’s Associate Vice-President of Graduate Studies has struck a working group as part of the Vision 2020 process to examine opportunities to expand experiential learning opportunities, including work/study opportunities at the graduate level.

Evaluate the opportunities to increase the number of direct admissions to PhD programs

- Minimum criteria for direct admission into PhD is now being formally communicated to all faculty members and placed information on all department website in an effort to inform and attract potential candidates.

Improved targeting of potential applicants

- In consultation with departments and the GSPA, the Graduate Recruitment Officer and the Strategic Graduate Enrolment Manager have developed a set of targeted email communications to a range of potential applicants, with an aim to track their effectiveness via analytical tools so to optimize communication in future.

Review and enhance PhD programs

- Graduate Studies developed the concept of “pathways” as a means of communicating to prospective applicants and existing students that a PhD degree from Waterloo Engineering can lead to careers in a wide spectrum of sectors, including academia, industry, and start-ups/commercialization. This information was included in the recruiting brochures and on the future graduate student web site.
Graduate Studies is currently working to develop a set of example professional development schedules that would identify a recommended sequence of co-curricular activities to support a desired career path (e.g. separate schedules to support a career in academia, industry, start-up/commercialization).

Goal C2: Improve Graduate Operations and Service

Provide excellent service to all clients

- Graduate Studies continues to work within Faculty and with University partners to improve administrative processes and to train/advise Departments on best practices.

Improve the quality and delivery of information

- Graduate Studies has reviewed and revised information on EGSO websites, and created SharePoint sites with reference information for department coordinators.
- The Graduate Studies Office continues to provide weekly reports to Associate Chairs and Graduate Coordinators of in-cycle admissions data.

Ensure timely processing of applications and admission correspondence

- The substantial improvements that have been made in recent years have been maintained, despite increasing number of applications.

Develop an effective and efficient strategy for managing cases of academic discipline and grievances

- Efforts have been focused on the development of comprehensive documentation associated with a number of key graduate student program milestones and on developing better university guidelines for academic offenses associated with plagiarism. The goal has been to more clearly articulate expectations and processes so to (i) reduce the number of plagiarism cases, and (ii) more expeditiously address cases that do arise.
- A series of student success workshops were organized by the EGSO for new professional Masters students admitted in F18 term. A key component of the workshop was focused on academic integrity.

Goal C3: Improve the Graduate Program

Foster consistently high quality graduate student supervision

- A University-level working group tasked with examining a range of questions surrounding graduate supervision has been recently formed. It is expected that this group will begin reporting in mid-2019.

Improve graduate course offerings

- A number of department have been reviewing and revising course offerings, as many develop specializations. A systematic, Faculty-wide review of graduate course offerings is anticipated to be undertaken once these specializations are implemented and course offerings stabilize.

Increase the academic rigour of graduate programs

- Addressing academic rigour requires that we first develop basic metrics for learning outcomes as a means for measuring academic rigour, and then determine the level to which rigour is desired within the Faculty, both of which are non-trivial. Rather, the Graduate Studies Office will shift its focus to articulating the learning outcomes from each of our graduate programs and then assessing how well those programs achieve those outcomes.

Improve the quality of students admitted to graduate programs

- Capturing student/applicant quality in one or more quantitative metric remains challenging and therefore monitoring changes in applicant quality over time is difficult. However, we have adopted the following strategies:
  - Implement scholarships that are specifically targeted at top quality applicants;
  - Encourage departments to require applicants to provide standardized test scores and use these as part of the applicant evaluation process;
  - Include the world rankings (e.g. THE, QS, etc.) of an applicant’s previous institution as part of the applicant record, so to easily identify institution quality;
- Implement applicant review tools (OGSAS) that better facilitate committee reviews and sharing of review comments from other faculty reviewers. This is being made available to departments in Engineering for the 2019 admission cycle.

Goal C4: Enhance the Graduate Student Experience

Evaluate current graduate student funding

- Minimum funding levels for research students are reviewed annually (by University for doctoral students and by EGSO/APC for MASc students).
- The Associate Dean, Graduate Studies is a member on the University Graduate Student Support Advisory Committee (GSSAC), which has made a commitment to conduct a comprehensive review of graduate student funding across the University in early 2019.
- Consideration of new models for funding graduate students in Engineering will need to wait until the details of the latest version of the Waterloo Budget Model are finalized.

Develop metrics for measuring and monitoring Engineering graduate student experience

- At present, we do not have good data that measure the quality of the student experience for graduate students in Engineering. There is a need to: identify what data are already being collected (often both other units); how meaningful these data are for our programs; whether or not other data need to be obtained (and if so, how); and, finally, how to use these data to provide metrics that support decision making for enhancing the student experience.

D. Research

In the 2017/18 fiscal year, the Faculty of Engineering earned $72.5M in total research funding, a new high. More than one-third of this amount is derived from various NSERC programs. The Faculty’s NSERC Collaborative Research and Development (CRD) grants nearly reached the $6M mark for the first time (nearly doubling since 2013-14). Funding from industry was $17M, a new high in the Faculty’s history and a 36% increase from the prior year. The Faculty received two NSERC Strategic Partnership grants (water resources, advanced manufacturing) and an NSERC Synergy Award (one of four awarded nationally).

The Faculty received five Canadian Foundation for Innovation (CFI) Innovation Fund (IF) awards, totalling $14.6M. A Canada 150 Research Chair (one award of 26 nationally) recruited Dr. Kerstin Dautenhahn with a federal contribution of $2.5M over 7 years. The Faculty earned two ORF Research Excellence grants of $4.0M and $3.1M. The Advanced Manufacturing Consortium (AMC) started with provincial funding of $35M over 5 years. Three industry-sponsored research chairs (Ripple, Cisco, Loblaw) were also awarded.

There were numerous honours and recognitions. One researcher became a Fellow of the Royal Society of Canada’s Academy of Science (W. Zhuang) and one became a member of the Royal Society of Canada College of New Scholars (F. Gu). Further, one earned the Rutherford Memorial Medal (Z. Chen), one became an Officer of the Order of Canada (K. Hipel), and one earned the Miroslaw Romanowski Medal (K. Hipel). Six faculty members became new Canada Research Chairs, four faculty members renewed Canada Research Chairs, and three junior faculty members received the province’s Early Researcher Awards.

Goal D1: Increase Research Funding

- In 2017/18, the Faculty’s total research funding reached 95.8% of the target. Funding from NSERC reached $24.5M, the highest ever.
- Partnership funding continues to increase steadily, with double-digit percentage increases in the last three years (27.5% increase in 2017-18 over 2016-17).
- Federal tri-council funding represents about one-quarter (25%) of all Waterloo Engineering funding. Provincial (13%), Industry (17%), Other (11%) and Federal non-Tri-Council (7%) makes up the rest for 2018.
- Waterloo Engineering total research funding represents about one-third of research funding at the University of Waterloo.
- Of the nearly $25M of NSERC funding in 2017-18, $7.5M represents Discovery Grant funding and nearly $6M represents Collaborative Research and Development grants, which is a program that has had a steady increase in funding to Waterloo Engineering doubling since 2013-14.
Three faculty members received Early Researcher Awards, two received Discovery Accelerator Supplements, two received NSERC Discovery Grant DND Supplements.

One faculty member (S. Boumaiza) earned an NSERC Synergy Award, only one of four national recipients.

Encourage and support researchers to pursue multi-year partnership programs

- The Faculty continues to target large and multi-year funding through programs such as NSERC Strategic Partnership Grants--Network (SPG-N) and Collaborative Research and Training Experience (CREATE).

- Waterloo Engineering professors (E. Toyserkani, M. Emelko) are principal investigator (PIs) on two of the nation’s three NSERC SPG-N grants announced in 2018, a truly outstanding recognition and an example of our research leadership.

- Three new NSERC Industrial Research Chairs (IRCs) were announced in 2018: Ripple Chair – University Blockchain Research Initiatives (A. Hasan), Cisco Canada Chair in 5G Systems (C. Rosenberg), and Loblaw Companies Limited Chair (F. Karray).

- The Faculty received a successful NSERC CREATE (Collaborative Research Training and Experience program) awarded in 2018 “Training in Global Biomedical Technology Research and Innovation” ($1.65M) with C. Burns as PI. This is the first CREATE awarded at the University of Waterloo since 2015.

- In 2018, there were five successful Canadian Foundation for Innovation (CFI) Innovation Fund (IF) projects announced in the Faculty amounting to $14.6M of funding. Matching of 1:1 at the provincial level through the Ontario Research Fund (ORF) Research Infrastructure (RI) program generates another $14.6M of funding.

- Two projects received provincial level ORF – Research Excellence (RE) program grants, contributing $7.1M combined (A. Safavi-Naeini, H. Tizhoosh).

- The Advanced Manufacturing Consortium (AMC) was established and started operations within the Faculty, and in collaboration with McMaster and Western universities, providing $35M joint funding over five years.

- The Engineering Research Office (ERO) provides support for proposal shaping, development, and review for all sizes of partnership grants. Further, the ERO facilitates industry-academia interactions to channel
opportunities into funding opportunities and enabling their success. The ERO provides logistics for on-site visits on-site review committees and industry partners.

Support and motivate faculty to pursue special large funding programs

- A Canada 150 Research Chair (K. Dautenhahn) was awarded with federal contributions amounting to $350k per year for seven years.
- Canada Excellence Research Chair (CERC) with a value of $10M was awarded to Waterloo Engineering as one of eleven awarded nationally in Phase 2 (out of 54 applications). Recruitment process is continuing.
- Six new Canada Research Chairs (CRCs) were awarded and four renewals were also awarded.
- Waterloo Engineering is part of the recently announced SCALE.AI supercluster initiative.
- To strengthen large-scale applications (CFI, CREATE, FedDev), the Faculty contributes cash that is matched by the university. When appropriate, the Faculty also contributes to the renovation and construction cost. In the most recent CFI-IF competition, that were announced in 2018, Waterloo Engineering professors has been PIs on five successful grants, totalling nearly $15M.

Encourage and support academic units to recruit best faculty and in strategic areas

- The Faculty prioritized CFI John R. Evans Leaders Fund (JELF) for recruitment of high quality faculty members.
- The ERO regularly provides writing and strategic information to academic units on CRC planning to attract or retain the best faculty members.

Emerging activities

- With the introduction of the new NSERC Research Partnerships program, the ERO will encourage faculty members to continue applying for small, medium and large grants, and continue seeking out Industry Research Chair opportunities. We expect that this new program will start sometime in 2019.
- To increase research activity, a focus on SSHRC and CIHR funding opportunities will commence. This is expected to increase overall funding and support segments of Waterloo Engineering (and our research partnerships) not suitable for NSERC funding opportunities.

Goal D2: Establish a Shared Commitment to Research Excellence

Support and motivate increased research activity

- The ERO continues to proactively build relationships with funding agencies, potential sponsors and other stakeholders to maximize the possibility of increasing research partnerships.
- Calls for research proposals are routinely emailed to Waterloo Engineering faculty members to ensure they are aware of relevant opportunities. For the case of specialized awards (e.g., early career, senior researchers), the ERO reaches out to individuals to encourage applications.

Support the development of faculty members as researchers

- The ERO provides new faculty members guidance on planning and launching their research programs at Waterloo.
- Researchers have the opportunity for ERO staff to review their grant applications. Internal deadlines allow for high volume funding opportunities to be managed more effectively.
- To help prepare applications for large grants, the provision of dedicated writers to faculty members can be made on a contract basis, depending on availability.

Develop stronger ties with industry

- The ERO continues to routinely hold meetings with large, medium and small companies to discuss industrial challenges that can be addressed through research to connect with research faculty.
- The ERO actively collaborates with the University’s Corporate Research Partnership Managers to raise awareness and visibility of our research strengths.
- Waterloo Engineering shares research with broader audiences through conferences such as OCE Discovery and Waterloo Innovation Summit.
The ERO supported themed research events held on campus in 2017-18 on topics including automotive and artificial intelligence technology that brought together academics and existing or potential industry partners to network and learn about new developments and opportunities for collaboration in these fields.

The Research Theme Sites, facilitated by the ERO, representing faculty research applications has significantly improved the ERO’s ability to identify and promote researcher expertise that is relevant to a company’s needs.

The ERO has contact with a broad spectrum of companies to rally support for strategic faculty initiatives. These conversations have deepened relationships with industry partners by demonstrating stakeholder engagement on issues that are critical to their long-term growth – talent development, access to leading-edge R&D equipment, and sources of emerging technology expertise.

A key example of a successful program requiring industry engagement is the Advanced Manufacturing Consortium (AMC) with planned hires within the Faculty for driving this key joint government-industry-academia engagement.

Partner with a targeted set of leading global universities

Please review Section II.G. for more detail regarding efforts to develop international partnerships.

Emerging activities

The ERO will develop a progression of research grant expectations for new faculty members and present this to them as part of the initiation meeting with the ERO. This will guide new faculty members with anticipated steps through a process of raising research funds (independently and jointly), recruiting HQP (highly qualified persons), publishing research results, and directing outcomes to industry or commercialization.

The ERO is considering enhanced efforts for seeking, assessing, and participating in industry conferences that would support the academic research needs within Waterloo Engineering. Key fields such as additive manufacturing, 5G systems, artificial intelligence, as examples.

Goal D3: Eliminate Barriers to Research Success

Enable a culture of collaboration and co-operation

Waterloo’s Faculties of Engineering and Mathematics jointly led the launch two new research institutes – the Waterloo Artificial Intelligence Institute (launched April 2018) and the Cybersecurity and Privacy Institute (to be launched in 2018-19). The launch of these two institutes is strategic and timely to address current trends and needs in research and industry.

Waterloo Engineering is already involved or leads many Senate approved research institutes and centres, such as the Waterloo Centre for Automotive Research (WatCAR), where researchers from various disciplines collaborate.

The ERO continues to foster interdisciplinary research in our identified areas of strength, collaborating with academic units to seek new external partnerships and identify funding opportunities.

Improve client service

The ERO provides service directly to researchers through review of their grant applications for a variety of funding programs. In addition, the ERO安排 technical writing support for large initiatives, and assistance organizing site visits for major funding programs.

Typically, one or two temporary writers are engaged to assist with review of the large volume of applications during the peak period of RTI and Discovery grants.

Improve access to resources

To help faculty members develop proposals for large grants, the ERO will arrange technical writers on a contract basis through the university’s Office of Research and share the cost.

Engineering normally allocates much of its CFI Infrastructure Operating Fund to those who help generate such funds through successful CFI-IF and CFI-JELF grants.

The ERO strives to identify NSERC-RTI and CFI-IF funded equipment for shared use by multiple research groups.
Improve the efficacy of communications

- Through frequent emails, faculty members are notified of potential funding opportunities, information sessions, webinars, and so on.
- The Manager of the Engineering Machine Shop, once a direct report to the Associate Dean, Research and External Partnerships, is now a direct report to the Vice-Dean, Faculty of Engineering. This shift has removed a layer of reporting and enabled improvements in efficiency and communications.

Emerging activities

- By better informing new faculty members of expected research escalation of funding and students, we hope that new faculty ramp up their research work more rapidly leading to successful tenure and sustained high-quality research contributions.
- The ERO will start to build stronger research inter-faculty relationships and within Engineering to accelerate success in SSHRC and CIHR funding opportunities, as well as to improve success in NSERC programs.
- ERO will continue to review and provide feedback on the NSERC Research Partnerships program and, once defined, communicate the nature of this new program to Engineering faculty to enable early success with this new, bundled program.

Goal D4: Celebrate Research Excellence

Recognize research excellence

- The Engineering Research Excellence Awards (EREA) are presented each year to tenured or tenure-track faculty members in the Faculty of Engineering in recognition of outstanding research accomplishments. In 2017/18, the recipients of the Engineering Excellence Awards were Ning Jiang (CEE, assistant professor), Patrick Mitran (ECE, associate professor), and Mustafa Yavuz (MME, full professor).
- Wojciech Golab (ECE), Ning Jiang (SDE), and Youngki Yoon (ECE) each received the Ontario government’s Early Researcher Award (Round 13).
- NSERC Discovery Accelerator Supplements from the 2016-17 competition were awarded to Giovanni Cascante (CEE), David Clausi (SDE), Krzysztof Czarnecki (ECE), Catherine Gebotys (ECE), Arie Gurfinkel (ECE), Kevin Musselman (MME), Sriram Narasimhan (CEE), Rodolfo Pellizzoni (ECE), Aiping Yu (ChE). 2017-18 results have yet to be announced.
- NSERC Discover Grant DND (Department of National Defence) Supplements were awarded to Professors Krzysztof Czarnecki (ECE), Ehab El-Saadany (ECE), Sheshakamal Jayaram (ECE), Manoj Sachdev (ECE), Duane Cronin (MME), and David Clausi (SDE).
- Slim Boumaiza received an NSERC Synergy Award ($200k), one of only four national recipients.
- The Faculty awarded six new Canada Research Chairs (CRCs): Zhongwei Chen (Tier 1, ChE), Ehsan Tooskeran (Tier 1, MME), Norman Zhou (Tier 1, MME), Luis Ricardo-Sandoval (Tier 2, ChE), Stephen Smith (Tier 2, ECE), and Lin Tan (Tier 2, ECE).
- The Faculty renewed three CRCs: Frank Gu (Tier 2, ChE), Raafat Mansour (Tier 1, ECE), En-hui Yang (Tier 1, ECE), and Catherine Rosenberg (Tier 1, ECE).
- Three new industry sponsored chairs were awarded to Engineering faculty members: Anwar Hasan (Ripple Chair, University Blockchain Research Initiative), Catherine Rosenberg (Cisco Canada Chair in 5G Systems), and Fakhri Karray (Loblaw Companies Limited Chair).
- Wiehua Zhang (ECE) became a Fellow of the Royal Society of Canada’s Academy of Science.
- Frank Gu (ChE) joined the Royal Society of Canada College of New Scholars.
- Zhongwei Chen (ChE) was awarded the Rutherford Memorial Medal in Chemistry.
- Keith Hipel (SDE) received the Royal Society of Canada Miroslaw Romanowski Medal.
- Keith Hipel (SDE) became an Officer of the Order of Canada.

Increase public awareness of research strengths and achievements

- Waterloo Engineering research stories are regularly featured on the faculty’s and university’s social media channels, including Facebook and Twitter.
The ERO participates in the Engineering Communications Council meeting which facilitates information sharing about events and marketing initiatives and provides an opportunity to encourage academic units and centres to promote their research.

The ERO coordinates and hosts visits by representatives of the municipal, provincial, and federal governments to demonstrate ongoing research activities and provide content for their marketing efforts to attract foreign corporate investment to Ontario.

Emerging activities

- A more active approach for identifying and promoting early career research successes will be conducted as part of the intake process for new faculty.

**Goal D5: Strategically Identify and Assess Research Strengths**

Pursue targeted partnerships and funding aligned with identified strength areas

- In 2017-18, the ERO received a Canada Excellence Research Chair in Human-Centered Robotics and Machine Intelligence. The total budget for the chair’s proposed research is nearly $25M. Potential candidates for this position are being considered.

- The ERO applied and the Faculty received a Canada 150 Research Chair valued at $350K/year for seven years in Intelligent Robotics. The total budget for the chair’s proposed research is about $10M. This was awarded to Kerstin Dautenhahn who will start her position in August 2018.

Emerging activities

- A strategic initiative to better understand the breadth of research efforts and associated faculty members will be considered within Waterloo Engineering.

**E. Teaching**

Inaugurated in May 2012, the Associate Dean, Teaching (ADT) portfolio completed its fifth complete calendar year of operation in 2017. Regular operational activities continue to proceed for the strategies associated with all four ADT portfolio goals. Given its relative newness as an operational unit and its uniqueness as the only ADT portfolio in the University, the regular operation of clearly identified activities and the development of teaching excellence continue to be notable measures of significant progress.

Based on the experience of 2017 and noting the impact of activities, several strategies have been identified as needing adjustment. These strategies and the adjustments implemented and underway in 2018 are as follows:

- The ADT portfolio’s support staff position title and job description were revised to better reflect the scope and responsibilities of the role;
- As part of the planning process reassess how the ADT portfolio can best connect its knowledge and experience to the academic units;
- Develop strategies for the continual development and evaluation of TAs;
- Re-affirm the value of a universal Faculty-wide exit survey and ensure that this and similar data such as that from the National Survey of Student Engagement is being fully utilized in continual program improvement processes; and
- To give increased priority to understanding and improving the assessment of teaching potential when hiring new faculty including sessional instructors.

**Goal E1: Enhance Support for Teaching at the Faculty Level**

Develop and foster a community comprised of department representatives dedicated to teaching

- We continued to support and regularly meet with teaching "champions" in each of the academic units. Monthly meetings provided a chance for champions to report on activities and issues within their unit, to share successful experiences, and to work on projects of broad interest to the Faculty. For example, the group identified the Annual Engineering Teaching Event as a project of interest and took a lead role in developing its theme and basic structure. Several meetings later in the year were devoted to initiation of the next Faculty strategic planning exercise.
Focus for 2018: As the ADT portfolio matures it has developed a deep body of knowledge in support of the development of teaching excellence, and is known within the Faculty and University for this expertise. An emphasis of the strategic planning exercise should be to propose strategies for better transferring and utilizing this knowledge base within the academic units. This may require re-thinking the structure and organization of the departmental representatives dedicated to championing teaching.

Assess the roles of the ADT portfolio and recommend organizational and structural change as necessary

With the experience of the portfolio's first five years, personnel roles have been assessed and better defined. Of particular focus in 2017 was the revision of the title and job description of the portfolio’s sole support staff role. The revised title, Teaching Development Associate (previously Assistant to the Associate Dean, Teaching), was chosen to better reflect the independent nature of the position’s responsibilities, which are largely operational in contract with the ADT’s strategic and executive responsibilities.

Goal E2: Contribute to the Development of Faculty Members and TAs as Teachers

Establish minimum teaching development expectations for all new faculty members

- All appointment letters for regular faculty positions contain an explicit statement on the importance of our teaching mandate and outline the expectation that all new faculty will develop a plan for “Learning about Teaching” within two months of the start of their appointment, a practice which began in 2012. The Centre for Teaching Excellence offers a set of workshops which are mandatory to those without equivalent experience.
- The ADT meets with all new faculty members in definite term and tenure track positions to review incoming teaching background, plans for teaching development, resources for teaching development, and mandatory workshop requirement.
- Eleven tenure track faculty attended the bi-annual lunch for new faculty, held in February 2018. Standards, methods of assessment, and criteria for awarding tenure were discussed.
- Student course evaluation results for all probationary and definite term faculty continue to be reviewed at the end of each teaching term. For graduate courses, this review is done in collaboration with Associate Dean, Graduate Studies. This resulted in 22 consultations with probationary term faculty members to discuss teaching development challenges.

Promote opportunities for all instructors to learn more about teaching over their career

- The ADT continued to improve access to the Instructional Skills Workshops (ISW):
  - Facilitated one ISW session for Engineering instructors (December 2017);
  - Promoted CTE’s four ISW sessions to Engineering instructors (February 2017, June 2017, August 2017, and November 2017);
  - Promoted CTE’s May 2017 Facilitator Development Workshop, wherein 3 instructors from Engineering became certified ISW facilitators.
- The ADT continued the tradition of the Annual Engineering Teaching Event. The theme for the event, which was held on October 31, 2017, was “Engineering Education & the Performing Arts”. 35 participants from Engineering attended this two-hour workshop, a significant increase from 2016 (13).
- Access to teaching resources including workshop materials for all Engineering faculty and staff was continued via the Engineering Teaching SharePoint site.
- ExpectTations, a workshop for TA Training was offered both in April 2017 (107 participants) and in December 2017 (248 participants). The workshop continued with a blended delivery, which included:
  - Three online modules focused on academic integrity, ethical behaviour, and safety;
  - A workbook with participant and mentor versions focusing on essential development in TA roles;
  - A set of TA web pages that include an overview of roles and responsibilities, as well as resources such as teaching tips and videos demonstrating exemplary TA activity.
- The annual teaching conference (Opportunities and New Directions) was held on April 27, 2017, with 32 participants from Engineering (38 in 2016).
- The ADT promoted participation in 2017 Teaching Excellence Academy (TEA) workshop.
The ADT delivered presentations on teaching excellence and its assessment to the ECE Merit Committee, CEE Department, and ECE Tenure & Promotion Committee in 2017.

Provide mentorship in teaching

- While each unit has the resources of a local teaching champion, mentorship in teaching remains a high priority activity for the ADT. The ADT had 22 meetings with probationary instructors in 2017 and also met with 4 tenured instructors.

**Goal E3: Affirm the Importance of Teaching**

Include an assessment of teaching potential when hiring new faculty

- While most departments are assessing teaching potential to some degree in the hiring process, the extent and uniformity of these assessments is unknown. In addition, there is no evidence that existing resources for peer evaluation of teaching (developed by the Engineering Teaching Development Committee in 2014) are being used. This remains a priority issue for the ADT.

Measure teaching quality and outcomes for individual and institutional improvement

- The ADT office continues to maintain and improve Student Course Evaluation processes:
  - Standard reporting for course evaluation scores, that includes standard aggregate properties (e.g. mean, 85th and 15th percentiles) was facilitated in T&P presentations for all courses in each unit;
  - The ADT supported a motion committing the university to the implementation of a universally applicable student course evaluation instrument and an online delivery system;
  - The ADT has continued to provide Chairs/Directors and relevant committees with data and information to inform the use of student course evaluation data in annual merit and T&P decisions.

<table>
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<th>Undergrad. Q10 - What is your overall appraisal of the quality of teaching in this course?</th>
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<table>
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<th>Year</th>
<th>Graduate Courses</th>
<th>Graduate Q9 – Overall, I would rate this course as excellent … poor.</th>
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<td></td>
<td></td>
<td>Mean</td>
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<td>2014</td>
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<td>80.6</td>
</tr>
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</table>

- The ADT facilitated a faculty-wide exit survey in Winter 2018 with the support of the Graduate Attributes Lecturers, the results of which were shared with departments for analysis and action.

Recognize and reward excellence in teaching

- Eight nominations were submitted for the Sandford Fleming Foundation Teaching Excellence Awards. The winners were Wayne Chang (Conrad), Carol Hulls (MME), Rajinder Pal (CHE) and Derek Wright (ECE).
- The ADT met with nominators to support their nomination of Distinguished Teaching Award (DTA) candidates. 14 nominations were received, and two Engineering professors, Sanjeev Bedi (MME) and Dan Davison (ECE) were ultimately selected as university-wide recipients. This was the second year in a row in which two of the four university-wide DTA recipients were Engineering faculty members.
- The ADT supported the Engineering Student Society (EngSoc) Teaching Excellence Award selection process, sponsored and implemented by EngSoc. Matt Borland (SYDE – Winter), Igor Ivkovic (SYDE – Spring), and Eline Boghaert (CHE – Fall) were named recipients in 2017.

- The ADT supported the nomination of Carol Hulls for the 2017 OCUFA Teaching Award.

- Gordon Stubley, ADT, was recognized as a 3M National Teaching Fellow in 2017. The knowledge and experience gained from the nomination process is being applied to new nomination efforts.

Communicate commitment to the Faculty’s teaching mandate

- The ADT office continues to develop the public-facing Teaching and Learning pages on Faculty web site and the Engineering Teaching Community site.

- In co-operation with University Teaching Fellows, the ADT supported CTE initiatives to document and promote exemplary stories of excellent teaching.

**Goal E4: Support Teaching Innovations and Strategies for Integrating Learning**

Introduce an innovative undergraduate learning environment for all engineering students

- Dr. Sanjeev Bedi’s NSERC Chair in Immersive Design Engineering Activities (IDEAs) began in May of 2016 with continuing support from the Dean of Engineering, and five companies: ANSYS Canada Ltd., D2L Corp., Rockwell Automation Canada Control Systems, Quanser Inc., and Skyjack Inc.

- In the second year of the chair, over 3,000 unique students in 35 courses from 11 programs participated in at least one Ideas Clinic activity. This represented a 50% growth in students over the prior year. These activities included:
  - Engineering Design Days: nine separate Design Days were held, where in students worked in teams to solve complex discipline-specific problems. Activities are 2 days in length, immersive, hands-on, and were run in Systems Design, Biomedical, Mechatronics, Management, Electrical, and Computer Engineering. In addition, new Engineering Design Days events were offered to 1B Mechanical, 2A Civil, and second year Environmental/Geological Engineering. Work has begun on Engineering Days activities for Software, Nano, and first year Environmental and Geological Engineering for 2018/19.
  - The inaugural EngCon pre-capstone design convention: EngCon was a full day convention for 3rd and 4th year students with a focus on Engineering Design. This convention brought together more than 150 3rd/4th year students, industry representatives from 14 different companies, as well as alumni, instructors, and entrepreneurs to share ideas, get advice, and build professional networks. The Departments of Electrical and Computer, and Mechanical and Mechatronics Engineering provided financial support for the event, and instructors, staff, and students from across the Faculty volunteered their time to make the event a success.
  - Five teamwork training modules, which were offered in 12 courses to over 1,000 students and developed with support from a LITE full grant.

- With the help of Professor Steve Lambert, a capstone competition focused on Engineering Analysis was run for the second time in the Winter 2019 term. A team of students from Mechanical Engineering were the first place winners, with runners-up from Management Engineering and Chemical Engineering.

- The Engineering Ideas Clinic continued its support of the Engineering BASE program in the winter and spring terms. This support is transitioning to the First Year Engineering Office in future terms.

- Twenty-two different members of the Ideas Clinic authored and/or presented papers at engineering education conferences in 2017, including:
  - papers on the MTE and SYDE/BME Engineering Design Days at the Canadian Engineering Education Association (CEEA) Conference in Toronto;
  - four different papers on standalone activities at CEEA in Toronto; and
  - a paper on the teamwork training modules, plus a paper on a standalone activity in CIV/ENVE/GEO at the American Society for Engineering Education (ASEE) Annual Conference in Columbus

- The Ideas Clinic hired 15 co-op students from a broad range of programs in 2017/18. These students designed equipment for a diverse set of activities including a model of a car’s suspension, PLC programming for an assembly line, programming apps for a Microsoft Hololens, and ANSYS AIM tutorials, among others.
Support teaching innovations and curriculum renewal

- The ADT continues to work explicitly with the Ideas Clinic team to develop common understanding of the theoretical foundations of learning and teaching knowledge that underpins the proposed learning activities.

F. Outreach

The Waterloo Engineering Outreach program remains a key provider of camps and events in the City of Waterloo. The established reputation of Engineering Outreach, coupled with experienced in-house staff allowed for the delivery of accessible, enriching, and high-quality programming to thousands of students, including current Waterloo Engineering students. Core, established activities, such as Engineering Science Quest, remain a priority, with over 300 campers registered each week during the summer months. Simultaneously, Engineering Outreach continues to seek opportunities for new program delivery and content creation, so to expand both the number of workshops offered, but the reach of our activities.

Goal F1: Expand the Scope of Waterloo Engineering Outreach Programs

Expand outreach activities to include high school programming

- Engineering Outreach again expanded its Catalyst program for high school students, with 77 enrolled for 2017.
- Off-campus and weekend programming increased from 2016/17, with 700 individual visits/programs offered.
- A variety of outreach programs for current undergraduates were undertaken, with a particular emphasis on events and activities for Women in Engineering and International students, including:
  - Women in Engineering Living Learning Community
  - International Students Living Learning Community
  - Mini Hackathon
  - Outreach Squad
  - Peer Mentorship
  - WiE Wednesdays

Figure 15: High School Program Participation Performance to Target
Goal F2: Enhance the Waterloo Engineering Community through Participation in Outreach

Engage current Waterloo Engineering community members in outreach activities
- Strategic planning activities are ongoing, with campus community engagement expected to remain a priority.

Diversity

The Engineering Outreach office continued with its current focus on increasing the number of females at all levels in the faculty. In addition to traditional events and activities, new initiatives, such as the Women in Engineering Living Learning Community (WiE LLC) were launched in 2017. The WiE LLC is an example of Outreach’s leadership where a partnership with St. Paul’s Residence allows UW to offer a welcoming and nurturing environment to incoming undergraduate female engineering students. The WiE LLC is expected to continue in 2018, and an additional Living Learning Community for international students will also be initiated.

Goal F3: Increase the Participation of Women in Engineering at Waterloo

Increase the confirmation rates of offers made to female undergraduate engineering applicants
- Confirmation rates of our female engineering students increased marginally in 2017/18 to 42.6%. For the first time, the percentage of female entrants to first-year engineering exceeded 30%. By contrast, the 2017 national average for female enrolment in Engineering is 23.9%.

Establish best practices related to the recruitment of women faculty
- Similar to previous years, the Associate Dean Outreach has offered to meet with each Departmental Advisory Committee on Appointments (DACA) to discuss diversity in the applicant pool and best hiring practices.
- The percentage of women on faculty was just below target at 18.1%. This represents a 29% increase since the start of the plan period.
Goal F4: Build an Inclusive Atmosphere within Waterloo Engineering

Establish a framework to report and respond to issues of diversity and inclusivity

- Engineering Outreach continues to inform students about the Women in Engineering committee and activities. Part of the role of the Associate Dean, Outreach is to provide support and to discuss issues around diversity and inclusivity. The Outreach office continues to work with on-campus experts to understand and implement best practices to allow our female students to support women in our engineering programs. The office also continues to support a large research study being undertaken by Christine Logel at Renison University on social belonging interventions to help improve the experience of engineering students in first year, with emphasis on female students. This study began in September 2015 and will continue over the next three years.

G. Internationalization

The Associate Dean (AD), International, and the Engineering International Office (EIO) continue to develop and enhance campus and international partnerships related to academic mobility and international collaborative research partnerships. In the 2017/18 planning year, 14 international research agreements were signed or renewed, and one new student exchange agreement was created. Information regarding current mobility agreements in the EIO database has now been made available to members of the Engineering faculty.

Mental wellness continues to be a focal point for all of our students but in particular for international students given their unique characteristics and greater difficulty in adapting to the University of Waterloo environment. In partnership with the Engineering Outreach Office, the EIO has established a living learning community (LLC) hosted by St. Paul's University College targeted for first year international students. We also plan to offer opportunities for social interaction and engagement for new international students in an attempt to provide a friendly environment for students outside of normal academic hours.

Goal G1: Consolidate and Expand Internationalization Efforts Within the Faculty of Engineering

Enhance co-ordination and collaboration on internationalization across the Faculty

- The EIO is now recognized within the Faculty at large as the facilitator, or liaison for all international activity. The EIO mindfully monitors and ensures that all international endeavours represent and consider the best interests of the Faculty of Engineering as a whole. Efforts in the past year and prior have affected the balance in the number of students going on exchange from the University of Waterloo and the number of students coming to the UW on exchange.

Facilitate visits by international delegations to Waterloo Engineering

- In the 2017 calendar year the Engineering International Office facilitated or participated in over 20 international visits by delegations from partner, and/or prospective partner, institutions, or government officials.
- Twenty-six Engineering faculty members participated in international collaborative workshops with: Beijing University of Posts and Telecommunications (BUPT), Kings College London (KCL), and National University of Singapore (NUS). These workshops immediately resulted in five peer-to-peer partnerships between UW and NUS faculty members, with potential for numerous other such collaborations. For example, another six peer-to-peer partnerships were started in a follow up workshop with NUS held at Waterloo in June 2018.

Further develop the Faculty’s strategic plan for internationalization to reflect the new office and consolidated portfolio

- The AD International continues to explore additional mobility and research partnerships with international institutions most closely aligned with the Faculty’s plans for a notable and diverse international presence. Recently identified institutions under consideration include, but are not necessarily restricted to South Mediterranean University, Tunisia, IIT Madras, India and Politecnico di Torino, Italy (more specifically related to automotive research and hosting of I.V.G.S. students).

Working Group on International Travel Issues

The AD International will continue to actively participate in the newly formed Working Group on International Travel Issues, created by the Associate Vice-President, International, to review and monitor considerations of international travel by all University of Waterloo members: faculty, staff and students both going abroad from and to UW.
Additionally, as earlier mentioned, the EIO will continue to provide leadership and oversight on all matters related to internationalization within the Faculty and will serve in a liaison and support role with department faculty and staff to help promote international initiatives.

**Goal G2: Increase International Undergraduate Enrolments**

Enhance international recruitment efforts

- Though international intake decreased slightly in 2017, Engineering continues to exceed its international intake targets.
- Further details on international recruitment initiatives are provided in Section II.B of this report.

*Figure 18: International Undergraduate Intake Plan Performance to Target*

Provide additional support to Waterloo Engineering international students

- The most recent notable development in efforts to support Waterloo engineering International students is exemplified in the creation and development of the International Living Learning Community. These communities were developed in an effort to respond to a sense of loneliness and isolation felt by many international students. Many international students do not participate in organized events but it is hoped that by sharing a residence with others of similar cultural background, they might be able to share experiences that add to their mental wellbeing.
- 20 places have been set aside at St. Paul’s College for the 2018/19 academic year and as of early July, all 20 places were filled. Due to the overwhelming response, an expanded program will be considered next year with additional places in the Village Residences.
- The EIO will continue to reach out to this group of students through written communication and community building events throughout the 1A term.

**Goal G3: Increase International Experience Opportunities for Undergraduates**

Increase participation in international exchange

- The AD International has continued efforts to more actively express the best interests of the Engineering faculty with Waterloo International on whether or not to continue partnerships and or establish new partnerships, with due consideration for:
  - Ensuring availability of choice in all regions of the world;
  - Level of activity during the past 5-year cycle;
  - Alignment of course offerings to meet needs of Waterloo engineering students.
- These efforts have resulted in a near complete balance between the numbers of Engineering students going abroad and coming from abroad to participate in international exchange opportunities.
- Meetings with classes have expanded to 1B and 2A classes to introduce students to the benefits and opportunities for academic and co-op international exchange.
- EIO has continued to work toward developing new agreements in targeted areas of engineering less represented in current mobility and research agreements such as Biomedical Engineering and the new Architectural Engineering program.
Another effort to achieve better balance between incoming and outgoing exchange students was the EIO’s continued work with Waterloo International and Student Success Office Global Learning Co-ordinators to promote placement in previously less attended exchanges. One example implemented is the availability of group placements to less popular exchange destinations. In these situations, a few students decide together to participate in a mobility agreement at a partner institution and are then placed as a group.

Additionally, the first five Engineering International Exchange Awards were awarded this year in a further effort to encourage International mobility opportunities by alleviating some of the related financial burden associated with these opportunities.

Figure 19: Undergraduate International Exchange Terms

Develop additional international co-op work term opportunities

- Engineering students continue to account for approximately half of the total number of international co-op placements across the campus. The development of jobs outside of North America remains a challenge, though many students have achieved success securing employment abroad via individual networking.
- A successful pilot program, allowing students access to the facilitated co-op job search process while on exchange, has eliminated one of the reservations students had about participating in an exchange, since they have equal access to co-op job opportunities and are not disadvantaged by their exchange.

Figure 20: International Co-op Work Terms Performance to Target

Leverage opportunities for co-op job development within exchange agreements

- A major effort by the EIO in this area has been the promotion of hybrid agreements when approached by international institutions wishing to partner with the University of Waterloo. In these agreements, academic study spots are offered for inbound students from partner institutions, in exchange for Co-op placement opportunities for UW students at the partner’s home country. An example of this would be the proposal of such an agreement with King’s College London, currently in development with Waterloo International, and a similar agreement in Thailand.
Also, as previously mentioned, students on exchange now have access to WaterlooWorks while on their exchange.

**Goal G4: Increase International Graduate Studies and Research Collaborations**

Develop an international research strategy

- Definite strides are being met in the development of international research collaboration opportunities. Looking back on previous international research workshops held two or more years ago, courses, research publications and joint funding applications all appear to be coming to fruition.

- This past planning period, the Tsinghua University–University of Waterloo Joint Research Centre for Micro/Nano Energy & Environmental Technology was established. This effort was jointly led by Professor Zhongchao Tan from the Department of Mechanical and Mechatronics Engineering and Professor Qinghai Li of the Department of Thermal Engineering Group at Tsinghua University. Approved October 11, 2017, seed funding totalling $400,000 was made available to promote research partnerships between the two schools. The first Collaboration Strategies Workshop on Micro/Nano Technologies for Clean Energy & Environment was held at Tsinghua University on March 28, 2018. Ten researchers from Waterloo participated in the workshop. On March 29, 2019, the Centre was officially launched in Beijing by a University of Waterloo delegation, led by Feridun Hamdullahpur, President and Vice-Chancellor, and Pearl Sullivan, Dean of Engineering, along with Xu Chen, Chancellor of Tsinghua.

- Peer-to-Peer partnerships with National University of Singapore were also established in 2017/18 with seed funding in the amount of $360,000 (CDN) jointly provided by UW Engineering and NUS Engineering. 11 joint partnerships have been started primarily in the biomedical research sector. Funding is provided to accept/hire Canadian or Permanent Resident students by UW researchers, and to fund travel and research support for NUS researchers. Seed funding provided is for the first year of the partnership only. Subsequent funding is provided by individual researchers through existing or future research grants.

Pursue strategic internationalization in graduate studies

- A key goal in the pursuit of internationalization in graduate studies has been to improve the in-bound graduate exchange student experience. During the latter part of the reporting year the EIO was granted access to vet and process applications for these students. It is anticipated that this will greatly reduce the processing time for these applicants, thereby making their interactions with Waterloo more positive from the onset.

- A main focus for the EIO in the coming year will be to identify opportunities for increased communication with engineering graduate students on opportunities to participate in international experiences. One such effort in this direction would be the creation of joint supervision of PhD admits through funding arranged during workshops held with NUS.

- The AD International anticipates that similar collaborative research will develop in the coming year as a result of similar workshops which were also held, in conjunction with Kings College London, and Beijing University of Posts and Telecommunications this past year.

**H. Entrepreneurship**

Waterloo Engineering continues to nurture start-up activities to support student entrepreneur aspirations. The Faculty is committed to fostering a culture of entrepreneurship from first year, where student founders interested in addressing market opportunities in technology and product are supported. Wide-ranging facilities and mentoring are provided for ideas development, design and build opportunities, seed funding through the Engineering of the Future Endowment, and open access to research labs and makerspaces. Over 650 start-ups, spin-offs, and mature companies have Waterloo Engineering students, faculty, staff, or alumni as founders. These organizations help contribute to University of Waterloo's Pitchbook ranking, where we regularly rank as the #1 Canadian university (#20 worldwide) on the list of Top 50 University Producing VC-backed Entrepreneurs – Undergraduate Program.

**Goal H1: Provide Academic Programming to Support Student Interest and Development in Entrepreneurship**

Maintain our flagship graduate programming

- The University Senate in 2018 approved changing the name of the Conrad Business, Entrepreneurship and Technology Centre to the Conrad School of Entrepreneurship and Business. This is an important milestone since the Conrad School will now be recognized as an academic unit.
The Conrad School will continue to focus on the Master in Business, Entrepreneurship and Technology (MBET), both full-time and part-time, while considering new iterations and forms of this flagship program.

Additional details can be found in the academic unit report by the Conrad School in section II.L of this report.

Develop additional academic programs for students interested in entrepreneurship

- The Conrad School continues to grow its enrolment in both the entrepreneurship minor program (offered to students across campus) and the entrepreneurship option (offered to Engineering students), with 19 and 17 registrants, respectively.
- The Conrad School’s entrepreneurship diploma program for professional master graduate student students in engineering remains very successful. A proposal to expand the program is under consideration.
- Additional details can be found in the academic unit report by the Conrad School in section II.L of this report.

Expand and enhance the Enterprise Co-op (E Co-op) program

- In 2017, the E Co-op program had 49 student participants. Of these, 24 were Faculty of Engineering students.

Develop a formal opportunity to expose select engineering students to entrepreneurship during their first work term

- In 2017, 53 students from 12 different engineering programs participated in the Bridging Entrepreneurs to Students (BETS) program. Participating students received one week of workplace skills training, followed by three 5-week placements with start-ups in the Waterloo Region and the Greater Toronto Area.

Goal H2: Develop Extra-Curricular Initiatives to Support and Encourage Entrepreneurial Students and Projects

Develop a mechanism to help generate funding for student start-ups

- The Faculty of Engineering distributed $87K to entrepreneurial students through the Norman Esch Entrepreneurship Awards for Capstone Design and the Engineer of the Future Trust.
- The Palihapitiya/Lau Venture Creation Fund continued for its second year. One Capstone Design who is pursuing their project after graduation was awarded $50,000.

Provide access to tools and facilities to support young entrepreneurs during their studies and after graduation

- Access is provided to the student machine shop and G2N facilities to support capstone design and start-ups.

Partner with members of local, national and international entrepreneurship communities to develop opportunities for our entrepreneurial students

- For the fourth year, the Faculty of Engineering partnered with the student-organized hackathon HackTheNorth. 1,000 students from around the world were selected to participate in a 36-hour hackathon. Participants were able to interact with many notable mentors and tech founders.

Goal H3: Develop New Spaces and Infrastructure to Support Entrepreneurship and Innovation

Embed the facilitation of entrepreneurship in the design of Engineering 7 (E7)

- E7 occupancy began in summer of 2018. The building will support expanded entrepreneurship and innovation initiatives across the Faculty of Engineering. The Conrad School will also make its home in the new building, further cementing E7 as the engineering hub for entrepreneurial activity.

I. Space

Since 2011, Waterloo Engineering’s main campus space holdings have increased by 26%, to a total of 60,219 net assignable square metres (nasm) in 2018. Despite this increase, space constraints remain an impediment to the Faculty’s strategic development. Our current space plan anticipates a significant increase to our space holdings in late 2018. The increase will primarily be achieved through the construction of a new building, Engineering 7 (E7), on the East Campus.
Goal I1: Maintain a Current Comprehensive Space Plan for the Faculty

Track and report on space allocations and reallocations at a unit level

- Waterloo Engineering’s space and facilities team continues to work with the university offices involved in the management of institutional space records. Together the groups have realized more efficient options for updates in systems going forward.

- Engineering has worked closely with the university offices to co-ordinate selected exchanges of space in the EIT and Physics buildings. Offices in both these buildings have now been transferred to the University as part of the agreement which has resulted in EC4 being made available to address the pressing research endeavours of the Departments of Mechanical & Mechatronics Engineering and Systems Design Engineering.

Goal I2: Create the Space Required to Meet Operational and Strategic Needs

Renovate and construct new space as required

- Since the ground-breaking of the new E7 building in November 2015, Ellis Don made impressive progress on the site with building completion in August 2018. Construction deficiencies, which are inevitable in all such major projects, are now ongoing.

Table 10: Projected Impact of E7 on Space Holdings (Core Categories Only)

<table>
<thead>
<tr>
<th>Space by Core Category</th>
<th>Current Seating Capacity</th>
<th>Current Total nasms</th>
<th>Future Seating Capacity (with E7)</th>
<th>Future Total nasms (with E7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture / Classrooms</td>
<td>1,753</td>
<td>2,580</td>
<td>3,327</td>
<td>5,543</td>
</tr>
<tr>
<td>Teaching Labs</td>
<td>3,159</td>
<td>9,569</td>
<td>3,159</td>
<td>9,569</td>
</tr>
<tr>
<td>Research Labs</td>
<td>n/a</td>
<td>19,580</td>
<td>n/a</td>
<td>21,644</td>
</tr>
<tr>
<td>Workshop / Machine Shop Spaces</td>
<td>n/a</td>
<td>1,526</td>
<td>n/a</td>
<td>1,756</td>
</tr>
<tr>
<td>Student Office Spaces</td>
<td>2,387</td>
<td>10,784</td>
<td>2,866</td>
<td>13,174</td>
</tr>
</tbody>
</table>

- An extensive renovation of part of the DWE A-Wing second floor has been completed. This renovation allowed for the relocation of the computer support personal (Engineering Computing) from the Physics Building to DWE. The second floor DWE renovations have also provided for a planned second expansion of the undergraduate mechatronics laboratory facilities.

- With the final relocation of the IST services out of E2 space, the Faculty of Engineering has been able to advance the development and renovation of the Engineering Undergraduate Office in E2. This project has included the removal of asbestos in E2. The successful completion of these important undergraduate student offices in late November 2018 has provided a welcoming space for our students and the appropriate student counselling services.

- The Faculty of Engineering established an innovative Architectural Engineering Program with the first student intake in September 2018. In late 2017, a large area on the ground floor of the CPH, previously occupied by the Engineering Undergraduate Office, was gutted and targeted to establish the first of two large Design Teaching Studios to support the unique teaching requirements of this new program. The new facility was scheduled to open in September 2018, but this has been delayed due to unexpected on-site construction difficulties and will now open in January 2019. A temporary home for the many students who enrolled in the Program in September 2018 has been established on the 7th floor of E7.

- Construction of the second Design Teaching Studio commenced in April 2018. It is located on the 3rd floor of the CPH and is scheduled for completion in 2019. The insertion of these Design Teaching Studios in the CPH will certainly transform the character and appearance of Carl Pollock Hall.

- Planning was initiated in late 2017 to establish a facility to accommodate research into autonomous vehicles which represents a major undertaking within the Faculty of Engineering. Approval was secured to build AVRIL, the Autonomous Vehicle Research and Intelligence Laboratory, on the East Campus. Supported by the Canada Foundation for Innovation, the Ontario Research Fund, the University of Waterloo, and the Faculty of Engineering, AVRIL will be Canada’s first building with full instrumentation facilities for 10 automotive bays to support research and development of autonomous vehicles.
Goal I3: Harmonize All Aspects of Safety within the Faculty of Engineering

Engineering Safety Planning Committee

- The Engineering Safety Planning Committee (ESPC) continues to meet each term with safety representatives from all academic units and the machine shops. This provides a forum to review the status of the group projects, for presentation of any new requirements from the UW Safety Office, for open discussion of implementation methods, the review of any safety incidents that have occurred and sharing of lessons learned and corrective actions taken. Further, a roundtable discussion of new safety-improvement ideas is conducted for the benefit and consideration of all attendees.

- As a “Continuous Improvement” process, the ESPC regularly meets each term with safety representatives from all engineering academic units and the machine shops. This provides a forum to review the status of the group projects, for presentation of any new requirements from the UW Safety Office, for open discussion of implementation methods, the review of any significant safety incidents that have occurred and sharing of lessons learned and corrective and preventive actions taken. Further, a roundtable discussion of new safety-improvement ideas is conducted for the benefit and consideration of all attendees. This provides a great opportunity for learning, action and measuring, to improve the safety of all Engineering personnel.

Identify and pursue initiatives to improve safety and risk management in the Faculty

- The ESPC has created a standard “template” for the creation of all Standard Operating Procedures (SOP’s), and a SharePoint depository for open access to these documents for all departments. To date, over 60 SOP’s have been created and shared.

- Each department is requested to perform Hazard Analyses in their labs to determine where Standard Operating Procedures (SOP) are needed or Safety Warning Stickers are to be applied. The SOP’s developed are to be stored in a secure online repository for all Engineering Safety Planning Committee (ESPC) members to access.

- All ESPC members are currently involved with performing safety audits in their labs and updating their department equipment hazard analyses. They are also confirming the safety training of their faculty, staff, researchers and graduate students.

- ESPC members are encouraged to request that a “Safety First” agenda item be presented at monthly department meetings, thereby emphasizing the concept that safety is a top issue for the departments. This has been achieved by most departments to date.

- The ESPC has made the recommendation for Research Lab secure access, the optimal method is to install WATCARD swipe access. This would provide for specific access for each person on campus to various lab rooms for which they have permission.

- We are pleased to report that a revamped QNC Safety Committee has been created and is meeting each term to help oversee the safe operation of the QNC labs and the safety of the students within.

J. Information Technology

In 2017/18 Engineering Computing has successfully completed and started a number of projects to meet the strategic goals, including:

- Thesis submission system for EGSO (in final stage of implementation);
- Engineering safety system (in progress);
- Engineering accreditation system (in progress);
- Linux on Engineering Computing lab machines (completed);
- OFIS/Faculty profiles integration (completed);
- Dean’s Office automation (in progress);
- GPU sharing for courses (in progress);
- Security and accessibility testing tools for Engineering IT staff (in final stages of implementation).
Goal J1: Ensure a Quality Computing Environment
Upgrade and/or renovate undergraduate computer labs and terminal servers on a rotating basis
- Upgraded all lab PCs to Windows 10.
- Implemented a system allowing users to run Linux OS from lab machines. Now available in multimedia and graphics labs, on 300 computers.

Integrate faculty profiles with OFIS to facilitate editing of profile web pages directly by faculty members
- The integration project was completed in 2018.

Goal J2: Enhance Support to Computing Clients
- Engineering Computing continues to improve IT service desk access and computer support for faculty and staff.

Goal J3: Support Improvements to Operational Efficiency and Innovation in Service Delivery
- The Associate Dean, Computing continues to implement a process by which inefficient or ineffective operations and duplication of efforts are identified and solutions developed, either by adapting and sharing existing systems or by implementing new systems. A number of projects were initiated or enhanced in 2017/18:
  - A system for GPU sharing in the courses teaching Deep Learning. The initial system was developed and piloted in one graduate course in Spring 2018. Modifications were made based on the feedback. Another pilot is scheduled for Winter 2019.
  - Computer security system. Patrick Matlock (seconded from IST) is currently developing a system that will allow IT staff across the Faculty of Engineering to monitor the security of the servers and workstations in the Faculty. The system is expected to be completed by the end of 2018.
  - Engineering accreditation system. Engineering computing together with the office of the AD, Co-operative Education and Professional Affairs, are developing a system to support the accreditation process. The system is in the final stages of development.
  - EGO thesis submission system. Engineering computing together with the office of the AD, Graduate Studies, are developing a system to support the process of PhD thesis submission. The system is in the final stages of development.
  - Engineering safety system. Engineering computing are developing a safety system that would allow tracking of the completion of safety courses by staff, faculty and students. The system development is in progress.
  - Dean’s Office automation system. Engineering computing are developing a system that would automate common workflows in the Dean’s Office, such as non-faculty appointments process. The system development is in progress.

K. Advancement
Engineering Advancement well exceeded its initial Educating the Engineer of the Future campaign fundraising goal of $70M, securing $100M by the end of October 2018. The campaign concluded with the opening of E7 on October 29, 2018, with final efforts focused on closing the $8M infrastructure gap. A $12 million gift, which will assist in the Faculty in eliminating the debt for E5 and E6, was successfully closed in 2017/18. Meanwhile, Engineering Advancement continues to focus on the enhancement of donor relations, so to ultimately augment the Faculty’s culture of philanthropy. The Advancement Office has highlighted the Faculty’s impactful research by way of strategic media relations, and best-in-class marketing communications, expanding audience reach and ensuring the consistent and effective deployment of the Faculty’s brand.
Goal K1: Secure the Philanthropic Support Required for our Priority Initiatives

Develop and execute a fundraising strategy for our strategic priorities, in particular as they relate to capital needs and graduate fellowships

- During 2017/2018, the Engineering Advancement team continued to focus their efforts on closing the infrastructure gap of $8M for E7 while achieving the stretch goal of $80M, as the initial campaign goal of $70M was met in 2016/17. We successfully closed a $12M gift which assisted the faculty in eliminating the debt for E5 and E6.

- With the campaign close on October 29th, 2018, the urgent focus of fundraising efforts continues to be on 1:1 meetings and solicitations of major gifts from alumni and friends for campaign priorities such as Ideas Clinic, Engineer of the Future Endowment and Graduate Scholarships.

- In addition to soliciting alumni and friends, Engineering Advancement also successfully responded to increased corporate interest in program and research support, establishing the $1M Cisco Research Chair, $1.75M Ripple Chair and graduate fellowships in blockchain research, and $200K GM graduate scholarships. The team leveraged the establishment and the launch of the Waterloo Artificial Intelligence Institute to attract sponsorships from large corporate partners such as Loblaw ($1M), Nutrien ($1M), Shopify ($1M), Magna ($200K), Manulife ($400K), and BMW ($40K).

- The Development team went through transition in the last year and welcomed two new front line fundraisers and a Donor Relations Officer. The team now includes: three full-time fundraisers, a full-time donor relations officer, a full-time Sr. Development writer, the Associate Director of Development and Alumni Affairs, and the Director of Advancement with support from marketing and communications, the event manager, alumni affairs and administrative support. Each position has an expected annual fundraising goal based on their USG level. As a result, fundraising capacity by head count/ position USG level is $10M annually and our annual team goal is based on this expectancy.

Figure 21: Campaign Progress ($ Millions), May 1, 2013 to April 30, 2018

Maintain Faculty-level fundraising while supporting departmental priorities through enhanced annual fund initiatives and goals

- Waterloo Engineering is donor-centric in its fundraising approach, working with donors to match their philanthropic interests in Engineering with our broad range of programs, student needs and projects. During the past year, financial and in-kind support has been raised to support departmental needs through undesignated and designated donations (to merit-based scholarships, program support and equipment) as well as targeted donor gifts such as: Google/Tides Foundation Grant for Outreach ($200K USD). During the past year, the development team also worked with faculty members to facilitate and provide receipts for a greater number of in-kind donations.

- Engineering Advancement continues to build capacity through the annual fund by developing strong, priority-focused call scripts for the student callers. It is clear that Engineering alumni that donate on an annual basis and at the leadership level are interested in supporting undergraduate students or their home department rather than infrastructure. As a result, donations through the call centre are focused on the Engineer of the Future Endowment and a trial is also underway to fundraise for Engineering Outreach activities.
• Success in raising funds for Capstone Design initiatives continues as a result of a coordinated Faculty-wide effort around the Capstone cycle and symposium promotion. Engineering Advancement has developed a Capstone Design sponsorship package with varying giving levels and associated benefits to further assist the development team in securing program support.

• The Advancement office is continuing to use the Keystone (Faculty, Staff and Retirees) appeals to ensure that the Faculty is aware of significant donations to engineering and that the campaign goals are well known. In the final phase of the campaign the team has continued to work on 1:1 meetings with faculty, staff and retirees to provide campaign updates and solicit their support.

Increase the focus on donor relations and enhance the culture of philanthropy within the Faculty

• The development and maintenance of strong donor relationships within the Faculty of Engineering is critically important to building the necessary capacity to reach current fundraising priorities. Through customized stewardship plans for our existing top 30 donors, detailed gift acknowledgement and recognition guidelines, the Donor Relations Officer aimed at keeping our donors strategically involved and engaged to a higher degree. Significant planning went into the campaign closing activities, E7’s opening ceremony and design and development of the permanent and the digital donor wall which will honor the Faculty’s lifetime supporters.

• The series of annual student engagement events (Grad Toast, Engineering Day and Give Thanks Day), developed to strengthen the engineering student engagement and the Faculty’s culture of philanthropy continued to be well-received by the students as well as the Faculty members. In 2017, over 1400 students, faculty and alumni attended the Engineering Day celebrations. At the Give Thanks Day, students wrote over 300 thank you cards which were mailed to the first time donors to provide personalized stewardship with the goal of increasing donor retention and ultimately encourage higher giving levels.

Engage our alumni at a higher level by offering strategic engagement opportunities based on their interests and capacity

• In 2017, twelve events and the Faculty’s fall Reunion were organized by Waterloo Engineering’s Advancement Unit in our key geographic areas (Waterloo, GTA, Calgary and San Francisco / Bay Area). A total of 5,899 alumni (and friends) were reached through these events. In addition, the number of one-to-one meetings with key alumni increased, as did the continued development of the Waterloo Engineering Hub on the Ten Thousand Coffees networking platform, all of which furthered the connection and engagement with these individuals and strengthened the global alumni network.

Goal K2: Enhance the Faculty’s Reputation as a World-Class Leader in Engineering Research and Education

Strengthen the Faculty brand through consistent messaging and visual identity

• Over the past year, Advancement has strengthened media relations activities focusing on the research work of the faculty. Working closely with the Media Relations team within Waterloo, Advancement identified research work with a broad media appeal while demonstrating the significant depth of the research. An Earned Media Editorial Process has also been established as a means to expand audience reach into global markets.

• Benchmarks for marketing and communications have been established to ensure that the value of time in our Earned Media activities is considered. Working with an online media intelligence company, the Advancement team is able to economically monitor news and social media to better understand how Waterloo’s reputation is expanded. There was a 50% year-over-year increase in the number of articles published – earned media coverage from the last reporting period. There was also a 26% year-over-year increase in the number of different countries earned media coverage appeared in.

• We continue to build out the faculty’s campaign site (engineerthefuture.ca) to share feature stories that profile the strengths of the faculty, students and alumni. There is a regular growth in traffic to the site with specific audience interest in research profiles. The site is also a key source of information for our fundraising initiatives.

• We continued to work with the University’s Brand Refinement team to support the Waterloo Beyond Campaigns that included print and online media campaigns that promoted faculty research work. This refinement project included the Waterloo Global Impact report that included a series of profiles of engineering faculty, uncovered through our media planning approach.
Strategic Plan Progress Report: 2017/18

Expand Waterloo Engineering’s profile as a world-class school of engineering

- The Advancement office continued to strengthen our reputation as a leader in engineering education and research by profiling, showcasing and sharing our successes as broadly as possible. For example, the following items garnered national and/or international attention and were promoted to our key target audiences using various media channels as appropriate:
  - Civil Engineering PhD student research – *Save yourself first in emergencies, study suggests* – published in June 2017;
  - Fakhri Karray, Electrical and Computer Engineering – *New software can detect when people text and drive* – published in September 2017;
  - David Simakov, Chemical Engineering – *Manure could heat your home* – published in March 2018;

- We have leveraged key events that generate strong Canadian and Global media interest, ensuring that Waterloo Engineering connection to the event or announcement reflects positively on the Faculty and expands awareness:
  - **Prime Minister Justin Trudeau speaks at Hack the North**: coverage in at least 8 publications with a potential reach of over 1 million;
  - **Supercluster Funding announcement of SCALE AI, AI powered supply chains**: story was picked up by 276 news outlets located in 4 countries and had 3,140 associated social media interactions in the first 5 days after the original news release was deployed. To date, there have been over 1,780 articles published that mention SCALE.AI in 21 countries with a potential reach of 270 million;
  - **Opening of the Waterloo Institute of Artificial Intelligence**: story was picked up by 173 news outlets located in 4 countries and had 156 associated social media interactions in the first 5 days after the original news release was deployed.

Improve all web sites and introduce new electronic and social media strategies

- The Advancement Office has strengthened online content by launching research theme sites in Additive Manufacturing, Advanced Robotics, Operational AI, Autonomous Vehicles, Big Data Analytics, Cybersecurity, Energy Storage, Imaging, Smart Infrastructure, Wireless Communications and Networks. The goal for this project is to support our marketing and communications efforts as we work to build global awareness of our research expertise and achievements.

- We have migrated/created 34 web sites in the Waterloo Content Management System (WCMS) in the past year.

- Over 550,000 individual/unique users accessed the Faculty of Engineering website from May 2017 – May, 2018, representing almost 950,000 sessions.

- Engineering Advancement has successfully linked all of the Department sites to Engineering Computing’s Online Faculty Information System (OFIS) to ensure that all profiles on department sites are fed directly from OFIS.

- In collaboration with Media Relations, the Advancement team has updated a system for media to easily find faculty who are working within a specific research area: Expertise Finder. The information for this system is pulled from OFIS to allow us to manage one database of faculty and work to ensure that information is kept up to date without excessive or duplicated effort.

- In our successful efforts to recruit for Architectural Engineering, a series of unique tactics were executed to provide information about the new program as a means to attract potential students and clarify program distinctions from both Architecture and Civil Engineering. These tactics included a unique program website, online information request systems, a program video, a Facebook Live Event, a program reception at You@Waterloo day, and communications pieces to distinguish program interests. Our recruitment efforts created over 324 applications which led to 103 confirmations from future students.

- The Advancement team has sought to strengthen their presence in social media sites as appropriate, such as the creation of impactful videos in Instagram, and launching a Showcase page within the UW LinkedIn page.
- 90 new videos were added to the Waterloo Engineering YouTube Channel including 51 new videos related to Capstone projects and 10 videos featuring recipients of the Engineer of the Future Fund.

Develop and implement a strategic graduate student recruitment program
- To better integrate with the new Engineering Strategic Graduate Enrolment Manager position approved in 2017, the vacant Graduate Recruitment Officer position moved from MarCom to the EGSO in August 2017. The role was filled in April 2018.
- In our continued effort to improve systems for attracting and tracking applicants, we have been working on improving the customer relationship management (CRM) system. Within the CRM a “Contact a Prof” form was created to improve the mode of communication between prospective students and supervisors. The form sends a template email that allows faculty members to rapidly assess the information provided by students and select a quick response option. Over 3,767 prospective graduate students completed a form from July to May 2018.
- Over four years ago, Waterloo Engineering led the creation of the Canadian Graduate Engineering Consortium. This progressive recruitment initiative has built a collaborative partnership with participating institutions, which now include McGill, UBC, the University of Alberta, the University of Toronto, McMaster and Queens. Since its inception, there has been a notable increase of master’s applications from consortium institutions, whereas applications from non-consortium schools have been relatively flat.

Highlights for the year included:
- A steady involvement and commitment from Engineering Ambassadors (current count of 85 ambassadors per term)
- Over 960 groups were provided faculty-specific tours in the 2017-2018 recruitment cycle.
  - Over 120 trained faculty members actively volunteered for undergraduate recruitment events.
  - 15 to 18,000 pre-registrants to attend the Fall and March Break Open Houses.
  - Creation of the Architecture, Architectural, and Civil Engineering comparison document.
  - This year saw the opening of a first of its kind International Engineering Living and Learning Community in St. Paul’s with 19 residents. As a residence community established to offer support for international students in engineering while offering complete integration support in programming.
  - The second year of the WIIE Living Learning Community grew to 66 members, up 43% from 46 in 2017.
  - The overnight event for Women in Engineering continues to support our confirmation strategies with over 85% of 77 attendees confirming their offer. Each student invited to the event had not confirmed their offer at that time.
- Media interest and coverage of Waterloo Engineering continues to grow based on the value of the research work conducted by faculty and our graduate students and the success of our alumni, particularly our startup founders. Waterloo Engineering is also a major element of the positive economic growth story of the Waterloo Region, making our faculty and facilities a key stop for media and alumni visiting the region.
- 3rd annual faculty partnership with student-organized, HackTheNorth – Canada’s largest hackathon that attracted not only an elite gathering of some 1,000 talented student hackers and well-known venture capitalists, donors, and industry partners from Silicon Valley, but the Prime Minister Justin Trudeau who addressed the hackers at the opening night ceremonies.

Lead efforts to keep faculty and staff informed of key initiatives and achievements
- The Engineering Communications Council met bi-monthly to share news and developments of importance within the faculty. The meetings are attended by representatives from all Engineering academic units, key Centres and Institutes, Student Relations, the Engineering Research Office and the Sedra Student Design Centre.
- The Advancement team is working with the departments to update online faculty profiles via the OFIS platform. This initiative is also meant to support Engineering Computing’s efforts to provide a one-stop location for all faculty data and information.
- As a means to build better integration of content across the Faculty and to support the best practice of web pages for the faculty, the Advancement team launched the Digital Media Council. This group includes representatives from across the Faculty who are assigned to keep Online content up to date. The group meets once a term have each meeting works through a specific agenda of items that draw for a range of digital requirements including IST updates to WCMS, OFIS integration, strategic marketing communications planning.

Support Vision 2015 development and alumni objectives with best-in-class marketing communications

- With the 60th Anniversary of the Faculty and the University, Advancement created a series of videos featuring Doug Wright and his family was shared with Alumni via eWEAL in June. The multigenerational story of the Wright family was the focus for the video’s while highlighting Wrights impact as first Dean. Story focus on multigenerational stories that represent the engineering family.

- A special 60th anniversary edition of WEAL was published to coincide with the July 1st anniversary date with a focus on Faculty and alumni advancements over the past 60 years, multigenerational stories that in some cases span many decades and present a history timeline.

- Media interest and coverage of Waterloo Engineering continued to grow based on the success of our alumni, particularly our start-up founders. Waterloo Engineering is also a major element of the positive economic growth story of the Waterloo Region, making our faculty and facilities a key stop for media and alumni visiting the region.

- The Advancement team continues to strengthen campaign communications through the engineerthefuture.ca site and e-mail newsletter as a means to share news from the faculty while positioning the efforts of the Educating the Engineer of the Future campaign. We are also working to strengthen our process for ongoing Alumni communications, taking a more strategic approach to our processes and ensuring the that importance of the campaign messaging remains front and centre.

L. Academic Unit Progress Report Summaries

This section presents a summary of each of the annual strategic plan progress reports provided by our academic units. These reflect progress on the goals and targets outlined in their implementation plans, which were included as an appendix to the original Vision 2015 strategic plan.

School of Architecture

Anne Bordeleau, O’Donovan Director

In Undergraduate studies, we have maintained a high educational quality and access to great student opportunities (exchange, design-build, Rome program and internal cooperative work terms). We have created better alignments in the curriculum and reduced the total number of courses by reviewing the sequence and content of courses in some of the streams; we have been streamlining our newest stream in digital media and fabrication and implemented additional electives; we have also successfully initiated more design-build projects, including projects that forge relationships with indigenous communities in the region (Mississaugas of the New Credit and Six Nations). We continue to offer rich international opportunities, with around 43% of cooperative work terms being international, a solidified presence in Rome, and other opportunities to study, research and work abroad. Our undergraduate program remains highly attractive, its reputation remains outstanding, and international enrolment has increased. However, we must continue to work on the transition to MArch to retain our best BAS graduates: currently, just over 50% of our undergraduate students return to Waterloo for their graduate program. Finally, we have to continue to work on effectively reducing student work load to support better learning and prioritize our students’ wellbeing.

For the Graduate program, we continue to work to reduce the time to completion, and we have implemented a number of structural shifts as well as some additional support courses to that end. These include courses on methodology, as well as block courses in professional practice. We are currently ensuring that all Student Performance Criteria (as mandated by the Canadian Architectural Certification Board) continue to be met with this new teaching structure. Over the past year, we have also supported growth in the graduate program and created a better transition for students joining Waterloo Architecture MArch program from other pre-professional degrees. In order to manage human resources, we are moving to a better and more distributed system to allocate graduate supervisory responsibilities. We have also instituted a system wherein there is some recognition of graduate supervision as part of a faculty’s teaching responsibilities. We are still seeking improvement in other areas so that we can better respond to student and faculty concerns. This includes diversifying graduate course offerings; better...
supporting the dissemination of graduate research; encouraging co-authored work, directed research and funding; and implementing a variety of Masters’ programs such as post-professional Masters or directed streams.

In Research, we continue to make strides and have been meeting our research funding targets over the past few years. We are now considering raising those targets, though doing so would require more support and success in research grant application and dissemination. We must also continue to increase public awareness of research achievements. Finally, we need, in the short term, to establish more graduate programs that will bring post-graduate researchers to Waterloo Architecture. This will require a better identification of the areas faculty can support (e.g. Forensics Architecture, Living Architecture Systems, Architecture in the North).

More than ever, growth in research and the well-being of our community rely on the general health of our Operations. Regarding human resources, both Staff and Faculty complement plan will be on target in September 2019, and we are maintaining a percentage of women faculty at or above 40%. There has been more progress through ranks, but we must provide better support for tenure and promotion, as well as for research. This includes drafting clearer expectations as to what constitutes research in architecture for the benefits of our own faculty members, as well as members of Faculty and University committees. With the Waterloo Budget Model (WBM), we must bring additional revenues so as to maintain the quality of the education we offer. At the same time, we should carefully consider how we might better integrate our sessional instructors in the School’s budget, operations and planning. In the longer term, the implementation of Architecture Engineering and the proposed IDAT could help bring more financial resilience to the School, but this hinges on how the University will move forward to support new programs (i.e. how growth income will be redistributed). In the meantime, we continue to investigate the possibilities of post-professional masters as well as the Master in Design.

Fundraising is becoming ever more critical. We have made strides in alumni relations with the celebration of the 50th anniversary, but must continue to substantially increase our advancement activities for architecture. Key projects include fundraising for a new facility in Cambridge (underway), as well as fundraising to support three priority areas: (1) inclusivity and diversity achieved through funded Fellowships and International studios, (2) research and dissemination promotion through funded events such as lectures series and better research facilities, and (3) building and community for design-build projects, including collaboration with first nations communities.

### A. FACULTY AND STAFF PLAN

- With the retirement of a faculty member in September 2018, the Faculty Complement is on target, at 19 FTE for the Architecture programs.

- With the implementation of Architectural Engineering in the Fall 2018, the School of Architecture will be hiring for three new positions over the next three years. One of these positions has already been filled, with the hire of a tenure-track assistant professor as of August 2018. We plan to fill two additional tenure-track faculty positions over the next two years.

- The percentage of women remains on target at 40%.

- The Staff Complement is currently on target. However, with the implementation of the program in Architectural Engineering, as well as the need to proactively address the rising concern around mental health, we plan to add the equivalent of 1.5 FTE staff position dedicated to administrative support, technical support and wellness coordination.

### A1: Implement the Faculty Complement Plan

- Donald McKay will be retiring as of September 1st, 2018, bringing our faculty complement for Architecture on target.

- One new faculty member joined the School of Architecture as of August 1st, 2018. Jonathan Enns will be teaching both in Architecture and Architectural Engineering. We are also finalizing the hire of a second faculty member to teach across both programs, which would leave one last position to fill over the next two years, in response to the implementation of the new program in Architectural Engineering.

- Further growth of our faculty complement hinges on the approval of our proposed program in Integrated Design, which remains on hold (see Section G).
A2: Implement the Staff Complement Plan

- Though our Staff complement graph shows that we are on target, our staff position in Rome is not accounted for in our targets. In practice, our complement is in fact 12, and so we are short one staff member at present.

- We had a fair amount of movement this year, with three people permanently leaving the School of Architecture for other positions both within and outside the University. We are pleased to have filled the position of Resource Assistant with the hire of Nicole Guenther in that full-time position. However, our new Financial Officer has resigned, and we are in the midst of a search for that position.

- Given the increase in research funding, a position of Research Administrative Assistant has been created and approved. The position, contingent on continuous funding from the grant, is currently not filled.

- As mentioned above, we plan to add the equivalent of 1.5 FTE staff position to be split between administrative support, technical support and wellness coordination for the current community as well as the growth with Architectural Engineering.

- Further growth of our staff complement hinges on the approval of our proposed program in Integrated Design, which remains on hold (see Section G).
A3: Support Career-Long Development

- In addition to providing opportunities for two staff members to enroll in the Leadership Essentials Course, we have also supported our workshop manager’s professional development by funding his attendance to the Student Shop Managers Conference (Tulane, July 18-20, 2018), with a focus on safety and training.

A4: Better Support Promotion Through Grades and Evaluation of Faculty Members

- One faculty successfully obtained tenure this last year, and three new applications for tenure and promotion have been submitted for this cycle.
- We plan to submit School addenda for both the Annual Performance Review and Tenure and Promotion processes. These documents will be submitted in time for the next cycles.

A5: Review of Staff Positions and Job Descriptions

- We plan to carefully review the current staff job descriptions to establish whether there are any gaps and redundancies. With the recent departure of our workshop/studio technician (August 2018), we see an opportunity to reconsider how to staff the workshop and computing facilities to best respond to the current needs in architectural education and practice.
- At the same time, we are interested in evaluating whether job descriptions still match the tasks being required of our different staff members and if some essential tasks are currently not being included. This is a longer-term project that is important given the growth of our undergraduate with architectural engineering, and that of our graduate population over the past 5 years.

B. UNDERGRADUATE STUDIES PLAN

- The undergraduate intake target remains constant, at 76. This number includes both new students as well as internal transfer students, which are not shown in the graph included below. Given the accreditation requirement of maintaining ratios of 1:15 in studio courses, there is no intention to grow our target. The quality of applicants is high as we continue to receive between 1,100 and 1,200 applications every year to fill available spaces. Our acceptance rate is also very high, varying between 80 and 90%.
B1: To Maintain the Strength of the Undergraduate Core Curriculum

We have successfully achieved a number of our goals, eliminating redundancies, creating better alignments, increasing options in upper years and reducing the total work load, with particularly attention to the first and second year.

- We have finally reduced the course load in the first year, consolidating the content of some of the courses and eliminating one course in the first term. This will take effect in September 2019.
- We have further reduced the course load over the whole curriculum, reducing the total number of required credits from 29 to 27.5 credits. This will take effect in September 2019.
- We have successfully created more options in the curriculum without increasing the total number of courses for students by implementing options for advanced level courses in third and fourth year structures, visual and digital media, as well as cultural history and landscape and urbanism courses.
- Over the next year, the undergraduate office will continue to investigate alternatives to the current mode of delivery of some of our visual and digital media courses.
- We have submitted our proposed integration of the Communication course in the first year, without adding a new course but integrating the requirements into a remodelled existing course. Pending confirmation of University funding, this can be implemented in September 2019.

B2: To Supplement the Existing Curriculum in Areas that have been Less Developed Within the Core Curriculum, and to Expand our Capacity

- The changes that we introduced a few years ago will finally take effect this year, as students completing their 4B terms will have with more elective courses and opportunities to enrol in courses that are cross-listed at the graduate level.
- To bring in more diversity to the curriculum, we have been running course electives that are either engaging with indigenous communities in the region, or taught by indigenous scholars. These courses run in parallel with a design-build program that is developing collaborations with the Mississaugas of New Credit as well as with the Six Nations of the Grand River Reserve.
- As part of our mandate to increase the diversity of our curriculum, instructors in studio as well as in the cultural history stream ensure that case study and references range across times and cultures, including Islamic, Asian, South American or African references to offer a more culturally rich and diverse education.

B3: To Provide Expanded Opportunities for Global Study Abroad in Addition to the Rome Program both for Undergraduate and Graduate Students

- The Rome campus remains strong and is undoubtedly one of the highlights of the undergraduate program for our students.
- While nearly 50% of cooperative work placements are international, we would also like to support our students and faculty on courses that could take them to other destinations. This involves the creation of other types of courses (intensive study-abroad courses, option studios with field research components) and associated funding. This is a project that we need to continue to work on.

Figure 26: Proportion of Architecture co-op work terms by location.
B4: To Ensure that the Undergraduate Program is Geared Toward Retaining our Students and Encouraging them to Continue to the Waterloo MArch Program

- As noted above, we will finally be seeing the effect of the implementation of additional upper level elective courses this coming Spring.
- We have been holding our first series of public final thesis reviews and interim reviews to increase the visibility of the graduate student works to our undergraduate students. This has had a positive impact so far in the School community, but we have no way of measuring its effect on enrolment yet.
- While between 40% to 60% of our own graduate students continue to do their Master’s degree at Waterloo, we want to be more proactive in the recruitment of our own students to our Master’s program, especially attracting our strongest students to come back. This may involve an activity specifically targeting students on their 4A Rome term as they are applying to graduate programs. This effort could also benefit from the ability to send offers of admission to all qualified students, as well as offer of funding to the stronger students.

B5: Core Curricular Consolidation and Expansion of 500-Level Research Electives

- This has been approved and will be implemented as of September 2019. The changes include the shift from current core courses to a broader range of elective courses in environment and technology, visual and digital media, cultural history and theory, as well as landscape and urbanism.

B6: Introduce Opportunities, Funding and Support for Design-Build Projects

- There has been a net increase in design-build projects, both in relation to the initiatives with indigenous communities, as well as in support for projects such as Winter Station or Nuit Blanche. We are currently investigating the ability to provide more support by establishing a position that would link between the workshop and design-build course instruction.

C. GRADUATE STUDIES PLAN

- After a spike in intake that was largely caused by the transformation of our qualifying year to the master program, graduate intake continues to be above or on our target of 52.
- Our international student intake is consistently on or above target, while our CPR intake has fallen below target last year. This points to the need to increase our recruitment efforts both for our own undergraduate students, as well as to students graduating from other pre-professional architectural programs in Canada.
- We continue to address space concern and improve our ability to adequately house our graduate cohort which has grown from 119 to 154 (29.4% growth).

Figure 27: ARCH Graduate Intake Plan Performance to Target
C1: Program Modifications Phase I: Implement the MArch, MArch (co-op) and MArch (water)

- All these programs have been successfully implemented and we continue to monitor their progress.
- The MArch (co-op) is clearly an attractive option for students coming from different institutions. To improve the program, we need to create better interactions with Cooperative Education and ensure students receive information in time to apply for work permit when required.

C2: Program Modifications Phase II: MArch Curricular and Thesis Structure Revisions

- We have implemented a number of intermediary deadlines that better support student progression and help improve time to completion. The intention is to ensure no students take more than six terms to complete their Master’s Thesis.
- We have successfully piloted a more distributed system to allocate graduate supervisory responsibilities.
- We have added an option to present final work in the traditional review mode. The option of choosing between a traditional thesis defense and a final work presentation has been well received by students and faculty. The expectation is that it will also have a positive impact on students’ ability to complete their design thesis within the standard three to six terms.
- We have still not been successful in implementing a Rome option at the Graduate level. The challenge is to announce the program well in advance and ensure it attracts enough students to be worth running. The appeal of this program will rest on its successful integration into the curriculum for both new and continuing students.
- We continue to support students in international research travel opportunities. Our students have successfully secured funding either through MITACS, the University or the tri-agency, engaging in research in sites all over the world.

C3: Program Proposals Phase III: Additional Program Proposals

- The proposal for the undergraduate program in Integrated Design Arts and Technology has successfully been completed and submitted to both IAP and Engineering. Due to allocation of growth income under the Waterloo Budget Model, the review process is on hold.
- We are now focusing effort on creating attractive alternatives at the graduate level that could draw people to apply to Waterloo Architecture for directed research degrees. We will be developing these projects in line with our current mandate to better support research within the School.
- We are still investigating ways of implementing post-professional degrees, as well as the possibility of a PhD.

C4: Funding Support for Graduate Students

- We still need to find additional sources of financial support for graduate students, and most particularly, to make attractive offers to some of our stronger students who may otherwise choose to go to prestigious institutions outside of Canada. The challenge remains that our graduate program in architecture combines elements of professional and research masters programs. Each graduate produces an independent thesis, yet there is no base of research funding available to fund graduate students.
- As in other years, we have been able to provide entrance scholarships to all students who enter the program with an average of 80% and above. In addition, seven graduate students were successful in obtaining full
funding ($25K minimum) through government scholarships, up from an average of about four a year. A variety of additional sponsored scholarships are also regularly available, though we continue to seek additional sources of funding.

- Teaching assistantships (TA) provide the largest source of support for graduate students, with an average of 50 Teaching assistantships per year. We value the experience teaching assistantship provide to those students, the connections between cohorts that the positions help foster, as well as the contribution they make to the quality of undergraduate instruction and the effectiveness of the design studio.

- With additional faculty research and funding, an increasing number of research assistantships have also been available to graduate students. We continue to encourage growth in this area.

C5: Promote the Program Internationally Through Publication, Exhibition and Outreach

- We are in the final phases of the re-design of our web presence, a project that is urgent both for our students and for the School as the main window for recruitment and alumni connections. The renewed website will be implemented over Fall 2018.

- Last year, more than a dozen of our graduate students have presented papers at conferences, including conferences such as ACSA, Society for the Study of Architecture in Canada, the National Conference for the Beginning Design Student, as well as publications such as Site Magazine. Many other participate in installations such as at Nuit Blanche in Toronto. Internally, students have successfully organized the publication of a new graduate publication. Entitled Galt, the publication is an independent student publication that included both papers and projects.

- We have successfully run our two students works exhibitions, our annual Project Review and Masterworks. Project Review also includes the production of a publication. For Masterworks, we were also successful in getting the work of some of our students at the Azrieli School of Architecture Gallery, in Ottawa. In addition to these more formal events, we have now instituted a set of compulsory graduate reviews that enable all students to present to a large group of faculty reviewers each end of term. One of these events takes the form of a Symposium, preparing our graduates to gain confidence to apply to different conferences.

- The promotion of the program also benefits from success of alumni, and our ability to communicate this properly on our website. The success of young firms such as Partisans and Office OU, or more established firms such as Hariri Pontarini, Shim & Sutcliffe or Alison Brookes Architect must be better promoted in our School news.

C6: Improve Facilities and Review the Demand on Human Resources for the Graduate Program

- We have successfully completed the first phase of reorganization for our graduate offices, enabling each office to successfully work with groups of 15 students, along with a larger graduate office for the incoming 2-year stream Master students.

- We have successfully run a first pilot of the balloting system for the allocation of thesis supervisors, distributing the supervisory load among all faculty members.

- We continue to work on the improvement of access to the workshop and fabrication facilities, exploring better interaction with instructors in certain courses such as design-build projects and fabrication classes.

C7: Reinforce Graduate Program Identity and Improve Recruitment

- Since the shift from the B.Arch to the BAS + MArch, the appeal and recognition of the graduate part of our program has not been as well defined. 66% of our graduate students completed their undergraduate degree at Waterloo, but 50% of our total undergraduate students look for other programs in Canada and beyond. Meanwhile, we fail to attract the strongest applicants from other Canadian or international institutions.

- Our international intake has been over target, but our domestic intake has been falling below target. We need to attract students from other Canadian institutions. We must also find ways to keep some of our strongest students through the graduate program.

- One of our priorities will be to increase the appeal and visibility of our graduate program and work on Graduate programs identity, success and growth. This means more graduate course offerings, opportunities for funded masters through a directed research options, but also fostering students’ agency in the world by promoting and supporting publications, workshops, conferences, as well as more funding in general for their own projects.
D. RESEARCH PLAN

- We have had success in securing research funding, doubling our target figures in both total and per faculty funding.

*Figure 29: ARCH Research Funding Plan Performance to Target*

*Figure 30: ARCH Research Funding/TTS Faculty Performance to Target*

D1: Implement the Research Funding Plan

- While funding is lower than it was last year, it still remains much higher than the average over the past 10 years. We need to continue to support this trend by providing better support to new and continuing faculty to apply and be successful in seeking funding.

- Faculty have been applying for and successfully receiving funding and awards, including funding from the Forestry of Innovation Investment (David Correa, $17,000), a SSHRC Insight Development Grant (Maya Przybylski, $57,383 [July 2018]) while others continue to work on existing grants (Lola Sheppard, Philip Beesley, Tracey Eve Winton and Elizabeth English). With internal funding from the University, John McMinn is also continuing to set up a collaborative Design-Build program with first nations in the region. At $736,000, our annual research funding is more than double our $360,000 target. Other projects have been funded through MITACS Globalink Awards.

- In order to promote a culture of research, we have emphasized the dual role at the graduate office, which is now to both support Graduate Studies as well as Research. Having named two officers to share the role, the intention is to have Jane Hutton and Lola Sheppard develop a program of support that includes workshops, review sessions, and more structure around the different elements of grant applications (e.g. project, in-kind support, partners, budget, etc.).

D2: Increase Public Awareness of Research Strengths and Achievements

- Philips Beesley’s work with the Living Architecture Systems Group has been exhibited in a number of international venues, as well as at the Royal Ontario Museum (in collaboration with designer Iris van Herpen), where the exhibition *The Evidence Room* (collaboration of Anne Bordeleau, Donald McKay and Robert Jan van Pelt) was also extended as one of the ROM’s most visited exhibitions. Research in Architecture can be made visible through exhibitions, publications and mentions to faculty members as professors at the University but also members in design practices that are engaged in research as well as built projects, and
these exhibitions, as well as that of other faculty members (e.g. Lola Sheppard with Lateral Office at the Seoul Biennale in 2017 or the Rhode Island School of Design in 2018) are successes that reflect on the School as a whole. For other faculties, publications are the main mode of dissemination of scholarship. This year, Andrew Levitt published his second book *Listening to Design*, and Jane Hutton published an edited book: *Landscript 5: Material Culture: Assembling and Disassembling Landscapes.*

- Participation in conferences – whether academic or more for the general public – also increases the visibility of the School’s research. This past year, there were many contributions to conferences including Jane Hutton co-chairing a panel on Environmental Crisis at the ACSA Conference in Madrid; Rick Haldenby presenting his research on post-war architecture in different venues across the Waterloo region, as well as the OAA and RAIC conferences; and Andrew Levitt’s participation at a round table on Embodied Design at the Ontario Association of Landscape design. Many other faculty members were invited to offer key notes or participated at different international conferences (Jane Hutton, Maya Przybylski, Anne Bordeleau, Marie-Paule Macdonald, Robert Jan van Pelt, Terri Meyer Boake).

- We continue to work at raising the School’s profile both within and outside of the University. With the implementation of Architectural Engineering, there are new opportunities for collaborative research. Some of faculty members have also been collaborating on projects on campus (Maya Przybylski and David Correa with Sriram Naramsimhan on E7), and there is a plan to apply for a collaborative CFI across Architecture, Civil and Environmental Engineering as well as research in Mathematics and Computer Science.

D3: Consider Opportunities for Involvement of Directed Research Within the Graduate Program

- Our plans to introduce a directed research stream are still ongoing, with the intention to run a pilot in Fall 2019. This would be done within the existing structure of the MArch program.

E. TEACHING

E1: Recognize and Reward Excellence in Teaching

- We have submitted nominations to internal awards both at the University and faculty levels, one of which was recently successful. Moving forward, this is something we need to continue to do while also promoting submissions to external bodies (e.g. ACSA).

E2: Implement More Integrated Review of Teaching, Particularly for New Faculty Members

- While team teaching as well as our ‘open-door’ policy at the School of Architecture make it fairly easy to remain aware of our colleague’s approaches to teaching, we need to formalize a process by which we complement the students’ course evaluations while reviewing the performance of faculty teaching whether for annual review, tenure or promotion.

F. OUTREACH

F1: Continue to Cultivate Relationship with the Local Community

- Students continue to occupy a store-front on Main street in Cambridge, fostering connections with the local community with different events and activities (night market, film showing, exhibitions, workshops, reviews, etc).

- We have not made progress on a summer outreach program for local camps, though this is something we want to continue to explore and hopefully implement.

F2: Build Stronger Outreach to First Nations of the Region

- Over the past two years, the Design-Build initiatives has been building relationships with members of two first nations in the area: the Mississaugas of New Credit and the Six Nations of the Grand River Reserve. We intend on building a longer-term collaboration that would come together with outreach to prospective students and contributors to the program.

G. INTERNATIONALIZATION

G1: Increase Opportunities for International Experiences

- The attempt to set up a second studio in Rome was not successful this year with too few registrants. Our ability to incorporate such opportunities on a regular basis will hinge on our ability to generate interest among students. It would also be helped by funding to alleviate the cost that a term abroad represents.
G2: Increase International Student Enrolment

- Our international enrolment is currently over target at the Graduate level, with over 12% of the student body being composed of international students. At the undergraduate level, over 13% of our students are international, representing a small increase.

H. ENTREPRENEURSHIP

H1: Expand the Professional Opportunities of our Students

- Our biannual event, Paths to Practice, continues to be a successful vehicle for introducing students to the wide range of professional paths they can explore as architects.

H2: Introduce some Entrepreneurship Electives

- As we introduce more electives in the program and look to have both Architecture and Architectural Engineering Students on the Cambridge Campus, there is an opportunity to introduce electives that would give students basic entrepreneurial skills (business strategy, marketing, finance and financing, etc.).

I. SPACE PLAN

I1: Upgrade and Expand the Satellite Facility in Rome

- Renovations have been completed. The upgrade is ongoing, including the provision of newer computers, and the possibility of a projection outside of the classroom for larger cohorts.

I2: Subject to Introduction of the New Program to be Proposed in Integrated Design, Expand the Cambridge Campus

- The Integrated Design Arts and Technology proposal has been submitted to IAP. Following the submission, it became clear that the project would not be viable under the current proposal for growth income redistribution. In response to this situation, we are now pursuing growth largely in research as well as to house the increase in student population as well as the increased activity resulting from an increasing number of design-build projects. The expansion project was presented to the Municipality of Cambridge last May and received very positively. As it stands, there is support from both the University and the Municipality, should we be able to secure additional funding from the Federal and Provincial governments.

I3: Commit Space to be Used in the Future by Architectural Engineering Students

- We have completed the first phase of our space reallocation, setting up the studios to receive the full new cohort of Architectural Engineering students, in addition to our two cohorts of undergraduate architecture students. Other projects (re-wiring, ventilation, workshop) are still ongoing but on track for completion by the time the 3A Architectural Engineering students will be in Cambridge.

J. ADVANCEMENT PLAN

J1: Expand Alumni-Related Activities

- We have been connecting with alumni more regularly, both with the launch and continued celebration of our 50th anniversary this past year, as well as through an alumni event in Toronto. We still need to set up a formal and regular communication channel for alumni; a current plan is to set up a newsletter that could update on the School of Architecture’s activities every term.

J2: Substantially Increase Advancement Activities for Architecture

- While we do not have the funds to support a position dedicated to fundraising, as recommended by Engineering Advancement, we have been receiving more support from the Advancement team, successfully securing a number of small short term donations. Hence, we received $12,000 last year to support ongoing activities over the next five years, together with one-time funding of $78,000. We were also able to raise a $75,000 endowment in the honour of a student that tragically died from a cycling accident, supporting an annual scholarship of $2,250.

J3: Update Fundraising Plan and Strategy

- In the next year, we must prioritize fundraising and develop a clear and realistic fundraising plan and strategy. Currently, the first focus area is to raise funds to support diversity and internationalization, through the creation of a funded fellowship that could attract young faculty member to teach and contribute to the curriculum for a year. The second is to raise funds to support research and dissemination, contributing both to
School events and to support student and faculty travel. Finally, we want to be able to better support design-build projects, research and fabrication more broadly, and this calls for a new facility.

K. PROPOSED NEW PROGRAM PLAN: INTEGRATED DESIGN

K1: Propose, Acquire Approval for, and Launch an Undergraduate Degree Program in Integrated Design

- As described under point I2, we have completed and submitted the proposal for the Integrated Design Arts and Technology program to IAP. While the project in itself is financially viable (assuming central costs and normal income flow), it is not currently viable under the WBM proposal for growth income redistribution at the University level. Our next step hinges on whether this model for growth income redistribution changes.

K2: Propose, Acquire Approval for, and Launch a non-Professional Master in Integrated Design Degree Program

- We are still contemplating advancing the project for the Masters, exploring ways in which this could fit within the existing structure and benefit both our program while working to fulfil our University graduate target.

Department of Chemical Engineering

Eric Croiset, Chair

After several years of having fewer faculty members than necessary, as a result of several resignations and retirements, the Department’s faculty complement is now at 38.5, slightly exceeding our target. The Department has devoted particular attention to increasing the percentage of female faculty members. From only 6% in 2011, the percentage of female faculty members in 2018 has increased to almost 16%, above the target of 13%.

For the undergraduate program, the CPR enrolment has remained below target since 2013, which may have been attributed to the past downturn in the oil and gas industry. While this was obviously worrisome, enrolment data for Fall 2018 indicates that this situation may be behind us, with expected CPR enrolment above target. The employment of first-year co-op students has been a recurring issue for many years, but the 2017/18 academic year saw a noticeable increase in the number of jobs for first-year students outside the university, which is very encouraging. In addition, over the past year, the department has significantly modified the first-year curriculum to improve the “marketability” of our junior students, with, in particular, opportunities to increase their computer, communication and hands-on skills.

Regarding the graduate program, the overall student intake of 86 aligns with our total intake target of 84. However, an important departure from the target is the number of CPR PhD students, which was well below target. This low number, however was offset by a higher than targeted number of international students. We are examining possible changes to our MEng program to make it more attractive, particularly for CPR students.

In 2017/18, our research funding totalled $8M, which is slightly above our target of $7.75M. Although research funding is healthy, we are still lacking major grants originating from the Department, which must be rectified.

A. FACULTY AND STAFF PLAN

A1: Recruitment of New Faculty According to the Schedule in the Faculty Complement Table

- After a low point in the number of faculty numbers in 2015, which resulted from retirement and resignations, we have steadily increased the number of faculty in the department. As of May 1, 2018, we attained the targeted value of 38. The department’s actual faculty complement is now 38.5.

- During the second half of 2018, however, two faculty members resigned. We are actively working to hire replacements. One position is advertised, and the second one will be advertised before the end of 2018.

- One additional position, which is the second position for the Biomedical Engineering program, is to be advertised before the end of 2018 as well.

- Regarding lecturers, a position has been offered to a third lecturer, who will start during the Winter 2019 term.

- A challenge/opportunity for the next two to three years is the relatively large number of faculty members who are anticipated to retire. We are about to embark on a planning exercise in which a high priority will be faculty replacement (research vs. teaching stream, area of research).
A2: Increase Number of Female Faculty Members

- We are very pleased to report that the percentage of female faculty members has exceeded the target: 15.6% actual vs. 13% target. In 2011, we had only two female faculty members, and we have since hired four new female faculty members, for a current total of six.

- An additional female lecturer has been hired to begin in Winter 2019, and is not yet represented in our complement. In addition, among the three positions to be advertised by the end of 2018, it is hoped that at least one successful candidate will be a woman. It is, therefore, anticipated that over the next couple of years, more than 19% of the Department of Chemical Engineering’s faculty members will be women.

A3: Increase the Number of Faculty Holding Professional Engineering License

- The percentage of faculty members holding or having applied for PEng licencing has been oscillating around 74% over the past four years, which is far from the 90% target. With an overall growth in faculty complement, however, the raw number of faculty members holding PEng certification has steadily increased over the past four years, reaching an all time high of 25 in 2018.

- As of May 1, 2018, ten faculty members had not applied for their PEng certification. Among those ten, two are fully eligible and experienced professors who should have registered for their PEng long ago; four are recently hired faculty members who are about to apply; and four are ineligible for PEng certification, having no Bachelor’s degree in the field of engineering.

- Over the 2018-2019 academic year, the goal is to have all six eligible members mentioned in the previous bullet apply for PEng certification, which should bring the percentage of faculty members holding or having applied for their PEng in the mid to high 80s.
A4: Recruit New Staff as Shown in the Staff Complement Table

- Staffing positions are right on target as of 2018.

A5: Introduce Strategies for Inter-Departmental Social and Professional Interactions

- We have continued to take measures to make the departmental flagship seminar series more prominent.
- The monthly research presentation/casual gathering has been replaced by a monthly casual coffee hour for both faculty members and graduate students/post-doctoral fellows. The coffee hours have been experiencing mixed results, so we will explore changes that could make them more impactful.
- We continue to organize several social events throughout the year to connect faculty, staff and students (e.g. Meet the Profs., CEGSA BBQ, Graduation receptions). There is a tendency for faculty to segregate from students, especially for undergraduate focused events. The Department will review potential changes that could encourage better interaction between students and faculty members during those events.

B. UNDERGRADUATE STUDIES PLAN

- Since 2013, the total CHE undergraduate intake has remained under target, with our lowest enrolment in Fall 2017. As mentioned in the previous progress report, the fact that we have been consistently below target, especially for CPR students, over the past four years is worrisome. One hypothesis to explain low enrolment could be the impact of the economic downturn on the energy sector over the past few years: given that the oil and gas industry having historically hired a large number of chemical engineers, applicants and their parents may be reluctant to consider such a career. It seems that this situation is not specific to Waterloo, however, as other chemical engineering departments in Canada have faced similar situations. To remediate this at our level, the Department is working with the Faculty of Engineering to prepare a short promotional video, which will be released in the Fall 2018.
- As mentioned in the previous report, another factor in lower-than-expected enrolment numbers may be the difficulty for our first-year students to find their first co-op job. Over the last year, major changes have been made to the first-year curriculum in an attempt to equip first-year students with skills that are more attractive to potential employers. Although those changes have not yet been fully implemented, recent co-op data have...
shown a notable improvement from the previous years in first-year Chemical Engineering students' employability outside UW. It is too soon to draw any conclusions, but initial signs are encouraging.

- At the time of writing this report, intake data for 2018 are significantly higher than the previous years. Although the final numbers won’t be known until November 2018, this is a very positive development, and we will see in the coming years if it is a trend.

Figure 35: CHE Undergraduate Intake Plan Performance to Target

![Figure 35: CHE Undergraduate Intake Plan Performance to Target](chart1)

Figure 36: CHE Undergraduate Intake Plan Performance to Target, Visa Status

![Figure 36: CHE Undergraduate Intake Plan Performance to Target, Visa Status](chart2)

Figure 37: NANTE Undergraduate Intake Plan Performance to Target

![Figure 37: NANTE Undergraduate Intake Plan Performance to Target](chart3)
B1: Improve the Laboratory Experience in the Curriculum

- With the newly implemented undergraduate labs, thanks to the $2.3M Vision 2015 Undergraduate Laboratory Enhancement Initiative, we can now offer students additional interesting lab activities. In particular, we are expanding project-based labs at the senior level. Students seem to have more a positive experience using upgraded lab equipment and learning from lab courses.

- A recurring complaint from students relates to the amount of tedious work (e.g. time consuming reports) required as part of some lab courses, which detracts from their laboratory experience. The Undergraduate Review Committee, in consultation with the lab instructors, have modified the deliverables of some lab courses to address this issue.

- The undergraduate labs are run independently from the lectures. While this approach presents several benefits, we see that it also disengages some faculty members from lab activities. We now ask the lab instructors to present updates on the Undergraduate Labs at least once a year during a Departmental meeting.
B2: Improve the Undergraduate Curriculum

- Under the lead of the Graduate Attribute Lecturer, we continue making progress toward meeting the requirements for the new outcomes-based CEAB accreditation. We will complete gathering data for all attributes during 2018. We will continue encouraging stakeholder engagement by hosting all faculty members at two meetings dedicated to the analysis of those data: one in the Fall 2018, and another in the Winter or Spring 2019. We anticipate being fully prepared for the November 2019 accreditation visit by May/June 2019.

- The department made two major changes in the undergraduate curriculum in 2018:
  - A profound revamp of the first-year curriculum, with the objective of making first-year students more employable for their first co-op. Those changes include the introduction of a Computer Literacy and Programming for Chemical Engineers course in 1A to equip our students with better computer skills, as well as the introduction of Chemical Engineering Studio in 1A and 1B, to focus on design process and communication skills and to provide students with more hands-on experience.
  - Removal of work reports 200, 300 and 400, which are being replaced by four short, structured reports requiring reflection on practical experience obtained during the work term and by a new course, CHE 450 (Technical Work-term Report).

- Again this year, insufficient resources prevented us from increasing the number of Technical Electives.

B3: Improve the Co-op Experience

- An important focus in the past year was to increase the employability of the first-year CHE students through significant curriculum changes, as described previously. Time will tell whether those modifications will have an important positive impact on first-year student employment outside the university.

- Appointment of a departmental Industrial Liaison/Co-operative Education Liaison Officer is still desirable, but this is not the highest staffing priority, and the recurrent uncertainty related to the new budget model limits our staffing options.

B4: Improve Links with Alumni and Industry

- The exit survey for the 4B class is now being used systematically.

- The Chemical Engineering LinkedIn account is now being updated every year. At the initiative of the Chemical Engineering Graduate Student Association (CEGSA), this account is also used to find speakers with an industrial background to complement other research seminars proposed to graduate students.

C. GRADUATE STUDIES PLAN

- Our 2017 total graduate intake was on target, with 86 new students. This is a slight decrease from the previous two years, which were both significantly above target. The total PhD intake has remained constant at 26 for three years in a row. The total MASc intake has slightly increased over the past year (36 in 2017 vs. 33 in 2016). The most important change is the large decrease in MEng intake, which dropped to 24 from about 40 the previous couple of years. Once we know more about the implications of the Waterloo Budget Model, we will be in a much better position to set appropriate targets for the MEng program.

- For the year 2017, the CPR PhD intake dropped significantly compared to the previous year, from 9 down to 5, considerably below our target of 10. Since the total PhD intake did not change, this may indicate the difficulty to attract CPR PhD students in our program. The number of CPR MASc intake also decreased, but to a lesser extent: from 20 in 2016 to 17 in 2017. On the other hand, we have seen a slight increase in CPR MEng intake, from 3 to 5.5, but still below the target of 7. Our MEng program continued to attract primarily visa students.

- In order to make our MEng program more appealing, in particular to CPR students, we have started in the past year looking at the possibility of creating some specializations within our MEng programs. This will require a few more courses and therefore a bit more resources. Once the uncertainty surrounding the new budget model is removed, we will be in a better position to realize the possibility of such a change in the MEng program.
C1: Improve Recruitment of High Quality Graduate Students

- We have continued to follow the strategies indicated in the last three reporting periods (e.g. Cooperate with the Faculty of Engineering to host an on-campus recruitment event for potential CPR students from other Canadian institutions; host a recruitment event for third- and fourth-year Waterloo students; develop more effective advertising tools in collaboration with the Faculty of Engineering, and participate on the Graduate Recruitment Working Group).
- We continue to participate systematically in graduate fairs at the annual Canadian Chemical Engineering conference. In 2018, we participated for the first time in the graduate fair at the American Institute of Chemical Engineering conference.
- We continue to see a number of students transfer from the MEng program to the MASc program, as well as from the MASc program to the PhD program. This seems to be an effective way to increase enrolment in the MASc and PhD programs and maintain our connections with high quality students.

C2: Improve the Graduate Course Offering and Quality

- The Department has made significant revisions to graduate course requirements. The core course model has been abandoned and replaced by the introduction of a few mandatory courses. This will ensure that students graduating from our Department have demonstrated core knowledge in chemical engineering and more flexibility in course selection. Those changes will take effect in Fall 2019.
- Associated with the changes mentioned previously, most courses (especially prescribed courses) are scheduled in a given term. This will give consistency in course offering, allowing students to better plan course selection. In addition, this will ensure that MEng students, who are admitted in the Fall term only, can complete their degree in one year.

C3: Determine the Feasibility of an Online MEng Program

- The creation of an online MEng program is still on hold and has become a low priority. We do not foresee, with what is known about the new budget model, that such a move will be beneficial to the Department.
Improving our current MEng program seems to be a more effective and less resource intensive way to increase enrolment.

D. RESEARCH PLAN

- Total research funding is somewhat lower than the previous year, which was a record high in the history of the Department. Yet, total funding was over $8M, and above our target of $7.75M.

Figure 43: CHE Research Funding Plan Performance to Target

![Figure 43: CHE Research Funding Plan Performance to Target]

Figure 44: CHE Research Funding Plan/TTS Performance to Target

![Figure 44: CHE Research Funding Plan/TTS Performance to Target]

D1: Develop Research Theme Planning Documents

- We continue to routinely maintain the inventory of current major equipment within the Department. This inventory is made available to all our faculty members.

- Although we did mention in the past progress report that we would work toward a planning report related to research, we did not have time to do this in the past year. However, the coming year will be devoted to the next planning exercise and a plan for research will be a priority.

D2: Improve Research Funding

- In the past year, the Waterloo Centre for Electrochemical Energy, largely composed of Chemical Engineering faculty members, has been created. It is anticipated that this Centre will foster collaborative research, and a CFI application is currently being prepared.

- Our Department has been successful in a CRC Tier 1 application in the area of Advanced Manufacturing. In addition, the Department has also been successful in an internal nomination for another Canada Research Chairs Tier 1, whose result will be known in October/November 2018. On the other hand, one of our CRC Tier 2 Chair has resigned to join another university.

- In the coming year, as part of the next planning exercise, we will devise strategies to increase collaborative research within the Department and identify how this can contribute to major grant funding.
D3: Improve Research Support

- The next priority in terms of research support remains the hiring of an additional technical staff member for the central analytical lab. Although we haven’t yet hired such person, we have created a job description and we will likely move ahead with the hiring process in late 2018 or early 2019.

- At the moment, hiring an Industry Liaison Officer is a low priority.

D4: Foster Multidisciplinary Research and Collegiality

- The informal monthly get-together lunch, where a faculty member presented a broad overview of his/her research, has been replaced by a monthly coffee get-together where graduate students are also invited to socialize. We will continue to improve this activity to garner more participation.

E. SPACE PLAN

E1: Work Towards the Construction of E8

- The new WCEE centre, mentioned previously, has been finalized. We are now starting a major CFI application. We will then look at the possibility of leveraging this Centre to raise funds to partially support the development of E8.

- We have continued to make annual contributions to the Engineering building fund to reduce the debt associated with the E6 building. With the good news of a large donation secured by the Faculty of Engineering, this will help to reduce significantly the time to pay the E6 debt. In consultation with the FOE, it is hoped that a plan can be formulated to completely eliminate any debt related to E6 in the near future.

E2: Improve Effectiveness of Research Lab Space Allocation

- The space committee established guidelines regarding space allocation. A formal process to guide researchers’ requests for additional space has also been implemented.

- Now that we know better how much space costs in the new budget model, the space committee will look further into the implication of the new budget on space and how we can optimize space utilization.

- As indicated in the previous reports, increasing the amount of communal lab space is still a high priority, but it is still contingent to the hiring of an additional analytical lab technician, as mentioned in goal D3. We intend to hire this technician in 2019, after which we will be able to move forward with expanding the centralized analytical space.

F. TECHNICAL SERVICES PLAN

F1: Develop and Implement a Technical Services Plan for the Department

- Under the supervision of the Director of Technical Operations (DTO), the technical services operation plan has been more effective than prior to the hiring of the DTO. The DTO reports monthly to the Chair.

- All technical services within the Department, with the exception of the glass blower, are now requested and documented via Request Tracker (RT).

Department of Civil & Environmental Engineering

Carl Haas, Chair

A number of departmental goals and strategies progressed well over the past year. At the undergraduate level, development for the new Architectural Engineering (AE) program was completed, and the program was successfully launched in Fall 2018. For our other undergraduate programs, the department continues its implementation of curriculum and course content revisions for all programs following a prior comprehensive review. Simultaneously, we have worked to improve engagement with, and the experience of our undergraduate students; many more student events are being hosted, the undergraduate student groups budget has been increased by 500%, and the undergraduate computing lab is receiving major new reinvestments.

At the graduate level, we have completed the development of a new MEng diploma program aimed at further increasing CPR and international graduate enrolments. We are also beginning to see the impacts of implementing a final oral examination in the MASc Program, an opportunity previously identified by our graduate students to highlight their research contributions.
The department is also progressing well on its graduate attributes assessment for all programs, facilitated by our Graduate Attributes Lecturer and Accreditation Assistant. In addition, many of our faculty members are exploring novel teaching methods in lectures and labs. These CEE specific experiences are now being shared through brief presentations at CEE Department Meetings.

The department continues to work with the recommendations of a CEE retreat focused on effective hiring (May 2017) to implement new hiring processes. As a result, seven faculty positions and two staff positions were filled in the last year. Staff positions are now on target, though targets contained in this report do not account for the launch of the new Architectural Engineering program. Accordingly, we expect continued hiring to reach the necessary staff and faculty complement.

A. FACULTY AND STAFF PLAN

- With new hires, retirements, departures and a deceased faculty member, the complement fluctuated over the year, ending down two at 32.75 TTS and 3 LECT. Three of the preceding positions were lost to senior administration postings outside of the department, and half a dozen faculty members are on sabbatical typically at any one time, so the effective research and teaching complements were below 30 TTS.
- Searches that occurred included:
  - Environmental Engineering: Dr. Pham will start January 2019;
  - Smart Structures & Systems: Dr. Yeum will start September 2018;
  - Building Materials & Structures: Dr. Hrynyk start March 2019;
  - Architectural Engineering Lecturer (1 or 2 openings filled for AE program): Dr. Cory Zurell start January 2019;
  - Architectural Engineering Faculty (2 of 2 openings filled for AE program starting Fall 2018): Dr. Daniel Lacroix start September 2018;
  - Turkstra Endowed Chair – expect successful search for Fall 2018 or Winter 2019 start date.
- The target for May 2019 is thus 42.75.
- CEE currently exceeds its target for % women faculty, and continues to recruit top female candidates for all faculty searches. The target may need to be adjusted higher and this will be discussed internally.
- CEE reached 93.4% PEng registration in 2017/18 (highest in Engineering), and continues to approach its target of 95%. New faculty and those who have not yet become registered are routinely encouraged to complete the process.
- Staffing levels increased, with two new positions filled in Architectural Engineering: the Undergraduate Coordinator/Administrative Assistant (Eleanor Clarke) and Technologist (Dan Jessel). In all, 19 positions are currently filled with permanent staff: 9 Administrative staff, 8 Technology staff and 2 IT staff. One position (Department Assistant) remains open, while one other position (Financial Assistant, Research & Contracts) moved from contract to permanent status.

Figure 45: CEE Regular Faculty Complement Plan Performance to Target
A1: Implement Faculty Complement Plan

- CEE will reach its target complement in the following years by launching a number of searches in this reporting year, including:
  - Architectural Engineering Lecturer (1 position for AE program starting Fall 2019);
  - Architectural Engineering Faculty (1 position for AE program starting Fall 2019);
  - Civil biomechanical systems (Brodland (retired)) for Fall 2019 start;
  - Water resources (Soulis (deceased)) for Fall 2019 start.

- The target for May 2020 is thus 46.75. Two to three retirements are anticipated in the next two to three years, and 5 positions will open up under the AE implementation plan. The target for May 2022 after the incremental hires related to the AE program are completed is thus 51.75.
All these plans are subject to budget constraints and future income under the new Waterloo Budget Model as well as mission critical approvals from the center.

A2: Implement Staff Complement Plan

All staff positions have been filled. One position will require replacement due to upcoming retirement: Technologist, Fluid Mechanics (Terry Ridgway). One more administrative and technician position (to be shared with Architecture) will open up under the AE implementation plan.

A3: Options for Growth

- The single largest opportunity to grow in CEE is through our Architectural Engineering (AE) program. This program has been developed in collaboration with the School of Architecture over the past several years, has been approved at all levels, and is now being implemented over the course of the next five years following its launch in Fall 2018. CEE growth associated with AE program (figures not specifically included in Vision 2015 Plan) include:
  - Cohort of 85 undergraduate students per year (total FTE approx. 300 at steady state);
  - New faculty positions: 8 TTS and 2 LECT;
  - New staff positions: 2 Admin and 2 Technical;
  - New research thrusts in urban systems, building science, intelligent cities, distributed energy systems and big data;
  - Graduate student growth associated with new TTS faculty and research thrusts.

- Through a generous donation by Dr. Carl Turkstra (UW PhD 1963), an endowed chair has been created to strengthen the connection between municipal leadership and civil engineering. The Chair’s aim is to develop the leaders our municipalities need for devising new methods and approaches to infrastructure engineering while effectively communicating their value and worthiness to society. The Turkstra Chair will create a new TTS position, and thus increases the faculty complement by one TTS. An Advisory Board was assembled to shape the Chair mandate, and advertising for the Chair begin in early 2018.

- Graduate enrolment is anticipated to increase over the next several years as the AE program comes online, and as new MEng Diplomas and programs gain traction.

B. UNDERGRADUATE STUDIES PLAN

- Targets remained consistent for all three programs (Civil – CIVE, Environmental – ENVE and Geological – GEOE); targets may be adjusted in the future to better balance the programs.

- CIVE intake enrolment experiences only minor fluctuations from target. Given the incoming cohort size and the strong student demand to transfer into CIVE from other programs, 2A class sizes range from 120-140; no further growth is practical without adding a second stream.

- ENVE and GEOE cohort sizes are somewhat cyclical and fluctuations are proportionally larger than CIVE given their smaller targets. During the current reporting period, there has been a decrease in applications to these programs, resulting in below-target enrolments. A preliminary investigation based on student engagement suggests that a lack of clear differentiation between programs within the department and broader faculty may be a culprit. Additionally, real or perceived market fluctuations affecting co-op and full-time employment opportunities may also impact applicant decisions. Accordingly, CEE is working with Engineering Admissions, Marketing and Communications, and Digital Media to develop strategies to improve department-wide program “branding,” recruitment, and retention.
Figure 49: CIVE Undergraduate Intake Plan Performance to Target

Figure 50: CIVE Undergraduate Intake Plan Performance to Target, Visa Status

Figure 51: ENVE Undergraduate Intake Plan Performance to Target

Figure 52: ENVE Undergraduate Intake Plan Performance to Target, Visa Status
B1: Comprehensive Curriculum and Course Content Revisions Implementation

- The comprehensive assessment and renewal of our current programs resulted in a broad range of proposed changes to our curricula from First Year through graduation. The changes were intended to improve student engagement and success, to provide better integration with course material in second-year courses and above, and to increase student exposure to engineering faculty in the classroom. The new curricula include a number of new courses, as well as revision of numerous existing courses.

- The new curricula were introduced starting with the first-year classes in September 2015. Students have now experienced terms 1A to 3A of the curricula. CEE is reviewing and reflecting on the student and instructor experiences with the new curricula. This will be ongoing as it becomes an integral part of the graduate attributes and outcomes assessment process in CEE.

- An exciting development in the curriculum was the introduction of a “Communications in the Engineering Profession” course in the 1A term. This course was developed by CEE in collaboration with the English and Drama and Speech Communication Departments. The course was offered to CIVE, ENVE and GEOE students for the first time in the Fall 2017 term. Notably, class section sizes were capped at 25 students to facilitate opportunities for detailed feedback and contact with instructors.

- CEE continues to plan and develop specializations in each program, which will require students to focus their technical electives in a theme area (e.g., water resources, transportation, structural design, green energy).

B2: Laboratory Equipment Upgrades and Enhancements

- A significant program of upgrading and expanding laboratory equipment in undergraduate teaching laboratories was undertaken. Laboratory enhancements and upgrades have enriched the hands-on experience of our undergraduate students, and new, modernized equipment continues to be integrated into courses, where appropriate.

B3: Student Retention

- The improvement of student retention in the ENVE and GEOE programs is an important goal for the CEE Department moving forward. Extensive engagement, especially with students requesting transfers out of
ENVE and GEOE, has revealed two major misconceptions: (i) that CIVE offered better career training and employment opportunities, particularly in water and wastewater treatment, green energy, and sustainability, and (ii) that ENVE and GEOE were merely sub-specializations of CIVE, rather than unique programs. Some students also reported that they had received deflected offers of admission into ENVE or GEOE, having initially applied for entry into CIVE.

- As a result, several efforts related to student retention have been undertaken, with an aim to highlight the uniqueness of, and career opportunities afforded by the ENVE and GEOE programs for current students and applicants. Some of these efforts include:
  - Revision of recruiting materials to better differentiate between, and describe unique aspects of ENVE, GEOE and CIVE programs;
  - Revision of course prefixes in the program calendar from CIVE to ENVE or GEOE wherever relevant;
  - CEE participation in all decisions related to transfers in and out of CEE, including those in first year;
  - Information sessions (“Town Hall Meetings”) for first and second year ENVE and GEOE students with faculty and upper-year students to discuss program and job opportunities, student experiences, etc.;
  - Identification of opportunities to create new options or specializations related to ENVE and GEOE to attract and retain students.

B4: Student Engagement/Experience

- The new first year communications course (GENE 199 – Communications in the Engineering Profession) is capped at 25 students per session to ensure student instructor engagement.

- In 2017/18 CEE Capstone Design Project courses received over $20,000 of funding and awards from CEE and corporate sponsor MTE Consultants Inc. MTE directly sponsors $5,000 worth of awards for our Design Pitch competitions and Capstone Design Symposium presentations.

- Undergraduate project teams have been encouraged to compete in national and international design competitions. CEE’s commitment to these initiatives is evident both in mentorship and financial support (totaling approximately $25,000 in 2017/18).
  - CEE student design teams hosted several national competitions for the Canadian Society for Civil Engineering (CSCE): Concrete Toboggan, Concrete Canoe, and Steel Bridge competitions.
  - The University of Waterloo Habitat for Humanity Design Team (Warrior Home), founded by CEE UG students, participated in the U.S. Department of Energy’s Race to Zero Student Design Competition. The competition challenged collegiate teams to apply sound building science principles to create cost-effective, market-ready designs that meet DOE’s Zero Energy Ready Home program requirements; the Warrior Home team placed first in the attached housing category.

- The number of student initiatives/chapters continues to increase and is at a level that they are competing for the limited CEE funding available. We continue to initiate discussions with students with the goal to provide sufficient faculty and financial support, but not to dictate direction or restrict student enthusiasm and creativity.

- In addition to the successes of the various student design teams, the Civil, Environmental, and Geological Engineering Society (CEGES) UW Chapter was named the society’s President’s Best Student Chapter at the CSCE Conference in June 2017.

B5: Architectural Engineering (AE) Program

- Following approval by the Senate and submission to the Ontario Quality Council in December 2017, Architectural Engineering was given the green light to begin advertising for 2018 admission. Despite approval being granted quite late in the recruitment cycle, 358 applications were received, resulting in 103 confirmations for 1A in September 2018.

- Hiring activity for AE began in early 2018; to date, 2 staff members (1 admin, and 1 tech), 2 tenure-track faculty and 1 lecturer have been hired in CEE, in addition to 1 tenure-track faculty in ARCH.

- 2 additional CEE faculty hires (1 TTS, 1 lecturer), 1 additional ARCH faculty hire, and 2 additional staff members are anticipated prior to the end of the 2019/2020 fiscal year.

- 2 studios and a “maker space” are being constructed in CPH for this new program. The first studio and maker space construction project faced delays and are now expected to be completed partway through the fall 2018
term. As a result, temporary spaces in E7 and DWE will be used to deliver the fall courses. The second studio construction is now underway and should be completed in the summer of 2019.

- 2018/2019 will be the first full admissions cycle for this new program. In collaboration with Engineering Admissions, CEE is aiming to increase the number of applicants in the coming year, so to expand the pool of high-quality candidates.

- CEE will also be working closely with Co-operative Education, to ensure that as many of our new and future AE students as possible find placements for their first work terms.

B6: Novel Teaching Methods

- A primary objective of the 2014/15 curriculum revisions was to enhance experiential learning, and to encourage CEE instructors to introduce new teaching methods to promote active learning and foster students’ deep learning and retention of knowledge. Student feedback to date has been very positive, and indications are that student engagement and learning have been deepened.

- Additional models to demonstrate physical concepts were developed with the IDEAS Clinic, to enhance instruction of such concepts as fluid statics, trusses, one-way and two-way slabs, and tributary areas. These models supplement the models previously introduced to allow first-year students to feel and experiment with the forces present in beams, arches, dams, tanks, culverts, retaining walls, suspension bridges and other structures.

- First-year Civil, Environmental and Geological engineering students were given a project to design a playground for two local schools. The project allowed the students to learn and apply the design process in a realistic context, and enhanced their engagement in the course. As well, the project was very well received by the school children, principals and the head of facilities for the Waterloo Regional District School Board.

- Videos were developed by CEE faculty supported by funding from the Centre for Teaching Excellence (CTE) to cover challenging first-year concepts. The videos are intended to assist with retention core concepts by providing opportunity for reflection on class learning.

- Design Days, 2-day events where students work in groups to propose solutions to design problems, were successfully implemented for all CEE cohorts in collaboration with the Ideas Clinic. Students were excused from their regularly scheduled classes to participate in Design Days, which were designed to integrate with core class learning. Although the proposed design solutions were evaluated as part of the competition, the project carried no weight in the related course grading schemes. The goal was to create a learning environment with no risk of failure, so that the students could be completely immersed in the key concepts with the freedom to explore creative ideas without consequence.

B7: Use of TAs

- CEE continues to formally evaluate TAs, including both student and instructor feedback, and use the results to assign future TA positions. Efforts to improve feedback rates continue and include the creation of class time for on-line survey completion.

- Outstanding CEE TAs are recognized each term with monetary awards and certificates, including:
  - Outstanding performance by TAs and graduate student sessional lecturers were recognized with a certificate for Continuing Excellence in Teaching;
  - New in 2017-18, an additional certificate recognizing outstanding performance by a team of TAs was granted.

C. GRADUATE STUDIES PLAN

- Overall graduate intake was above target, though intake of CPRs into the PhD and MSc programs was below target, consistent with nation-wide trends in graduate enrolment.

- The total number of MEng students in 2017 is above target because of the acceptance of international students in the program as of Fall 2017.
C1: Graduate Growth and Quality

- The growth in graduate enrolment is largely a result of the intake of international students into the MEng program. The number of graduate research students supervised per faculty member has also increased and remains above the faculty average.

- Increasing overall graduate student quality is an ongoing goal. The department has changed the internal policy of matching the President’s Graduate Scholarship, in order to align with the rest of the Faculty. As a result, the graduate studies committee can use the graduate fund to reward excellence in research, support the attendance of students at international conferences, or to give additional support to faculty members to take high-quality CPR students. The department also developed certificates to recognize voluntary work done by graduate students in collaboration with the CEE association of graduate students.

- Additional growth in the MEng (course-based) program is being promoted through strategic changes to the program structure, the admission of international students, and the adoption of improved recruitment practices coordinated by the Faculty of Engineering.

- Further growth in MEng is expected once proposed graduate diplomas are approved by the Graduate Studies and Postdoctoral Affairs Office (GSPA). In addition, the Associate Dean and the Associate Provost of Graduate Studies are working on the introduction of specializations, with approval expected by end of 2018.

C2: Graduate Course Offerings

- The CEE department has established a core set of graduate courses that are normally offered at least once every year, and approved a set of courses that will be part of four specializations. The implementation of these changes is pending the approval of GSPA.

- The average number of graduate courses offered remained consistent. With the new AE program, the number of courses is expected to rise, straining existing resources. CEE, however, is committed to ensuring a minimum number of available courses by hiring sessionals on an as-needed basis.

- It is expected that additional graduate courses from recognized industry leaders will be offered yearly with the additional resources generated by international MEng students.
C3: MEng Program(s)
- The department approved four new specializations to update the MEng program, and to make it more attractive to prospective students. The implementation of these changes is pending GSPA approval.

C4: Graduate Student Experience
- The content of the compulsory “Research Methods Workshop” course has been updated to include presentations on library resources and academic integrity, as well as presentations by eight faculty members. CEE also anticipates the inclusion of a module focused on mental health.
- PhD students recognized for teaching excellence were given the opportunity to teach undergraduate and graduate courses as sessional lecturers.
- The selection of an outstanding CEE TA each term has continued, so to encourage and reward TA excellence. Recent recipients include Stanley Fong (Winter 2017), Kyle Balkos (Spring 2017), Mina Lee (Fall 2017), Dylan Dowling (Winter 2018), and Rajdip Nayek (Spring 2018).
- The Special Recognition Certificate promotes sustained excellence in various achievements. Recipients in the past year were Colin Van Niejenhuis and Kevin Goorts.
- CEE has completed a series of renovations to graduate student office space.
- Many opportunities for socialization among the graduate students, faculty and staff are organized each year. New welcome and orientation events have been scheduled for MEng and Research students in Fall 2018.

C5: Graduate Student Progression
- The Associate Chair of Graduate Studies continues to meet with students exhibiting signs of difficulty, particularly students struggling academically and those with identified mental health issues, in order to provide support and ultimately aid in their progression.
- A new electronic format of the Activity Report has been adopted by the department, so to reduce processing time and enhance the filing process.

C6: Final Oral Examination in the MASc Program
- With the approval process complete, the first oral defences for MASc students will take place Spring 2019.

D. RESEARCH PLAN
- CEE research funding rebounded significantly after declining steadily in recent years. Total funding is nearing target values, while funding per CEE faculty member in 2017/18 is now at target, and among the highest average values in the Faculty.
- Research funding per faculty member is expected to decline substantially, as a number of early-career faculty members begin employment in the coming months. CEE plans to actively mentor them and has provided substantial start-ups grants to these individuals.

Figure 57: CEE Research Funding Plan Performance to Target

![Graph showing CEE Research Funding Plan Performance to Target from 2010/11 to 2017/18.](image)
D1: Identification of Emerging Research Areas

- The newly-formed Research Committee (2017) has been tasked with identifying emerging research areas within and related to CEE. While this initiative was stalled due to unexpected administrative changes, we anticipate the Committee’s activities to resume to ensure continued success in securing research funds.

D2: Strategies to Increase Research Funding, Output, Capacity and Impact

- The new Research Committee will work to identify strategies for this purpose.

D4: Improve Research Collaborations

- It is our observation that it is difficult to force collaborations, and that these happen better organically. As such, this item is no longer a specific priority.

D5: Marketing CEE Research

- See Item F1.

E. SPACE PLAN

CEE continues to consolidate its space holdings into as few buildings as possible to improve contiguous space functionality. The majority of CEE space holdings reside in Engineering 2, with heavy equipment lab space in Engineering 3, Environmental and Geological Engineering teaching and research labs in DWE C-Wing, and faculty and graduate student offices predominantly in CPH.

E1: Space Renovations

- CEE’s major space acquisition in 2017 was an area between the first and third floors of CPH to house two Design Studios, which will serve as the home for the new AE program. The first design studio is scheduled to open in the fall of 2018 with the second studio scheduled to be completed by the end of 2018. Additional office space to house associated faculty, staff and graduate students is being identified in CPH.

- Other recent renovations have included a new non-destructive testing lab in E2, which will make way for a structures lab expansion in E3. A number of other labs have been relocated into E2 due to space acquisitions in CPH by Engineering Computing.

- CEE has begun an E7 space reallocation plan for a series of offices that will be acquired in DWE C-Wing and E2 after other departments, programs and services have moved to E7. This is anticipated in the summer of 2018 and will provide much-needed office space for faculty, staff and graduate students.

F. EXTERNAL RELATIONS PLAN

F1: Marketing CEE Research

- A concerted effort has been undertaken to routinely feature CEE research accomplishments and news on the CEE Departmental website. As well, selected features and accomplishments are sent to the Faculty of Engineering office for inclusion on Faculty web updates and alumni communications.

- CEE has begun to transition to “Open Scholar” websites for faculty members. This platform is simpler to create and maintain websites than other formats, and offers brand consistency. CEE faculty can now request an open scholar website from the CEE IT Manager.
A marketing strategy will be developed to highlight the various research thrusts ongoing in CEE; this is a future effort for CEE.

F2: Alumni Engagement

- CEE has recognized the need to increase engagement opportunities with CEE alumni. An annual report to connect with alumni and share key information is being considered as a first step.
- An Industry Board of Advisors is being considered as part of our Graduate Attributes and Outcomes Assessment process. The Advisory Board would be similar to a “Visiting Committee,” which is a common mechanism in many US universities. Although the purpose of this board is not specific to alumni engagement, it would be an excellent opportunity to engage alumni. A proposal for the Board of Advisors was developed in the fall 2017, and is expected to be initiated in fall 2018.

Conrad School of Entrepreneurship and Business

Mark Weber, Eyton Director

The planning period has been one of great success and transformation for Conrad. Conrad began the period in cramped rented space off campus teaching approximately 70 students a year with a dedicated faculty of 3; now, Conrad has a new on-campus home in E7, teaching more than 1,200 students a year with a full-time complement of 12 dedicated faculty members. In 2010, Conrad was a Centre with governance challenges, offering 3 programs and one undergraduate elective course. Now, Conrad is a full-fledged School within the Faculty of Engineering, offering 7 programs (with 2-3 more planned) and 9 undergraduate electives, with 3 others in various stages of approval.

In 2017, the Conrad faculty and staff unanimously adopted its strategic aspiration mission: To be the academic engine of entrepreneurship and innovation education at Canada’s most entrepreneurial and innovative university. To become one of the world’s leading centres for entrepreneurship and innovation education and widely respected for the quality of our scholarship globally.

The successes of the planning period ended in 2018 have gone a long way to Conrad achieving its aspiration.

A. FACULTY AND STAFF PLAN

- Conrad has added exceptional faculty, combining truly excellent teaching and research capacity.
- Conrad has deliberately pursued a blended strategy of adding full-time tenure-stream and teaching-stream faculty.
- Slower program growth than initially anticipated has prompted a responsible slowing of making full-time additions to faculty. However, we added an additional tenure-stream and lecturer hire immediately following the 2017/2018 year, and anticipate continued tenure stream growth going forward.

Figure 59: CONRAD Regular Faculty Complement Plan Performance to Target
A1: Convert Enterprise Co-op Coordinator Position from a Contract to a Continuing Appointment (Once Permanent Mandate to Run E Co-op is Secured)

- At this time, no permanent mandate has been possible given budget model negotiations at the university level. The current Enterprise Co-op Coordinator has won faculty and university-level teaching awards, and Conrad intends to pursue a continuing appointment in the coming year.

A2: Replace Individuals in Non-complement/Part-time Positions such as the Entrepreneur-in-Residence and Lead Mentor/Business Plan Coach as Required During the Planning Period

- Alyson Hewitt from MaRS in Toronto has been added as Conrad’s Social Entrepreneur in Residence. Additional support roles have been filled in relation to our summer school programming.

B. UNDERGRADUATE STUDIES PLAN

B1: Secure Permanent Mandate to Run Enterprise Co-Op

- As noted above, this has not been possible in the context of ongoing budget model negotiations, although the university did extend the original agreement by four years during this plan. As the budget model issues are finalized, a permanent funding arrangement will be pursued again.

B2: Collaborate With CECA in Developing Programs Around Alternative Labour Models

- Conrad has begun discussions with Co-operative Education (formerly CECA) in relationship to the role it might play in new programs at both the graduate and undergraduate levels.

B3: Explore Opportunities to Create Undergraduate Entrepreneurship Options/Specializations

- Conrad now offers an Option in Entrepreneurship to undergraduates in the Faculty of Engineering, and also a minor to undergraduates in every other faculty at UW.
- The original program structures have been streamlined and updated in the current plan year.
Several new undergraduate electives have been put in place (e.g., Sales, Customer Experience Design) and others are expected to come on-stream in the coming months, including courses in Entrepreneurial Negotiations, Management Consulting, and Family Business.

Conrad is partnering with other units to help bolster the breadth and quality of their business and entrepreneurship offerings to their students.

**B4: Provide Support for Capstone Entrepreneurship Awards**

- Conrad partners with the Faculty on the Esch Capstone award program, delivering its central entrepreneurship content and related coaching.

**C. GRADUATE STUDIES PLAN**

- Conrad is now delivering MBET enrolment consistent with plan targets. This has largely been achieved through the entrepreneurial redesign and relaunch of the part-time “Weekend” MBET program.

- In a context in which government funds generate entrepreneurship support programs, it has become more difficult to attract full-time domestic students than anticipated; however, the Weekend format is helping to address this, as it is populated almost entirely by domestic students.

**Figure 62: CONRAD Graduate Intake Plan Performance to Target**

**Figure 63: CONRAD Graduate Intake Plan Performance to Target, Visa Status**

**C1: Enhance MBET Program**

- During the latter years of the planning period, Conrad rationalized and redesigned key aspects of the MBET curriculum and program delivery. In preparing for the next planning period, current students and recent alumni were surveyed. The evidence is broadly supportive of enhancement success. Students are very happy with faculty, staff, and the educational and support communities created and maintained by Conrad. Concerns with facilities will be completely addressed by the move to E7 in summer 2018.

**C2: Launch a Part-time MBET Program**

- Conrad launched a new weekend-format, part-time MBET program in 2017/18. This initiative was a success, attracting 25 students to the initial cohort, and 21 to the second.
The Part-time program has allowed Conrad to meet its graduate enrolment targets in the final year of the plan period.

C3: Offer Certificate in Business and Entrepreneurship to Students in MEng Degree Programs
- Conrad now offers six electives to MEng students, with a seventh planned for 2018/19.
- These electives have been very successful, attracting 200-300 enrolments in each of the last three years.
- Plans are taking shape to further augment the business offerings to MEng students.

C4: Develop a Strategic Marketing Plan to Ensure Graduate Intake Targets are Met
- Conrad continues to experiment with the right mix of marketing and recruitment activities to ensure graduate intake targets are being met every year.
- Use of recruiters in some target international markets is one new initiative that is showing promise.

C5: Explore Opportunities for Additional Taught Master’s Programs to Launch in 2015-2020 period
- Exploration of taught Masters program ideas led to the launch of the Weekend MBET, which has been successful.
- A new professional masters program is again under consideration.

C6: Plan for Introduction of Research-based Master’s and/or PhD Program in the 2015-2020 period
- A proposal for a PhD program in business and entrepreneurship has been drafted and approved in principle by Conrad faculty members. It will go under formal review in Fall 2018, with the first student intake targeted for Fall 2020. This program will allow Conrad to significantly enhance its research capacity and impact.

D. RESEARCH PLAN
- Research funding dramatically exceeded targets during the plan period, though this was primarily due to a single exceedingly large grant to two faculty members.
- Research-active faculty have been highly successful in SSHRC competitions, with each faculty member who has applied experiencing success over the last four years. Those who have not applied have other sources of research funding or have been on leaves of absence.

Figure 64: CONRAD Research Funding Plan Performance to Target
D1: Grow Conrad’s Research Capacity and Reputation

- During the plan period, Conrad has doubled its tenure-stream faculty numbers.
- Conrad has initiated a number of research intensity initiatives, including the Conrad Research Excellence Chair program, a visiting lecturer program, small grants to support emerging research programs and pedagogical study and publishing by teaching-stream faculty.
- The planned addition of a PhD program – one of only four in Canada with an explicit focus on entrepreneurship – will further advance these efforts.

D3: Develop Opportunities for New Faculty to Supervise Research Master’s and PhD Students

- The planned Conrad doctoral program will offer these opportunities.

D5: Identify a Senior Faculty Member to Champion Research Development

- Shavin Malhotra, the first Conrad Research Excellence Chair, leads the doctoral program development initiative, and offers senior faculty leadership to a number of other research culture initiatives. Junior faculty have taken up other roles to support that effort as an intensified and enhanced research culture is built.

E. DEVELOPMENT PLAN

E3: Work Closely with Faculty and University Development Efforts to Support Entrepreneurship

- Conrad continues to work closely with the Faculty and University-level development efforts that support entrepreneurship.

F. GOVERNANCE, ADMINISTRATION AND LEADERSHIP PLAN

F1: Complete Transition from Independent Research Centre to School within the Faculty of Engineering

- In June, 2018, the Board of Governors made Conrad a School within the Faculty of Engineering: The Conrad School of Entrepreneurship and Business.

F2: Launch “Conrad” Brand and Develop a Distinctive Identity for the Centre as an Academic Unit within the Faculty of Engineering

- A distinctive Conrad brand was established early in the planning period. It is now being refreshed and a rebrand is being readied to align with Conrad’s new status as a School.

F3: Clarify Role of Advisory Council

- The advisory council was deemed to have served a very important purpose in Conrad’s founding and development, but to be less useful in its current form to the School’s next stage of development and was disbanded. Instead, Conrad is forming a group of dedicated informal community advisors that can be drawn upon at moments of strategic relevance.

F4: Review Role of Entrepreneur-in-Residence (EIR)

- A Social Entrepreneur-in-Residence role has been added. At the same time, the role of EIR was scaled back significantly due to the addition of many new faculty members with rich professional and academic expertise.
In combination, the two EIR roles now involve a total of 225 hours of annual commitment to act as resources to Conrad students.

Department of Electrical & Computer Engineering

Vincent Gaudet, Chair

In 2017-18, the Department of Electrical and Computer Engineering (ECE) continued to expand, albeit at a slower pace than in previous years. It is now one of the largest engineering departments in Canada, with 94 regular faculty members and 53 instructional, research laboratory, and administrative staff. ECE has over 2,400 undergraduate students (including our pro-rated share of four collaborative programs), 580 graduate students, and 13,200 alumni. This past year, the department raised $20.4M in annual external research funding, representing an increase of 13.4% over two years.

ECE continues to make good progress towards its Strategic Plan targets, and is in excellent fiscal health. In the coming years, the Waterloo/Engineering Budget Model will bring both challenges and opportunities.

Our undergraduate plan has been focused on admissions and recruitment, student retention and engagement, infrastructure, and teaching quality. We have successfully increased our admission of both international students and female students; currently, over 20% of our incoming undergraduate students are international, while females make up 18% of our incoming cohort. ECE has taken several initiatives and put into place significant resources to enhance student engagement and experience. We have been holding regular town hall meetings with large groups of undergraduate students who have provided excellent feedback. This feedback has led to a major overhaul of our undergraduate ECE curriculum, which began its deployment in Fall 2017, with further changes to follow for the incoming class of 2018.

At the graduate level, our plan called for additional financial resources to be provided to ECE graduate students in the form of scholarships and Teaching Assistantships (TA). Our graduate program has been strengthened through the introduction of core courses for research graduate students and an increase to four courses required for PhD graduate students. ECE has split the PhD comprehensive examination into a background exam and a thesis proposal exam to ensure regular and timely feedback for our students. Currently, we are looking into our graduate admissions procedures, focusing on improving the information provided to potential supervisors when they are seeking new graduate students, and on improving timelines to make offers.

Our faculty members have been successful in receiving major research grants from NSERC, ORF, and CFI. ECE has also started to put greater effort into nominating its faculty members for external research and professional awards. In early 2018, Prof. Ehab El-Saadany was elevated to the grade of Fellow of the Institute of Electrical and Electronics Engineers (IEEE), bringing the number of active Fellows within ECE to 19. Also, Prof. Weihua Zhuang was inducted into the Royal Society of Canada (RSC), becoming the fourth active RSC Fellow in ECE.

We have recently reorganized our administrative staff structure, in particular the finance team, to provide better service to our faculty members. One of our administrative managers has been reappointed as the ECE Communications and Awards Officer, with a mandate to overhaul both our internal and external communications strategy.

### A. FACULTY AND STAFF PLAN

One new faculty member started in 2017-18, and 5 administrative staff and 2 lab instructors were recruited. Over the past few years, several external factors (research, immigration, safety, etc.) have contributed to increased compliance responsibilities, and these new requirements impact staff through evolving responsibilities. To meet these increasing demands, ECE continues to rework and reshape the existing staff complement to better serve colleagues, students and the university community. The consolidation of the finance teams provides one point of contact for better service and an integrated/cross-functional team with a holistic problem-solving approach. One position was re-purposed to manage communications, award nominations, and research initiatives to enhance the recognition and reputation of ECE through strategic research support and integrated communications. The graduate studies team has also been re-organized to provide better service for Masters students, graduate funding, as well as additional support for management of the growing number of graduate studies applications.

Space constraints remain problematic, but this should be alleviated somewhat with the opening of E7 in 2018. ECE will have two floors in E7, which will include five large classrooms providing home rooms to all ECE undergraduate students, two smaller classrooms for graduate courses and technical electives, as well as office and research lab space. In addition, the undergraduate academic support staff will be relocated to E7 for better service and
accessibility for our undergraduate students. There is also a plan to hire a limited-term Student Wellbeing Coordinator to support student health and community building.

A1: Implement the ECE Faculty Hiring Plan

- ECE hired one faculty member, Sahar Pirooz Azad (Assistant Professor, power systems), and lost one faculty member (Allyson Giannikouris). In 2017-2018 we also conducted faculty searches for three positions: computer software, computer systems, and biomedical devices, circuits and systems, with faculty members in two of those searches expected to start during the 2018-2019 timeframe. In 2018-2019, we expect to undertake new searches in the computer systems and computer hardware (Mechatronics Engineering expansion) areas.

- We continue to actively encourage faculty members to register as professional engineers (P.Eng.), with a focus on recently hired faculty members. There was a decrease in licensing rates from 2014 to 2016, due to retirements of licensed faculty and hiring of new unlicensed faculty. However, we are back to a licensing rate of around 70%. Several faculty members either registered for PEO or wrote the professional practice exam in 2017-2018, and we therefore expect an improvement in licensing rates as we get the ball rolling on our 2019 accreditation site visit.

Figure 66: ECE Regular Faculty Complement Plan Performance to Target

Figure 67: ECE Regular Faculty Complement Plan Performance to Target, % Women
A2: Implement the ECE Staff Hiring Plan

- The department filled two administrative staff positions (Ally Knepper-Woods, Lisa Habel), and one Laboratory Instructor position (Frank Coutu). During the same period, one staff member was promoted, two staff members retired, one staff member transferred to another department, and one position was vacated. In addition, two administrative staff secondments were filled with temporary re-assignments. Three Lab Instructor positions remain unfilled and recruitment is ongoing.

B. UNDERGRADUATE STUDIES PLAN

At the undergraduate level, the department is responsible for 2,433 students (pro-rated for shared programs). ECE manages three combined cohorts of students enrolled in Electrical Engineering (EE) and Computer Engineering (CE), and also participates in four collaborative engineering programs: Software Engineering (SE) with a 50% share, Mechatronics Engineering (MTE) with a 20% share, Nanotechnology Engineering (NE) with a 33% share, and Biomedical Engineering with a 10% share of students.
Figure 71: EE&CE Undergraduate Intake Plan Performance to Target, Visa Status

Figure 72: SE Undergraduate Intake Plan Performance to Target

Figure 73: SE Undergraduate Intake Plan Performance to Target, Visa Status

Figure 74: NANTE Undergraduate Intake Plan Performance to Target
Figure 75: NANTE Undergraduate Intake Plan Performance to Target, Visa Status

Figure 76: MCTR Undergraduate Intake Plan Performance to Target

Figure 77: MCTR Undergraduate Intake Plan Performance to Target, Visa Status

Figure 78: BIOE Undergraduate Intake Plan Performance to Target
B1: Enhance the Quality of Admitted Students in Electrical and Computer Engineering

- We continue to pool EE and CE students to help ensure that we admit the best students. To avoid diluting the quality of incoming students, we have maintained a consistent overall admission target. Currently, the ratio of EE to CE is approximately 1:1.8, with a trend towards greater imbalance. We need to monitor this closely as further imbalance places our EE classes in jeopardy. Some mitigating action has been taken in the admission process, with students selecting EE being given preference at the lower end of the tail.

- ECE had been gradually increasing the proportion of visa students admitted, but saw a decrease in visa student enrolment in 2017. Visa totals, however, remain above target.

- ECE is very well represented by faculty members in various promotional events to attract students like the Ontario’s University Fair, Fall and March Break Open Houses. For example, in OUF, we had the largest number of faculty members present of any engineering department for two consecutive years.

- We have begun development of promotional videos describing the fields of Electrical and Computer Engineering, the opportunities they present to students, and how students can succeed in our program. The videos are intended to be informative, while also attracting students with a growth mindset to our programs.

B2: Improve Student Retention Rates and Enhance Student Engagement

- We piloted ECE Design Days in collaboration with Ideas Clinic in 1B where students solved open-ended problems over two days. Classes were suspended during this time and labs re-scheduled to avoid conflict. The goals of the ECE Design Days were to:
  - Give students more hands-on design experience early on so they can be more resourceful and confident problem solvers;
  - Give students opportunities for cross-course, program level knowledge integration;
  - Increase student self-confidence by allowing them to fail without penalty;
  - Build more interactions between the students within the class and with their seniors.

- The pilot for the Design Days was highly successful with overwhelmingly positive student feedback. A video of the event can be watched at: [https://youtu.be/Ri1WlshIT7s](https://youtu.be/Ri1WlshIT7s). We are currently investigating ways to integrate the Design Days with the curriculum going forward.

- We have started a number of initiatives to improve student engagement, including:
  - Joint class representative meetings at the beginning of each term;
  - Trivia event about ECE with our 1st year students. Select students from upper years also attended the event and interacted with the 1st year students;
  - We are forming a ECE Undergraduate Society, to be led by students. The Society will be launched in November 2018;
  - We have relaunched the IEEE Undergraduate Society.

- The mental health of our students has become one of our top priorities. To help students deal with stress and mental health related issues, an email is sent to all students at strategic times in the term, directing them to the various counselling services available on campus and how students can avail of them. The students are
also asked to contact the undergraduate office of the Department if they are having issues or cannot get in touch with the counselling services. Further, we developed workshops on mental health and provided them to our first year students. The workshops focused on developing resiliency and study skills needed to succeed in our program. We are currently in process of hiring an embedded Mental Wellbeing Coordinator, a position which will be open to all our students including undergraduate and graduate.

- In order to make students more invested in their education, it has also been mandated that the Associate Chair, Undergraduate Studies will be running the class-professor hours. The intention is to use this opportunity to speak with students about the courses they are taking and how they relate to the future terms and career goals.

B3: Enhance the Undergraduate Student Experience through Infrastructure Improvements

- To increase the amount of departmental space dedicated to undergraduates, we built a dedicated 400 nasm ECE student space in E2, by re-arranging existing lab rooms. The location is ideal, right next to almost all undergraduate ECE labs. In addition, the department will have two floors in the E7 building, including five large classrooms to provide home rooms to all EE and CE undergraduate students. We also relaunched IEEE Undergraduate Society with a dedicated space that will be filled with equipment to enable the makers in our program.

- ECE has started modernizing its laboratories based on open-ended design problems and more hands-on activities. The laboratories are being designed not only to reinforce the materials taught in courses, but also to introduce the students to the applications and further supplement their knowledge. We have identified at least one lab every term where critical thinking and problem solving skills will be emphasized.

- Under the new Waterloo Budget Model where the Faculty of Engineering has given its departments and schools budgetary control, ECE has decided to set aside a pool on money for ongoing maintenance and upgrading of our labs to ensure continued access to modernized and relevant equipment.

B4: Improve Overall Teaching Quality

- The department has made progress in implementing an outcomes-based assessment process, as mandated by the CEAB. To this end, we have hired an Outcomes Lecturer and an Accreditation Assistant and are collecting data on every course.

- The ECE Teaching Quality Coordinator (TQC) works closely with instructors and others in the university to determine best practices for teaching and to support individual instructors. The TQC also chairs two meetings each term in which student representatives and instructors discuss their courses. The purpose is to provide two-way communication and to resolve issues that may arise. The TQC is actively engaged in sessional instructor selection process to keep teaching quality a significant portion of the hiring criteria.

- In 2015, we created a taskforce to look into improving our undergraduate laboratories. The taskforce has been responsible for carrying out student surveys to identify areas of concern. Based on findings, ECE has systematically reviewed all labs to ensure that content is streamlined with clear purposes and reasonable workload, and is in the process of phasing in these improvements.

B5: Increase and Enhance Communication with Students

- ECE has enacted a policy of holding at least one Town Hall meeting with every cohort in the academic term. In many of these town halls, students are presented with proposed curricular changes, and their feedback is gathered. This approach has allowed ECE to further enhance its curriculum, while also engaging our students and making them feel like an important voice in the department. We have already started seeing very positive results from our continual communications with students, and engagement has steadily increased over the last 4 years.

B6: Additional Objectives

- ECE’s goals in achieving certain outcomes in our students have been defined as:
  - Creating a growth mindset in our students where due to the self-efficacy they build during the program, they have the self-confidence to tackle any problem;
  - Developing critical thinking and problem solving skills in our students;
  - Converting our students from good learners to good leaders.
• As part of these goals, we have modified our curricula, with changes launched in 2017-2018. Continued tweaks to the program are currently in the approval process. The new curricula provide students more choice with 8 technical electives instead of 5, introduce a second course in Statistics, and allow for the design of more courses in Machine Learning and Artificial Intelligence. We also offered a new course in Autonomous Vehicles in Winter of 2018 as a Technical Elective, which was very well received by students.

C. GRADUATE STUDIES PLAN

The graduate studies program in Electrical and Computer Engineering (ECE) at the University of Waterloo is one of the largest graduate programs in Canada, with nine different program options. In the past few years, the department has made substantial growth in the number of graduate students, with 211 students enrolled in 2017. Recent increases are largely due to the success of the course-based Master’s program (MEng). Unfortunately, however, the enrolment and subsequent degree completion numbers for ECE’s research programs have declined from the projected targets.

Figure 80: ECE Graduate Intake Plan Performance to Target

Figure 81: ECE Graduate Intake Plan Performance to Target, Visa Status

C1: Increase the Rigour of the PhD Examination
• The split PhD Comprehensive Examinations model (Background and Proposal Exams) introduced in 2015 has been able to identify those PhD students with weaker background preparations much earlier in the program. This, in turn, has allowed for early intervention by the ECE Graduate Office to address concerns, so to ultimately ensure overall program quality, while strictly adhering to graduation timelines.

C2: Provide High-Quality PhD Supervision and Support Timely Degree Completion
• In Winter 2018, the Term Activity Report (TAR) system was significantly improved by introducing four different categories of evaluations, and streamlining the timelines of the submission and evaluation process. Further improvements to the TAR system are under discussion, such as to include confidential fields for students or their supervisors to submit information related to mental health, supervision, or other concerns or extenuating circumstances.
• ECE remains committed to ensuring that our graduate students have the best possible student experience over the course of their studies. The implementation of a formal mentorship program for faculty is expected to significantly improve the quality of graduate student supervision. Also, a new graduate student exit survey initiative will provide further insight the supervisory relationship and will drive future actions.
C3: Increase Graduate Course Requirements

- ECE has continued to work hard to bolster the quality and rigour of its various graduate programs. The introduction of core courses for MASc and PhD programs as well as the implementation of the split comprehensive exam are two examples of how the Department is already making changes in this respect.

- In the MEng program, 3 new Diploma options are being launched in 2018, and a review of acceptable courses to meet degree requirements is being launched.

- The continued enforcement of PhD milestone deadlines will have a significant impact on filtering out unsuitable PhD candidates early on and decreasing overall degree completion times.

C4: Increase Recruitment Efforts to Attract CPR Students and Improve Graduate Funding

- In the 2018-2019 admission cycle, ECE adopted a new reviewer platform, OGSAS (Online Graduate Student Admission System), which is more user friendly than Quest, and provides a forum to rank the applications based on relative merit. The OGSAS was well received by faculty members, and it is being planned to be used for the 2019-20 admission cycle as well.

- ECE recognizes the importance of timely admission offers to increase the rate of offer acceptance. As a result, all applications were ranked by an Admissions Committee and the outstanding CPR applications were individually identified, and directed to prospective ECE faculty supervisors for early decisions. Special incentive was also offered by the ECE Chair to faculty members for their early admission decisions.

- CPR students were also guaranteed two TA tasks per year at the time of their admission, significantly bolstering their funding package.

C5: Restructure the MEng Program with a Focus on Quality

- Recently introduced Graduate Diplomas are proving to be an attractive feature of the MEng Program. Approximately 50% of the MEng students choose to orient their choice of courses to obtain one (or more) of four Graduate Diplomas.

- A Project Course has been introduced which can be taken by all ECE MEng students that meet the requirements. The course engages students in a 4-month research project under the direct supervision of an ECE faculty member. The motivation for this is to train MEng students to acquire more problem-solving skills and experience in research project participation, all the while broadening their learning horizon beyond the scope of regular courses.

- Discussions are in the advanced stages to introduce MEng specializations, which will enable MEng students to further focus their course choices on a specific area of interest. Implementation is expected in Fall 2018.

- With the growth of ECE’s MEng program and more and more professionals seeking out graduate degrees, the demand for online course offerings is increasing. ECE intends to explore the option of making its foundational core courses available online so that they can be offered multiple times of year to a wider student base. The most likely courses to be selected for a pilot are ECE 650 and ECE 651. The Departmental Graduate Studies Office will liaise with the course instructor and TQC on best practices and implementation strategies.

C6: Improve Graduate Student Experience

- The ECE Graduate Office has migrated a number of operational tasks to online environments, including TA applications and selections, TAR submissions, termly monitoring of academic progression, TA evaluations, program extensions, announcement of vacant research positions with faculty, and several others.

- The ECE Graduate Office has also created a comprehensive set of Handbooks suited for graduate students and faculty, which provide updated information on all aspects of graduate studies.

- ECE intends to hire an ECE Wellness Coordinator in Fall 2018, which will provide additional mental health and wellness support to our graduate students.

- The ECE Graduate Studies Office will coordinate with the ECE Graduate Students Association (ECE-GSA) to create a pilot mentorship program for all ECE graduate students matriculating in January 2019 to be paired with a current ECE Graduate student in the same research area and/or program (for MEng students). Furthermore, Counselling Services will be invited to provide QPR training as part of the orientation for new graduate students in September.
C7: Addition of New OGS Approved Area of Research

- ECE’s addition of Biomedical Engineering to the OCGS-approved research areas in September 2017 will further expand the department’s research scope and help attract more top quality students to our graduate programs. Two new core courses were developed to support this area of research: ECE 601 Foundations of Biology in Engineering, and ECE 608 Quantitative Methods in Biomedical Engineering.

C8: Additional Objectives

- In Spring 2018, a new Working Group was established in the ECE Department with the mandate to review the existing ECE graduate programs, identify their strengths and weaknesses, and develop a long-term strategic vision for the programs over a 5-year/10-year timeframe. The Working Group will propose department-level strategic directions to build upon the identified strengths and rectify the weaknesses. The Working Group has been meeting at regularly.

D. RESEARCH PLAN

ECE received $20.4 million in research funding in 2017-18, a 4% increase over 2016-2017. The consistently positive trend in research funding continues following the drop seen between 2012 and 2014. Although the department is still below the target, ECE has developed a strong, diversified and supportive research environment that helps faculty members increase their productivity and secure research funding. The department is developing and increasing funding for initiatives aimed at attracting more government and industrial research funds that are succeeding, as outlined in the following sections of this report. Also, the ECE department has put special emphasis on promoting productive faculty members through professional and research awards in the past 5 years. These efforts are increasing ECE’s research visibility and ranking across various indices.

**Figure 82: ECE Research Funding Plan Performance to Target**

**Figure 83: ECE Research Funding Plan/TTS Performance to Target**

D1: Increase the Department’s Research Visibility

- The ECE Distinguished Lecture Series invites internationally renowned experts to visit the department and lecture to our students. Presentations in 2018 by Prof. Joachim Burghartz (CTO, IMS Chips, Stuttgart Germany), Prof. Yoshihisa Yamamoto (Stanford), Prof. Frederick Abernathy (Harvard), and Mr. Terry Young (VP, IESO) were very well-received, with approximately 100 attendees on average. In addition, ECE hosted
16 talks by IEEE Distinguished Lecturers (DLs) in 2017-2018, events which attracted researchers from other UW departments and local companies.

- We are continually improving our communication outreach to students and staff. A strong emphasis is placed on highlighting faculty research accomplishments, which are posted online and on various social media, as well as being regularly displayed on a large-screen, interactive computer in the ECE reception area.

D2: Improve Research Quality

- ECE funds two Research Awards annually to acknowledge and reward excellence in research. Recipients are selected by the department’s Merit Committee, and are given a reduced teaching load for one year.

- The ECE department aims to attract and secure the best and brightest graduate students through improved communication and more effective admission processes. By stimulating dissemination of research results produced by our Masters and Doctoral candidates at international conferences and high-impact journals, we anticipate that the quality of our research output and reputation will continue to improve.

- The department is actively involved in promoting collaborative research within our faculty and across disciplines. For example, over 300 faculty members, students and industry representatives participated in ECE Open House networking events in 2018, which are aimed at increasing research collaborations between faculty and local industry.

D3: Improve the Department’s Research Profile

- ECE actively stimulates and supports nominations of faculty members for various national and international research and professional awards from the IEEE and national prizes from NSERC (e.g. E.W.M. Steacie Award). Examples of recent successes include Slim Boumaiza (NSERC Synergy Award for Innovation), Ehab El-Saadany (IEEE Fellow), Fakhri Karray (CAE Fellow), and Weihua Zhuang (Royal Society of Canada Fellow). All nominees receive full and unconditional support from the department when developing and preparing a nomination and supporting documents.

- ECE continues to broadly communicate department achievements, such as research grants, best paper and professional awards, on our websites and social media feeds, so to increase our research profile.

D4: Increase Research Funds

- ECE is eager to stimulate faculty participation and improve our yield in collaborative research programs funded by frameworks such as the ORF, CFI, NSERC Strategic Projects, the Federal Supercluster program, etc. In 2016, the department began contributing funding directly to proposals at the federal and provincial levels, an effort which has seen success among junior and senior researchers. Examples include:
  - Wojciech Golab and Youngki Yoon received Ontario Early Researcher Awards as junior researchers;
  - Senior researchers William Wong (PI) and Ali Safavi (PI) won infrastructure grants of $5.5M (CFI/ORF) and $4M (ORF-RE), respectively.

- Department funding is also available to support the preparation of proposals (e.g. support for writing) and to provide expert advice to faculty preparing research applications via members of the ECE Research Committee. These grants, combined with other Department Research Awards, add up to $400,000 per year allocated by the department to fund new research initiatives.

- The department recognizes that while we have been very successful in attracting funding from tri-agency programs, more industry money should be flowing to our researchers. The department is working with OCE, NSERC and Mitacs to improve our outreach to local industry through themed events aimed at increasing university-industry interaction and participation in collaborative research projects (e.g., NSERC CRD, direct industry funding, OCE and Mitacs projects, etc.). Industry partner Keysight Technologies is also co-sponsoring these events. ECE has run three events in 2018 (Flexible Electronics, Quantum Technologies, Power & Energy) with over 25 representatives from local companies attending each event on average. We and plan to run another 3 events in 2018-2019 (Communication, Software Technologies and Robotics/Machine Learning) and will evaluate their impact on our programs during the same time frame.

D5: Improve the Research Environment

- The department continues to work collaboratively with the Office of Research on refinement of the Research Financial Compliance process, which continues to be a strong area of concern to ECE faculty members because of its effect on their research productivity and effectiveness.
Improving the efficiency and yield from our graduate admissions process is essential in order to recruit the most talented applicants. ECE has adopted new software (Odyssey) and processes that have improved the efficacy of our graduate screening and admissions process substantially. This software is now being rolled out to benefit other departments in the Faculty.

E. RECRUITMENT AND OUTREACH

E1: Improve Deployment of ECE Outreach Efforts
- A faculty member serves as ECE Outreach Coordinator, organizing our participation in all faculty recruitment and outreach activities. We also have created an administrative staff position of ECE Communications and Awards Officer to assist with these tasks.

E2: Increase Faculty Participation in Existing Outreach Activities
- The department continues to participate heavily in Engineering Explorations (Grades 6, 7, 8), March & November Open Houses, You@Waterloo Day, FIRST Lego League, Ontario University Fair and Regional science fairs. Departmental participation has remained steady.
- We have begun soliciting ideas from ECE graduate students for the development of ECE-themed modules for Engineering Science Quest (Grades 1 to 9) and the Catalyst Weekend Conference (Grade 11).

E3: Increase Alumni and Undergraduate Participation
- The Engineering Ambassador program has been an excellent resource that has helped identify and train ECE students that are well suited to recruitment and outreach. These trusted volunteers help organize events, deliver tours, and act as the face of ECE to visitors and prospective students.
- Participation in the Waterloo Aerial Robotics Group (WARG) has increased significantly. The team now has 40 regular members.
- A spirit committee has been created to help improve student morale and engagement.

E4: Develop ECE Student Design Teams
- We continue to develop and support student design teams. In 2017-2018, ECE once again provided over $10,000 in funding as well as technical support through our talented faculty and staff. Supported teams include: (i) Waterloo Aerial Robotics Group, and (ii) Midnight Sun Solar Car.
- In 2017-2018, ECE continued to sponsor many events aimed at increasing student morale, including a 4A class social event, 2B Class events, and barbeques.
- We sponsored the Ontario Engineering Competition in order to encourage student participation.

E5: Create an Online Repository of Event Media
- With the assistance of the Infrastructure Support team, ECE keeps track of media related to outreach and spirit events in a staff-accessible server.

F. ANNUAL ASSESSMENT AND CALIBRATION

- Full-day retreats were organized in December 2017 and April 2018 to discuss various departmental issues, including ECE’s progress on our strategic plan and planning for our next Strategic Plan. The retreats focused on research space allocation, quality of our graduate student application pool, the most recent exit survey data from our undergraduate students, and the annual merit review process.

Department of Management Sciences

Qi-Ming He, Chair

The undergraduate Management Engineering program continues to show strong signs: students have achieved success in their co-op work terms, while also gaining institutional and provincial recognition for their capstone design projects. With increased targets, we admitted our largest-ever undergraduate cohort in 2017, with 84 new students joining the Management Engineering program.

At the graduate level, we are also setting enrolment records for our department, with 105 students enrolled in graduate programs. This represents an increase of over 50% from 2016, growth largely attributed to the popularity of
our professional Masters program. The recently introduced Graduate Diploma in Data Analytics is also progressing very well. We expect between 20 and 30 students to earn the diploma in the Fall 2018 convocation.

Work on developing outcomes-based assessment (OBA) is nearing completion. We now have capability to generate reports for all graduate attributes and program level indicators based on collected outcomes from each course using an in-house OBA Excel Workbook.

A. FACULTY AND STAFF PLAN

- The faculty complement target remains at 30.3 with 27.3 tenured/tenure-track faculty and 3 lecturers. This target will require future revision, as we come to understand implications of the new Waterloo Budget model.

- With a new hire in the area of Human Computer Interaction as of August 1, 2018, our current faculty complement is at 22.3. We are targeting to fill 2 positions during 2018/2019 academic year, while an additional planned hiring in the area of Management of Technology has been postponed.

- We continue to outperform our targets with respect to PEng registration of our faculty members, and the proportion of female faculty members in our department.

Figure 84: MSCI Regular Faculty Complement Plan Performance to Target

Figure 85: MSCI Regular Faculty PEng Status Performance to Target
A1: Faculty High Performance
- We continue to target top candidates for our faculty positions. In 2017/2018 we advertised for four faculty positions. Although we made offers in three of the four positions, we were only able to hire one new faculty member.
- We decided to postpone hiring in the area of Management of Technology to assess our teaching needs as enrollment seems to be dropping.

A2: Staff High Performance
- We have met our target with respect to Staff complement for 2018. In the upcoming year, however, one staff member will retire and another will go on Maternity Leave.
- We plan to re-evaluate current staff job descriptions and reorganize our staff duties to respond to new change.
- With the Waterloo Budget Model, we plan to create a “Finance Staff” position to ensure a healthy financial situation for the department.

A3: Department Information Tracking Tool Development
- We continue to receive support from ECE for updates to Filemaker Pro.
B. UNDERGRADUATE STUDIES PLAN

Figure 88: MGMT Undergraduate Intake Plan Performance to Target

Figure 89: MGMT Undergraduate Intake Plan Performance to Target, Visa Status

B1: Implement Outcomes-based Program Evaluation

- We developed capability to generate reports for all graduate attributes and program level indicators based on collected outcomes from each course using an OBA Excel Workbook, developed within the department. Management Sciences has had the full participation of all instructors and courses for OBA collection via the Workbook.
- All course outlines have been updated to include intended learning objectives.
- The collected OBA data has already allowed for review and improvement to our curriculum, ensuring better coverage of key topics such as professional engineering and ethics.

B2: Reduce Student Attrition by Increasing Student Admission Averages

- The Management Engineering program has continued a recent trend of improving admission quality, with fewer students receiving deflected offers from other programs. As a result, the cohorts continue to be stronger, and attrition has steadily decreased. In Fall 2018, the 2A cohort will consist of 88 enrolled students, representing a net gain of 4 students from their initial intake in Fall 2017.

B3: Increase the Average Teaching Quality of Faculty and TAs

- We continue to work to improve quality by collecting and reviewing data from the OBA process, midterm feedback, and the work being done by our Teaching Liaison, Prof. Ken McKay.
- As noted above, our 2A cohort is a strong 88 students, which reflects both their strength and our efforts in MSCI 100 to reduce the failure rate of our first year students.
- We are actively working with the Chemical Engineering department to improve student learning experience in CHE 102 and support new teaching methods.
B4: Enhance the Social, Professional, and Intellectual Experience of Our Students

- Results from recent exit surveys confirm that the student experience in Management Sciences continues to be strong. Despite that, the department continues to make improvements to the student experience where possible. New lighting was installed in our fourth year design studio to provide a comfortable work environment. In addition, we actively make improvements to the furnishings to further support student needs in the space.

- The student chapter of IISE, along with its faculty advisor, continues to develop meetings and events that enhance student experience.

B5: Expand MSCI Option Course Offerings

- We have made changes to the curriculum to make it easier for all engineering students to fit MSCI courses within schedules.

- The MSCI option remains the most popular in engineering, though in recent years we have experienced a decline in enrollment in the main courses constituting the option. A review is ongoing to understand causes, and hopefully rectify identified issues and barriers.

B6: Comprehensive Review of the Undergraduate Program

- As part of OBA, we now have a continual improvement mechanism whereby the program is evaluated through both OBA-collected data and feedback from stakeholders. Changes can then be considered and implemented as appropriate.

- We have begun a pilot program with WatPD to improve the work report experience for students and make it more relevant to their education.

C. GRADUATE STUDIES PLAN

- Overall enrolment was at its highest in 2017, with record numbers of visa students driving our performance. While we exceeded our CPR targets for both MMSc and PhD students, we did not meet our target for MASc.

- The demand for our professional Master’s program (MMSc) has increased significantly. Most of the increase is attributed to international students.

Figure 90: MSCI Graduate Intake Plan Performance to Target
C1: Excellence in Graduate Programs
- Interest for the graduate diploma in data analytics (GDDA) is very strong, and is a significant contributor to the increased enrolment in our MMSc program. In 2018, there are more than 20 MMSc students earning the GDDA, compared to only 5 in 2017.

C2: Enhanced MMSc Online Program
- Though no progress was made on this goal, it remains a priority area for future.

D. RESEARCH PLAN
- Research funding continues to trend upward in Management Sciences, with total funding exceeding our target by approximately 13%. Funding per TTS faculty member is also above target by over 50%.
- We continue to encourage faculty members to seek research funding from various sources. We help and support junior faculty members to apply for research grants.
D1: Increase Research Funding Level
- The department continues to support faculty who are actively applying for grants, especially for junior faculty members.
- The department offers graduate MMSc students a co-op option, which enables students to self-fund by way of co-op employment. About 25 student/year take on this opportunity.

E. EXTERNAL RELATIONS PLAN

E1: Strengthen Existing Industry Relationships
- The Industrial Advisory Group continues to be in the departmental plans, though is yet to be implemented.

E2: Create New Industry Partnerships
- The Riipen platform was successfully used to solicit capstone design project topics from industry. We will continue to use this tool in coming years to generate connections with new industry partners.
- We have also continued to solicit capstone projects from alumni, resulting in a new project with Bell Canada for the 2018-2019 cycle.

E3: Strengthen the Relationship with Our Growing and Diverse Alumni Body
- A Management Engineering Alumni Talks series was established to bring two Management Engineering alumni to campus each term to give a seminar. As of January 2018, three such talks have been organized.
- A regular newsletter is being sent to all Management Engineering alumni each term. Management Sciences intends to produce a similar newsletter for graduate alumni.
- A tool was created by Management Engineering students to automate the management of employment and other alumni statistics from LinkedIn.
- 13 alumni attended and helped evaluate projects at the 2018 Management Engineering Capstone Design Symposium.

E4: Better Communicate the Department, Mission and Relevant Information to a Variety of Audiences Through Our Web Presence
- A new departmental website was launched to better differentiate our programs and department, so to ultimately attract prospective students. In addition, content was improved to better serve current students.
- Faculty members are being encouraged and assisted to improve their personal and lab websites.
- We continue to regularly review and update all website content, with the goal of ensuring that content is accurate, informative, and professional

Department of Mechanical & Mechatronics Engineering

Jan Huissoon, Chair

The Department of Mechanical & Mechatronics Engineering has continued to increase in size with the implementation of the undergraduate Mechatronics Engineering program expansion and the new Biomedical Engineering program. The success of the Multi-Scale Additive Manufacturing research initiative has also greatly extended our research profile, as have the TransCanada and General Motors Industrial Research Chairs.

The Department has been actively hiring new faculty for both undergraduate program expansion, as well as for Research Chair support and to replace faculty retirements. Five new faculty members took up tenure-track academic positions in the Department last year, while two faculty candidates are in the process of completing offers, and a further six faculty positions are in the hiring process.

Admission to our undergraduate programs remains consistent, with Mechanical Engineering (ME) achieving intake close to target, and Mechatronics Engineering (MCTR) again exceeding targets by a significant margin. Our initiative to improve the undergraduate experience with the MME Clinic and WATiMake lab has been very successful, and we have restructured technical support staff to accommodate these initiatives.

Research funding has continued to increase, and is currently almost double the Faculty average. The Additive Manufacturing research initiative led by Prof. Toyserkani has been hugely successful, to the extent that we need to lease off-campus space to accommodate lab space requirements.
A. FACULTY AND STAFF PLAN

- The net faculty complement increased by 1 to 58.5, despite hiring 5 new faculty members. This was due to the retirement of 4 faculty members and one resignation during the year. We had completed the hiring process for 3 additional new faculty, but their start date falls outside calendar 2017/18. A further six positions are in search.

Figure 94: MME Regular Faculty Complement Plan Performance to Target

- We had hoped to further improve on our past performance of exceeding our target of the percentage of women faculty members, and while we received applications from several highly qualified female applicants for open positions, they had already accepted offers from other institutions when we invited them for interview.

Figure 95: MME Regular Faculty Complement Plan Performance to Target, % Women

- Our percentage of Professional Engineers has been slipping over the past few years as we have hired junior faculty who do not yet hold a PEng. This has been further affected by the retirement of several PEng holders. However, many of the recent hires hold temporary status, and are working towards gaining the requisite experience or have applied to sit the professional exam.

Figure 96: MME Regular Faculty PEng Status Performance to Target
A1: Hire New Faculty to Support New Initiatives

- Four positions were hired as a result of the Mechatronics expansion, in addition to 1 CRC junior faculty member.

A2: Replace Faculty Retirements with Positions in Emerging Areas

- Two positions vacated by recent retirements were replaced, and three others are currently in search.
- MME is focusing on new areas in Materials and Solid Mechanics, as well as on Assistive Robotics and Autonomous Vehicles.

A3: To Better Support the Department’s New Activities, Increase FTE Staff Complement

- The reporting structure for the technical staff has been realigned to better support the Design project and WATIMake labs.

A4: Provide Professional Development and Training for Our Staff

- The 18 administrative staff attended 139 training sessions for a total of 379.50 hours.
- Available data for the Tech staff indicate that 7 staff members attended 59 training sessions for a total of 293.50 hours.

B. UNDERGRADUATE STUDIES PLAN

- ME enrolled 207 new students in 1A in Fall 2017, only slightly above our target of 206. Preliminary data suggests that ME will be significantly more over target in Fall 2018.
- We have been consistently over our intake targets for MTE since the program was launched, a trend that has worsened in recent years. Preliminary data indicates that we will again be significantly over target in Fall 2018. Coupled with possible oversubscription in ME and the steady rise in the MTE targets until steady state is reached, departmental resources will be strained in supporting these large cohorts.
B1: Establish an Engineering Clinic within our Undergraduate Programs

- The MME Clinic and WATiMake lab facility were established by Prof. Andrew Trivett in 2013. This highly successful undergraduate facility and experience became the inspiration for the Faculty-wide IDEAS Clinic. Following Prof. Trivett’s resignation in 2016, the MME technical staff organization was realigned to provide 4 dedicated junior technical staff members to run these undergraduate facilities, under the guidance of one of our senior technical staff members. The WATiMake and Capstone studio space in DWE are very heavily used by our undergraduates, and provide significant support (both facilities and space) for cornerstone and capstone projects.

B2: Improve the Undergraduate Experience

- The MME Clinic and WATiMake labs have greatly improved the undergraduate facilities/experience, and this will be further enhanced with the opening of the new lecture rooms and ‘garages’ in E7. We have always strived to provide our undergraduate classes with ‘home’ classrooms so that the students can form a sense of community within their cohorts. This should now be possible for all classes with the E5 and E7 classrooms.

B3: Undergraduate Lab Renewal

- By moving the Additive Manufacturing research lab space to EC4, the undergraduate lab space in E3 has been nearly doubled. We have also updated the electronic test and measurement equipment in the both E3X undergraduate labs.

B4: Increase Admission to Mechatronics Engineering

- The admission targets that were originally set for the expansion of the Mechatronics Engineering program have consistently been exceeded, and are now at steady-state values.

C. GRADUATE STUDIES PLAN

- The inclusion of non-CPR students to the MEng program has significantly increased our intake. We have been able to exceed targets in all categories (except diploma) and anticipate continuing to do so in the future.
C1: Increase Graduate Student Funding

- The department has increased the minimum RA for MASc and PhD students to reduce the financial burden on students.

C2: Expand Graduate Program with Emphasis on Quality

- To improve the quality of our MEng students, the department graduate office has implemented a more stringent review process. This is now possible due to the larger number of applicants to our MEng program.

D. RESEARCH PLAN

- MME has been closing the gap between targeted and actual total funding over the past several years, and have now exceed target for the first time since 2011/12. The research funding per faculty member is now almost double the Faculty average, and we anticipate this trend will continue.

Figure 106: MME Research Funding Plan Performance to Target

Figure 107: MME Research Funding Plan/TTS Performance to Target
D1: Increase Research Funding
- Research funding has continued to increase, with some large successful funding grants.

D2: Promote Identified Focus Areas
- Advanced Manufacturing and Additive Manufacturing have been promoted and showcased in our EC4 facility.

E. PHYSICAL SPACE PLAN

E1: Create New Space and Explore Rental of Off-Campus Space
- The Multi-Scale Additive Manufacturing (MSAM) lab initiative has significant space requirements that the department is not able to provide. We are currently exploring commercial space on North campus that the department has agreed to subsidize. Off-campus space has also been rented for our autonomous vehicles, although the need for this will be resolved with the construction of the on-campus AVRIL building.

E2: Rationalize and Actively Track Space Utilization
- Space in EC4 was re-arranged and optimized to provide much-needed graduate seating space, and E7 will provide even more space once open. We are implementing an on-line system to track graduate seating and lab space utilization.

Department of Systems Design
Paul Fieguth, Chair

The 2017/18 academic year saw many successes for the Department, and we are optimistic in our outlook for the coming year. This document will report on a variety of goals, some of which saw progress and others not, however the allocation and organization of E7 space took primary priority, and the further development of the Biomedical Engineering program, particularly fourth-year electives, was also of significant importance.

A major strategic success this year saw the hiring of eight new faculty members into the department. Much of these hires were the result of continued growth of Biomedical Engineering and Mechatronics Engineering. Planning space in E7 to accommodate growth in faculty, staff and students was also prioritized, with occupancy expected in Spring 2018. SYDE was also pleased by the continued support by an alumna for the continuation of hands-on design, prototyping, and lab facilities.

The department continues to work on key priorities, such as improvements to the Maker Space. The space has seen significant progress in the past few years, but an opportunity for expansion remains. Also, SYDE continues to work on graduate course offerings, though more progress is needed in this area. Graduate program specializations and partnerships has also been identified as a significant priority, particularly in light of the adoption of a university-wide definition for graduate specializations, and work will continue in future. Finally, a graduate program in Biomedical Engineering remains of significant importance to the department, and we anticipate continued progress in the upcoming year.

A. FACULTY AND STAFF PLAN
- A remarkable eight faculty members joined Systems Design Engineering between August 2017 and August 2018, including:
  - Dr. Nima Mohtaram was hired into a Lecturer position, bringing substantial expertise to the Biomedical Engineering program;
  - Dr. Reem Roufail was hired into a Graduate Attributes Lecturer position, bringing support for outcomes education and accreditation;
  - Dr. Nima Maftoon was hired into a new tenure-track position, having a research focus on biodevices (cochlear implants) and biomechanics (inner-ear simulation);
  - Dr. Siby Samuel was hired into a tenure-track position, to fill a vacancy in the human factors area, with a research focus on transportation human factors and safety;
  - Dr. Parsin Haji-Reza was hired into a new tenure-track position, having a research focus on photo-acoustic systems and associated biodevices;
  - Dr. Jennifer Howcroft was hired into a new lecturer position, to complete our complement of Systems Design and Biomedical lecturers. She brings expertise in design and human factors.
- Dr. Kerstin Dautenhahn came to UW Engineering as a Canada-150 Chair, having a tenured position with a 49% appointment in Systems Design, with expertise in social robotics.

- Dr. Chrystopher Nehaniv came to UW Engineering as part of the Canada-150 hiring, with a 67% appointment in Systems Design, having expertise in discrete-event systems.

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Figure 108: SDE Regular Faculty Complement Plan Performance to Target

Figure 109: SDE Regular Faculty Complement Plan Performance to Target, %Women

Figure 110: SDE Regular Faculty PEng Status Performance to Target
A2: Faculty and Teaching Assignments

- The number of graduate courses has improved, and the plan to increase the number of courses is in place, particularly with the completion of our lecturer complement. Additional courses need to be created in the Biomedical and Artificial Intelligence domains, as well as a focus on more regular offering of certain Systems Design courses.

A3: Staff Restructuring

- We are in the midst of a staffing re-organization, motivated by a number of factors:
  - With the most senior Biomedical Engineering class reaching fourth-year in 2018, the Biomedical program is now effectively at steady state, which has necessitated some reorganizing of staff support for the undergraduate programs;
  - The opening of E7 led to some degree of reallocation;
  - The secondment of the staff member responsible for accreditation support has led to further consideration with regard to managing such support;
  - A number of research groups within the department have requested part-time staff support;
  - The department has been asked to have backup support on financial transactions and approvals. Currently only one staff member in the department undertakes financial approvals, which has led to some challenges during vacations / absences.

B. UNDERGRADUATE STUDIES PLAN

- The Biomedical Engineering continues to see huge demand; each admission cycle has seen a considerable number of applications with which to meet intake targets. With the admission of the fall 2018 cohort, the program is effectively at steady state, and we do not expect continued increases to intake targets.

- The number of Systems Design applicants has been satisfactory, with a notable increase in 2017/18. We do not know the basis for the increase, but need to continue a vigorous presence at on-campus events and continued visibility / impact as a department.

Figure 111: SDE Regular Staff Complement Plan Performance to Target

Figure 112: SDE Undergraduate Intake Plan Performance to Target
B1: Teaching Quality

- The plan on improving teaching quality focuses on a strong promotion of the instructional skills workshop and the teaching excellence academy among Systems Design faculty. Up to the present, twelve Systems Design faculty have taken part in one of these, representing one third of the department. Anecdotally, the department also has relatively high participation at the UW Teaching Conference, which is promoted strongly within the department. The plan is to maintain a focus on teaching via a teaching-based retreat some time in 2019.

B2: Laboratory Program

- The Biomedical expansion labs in DWE are largely complete, as lab renovations are finalized and all necessary equipment has been purchased. Since not all fourth-year Biomedical elective courses are yet in place, the educational program associated with the labs is not yet finalized.

- It has become ever more apparent that the digital-circuits-controls labs need further attention, on the basis of very consistent student feedback. There are many factors at play, including overall student workload, degree of student preparation for hands-on lab-like tasks, and the degree of separation of duties between in-class and in-lab tasks. Improving the lab experience remains a priority.

B3: Other Curriculum Components

- After being vacant for nearly a year, SYDE hired a full-time Graduate Attributes Lecturer in August 2017, bringing back a focus on course assessments and curricular improvement. Significant progress has been realized on curricular outcomes assessments for both the Biomedical and Systems Design Engineering programs, with workshops being held at the end of every term to engage with instructors from that term to prepare their outcome assessments.

- Following our curriculum review retreat in April 2017, committees dedicated to focused streams of courses were struck for design and mathematics. Of these, the design committee has been very active, and a variety of initiatives have been undertaken. The mathematics committee has been inactive for some time, however there remains significant need and interest to restart this process, particularly for the Systems Design curriculum. Making progress on the Systems Design mathematics stream is an explicit goal for 2018/19.

C. GRADUATE STUDIES PLAN

- Overall graduate student intake continues to be at or above target. What is most striking, however, is that PhD intake (both domestic and international) is significantly below target, whereas the course-based Master’s program is significantly above target. We do not have an explanation for the steady and rapid rise in international course-based Master’s enrollments, but the improvement / re-organization of the Systems Design graduate program is a high priority, in order to continue attracting MEng students.
C1: Graduate Growth

- The Biomedical Engineering program and expanded Mechatronics Engineering program continue to lead to significant hiring in Systems Design (as discussed in Section A) which leads to growth in the graduate program. This very significant increase in department complement, however, will take a few years to be reflected in graduate numbers.

- The major increases in MEng enrolments have prompted a serious look at our graduate offerings. The increased number of course-based Master’s students, and subsequent demand for consistency and quality of graduate course offerings, has revealed systematic issues not previously recognized with predominantly research-based students, issues which SYDE will work to address in future.

C2: Graduate Program Quality

- A firm plan has been developed for graduate teaching tasks, which will at least ensure a basic minimum number of courses on offer, a minimum which increases every year. Key steps:
  - A lecturer was hired in 2017/18 to increase teaching tasks in the department and to allow the graduate program to expand its offerings;
  - Graduate course targets have been established, with a target of 10 courses taught in 2017, and increasing by 2 courses every year through 2022;
  - A list of graduate courses by year has been proposed, with effort made to ensure a reasonable distribution of graduate courses by topic area;
  - Graduate course offerings will be better communicated to current and prospective students, and made available well in advance.

- A number of steps have been taken towards the development of program identity:
  - Periodic graduate lunch sessions, on a variety of themes;
  - The deliberate encouragement for the formation of a graduate student association has been quite successful, and the SYDE GSA had more than ten events in 2017/18;
The plans for “core” courses at the graduate level are complete, with offerings of SYDE 600 and SYDE 660 now in place. The courses will be core (mandatory) for MEng students, but also open to MASc / PhD students.

C3: Biomedical Engineering Graduate Program

- There has been a significant interest in forming a Biomedical Engineering graduate program for many years. Final details are now being resolved, as the overall objectives, courses, and buy-in from other departments are more or less in place. While the graduate program submission process has seen slower progress than hoped, it is absolutely a top priority to have this proposal submitted in 2018/19.

C4: Graduate Program Options / Diplomas

- In response to the significant issues identified with MEng students (including high enrolment but also high attrition), the MEng program would be significantly strengthened and more attractive if it offered a more explicit set of foci. To this end, seven graduate diplomas were developed in 2016/17, and with recent university-level definitions for graduate specializations nearly in place, we anticipate submission of these proposals in 2019.

C5: Artificial Intelligence

- The area of Artificial Intelligence (and related areas of Machine Intelligence, Machine Learning etc.) is rapidly growing in every respect. Systems Design Engineering has had undergraduate and graduate courses in this area for more than 40 years, and needs to maintain a presence in this area. In 2017/18, efforts were focused on a proposal for a course-based stand-alone MEng program in AI, however resource limitations and other factors prevented the proposal from moving forward. With graduate specializations now defined at the University level, however, Systems Design intends to quickly resume focus on AI via the development of a specialization in 2018/19, so to capitalize on the rapid growth of this sector.

D. RESEARCH PLAN

We have been slightly behind research funding targets for 2016/17 and 2017/18. Hiring associated with the Biomedical Engineering program has been primarily at the junior level, meaning that the department now has a higher proportion of junior professors. It is therefore expected to take a few years before these faculty members have developed and grown their research programs and associated funding. Overall, Systems Design faculty members have been quite successful in recent grant cycles, so the target numbers would not appear to reflect research opportunities and activities within departmental labs.

Figure 120: SDE Research Funding Plan Performance to Target
D1: Research Directions

- We continue to follow the longer-term hiring plan of the Biomedical Engineering program. We are now advertising for the second cycle of three hires (Biosignals, Biodevices, Biomechanics). Once that hiring is completed the department will need to re-assess strategic directions.

D3: Research Space Planning

- With E7 open as of August 2018 a very large amount of time and planning has been dedicated to research space plans. Departmental research is located in E7, E2, EC4, CPH, E3X and DWE. The opening of E7 will allow some of the other research space to be released / rationalized / repurposed. The question of research space is a current priority, but will also require ongoing management.

E. BIOMEDICAL ENGINEERING PLAN

The fifth cohort of Biomedical Engineering arriving in Fall 2018 will bring the program effectively to steady state. Incoming students remain very strong academically, and the multiple departments and labs have worked very well together to deliver an outstanding program.

E1: Biomedical Engineering Undergraduate Program

- In 2018/19, the program will have students at every level, and the first students will be graduating in June 2019. While the program will be effectively at steady state, enrolment will continue to grow slightly, due to the gradually increasing intake targets set in the early years of the program.

- With every year, an additional year of undergraduate curriculum, syllabi, and course details has needed to be developed and put into place. In 2017/18, as in previous years, there continued to be adjustments to course placements and lab sequencing, however this process of curriculum revisions is now mostly complete.

E2: Biomedical Engineering Graduate Program

- Please see Section C3.

E3: Biomedical Engineering Undergraduate Laboratories

- Following the approval of $420,000 by the Provost in 2016/17 for Biomedical Lab equipment, a number of equipment purchases took place in 2017/18. The work ahead for 2018/19 is to develop a plan for courses / electives to use the equipment, and to coordinate staffing plans for the space.

F. DESIGN PLAN

F1: Design Sequence

- A lot of work has been undertaken in design aspects of the program. These include
  - Tighter integration of SYDE 101 and 101L / BME 101 / 101L;
  - Update of Design Days to improve student engagement;
  - Further optional design activities, soldering workshops, other hands-on activities;
  - Inclusion of deliberate iteration / design sprints in SYDE 361.
- In many ways, the successful update of many design courses and the continued activity of the departmental design committee means that design course / design sequence planning will continue on an ongoing basis.

**F4: Ideas Clinic**
- The Ideas Clinic planning was stalled in 2016/17, due to the resignation of Graduate Attributes (GA) Lecturer Michele Bristow, who had been leading it. A new GA Lecturer (Reem Roufail) was hired in August 2017, however the role’s priority in 2017/18 was shifted to manage the workload associated with accreditation (including mock accreditation and full accreditation visits for BME in 2018, and full accreditation visits for SYDE in 2019). This workload shift is expected to continue in 2018/19.

**F5: SYDE Maker Space**
- Strong support from a Systems Design alumna continued into its third year. The focus this year is more on BME lab support and support for design-project costs.

**G. ADVANCEMENT PLAN**
- We have an annual alumni event on the same day as the design symposium. This change, made in 2016/17, was again effective in 2017/18, so the department intends to continue in this manner.
- We had very high numbers of Systems Design alumni return for reunion. Ideally the department would more successfully engage this alumni, at least during their return to campus. Informal tours were offered by the department in 2017 and 2018.
- At alumni events there are many alumni who express an interest in engaging with the department, and so effective mechanisms need to be developed for such engagement. We are considering ways to connect alumni to design projects.
III. Key Metrics and Performance Indicators

The information presented in this section focuses on overview data at the Faculty level. For more detailed information at the department or program level, please refer to the tabular data presented in Appendices A-H. For data definitions and sources, please refer to the alpha-numeric code in parentheses at the end of each figure and in Appendix I.

A. Faculty and Staff

Since 2007, the regular faculty complement in Waterloo Engineering has grown by 75 (31%), and the number of women faculty has increased by 23 (67%).

As of May 1, 2018 Waterloo Engineering’s regular faculty complement was 318, comprised of 285.53 tenured/tenure-stream faculty and 32.49 lecturers (definite-term and continuing).

The proportion of faculty who are women ranged among departments from 14% to 40%, with a faculty-wide average of 18.08%.
Our complement includes faculty members who have earned PhDs from a wide range of schools (see Figure 124). The proportion of faculty who have earned degrees from Waterloo has declined by almost 5 percentage points over the duration of this plan period, as a broader and more global representation of PhD schools has developed.

As shown in Figure 125, between 60% and 90% of faculty members in academic departments are registered or have applied for the PEng (including some limited licences).

As of May 1, 2018, 37% of our faculty members are 55 years old or older, which is an increase of 15% over the plan period. Conversely, the proportion of faculty members under the age of 40 has decreased to 18% from 27% in 2011 (see Figure 126).

In addition to our regular faculty complement, the contributions of a wide range of non-regular faculty members enrich our academic and research environment.

The staff complement in Waterloo Engineering has grown by 59 (32%) since 2007. As of May 1, 2018 there were 241 regular FTE staff members in engineering: 156 FTE (78 technical staff and 78 administrative staff) in our academic
units and 85 (64 administrative and 21 technical) in our administrative units. The current distribution of staff is shown in Figure 130 and Figure 131.

Figure 130: FTE Staff in Academic Units, 2018 (A7)

Figure 131: FTE Staff in Administrative Units, 2018 (A7)

Figure 132: Age Distribution of Staff, 2018 (A8)

The proportion of our staff complement that is 55 years of age and older is 27%, an increase of 6 percent during the plan period. At the same time, the number of staff below the age of 40 has also risen by 6% since 2011 to 32% in 2018. Accordingly, there appears to be steady renewal of staff across the departments.

Figure 133: Faculty to Staff Ratios, 2006-2018 (A10)

The average ratio of regular faculty members to FTE staff members for the faculty as a whole (including staff in administrative units, which do not typically have a faculty complement) has remained stable since 2006.
As of May 1, 2018, the ratio of regular faculty to all FTE staff was 1.3 for the faculty as a whole and 2.0 in academic units only (i.e. excluding staff in administrative support offices). Figure 134 shows the distribution of this ratio across academic units, which varies among disciplines, largely due to their varying technical intensity.

**B. Undergraduate Studies**

Since 2007, our undergraduate enrolment (head count) has increased by 40%, to a record total of 7,845 students as of November 1, 2017. Over the same time frame, international student enrolment grew by nearly 800 students (303%) and the enrolment of female students increased by over 1,200 students (119%), setting records for female and international student enrolment every single year.
Figure 136 shows the distribution of the Fall 2017 undergraduate enrolment in the Faculty of Engineering by program, including our newest program, Biomedical Engineering, which launched in fall 2014.

Widely recognized as one indicator of undergraduate program quality, the ratio of undergraduate students to regular faculty members is a metric we monitor annually. Figure 137 shows a gradual increase in this ratio since the lows reached prior to 2009/10, reaching 19.4 this year. Despite strategic increases to the faculty complement in recent years, this ratio has risen due to commensurate undergraduate enrolment increases across programs, including the launch of the Biomedical Engineering program and the expansion of our highly sought-after Mechatronics Engineering program, both in Fall 2014. It is important to note that calculation of this ratio does not include faculty members who had been hired but had not yet started their positions as of May 1. Faculty hiring for vacant or new positions will be a priority in the next year.

The distribution of this ratio by department is shown in Figure 138.
From 2007-2017, first-year intake into the Faculty of Engineering has increased by nearly 300 students or 22% (Figure 139). Over the same time period, international admissions have increased by 86% and the number of female students admitted to the first-year class has increased by 119%, to 512.

Figure 140 depicts a steady increase in the proportion of undergraduate students entering Waterloo Engineering with incoming final high school averages of at least 95% and between 90-94%. In 2017 approximately 88% of entering students had a final high school average of 90% or higher, another record high, and an affirmation of the exceptionally high quality students we attract to our renowned undergraduate program.

As our undergraduate student enrolment increases, so does the number of work terms required to fulfill our commitment to co-operative education for all undergraduates. In 2017, the number of required work terms reached an all-time high of 8,955. This is an increase of more than 2,700 work terms (43%) from the number required in 2007. Despite this substantial increase, our students achieved an employment rate of 98.6% in 2017, slightly above historical performance ranging from 96% to 98%. In fact, 2017 witnessed the fewest unemployed students of any year in the past decade, a testament to the employability of our students. In addition, co-op success spanned all departments in 2017, with employment rates ranging from 96.4% to 99.5% across the programs (see Figure 142).
Work terms afford engineering undergraduate students at Waterloo the unique opportunity to explore multiple work settings over the course of their studies, including global experiences. Over the past decade the number of work terms completed outside of Canada has increased by 89%, reaching a record total of 1,623 in 2017 (Figure 143).

In addition to international work terms, another valuable global experience available to Waterloo Engineering undergraduates is international exchange. In 2017, Waterloo undergraduates participated in 105 outbound exchange terms (Figure 144).

Waterloo continues to grant the most engineering bachelor’s degrees of all universities in Canada. Over the past decade, degrees awarded annually to Waterloo Engineering undergraduate students increased by 53%, with 1,269 degrees awarded in 2017. Figure 146 shows the distribution of undergraduate degrees granted in 2017 by program.
Figure 147 illustrates the number of degrees granted per regular faculty member over the past seven years, with a clear, steady increase during that period. Figure 148 displays this same ratio across departments in 2017 only.

C. Graduate Studies

Figure 149: Graduate Enrolment, 2006-2017 (C1)
Over the past 10 years, our graduate enrolment (head count) has increased by 45%, or 650 students, to reach 2,079 on November 1, 2017. Over that period, PhD enrolment increased by 32% and the number of female students enrolled increased by 82%. Despite these significant increases, however, the number of students who are Canadian or Permanent Residents decreased by 5%, reflecting the increasing proportion of international students that comprise the graduate student body.

Figure 150: Graduate Enrolment, Fall 2017 (C1)

Figure 150 shows the distribution of Fall 2017 graduate enrolment by department, visa status and gender. Figure 152 normalizes that data to tenured-tenure/stream faculty. In Figure 151, which shows the trend over the past 10 years in graduate student to faculty ratios, it can be seen that the ratio of research students to faculty members has been relatively stable since 2008/2009. Ratios for all students (i.e. including professional masters), however, are more variable during this same period.

Figure 151: FTE Graduate Students per TTS Faculty Member, 2005/06-2017/18 (C5)

Figure 152: FTE Graduate Students per TTS Faculty Member, 2017/18 (C5)
While graduate enrolments have been increasing over the past decade, so too have undergraduate enrolments (which have outpaced graduate student growth in recent years). As shown in Figure 153 we track the proportion of the overall FTE student enrolment that is comprised of graduate students as a means to better understand graduate growth in the context of overall faculty activity. In 2017/18, the graduate proportion of total FTE student enrolment was 22.0%, with individual departments ranging from 17.0% to 32.1% (excluding Conrad, which is comprised entirely of professional master’s graduate students).

Figure 154 shows the trend in engineering graduate admissions by program type over the past five years. Fall 2017 witnessed a considerable increase in enrolment in Professional Master’s programs, after 5 years of relative stability. The largest increases in Professional Master’s were seen in MME (+57), MSCI (+32) and ECE (+24). Despite these enrolment increases, however, the number of new entrants with Canadian citizenship or Permanent Residency has remained flat, or decreased slightly. Figure 155 provides department-level detail of the most current year’s admissions.

We monitor average graduate student support (as shown in Figure 156 and Figure 157) because financial support for research graduate students has an important impact on the quality of our graduate student experience and on the competitiveness of our graduate recruitment efforts. Additionally, the proportion of students holding external scholarships can be considered a measure of student quality.
Over the past 10 years, degrees awarded annually to Waterloo Engineering graduate students increased by 248 (66.0%), reaching 624 in 2017. This represents a small increase from 2016, where 603 degrees were awarded.

Figure 159 and Figure 160 and shows the ratio of degree granted per TTS Faculty member. Unsurprisingly, this year’s ratios were relatively unchanged from 2016, as both degrees count and faculty complement experienced only small and relatively comparable increases compared to last year.
D. Research

In 2017/18, research funding to Waterloo Engineering faculty members reached $72,462,764 or $256,302 per tenured/tenure-stream faculty member. This represents a 54.1% increase in total research funding and a 38.0% increase in funding per tenured/tenure-stream faculty member since 2008/09.
Distribution of total funding by sector is shown in Figure 162. Figure 163 breaks out annual funding earned from infrastructure funding programs, allowing for consideration of the portion of each year’s funding total that is directed to research operating support.

Tri-Council funding has increased by 68.7% since 2008/09, reaching an all-time high of $25.3M in 2017/18, accounting for 34.9% of all research funding (Figure 162). NSERC funding, in turn, accounted for 96.7% of Tri-Council funding; as such, the growth of NSERC funding types (i.e. Tri-Council excluding SSHRC and CIHR) over time is explored further in Figure 164, with the most considerable growth being in Partnership funding (+$8.2M). The distribution of Tri-Council funding and of NSERC funding by program in 2017/18 alone is provided in Figure 165 and Figure 166.
Industry research funding, meanwhile, increased by 221.1% to $17.0M between 2008/09 and 2017/18. As seen in Figure 167, the large majority of industry funding results from Canadian investment, though both US and International funds have also increased considerably over time. Total non-Canadian industry investment now stands at $3.9M, an increase of 182.2% since 2008/09.

Another indicator of research excellence can be seen through major research chair holders. As shown in Figure 168, 55 Waterloo Engineering faculty members (16% of the tenured/tenure-stream complement) hold major research chairs.

A selection of bibliometric indicators has also been included here to provide additional insight into our scholarly output and research impact.

Figure 169, Figure 170, and Figure 171 are based on a sample of University of Waterloo research documents in the scholarly areas where Faculty of Engineering researchers are most active. The sample is limited to documents indexed by Thomson Reuters and includes all documents types authored by University of Waterloo-affiliated individuals in publications classified as engineering, materials science or computer science. Because these data are defined by Thomson Reuter's subject classification of the publication and not by the academic department of the author, they will include documents by University of Waterloo authors outside the Faculty of Engineering and will miss the work of some engineering faculty members who publish outside these three areas.

Furthermore, it is important to note that because publication expectations and citation practices vary among research disciplines, and because the amount of source material indexed by Thomson Reuters in each discipline varies, it is not meaningful to compare bibliometric data among disciplines. To that end, the data presented must be considered over time within each subject area, but without comparison between or among areas.

Figure 169 shows the increasing number of documents published by Waterloo authors between the 2002-06 period and the 2013-17 period, in publications classified by Thomson Reuters as computer science (23.6% growth), materials science (265.2% growth) and engineering (76.3% growth). Influences on this growth may include: increases to the faculty complement; growth in the amount of material indexed by Thomson Reuters; and increased output by individual researchers.
Figure 169: University of Waterloo* Documents in Thomson Reuters-indexed Publications Classified as Engineering, Materials Science or Computer Science (D10)


table

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<th>Year</th>
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<td>2013-17</td>
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<td>2228</td>
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Figure 170 examines the impact of these publications, using a normalized indicator of citations (also limited to those in Thomson Reuters-indexed publications) to the documents that make up the sample represented in Figure 169. The use of this normalized indicator addresses the challenge of differing citation patterns in each discipline by measuring Waterloo’s impact (citations per document) in the specified disciplinary category relative to the impact of all institutions in the same category overall. In this way, assessments can be made by noting to what extent the institution is under- or over-performing the overall system norm (defined as 1.0) for that specific subject.

Figure 170: Category Normalized Citation Impact (in Engineering, Materials Science or Computer Science Categories) of University of Waterloo* Publications in Thomson Reuters-indexed Publications (D11)


table

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<th>Year</th>
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As shown in Figure 170, Waterloo’s citation impact relative to the norm of each category we are tracking has consistently met or exceeded 1.0, which indicates that Waterloo’s impact in the category is equal to or greater than the average impact in the category overall. Waterloo’s category-normalized citation impact in engineering has decreased slightly in recent years, while results in materials science and computer science appear more stable. A similar pattern is seen in the proportion of engineering documents that are in the top 10% of all documents in Thomson Reuters-indexed publications classified as materials science, as measured by the number of citations in Thomson Reuters-indexed publications (see Figure 171): following years of relative stability, engineering results have decreased to 10.6%, while computer science and materials science have remained relatively flat.
Because the data presented in Figure 169, Figure 170, and Figure 171 are provided by Thomson Reuters journal classification and not by academic department, they will include researchers outside the Faculty of Engineering who are publishing in engineering, materials science or computer science journals and will exclude some Faculty of Engineering researchers who publish outside these areas.

**E. Women in Engineering**

The total number of women students and faculty in the Faculty of Engineering has increased by 81.3% since 2009 to reach 2,906.

As we work to increase the participation of women in engineering disciplines specifically, it is a positive indicator that the number of women at all levels in engineering programs (excluding Architecture) has increased since 2009: undergraduate students have increased 115.7% to 2,019; graduate students have increased 39.7% to 514; and faculty have increased 58.3% to 47.5.
Figure 173 and Figure 174 provide details of the current participation of women in our engineering programs and in our School of Architecture separately.

Figure 173: Women in Engineering Programs, 2017 (E1)

Figure 174: Women in Architecture, 2017 (E2)

F. Internationalization

Since 2009, international student enrolment in undergraduate programs has increased by 145.6% to 1,179, while graduate programs have seen an increase of 94.1%, with 1,081 international students enrolled.

While the percentage growth in international undergraduate students might appear high, it must be noted this growth is over a very low baseline. Over the past decade, we have added international places incrementally to our existing domestic undergraduate intake targets.

The current proportion of undergraduate students who are international is 14.7% (see Figure 176). International students now account for 52.0% of graduate students.

Figure 176: International Students, 2017 (F1)

Our efforts to increase international opportunities for undergraduate students have proven successful, with the number of international co-op terms growing by 155.6% (to a record 1,623) and outgoing exchange students ranging from 74 to 105 from 2009 to 2017 (see Figure 177).

Figure 177 shows the composition of our industrial research funding in 2017/18, with 23% of our industrial research funding coming from outside Canada in the past year.
Another possible measure of our international reach is the level of international collaboration involved in the scholarly output of our researchers. Analysis of a sample of all documents indexed by Thomson Reuters that were published by University of Waterloo-affiliated individuals in publications classified as engineering, materials science or computer science (see Figure 179) allows us to observe that an increasing proportion of those documents are published with at least one international co-author. During the 2013-2017 period, 51.9% of documents by Waterloo authors in publications classified as engineering, 52.9% of documents under materials science and 69.5% of documents in those classified as computer science involved international collaboration.
G. Space

Waterloo Engineering space holdings have increased by 23,308 nasm (61.6%) since 2006/07, to reach 61,119 nasm. While this is a significant achievement, space limitations remain the most pressing constraint to the achievement of many of our plan goals. Current projects, including the acquisition of EC4 and the ongoing construction of Engineering 7, will help alleviate those pressures in the coming years.

H. Advancement

As of December 31, 2017 Waterloo Engineering had graduated a total of 44,647 alumni, 40,328 (90.3%) for whom the Office of Alumni Affairs had at least one method of contact. Of those, 4.2% made a donation to the University of Waterloo in 2017. Figure 181 shows the total number of alumni, those for whom we have a method of contact, and those who have donated to Waterloo each year.
In addition to the number of alumni who choose to make a gift to the University of Waterloo in each year, another important indicator of the degree of affinity our alumni feel for their alma mater is the proportion of all alumni who have ever, over their “lifetime” as an alumnus, made a donation to the university. At the end of 2017, 37.9% of all Waterloo Engineering alumni had done so (see Figure 182 for departmental distribution).

Alumni donations are part of the overall picture of philanthropic support that helps move Waterloo Engineering forward. FIGURE details total funds raised for Waterloo Engineering in the past seven years. With the public launch of our Educating the Engineer of the Future campaign, a new target and priorities have been set. FIGURE shows we have reached 132% of the campaign goal of $70M since May 1, 2013.

Figure 182: Alumni Who Have Donated to Waterloo as of December 31, 2017 (H3)
IV. Appendices

The tables appended here contain the data for this plan year that were provided to all Waterloo Engineering units in order to assist in their planning and annual plan review and progress update. Data for past years are available in previous progress reports, posted online at [https://uwaterloo.ca/engineering/about/strategic-planning](https://uwaterloo.ca/engineering/about/strategic-planning). Appendix 0I provides the definitions and sources used to create these data.

A. Faculty and Staff Data Tables

**Table 11: Total Regular Faculty, 2017/18**

<table>
<thead>
<tr>
<th>Department</th>
<th>Prof</th>
<th>Assoc Prof</th>
<th>Asst Prof</th>
<th>Lect</th>
<th>Total</th>
<th>Female</th>
<th>% Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>5.0</td>
<td>9.0</td>
<td>4.0</td>
<td>2.0</td>
<td>20.0</td>
<td>8.0</td>
<td>40.0%</td>
</tr>
<tr>
<td>Chemical</td>
<td>22.5</td>
<td>9.0</td>
<td>5.0</td>
<td>2.0</td>
<td>38.5</td>
<td>6.0</td>
<td>15.6%</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>16.3</td>
<td>14.5</td>
<td>3.0</td>
<td>3.0</td>
<td>36.8</td>
<td>5.5</td>
<td>15.0%</td>
</tr>
<tr>
<td>Conrad</td>
<td>0.5</td>
<td>4.0</td>
<td>1.0</td>
<td>4.0</td>
<td>9.5</td>
<td>2.0</td>
<td>21.1%</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>45.0</td>
<td>28.0</td>
<td>14.0</td>
<td>6.5</td>
<td>93.5</td>
<td>13.0</td>
<td>13.9%</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>6.3</td>
<td>11.0</td>
<td>4.0</td>
<td>3.0</td>
<td>24.3</td>
<td>7.0</td>
<td>28.9%</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>29.0</td>
<td>15.0</td>
<td>10.0</td>
<td>4.5</td>
<td>58.5</td>
<td>10.0</td>
<td>17.1%</td>
</tr>
<tr>
<td>Systems Design</td>
<td>13.5</td>
<td>8.0</td>
<td>8.0</td>
<td>5.0</td>
<td>34.5</td>
<td>5.0</td>
<td>14.5%</td>
</tr>
<tr>
<td>Administrative Units</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>2.5</td>
<td>2.5</td>
<td>1.0</td>
<td>39.8%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>138.0</td>
<td>98.5</td>
<td>49.0</td>
<td>32.5</td>
<td>318.0</td>
<td>57.5</td>
<td>18.1%</td>
</tr>
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</table>

**Table 12: Distribution of Regular Faculty by P.Eng. Status, 2017/18**

<table>
<thead>
<tr>
<th>Department</th>
<th>Registered</th>
<th>Applied</th>
<th>Not Applied</th>
<th>Not Eligible</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical</td>
<td>25.0</td>
<td>3.0</td>
<td>10.5</td>
<td>0.0</td>
<td>38.5</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>30.2</td>
<td>3.0</td>
<td>3.5</td>
<td>0.0</td>
<td>36.8</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>62.5</td>
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<td>25.0</td>
<td>0.0</td>
<td>92.5</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>13.3</td>
<td>6.0</td>
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<td>5.0</td>
<td>24.3</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>46.5</td>
<td>3.0</td>
<td>9.0</td>
<td>0.0</td>
<td>58.5</td>
</tr>
<tr>
<td>Systems Design</td>
<td>21.5</td>
<td>1.0</td>
<td>10.0</td>
<td>0.0</td>
<td>32.5</td>
</tr>
<tr>
<td>Administrative Units</td>
<td>1.5</td>
<td>1.0</td>
<td>0.0</td>
<td>0.0</td>
<td>2.5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>195.7</td>
<td>22.0</td>
<td>52.0</td>
<td>5.0</td>
<td>285.5</td>
</tr>
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</table>

**Table 13: Distribution of Regular Faculty by Age, 2017/18**

<table>
<thead>
<tr>
<th>Age</th>
<th>&lt;35</th>
<th>35-39</th>
<th>40-44</th>
<th>45-49</th>
<th>50-54</th>
<th>55-59</th>
<th>60-64</th>
<th>65+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular Faculty</td>
<td>13</td>
<td>44</td>
<td>61</td>
<td>49</td>
<td>43</td>
<td>57</td>
<td>38</td>
<td>25</td>
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</table>

**Table 14: Distribution of TTS Faculty by PhD School, 2017/18**

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<thead>
<tr>
<th>School</th>
<th>Waterloo</th>
<th>Ontario</th>
<th>Canada</th>
<th>USA</th>
<th>Int'l</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTS Faculty</td>
<td>66</td>
<td>55.5</td>
<td>37.5</td>
<td>72.5</td>
<td>43.5</td>
</tr>
</tbody>
</table>
Table 15: Total Non-Regular and Non-Faculty Appointments, 2017

<table>
<thead>
<tr>
<th>Department</th>
<th>Adjunct Profs</th>
<th>Lect (Adj/Special)</th>
<th>Rsch Profs</th>
<th>Post Docs</th>
<th>Rsch Assoc</th>
<th>Visitors</th>
<th>Def-term Profs</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
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<td>18</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>Chemical</td>
<td>21</td>
<td>0</td>
<td>0</td>
<td>46</td>
<td>6</td>
<td>28</td>
<td>0</td>
<td>101</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>32</td>
<td>5</td>
<td>3</td>
<td>26</td>
<td>10</td>
<td>7</td>
<td>0</td>
<td>83</td>
</tr>
<tr>
<td>Conrad</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>34</td>
<td>8</td>
<td>6</td>
<td>69</td>
<td>38</td>
<td>43</td>
<td>0</td>
<td>198</td>
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<tr>
<td>Management Sciences</td>
<td>27</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>36</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>41</td>
<td>9</td>
<td>3</td>
<td>49</td>
<td>29</td>
<td>22</td>
<td>0</td>
<td>153</td>
</tr>
<tr>
<td>Systems Design</td>
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<td>1</td>
<td>22</td>
<td>3</td>
<td>10</td>
<td>0</td>
<td>72</td>
</tr>
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<td>Administrative Units</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>192</td>
<td>49</td>
<td>13</td>
<td>213</td>
<td>88</td>
<td>112</td>
<td>0</td>
<td>667</td>
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</table>

Table 16: Selected Major Faculty Awards and Honours, 2017/18

<table>
<thead>
<tr>
<th>Department</th>
<th>Faculty Member</th>
<th>Award</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical Engineering</td>
<td>Abukhdeir, Nasser</td>
<td>Early Researcher Award</td>
</tr>
<tr>
<td></td>
<td>Chen, Zhongwei</td>
<td>Canada Research Chair: Tier 1</td>
</tr>
<tr>
<td></td>
<td>Chen, Zhongwei</td>
<td>Royal Society of Canada Rutherford Memorial Medal</td>
</tr>
<tr>
<td></td>
<td>Chen, Zhongwei</td>
<td>Canadian Academy of Engineering Fellow</td>
</tr>
<tr>
<td></td>
<td>Gu, Frank</td>
<td>Canada Research Chair: Tier 2 (Renewal)</td>
</tr>
<tr>
<td></td>
<td>Pal, Rajinder</td>
<td>Royal Society of Canada College of New Scholars, Artists and Scientists Member</td>
</tr>
<tr>
<td></td>
<td>Ricardez Sandoval, Luis</td>
<td>Faculty of Engineering/Sandford Fleming Foundation Teaching Excellence Award</td>
</tr>
<tr>
<td></td>
<td>Zhao, Boxin</td>
<td>Canada Research Chair: Tier 2 Engineering Research Excellence Award</td>
</tr>
<tr>
<td>Civil &amp; Environmental Engineering</td>
<td>Basu, Nandita</td>
<td>Engineering Research Excellence Award</td>
</tr>
<tr>
<td></td>
<td>Haas, Ralph</td>
<td>World Congress on Pavement Asset Management International Award</td>
</tr>
<tr>
<td></td>
<td>Tighe, Susan</td>
<td>Canadian Academy of Engineering Fellow</td>
</tr>
<tr>
<td>Conrad</td>
<td>Chang, Wayne</td>
<td>Faculty of Engineering/Sandford Fleming Foundation Teaching Excellence Award</td>
</tr>
<tr>
<td></td>
<td>Chang, Wayne</td>
<td>Distinguished Teacher Award, UW</td>
</tr>
<tr>
<td>Electrical &amp; Computer Engineering</td>
<td>Bajcsy, Michal</td>
<td>Early Researcher Award</td>
</tr>
<tr>
<td></td>
<td>Boumaiza, Slim</td>
<td>NSERC Synergy Award for Innovation</td>
</tr>
<tr>
<td></td>
<td>Canizares, Claudio</td>
<td>IEEE PES Outstanding Power Engineering Educator Award</td>
</tr>
<tr>
<td></td>
<td>El-Saadany, Ehab</td>
<td>IEEE Fellow</td>
</tr>
<tr>
<td></td>
<td>Ganesh, Vijay</td>
<td>Silver Medals (two) at 2017 SAT Competition</td>
</tr>
<tr>
<td></td>
<td>Golab, Wojciech</td>
<td>Early Researcher Award</td>
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<tr>
<td></td>
<td>Golab, Wojciech</td>
<td>SSS 2017 Best Paper Award</td>
</tr>
<tr>
<td></td>
<td>Gong, Guang</td>
<td>University Research Chair</td>
</tr>
<tr>
<td></td>
<td>Kim, Na Young</td>
<td>Early Researcher Award</td>
</tr>
<tr>
<td></td>
<td>Mansour, Raafat</td>
<td>Canada Research Chair: Tier 1 (Renewal)</td>
</tr>
<tr>
<td></td>
<td>Mansour, R'Aafat</td>
<td>2017 Transducers Outstanding Paper Award</td>
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<td></td>
<td>Miao, Guo-Xing</td>
<td>Early Researcher Award</td>
</tr>
<tr>
<td></td>
<td>Reimer, Michael</td>
<td>Cisco Research Chair</td>
</tr>
<tr>
<td></td>
<td>Rosenberg, Catherine</td>
<td>Canada Research Chair: Tier 1 (Renewal)</td>
</tr>
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<td></td>
<td>Rosenberg, Catherine</td>
<td>ACM MobileHCI 2017 Best Workshop Paper Award</td>
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<td></td>
<td>Shaker, George</td>
<td>IEEE Communications Society Education Award</td>
</tr>
<tr>
<td></td>
<td>Shen, Sherman</td>
<td></td>
</tr>
<tr>
<td>Department</td>
<td>Faculty Member</td>
<td>Award</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Shen, Sherman</td>
<td>2017 IEEE Best Land Transportation Paper Award</td>
</tr>
<tr>
<td></td>
<td>Smith, Stephen</td>
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</tr>
<tr>
<td></td>
<td>Tan, Lin</td>
<td>Canada Research Chair: Tier 2</td>
</tr>
<tr>
<td></td>
<td>Wang, Zhou</td>
<td>University Research Chair</td>
</tr>
<tr>
<td></td>
<td>Wang, Zhou</td>
<td>Engineering Research Chair Excellence Award</td>
</tr>
<tr>
<td></td>
<td>Wright, Derek</td>
<td>Engineering Teaching Chair Excellence Award</td>
</tr>
<tr>
<td></td>
<td>Wright, Derek</td>
<td>Faculty of Engineering/Sandford Fleming Foundation Teaching Excellence Award</td>
</tr>
<tr>
<td></td>
<td>Yang, En-hui</td>
<td>Canada Research Chair: Tier 1 (Renewal)</td>
</tr>
<tr>
<td></td>
<td>Yoon, Youngki</td>
<td>Early Researcher Award</td>
</tr>
<tr>
<td></td>
<td>Yu, Alfred</td>
<td>Early Researcher Award</td>
</tr>
<tr>
<td></td>
<td>Yu, Alfred</td>
<td>International Society for Therapeutic Ultrasound Frederic Lizzi Early Career Award</td>
</tr>
<tr>
<td></td>
<td>Zhuang, Weihua</td>
<td>Royal Society of Canada Fellow</td>
</tr>
<tr>
<td></td>
<td>Zhuang, Weihua</td>
<td>Canada Research Chair: Tier 1 (Renewal)</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>Abouee Mehrizi, Hossein</td>
<td>2017 INFORMS Chuck Revelle Rising Star Award</td>
</tr>
<tr>
<td></td>
<td>Alumur Alev, Sibel</td>
<td>Early Researcher Award</td>
</tr>
<tr>
<td></td>
<td>Bedi, Sanjeev</td>
<td>NSERC Chair in Immersive Design Engineering Activities</td>
</tr>
<tr>
<td></td>
<td>Cronin, Duane</td>
<td>Canada Research Chair: Tier 1</td>
</tr>
<tr>
<td></td>
<td>Hulls, Carol</td>
<td>Faculty of Engineering/Sandford Fleming Foundation Teaching Excellence Award</td>
</tr>
<tr>
<td></td>
<td>Li, Xianguo</td>
<td>Canadian Academy of Engineering Fellow</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>Mitra, Sushanta</td>
<td>American Academy of Engineering Fellow</td>
</tr>
<tr>
<td>Engineering</td>
<td>Mitra, Sushanta</td>
<td>Indian National Academy of Engineering Fellow</td>
</tr>
<tr>
<td></td>
<td>Toyserkani, Ehsan</td>
<td>Canada Research Chair: Tier 1</td>
</tr>
<tr>
<td></td>
<td>Wells Mary</td>
<td>Engineers Canada Award for Support of Women in Engineering</td>
</tr>
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<td></td>
<td>Wells, Mary</td>
<td>NSERC Award for Science Promotion</td>
</tr>
<tr>
<td></td>
<td>Worsswick, Michael</td>
<td>Society of Automotive Engineers (SAE) International Fellow</td>
</tr>
<tr>
<td></td>
<td>Zhou, Norman</td>
<td>Canada Research Chair: Tier 1</td>
</tr>
<tr>
<td>Systems Design Engineering</td>
<td>Eliasmith, Chris</td>
<td>Canada Research Chair: Tier 1</td>
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<tr>
<td></td>
<td>Hipel, Keith</td>
<td>Ven Te Chow Award</td>
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<td>Hipel, Keith</td>
<td>Order of Canada</td>
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<td>Hipel, Keith</td>
<td>Royal Society of Canada Miroslaw Romanowski Medal</td>
</tr>
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<td>Ivkovic, Igor</td>
<td>Engineering Society Teaching Excellence Award</td>
</tr>
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<td></td>
<td>Jiang, Ning</td>
<td>Early Researcher Award</td>
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<td>Wong, Alex</td>
<td>Best Student Paper Award, Ottawa Hockey Analytics Conference</td>
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<td></td>
<td></td>
<td>Best Paper Award at 31st Neural Information Processing Systems (NIPS)</td>
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<td></td>
<td></td>
<td>Transparent and interpretable Machine Learning in Safety Critical Environments</td>
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<td></td>
<td>Wong, Alexander</td>
<td>Workshop</td>
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<td></td>
<td></td>
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</tbody>
</table>

Table 17: FTE Staff, 2017/18

<table>
<thead>
<tr>
<th>Department</th>
<th>Admin</th>
<th>Tech</th>
<th>Total</th>
<th># Female</th>
<th>% Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>6.0</td>
<td>5.0</td>
<td>11.0</td>
<td>6.0</td>
<td>54.5%</td>
</tr>
<tr>
<td>Chemical</td>
<td>8.0</td>
<td>12.0</td>
<td>20.0</td>
<td>10.0</td>
<td>50.0%</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>9.0</td>
<td>10.0</td>
<td>19.0</td>
<td>9.0</td>
<td>47.4%</td>
</tr>
<tr>
<td>Conrad</td>
<td>4.0</td>
<td>0.0</td>
<td>4.0</td>
<td>3.0</td>
<td>75.0%</td>
</tr>
</tbody>
</table>

Strategic Plan Progress Report: 2017/18
## Table 18: Distribution of FTE Staff by Age, 2017/18

<table>
<thead>
<tr>
<th>Age Group</th>
<th>FTE Staff</th>
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<td>&lt;30</td>
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<td>30-34</td>
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<tr>
<td>35-39</td>
<td>35.0</td>
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<tr>
<td>40-44</td>
<td>25.0</td>
</tr>
<tr>
<td>45-49</td>
<td>24.0</td>
</tr>
<tr>
<td>50-54</td>
<td>50.0</td>
</tr>
<tr>
<td>55-59</td>
<td>37.2</td>
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<td>60+</td>
<td>27.8</td>
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<tr>
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</tr>
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</table>

## Table 19: Staff Awards and Honours, 2017

<table>
<thead>
<tr>
<th>Department</th>
<th>Staff Member</th>
<th>Award</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil &amp; Environmental Engineering</td>
<td>Shirley Springall</td>
<td>Dean of Engineering Outstanding Staff Performance Award</td>
</tr>
<tr>
<td>Electrical &amp; Computer Engineering</td>
<td>Fernando Rivero Hernandez</td>
<td>Dean of Engineering Outstanding Staff Performance Award</td>
</tr>
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</table>

## Table 20: Faculty : Staff Ratios, 2017/18

<table>
<thead>
<tr>
<th>Department</th>
<th>Faculty to Admin Staff</th>
<th>Faculty to Tech Staff</th>
<th>Faculty to Total Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>3.33</td>
<td>4.00</td>
<td>1.82</td>
</tr>
<tr>
<td>Chemical</td>
<td>4.81</td>
<td>3.21</td>
<td>1.93</td>
</tr>
<tr>
<td>Civil &amp; Environmental Engineering</td>
<td>4.08</td>
<td>3.68</td>
<td>1.93</td>
</tr>
<tr>
<td>Conrad</td>
<td>2.38</td>
<td>0.00</td>
<td>2.38</td>
</tr>
<tr>
<td>Electrical &amp; Computer Engineering</td>
<td>4.35</td>
<td>3.74</td>
<td>2.01</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>3.32</td>
<td>12.13</td>
<td>2.61</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics Engineering</td>
<td>3.73</td>
<td>3.25</td>
<td>1.74</td>
</tr>
<tr>
<td>Systems Design</td>
<td>5.31</td>
<td>5.75</td>
<td>2.76</td>
</tr>
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<td>FACULTY TOTAL</td>
<td>2.24</td>
<td>3.21</td>
<td>1.32</td>
</tr>
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<td>Academic Units Only</td>
<td>4.08</td>
<td>4.08</td>
<td>2.04</td>
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</table>
## B. Undergraduate Studies Data Tables

### Table 21: Total Undergraduate Enrolment (head count), Fall 2017

<table>
<thead>
<tr>
<th>Program</th>
<th>Total</th>
<th>#Female</th>
<th>% Female</th>
<th>#Int'l</th>
<th>% Int'l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>370</td>
<td>225</td>
<td>60.8%</td>
<td>19</td>
<td>5.1%</td>
</tr>
<tr>
<td>Biomedical</td>
<td>207</td>
<td>122</td>
<td>58.9%</td>
<td>7</td>
<td>3.4%</td>
</tr>
<tr>
<td>Chemical</td>
<td>639</td>
<td>278</td>
<td>43.5%</td>
<td>102</td>
<td>16.0%</td>
</tr>
<tr>
<td>Civil</td>
<td>646</td>
<td>213</td>
<td>33.0%</td>
<td>93</td>
<td>14.4%</td>
</tr>
<tr>
<td>Computer</td>
<td>1182</td>
<td>179</td>
<td>15.1%</td>
<td>265</td>
<td>22.4%</td>
</tr>
<tr>
<td>Electrical</td>
<td>568</td>
<td>119</td>
<td>21.0%</td>
<td>105</td>
<td>18.5%</td>
</tr>
<tr>
<td>Environmental</td>
<td>276</td>
<td>158</td>
<td>57.2%</td>
<td>36</td>
<td>13.0%</td>
</tr>
<tr>
<td>Geological</td>
<td>112</td>
<td>37</td>
<td>33.0%</td>
<td>4</td>
<td>3.6%</td>
</tr>
<tr>
<td>Management</td>
<td>340</td>
<td>144</td>
<td>42.4%</td>
<td>35</td>
<td>10.3%</td>
</tr>
<tr>
<td>Mechanical</td>
<td>1037</td>
<td>186</td>
<td>17.9%</td>
<td>140</td>
<td>13.5%</td>
</tr>
<tr>
<td>Mechatronics</td>
<td>913</td>
<td>162</td>
<td>17.7%</td>
<td>111</td>
<td>12.2%</td>
</tr>
<tr>
<td>Nanotechnology</td>
<td>478</td>
<td>132</td>
<td>27.6%</td>
<td>41</td>
<td>8.6%</td>
</tr>
<tr>
<td>Software</td>
<td>637</td>
<td>120</td>
<td>18.8%</td>
<td>85</td>
<td>13.3%</td>
</tr>
<tr>
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<td>440</td>
<td>169</td>
<td>38.4%</td>
<td>13</td>
<td>3.0%</td>
</tr>
<tr>
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<td>7845</td>
<td>2244</td>
<td>28.6%</td>
<td>1056</td>
<td>13.5%</td>
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### Table 22: FTE Undergraduate Enrolment, 2017/18

<table>
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<tr>
<th>Program</th>
<th>Total</th>
<th># Female</th>
<th>% Female</th>
<th>#Int'l</th>
<th>% Int'l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>288.3</td>
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<td>61.0%</td>
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<td>4.5%</td>
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<tr>
<td>Biomedical</td>
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<td>98.0</td>
<td>59.2%</td>
<td>6.1</td>
<td>3.7%</td>
</tr>
<tr>
<td>Chemical</td>
<td>512.9</td>
<td>218.7</td>
<td>42.6%</td>
<td>80.3</td>
<td>15.7%</td>
</tr>
<tr>
<td>Civil</td>
<td>528.0</td>
<td>174.3</td>
<td>33.0%</td>
<td>73.4</td>
<td>13.9%</td>
</tr>
<tr>
<td>Computer</td>
<td>937.7</td>
<td>143.1</td>
<td>15.3%</td>
<td>205.3</td>
<td>21.9%</td>
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<td>Electrical</td>
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<td>20.3%</td>
<td>87.9</td>
<td>18.6%</td>
</tr>
<tr>
<td>Environmental</td>
<td>210.2</td>
<td>119.4</td>
<td>56.8%</td>
<td>24.2</td>
<td>11.5%</td>
</tr>
<tr>
<td>Geological</td>
<td>88.3</td>
<td>27.6</td>
<td>31.3%</td>
<td>2.5</td>
<td>2.8%</td>
</tr>
<tr>
<td>Management</td>
<td>273.1</td>
<td>115.2</td>
<td>42.2%</td>
<td>28.0</td>
<td>10.3%</td>
</tr>
<tr>
<td>Mechanical</td>
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<td>144.1</td>
<td>17.4%</td>
<td>115.3</td>
<td>13.9%</td>
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<td>Mechatronics</td>
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<td>126.1</td>
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<td>80.9</td>
<td>11.3%</td>
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<tr>
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<td>27.2%</td>
<td>32.3</td>
<td>8.4%</td>
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<tr>
<td>Software</td>
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<td>100.3</td>
<td>19.1%</td>
<td>69.2</td>
<td>13.2%</td>
</tr>
<tr>
<td>Systems Design</td>
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<td>136.4</td>
<td>38.8%</td>
<td>10.0</td>
<td>2.8%</td>
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<td><strong>TOTAL</strong></td>
<td>6281.4</td>
<td>1779.2</td>
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<td>828.5</td>
<td>13.2%</td>
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</table>

### Table 23: Undergraduate Degrees Granted, 2017

<table>
<thead>
<tr>
<th>Program</th>
<th>Total</th>
<th># Female</th>
<th>% Female</th>
<th>#Int'l</th>
<th>% Int'l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
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<td>36</td>
<td>58.1%</td>
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<td>1.6%</td>
</tr>
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<td>31.3%</td>
<td>20</td>
<td>13.9%</td>
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<tr>
<td>Civil</td>
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<td>Computer</td>
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<td>13.1%</td>
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<tr>
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<td>15.1%</td>
<td>18</td>
<td>15.1%</td>
</tr>
<tr>
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<td>Program</td>
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<td>% Female</td>
<td>#Int’l</td>
<td>% Int’l</td>
</tr>
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<td>---------------</td>
<td>-------</td>
<td>---------</td>
<td>----------</td>
<td>--------</td>
<td>---------</td>
</tr>
<tr>
<td>Geological</td>
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<td>1</td>
<td>4.3%</td>
</tr>
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<td>38.8%</td>
<td>7</td>
<td>14.3%</td>
</tr>
<tr>
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<td>23</td>
<td>12.3%</td>
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<tr>
<td>Mechatronics</td>
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<td>8</td>
<td>8.2%</td>
<td>11</td>
<td>11.2%</td>
</tr>
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<td>Nanotechnology</td>
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<td>8</td>
<td>8.7%</td>
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<tr>
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<td>7</td>
<td>6.6%</td>
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<td>0.0%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1269</td>
<td>292</td>
<td>23.0%</td>
<td>144</td>
<td>11.3%</td>
</tr>
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</table>

Table 24: Undergraduate Year One New Admissions, Fall 2017

<table>
<thead>
<tr>
<th>Program</th>
<th>CPR</th>
<th>Int’l</th>
<th>Total</th>
<th># Female</th>
<th>% Female</th>
<th>% of total target</th>
<th>% of int’l target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>69</td>
<td>4</td>
<td>73</td>
<td>40</td>
<td>54.8%</td>
<td>96.1%</td>
<td>66.7%</td>
</tr>
<tr>
<td>Biomedical</td>
<td>65</td>
<td>3</td>
<td>68</td>
<td>41</td>
<td>60.3%</td>
<td>97.1%</td>
<td>60.0%</td>
</tr>
<tr>
<td>Chemical</td>
<td>101</td>
<td>16</td>
<td>117</td>
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<td>84.2%</td>
<td>84.2%</td>
</tr>
<tr>
<td>Civil</td>
<td>125</td>
<td>11</td>
<td>136</td>
<td>42</td>
<td>30.9%</td>
<td>112.4%</td>
<td>68.8%</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>280</td>
<td>61</td>
<td>341</td>
<td>71</td>
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<td>97.7%</td>
<td>113.0%</td>
</tr>
<tr>
<td>Environmental</td>
<td>52</td>
<td>6</td>
<td>58</td>
<td>25</td>
<td>43.1%</td>
<td>85.3%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Geological</td>
<td>17</td>
<td>1</td>
<td>18</td>
<td>7</td>
<td>38.9%</td>
<td>60.0%</td>
<td>33.3%</td>
</tr>
<tr>
<td>Management</td>
<td>74</td>
<td>10</td>
<td>84</td>
<td>37</td>
<td>44.0%</td>
<td>120.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Mechanical</td>
<td>182</td>
<td>26</td>
<td>208</td>
<td>42</td>
<td>20.2%</td>
<td>100.5%</td>
<td>118.2%</td>
</tr>
<tr>
<td>Mechatronics</td>
<td>180</td>
<td>30</td>
<td>210</td>
<td>48</td>
<td>22.9%</td>
<td>115.4%</td>
<td>136.4%</td>
</tr>
<tr>
<td>Nanotechnology</td>
<td>104</td>
<td>6</td>
<td>110</td>
<td>41</td>
<td>37.3%</td>
<td>96.5%</td>
<td>66.7%</td>
</tr>
<tr>
<td>Software</td>
<td>115</td>
<td>19</td>
<td>134</td>
<td>35</td>
<td>26.1%</td>
<td>108.9%</td>
<td>146.2%</td>
</tr>
<tr>
<td>Systems Design</td>
<td>81</td>
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<td>85</td>
<td>33</td>
<td>38.8%</td>
<td>94.4%</td>
<td>80.0%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1445</td>
<td>197</td>
<td>1642</td>
<td>512</td>
<td>31.2%</td>
<td>100.2%</td>
<td>103.7%</td>
</tr>
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</table>

Table 25: Undergraduate Admissions by Entering Average Grade Range, 2017

<table>
<thead>
<tr>
<th>Grade Range</th>
<th>% of year one new admissions</th>
<th>90-94%</th>
<th>&gt;=95%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>44.0%</td>
<td>44.2%</td>
</tr>
</tbody>
</table>

Table 26: Undergraduate Student : Faculty Ratio, 2017/18

<table>
<thead>
<tr>
<th>Department</th>
<th>Student:Faculty Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>14.4</td>
</tr>
<tr>
<td>Chemical</td>
<td>17.1</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>22.5</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>21.0</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>11.3</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>21.8</td>
</tr>
<tr>
<td>Systems Design</td>
<td>18.8</td>
</tr>
<tr>
<td>TOTAL</td>
<td>19.4</td>
</tr>
</tbody>
</table>
### Table 27: Undergraduate Degrees Granted: Faculty Ratio, 2017/18

<table>
<thead>
<tr>
<th>Department</th>
<th>Degrees:Faculty Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>3.1</td>
</tr>
<tr>
<td>Chemical</td>
<td>4.5</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>4.7</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>4.0</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>2.0</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>4.2</td>
</tr>
<tr>
<td>Systems Design</td>
<td>3.2</td>
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<td><strong>3.9</strong></td>
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</table>

### Table 28: Co-op Employment, 2017

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Seeking Employment</th>
<th>Employed</th>
<th>Unemployed</th>
<th>% Employed</th>
<th>% Int'l Work Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
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<td>99.0%</td>
<td>50.1%</td>
</tr>
<tr>
<td>Biomedical</td>
<td>192</td>
<td>191</td>
<td>1</td>
<td>99.5%</td>
<td>7.9%</td>
</tr>
<tr>
<td>Chemical</td>
<td>754</td>
<td>730</td>
<td>24</td>
<td>96.8%</td>
<td>5.9%</td>
</tr>
<tr>
<td>Civil</td>
<td>755</td>
<td>740</td>
<td>15</td>
<td>98.0%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Computer</td>
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<td>1338</td>
<td>14</td>
<td>99.0%</td>
<td>20.4%</td>
</tr>
<tr>
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<td>99.0%</td>
<td>12.9%</td>
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<td>294</td>
<td>11</td>
<td>96.4%</td>
<td>5.1%</td>
</tr>
<tr>
<td>Geological</td>
<td>126</td>
<td>122</td>
<td>4</td>
<td>96.8%</td>
<td>3.3%</td>
</tr>
<tr>
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<td>362</td>
<td>4</td>
<td>98.9%</td>
<td>14.1%</td>
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<tr>
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<td>15</td>
<td>98.8%</td>
<td>11.8%</td>
</tr>
<tr>
<td>Mechatronics</td>
<td>965</td>
<td>957</td>
<td>8</td>
<td>99.2%</td>
<td>17.5%</td>
</tr>
<tr>
<td>Nanotechnology</td>
<td>542</td>
<td>530</td>
<td>12</td>
<td>97.8%</td>
<td>24.0%</td>
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<tr>
<td>Software</td>
<td>749</td>
<td>745</td>
<td>4</td>
<td>99.5%</td>
<td>45.9%</td>
</tr>
<tr>
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<td>496</td>
<td>6</td>
<td>98.8%</td>
<td>20.4%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
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<td><strong>8826</strong></td>
<td><strong>129</strong></td>
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### Table 29: Co-op Earnings, 2017/18 ($ millions)

<table>
<thead>
<tr>
<th>Faculty of Engineering</th>
<th>University of Waterloo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Co-op Earnings</td>
<td>$112.4 M</td>
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### Table 30: Undergraduate Exchange Participation, 2017

<table>
<thead>
<tr>
<th></th>
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<th>Incoming</th>
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<tr>
<td>Total Exchange Terms</td>
<td>105</td>
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</tr>
</tbody>
</table>

### C. Graduate Studies Data Tables

#### Table 31: Total Graduate Enrolment (Head Count), Fall 2017

<table>
<thead>
<tr>
<th>Department</th>
<th>PhD</th>
<th>Rsch Master</th>
<th>Prof Master</th>
<th>Non Deg</th>
<th>Total</th>
<th>Female</th>
<th>% Female</th>
<th># Int'l</th>
<th>% Int'l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>n/a</td>
<td>154</td>
<td>n/a</td>
<td>2</td>
<td>156</td>
<td>92</td>
<td>59.0%</td>
<td>21</td>
<td>13.5%</td>
</tr>
</tbody>
</table>

Strategic Plan Progress Report: 2017/18
### Table 32: FTE Graduate Enrolment, 2017/18

<table>
<thead>
<tr>
<th>Department</th>
<th>PhD</th>
<th>Rsch Master</th>
<th>Prof Master</th>
<th>Total</th>
<th># Female</th>
<th>% Female</th>
<th># Int'l</th>
<th>% Int'l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical</td>
<td>112</td>
<td>83</td>
<td>37</td>
<td>1</td>
<td>233</td>
<td>73</td>
<td>142</td>
<td>60.9%</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>114</td>
<td>92</td>
<td>34</td>
<td>2</td>
<td>242</td>
<td>78</td>
<td>102</td>
<td>42.1%</td>
</tr>
<tr>
<td>Conrad</td>
<td>n/a</td>
<td>n/a</td>
<td>74</td>
<td>2</td>
<td>76</td>
<td>30</td>
<td>29</td>
<td>38.2%</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>260</td>
<td>163</td>
<td>164</td>
<td>1</td>
<td>588</td>
<td>130</td>
<td>357</td>
<td>60.7%</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>27</td>
<td>14</td>
<td>168</td>
<td>3</td>
<td>212</td>
<td>90</td>
<td>131</td>
<td>61.8%</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>169</td>
<td>134</td>
<td>116</td>
<td>5</td>
<td>424</td>
<td>63</td>
<td>211</td>
<td>49.8%</td>
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<tr>
<td>Systems Design</td>
<td>62</td>
<td>44</td>
<td>41</td>
<td>1</td>
<td>148</td>
<td>50</td>
<td>88</td>
<td>59.5%</td>
</tr>
<tr>
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<td>744</td>
<td>684</td>
<td>634</td>
<td>17</td>
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<td>1081</td>
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</table>

### Table 33: Graduate Degrees Granted, 2017

<table>
<thead>
<tr>
<th>Department</th>
<th>PhD</th>
<th>Rsch Master</th>
<th>Prof Master</th>
<th>Total</th>
<th># Female</th>
<th>% Female</th>
<th># Int'l</th>
<th>% Int'l</th>
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</thead>
<tbody>
<tr>
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<td>47</td>
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<td>51.1%</td>
<td>5</td>
<td>10.6%</td>
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<tr>
<td>Chemical</td>
<td>25</td>
<td>29</td>
<td>23</td>
<td>77</td>
<td>19</td>
<td>24.7%</td>
<td>46</td>
<td>59.7%</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>25</td>
<td>35</td>
<td>14</td>
<td>74</td>
<td>23</td>
<td>31.1%</td>
<td>14</td>
<td>18.9%</td>
</tr>
<tr>
<td>Conrad</td>
<td>n/a</td>
<td>n/a</td>
<td>37</td>
<td>37</td>
<td>9</td>
<td>24.3%</td>
<td>21</td>
<td>56.8%</td>
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<tr>
<td>Electrical &amp; Computer</td>
<td>33</td>
<td>64</td>
<td>102</td>
<td>199</td>
<td>64</td>
<td>32.2%</td>
<td>126</td>
<td>63.3%</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>5</td>
<td>11</td>
<td>46</td>
<td>62</td>
<td>27</td>
<td>43.5%</td>
<td>38</td>
<td>61.3%</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>25</td>
<td>52</td>
<td>17</td>
<td>94</td>
<td>11</td>
<td>11.7%</td>
<td>32</td>
<td>34.0%</td>
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<tr>
<td>Systems Design</td>
<td>14</td>
<td>14</td>
<td>5</td>
<td>34</td>
<td>13</td>
<td>38.2%</td>
<td>23</td>
<td>67.6%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>127</td>
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<td>245</td>
<td>624</td>
<td>190</td>
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<td>305</td>
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### Table 34: FTE Graduate Student Admissions, 2017

<table>
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<th>Department</th>
<th>Degree Type</th>
<th>CPR</th>
<th>Int'l</th>
<th>Total</th>
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<td>Architecture</td>
<td>PhD</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Research Master</td>
<td>43.0</td>
<td>8.0</td>
<td>51.0</td>
</tr>
<tr>
<td></td>
<td>Professional Master</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>43.0</td>
<td>8.0</td>
<td>51.0</td>
</tr>
<tr>
<td>Chemical</td>
<td>PhD</td>
<td>5.3</td>
<td>21.0</td>
<td>26.3</td>
</tr>
<tr>
<td></td>
<td>Research Master</td>
<td>17.0</td>
<td>19.0</td>
<td>36.0</td>
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<tr>
<td></td>
<td>Professional Master</td>
<td>5.5</td>
<td>18.0</td>
<td>23.5</td>
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<tr>
<td></td>
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<td>58.0</td>
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<td>Degree Type</td>
<td>CPR</td>
<td>Int'l</td>
<td>Total</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------</td>
<td>------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>PhD</td>
<td>5.3</td>
<td>16.0</td>
<td>21.3</td>
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<tr>
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<td>10.0</td>
<td>35.0</td>
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<tr>
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<td>Professional Master</td>
<td>8.5</td>
<td>14.0</td>
<td>22.5</td>
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<td></td>
<td>Total</td>
<td>38.8</td>
<td>40.0</td>
<td>78.8</td>
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<td>n/a</td>
<td>n/a</td>
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<tr>
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<td>Research Master</td>
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<td>n/a</td>
<td>n/a</td>
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<tr>
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<td>Professional Master</td>
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<td>29.0</td>
<td>54.8</td>
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<td>65.3</td>
<td>90.9</td>
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<td></td>
<td>Total</td>
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<td>144.3</td>
<td>211.1</td>
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<td>5.0</td>
<td>10.0</td>
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<td></td>
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<td>2.0</td>
<td>3.0</td>
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<td></td>
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<td>68.6</td>
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<td>40.3</td>
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<tr>
<td></td>
<td>Professional Master</td>
<td>26.8</td>
<td>52.0</td>
<td>78.8</td>
</tr>
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<td>93.0</td>
<td>168.7</td>
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<td>5.0</td>
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</tr>
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<td>7.0</td>
<td>17.0</td>
</tr>
<tr>
<td></td>
<td>Professional Master</td>
<td>3.3</td>
<td>26.0</td>
<td>29.3</td>
</tr>
<tr>
<td></td>
<td>Total</td>
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<td>38.0</td>
<td>55.9</td>
</tr>
<tr>
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<td>PhD</td>
<td>41.8</td>
<td>121.0</td>
<td>162.8</td>
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<td>92.0</td>
<td>256.5</td>
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<td>272.9</td>
<td>391.9</td>
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<td>485.9</td>
<td>811.2</td>
</tr>
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</table>

Table 35: Graduate Student : Faculty Ratio, 2017/18

<table>
<thead>
<tr>
<th>Department</th>
<th>PhD</th>
<th>Rsch Master</th>
<th>Prof Master</th>
<th>Non Deg</th>
<th>All Students</th>
<th>Rsch Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>n/a</td>
<td>6.1</td>
<td>n/a</td>
<td>0.1</td>
<td>6.1</td>
<td>6.1</td>
</tr>
<tr>
<td>Chemical</td>
<td>2.9</td>
<td>2.1</td>
<td>0.8</td>
<td>0.0</td>
<td>5.9</td>
<td>5.0</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>3.0</td>
<td>2.4</td>
<td>0.6</td>
<td>0.1</td>
<td>6.0</td>
<td>5.3</td>
</tr>
<tr>
<td>Conrad</td>
<td>n/a</td>
<td>n/a</td>
<td>8.8</td>
<td>0.1</td>
<td>8.9</td>
<td>0.0</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>2.7</td>
<td>1.6</td>
<td>1.2</td>
<td>0.0</td>
<td>5.5</td>
<td>4.3</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>1.1</td>
<td>0.7</td>
<td>4.2</td>
<td>0.1</td>
<td>6.1</td>
<td>1.8</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>2.9</td>
<td>2.2</td>
<td>0.8</td>
<td>0.6</td>
<td>6.5</td>
<td>5.1</td>
</tr>
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<td>1.4</td>
<td>1.0</td>
<td>0.0</td>
<td>4.2</td>
<td>3.2</td>
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<td>TOTAL</td>
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<td>2.0</td>
<td>1.3</td>
<td>0.1</td>
<td>5.8</td>
<td>4.4</td>
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</tbody>
</table>

Table 36: Graduate Degrees Granted : Faculty Ratio, 2017

<table>
<thead>
<tr>
<th>Department</th>
<th>PhD</th>
<th>Rsch Master</th>
<th>Prof Master</th>
<th>All Students</th>
<th>Rsch Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
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<td>n/a</td>
<td>2.6</td>
<td>2.6</td>
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<td>Chemical</td>
<td>0.7</td>
<td>0.8</td>
<td>0.6</td>
<td>2.1</td>
<td>1.5</td>
</tr>
</tbody>
</table>
### Table 37: Graduate Proportion of Total FTE Enrolment, 2017/18

<table>
<thead>
<tr>
<th>Department</th>
<th>FTE Graduate Students:All Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>27.6%</td>
</tr>
<tr>
<td>Chemical</td>
<td>24.6%</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>19.8%</td>
</tr>
<tr>
<td>Conrad</td>
<td>100.0%</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>19.7%</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>32.1%</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>21.7%</td>
</tr>
<tr>
<td>Systems Design</td>
<td>17.0%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>22.0%</td>
</tr>
</tbody>
</table>

### Table 38: Research Master’s Student Financial Support, 2017/18

<table>
<thead>
<tr>
<th>Research Master’s Students</th>
<th>% of FTEs Supported</th>
<th>Avg $ Supported FTEs</th>
<th>% FTEs with GRS</th>
<th>% FTEs with TA</th>
<th>% FTEs with Ext Schlp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>44.2%</td>
<td>$12,118.70</td>
<td>0.0%</td>
<td>16.4%</td>
<td>7.3%</td>
</tr>
<tr>
<td>Chemical</td>
<td>93.1%</td>
<td>$28,485.68</td>
<td>73.7%</td>
<td>25.4%</td>
<td>20.7%</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>94.5%</td>
<td>$27,013.47</td>
<td>83.9%</td>
<td>29.9%</td>
<td>13.8%</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>95.9%</td>
<td>$31,976.43</td>
<td>83.1%</td>
<td>30.2%</td>
<td>16.2%</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>96.0%</td>
<td>$30,371.62</td>
<td>93.7%</td>
<td>58.0%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>83.6%</td>
<td>$27,773.00</td>
<td>70.7%</td>
<td>24.8%</td>
<td>9.7%</td>
</tr>
<tr>
<td>Systems Design</td>
<td>96.9%</td>
<td>$30,930.36</td>
<td>83.3%</td>
<td>41.5%</td>
<td>22.3%</td>
</tr>
<tr>
<td>TOTAL (excl. Architecture)</td>
<td>91.7%</td>
<td>$29,336.05</td>
<td>78.4%</td>
<td>29.6%</td>
<td>14.7%</td>
</tr>
</tbody>
</table>

### Table 39: Doctoral Student Financial Support, 2017/18

<table>
<thead>
<tr>
<th>Doctoral Students</th>
<th>% of FTEs Supported</th>
<th>Avg $ Supported FTEs</th>
<th>% FTEs with GRS</th>
<th>% FTEs with TA</th>
<th>% FTEs with Ext Schlp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical</td>
<td>97.1%</td>
<td>$41,932.22</td>
<td>74.5%</td>
<td>29.8%</td>
<td>31.5%</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>95.2%</td>
<td>$39,444.38</td>
<td>76.6%</td>
<td>30.7%</td>
<td>24.4%</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>97.3%</td>
<td>$42,758.88</td>
<td>77.7%</td>
<td>36.3%</td>
<td>27.1%</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>93.7%</td>
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<td>84.2%</td>
<td>54.2%</td>
<td>20.3%</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>96.7%</td>
<td>$43,057.41</td>
<td>82.8%</td>
<td>34.9%</td>
<td>28.2%</td>
</tr>
<tr>
<td>Systems Design</td>
<td>92.1%</td>
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<td>64.0%</td>
<td>44.4%</td>
<td>37.1%</td>
</tr>
<tr>
<td>TOTAL</td>
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<td>77.3%</td>
<td>35.4%</td>
<td>28.2%</td>
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</table>
## D. Research Data Tables

### Table 40: Total Sponsored Research Funding by Source, 2017/18

<table>
<thead>
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<th>Department</th>
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<th>Federal (excl Tri-Council)</th>
<th>Provincial</th>
<th>Industry</th>
<th>Other</th>
<th>Total</th>
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<td>$175,000</td>
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<td>$0</td>
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<td>1,409,346</td>
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<tr>
<td>Civil &amp; Environmental</td>
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<td>$1,248,400</td>
<td>$1,086,968</td>
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<td>$9,924,109</td>
</tr>
<tr>
<td>Conrad</td>
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<td>$0</td>
<td>$143,280</td>
<td>$0</td>
<td>785,074</td>
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</tr>
<tr>
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<td>$9,076,861</td>
<td>$2,093,130</td>
<td>$2,224,341</td>
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<td>$131,564</td>
<td>218,093</td>
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<tr>
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<td><strong>$25,290,409</strong></td>
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### Table 41: Total Sponsored Research Funding by Type, 2017/18

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<th>Department</th>
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<th>Infrastructure Research Funds</th>
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<tr>
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<td>Electrical &amp; Computer</td>
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### Table 42: Total Tri-Council Funding, 2017/18

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<th>Department</th>
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<th>NSERC</th>
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<td><strong>$693,757</strong></td>
<td><strong>$24,452,967</strong></td>
<td><strong>$25,290,409</strong></td>
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### Table 43: NSERC Funding by Type, 2017/18

<table>
<thead>
<tr>
<th>Department</th>
<th>Discovery</th>
<th>RTI</th>
<th>Strategic</th>
<th>Partnership</th>
<th>Other</th>
<th>Total</th>
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<td>$0</td>
<td>$0</td>
<td>$0</td>
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<td>$0</td>
<td>$0</td>
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<td>$0</td>
<td>$0</td>
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<td>$0</td>
<td>$0</td>
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<td>$0</td>
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<td>$0</td>
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<tr>
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<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
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<td>$0</td>
<td>$0</td>
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<td>$0</td>
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<td>$0</td>
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<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$143,685</strong></td>
<td><strong>$693,757</strong></td>
<td><strong>$24,452,967</strong></td>
<td><strong>$25,290,409</strong></td>
<td><strong>$0</strong></td>
<td><strong>$0</strong></td>
</tr>
<tr>
<td>Department</td>
<td>Discovery</td>
<td>RTI</td>
<td>Strategic</td>
<td>Partnership</td>
<td>Other</td>
<td>Total</td>
</tr>
<tr>
<td>-----------------------</td>
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<td>-----------</td>
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</tr>
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</tr>
<tr>
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</table>

Table 44: Share of NSERC in Engineering Subject Groups, 2017/18

<table>
<thead>
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<th>Share of Awards</th>
<th>Share of Funding</th>
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Table 45: Provincial Funding by Type, 2017/18

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<th>Department</th>
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<th>ORF:RE</th>
<th>ORF:RI</th>
<th>Other</th>
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<td>$0</td>
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<td>$624,587</td>
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</table>

Table 46: Industry Funding by Source, 2017/18

<table>
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<th>Canada</th>
<th>USA</th>
<th>Int’l</th>
<th>Total</th>
</tr>
</thead>
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<tr>
<td>Architecture</td>
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<td>$0</td>
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<td>$0</td>
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Table 47: Total Sponsored Research Funding: Faculty Ratio, 2017/18

<table>
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<th>Department</th>
<th>Research Funding/TTS Faculty</th>
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<td>Excluding Architecture &amp; Conrad</td>
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</table>

Table 48: Research Chair Holders, by Department, 2018

<table>
<thead>
<tr>
<th>Department</th>
<th>Cda Rsch Chair</th>
<th>Endowed Chair</th>
<th>NSERC Chair</th>
<th>Other Chair</th>
<th>Univ Rsch Chair</th>
<th>Univ Prof</th>
<th>Total</th>
</tr>
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<td>0</td>
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<td>0</td>
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Table 49: Canada Research Chairs, Tier 1

<table>
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<tbody>
<tr>
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</tr>
<tr>
<td>Haas, Carl, CEE</td>
<td>CRC in Infrastructure Construction and Management</td>
</tr>
<tr>
<td>Khandani, Amir Keyvan, ECE</td>
<td>CRC in Wireless Systems</td>
</tr>
<tr>
<td>Mansour, Raafat, ECE</td>
<td>CRC in Micro and Nano Integrated RF Systems</td>
</tr>
<tr>
<td>Rosenberg, Catherine, ECE</td>
<td>CRC in the Future Internet</td>
</tr>
<tr>
<td>Yang, En-Hui, ECE</td>
<td>CRC in Information Theory and Multimedia Data Compression</td>
</tr>
<tr>
<td>Zhuang, Weihua, ECE</td>
<td>CRC in Wireless Communication Networks</td>
</tr>
<tr>
<td>Cronin, Duane, MME</td>
<td>EMBARGOED</td>
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<tr>
<td>Khajepour, Amir, MME</td>
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</tr>
<tr>
<td>Toyserkani, Ehsan, MME</td>
<td>CRC in Multi-Scale Additive Manufacturing</td>
</tr>
<tr>
<td>Worswick, Michael, MME</td>
<td>CRC in Light Weight Materials under Extreme Deformation: Forming and Impact</td>
</tr>
<tr>
<td>Zhou, Norman, MME</td>
<td>CRC in Advanced Materials Joining and Processing</td>
</tr>
<tr>
<td>Eliasmith, Chris, SDE</td>
<td>CRC in Theoretical Neuroscience</td>
</tr>
<tr>
<td>McPhee, John, SDE</td>
<td>CRC in Biomechatronic System Dynamics</td>
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</tbody>
</table>
### Table 50: Canada Research Chairs, Tier 2

<table>
<thead>
<tr>
<th>Chair Holder</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gu, Frank, CHE</td>
<td>CRC in Advanced Targeted Delivery Systems</td>
</tr>
<tr>
<td>Ricardez-Sandoval, Luis, CHE</td>
<td>CRC in Multiscale Modelling and Process Systems</td>
</tr>
<tr>
<td>Craig, James, CEE</td>
<td>CRC in Environmental Modeling and Analysis</td>
</tr>
<tr>
<td>Narasimhan, Sriram, CEE</td>
<td>CRC in Smart Infrastructure</td>
</tr>
<tr>
<td>El-Saadany, Ehab F, ECE</td>
<td>CRC in Energy Systems</td>
</tr>
<tr>
<td>Smith, Stephen, ECE</td>
<td>CRC in Autonomous Systems</td>
</tr>
<tr>
<td>Tan, Lin, ECE</td>
<td>CRC in Software Dependability</td>
</tr>
<tr>
<td>Abouee Mehrizi, Hossein, MSCI</td>
<td>CRC in Health-Care Operations Management</td>
</tr>
<tr>
<td>Golab, Lukasz, MSCI</td>
<td>CRC in Data Analytics for Sustainability</td>
</tr>
<tr>
<td>Ren, Carolyn L., MME</td>
<td>CRC in Lab-on-a-Chip Technology</td>
</tr>
<tr>
<td>Wong, Alexander, SDE</td>
<td>CRC in Medical Imaging Systems</td>
</tr>
<tr>
<td>Yeow, John, SDE</td>
<td>CRC in Micro and NanoDevices</td>
</tr>
</tbody>
</table>

### Table 51: NSERC Chairs

<table>
<thead>
<tr>
<th>Chair Holder</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huck, Peter, CEE</td>
<td>NSERC Industrial Research Chair in Water Treatment</td>
</tr>
<tr>
<td>Pandey, Mahesh, CEE</td>
<td>NSERC Industrial Research Chair in Management of Engineering Systems</td>
</tr>
<tr>
<td>Khandani, Amir, ECE</td>
<td>NSERC Ciena Industrial Research Chair in Information Theory of Optical Networks</td>
</tr>
<tr>
<td>Safavi-Naeini, Safieddin (Ali), ECE</td>
<td>NSERC C-COM Industrial Research Chair in Intelligent Antenna and Radio Systems for Next Generation Millimeter-Wave Mobile</td>
</tr>
<tr>
<td>Bedi, Sanjeev, MME</td>
<td>NSERC Chair in Immersive Design Engineering Activities (IDEAs)</td>
</tr>
<tr>
<td>Gerlich, Adrian, MME</td>
<td>NSERC / TransCanada Associate Industrial Research Chair in Welding for Energy Infrastructure</td>
</tr>
<tr>
<td>Inal, Kaan, MME</td>
<td>NSERC Industrial Research Chair in Modelling, Simulation and Finite Elements Methods</td>
</tr>
<tr>
<td>Khajepour, Amir, MME</td>
<td>NSERC Industrial Research Chair in Mechanical Systems and Instrumentation</td>
</tr>
</tbody>
</table>

### Table 52: Endowed Chairs

<table>
<thead>
<tr>
<th>Chair Holder</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tighe, Susan, CEE</td>
<td>Norman W. McLeod Chair in Sustainable Pavement Engineering</td>
</tr>
<tr>
<td>Canizares, Claudio, ECE</td>
<td>Hydro One Research Chair</td>
</tr>
<tr>
<td>Chaudhuri, Sujit, ECE</td>
<td>Val O'Donovan Chair in RF/Microwaves and Photonics</td>
</tr>
<tr>
<td>Wasilewski, Zbig, ECE</td>
<td>Waterloo Institute for Nanotechnology (WIN) Endowed Chair</td>
</tr>
</tbody>
</table>

### Table 53: University Research Chairs and University Professors

<table>
<thead>
<tr>
<th>University Research Chairs</th>
<th>University Professors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chen, Pu, CHE</td>
<td>Long, John, ECE</td>
</tr>
<tr>
<td>Feng, Xianshe, CHE</td>
<td>Mazumdar, Ravi, ECE</td>
</tr>
<tr>
<td>Matzen, Mark, CHE</td>
<td>Wang, Zhou, ECE</td>
</tr>
<tr>
<td>Tam, Michael, CHE</td>
<td>Cronin, Duane, MME</td>
</tr>
<tr>
<td>Gong, Guang, ECE</td>
<td>Li, Xianguo, MME</td>
</tr>
<tr>
<td>Jayaram, Shesha, ECE</td>
<td>Toyserkani, Ehsan, MME</td>
</tr>
<tr>
<td>Karray, Fakredine, ECE</td>
<td>Zhou, Norman, MME</td>
</tr>
</tbody>
</table>

Strategic Plan Progress Report: 2017/18 150
Table 54: University of Waterloo Documents in Engineering, Materials Science or Computer Science Publications Indexed by Thomson Reuters, 2013-2017

<table>
<thead>
<tr>
<th>Engineering</th>
<th>Materials Science</th>
<th>Computer Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indexed Documents</td>
<td>2228</td>
<td>964</td>
</tr>
</tbody>
</table>

Table 55: Category-Normalized Citation Impact of University of Waterloo Documents in Engineering, Materials Science or Computer Science Publications Indexed by Thomson Reuters, 2013-2017

<table>
<thead>
<tr>
<th>Engineering</th>
<th>Materials Science</th>
<th>Computer Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category-Normalized Citation Impact</td>
<td>1.16</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Table 56: Percentage of University of Waterloo Documents in Engineering, Materials Science or Computer Science Publications Indexed by Thomson Reuters that are in the Top 10%, 2013-2017

<table>
<thead>
<tr>
<th>Engineering</th>
<th>Materials Science</th>
<th>Computer Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage in Top 10%</td>
<td>10.6%</td>
<td>17.0%</td>
</tr>
</tbody>
</table>

Table 57: Percentage of University of Waterloo Documents in Engineering, Materials Science or Computer Science Publications Indexed by Thomson Reuters with International Collaboration, 2013-2017

<table>
<thead>
<tr>
<th>Engineering</th>
<th>Materials Science</th>
<th>Computer Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage with International Collaboration</td>
<td>51.9%</td>
<td>52.9%</td>
</tr>
</tbody>
</table>

E. Women in Engineering Data Tables

Table 58: Women in Engineering, 2017

<table>
<thead>
<tr>
<th>#</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate First-year Class</td>
<td>514</td>
</tr>
<tr>
<td>All Undergraduate Students</td>
<td>2019</td>
</tr>
<tr>
<td>Undergraduate Degrees Granted</td>
<td>256</td>
</tr>
<tr>
<td>All Graduate Students</td>
<td>514</td>
</tr>
<tr>
<td>All Graduate Degrees Granted</td>
<td>166</td>
</tr>
<tr>
<td>PhD Degrees Granted</td>
<td>25</td>
</tr>
<tr>
<td>Faculty Members</td>
<td>47.5</td>
</tr>
</tbody>
</table>

Table 59: Women in Architecture, 2017

<table>
<thead>
<tr>
<th>#</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate First-year Class</td>
<td>43</td>
</tr>
<tr>
<td>All Undergraduate Students</td>
<td>225</td>
</tr>
<tr>
<td>Undergraduate Degrees Granted</td>
<td>36</td>
</tr>
<tr>
<td>All Graduate Students</td>
<td>92</td>
</tr>
<tr>
<td>All Graduate Degrees Granted</td>
<td>24</td>
</tr>
<tr>
<td>Faculty Members</td>
<td>8</td>
</tr>
</tbody>
</table>

F. Internationalization Data Tables

Table 60: International Students, 2017

<table>
<thead>
<tr>
<th>#</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate New Admissions</td>
<td>249</td>
</tr>
<tr>
<td>All Undergraduate Students</td>
<td>1179</td>
</tr>
<tr>
<td>Undergraduate Degrees Granted</td>
<td>144</td>
</tr>
<tr>
<td>Undergraduate Co-op Work Terms</td>
<td>1623</td>
</tr>
<tr>
<td>Outgoing Exchange Terms</td>
<td>105</td>
</tr>
<tr>
<td>Incoming Exchange Terms</td>
<td>107</td>
</tr>
</tbody>
</table>
### G. Space Data Tables

**Table 61: Space Holdings (nasm), 2017**

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Additional</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017/18</td>
<td>60,596</td>
<td>523</td>
<td>61,119</td>
</tr>
</tbody>
</table>

### H. Advancement Data Tables

#### Table 62: Waterloo Engineering Total Alumni, 2017

<table>
<thead>
<tr>
<th>Department</th>
<th>#</th>
<th>% reach-able</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>2,404</td>
<td>88.2%</td>
</tr>
<tr>
<td>Chemical</td>
<td>5,580</td>
<td>89.8%</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>7,660</td>
<td>88.1%</td>
</tr>
<tr>
<td>Conrad</td>
<td>572</td>
<td>96.7%</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>13,245</td>
<td>91.9%</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>2,190</td>
<td>87.4%</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>9,190</td>
<td>90.3%</td>
</tr>
<tr>
<td>Systems Design</td>
<td>3,807</td>
<td>92.2%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>44,647</td>
<td>90.3%</td>
</tr>
</tbody>
</table>

#### Table 63: Waterloo Engineering Alumni Donors, 2017

<table>
<thead>
<tr>
<th>Department</th>
<th>#</th>
<th>% of reach-able</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>62</td>
<td>2.9%</td>
</tr>
<tr>
<td>Chemical</td>
<td>231</td>
<td>4.6%</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>321</td>
<td>4.8%</td>
</tr>
<tr>
<td>Conrad</td>
<td>10</td>
<td>1.8%</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>432</td>
<td>3.6%</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>63</td>
<td>3.3%</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>386</td>
<td>4.6%</td>
</tr>
<tr>
<td>Systems Design</td>
<td>177</td>
<td>5.0%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>1,681</td>
<td>4.2%</td>
</tr>
</tbody>
</table>

#### Table 64: Engineering Alumni Donating to University of Waterloo, Lifetime

<table>
<thead>
<tr>
<th>Department</th>
<th># Donating</th>
<th>% Donating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>647</td>
<td>30.5%</td>
</tr>
<tr>
<td>Chemical</td>
<td>1,973</td>
<td>39.4%</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>2,979</td>
<td>44.1%</td>
</tr>
<tr>
<td>Conrad</td>
<td>50</td>
<td>9.0%</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>3,991</td>
<td>32.8%</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>565</td>
<td>29.5%</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>3,543</td>
<td>42.7%</td>
</tr>
<tr>
<td>Systems Design</td>
<td>1,518</td>
<td>43.3%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>15,265</td>
<td>37.9%</td>
</tr>
</tbody>
</table>

#### Table 65: Funds Raised for the Faculty of Engineering, 2017/18

<table>
<thead>
<tr>
<th></th>
<th>Cash Received ($M)</th>
<th>New Pledges Received ($M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funds Raised</td>
<td>$10.3</td>
<td>$12.8</td>
</tr>
</tbody>
</table>
Table 66: Educating the Engineering of the Future Campaign Progress to May 1, 2018

<table>
<thead>
<tr>
<th>Priority Project</th>
<th>Goal</th>
<th>$ Raised</th>
<th>% of Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilities</td>
<td>$45.0</td>
<td>$49.4</td>
<td>109.8%</td>
</tr>
<tr>
<td>Graduate Scholarships</td>
<td>$3.5</td>
<td>$1.5</td>
<td>42.9%</td>
</tr>
<tr>
<td>Chairs</td>
<td>$10.0</td>
<td>$7.2</td>
<td>72.0%</td>
</tr>
<tr>
<td>Student Experience</td>
<td>$11.5</td>
<td>$18.4</td>
<td>160.0%</td>
</tr>
<tr>
<td>Other</td>
<td>n/a</td>
<td>$16.2</td>
<td>n/a</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$70.0</td>
<td>$92.7</td>
<td>132.4%</td>
</tr>
</tbody>
</table>

Table 67: Alumni Attending Selected Class Reunions, 2017

<table>
<thead>
<tr>
<th>Department</th>
<th>5-yr</th>
<th>10-yr</th>
<th>15-yr</th>
<th>20-yr</th>
<th>25-yr</th>
<th>30-yr</th>
<th>35-yr</th>
<th>40-yr</th>
<th>45-yr</th>
<th>50-yr</th>
<th>55-yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical</td>
<td>2.4%</td>
<td>1.1%</td>
<td>3.5%</td>
<td>5.3%</td>
<td>6.8%</td>
<td>44.2%</td>
<td>27.0%</td>
<td>11.8%</td>
<td>33.3%</td>
<td>28.6%</td>
<td></td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>3.4%</td>
<td>4.8%</td>
<td>1.2%</td>
<td>12.2%</td>
<td>17.1%</td>
<td>17.6%</td>
<td>3.0%</td>
<td>5.2%</td>
<td>3.7%</td>
<td>9.1%</td>
<td>47.6%</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>1.5%</td>
<td>2.0%</td>
<td>2.9%</td>
<td>9.2%</td>
<td>15.1%</td>
<td>11.8%</td>
<td>10.1%</td>
<td>6.0%</td>
<td>5.3%</td>
<td>19.5%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>1.2%</td>
<td>3.5%</td>
<td>3.7%</td>
<td>5.1%</td>
<td>22.5%</td>
<td>8.6%</td>
<td>16.9%</td>
<td>70.6%</td>
<td>3.9%</td>
<td>42.2%</td>
<td>10.0%</td>
</tr>
<tr>
<td>Systems Design</td>
<td>2.8%</td>
<td>1.5%</td>
<td>16.1%</td>
<td>17.7%</td>
<td>26.3%</td>
<td>17.5%</td>
<td>0.0%</td>
<td>54.1%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>OVERALL PARTICIPATION</td>
<td>1.7%</td>
<td>2.4%</td>
<td>4.6%</td>
<td>8.3%</td>
<td>19.7%</td>
<td>11.4%</td>
<td>13.3%</td>
<td>25.9%</td>
<td>5.7%</td>
<td>24.5%</td>
<td>40.5%</td>
</tr>
</tbody>
</table>

Table 68: Alumni Events, 2017

<table>
<thead>
<tr>
<th>Event</th>
<th>City</th>
<th>Date</th>
<th>Attendance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterloo Engineering Alumni Ski Day</td>
<td>Collingwood, ON</td>
<td>20-01-2017</td>
<td>265</td>
</tr>
<tr>
<td>Waterloo Engineering Alumni Reception at Razer USA</td>
<td>San Francisco, CA</td>
<td>07-02-2017</td>
<td>65</td>
</tr>
<tr>
<td>Waterloo Engineering Alumni Reception at NVIDIA</td>
<td>Palo Alto, CA</td>
<td>09-02-2017</td>
<td>115</td>
</tr>
<tr>
<td>Up Close and Personal with SYDE</td>
<td>Waterloo, ON</td>
<td>28-03-2017</td>
<td>38</td>
</tr>
<tr>
<td>Grad Class Toast</td>
<td>Waterloo, ON</td>
<td>29-03-2017</td>
<td>300</td>
</tr>
<tr>
<td>Waterloo Engineering Alumni Whiskey Tasting Reception in Calgary</td>
<td>Calgary, AB</td>
<td>20-04-2017</td>
<td>50</td>
</tr>
<tr>
<td>MBET Alumni Event - Spring Mixer</td>
<td>Toronto, ON</td>
<td>31-05-2017</td>
<td>75</td>
</tr>
<tr>
<td>Engineering Class of 2017 Post-Convocation Receptions (3 receptions total)</td>
<td>Waterloo, ON</td>
<td>17-06-2017</td>
<td>3,216</td>
</tr>
<tr>
<td>Engineering Class of 2017 Post-Convocation Reception</td>
<td>Waterloo, ON</td>
<td>21-10-2017</td>
<td>800</td>
</tr>
<tr>
<td>Engineering Class of 2017 Post-Convocation Reception</td>
<td>Waterloo, ON</td>
<td>30-09-2017</td>
<td>795</td>
</tr>
<tr>
<td>Engineering Class of 2017 Post-Convocation Reception</td>
<td>Boston, MA</td>
<td>18-10-2017</td>
<td>65</td>
</tr>
</tbody>
</table>

*attendance includes alumni and guests
## I. Data Notes
### Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acad</td>
<td>Academic Unit (department, school or academic centre)</td>
</tr>
<tr>
<td>Admin</td>
<td>Administrative Unit or Administrative Staff</td>
</tr>
<tr>
<td>ARCH</td>
<td>Architecture (school or program)</td>
</tr>
<tr>
<td>Assoc Prof</td>
<td>Associate Professor</td>
</tr>
<tr>
<td>Asst Prof</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>BME</td>
<td>Biomedical Engineering (program)</td>
</tr>
<tr>
<td>CEE</td>
<td>Civil &amp; Environmental Engineering Department</td>
</tr>
<tr>
<td>CFI</td>
<td>Canada Foundation for Innovation</td>
</tr>
<tr>
<td>CHE</td>
<td>Chemical Engineering (department or program)</td>
</tr>
<tr>
<td>CIHR</td>
<td>Canadian Institutes for Health Research</td>
</tr>
<tr>
<td>CIVE</td>
<td>Civil Engineering (program)</td>
</tr>
<tr>
<td>CE</td>
<td>Computer Engineering (program)</td>
</tr>
<tr>
<td>Conrad</td>
<td>Conrad Business, Entrepreneurship &amp; Technology Centre</td>
</tr>
<tr>
<td>CPR</td>
<td>Canadian or Permanent Resident</td>
</tr>
<tr>
<td>Def Term</td>
<td>Definite Term</td>
</tr>
<tr>
<td>DOE</td>
<td>Dean of Engineering Office</td>
</tr>
<tr>
<td>ECE</td>
<td>Electrical &amp; Computer Engineering Department</td>
</tr>
<tr>
<td>EE</td>
<td>Electrical Engineering (program)</td>
</tr>
<tr>
<td>Enrol't</td>
<td>Enrolment</td>
</tr>
<tr>
<td>ENVE</td>
<td>Environmental Engineering (program)</td>
</tr>
<tr>
<td>ERA</td>
<td>Early Researcher Award (formerly Premier’s Research Excellence Award or PREA)</td>
</tr>
<tr>
<td>Ext</td>
<td>External</td>
</tr>
<tr>
<td>FOE</td>
<td>Faculty of Engineering</td>
</tr>
<tr>
<td>FTE</td>
<td>Full-time equivalent</td>
</tr>
<tr>
<td>GENE</td>
<td>Undergraduate students not registered in an academic program (e.g. exchange students and students registered in the Qualifying Program for Readmission)</td>
</tr>
<tr>
<td>GEOE</td>
<td>Geological Engineering (program)</td>
</tr>
<tr>
<td>GRS</td>
<td>Graduate Research Studentship</td>
</tr>
<tr>
<td>Int'l</td>
<td>International</td>
</tr>
<tr>
<td>Lect</td>
<td>Lecturer</td>
</tr>
<tr>
<td>MAESD</td>
<td>Ministry of Advanced Education and Skills Development (formerly MTCU)</td>
</tr>
<tr>
<td>ME</td>
<td>Mechanical Engineering (program)</td>
</tr>
<tr>
<td>MCTR</td>
<td>Mechatronics Engineering (program)</td>
</tr>
<tr>
<td>MGMT</td>
<td>Management Engineering (program)</td>
</tr>
<tr>
<td>MME</td>
<td>Mechanical &amp; Mechatronics Engineering Department</td>
</tr>
<tr>
<td>MSCI</td>
<td>Management Sciences Department</td>
</tr>
<tr>
<td>NANTE</td>
<td>Nanotechnology Engineering (program)</td>
</tr>
<tr>
<td>nasm</td>
<td>Net assignable square metre</td>
</tr>
<tr>
<td>Non-Deg</td>
<td>Non-degree (for graduate students, includes diploma and certificate students)</td>
</tr>
<tr>
<td>NSERC</td>
<td>Natural Sciences and Engineering Research Council</td>
</tr>
<tr>
<td>OCE</td>
<td>Ontario Centres of Excellence</td>
</tr>
<tr>
<td>ORF</td>
<td>Ontario Research Fund (RE = Research Excellence &amp; RI = Research Infrastructure)</td>
</tr>
<tr>
<td>PostDoc</td>
<td>Post-doctoral Fellow</td>
</tr>
<tr>
<td>Prof</td>
<td>Professor</td>
</tr>
<tr>
<td>Prof Master</td>
<td>Professional Master (i.e. coursework; without a thesis)</td>
</tr>
<tr>
<td>Rsch Assoc</td>
<td>Research Associate</td>
</tr>
<tr>
<td>Rsch Master</td>
<td>Research Master (i.e. with a thesis)</td>
</tr>
<tr>
<td>Rsch Prof</td>
<td>Research Professor</td>
</tr>
<tr>
<td>RTI</td>
<td>Research Tools and Instruments (NSERC Program)</td>
</tr>
<tr>
<td>Schlp</td>
<td>Scholarship</td>
</tr>
<tr>
<td>SDE</td>
<td>Systems Design Engineering (department or program)</td>
</tr>
<tr>
<td>SE</td>
<td>Software Engineering (program)</td>
</tr>
<tr>
<td>SSHRC</td>
<td>Social Sciences and Humanities Research Council</td>
</tr>
<tr>
<td>TA</td>
<td>Teaching Assistant</td>
</tr>
<tr>
<td>Tech</td>
<td>Technical Staff</td>
</tr>
<tr>
<td>TTS</td>
<td>Tenured and tenure-stream faculty</td>
</tr>
<tr>
<td>UAE</td>
<td>United Arab Emirates (where Waterloo formerly had a campus, in Dubai)</td>
</tr>
<tr>
<td>Univ</td>
<td>University</td>
</tr>
</tbody>
</table>
Notes on Tables

1  Key Metrics
   Space Holdings excludes Architecture and Conrad
   In May 2014 previous space holdings calculations, which included projections for space under construction, were updated with actual figures. Baseline and previous year data have been restated with actuals.

2  Key Performance Indicators
   Undergraduate Students/Faculty excludes CSTV faculty (included elsewhere in Systems Design) and excludes proportion of students in joint programs with other Faculties.
   Graduate Students/Faculty includes only tenured and tenure-stream faculty.
   Space Holdings/Student, Sponsored Research Funds/Faculty and Sponsored Research Funds/Budget exclude Architecture and Conrad.
   Budget/Student is widely considered an acceptable measure of the richness of a unit’s educational program and is not intended to represent the amount of money spent directly on each student.

3  Institutional Context
   Source for each metric is consistent with its measurement described below.

4  Provincial and National Context
   Source: Engineers Canada enrolment and degrees report (most recent available)
   Per Engineers Canada guidelines, excludes Architecture and new programs yet to be accredited.

Data Definitions and Sources

A-1  Total Regular Faculty
   Source: Dean of Engineering Office | As of: May 1
   Excludes definite-term, research and visiting professors and definite-term lecturers with appointments less than 2 years; excludes faculty members in full-time senior university administrative positions (e.g. president); Excludes positions not yet filled on May 1
   Systems Design includes CSTV

A-2  Distribution of Regular Faculty by PEng Status
   Source: Associate Dean, Co-operative Education & Professional Affairs | As of: May 1
   Excludes faculty in Architecture, Conrad and CSTV; ineligible=degree(s)from a discipline ineligible for PEng

A-3  Distribution of Regular Faculty by Age
   Source: Dean of Engineering Office | As of: May 1
   Head count of faculty (rather than FTE) to maintain confidentiality. Joint appointees between two Engineering departments will be counted twice.

A-4  Distribution of TTS Faculty by PhD School
   Source: Dean of Engineering Office | As of: May 1
   Excludes faculty who do not hold a PhD

A-5  Total Non-regular and Non-faculty Appointments
   Source: Dean of Engineering Office | As of: May 1
   Count of current appointments on May 1 (a small proportion of individuals might hold multiple appointments)

A-6  Selected Major Faculty Awards and Honours
   Source: Dean of Engineering Office | As of: Dec. 31

A-7  FTE Staff
   Source: Waterloo Human Resources | As of: May 1
   Full-time equivalent filled positions paid from the operating budget
   Research institutes include WatCAR, WIN and WISE; Undergraduate Office includes Teaching Office and Student Design Centre staff
   Excludes positions which were under recruitment/not yet filled on May 1

A-8  Distribution of FTE Staff by Age
   Source: Waterloo Human Resource | As of: May 1

A-9  Staff Awards and Honours
   Source: Dean of Engineering Office | As of: Dec. 31

A-10 Faculty:Staff Ratios
    Total regular faculty/FTE staff paid from the operating budget
    Faculty Total includes staff and faculty in administrative units (e.g. Dean’s Office, Machine Shop, Undergraduate Office, etc.); Academic Units Only excludes support units

B-1  Total Undergraduate Enrolment (head count)
   Source: Waterloo Institutional Analysis and Planning Office | As of: Nov.1
   All undergraduates registered in the fall term (in class or on co-op) on MAESD count date
   Includes students on official co-op work term; includes all students in programs offered jointly with other faculties (i.e. software and nanotechnology); excludes part-time students; excludes students in GENE

B-2  FTE Undergraduate Enrolment
Equivalent student registrations in two academic terms in a year; this counters the impact of our co-op program, due to which a proportion of students will have 2 work terms and 1 academic term in a given year.

Annual FTE = (spring + fall + winter registrations, excluding students on co-op)/2

Includes all students in programs offered jointly with other faculties (i.e. software and nanotechnology); excludes part-time students; excludes students in GENE.

Undergraduate Degrees Granted

Source: Waterloo Institutional Analysis and Planning Office | As of: Dec. 31

Total engineering undergraduate students graduating in the calendar year includes all students in programs offered jointly with other faculties (i.e. software and nanotechnology); count by first major (double-major degrees are counted only once).

Undergraduate Year One New Admissions

Source: Waterloo Institutional Analysis and Planning Office | As of: Nov. 1

Total new engineering undergraduates registered in the fall term includes all students in programs offered jointly with other faculties (i.e. software and nanotechnology).

Undergraduate Admissions by Average Grade Ranges

Source: Waterloo Registrar’s Office | As of: Nov. 1

Average based on best final 6 U or M courses; averages with .5% are rounded up (e.g. 94.5% to 94.9% are included in 95%)

Undergraduate Students:Faculty Ratio

FTE undergraduate students/regular faculty members

Regular faculty here excludes CSTV faculty (included elsewhere in Systems Design); FTE students here exclude ½ of software students and ⅛ of nanotechnology students; mechatronics students are allocated ⅔ to MME, 1/5 to ECE and 1/5 to SDE; biomedical students are allocated 1/10 to CHE, 1/10 to ECE, 1/10 to MME and 7/10 to SDE.

Undergraduate Degrees Granted:Faculty Ratio

Engineering undergraduate degrees granted/regular faculty members

Regular faculty here excludes CSTV faculty (included elsewhere in Systems Design); FTE students here exclude ½ of software students and ⅛ of nanotechnology students; mechatronics students are allocated ⅔ to MME, 1/5 to ECE and 1/5 to SDE; biomedical students are allocated 1/10 to CHE, 1/10 to ECE, 1/10 to MME and 7/10 to SDE.

Co-op Employment

Source: Waterloo Co-operative Education Office | As of: Dec. 31

Excludes students who advised Co-operative Education that they were not seeking employment or who did not participate in the interview process and did not provide information on their status.

% international placements is share of "employed" terms outside of Canada.

Total Co-op Earnings by Fiscal Year

Source: Waterloo Co-operative Education Office | As of: May 1

Estimate of total earnings by all co-op students on work terms for a fiscal year extrapolated from the hourly, weekly or monthly wages reported for each co-op student.

Does not include wages earned internationally.

Undergraduate Exchange Participation

Source: Engineering Exchange Office | As of: Dec. 31

Count of student terms spent on exchange in the calendar year. Outgoing: Waterloo students on exchange elsewhere; Incoming: students studying at Waterloo on exchange.

Total Graduate Enrolment (head count)

Source: Waterloo Institutional Analysis and Planning Office | As of: Nov. 1

All graduate students registered in fall term (full-time or part-time) includes non-degree students (which include diploma and certificate programs).

FTE Graduate Enrolment

Source: Waterloo Institutional Analysis and Planning Office | As of: May 1

FTE = (SpringFTE+FallFTE+WinterFTE)/3 | Each term’s FTE = FT+(PT*0.3)

Nanotechnology students are counted in the department in which they are registered; non-degree students are excluded.

Graduate Degrees Granted

Source: Waterloo Institutional Analysis and Planning Office | As of: Dec. 31

Total engineering graduate students graduating in the calendar year includes non-degree students (double-major degrees are counted only once).
C-4  FTE Graduate Student Admissions  
Source: Waterloo Institutional Analysis and Planning Office | As of: Nov.1  
Total of FTE (FT+(PT*0.3)) of all new graduate student admissions in 3 terms (calendar year)  
Nanotechnology students are counted in the department in which they are registered; non-degree students are excluded; course-based master are included with professional master prior to 2012  
C-5  Graduate Students:Faculty Ratio  
FTE graduate students/tenured and tenure-stream faculty members  
All Students includes non-degree students; Research Students includes PhD+Research Master students only; totals might not add precisely due to rounding  
C-6  Graduate Degrees Granted:Faculty Ratio  
Graduate degrees granted/TTS faculty members  
C-7  Graduate Proportion of Total FTE Enrolment  
FTE graduate students/(FTE graduate students+FTE undergraduate students)  
C-8  Graduate Student Financial Support  
Source: Waterloo Graduate Studies Office | As of: May 1  
Research Master Faculty average excludes Architecture. Includes IDSA and IMSA to international students.

D-1  Total Sponsored Research Funding  
Source: Waterloo Office of Research | As of: May 1  
Research funding data presented in multi-year graphs are the most up-to-date data available, and include Office of Research updates made to previous years’ funding after the final report for that year. Tabular data are not restated. Infrastructure funding includes CFI, ORF-RI and NSERC RTI grants.  
D-2  Total Tri-Council Funding  
Source: Waterloo Office of Research | As of: May 1  
D-3  NSERC Funding by type  
Source: Waterloo Office of Research | As of: May 1  
Discovery includes Accelerator Supplements; Partnerships was formerly called Industry  
D-4  University of Waterloo Share of NSERC Funding and Awards in Engineering Subject Groups  
Source: NSERC Awards Database | As of: May 1  
Includes NSERC awards and funding earned by any University of Waterloo researcher in 19 NSERC research subject areas (comprised of 157 subjects) identified as related to engineering (Agricultural Eng, Artificial Intelligence, Biomedical Eng, Chemical Eng, Civil Eng, Design&Manufacturing, Electrical&EElectronic Eng, Environmental Eng, Fluid Mechanics, Forest Eng, Fuel&Energy Tech, Industrial Eng, Information Tech, Materials Sci&Tech, Mechanical Eng, Mining&Mineral Processing, Nuclear Eng, Robotics, Structural Eng)  
D-5  Provincial Funding by type  
Source: Waterloo Office of Research | As of: May 1  
Other includes Ministry, FedDev and Ontario Research Chair funding  
D-6  Industry Funding by source  
Source: Waterloo Office of Research | As of: May 1  
D-7  Total Sponsored Research Funding:Faculty Ratio  
Sponsored research funds/tenured and tenure-stream faculty members  
D-8  Total Sponsored Research Funding:Budget Ratio  
Sponsored research funds/permanent recurring budget  
D-9  Research Chair Holders  
Source: Engineering Research Office & Dean of Engineering Office | As of: May 1  
D-10 University of Waterloo Documents in Engineering, Materials Science or Computer Science Publications Indexed by Thomson Reuters  
Limited to documents in publications indexed by Thomson Reuters. Includes publications by all researchers affiliated with the University of Waterloo in publications classified by Thomson Reuters Essential Science Indicators as engineering, materials science, or computer science. Includes all documents published in each five-year period (over 95% of documents are articles and proceedings papers).  
D-11 Category Normalized Citation Impact (for each of the categories Engineering, Materials Science and Computer Science) of University of Waterloo Documents in Publications Indexed by Thomson Reuters  
Category Normalized Citation Impact =Impact (citations per paper) of an institution in a subject area relative to the impact of all institutions in the subject area overall, normalized for subject year and document type. Publications and citations are both limited to Thomson Reuters-indexed publications.  
D-12 % of University of Waterloo Documents in Engineering, Materials Science or Computer Science Publications Indexed by Thomson Reuters that are in the Top 10%  
Percentage of total Waterloo documents in the given subject area that are in the top 10% of all papers in that subject area, based on citations by category, year and document type. Publications and citations are both limited to Thomson Reuters-indexed publications.

D-13 % of University of Waterloo Documents in Engineering, Materials Science or Computer Science Publications Indexed by Thomson Reuters with International Collaboration
% of total Waterloo documents in the given subject area that contain one or more international co-authors.

E-1 Women in Engineering Disciplines and Women in Architecture
& Undergraduate year one new admissions excludes continuing students, Nov. 1
E-2 All undergraduate students = head count, Nov. 1
Undergraduate degrees granted in the calendar year, Dec. 31
All graduate students = head count, Nov. 1
Graduate degrees granted for the calendar year, Dec. 31
Professors = regular faculty, May 1

F-1 International Students
Undergraduate year one new admissions excludes continuing students, Nov. 1
All undergraduate students = head count, Nov. 1
Undergraduate degrees granted in the calendar year, Dec. 31
Undergraduate Co-op Work Terms = # and % of "employed" terms outside Canada, Dec. 31
All graduate students = head count, Nov. 1
Graduate degrees granted for the calendar year, Dec. 31
Outgoing Exchange Students = Terms spent by Waterloo students on exchange elsewhere, Dec. 31
Incoming Exchange Students = Terms spent by students studying at Waterloo on exchange, Dec. 31

G-1 Space Holdings
Source: Waterloo Institutional Analysis and Planning Office | As of: May 1
Space Holdings excludes Architecture and Conrad
In May 2014 previous space holdings calculations, which included projections for space under construction, were updated with actual figures. Baseline and previous year data have been restated with actuals.

H-1 Total Alumni
Source: Waterloo Office of Alumni Affairs | As of: Dec. 31
Total of all alumni who have graduated with a degree from Waterloo Engineering
Includes all Architecture, Conrad, and software engineering alumni; includes deceased and honorary alumni; count by preferred major (each alumnus is counted only once)

H-2 Engineering Alumni Donating to the University of Waterloo in the year
Source: Waterloo Office of Alumni Affairs | As of: Dec. 31
Includes donations by alumni in the given calendar year

H-3 Engineering Alumni Donating to the University of Waterloo in their lifetime
Source: Waterloo Office of Alumni Affairs | As of: Dec. 31
Includes donations by alumni at any time before December 31 of the current year

H-4 Funds Raised for the Faculty of Engineering
Source: Waterloo Office of Development | As of: May 1
Cash Received includes all cash, gifts-in-kind and other gifts received (including payments on pledges counted in previous years); New pledges includes all pledges, cash, gifts-in-kind and other gifts raised (including those not paid this year)

H-5 Campaign Progress to Date
Source: Waterloo Office of Development | As of: May 1
*Educating the Engineer of the Future Campaign* target set and progress tracked from May 1, 2013 onward.
“Other” includes private sector research funds.

H-6 Alumni Attending Selected Class Reunions
Source: Engineering Alumni Office | As of: Dec. 31
Includes only departments with an undergraduate program in the given reunion year

H-7 Alumni Events
Source: Engineering Alumni Office | As of: Dec. 31

H-8 Dean’s Advisory Council Members
Source: Engineering Advancement Office | As of: May 1