Waterloo Engineering Strategic Plan 2011-2018

Building on Excellence

Progress Report 2016/17

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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.

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 is the formal outcome of the fourth such 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.

The Engineering Graduate office looks forward to continued improvements in the coming years.

Our faculty and staff complements remained relatively consistent compared to the prior year. Of the 310 faculty, 17.91% (16.38% excluding Architecture) are female. Comparatively, NCDEAS – Engineers Canada reported that the percentage of female faculty in Canadian Engineering departments is 14.9% as at 2016; thus indicating that Waterloo Engineering is well above the average. The staff complement increased by 4 positions compared to the prior year; maintaining a stable faculty to staff ratio of 1.33:1 across academic and administrative units. 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 7,630 students, 27% of which are female. We continue to attract large numbers of very high-quality applicants: In 2016, 87% of entering students had a final high school average of 90% or higher, an affirmation of the exceptionally high quality students we attract to our renowned undergraduate program. Waterloo Engineering students completed a record 8,514 co-op work terms, earning $112M and achieving a 98% employment rate in 2016. Ongoing strategies to enhance the undergraduate student experience and success show promising results. Waterloo Engineering continues to foster an experiential learning environment. These activities are evidenced by the high participation rates in the Sedra Student Design Centre (SDC). Well over 500 students, on over 30 different student teams regularly access the resources of SDC in a typical term. Of the many student teams, Waterloop has been particularly exceptional and exemplifies our students’ commitment to designing solutions to society’s greatest problems. This is the only team representing Canada in the SpaceX Hyperloop Competition, a North American university level competition to build the fastest and safest half-scale Hyperloop prototype. Our co-operative education program remains a cornerstone of the undergraduate program.

Enrolment in our graduate programs has increased by 31% over the last 10 years to 1,872 students. PhD students received an average funding support of $40,840; representing an increase of 5% compared to the prior year. Research Masters students received an average funding support of $30,226; consistent with the prior year. 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. The Engineering Graduate office looks forward to continued improvements in the coming years.

In the 2016/17 fiscal year, the Faculty of Engineering earned $64.4M in research funding, of which more than one third came from various NSERC programs. 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, last year Chen Zhongwei and John Yeow became members of the Royal Society of Canada’s College of New Scholars, Artists and Scientists, and Sherman Shen was named the University Professor. Luis Ricardez-Sandoval, Stephen Smith and Lin Tan became new Tier 2, Canada Research Chair and seven junior faculty members received the province’s Early Researcher Awards. Waterloo Engineering applied for the prestigious C150 and Canada Excellence Research Chair. We look forward to receiving results on the applications in early 2018.

In 2016/17, 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 December 2016 (238 participants) and April 2017 (114 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. During the year, Gordon Stubley, Associate Dean, Teaching, was awarded the 3M National Teaching Fellowship. The Engineering Ideas Clinic™ continues to provide exciting opportunities for students to apply technical knowledge in a...
hands-on setting. The students thrive in the Clinic’s reflective learning environment. Over 2000 unique students from 10 programs participated in at least one of the 21 Ideas Clinic activities.

The Waterloo Engineering outreach program continued to be in high demand during 2016/2017. 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 has increased by 96% since 2009. In order to better support these students, a Women in Engineering Living Learning Community centre will be launched in Fall 2017. 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 proportion of co-operative education work terms filled outside of Canada increased to a record high of 1,519 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 leads to great innovation. To date, over 650 startups have been identified with Waterloo Engineering students, researchers or alumni as founders. We awarded $60K to our entrepreneurial students in 2016/17 through the Norman Esch Entrepreneurship Awards for Capstone Design. Through the Engineer of the Future Fund, a total of 24 entrepreneurial organization were supported. In 2016/17, 47 students from 11 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 startups 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. Waterloo Engineering increased their current space by 3,239 nasm through the repurposing of the EC4 building and looks forward to Engineering 7 opening in the next year. 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 continues to secure philanthropic support for the faculty’s strategic priorities. In November 2015, we launched the Educating the Engineer of the Future campaign with the Engineering 7 ground-breaking event. With a goal to raise $70M from private sector sources, we have raised $73.3M to date. 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.

Overall, this report highlights another very successful year of progress toward our strategic goals. We have achieved this success through the ongoing commitment of the faculty’s leadership and the exemplary work of all our students, staff, faculty, alumni and partners. We look forward to another excellent year and launching the development process for the next strategic plan starting in 2017/18.
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 C5: Support the Successful Implementation of WatPD-Engineering
Goal C6: Ensure the Ongoing Accreditation of all Engineering Programs
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 D6: Support Teaching Innovations and Strategies for Integrating Learning
Goal D7: Expand the Scope of Waterloo Engineering Outreach Programs
Goal D8: Enhance the Waterloo Engineering Community through Participation in Outreach
Goal D9: Increase the Participation of Women in Engineering at Waterloo
Goal D10: Build an Inclusive Atmosphere within Waterloo Engineering
Goal D11: Consolidate and Expand Internationalization Efforts within the Faculty of Engineering
Goal D12: Increase International Undergraduate Enrolments
Goal D13: Increase International Experience Opportunities for Undergraduates
Goal D14: Increase International Graduate Studies and Research Collaborations
Goal D15: Provide Academic Programming to Support Student Interest and Development in Entrepreneurship
Goal D16: Develop Extra-curricular Initiatives to Support and Encourage Entrepreneurial Students and Projects
Goal D17: Develop New Spaces and Infrastructure to Support Entrepreneurship and Innovation
Goal D18: Maintain a Current Comprehensive Space Plan for the Faculty
Goal D19: Create the Space Required to Meet Operational and Strategic Needs
Goal D20: Harmonize All Aspects of Safety within the Faculty of Engineering
Goal D21: Ensure a Quality Computing Environment
Goal D22: Enhance Support to Computing Clients
Goal D23: Support Improvements to Operational Efficiency and Innovation in Service Delivery
Goal D24: Secure the Philanthropic Support Required for our Priority Initiatives
Goal D25: 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>
<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, I3, 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>2016/17</th>
<th>% Change from Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty</td>
<td>310</td>
<td>14.3%</td>
</tr>
<tr>
<td>Staff</td>
<td>233</td>
<td>20.0%</td>
</tr>
<tr>
<td>Undergraduate Students (FTE)</td>
<td>6101</td>
<td>21.4%</td>
</tr>
<tr>
<td>Undergraduate Students (head count)</td>
<td>7630</td>
<td>20.2%</td>
</tr>
<tr>
<td>International Undergraduate Students</td>
<td>1011</td>
<td>118.8%</td>
</tr>
<tr>
<td>Female Undergraduate Students</td>
<td>2058</td>
<td>71.9%</td>
</tr>
<tr>
<td>Undergraduate Degrees Granted</td>
<td>1209</td>
<td>31.7%</td>
</tr>
<tr>
<td>Graduate Students (FTE)</td>
<td>1517</td>
<td>-0.1%</td>
</tr>
<tr>
<td>Graduate Students (head count)</td>
<td>1872</td>
<td>1.5%</td>
</tr>
<tr>
<td>International Graduate Students</td>
<td>919</td>
<td>46.8%</td>
</tr>
<tr>
<td>Female Graduate Students</td>
<td>536</td>
<td>21.5%</td>
</tr>
<tr>
<td>Research Graduate Students</td>
<td>1394</td>
<td>11.5%</td>
</tr>
<tr>
<td>Graduate Degrees Granted</td>
<td>603</td>
<td>5.2%</td>
</tr>
<tr>
<td>PhD Degrees Granted</td>
<td>144</td>
<td>53.2%</td>
</tr>
<tr>
<td>Sponsored Research Funds ($Ms)</td>
<td>$64.4</td>
<td>6.6%</td>
</tr>
<tr>
<td>Alumni</td>
<td>42,924</td>
<td>29.9%</td>
</tr>
<tr>
<td>Main Campus Space Holdings (nasm)</td>
<td>60,596</td>
<td>25.6%</td>
</tr>
<tr>
<td>Permanent Recurring Budget ($Ms)</td>
<td>$90.1</td>
<td>40.1%</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>2016/17</th>
<th>% Change from Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female Faculty/Total Faculty</td>
<td>17.9%</td>
<td>27.9%</td>
</tr>
<tr>
<td>Faculty/Staff</td>
<td>1.33</td>
<td>-5.0%</td>
</tr>
<tr>
<td>Undergraduate Students/Faculty</td>
<td>19.3</td>
<td>9.0%</td>
</tr>
<tr>
<td>International Undergraduates/Total Undergraduates</td>
<td>13.3%</td>
<td>81.5%</td>
</tr>
<tr>
<td>Female Undergraduates/Total Undergraduates</td>
<td>27.0%</td>
<td>42.7%</td>
</tr>
<tr>
<td>Undergraduate Degrees Granted/Faculty</td>
<td>3.9</td>
<td>10.3%</td>
</tr>
<tr>
<td>Graduate Students/Faculty</td>
<td>5.4</td>
<td>-11.5%</td>
</tr>
<tr>
<td>Research Graduate Students/Faculty</td>
<td>4.3</td>
<td>-4.4%</td>
</tr>
<tr>
<td>International Graduate Students/Total Graduate Students</td>
<td>49.1%</td>
<td>44.8%</td>
</tr>
<tr>
<td>Female Graduate Students/Total Graduate Students</td>
<td>28.6%</td>
<td>19.8%</td>
</tr>
<tr>
<td>Graduate Degrees Granted/Faculty</td>
<td>2.2</td>
<td>-6.5%</td>
</tr>
<tr>
<td>PhD Degrees Granted/Faculty</td>
<td>0.5</td>
<td>27.5%</td>
</tr>
<tr>
<td>Graduate Students/Total Students</td>
<td>21.0%</td>
<td>-8.7%</td>
</tr>
<tr>
<td>Sponsored Research Funds/Faculty</td>
<td>$239,326</td>
<td>1.3%</td>
</tr>
<tr>
<td>Sponsored Research Funds/Permanent Recurring Budget</td>
<td>0.74</td>
<td>-26.7%</td>
</tr>
<tr>
<td>Main Campus Space Holdings/FTE Student (nasm)</td>
<td>8.0</td>
<td>2.4%</td>
</tr>
<tr>
<td>Permanent Recurring Budget/FTE Student</td>
<td>$11,826</td>
<td>20.3%</td>
</tr>
</tbody>
</table>

See Appendix IV. I 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 Sections III of this report.
Waterloo Engineering in Context

Table 4: Waterloo Engineering in the Institutional Context, 2016/17

<table>
<thead>
<tr>
<th>Metric</th>
<th>Share of University of Waterloo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate Students</td>
<td>23.5%</td>
</tr>
<tr>
<td>International Undergraduate</td>
<td>18.1%</td>
</tr>
<tr>
<td>Female Undergraduate Students</td>
<td>13.6%</td>
</tr>
<tr>
<td>Undergraduate Degrees Granted</td>
<td>20.3%</td>
</tr>
<tr>
<td>Graduate Students</td>
<td>35.4%</td>
</tr>
<tr>
<td>PhD Students</td>
<td>36.2%</td>
</tr>
<tr>
<td>International Graduate Students</td>
<td>52.5%</td>
</tr>
<tr>
<td>Female Graduate Students</td>
<td>23.7%</td>
</tr>
<tr>
<td>Graduate Degrees Granted</td>
<td>30.0%</td>
</tr>
<tr>
<td>PhD Degrees Granted</td>
<td>43.4%</td>
</tr>
<tr>
<td>Regular Faculty Members</td>
<td>25.1%</td>
</tr>
<tr>
<td>Sponsored Research Funds</td>
<td>31.3%</td>
</tr>
<tr>
<td>Alumni</td>
<td>22.9%</td>
</tr>
</tbody>
</table>

Table 5: Waterloo Engineering in the Provincial and National Contexts, 2016

<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>14.6%</td>
<td>6.8%</td>
</tr>
<tr>
<td>International Undergraduate</td>
<td>12.7%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Female Undergraduate Students</td>
<td>16.6%</td>
<td>7.9%</td>
</tr>
<tr>
<td>Undergraduate Degrees Granted</td>
<td>17.0%</td>
<td>7.9%</td>
</tr>
<tr>
<td>Graduate Students</td>
<td>14.9%</td>
<td>5.8%</td>
</tr>
<tr>
<td>PhD Students</td>
<td>19.0%</td>
<td>7.1%</td>
</tr>
<tr>
<td>International Graduate Students</td>
<td>16.6%</td>
<td>5.7%</td>
</tr>
<tr>
<td>Female Graduate Students</td>
<td>14.9%</td>
<td>5.9%</td>
</tr>
<tr>
<td>Graduate Degrees Granted</td>
<td>14.1%</td>
<td>7.0%</td>
</tr>
<tr>
<td>PhD Degrees Granted</td>
<td>22.1%</td>
<td>9.5%</td>
</tr>
<tr>
<td>Total Faculty</td>
<td>16.6%</td>
<td>6.7%</td>
</tr>
<tr>
<td>Female Faculty</td>
<td>17.7%</td>
<td>7.3%</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>60</td>
<td>3</td>
</tr>
<tr>
<td>Taiwan Rankings</td>
<td>69</td>
<td>2</td>
</tr>
<tr>
<td>Times Higher Education World University Rankings</td>
<td>78</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>

Table 7(a): 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)</td>
<td>4</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>

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.

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 14.3% and our staff complement by 18.8%. Section III.A of this report provides further information about our faculty and staff complements and the growth in both 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 will continue to remain a priority as we roll out our new including biomedical and architectural engineering programs, and the expansion of the mechatronics engineering program.

Goal A1: Increase the Faculty Complement Strategically

- As of May 1, 2017, our faculty complement was at 91.3% of target. There had been a slight decline of 1.2%, relative to the same time last year. However, actual complement only declined by 0.28 FTE while the target increased, year-over-year, by 4 FTEs. Additional hires will be prioritized in the coming year to ensure emerging program development needs are met.

![Figure 1: Faculty Complement Plan Performance to Target](image1.png)

![Figure 2: Faculty Complement Plan Performance to Target, % Women](image2.png)

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

- In 2016/17, 10 full-time equivalent (FTE) new faculty members joined the Faculty of Engineering and 13 positions were vacated due to retirements, resignations or ends of contracts, resulting in a net loss of 3 FTEs year-over-year.
- Search for 15 Mission Critical positions were initiated in 2016/17. 3 more positions were planned but not yet in search.
- The 10 positions were filled across 6 departments
- The proportion of female faculty member was at 18%, slightly higher than the target of 17.8%.
Recruit and hire outstanding faculty

- Faculty hiring continues to remain an important focus for the Faculty of Engineering with the continued expansion of the biomedical engineering and the mechatronics engineering programs.
- Additional hires are expected in the upcoming years to fill positions vacated through retirements, given that 35% 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

- In 2016/17, the staff target remained the same as the previous year.
- As of May 1, 2017, our staff complement reached 95% of target. This is up 2% from the same time last year. Staff hiring to meet target goals continues to be a priority.

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

- In 2016/17, 39 staff positions were filled. 3 of these positions were new and 26 were replacements. Waterloo Engineering will continue to focus on strategic hiring to ensure staff complement is appropriate.

Goal A3: Establish a Culture of Service Excellence

Provide staff development opportunities related to client service

- The annual staff conference (April 5-6, 2017) run by the University Organizational and Human Development (OHD) office offered a great program this year with a number of interesting topics including Transforming Polarized Thinking, Driving Change from the Grassroots and Student Employability Takes a Village.
- The staff conference was attended by 87 staff members in the Faculty of Engineering, which represents 37% of the full-time staff complement.
- Furthermore, 9 staff members in the Faculty of Engineering participated in the Management Development Day event on April 4, 2017. This full day event provided distinctive learning opportunities for managers to reflect on and further develop their management skills and practise in the key areas of leadership, change management, civility and inclusion, and employee engagement.

Recognize and reward excellence in client service

- The recipients of the 2016/17 staff excellence awards were announced at the staff and faculty awards dinner held in January are Emily Stafford (School of Architecture) and Martin Macleod (Engineering Computing).
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 Goal K2 of the advancement section of this report (see page 39).

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 now regularly solicits and supports nominations for deserving faculty members to prestigious national and international awards while the associate dean, teaching portfolio provides expertise and support specific to teaching awards for our outstanding instructors. The efforts and outcomes has been excellent, as presented in the research and teaching sections of this report, respectively (see pages 255 and 289).

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 147 courses through Organizational and Human Development (OHD) in 2016-17.
- The largest enrollment was for courses in OHD’s Exceptional Services (21), Integrity Matters (15), Personality Dimensions (24), Principles of Inclusivity (16) and Principles of Leadership (17).
- During the past year the following professional development took place to strengthen the skill set and capabilities of our Advancement staff, specifically:
  - Fundraising webinars and conferences for the Development staff in the area of transformational and major gift fundraising, capital campaign fundraising, donor relations, campaign marketing and branding.
  - Our Donor Relations Officer and Events Manager attended CASE conferences to learn more about their respective fields and best practices from other North American universities.
  - One of our Senior Communications Officers attended conferences on Forward Brand Storytelling and Storynomics that teaches communications and marketing professionals how to apply storytelling structure to their business to drive revenue, margins and brand loyalty.
  - One of our Senior Development Officers completed his Masters of Arts degree from the University of Waterloo and our Senior Alumni Officer is pursuing her Masters Degree at the University of Waterloo as well.

Goal A7: Fully Engage All Faculty Members
Promote a holistic and integrated view of teaching and research

- In 2016/17, we reviewed the summary data from the 2015/16 faculty merit reports as planned and gained some 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 progress was made on this strategy in 2016/17, it remains one we are committed to working on.

B. Undergraduate Studies

Waterloo Engineering’s undergraduate enrolment has increased by over 16% since 2011. Over the same time, the number of female students has increased by more than 58% and the number of international students by 70%. We continue to attract large numbers of very high-quality applicants: In 2016, 87% of entering students had a final high school average of 90% or higher, an affirmation of the exceptional students we attract to our renowned undergraduate program. To help identify the best future students from within this competitive applicant pool, Waterloo Engineering has piloted the Kira Talent video admissions platform to our admissions evaluation tools in 2017.

Waterloo Engineering continues to foster an experiential learning environment. These activities are evidenced by the high participation rates in the Sedra Student Design Centre and the Engineering Ideas Clinic™. These opportunities
provide unique learning experiences and provide students with an opportunity to apply and reflect on theoretical concepts.

Goal B1: Make Moderate and Strategic Increases to Undergraduate Intake Targets

- Figure 4, Waterloo Engineering slightly exceeded the undergraduate intake target for Fall 2016 admissions. Continued efforts are made to ensure that intake aligns with target due to the lab and tutorial space constraints.

- The apparent reduction in the international target from 2016 onward does not indicate a planned real reduction in international undergraduate student intake. Rather, this reduction reflects an administrative adjustment made to more accurately reflect the path that students in the Bridge to Academic Success in English (BASE) program follow. Though admitted to an engineering program, these students do not appear as engineering students in their first year and are thus not counted in the “actual” new intake figure below. These students do appear as continuing first-year students in engineering during their second year on campus.

Expand high-demand interdisciplinary undergraduate education

- Fall 2016 marked a very successful third year of 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 their intake targets increase over the coming years.

- A proposal for a new program in architectural engineering was developed and has to be approved by the Faculty (FOPS, FUGS, EFC and the University Senate) for a first intake in fall 2018.

- Plans for a new program in integrated design, to be offered by the School of Architecture, are expected to be brought forward in 2017/18.

- The engineering undergraduate recruitment staff, part of the engineering advancement and communications team, continue to work to attract excellent students to all of our undergraduate programs. Recruitment initiative highlights from this year included:
  - A continued increase in the number of Engineering Ambassadors
  - Over 600 groups were provided faculty-specific tours in the 2016-2017 recruitment cycle.
  - Over 120 trained faculty members actively volunteered for undergraduate recruitment events.
  - Over 17,000 participants pre-registered to attend the Fall and March Break Open Houses.

Enhance the international student applicant pool

- International student applications continue to experience strong growth in the key markets of India, Middle East and China.

- Current and future efforts by the engineering admissions team are focused on the diversification of markets. For example, Engineering has assisted the university’s Marketing and Undergraduate Recruitment office with a very successful entrance into Ecuador.
There is a current focus on growing U.S. interest through participation in the “Raise.me” micro-scholarships program for American high school students and attendance at new STEM College fairs in Houston, New York and San Francisco.

This year marks the creation of US finance and scholarship information for undergraduate recruitment initiatives focused on the USA.

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

- The decision was taken to begin using the Kira Talent video admissions platform as another tool to help identify the best possible future students. Beginning with the 2017 admissions cycle, applicants to all undergraduate programs, except architecture which already interviews applicants, will complete an online video exercise through the Kira Talent platform. Kira Talent is a proven platform, already in use to assess applicants to a scholarship within Waterloo Engineering and for admissions purposes by peer institutions and another high-demand Waterloo program.

**Goal B2: Enhance the Undergraduate Academic Program**

Redesign and modernize the lab experience

- Refer to Section L for Academic Unit Progress Report Summaries. Significant improvements in laboratory experiences are outlined in detail

Introduce a unique learning environment to Waterloo Engineering

- Excellent progress continues toward full implementation of the Engineering Ideas Clinic™ across all undergraduate programs, as reported in Goal E4 of the teaching section of this report (see page 28).

**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 will be replaced by at least one communication course. The Associate Dean, Undergraduate Studies continues to work with departments and programs to establish communication initiatives across the Faculty. Initiatives are in place in the Software Engineering and Mechanical Engineering programs. Civil Engineering has a well-developed plan ready to implement in fall 2017. Other departments are in the planning phase and most will have implementations by fall 2018.

- WEEF TAs continue to be trained and managed by the four engineering instructional support tutors and two first-year associate directors.

- 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 has fallen for the fourth consecutive year and is now the lowest since we began tracking this measure (1999). The average grade is also 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.

- The first-year taskforce, struck last year and chaired by Admissions Director Bill Anderson, has completed its work; one of the outcomes was the hiring of a co-op student to monitor first-year student loading. Results are expected next year.

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 it is expected that rule changes will be introduced to allow upper year students to drop one elective course (technical or a CSE) per term with the approval of their academic advisor.
• Engineering is working with the University's Diversity Office to enhance diversity training in first year. Current training involves a lecture format delivery. This year we are introducing short skits developed by the Diversity Office and performed by WEEF TAs.

**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. Last year counselling services and the undergraduate student Engineering Society (EngSoc) launched an informal discussion group over lunch hour. EngSoc is now working with counselling services to introduce the MATES (Mentor Assistance Through Education and Support) counselling-based peer support program in engineering. It is expected to launch this service in Fall 2017; it is expecting to offer counselling services over the lunch hour as well as after hours (e.g. 4:30 pm – 6:30 pm).

**Develop an annual student engagement survey**

- The most recent in-house survey was run in 2014. The aspiration is to develop a process by which this survey will be run in an ongoing fashion every two years. A student survey will be completed as part of the next strategic plan development.

- The National Survey of Student Engagement (NSSE) was completed by a third party ranking organization. The information is compiled and used for ranking against other institutions. Waterloo Engineering will receive a detailed, anonymous report of the responses for Engineering and Architecture students. This engagement information will provide insight into areas of improvement.

**Enhance first-year student transition experience**

- This priority has been a major focus of Engineering's Student Relations Officer (SRO) portfolio over the past year and into 2017/18.

- 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, an additional review of the new orientation schedule was completed in January 2017. Enhancements to orientation programming and events are planned for 2017.

- 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 from the Engineering First-Year Office, and the faculty relations manager for Engineering from the university's Student Success Office) reviewed the existing program from 2016 and worked to make enhancements for 2017.

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

- Waterloo Engineering proudly hosted the Engineering Student Societies Council of Ontario annual general meeting in 2017, with financial and staffing resources provided to ensure the success of this event.

- The Dean of Engineering provided $155,000 to support student teams and initiatives in 2016/17.

- Well over 500 students on over 30 different student teams regularly access the resources of our Sedra Student Design Centre (SDC) in a typical term. Resources include individual work spaces and access to shared resources including machine shop and welding, wood working and painting, computers, and electronics. Interest in student teams and resources provided to them continue to grow:
  - Interest in student teams continues to grow, with 5 new teams being added to the list of active student teams in the past year. These teams have all connected with faculty advisors who mentor and support the team leaders as they grow and move towards attending their first competitions.
  - Projects undertaken by student team are becoming more diverse and a better representation of all Engineering programs at Waterloo. The new teams that have formed in the past year have projects in the areas of Civil and Environmental Engineering, Software Engineering, Mechatronics Engineering and Management Engineering.
  - Hands-on project fabrication spaces and training continue to evolve to better meet the needs of students.
    - A Wood Projects Shop, with specialized equipment and staffed by a qualified supervisor, is being set up and will open shortly.
    - Plans are underway to open a Composites Shop in the SDC for student teams. This will also students to work in a safe, properly equipped environment as they manufacture parts using
carbon fibre. A series of hands-on workshops are also being planned to teach students the basic principles and techniques of composites.

- A high-voltage workspace specifically designed for student team projects that involve electric vehicles, is being constructed. This secure work area will only be accessible by teams that are working with high-voltage electrical systems, and will be equipped with a full set of safety equipment and special purpose tools.

- The 3D Print Centre, a retail space in the SDC that provides access to professional grade 3D printing equipment and printed circuit board manufacturing equipment, continues to expand the services it provides to students

  - A custom webform ordering system has been added. This, along with the on-line payment system allows students to place orders and pay remotely, and only have to come to campus to pick up their parts.

  - An electronics assembly area accessible to all students has been opened as part of the 3D Print Centre. Students have access to basic test and measurement equipment, soldering equipment, and a full set of surface mount packages, solder paste dispensing tools and a reflow oven. This is the only location on campus where students have free access to this type of equipment.

  - Collaboration with other 3D print providers across campus to provide information to students about costs and capabilities of the various types of equipment has been started. The goal is to inform students of the best choice for 3D printed parts (maker space vs. 3D Print Centre) for a particular application.

- External community events hosted annually at the SDC – including the FIRST LEGO League West Provincial Championship, the FIRST Robotics Competition Waterloo Regional, and the Waterloo Electric Vehicle (EV) Challenge – provide opportunities for students to connect as mentors with local schools or to volunteer to judge, referee or assist with setup at the events.

**Goal B5: Improve Undergraduate Studies Operations and Processes**

Develop enhanced opportunities for undergraduate students

- The multidisciplinary capstone courses GENE 403 and GENE 404 were offered for a third 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).

Enhance undergraduate processes

- The EUGO is working with Engineering Computing on two projects:

  - Automating the ranking process: Students’ ranks are now made available to students on the web via a secure log in procedure. The first phase has been implemented and now EC is working with the Registrar’s office to automate the process even further.

**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. Continued efforts are required to develop jobs for first work term students and to accommodate growth in the faculty due to the introduction of Biomedical Engineering and a second stream of Mechatronics Engineering. The implementation of the new employment administration system for co-op jobs, WaterlooWorks, was completed and is expected to offer significant opportunities for analysis. The WatPD Engineering program continues to have high completion rates and to receive positive evaluations by students.

**Goal B6: Increase the Number of Co-op Jobs**

Implement a program-focused initiative to assist in job development

- CECA continues to work with specific programs that have a low job/student ratio to review the employment situation and to develop a plan to address the low job/student ratio.

Develop additional international work term opportunities
As per the figure below, it can be observed that the number of international jobs in 2016 exceeded the target. This is the fifth consecutive year that this has been achieved. A majority of the new jobs were in the US. Efforts to develop jobs outside of North America have proven to be challenging.

Launch a research co-op program

Some progress has been achieved with the co-op 2.0 initiative and the first Co-op Certificate for work in research-focused positions on multiple work terms approved for Fall 2018 incoming students.

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), which was launched in 2014, is offering opportunities for 18 to 20 students per term to receive one week of workplace skills training and then work 3-5 week placements with start-ups. BETS placements are constrained to 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 nine elective WatPD courses including one WatPD Engineering course (PD22), Professionalism and Ethics in Engineering Practice, which aims to prepare students for the Professional Engineers Ontario’s Professional Practice Exam. Two new elective courses, PD11 (Processes for Technical Report Writing) and PD12 (Learning and Reflection in the Workplace), have been created and offered since Fall 2016. Three PD courses have been updated, PD21 (Developing Effective Plans), PD4 (Teamwork) and PD3 (Communication). Student overall course evaluation for WatPD elective courses is very similar to that of students from the other five faculties.

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

- The WatPD Engineering curriculum committee has initiated a review of the WatPD Engineering program.

- WatPD is reviewing its existing practices and exploring new opportunities to connect with students, staff and faculty.
Accreditation

The faculty continues to develop an outcomes process for program improvement that is mandated by CEAB. One of the six lecturer positions and one of the four accreditation assistant positions have been replaced by new members. Progress has been made on the refinement of curriculum maps and the development of processes for data collection and analysis. The development of processes for continual program improvement is moving very slowly and remains at the early stage of development. Significant work and collective efforts remain to be done to meet the CEAB expectations.

Goal B9: Ensure the Ongoing Accreditation of all Engineering Programs

Implement a system of outcomes assessment for all programs

- All 13 programs continue to develop their outcomes assessment and continual improvement processes. A set of common tools and processes is being finalized under the leadership of the Graduate Attribute Lecturers (GALs) which will be used to facilitate the outcomes process, tracking its progress and for reporting purposes.
- The integration of the six GALs and four accreditation assistants is progressing well.
- Development of curriculum maps and plans for data collection and analysis has improved but remains a complex and long process. The progress on the development of continual improvement processes has been extremely slow.

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 increased compared to 2016 but remains below the targeted value. Efforts to encourage and assist faculty with registration continue. The promotion of the importance of professional registration and how it is done will be reviewed.

Figure 6: Regular Faculty PEng Status Performance to Target

C. Graduate Studies

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. This process improved significantly despite a large increase in number of applications. With regards to admissions, the intake to graduate programs reached 97% of the overall target. This represents an increase of 25 students compared to the prior year. Although the overall target was nearly met, this is the result of offsetting variances observed in key target areas. Details regarding the variance breakdown are discussed below.

Goal C1: Strategically Increase Graduate Enrolment

- In 2016, intake was 97% of target. Although the percentage against target is slightly lower than in 2015 (98%), the number of students increased by 4% compared to the prior year.
- It is clear that demand from international applicants for all program categories is very strong. This interest reflects the world-renowned recognition of Waterloo Engineering. Given this demand, the EGSO (Engineering Graduate Studies Officer) will continue to develop necessary strategies for identifying and attracting top quality applicants and for developing financial models that are sustainable.
• Conversely, intake of domestic students (across all programs) only reached 76% of target. The largest deviation between actual and target was associated with the professional master’s programs.

• The research master’s continues to outperform intake targets, reaching 104% of target. This offsets target variances in other programs: 93% for PhD and 94% for professional master’s.

Figure 7: Graduate Intake Plan Performance to Target

Introduce new graduate programs in areas of strength

• Efforts are underway to introduce a new collaborative program in Data Analytics for research students. This is expected to move forward through various approvals beginning in Fall 17.

• Plans for graduate programs in Biomedical Engineering are under development. The EGSO will work collaboratively to determine the strategic development process for this program.

Enhance the professional master’s program

• Demand for admission to a number of the professional programs is very high, specifically from international applicants.

• Several departments have opened up their professional programs to international applicants or have dramatically increased their intake targets for international students to their professional programs.

• Several departments (SYDE, MME, CEE) have implemented changes to admission requirements to their professional programs to require the submission of GRE scores for applicants 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.

• Some departments have made, or are currently making, changes to their professional program requirements, including the introduction of core courses and Graduate Diplomas.

Develop and implement a strategic recruitment plan for graduate studies

• A new strategic enrolment manager (SEM) position has been created at the University level to support enrolment management for both undergraduate and graduate students. A new SEM position will also be created in FOE with a sole focus on graduate student recruitment and enrolment management for Engineering.

• As part of the recruitment process, efforts will be made to better articulate the pathway that graduate studies provides to a variety of career opportunities.

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

• A committee has been struck at the University level to explore co-op within graduate programs. Efforts within the FOE are on hold awaiting outcomes from this University led initiative.

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

• Guidelines for the admissions criteria for direct admission of applicants to the PhD program have been developed and utilized during the 2017 admission cycles. At present, these criteria appear to be effective and the number of students directly admitted will be expected to increase over time. The appropriateness of the admissions criteria will continue to be monitored.

Improved targeting of potential applicants
A “Contact a Professor” interface for our existing CRM (Customer Relationship Management) system is being developed. This interface will guide prospective applicants to research programs and connects them with potential supervisors. This system is expected to be implemented Spring 2017. The tool will enable tracking of the prospect pool, and enhance communications with prospects. Data will be collected to evaluate the effectiveness of the system.

Review and enhance PhD programs

- Data gathering took place in the current period. This included: focus group interviews with current PhD students, an investigation of PhD outcomes (e.g. where PhD graduates are employed), and a faculty barriers survey.
- The objective of the data gathering activities is to utilize the information to suggest changes/enhancements to PhD programs. However, development of specific program improvements have been delayed due to staff position vacancies in both EGSO and Graduate Marketing and Recruitment positions.

Goal C2: Improve Graduate Operations and Service

Provide excellent service to all clients

- The EGSO continues to seek opportunities to improve service to students, faculty members, and other academic support units.

Improve the quality and delivery of information

- EGSO now provides detailed in-cycle data regarding the processing of applications on a weekly basis.

Ensure timely processing of applications and admission correspondence

- Significant improvements have been made with application processing and admissions decisions. This has been achieved despite a large increase in the number of application. In 2016 the number of applications increased by 14% compared to the prior year.

Goal C3: Improve the Graduate Program

Foster consistently high quality graduate student supervision

- A Waterloo Engineering Award of Excellence in Graduate Student Supervision was developed and the first awards were given out at the Engineering Awards dinner this year.

Improve graduate course offerings

- The priorities of undergraduate course delivery can be a barrier to offering more graduate courses. Future meaningful progress on this goal will require a course audit and additional staffing resources.

Increase the academic rigour of graduate programs

- The EGSO and Academic units are more strictly enforcing deadlines for program extensions and PhD comprehensive examinations.

Improve the quality of students admitted to graduate programs

- The EGSO is working with the Graduate Recruitment Working Group to identify the characteristics of high quality students and then to ensure that admissions and application review processes within academic units make use of these characteristics to assess quality. As considerations continue, the following steps have been taken with the FOE:
  - Several departments have changed admission requirements for applications to professional programs to require the submission of GRE scores.
  - Several Departments are moving to the use of admission committees to review applicants.
  - The EGSO is more strictly enforcing admission requirements and approving fewer non-standard admissions and probationary admissions.
Goal C4: Enhance the Graduate Student Experience

Evaluate current graduate student funding

- The average level of financial support provided to graduate student in each of the different program types (e.g. MASc and PhD) is now being reviewed annually by the EGSO. Marketing materials are being updated as needed to reflect actual levels of funding rather than the guaranteed minimum level of funding.
- The FOE reviews the minimum level of funding for MASc students in engineering annually. It is expected that this support level will be increased at the beginning of the Spring 18 term by a Dean’s Scholarship Fund.
- A new model for funding research graduate students is being explored. If a new model were to be actioned, it must be financially sustainable; reward quality of applicants; recognize the limitations of individual faculty members to make long term funding commitments and to manage/absorb risk; be transparent so that applicants know what their costs and revenues will be as they compare competing offers; respect the role of faculty members in selecting students to supervise, and be competitive.

Establish a graduate student society in engineering

- Discussions were held with executive members of the Graduate Studies Association (GSA) and with members of the GSA from academic units within Engineering. The consensus was that a GSA at the Faculty level was not needed.

D. Research

In the 2016/17 fiscal year, the Faculty of Engineering earned $64.4M in research funding, of which more than one third came from various NSERC programs. The Faculty’s NSERC Collaborative Research and Development grants exceeded the $5M mark for the first time ever and was awarded three new NSERC Industrial Research Chairs. Funding from industry was $12.5M, a new high in the Faculty’s history. The Faculty also received two ORF Research Excellence grants of $4M each and an SSHRC Partnership grant valued at $2.5M. The Faculty led a successful FedDev Ontario grant worth of $8.9M to establish one of the five largest university based 3-D printing facilities in the world. In terms of honours and recognition, last year two researchers become members of the Royal Society of Canada’s College of New Scholars, Artists and Scientists, and one was named the University Professor. One faculty member became a new Canada Research Chair (see page 136) and seven junior faculty members received the province’s Early Researcher Awards (see page 126).

Goal D1: Increase Research Funding

- In 2016/17, the Faculty’s total research funding reached 94.66% of the target. Funding from NSERC exceeded $23M for the first time ever. Much of our NSERC funding was from the agency’s various partnership programs including its limited time Automotive Partnership Canada (APC) program. The Faculty has been highly successful with APC, and funding from this program comprised nearly 18% of the Faculty’s total tri-agency funding in 2014/15. With APC being phased out, the Faculty is actively pursuing alternative programs to fund its automotive research and has successfully secured two NSERC Industrial Research Chairs (IRC) in related areas.
- The Faculty’s collaboration with industry continues to grow. In 2016/17, our research funding from industry reached $12.5M and our professors collaborated with industry partners on more than 250 projects. The Faculty has been highly successful in leveraging industry contributions to attract additional funding from federal and provincial 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 are principal investigator (PIs) on two of the nation’s three recent successful NSERC SPG-N grants, a truly outstanding recognition and an example of our research leadership. NSERC funding for these two network grants will flow in starting the 2017/18 fiscal year.
Encourage and support researchers to pursue multi-year partnership programs

- In 2016/17, the Faculty received three new NSERC IRCs, which are for five years each and renewable. These IRCs are held by Professor Kaan Inal (Computational Mechanics for Efficient Automotive Structures), Professor Amir Khajepour (Holistic Vehicle Control) and Professor Ali Safavi-Naeini (Intelligent Antenna and Radio Systems). The Faculty also has a new NSERC Chair in Design Engineering awarded to Professor Sanjeev Bedi.

- To encourage and support researchers in applying for large partnership programs like the NSERC IRC and SPG-Project, the Faculty of Engineering routinely commits cash support.

- The Engineering Research Office (ERO) actively offers support for proposal development, application review and industry liaison for all sizes of partnership grants and provides logistics support for visits by on-site review committees and industry partners.

Support and motivate faculty to pursue special large funding programs

- To strengthen applications for programs like the CFI Innovation Fund (CFI-IF) and NSERC-CREATE, 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, Waterloo Engineering professors has been PIs on five successful grants, totalling nearly $15M. Much of the fund is expected to come to the Faculty of Engineering in the 2017/18 fiscal year.

- The ERO led by Jon Walgate and Dave Dietz, offers support to coordinate proposal development and liaise with industry partners and funding agencies for large programs such as FedDev. In the 2016/17 reporting year, a FedDev Ontario application developed with the ERO’s support has been awarded $8.9M. The fund is being used to develop one of the largest university based 3-D printing facilities in the world.

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

- The Faculty continues to set aside much of its CFI John R. Evans Leaders Fund (CFI-JELF) allocation to help academic units recruit the best faculty in strategic areas of research.

- The ERO offers support to academic units on CRC planning to attract and retain the best faculty.

**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 number of new and returning research partnerships.

- Faculty members are sent calls for research proposals to ensure they are aware of relevant opportunities.

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 are provided the opportunity to have their grant applications reviewed by ERO staff. To help prepare applications for large grants, faculty members are provided with dedicated writers on contract basis.

Develop stronger ties with industry
• The ERO continues to routinely hold meetings with large and small companies to discuss industrial challenges that can be addressed through research, and actively collaborates with the University's Corporate Research Partnership Managers and Centre for Career Action to raise awareness and visibility of our research strengths.

• Waterloo Engineering research is shared with broader audiences through conferences such as OCE Discovery and Waterloo Innovation Summit.

• The ERO supported themed research events held on campus in 2016/17 on topics including aerospace, defence, automotive, cybersecurity, 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.

• A database of faculty members' research applications has significantly improved the ERO’s ability to identify researcher expertise that is relevant to a company’s needs. The ERO continues to work towards linking external-facing websites to the appropriate internal database in order to further improve potential industry partners’ ability to find relevant researchers.

• The ERO is in contact with a broad spectrum of companies to rally support for strategic faculty initiatives including infrastructure, research, and undergraduate program expansion and startups. These conversations have deepened our 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. An example of an initiative involving industry support was in Engineering’s successful application to FedDev Ontario’s Investing in Commercial Partnerships program for the partial funding of the Multi-scale Additive Manufacturing lab in EC4.

Partner with a targeted set of leading global universities

• This strategy is reported on in Goal G4 of the internationalization section of this report (see page 35).

Goal D3: Eliminate Barriers to Research Success

Enable a culture of collaboration and co-operation

• Recently, Waterloo’s Faculties of Engineering and Mathematics jointly led the launch of two new research institutes – the Waterloo Artificial Intelligence Institute and the Cybersecurity and Privacy Institute. The launch of these two institutes is strategic and timely. Waterloo Engineering is already home to a number of Senate approved research institutes and prominent centres, such as the Waterloo Centre for Automotive Research, where researchers from various disciplines collaborate.

• The ERO is working to foster strong 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. Also, the ERO arranges grant writing support for large initiatives, and assistance organizing site visits for major funding programs.

• In 2016/17, two temporary writers were engaged to assist with review of the large volume of applications during the peak period of RTI and Discovery.

Improve access to resources

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

• The Faculty of Engineering normally allocates much of its CFI Infrastructure Operating and Maintenance 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 that can potentially be shared by multiple research groups.

• The Faculty realigned its machine shop facilities, allowing the shop in E3 to focus more the machining and fabrication needs of graduate students and research projects theses.

Improve the efficacy of communications

• Through frequent emails, faculty members are notified of potential funding opportunities, information session, webinars, etc. The ERO is working towards creating a better mechanism where faculty can find relevant information, important forms and notices of upcoming funding opportunities.
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 2016/17, the recipients of the Engineering Excellence Awards were Professors Hyung-Sool Lee (CEE), Simarjeet Saini (ECE), and Ali Elkamel (ChE).
- Professors Hossein Abouee Mehrizi (MSCI), Nasser Abukhdeir (ChE), Michal Bajcsy (ECE), Na Young Kim (ECE), Guo-Xing Miao (ECE), Michael Reimer (ECE), Alfred Yu (ECE) received the Ontario government’s Early Researcher Awards.
- Professors Mark Hancock (MSCI), Pin-Han Ho (ECE), Ning Jiang (SDE) and Stephen Smith (ECE) received NSERC Discovery Accelerator Supplements.
- Professor James Craig (CEE) is a new CRC-T2 in Hydrologic modelling & Analysis.
- Professor Xuemin (Sherman) Shen of ECE has been named a University Professor.
- Professors Zhongwei Chen (ChE) and John Yeow (SDE) have joined the 2016 cohort of the Royal Society of Canada’s (RSC) College of New Scholars, Artists and Scientists, which represents Canada’s next generation of leaders in the sciences and arts.
- Professor Frank Gu (ChE) has been named as a member of the 2017 cohort of the Royal Society of Canada’s (RSC) College of New Scholars, Artists and Scientists.
- Professor Weihua Zhuang (ECE) will be inducted as a Fellow of the RSC in November 2017.
- Professor Zhongwei Chen (ChE) will receive this year’s RSC Rutherford memorial Medal in Chemistry.
- Professor Keith Hipel (SDE) will receive this year’s RSC Miroslaw Romanowski Medal, Canada’s most prestigious environmental prize.

Increase public awareness of research strengths and achievements

- Waterloo Engineering research stories are being featured on the faculty’s and university’s social media channels, including Facebook and Twitter. Our researchers have been profiled in internal and external media more than 50 times in the past year. Additionally, Engineering was contacted numerous times by national and local media to request comment from research experts on topical news stories.

- Last year, a number of events served an important role in communicating our research:
  - The Waterloo Innovation Summit included a tour of Engineering 5 to see a sample of faculty members’ research as well as meet undergrad student teams and Engineering alumni who have founded local companies.
  - Engineering supported the inaugural Autotech Symposium held on campus that was organized by the Waterloo Economic Development Consortium, by providing speakers and tours of our research facilities.

- 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.

- The ERO developed the website for the Waterloo Artificial Intelligence Institute (Waterloo.ai) approved by Senate in June 2017. The website includes an overview of AI research expertise, featured AI technology projects, and a list of academic members. Efforts to attract corporate membership for the institute will begin in fall 2017.

- The ERO worked with the Engineering Marketing and Communications team to develop websites to profile strategic research topics in the faculty. In 2016/17 websites were created for robotics, additive manufacturing, autonomous vehicles, artificial intelligence, and data analytics to highlight the researchers and labs associated with these topic.

Goal D5: Strategically Identify and Assess Research Strengths

Pursue targeted partnerships and funding aligned with identified strength areas
In 2016/17, the ERO developed a large proposal for a Canada Excellence Research Chair in Human-Centered Robotics and Machine Intelligence. The total budget for the chair’s proposed research is nearly $25M.

In September 2017, the ERO submitted a nomination for 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.

In 2016/17, the Faculty led ‘Autonomoose’ became the first autonomous test vehicle licensed to operate on Canada’s public road. The fleet will grow in the coming year with multimillion dollar support from NSERC, CFI, the Province of Ontario and several private sector partners.

Waterloo Engineering has future plans to develop an Autonomous Vehicle Research Intelligence Lab (AVRIL). The facility will further support the Faculty’s research leadership in the field of automatic vehicles.

E. Teaching

Inaugurated in May 2012, the Associate Dean, Teaching (ADT) portfolio completed its fourth complete calendar year of operation. 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 clearly identified activities and the development of teaching excellence continues to be notable measures of significant progress.

Goal E1: Enhance Support for Teaching at the Faculty Level

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

- Every engineering department and the Conrad centre continues to have a teaching champion.
- Monthly lunch meetings with the teaching champions continued in the current year. These 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 Faculty interest. The monthly meetings facilitate an opportunity for communication and sharing. The groups will work together to develop a re-envisioned Annual Engineering Teaching Event to be held in late October 2017.
- As the ADT portfolio matures, it is clear its existence and participation in activities within the Faculty has resulted in teaching enhancements. The structural organization of the ADT portfolio has become more formalized and noticed independently from the particular office holders within the portfolio.

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

- Of particular focus in 2017 will be to re-structure the job position presently called “Assistant to the Associate Dean, Teaching.” As the ADT portfolio developed, so too did the function and qualifications requirements of this position.

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

Establish minimum teaching development expectations for all new faculty members

- 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. In the current period, the ADT met with 20 new faculty members.
- New faculty are welcomed to a bi-annual lunch to communicate procedures and practices. In the February, methods of assessment and criteria for awarding tenure were discussed.
- Student course evaluation results for all probationary and definite term faculty were 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 8 consultations with probationary term faculty members to discuss teaching development challenges and to offer advice for further development as appropriate.

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

- The ADT facilitated an Instructional Skills Workshop (ISW) for engineering (5 participants) and promoted the Centre for Teach Excellence (CTE) sessions to engineering instructors (11 engineering participants). The ADT continued to improve access to the Instructional Skills Workshop (ISW)
- The ADT held the Annual Engineering Teaching Event. The theme for the event was: "Assessment: Measuring the Impact of Our Teaching on Student Learning". 13 participants from Engineering attended this two-hour workshop (45 in 2015). While the turnout was lower than in 2015, participants fully engaged in the workshop activities.
• The Engineering Teaching SharePoint was appropriately maintained. The site provides all Engineering faculty and staff access to teaching resources; including workshop materials.

• The Teaching office offered the TA training workshop, ExpecTAtions in December 2016 (238 participants) and April 2017 (114 participants). The move from a late August offering to a December offering was necessitated by the changes in orientation dates.

• We promoted participation in annual teaching conference. The event was held April, 38 participants from Engineering were able to attend (48 in 2015).

• The ADT promoted participation in 2016 Teaching Excellence Academy (TEA) workshop.

• In October, the ADT co-facilitated (with CTE) a 2 hour workshop on threshold concepts for the SYDE retreat day.

Provide mentorship in teaching

• In 2016, the ADT met with 9 instructors to provide teaching mentorship. This includes meeting with 8 probationary instructors prompted by review of student course evaluations as mentioned above.

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, and resources for peer evaluation of teaching were developed by the ETDC in 2014, the extent and uniformity of these assessments across academic units is unclear. In 2016, the ADT will survey the academic units for present practices in assessing teaching potential and, through discussions with the Academic Policy Committee, develop a set of recommended practices for the Faculty.

Measure teaching quality and outcomes for individual and institutional improvement

• The ADT office remains focused on the maintenance and improvement of the student course evaluation processes. Progress in this area includes:
  - The adoption of the online delivery system, eValuate, for undergraduate and graduate course evaluations. After implementation, a thorough analysis of results was conducted to determine the impact of moving to an online delivery system; the impact was found to be insignificant.
  - Communication was provided to the faculty and department to reflect on the transition to electronic delivery.

Table 8: Undergraduate Course Evaluation Summative Question Responses, 2013-2016

<table>
<thead>
<tr>
<th>Year</th>
<th>Undergrad Courses</th>
<th>Undergrad. Q10 - What is your overall appraisal of the quality of teaching in this course?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>2016</td>
<td>723</td>
<td>78.1</td>
</tr>
<tr>
<td>2015</td>
<td>737</td>
<td>79.1</td>
</tr>
<tr>
<td>2014</td>
<td>711</td>
<td>78.8</td>
</tr>
<tr>
<td>2013</td>
<td>691</td>
<td>77.4</td>
</tr>
</tbody>
</table>

Table 9: Graduate Course Evaluation Summative Question Responses, 2013-2016

<table>
<thead>
<tr>
<th>Year</th>
<th>Graduate Courses</th>
<th>Graduate Q9 – Overall, I would rate this course as excellent … poor.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>2016</td>
<td>205</td>
<td>82.2</td>
</tr>
<tr>
<td>2015</td>
<td>179</td>
<td>83.2</td>
</tr>
<tr>
<td>2014</td>
<td>208</td>
<td>80.6</td>
</tr>
<tr>
<td>2013</td>
<td>185</td>
<td>79.8</td>
</tr>
</tbody>
</table>

• With the support of the Graduate Attributes Lecturers, the ADT facilitated a Faculty-wide exit survey in 2016. Resulting data and comments were shared with the departments for analysis and action.

Recognize and reward excellence in teaching
Six nominations were submitted for the Sandford Fleming Foundation Teaching Excellence Awards. The winners were: Hector Budman (CHE), Kaan Erkorkmaz (MME), and Igor Ivkovic (SYDE).

The ADT conducted meetings with departmental representatives to develop strategies for teaching award nominations in Engineering and to provide training on preparing nominations for University and external level awards.

To support Distinguished Teaching Award (DTA) nominations, the ADT office met with nominators and provided access to resources including a sample nomination package. For the 2016 competition, there were fourteen nominations under consideration and Bob McKillop (CEE) and Mark Pritzker (CHE) were two of four university-wide recipients. This marks the first time in 30 years that two Engineering faculty members received a DTA in the same year.

We continued to support the Engineering Student Society (EngSoc) Teaching Excellence Award process. Recipients were Derek Wright (ECE) Winter, Rania Al-Hammoud (CEE) Spring, and Chris Kohar (MME) Fall.

In spring 2016, the ADT office revised and resubmitted a nomination for a 3M National Teaching Fellowship, viewed as Canada’s premier recognition for teaching excellence and leadership in higher education. This nomination was successful; Gordon Stubley, Associate Dean, Teaching is now a 3M National Teaching Fellow. The knowledge and experience gained in the nomination process can be applied to future nomination efforts.

The ADT successfully supported the nomination of Carol Hulls for the Brightspace Innovation Award in Teaching and Learning.

Communicate commitment to the Faculty’s teaching mandate

The ADT office continues to develop the public-facing Teaching and Learning pages on the Faculty of Engineering website and the internal Engineering Teaching Development SharePoint site.

In co-operation with the group of University Teaching Fellows, the ADT supports 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 first year of the chair, over 2000 unique students from 10 programs participated in at least one of the 21 Ideas Clinic activities/initiatives including

- Engineering Design days activities
- Teamwork training modules
- Other standalone activities (such as the mechanics models in Civil Engineering, and using augmented reality in a data structures and algorithms course)

Engineering Design Days activities, which are typically 2-day long, immersive, hands-on, engineering design events, were run for the second time in Management Engineering, and were piloted in Biomedical, Computer, Electrical, Mechatronics, and Systems Design Engineering. Planning has started for Engineering Design Days activities for Mechanical and Civil Engineering as well as versions in second and third year.

Two, 4th year technical electives were offered with support from the Ideas Clinic. One of these courses was a cross-disciplinary course with students from Fine Arts. The second focussed on Analysis for Design.

A committee of staff and faculty from Engineering, the Centre for Teaching Excellence and the Student Success Office were given a LITE Full Grant to develop a set of training modules focussed on teamwork skills. Development of 4 out of 6 modules has now been completed.

With the help of Dr. Lambert, a capstone competition focused on Engineering Analysis was run for the first time in the Winter 2017 term. A team from Mechanical Engineering were the first recipients of this award. This competition is being expanded to broader definitions of analysis in 2018.

The Engineering Ideas Clinic continued its support of the Engineering BASE program (run by Renison) in the winter and spring terms.
The two Ideas Clinic staff positions were filled in the first year. Ms. Victoria Alderson started in Feb. 2017 as the Administrative Assistant for the Sedra Student Design Centre and the Engineering Ideas Clinic, and Mr. Chris Rennick started in late April 2017 as the Engineering Educational Developer with the Ideas Clinic. In addition, 16 Engineering undergraduate students were employed with the Ideas Clinic in the first year.

One paper on the Management Engineering Design Day implementation was presented at the Canadian Engineering Education Association Conference in Halifax, and one paper was presented at the American Society for Engineering Education Annual Conference in New Orleans in 2016.

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 continued to be in high demand during 2016/2017. 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. This speaks to the wide recognition of the excellent programming. Another highlight of the year was the expansion of the Engineering Science Quest program. Two additional camps were launched to meet the unwavering demand for the program. In 2010 we offered 12 camps (10 on campus, 2 off-campus). In 2016 the program has grown to 17 camps (14 on campus, 3 off-campus). The workshop program offered by Engineering Outreach continues to underperform against our targets. As an improvement initiative, a staff member has been assigned to increasing communication with local schools. It is expected that this strategy will increase the number of workshops in the next two years.

Goal F1: Expand the Scope of Waterloo Engineering Outreach Programs

Expand outreach activities to include high school programming

- The E-Cubed program, which focuses on engineering and entrepreneurship, continues to experience strong demand. The program filled 19 spots in 2016. This model of highly focused, one-week programming is being explored as an expansion opportunity as space/staffing allows.

- Engineering Outreach increased the number of high school Catalyst academic sections and staff. This increased the program enrollment from 36 in 2015 to 71 in 2016. The leadership program saw an increase in interest, 21 spots filled in 2015 compared to 30 in 2016.

- There was little interest from high schools in running a high school events surrounding the capstone design showcase in 2016. In 2017, this was dropped due to lack of interest from previous year, timing of the event (the majority being held during March Break), and a calendar that was already at capacity for that time period. This should be revisited in 2017/2018.

- In Winter 2017, the outreach office hosted an event in partnership with the Goethe Institute (WE GO.Design).
Increase the breadth of Kitchener-Waterloo school engagement

- In Fall 2017 it is expected that website redesign will simplify the signup process for workshop programs. The information available will clearly document the process to ensure clarity to interested parties.
- Due to the resource restriction in the period, workshop program improvements were delayed. It is expected that staff levels will stabilize in the next period; resulting in renewed focus.

Figure 10: ESQ Workshop 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 plans for increasing Waterloo Engineering community engagement were drafted. It is expected that the plans will be reviewed in 2017/2018; with the intentions of executing the plans at the end of the year.
- The method of tracking/engaging mentors has changed this past year. Working within the new system will be critical in implementing engagement activities.
- Engineering Explorations is an open house geared towards youth in grades 6 – 8. To ensure the success of the event, the program will be revised in 2018 to improve opportunities for engineering community members’ engagement.

Diversity

The Engineering Outreach office continued with its current focus on increasing the number of females at all levels in the faculty (undergraduate to faculty). In addition to the annual events, the office staff have been taking a more active role in the larger University discussions on such matters, by sitting on various committees and groups. A new initiative which will start in September 2017 is the creation of the Women in Engineering Living Learning Community (WiE-LLC). The WiE-LLC has been developed in partnership with St. Paul’s and will consist of a cluster of residence rooms for 1st year female engineering undergraduate students. The target for this program is 40 students with an emphasis on women enrolled in disciplines which have the lowest female representation (MME, ECE and Software Engineering). Upper year female engineering student peer leaders have be identified and hired as part of the WiE-LLC and programming has been developed with a working group. Activities in the WiE-LLC will be open to other female undergraduate students who do not live in the LLC.

The application for a seven year SSHRC grant titled “Engendering Success in STEM” was successful. As part of the grant, The Engineering Outreach office will be engaged in PRISM, (Promoting Rising Inclusion and STEM Motivation). The activities associated with this project will start in 2017/2018.

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 remained similar to those in 2014 and 2015. Despite the consistency, we saw an increase in our number (512) and percentage (29.1%) of women entering first year engineering in September 2016. Nationally in 2016 the percentage women going into engineering programs was 21%. University of Waterloo Engineering continues to significantly outperform most schools in attracting female engineering students.

Figure 11: Female Engineering Undergraduate Confirmation Rate Performance to Target

Establish best practices related to the recruitment of women faculty
- Similar to previous years, the Associate Dean Outreach has offered to meet with each Department Advisory Committees on Appointments (DACA) to discuss diversity in the applicant pool and best hiring practices.
- In the current period, the percentage of women on faculty met the target; 18% of faculty members are female. This represents a 28% increase since the start of the strategic plan.

Develop a better understanding of the experience of women in engineering at Waterloo
- A survey of current female and male engineering undergraduate students was completed as part of the Hydro One initiative. The survey asked a number of questions of both male and female students around experiences at Waterloo as well as co-op. Based on the results of this report, enhanced programming to support women in both their academic and co-op terms is being developed.
- In 2016/2017, the initial survey of the Women in Engineering (WiE) undergraduate experience was completed. The results of this survey are being used to inform activities going forward. The survey will be run again in three to four years to see if programming is still relevant and if attitudes have changed.

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 Associate Dean Outreach’s role is to provide support and to discuss issues around diversity and inclusivity. The outreach office continues to work and learn from the social psychologists on campus on best practices to allow our female students to support women in our engineering programs. The office is supporting 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 1st year with a particular focus on female students. This study started in September 2015 and will continue over the next four years.

G. Internationalization

The Associate Dean (AD), International, and his staff continue to develop and enhance campus and international partnerships related to academic mobility and international collaborative research partnerships. The number of international undergraduate students increased by 10% compared to the prior year. Similarly, the number of international graduate students increased by 8%. In the 2016/17 planning year, 15 international research agreements were signed or renewed, and three new student exchange agreements were created.

Goal G1: Consolidate and Expand Internationalization Efforts within the Faculty of Engineering
Enhance co-ordination and collaboration on internationalization across the faculty
• The Engineering International Office (EIO) continues to work with the Engineering Computing Office to further develop improvements to the website; specifically the appointment schedule application.

• The EIO will continue to work with Waterloo International to develop best practices in travel safety for all students, faculty and staff.

Facilitate visits by international delegations to Waterloo Engineering

• The Associate Dean, International continues to expand internationalization efforts within the Faculty of Engineering through international workshops. In March, a workshop was held at Southeast University in Nanjing, China. Participants from Waterloo included faculty members from Civil and Environmental Engineering and Electrical and Computer Engineering. Workshops vary not only in the primary areas of research presented and discussed, but also in the diversity of engineering faculty researchers participating.

• In addition to travelling abroad, the Associate Dean’s office hosted, or assisted in hosting, many international visiting delegations and student groups

Goal G2: Increase International Undergraduate Enrolments

Enhance international recruitment efforts

• Waterloo Engineering continues to exceed its undergraduate intake target for international students, as shown in Figure 12

• Details on the Faculty of Engineering’s international recruitment initiatives are provided in the undergraduate studies section of this report. See page 14.

Figure 22: International Undergraduate Student Intake Plan Performance to Target

Provide additional support to Waterloo Engineering international students

• The Engineering International office continues to support international student activity on the Waterloo campus. This is achieved through collaboration with Student Success Office (SSO) and the Engineering Society (EngSoc) on student centered events.

• The Engineering International office continues to try new methods to encourage participation and engage International students in Engineering. This continues to be a challenge, but the EIO is dedicated the further research and understand how improvements can be made.

Goal G3: Increase International Experience Opportunities for Undergraduates

Increase participation in international exchange

• In an effort to promote international experience opportunities for undergraduate students, the Associate Dean, International has secured funding to offer five $1,000 awards. These funds will assist Engineering students, demonstrating financial need, to participate in an established international exchange.

• In 2016, students engaged in 116 exchange terms. As noted in Figure 13, the exchange program rebounded from the prior year performance. This indicates that improvement strategies are resulting in positive change.

• The Associate Dean, International is facilitating the creation of institutional agreements in consultation with Waterloo International and Co-operative Education & Career Action (CECA). An agreement is currently being reviewed by an UK institution. This proposal will be a hybrid agreement as it will allow students travelling from Waterloo to participate in both an academic and a Co-op work term exchange. Students coming to Waterloo...
on exchange, would only be permitted to study. This structure will ensure that the maximum number of work term opportunities will be maintained for Waterloo students.

- The Engineering International Office has continued with a number of initiatives to enhance awareness and increase participation in undergraduate exchange through:
  - Information sessions held with Waterloo International and independently. These occur through visits to all 1B, 2A and 2B classes to present exchange opportunities and requirements. Additionally, the EIO works in collaboration with EngSoc to hold multiple information sessions throughout the year.
  - Increased communications with outbound exchange students to facilitate the navigation through the online application and information system, Passport.
  - Regular discussions with Waterloo International to address barriers in increasing student academic exchange terms to Waterloo. Initial discussions with new staff members and a new structure in Waterloo International have resulted in positive changes.

![Figure 33: Undergraduate International Exchange Terms](image)

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. More detail on international co-op work term development is presented under Goal B6 of the co-operative education section of this report (see page 18).
- The EIO continues to work with CECA towards Waterloo Works providing access for UW Exchange students. A pilot is expected to take place for Fall 2017 placements.
- Engineers Without Borders Waterloo is a student chapter of Engineers Without Borders Canada, an organization focused on using systems thinking and other engineering concepts to address poverty in developing nations. The University of Waterloo Engineering chapter now focuses on development work within Canada. Three main project areas include: fair trade, Indigenous solidarity and global engineering. Considering the organization’s focus shift from international ventures to national, this group will be a lost opportunity for international co-op experience.

![Figure 44: International Co-op Work Terms Performance to Target](image)
Goal G4: Increase International Graduate Studies and Research Collaborations

Pursue strategic internationalization in graduate studies

- In this planning year, graduate student engagement from co-tutelle agreements has declined slightly. During the current period, only two new students took advantage of this opportunity. International Visiting Graduate (IVGS) numbers seem to remain constant with fluctuations between 30 and 50 student visitors annually. Based on an informal assessment of enrollment trends in these types of graduate international mobility opportunities, shorter duration opportunities are being explored. It is possible that a shorter duration may result in higher participation rates. Shorter mobility opportunities would likely have less impact on a student’s time to program completion making them more attractive. In the current planning year, the EIO will investigate more short term visit opportunities for this student group, like short-term internships or course package offerings with new and existing international partners.

- The EIO hopes to improve in-bound graduate students’ experiences by offering one point of contact in Engineering from admission to course enrollment. The duties and responsibilities of admitting and advising in-bound, non-degree graduate exchange students will be absorbed by this office in the hope of providing faster and more consistent service through a ‘one stop shopping’ approach.

- Professor-to-professor partnerships resulting from workshops such as the one held at Southeast University in Nanjing, China, in March 2016 should help to initiate joint graduate student supervision between participating institutions. This will present increased opportunities for graduate student mobility.

Develop an international research strategy

- 15 new and renewed international mobility and research exchange agreements we finalized this year. Waterloo Engineering now has a total of 91 exchange partners. The International office with continue to concentrate on the pursuit of additional exchange opportunities in newer program areas in Engineering, such as Biomedical Engineering.

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 Engineer 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. UW is #20 (#1 Canadian university) on The Top 50 University Producing VC-backed Entrepreneurs – Undergraduate Program. On campus, Waterloo Engineering students again dominated all three terms of the Velocity Fund Finals on campus, winning the majority of wards and a top prize in each competition.

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

Maintain our flagship graduate programming

- Our Conrad Business, Entrepreneurship and Technology Centre (Conrad) continues 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.

Develop additional academic programs for students interested in entrepreneurship

- During the Spring 2015 convocation, the first person graduated with the Engineering Entrepreneurship option. In 2016/17, 12 students were enrolled in the specialized option.

- Conrad’s undergraduate minor program in entrepreneurship was launched for students across campus in September 2015.

- Conrad’s entrepreneurship diploma program for professional master graduate students in engineering remains very successful. A proposal to expand the program is under consideration.

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

- Conrad has secured a new three-year mandate to run the Enterprise Co-op (E Co-op) program for the University of Waterloo.

- In 2016, the E Co-op program 61 student participants. Of these, 29 were Faculty of Engineering students.

Develop a formal opportunity to expose select engineering students to entrepreneurship during their first work term
• In 2016/17, 47 students from 11 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 startups 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 startups

• With the support of our alumni in Canada and abroad, the Dean of Engineering has created a first in Canada – the Engineer of the Future Fund – a pool of discretionary micro-seed funding for budding entrepreneurs at Waterloo Engineering. In 2016/17 a total of 24 entrepreneurial organizations were supported.

• $60K was awarded at the fourth annual Norman Esch Entrepreneurship Awards for Capstone Design competition for engineering students.

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 startups.

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

• For the third 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. This year, we were pleased to welcome a surprise guest, Prime Minister, Justin Trudeau.

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 is expected to be completed in 2018. The building will support expanded entrepreneurship and innovation initiatives across the Faculty of Engineering, including Velocity start-up support.

Strengthen campus opportunities to build-test hardware devices and prototypes

• Students can now access additional resources to support device and prototype development through the Engineering Society's electronics components and hardware shop, RigidWare, and the 3D Print Centre in the Sedra Student Design Centre.

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 2017. 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 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 system 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 started being transferred to the University as part of the agreement that has allowed EC4 to be made available for Engineering research space requirements in the current year.

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 has made impressive progress on the site. The anticipated completion date for E7 is mid-year, 2018.
• The renovation of the DWE A-Wing third floor was successfully completed. This has provided space for the new biomedical engineering undergraduate program and expanded mechatronics undergraduate facilities.

• An extensive renovation of part of the DWE A-Wing second floor has been undertaken. This renovation will relocate the computer support personal from the Physics Building to DWE. This will allow for the vacated offices in the Physics Building to be transferred to the UW Space Group as required by the EC4 acquisition agreement. The second floor renovations will also allow for a planned second expansion of the undergraduate mechatronics laboratory facilities.

• EC4 has been revamped to accommodate expanded manufacturing research and related activities in the Departments of Mechanical & Mechatronics Engineering and Systems Design Engineering. Additional offices and laboratories have been established. As well, the air handling services and networking systems have been upgraded as required.

• 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 Offices in E2. This project has included the removal of asbestos in E2. Completion of these important undergraduate student offices in late November 2018 will provide a welcoming space.

Goal I3: Harmonize All Aspects of Safety within the Faculty of Engineering

Establish an 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.

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

• 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 grad 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.

• An ongoing goal of the ESPC is to see the former QNC Safety Committee reconvened to meet regularly to help oversee the safe operation of the QNC labs. We feel that this is very important, as there are 3 departments from 2 faculties that comprise the majority of occupancy in QNC (ECE, Chemistry and ChE). This sub-group should be working together to identify any unsafe conditions and resolve them regularly.

J. Information Technology

Engineering Computing successfully undertook a number of projects to meet the strategic information technology goals in 2016/17. Engineering Computing continued to improve the quality of the computing environment in Engineering and enhanced reliability of service. During the year, our own active directory domain to support our fall 2017 Windows 10 upgrades was deployed. Strategies to enhance client support, which were fully implemented in the second year of this plan period, are being maintained and enhanced. Several new tools and systems were developed, enhanced and deployed to improve operational efficiency and service delivery.

Goal J1: Ensure a Quality Computing Environment

Upgrade and/or renovate undergraduate computer labs and terminal servers on a rotating basis
• Computers were updated in the Wedge Lab.
• Hard disk drives were updated to solid state drives (SSDs) in 90% of lab computers.
• The process of converting labs to Windows 10 began with the Wedge Lab in winter 2017. It is expected that all labs will be converted by Fall 2017.
• Digital signage systems were redesigned to allow for remote updating of images and for automated updating to reflect service desk closures. New digital signage was implemented for the Engineering Machine Shop. Additionally, a new digital directory/event calendar will be initiated in Spring 2017.
• The process of deploying an active directory service for Engineering workstations and servers was initiated in Winter 2017. This will ensure the delivery of high quality computing services to users.

Goal J2: Enhance Support to Computing Clients
• The systems for software delivery to 2,400 client workstations was redesigned with a new user interface.
• 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 2016/17.
• A parking coordination system that allows guests of the Conrad Business and Entrepreneurship School to register their vehicles and avoid being ticketed was initiated in Winter 2017.
• A new system that manages Connect calendar schedules for student-facing units, such as undergraduate office counsellors, was completed in Winter 2017.
• In order manage safety training qualifications for members of groups working in the Sedra Design Centre and in Student Shops, a new Information System was implemented in Winter 2017. The plan is to expand this safety training Information System to all Engineering departments.
• We extended the Online Faculty Information System (OFIS) to automatically manage user profiles and departmental listings on the Waterloo Content Management System (WCMS).
• Engineering commuting developed a web-based system for First Year Engineering ranking reports that allows staff member to upload the extracts, validate and import the data, and generate the reports.
• We assisted in the development of a system for electronic access to course evaluation results data for instructors, department chairs and directors.
• Engineering commuting started the development of a new system that records and tracks information related to graduate student thesis completion to assist the Engineering Graduate Office.

K. Advancement
The Faculty of Engineering advancement unit continues to secure philanthropic support for the Faculty’s strategic priorities. During the current period, the fundraising campaign goal was surpassed by over $3M. To ensure that all infrastructure needs for E7 are met, the campaign has stretched their target to $80M. Meanwhile, alumni engagement is continuing to develop and deepen. Alumni attendance at key events increased by 10% compared to prior year. Additionally, the Advancement office has highlighted the Faculty’s impactful research; using best-in-class marketing communications has allowed for the promotion of University of Waterloo Engineering’s earned reputation as a premier engineering school. Marketing and communication strategies have continued to improve the global reach of the faculty’s brand; this has been achieved through a myriad media impressions.

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 the fiscal year 2016/2017, the Advancement office exceeded the initial fundraising campaign goal of $70 million. However, despite the $32.6 million investment from the federal government for the E7 building there is still a project gap of $8M for E7. In an effort to assist with the $8M infrastructure gap, we are continuing the campaign until the opening of E7 in fall 2018 with a stretch goal of $80 million.
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. By bringing customized donor relations into the forefront and under the portfolio of a dedicated Donor Relations Officer, we aim to keep our donors strategically involved and engaged to a higher degree.

The annual events (Grad Toast, Engineering day and Give Thanks day) implemented in 2016 strengthened engineering student engagement. The activities highlighted the Faculty’s culture of philanthropy and continue to be well-received by the students. These events allowed the engineering advancement office to build a stronger rapport with student groups such as EngSoc and WEEF. We will continue our efforts in this area and expect to see tangible future returns. This is a longer term strategy that is working to build enhanced alumni relationships.

Figure 15: Educating the Engineer of the Future Campaign Progress to Target

Maintain faculty-level fundraising while supporting department priorities through enhanced annual fund initiatives and goals

Waterloo Engineering is donor-centric in its fundraising approach, working with our 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 contributions have been raised to support departmental needs through undesignated donations (to merit-based scholarships, program support and equipment) as well as targeted donor gifts such as: Carl Turkstra Chair in Urban Engineering ($5M); equipment for mechatronics engineering, memorial scholarships for architecture, chemical engineering and systems design.

The Advancement office continues to build capacity through the annual fund. Alumni that donate on an annual basis and at the leadership level are interested in supporting undergraduate students or their home department. Thus, 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.

Raising funds for Capstone Design initiatives continued to be successful in the current period. This success has been achieved through a coordinated Faculty-wide effort. A Capstone sponsorship package is underway which will further assist the development team in securing program support. 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.

The development office is continuing 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 development office will continue to work with Department Chairs to engage faculty – this may include participation in departmental meetings to provide campaign updates and solicit faculty and staff for support.

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

In 2016, Waterloo Engineering’s Advancement Unit organized 13 events and the Faculty’s fall Reunion in our key geographic areas (Waterloo, GTA, Calgary and San Francisco/ Bay Area). 6328 alumni were reached through these events. This represents an increase of 10% compared to the prior year. In addition, the Advancement Office increased the number of one-to-one meetings with key alumni to further engage these individuals and strengthen the global alumni network.
Through consultation, the Advancement office determined that Alumni are interested targeted events that enable them to expand their network. To this end, in 2016 a new social networking platform was launched through Ten Thousand Coffees to facilitate networking opportunities on a broader scale. After one year of utilizing the platform the following results were achieved: 1588 members in our Waterloo Engineering Hub (400 future alumni, 22 staff, 11 faculty, 1155 alumni), 256 coffee chats, 3104 introductions made through the system, 256 actioned introductions, 2197 messages sent through the platform and 379 unique conversations.

One of our primary advancement goals continues to be the strategic advancement of our alumni. This is achieved through our alumni achievement medals program, eWEAL, WEAL, campaign stories, events, keynote addresses and speaking engagements by the Dean and faculty members.

Goal K2: Enhance the Faculty's Reputation as a Global Leader in Engineering Research and Education

Strengthen the faculty brand through consistent messaging and visual identity

- Media activities have been focused on the research work of the Faculty. Working closely with the Media Relations team within University of Waterloo, research work with a broad media appeal has been identified. The profiled work demonstrates the significant depth of the Engineering research.

- This year an Earned Media Editorial Process has been established to expand audience reach into global markets. Earned Media is unpaid, publicly obtained promotion. Working with an online media intelligence company, the Advancement team is able to economically monitor news and social media to better understand how we expand our reputation.

- 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 regular growth in traffic to the site with specific audience interest in research profiles. The site is also an important source of information for our fundraising initiatives.

- We worked closely with the university’s Brand Refinement team to support the successful rollout of the Waterloo Beyond Campaign. This included print and online media campaigns that promoted student ventures and faculty research work.

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

- The Advancement office continues 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 we promoted them to our key target audiences using various media channels as appropriate:
  - At Convocation in June 2017 the presidents of Y Combinator and the Chinese Academy of Sciences were recipients of Waterloo honorary doctorates. These prestigious guests helped garner impactful Earned Media.
  - In June 2017, Bloomberg Technology noted Engineering 7 in a story comparing Canadian technology advancement vs. the USA “Trudeau Versus Trump Is a Win for Toronto Tech and Innovation”
  - In January 2017 Co-founders of Thalmic Labs in Kitchener made the Forbes' 30 under 30 list, the news received broad media interest and led to profiles of the trio and noting their start at Waterloo Engineering.
  - In October 2016, Clearpath Robotics was profiled in Fortune Magazine “Why Caterpillar and GE Are Investing in This Self-Driving Vehicle Company” noting the company as being spun out of University of Waterloo.

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

- The Advancement Office have begun the process of improving available content to profile our research strengths in featured areas of expertise specifically with the launch of research theme sites in Additive Manufacturing, Advanced Robotics, Operational AI, Autonomous Vehicles and Big Data Analytics. 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.

- The transition of all Engineering sites to a mobile friendly or responsive platform has been completed. The work included the migration of over 50 sites into the new University of Waterloo style.

- Over 580,000 unique users accessed the Faculty of Engineering website (Jun 30 2016 – Jul 1, 2017).
• As our undergrad audience has gravitated to Instagram and Snapchat social media platforms, we have strengthened our participation and presence there. Our audience on Instagram has doubled in the past 6 months, now at 1,219 followers. In this highly visual platform we are able to present short, impactful videos that help to demonstrate the uniqueness of our programs.

• The Advancement office began a market test to evaluate the use of Facebook to create awareness for Management Sciences programs and saw valuable opportunities for future use. We are currently exploring the potential for creating broader awareness for 2 additional programs.

• 30 new videos were added to the Waterloo Engineering (www.youtube.com/user/UWaterlooengineering/videos) including 8 videos of faculty and student research work and 5 new videos to help students through grad studies requirements provided by the Manager of Grad Studies in ECE. A video was created to explain our research work in Artificial Intelligence, profiling Alex Wong. 2 promotional videos were created to acknowledge our 60th Anniversary Grad Studies. There were also 3 new testimonial videos for high profile alumni who shared the impact that their undergrad experience has had to their career. With the prestigious visits of Chunli Bai and Sam Altman at Convocation, there were 3 videos produced to document and broadly share the additional programming opportunities that took place at that time.

• University of Waterloo expanded the digital media asset management system to an enterprise model to allow for a wider range of access across the Faculty. Each department has been provided licencing to upload and use images as required and we are continuing to upload new photos on a regular basis.

Develop and implement a strategic graduate student recruitment program

• A focus has been placed on gaining insight into what motivates a prospective student to select a PhD program with explorations into understanding career outcomes and how that impacts thinking in the application process. A research project was conducted with current PhD students to gain a better understanding of student career objectives, enrolment behaviours, and perceptions of the current program offerings. Insights will be used to craft a well-defined value proposition and inform communications specific to career path options.

• In 2016, we brought in an external consultant to review Waterloo Engineering’s graduate recruitment and enrollment practices. Ruffalo Noel Levitz was selected and provided an on campus, complimentary assessment of our enrollment management operations. In addition, a workshop was delivered to the larger leadership to educate about the emergence of graduate enrollment management, from both a strategic and operational perspective.

• 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 McGill, UBC, University of Alberta and University of Toronto. Following three years of participating in the Consortium, there was a notable increase of research master’s applications from collaborating institutions for Fall 2016. Research master’s applications from Canadian institutions, not including Waterloo, jumped from 48 to 91 from Fall 2015 to Fall 2016.

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

Highlights for the year included:

• A continued increase in the number of Engineering Ambassadors (current count of 85 per term).
• Over 600 groups were provided faculty-specific tours in the 2016-2017 recruitment cycle.
• Over 120 trained faculty members actively volunteered for undergraduate recruitment events.
• 17,000+ registered to attend the Fall and March Break Open Houses.
• Creation of US finance and scholarship information for undergraduate recruitment initiatives focused on the USA
• This year saw the opening of a first of its kind Women in Engineering Living and Learning Community in St. Paul’s with 46 residents. As a residence community established to offer support for women in engineering while offering complete co-ed support in programming, there was significant interest in the residence.
• The annual, overnight event for Women in Engineering continues to support our confirmation strategies with over 92% of attendees confirming their offer.
• 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 within the faculty. The meetings are attended by representatives from all Engineering academic units, key Centres and Institutes, Student Relations, the Office of Engineering Research and the Sedra Student Design Centre.
- The Advancement office 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.

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

- A special 60th anniversary edition of WEAL (Waterloo Engineering Alumni Eletter) was published to coincide with the July 1st anniversary date. The issue was published with a focus on Faculty and alumni advancements over the past 60 years, multigenerational stories that in some cases span many decades, and a historical 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 an integral element of the positive economic growth in Waterloo Region, making our Faculty and facilities a key stop for media and alumni visiting the region.
- The Advancement office continues to strengthen campaign communications through the engineerthefuture.ca site. Alumni communications are continuing to be strengthened, taking a more strategic approach to our processes and ensuring that the importance and urgency 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

The School completed two review processes this past year, one with the Canadian Architectural Certification Board and the second with Quality Assurance Office. Upon the completion of these two review processes, the School received a set of recommendations from the latter, and a full six-year term of accreditation from the former. The full term of accreditation was of course the best possible outcome, and great news to receive as the School of Architecture is celebrating its 50th anniversary. Looking at the past 50 years, the School is taking the opportunity both to celebrate its achievements and to reassert its trajectory over the next decades.

Over the past year, we have been consolidating our program and its curriculum, advancing the School’s impact and relation to community, as well as reinvigorating the spirit of collegiality within the School. With respect to the curriculum, we have strengthened the graduate program by providing clearer definitions of expectations and offering more support for research through design. In the undergraduate degree, we continue to investigate ways to create more flexibility and monitor the workload. At the community level, there has been great interest from the municipality, local developers and regional industries in the proposal of a new program in Integrated Design and Technology (iDAT) as well as that of Architectural Engineering. We are continuing to work on these two projects. A site visit has already taken place for Architectural Engineering, and the team’s feedback so far has been very positive. For iDAT, the plan is to seek approval within Engineering in Winter 2018. Both these programs have become particularly crucial in light of the Waterloo Budget Model and to create more resilience and financial autonomy to the School of Architecture. With respect to collegiality, we have been working on internal guidelines that promote greater transparency in teaching assignments. We are also working on clarifying responsibilities and reporting structures for the various School committees, while developing a School’s addenda to faculty guidelines on tenure and promotion and annual evaluation.

We have met our targets for incoming undergraduate and graduate cohorts, greatly exceeded targets and average annual grant per faculty with respect to research funding, and remain closely aligned to our goals for both staff and faculty complement. Research has been disseminated quite broadly, whether in the work of Phillip Beesley and LASG (Living Architecture Systems Group), Lola Sheppard’s work with Lateral Office, The Evidence Room at the Royal Ontario Museum (Anne Bordeleau, Donald McKay and Robert Jan van Pelt), as well as the publications, conferences and installations of other faculty such as Adrian Blackwell, Elizabeth English, Jane Hutton or Dereck Revington.
While the submission of the program in Integrated Design and Technology has been challenged by the imperatives of dealing with the transition to the Waterloo Budget Model, the academic proposal is beginning the various stages of approval within the Faculty of Engineering. A financially viable growth that will also strengthen our presence in Cambridge and reinforce the reputation of the School of Architecture remains one of our main priorities over the next year.

Another priority that has emerged is the need to reconnect with our alumni and become much more active in fundraising. The intention is to develop and initiate a program and strategy for fundraising over the next year.

A. FACULTY AND STAFF PLAN

- The faculty complement is one above target, with an exceptional hire. There remains a need to recruit a faculty member with research in digital fabrication. We do not currently intend to replace the next faculty retirement unless there is growth with new programs.
- The percentage of women remains on target at 40%.
- The staff complement is in line with our targets, with one position dedicated to a member of staff based in Italy to assist with the administration of the Rome program and facilities.

Figure 56: ARCH Regular Faculty Complement Plan Performance to Target

Figure 17: ARCH Regular Faculty Complement Plan % Women Performance to Target
A1: Implement the Faculty Complement Plan

- Two new faculty members have joined the School since May 2016. Jane Hutton was hired in July 2017, and David Correa joined the School on December 1st, 2017.
- While our faculty complement stands at one above target, we are expecting growth with the approval of the Architectural Engineering program (currently pending). This joint program between Architecture and Civil and Environmental Engineering will call for 3 new positions in Architecture over the next 3 years.
- We also plan to grow our faculty complement with the approval for a new program in Integrated Design and Technology (see Section K).

A2: Implement the Staff Complement Plan

- We are still on target with the staff complement, considering that one of those positions is for the Rome program.
- We plan to have one additional staff position with the approval of the joint program in Architectural Engineering.
- We plan further growth in the staff complement with the approval of the new program in Integrated Design and Technology.

A3: Support career-long development

- Our Academic Administrative manager (now acting Administrative Officer Sarah Nichols) enrolled in the Leadership Essentials Course offered through University of Waterloo’s Organizational & Human Development. Two other staff members completed these courses, and we continue to encourage members to take the training opportunities offered through OHD.

A4: Better support promotion through grades and evaluation of Faculty members

- We will work to improve our support for faculty growth by reviewing current documents for Tenure and Promotion and Annual Performance Review. Our ambition is to produce documents that better cater to architecture as a discipline, both in terms of teaching and research. Working from a document that was put together by the Association of Collegiate Schools of Architecture, our plan is to offer clearer references to guide architecture faculty through these important stages in their career as architecture professors.

B. UNDERGRADUATE STUDIES PLAN

- Our undergraduate intake is on target and there is no plan to grow the Architecture undergraduate program itself. In Architecture, the costs associated with intake above 75 students are high given the accreditation requirement to have faculty to student ratios of 1:15 in studio courses. The quality of incoming students continues to be high and the application process enables us to select 76 students by interviewing about one third of our total number of applicants which continues to be above 1200. We are at nearly 90% in terms of the rate of acceptance of our offer of admission.
**B1: Maintain the Strength of the Undergraduate Core Curriculum**

Our goal is to review curriculum to eliminate some inefficiencies, create better alignments, and create space for new courses in digital media and fabrication.

- The latest revisions to the curriculum have been working well. We continue to work on curricular changes that would enable us to create more options for the students throughout the curriculum.
- New courses in visual and digital media have been integrated. We continue to investigate alternatives to their current modes of delivery, looking into whether they may work best if they were more integrated to the studio courses, or if we could offer them as workshops, or even as working days and thus carefully cap the required time commitment for these courses.
- We still plan to reduce the work load in the first year. We are looking for possibilities of consolidating some of the courses currently offered to create a few gaps in what is currently a very busy class schedule.
- We are finalizing plans for the integration of the new English and Communication course requirement. Our intention is to fulfill the writing and communication requirement within an existing course with clearer objectives on verbal and written communication.

**B2: Supplement the Existing Curriculum in Areas That Have Been Less Developed Within the Core Curriculum**

Our goal is to enhance the quality and experience of the undergraduate program through the integration of electives, a better preparation for graduate studies in the upper years, and reducing the number of scheduled hours in some terms.

- We have successfully created more options earlier on in the curriculum, having introduced an elective course in 2B. This means that students are encouraged earlier on to pursue some individual interests, although these explorations can also take place in studio given the openness of most studio projects.
- We are currently working to integrate courses and/or content that would bring more diversity to the curriculum. Some of this integration could happen through the elective courses (there are 6 elective courses in total), or by mindfully supplementing content in existing courses.

**B3: Provide Expanded Opportunities for Global Study Abroad In Addition to the Rome Program**

The goal to improve and expand the Rome studio has been met. We are now looking at ways to both use the studio more extensively, and also develop new opportunities for studies abroad.

- The plan is to seek fundraising that can enable additional study abroad opportunities, while continuing to bring the full fourth year student cohort to Rome every year. In the current structure of the curriculum, these courses would either have to be intensive three-week courses, or option studios that include a field research component. In either case, the courses require significant funding to be accessible to students and viable for faculty.

**B4: Ensure That the Undergraduate Program is Geared toward Retaining Our Students and Encouraging Them to Continue to the Waterloo MArch Graduate Program**

We have been attracting a larger number of external applicants both from Canada and abroad. We continue to work to retain a larger proportion of our BAS graduates into our master’s program.

- In order to attract our own students to continue into the graduate program, we have successfully implemented more advanced research courses in the final years of the undergraduate studies so that they can be prepared for their thesis research.
• We are currently working on a greater overlap between the masters’ program and the final year of the undergraduate degree so that graduate research has greater visibility for the fourth-year students. This involves, for example, the celebration of thesis work through formal public final reviews, as well as the plan to organize a graduate symposium in the Spring term when the 4B students are finalizing their choice on graduate schools.

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

• We are set to increase the amount of 500-level research electives, particularly in the last term of the fourth year. We are also investigating ways of introducing these electives along the different streams (digital and visual media, urbanism and landscape, technology and environment, as well as cultural history).

B6: Introduce opportunities, funding and support for design-build projects

• We have been running a greater number of design-build projects that give the School more visibility both within and beyond the community. Over the past year, there was a project on the Beaches in Toronto, one on the front plaza of the Gardiner Museum, and currently a collaboration with Kayanase at the Grand River First Nations Reserve. While these opportunities are very well-received by the students and the different communities, they require a greater time commitment, more space and more funding. We have successfully secured University funding for the Kayanase initiatives over five years. The objective is to find sources of funding that can help us continue to successfully run a variety of design build courses – whether as workshops, option studios or electives.

C. GRADUATE STUDIES PLAN

• Our graduate intake has been above target over the past three years (CPR and International students). The intention is to increase this target slightly over the next five years to reflect our current intake. We are working to put in place the appropriate support for the teaching and space requirements that this growth requires.

• We are also working on some structural changes in the support we give to graduate students as they progress in the program. This involves additional benchmarks, alternate presentation format, and a more structured process for the assignment of supervisors.

Figure 20: ARCH Graduate Intake Plan Performance to Target

Figure 21: ARCH Graduate Intake Plan Performance to Target by Visa Status
C1: Program Modifications Phase I: Implement the MArch, MArch (co-op) and MArch (water)

- The MArch, MArch (co-op) and MArch (water) have now been implemented, with advanced placement to Waterloo Architecture students that effectively enter in the second year of the MArch.
- We continue to monitor the implementation of these programs to improve as needed.

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

- We continue to monitor the MArch curriculum to improve student experience and be more efficient in the use of human resources. We have revisited the roles and responsibilities of the different committee members to reduce redundancies and decrease the demands on faculty time. We are also working towards a more even distribution of graduate supervision amongst faculty members, and a more transparent process of selection for students.
- We are instituting a set of clear deadlines, both final and intermediary, to support students to complete within the maximum amount of six terms. These include interim and final reviews, as well as public symposia.
- We have introduced an alternate format for final presentation to better support students who conduct their research through projects. The initial reception is very positive and we are hopeful that it will also help control students’ time to completion.
- 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 as varied as rural China, Paris, the Azores, or Bamyan in Afghanistan.
- We have announced the possibility of a Graduate Rome Studio which was well received. The studio could bring a group of up to 15 graduate students to Rome for 90 days in the Winter term.

C3: Program Proposals Phase III: Additional Program Proposals

- The proposed program in Architectural Engineering is being considered for approval by the Office of Quality Assurance. The site visit took place in September 2017 and the ambition is to advertise for the first cohort coming ideally in September 2018, or at the latest for 2019.
- The proposed program in Integrated Design Arts and Technology will be presented to FOPS for information. The financial analysis is being conducted at the Faculty level. The program would help us improve student experience in Cambridge and enable collaborative initiatives across departments as well as with industry and community partners.
- Together with the new undergraduate program in Integrated Design and Technology, we are developing a proposal for graduate degrees in Design that could also act as post-professional master’s degree. The plan currently is to implement both programs at the same time, and to welcome our first students for both the undergraduate and graduate programs in September 2019.
- We are still in the very early stages of discussing the implementation of a PhD program which could happen within the next 5 years.

C4: Funding Support for Graduate Students

In Architecture, graduate students work on self-directed and independent theses, and there is no base of research funding available. As we continue to look for funding, we are also open to the consideration of directed research which could come with funded student positions.

- We have a number of scholarships at the graduate level and continue to look for additional sources of funding.
- Teaching assistantships continue to be one important source of funding for our graduate students, with an average of 40 teaching assistantships annually. There has also been a rise in research assistantship positions.
- Three to five of our students continue to receive full funding annually, whether through tri-agency of other government scholarships, while others receive the different awards that the School has secured over the years – whether the RBC scholarships, Urban Strategies Scholarship, Barry Bell Scholarship, Dr. Daleep Singh Memorial or other University Scholarships. The possibility of directed research could also bring tri-agency funding to at least a few graduate students.

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

- We are actively working on the renewal of our web presence to be more aligned to other Schools of Architecture and the need for our students and prospective students to show and see the work online. We intend to actively work on and introduce changes to the website in the next year.
We are looking at ways of fostering greater graduate exchange through term colloquia and final reviews. The intention is to continue to encourage students to present and publish their work. This year, Waterloo Architecture students have been represented in different conferences, including at the International Conference on Amphibious Architecture, Design and Engineering in Waterloo (ICAADE), the Society of the Study of Architecture in Canada, and published in Site Magazine. Waterloo Architecture students have also had a very visible presence in Toronto through a number of design-build projects, including an installation on the beaches in Toronto for the Winter Stations, an activation of the Gardiner Museum front plaza over the month of July, and a number of contributions for the Nuit Blanche event in Toronto.

We continue to encourage students to showcase their work and seek recognition in national or international competitions. Graduate students have received awards in design competitions such as the 2017 Rethinking the Future Awards and the Canadian Institute of Steel Construction Architectural Student Design Competition, many obtained mentions in the American Society of Architectural Illustrators, while a great number partook in the 3MT competition here on Waterloo campus. Another great achievement this year was the award of the Canada Council Prix de Rome for Emerging Practitioners to a graduate student Piper Bernbaum, who also received the Governor’s General Gold Medal. Meanwhile, recent graduates have also done extremely, with Kristina Seo and Elaine Chau winning the 2017 Urban Marker Competition in Canada, Office OU (Uroas Novakovic, Sebastian Barthnicki and Nicolas Koff) winning the international design competition for the planning of a new National Museum Complex in South Korea, and many alumni shortlisted for the Ontario Association of Architect’s 2017 Design Excellence Awards.

C6: Improve facilities and review the demand on human resources for the Graduate Program

- Develop a plan to improve facilities (studio furniture, lounge, workshop and computer labs) to better support graduate students needs and research.
- Implement and monitor the changes in the selection of supervisor and the structure of the course Thesis Research and Design 2 to better manage human resources.

D. RESEARCH PLAN

- There has been a spike in research funding, with more faculty members obtaining research support, and some faculty members obtaining very significant funding. This has resulted with a level of funding per faculty that is triple our target of $320,000 to reach over 1 million dollars in funding in the current period. This is equivalent to about $60,000 per faculty, up from an average of about $15,000 over the preceding 5 years.
D1: Implement the Research Funding Plan

Success in securing research funding has been steadily increasing over the past two years. To continue to support this trend, we intend on providing more research support to all faculty.

- The research funding received has increased again this year. Faculty have been applying for and successfully receiving internal awards (John McMinn with a Robert Harding & Lois Claxton Humanities and Social Sciences Award $6,427) as well as external awards, with Lola Sheppard receiving a SSHRC Partnership Development Grant ($176,950), Maya Przybylski receiving 4A status on her Insight Development Grant application and obtaining a UW-RIF award ($8,000), likewise for Philip Beesley who also received an $8,000 UW-RIF for his SSHRC Insight Grant Application. Philip Beesley currently holds a $2,476,748 SSHRC Partnership Grant with collaborators in other departments on campus and internationally. In addition, Elizabeth English received $19,680 through the University of Waterloo Water Institute Seed Grant, a $249,600 (USD) Water Window Challenge grant, and $500,000 over 3 years from the National Research Council (NRC). Together, this brings funding threefold above last year’s number, from $337,354 to $1,056,063.

- This figure does not include other sources of funding, such as MITACS Globalink Awards, Canada Council Grants, Toronto Arts Council, Ontario Arts Council, nor does it consider private sources of funding such as the $350,000 raised for the Anne Bordeleau, Donald McKay, Robert Jan van Pelt’s project of The Evidence Room at the Royal Ontario Museum this year. When including all these amount, we continue to note the increasing trend in the ability to secure research funding.

- The plan is to continue to encourage faculty to apply for funding and to support them to be successful in their application. We also intend to submit applications that can enhance our research facilities in Cambridge and compliment the initiatives of the new programs we are seeking approval for (Integrated Design Arts and Technology and Architectural Engineering). The intention is also to seek opportunities for collaborations on partnership grants and the Canadian foundation for innovation (CFI).

D2: Increase Public Awareness of Research Strengths and Achievements

- Waterloo Architecture has been quite visible this year, with exhibitions, publications and mentions that include the work of Elizabeth English in Dwell Magazine and he co-chairing the International Conference on Amphibious Architecture, Design and Engineering in Waterloo (ICAADE), Philips Beesley’s work with the Living Architecture Systems Group with an exhibition at the Isabella Gardiner Museum in Boston, collaboration with designer Iris van Herpen featured in The New York Times, and the collaboration of Anne Bordeleau, Donald McKay and Robert Jan van Pelt on The Evidence Room, also featured in The New York Times and now showing at the Royal Ontario Museum as one of their most visited exhibition. In addition, the work of Jane Hutton was featured in the Canadian Centre for Architecture’s web journal, Adrian Blackwell participated in exhibitions at the Canadian Clay and Glass Museum in Waterloo and at the Université Laval in Québec City, Lola Sheppard, as part of Lateral Office, showed work at the Chicago and Seoul biennales, and published Many Norths, and Rick Haldenby was recognized by Waterloo Regional Heritage Foundation.

- We want to continue to raise the School’s profile both within and outside of the University. This will necessitate both a better dissemination – internally and externally – of the work currently done by faculty at Waterloo Architecture, as well as new research initiatives conducted either individually or through partnerships.

D3: Consider opportunities for involvement of directed research within the graduate program
• To provide an avenue for a closer involvement of graduate students in faculty research while supporting specific areas of research, we plan to investigate how a directed research model could be supported within the current structure of the graduate M.Arch degree program.

E. TEACHING PLAN

E1: Recognize and Reward Excellence in Teaching

We continue to promote some of the pedagogical models that Architecture uses and that could gain more visibility within the university and beyond. This is done through nominations to different teaching awards both internally and externally.

F. OUTREACH PLAN

F1: Continue to Cultivate Relationship with the Local Community

The School’s location in Cambridge provides opportunities to be firmly planted in its community, but also expand the reach of Waterloo University in the region. This is a project that we continue to promote.

• Our students continue to have a store front on Main Street where they reach out to the community. This year, we have been involved in the StopGaps initiatives, and featured in the local paper. The School continues to be a regular contributor to different community events, whether through Doors Open or groups such as On Empathy and Bridge, with students who take it as their mandate to be engaged in the local community.

• We are beginning to investigate the possibility of some outreach events in the summer that could bring both local youth to participate in additional camps on the Cambridge Satellite Campus, and there may be opportunities to organize more specific architecture camps for prospective students as well.

G. INTERNATIONALIZATION PLAN

G1: Increase Opportunities for International Experiences

The School of Architecture is planning to support additional opportunities for international experience, whether through graduate studios in Rome campus as a point to travel from in Europe; Encouraging more international research stay through grants such as MITACS or other international travel grants; or International studio courses that could be supported by targeted fundraising.

G2: Increase International Students Enrolment

We will continue to work with the University’s Marketing and Undergraduate Recruitment office to this effect to reach out to specific countries and schools to increase our international graduate enrolment.

H. ENTREPRENEURSHIP PLAN

H1: Expand the Professional Opportunities of Our Students

• We continue to promote professional opportunities and entrepreneurship to the students, introducing students to the Enterprise Co-op program run by the Conrad Centre for Business, Entrepreneurship and Technology, or organizing an event with professionals, “Paths to Practice,” on a biannual basis. In addition to this, CECA is now offering a number of workshops for Architecture students in Cambridge.

I. SPACE PLAN

I1: Upgrade and Expand the Satellite Facility in Rome

• The Rome Facility upgrade has been completed. The ambition is to use it more fully in the Winter, in addition to the Fall term.

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

• The space requirements for the new Integrated Design and Technology program is being finalized. We are currently working on a variety of options that can rely differently on new and existing buildings, with the possibility of parcelling the program in different locations within the downtown core. The project for expansion is still dependant on the approval of the program which we will seek to obtain by early 2018.

I3: Commit Space to Be Used In the Future by Architectural Engineering Students
The planning around the space for Architectural Engineering has been completed. The new layouts for the existing studios have been finalized, and the provision of Provost funding for new furniture has been approved. In addition to the studios, we will need to upgrade the workshop facilities and equipment, namely the electrical supply and a few additional machines that can meet the increased use. Funding for these required improvements has also been approved by the Provost.

J. ADVANCEMENT PLAN

J1: Expand Alumni-Related Activities

- We have been reaching out to alumni this year in relation to some of the events we held for the 50th anniversary of the School of Architecture. There was great attendance both for the alumni reception during the accreditation visit in February 2017, and for the dedication of the Larry A. Cummings lecture as the celebration of the launch of our 50th anniversary celebration in June 2017. Alumni were invited to a Toronto event in July 2017. We plan to reach out to more alumni as we continue to celebrate the 50th anniversary of the School.

J2: Substantially Increase Advancement Activities for Architecture

- We have received a report from the engineering advancement team on what a fundraising strategy could look like for architecture. It is clear that the implementation of a successful strategy would require both short term and long-term investments with a professional dedicated to fundraising in Architecture. In the absence of such resources, we are looking at alternative way of building contacts and reaching out to a larger proportion of our alumni. This will be one of the mandates for this year’s School celebrations as we look to the future.

- In addition to the fundraising that will need to happen once the proposal for a program in Integrated Design Arts and Technology is approved, advancement activities for the next years will be focused on three main areas: an investment in building and community for design-build projects; an investment in inclusivity and diversity for fellowships and international studios; and one for research and dissemination through lectures series, exhibitions and conferences.

K. PROPOSED NEW PROGRAM PLAN: INTEGRATED DESIGN

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

- We will present our Integrated Design and Technology program proposal to FOPS. Following the presentation, a survey will be completed with industries in related fields. The intention is to finalize the financial viability analysis in time for submission in Winter 2018. The program now calls for a cohort of 84 students in a four-year undergraduate degree with three focused areas of specialization – object, communication and environment. This would bring the student intake to 160 undergraduate students annually (76 in Architecture and 84 in Integrated Design and Technology).

K2: Propose, Acquire Approval For, and Launch a Non-Professional Master Program in Integrated Design

- From our assessment of industry needs and informal surveys of educational trajectories, we have established that there will be a high demand for the Master in Integrated Design and Technology from students who could graduate from a wide variety of fields ranging from arts to engineering and computer science. We are planning to begin with a graduate intake of 45 students from the inception of the program, and the intention is to initiate both programs (undergraduate and graduate) at the same time, with first cohorts coming into the programs in September 2019.

Department of Chemical Engineering

Eric Croiset, Chair

The Chemical Engineering Department faculty complement has continuously increased over the past three years, with two new faculty members hired last year. The faculty complement is now 34.5 FTE, closing the gap with our target of 37. The percentage of female faculty members decreased slightly (11.3% from 12%, with a target of 13%) because the two hired faculty members in the current reporting period were male. For the undergraduate program, the enrolment of CPR has remained below target for three consecutive years, which is worrisome. In addition, placement of 1st year co-op students remains an area for improvement. The Department will tackle these two issues by proposing changes to the 1st year curriculum to equip students with more employable skills, in particular communication and computer skills. Regarding the graduate program, overall student intake exceeded our target; this was mostly due to MEng intake. Our CPR PhD and MASC intakes were close to being on target: 1 below target of 27 for PhD students; and 3 above the target of 30 for MASC students. The past year was another record-breaking year for research funding reaching $8.7M.
For research space allocation, the Department embarked in a process to maximize space allocation. The first step in space allocation maximization was to devise a set of principles and guidelines to structure future space decisions.

A. FACULTY AND STAFF PLAN

A1: Recruit New Faculty According to the Schedule in the Faculty Complement Table

- After losing a high number of faculty members in the years 2013-2015 through resignations and retirements, the number of faculty members has steadily grown over the past 2-3 years. The faculty complement reached a total of 34.5 as of May 1, 2017. Two new faculty members joined the Department over this reporting period.

- In addition, offers have been made and signed to two new faculty members, including one female. These individuals will be joining us next year. It is also anticipated that at least one faculty member will retire in the coming year. As a result, we may be one short from the target next year.

- We have advertised for two new Lecturer positions, on a 3-year contract basis. It is anticipated that these hires will take place in the next reporting period.

- We have and will continue to utilize key advertising media and personal networks to recruit top faculty candidates in Canada and around the world.

- Moving to E6 has enabled us to ensure that appropriate laboratory and office facilities are available prior to starting the recruitment process. As a result, space considerations have been managed in a proactive manner.

- New faculty members receive teaching mentorship from the CHE Teaching Champion and research mentorship from a colleague selected by the Department Chair.

Figure 24: CHE Regular Faculty Complement Plan Performance to Target

A2: Increase Number of Female Faculty Members

- Although we did not lose any female faculty member, the percentage of female faculty members went down last year. This a result of the total faculty increasing; the two new hires in 2017 were male.

- However, among the two new faculty members who will join our Department in the coming year, one is a female faculty. Also, among the two advertised Lecturer positions, we are hoping that at least one of the successful candidates will be a female. In this case, it is anticipated that in 2018, we will reach or surpass our target of 13% of female faculty members.

- The past two progress reports mentioned the idea of investigating the possibility of mounting a seminar series focused on women senior PhD students and postdoctoral fellows across Canada. Although it is still our intent to do so, we were not able to achieve this in the past year.
A3: Increase the Number of Faculty Holding Professional Engineering License

- The percentage of faculty members holding PEng status, or having applied for PEng status, has increased slightly. This was achieved even while hiring two new faculty members. The number of registered PEng has increased by 2 over the last year. This indicates the trend and momentum is moving in the right direction.
- In the coming year the Department will continue to monitor more closely PEng status and applications in order for junior faculty members to cut the delay in applying for PEng.

A4: Recruit New Staff as Shown in the Staff Complement Table

- The graph indicates a reduction by 0.5 of the Staff complement. This is due to resignation of one full staff and the hiring of a part-time staff. Note that the staff who resigned has been immediately replaced by someone on a contract. Contract staff are not included in staff complement data. In the coming year, the contract position should be filled by a full-time employee. Once this change is made, the position will appear in the report and it is anticipated that our staff complement will be on target.
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 casual gathering has had some success, although we were expecting more attendance from faculty members. On the other hand, those gatherings are very well attended by staff members, technical and admin alike. We will continue doing this for the coming year, and assess at the end of the year what changes should be made to make it more effective.
- We continued to organize several social events to connect faculty, staff and students (e.g. Meet the Profs., CEGSA BBQ, Graduation receptions). The changes made in the previous year to the 4th Year Design Project Symposium have resulted in an increase participation from Faculty members and increased exchanges with students. It the coming year, efforts will be made to encourage even more participation from faculty members.

B. UNDERGRADUATE STUDIES PLAN

- Although the total CHE undergraduate intake has increased slightly in 2016, it remained slightly below target. Initial 2017 data indicates that CHE undergraduate intake is likely to also be below target. The fact that we have been consistently below target, especially for CPR students, over the past 3-4 years is worrisome. A plausible reason could be how hard the energy sector has been in a downturn over the past few years; this sector, in particular the oil and gas industry, has been an industry that has historically hired a large number of chemical engineers. This situation may give the impression to high-school students and their parents that Chemical Engineering may not be as attractive as it used to be.
- At this moment, the next step is to determine if this issue is more widely spread over other Chemical Engineering programs across Canada or if it is specific to University of Waterloo. For the coming year the Chair of Chemical Engineering at Waterloo will ask the other CHE Chairs in Canada to discuss this at one of their bi-annual meetings.
- Another factor in lower enrolment may be the difficulty experienced by our 1st year students to find their 1st co-op job. Although 1st year students have had difficulty obtaining employment, it should be noted that the overall co-op employment rate for CHE is 94.4%. That said, challenges with first term co-op employment seems to have been communicated to high-school students. This may be another factor that is making Chemical Engineering less attractive in the eyes of potential applicants. In the coming year, the Undergraduate Review Committee will bring forward changes to our Undergraduate program. The focus of activities will be particularly 1st year improvements. Effort will be given to equip junior students with new skills that would make them more employable.

Figure 98: CHE Undergraduate Intake Plan Performance to Target
B1: Improve the Laboratory Experience in the Curriculum

- The Undergraduate Laboratory Enhancement Initiative, with $2.3M in Provost funding support, continues to enhance Chemical Engineering undergraduate labs. The Department is in a position of offering more interesting lab activities to the students. In particular, we are expanding project based labs at the senior level. Students have a more positive experience using upgraded lab equipment and learning from lab courses.

- The Undergraduate Review Committee will consider the possibility of increasing the credit weight of some of the more demanding labs (project-based /open ended labs) to better reflect the amount of time students are spending on such labs. It is expected that the weight of those labs will be similar to that of core courses; 0.5 credit.

- Although running labs independently from the lectures presents a number of advantages, one major drawback is the disengagement of some faculty members in lab activities, and subsequently less than optimum integration of labs activities with formal lectures. To remediate this, the lab instructors will present regularly at the Departmental meetings. During the presentation updates, success stories and concerns about the undergraduate labs will be shared.

B2: Improve the Undergraduate Curriculum

- Under the lead of the Graduate Attribute Lecturers (GALs), we have continued making progress toward the new outcome-based accreditation. Particular progress has been noted in the gathering of extensive data about some of the graduate attributes.

- The plan for 2017 is to complete the gathering of data for all attributes. We will continue to allocate two dedicated meetings per year with all faculty members for stakeholder engagement: one in the Fall 2017 about the gathering of data, and another one in Winter or Spring 2018 about the analysis of those data.

- After the major change in our curriculum made last year related to the 4th year, the coming year will focus on modifying the 1st year curriculum to equip the students with more employable skills in the areas of communication and computer skills.

- Although an objective mentioned in the last two progress reports was to increase the offering of technical electives, this was not achieved in the past year. Increases to the number of graduate studies courses was
prioritized over increasing the number of technical electives. As a result, teaching resources were put towards graduate studies. When resources permit, it is still our intention to increase the number of technical electives being offered.

- In the past year, following a grant from eCampusOntario (Ontario Ministry of Advanced Education and Skills Development, formerly MTCU), some online modules were developed for CHE 102. This course, Chemistry for Engineers, is a service teaching course offered to most of the Engineering programs. Those modules, representing at that time half of the CHE 102 material, were tested in a couple of CHE 102 sessions during the Fall 2016. For the Fall 2017, four offerings of CHE 102 will be taught entirely based on the flipped class concept using online modules for all materials. If the experience is positive, the intent is to teach all CHE 102 offerings based on the online modules.

B3: Improve the Co-op Experience

- We continue working with Cooperative Education and Career Action (CECA), mostly through the Coop Working Group, to improve employability and the number of jobs posted for Chemical Engineering students, with specific attention to 1st year students. Effort will continue until there is a noted improvement in the employment of our first-year students.

- As mentioned previously, the department is currently working on making major changes to the 1st year curriculum to equip students with more marketable skills, notably communication and computer skills. Therefore, it is expected that major course calendar changes regarding the 1st year curriculum will be submitted in the Winter 2018 term.

- Appointment of a departmental Industrial liaison/CECA liaison officer is still highly desirable, but it is dependent on funding. At this time funding is not available. Such hiring will remain on hold until we have a good grasp of the implication of the new budget model.

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 used to find speakers with industrial background to complement research seminars proposed to graduate students.

C. GRADUATE STUDIES PLAN

- Our total graduate intake in 2016 has continued to exceed our target, with close to 100 new graduate students. This is due primarily to the higher intake of MEng students. Regarding MASc and PhD students, in 2016 we were very close to meeting our targets: 3 above the target of 30 for MASC and 1 below the target of 27 for PhD students.

- For the year 2016, we were slightly below target for CPR intake in our research programs. Although we far exceeded the target of total MEng intake, this was primarily due to the international students.

- Accepting more MEng students than the target was done on purpose as a conservative measure to prepare for the new budget model. This strategy was accomplished while still maintaining good in-class experience for all student. We may revise the MEng target once we have a better grasp of the impact of the new Waterloo Budget Model (WBM).

Figure 34: CHE Graduate Intake Plan Performance to Target
C1: Improve Recruitment of High Quality Graduate Students

- We have continued to follow the strategies indicated in the last two reporting periods to ensure CHE is recruiting high quality graduate students. CHE participated in the on-campus recruitment event for potential CPR students from other Canadian institutions. Also, a recruitment event for University Waterloo third- and fourth-year students was held. Finally, CHE is developing more effective advertising tools, in collaboration with the Faculty of Engineering and participation to the Graduate Recruitment Working group.

- We continue to see a number of transfers from MEng students to MASc, as well as MASc students to PhD students. This seems to be an effective way increase the number of MASc and PhD, with high quality students.

C2: Improve the Graduate Course Offering and Quality

- We are now in the routine of finalizing the graduate course offering for a given calendar year by June/July the year before. This ensures that courses offered in the Winter term are known 5-6 months in advance, those in the Spring term 9-10 month in advance, and those in the Fall term more than a year in advance.

- Excluding the courses held with 500-level courses, we have been able to increase our offering of graduate courses to 13 in 2017. It is expected that the number of courses will further increase to 15 for 2018.

- It is expected that significant calendar changes will take place before the end of the 2017/18 academic year. The core course model will be revisited and attempts will be made to make our MEng program more valuable.

C3: Determine the Feasibility of an Online MEng Program

- Discussion about the feasibility of an on-line MEng Programme in Chemical Engineering is on hold until we have a better grasp of the new Waterloo Budget Model. Our MEng program has been quite successful so far attracting a good number of students, improvements in the MEng program is likely more effective at the moment than embarking in an on-line MEng program.

D. RESEARCH PLAN

- In the previous reporting period (2015/16) we were pleased to report our highest research funding ever, breaking the bar of $8M. We are even more pleased to report that our research funding broke a new record for 2016/17, reaching $8.7M. This is extremely remarkable as 97% of this amount relates to operating grants. As we are filling vacant Faculty positions, we are hopeful to maintain, or increase this level of funding.
We are now in a routine process of maintaining the inventory of current major equipment within the Department. In the upcoming year, we will make this inventory available to all our faculty members. Although some discussion is taking place before advertising for a specific position, we have not yet put in place the task of assigning a co-ordinator for each research theme. As a result, we have not yet written a planning report related to research. It is expected that this will be a priority in developing the next strategic plan.

The Department is no longer considering appointing an Associate Chair Research, as it is not clear what benefit such position would bring to the department. This decision was reached as great resources are available from the Faculty of Engineering. As well, research funding has continued to grow and surpass target over the past years. Instead of an Associate Chair Research, the Department continues to favour the hiring of an Industry Relation Officer.

Canada Research Chairs are now allocated more strategically to cover a wider range of research fields. The Department is pleased that our nominee for a CRC Tier 2, in the area of process system analysis, has been successful. In the past year, we have also put forward an internal nominee for a CRC Tier 1 in Advanced Manufacturing; the results will be known later in 2017. As the nominee for CRC Tier 1 is currently a CRC Tier 2 holder, would he be successful, this would open up new CRC Tier 2 which would be filled during the next reporting period.

The Department and its faculty members continue to be extremely pleased with the performance of the administrative staff who was hired to manage research accounts. This was a very good hire. The next priority in terms of research support remains the hiring of an additional technical staff for the central analytical lab. Although, we would have liked to have hired such a person already, we still need to have a better understanding of the new Waterloo Budget Model to assess the feasibility of such hiring.
• We will continue to keep in mind the possibility of hiring an Industry Relation Officer, although this is not as high a priority as hiring another technical staff for the central analytical lab.

• As mentioned in goal D2 we did not appoint an Associate Chair Research, and do not intend to do this in a near future.

D4: Foster Multidisciplinary Research and Collegiality

• We have continued the organization of an informal monthly get-together lunch. During this lunch, faculty members present a broad overview of their research. It is also an opportunity to socialize and improve collegiality. These meetings have been attended by both faculty members and staff. There is opportunity to improve faculty member attendance in the future.

E. SPACE PLAN

E1: Work towards the construction of E8

• In the previous report, we mentioned that we were working toward the creation of an ambitious research centre. We indeed have prepared and submitted all required document to the higher administration, but unfortunately have not heard back on a decision; this is probably due to some of the major changes that occurred at the highest level of the university administration. Now that we have a new VP Research, CHE is expecting to see rapid approval for this Centre. It is expected that such a Centre could attract very good funding which could be used toward E8.

• We have continued to make annual contributions to the Engineering building to reduce the debt associated with the E6 building. Once we have a full grasp of the new Waterloo Budget Model, a priority will be to come up with a plan to repay our E6 debt within a reasonable time.

E2: Improve Effectiveness of Research Lab Space Allocation

• The space committee has established guideline principles regarding space allocation. A process has also been put in place when a researcher is requesting additional space; essentially, it consists of justifying such request, which is usually associated with a grant/contract, which covers a certain period. Such flex space is attributed over a definite time.

• As indicated in the previous report, increasing in the number of communal lab spaces is still a high priority, but it is still contingent to the hiring of an additional analytical lab technician, as mentioned in Goal D3, above.

F. TECHNICAL SERVICES PLAN

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

• Under the supervision of the Director of Technical Operation (DTO), the technical services operation plan has now reached a good level of maturity, and has led to greater effectiveness in this service. The DTO reports monthly to the Chair.

• Technical services within the Department are now requested and followed through using Request Tracker (RT). Two years ago it was implemented for the Departmental IT requests, and it has been extended last year to all technical services, with the exception of the glass blower position.

Department of Civil & Environmental Engineering

Carl Haas, Interim Chair

During the current reporting period, CEE has made strides towards reaching many strategic goals. Comprehensive curriculum and course content revision implementation continues. The Department has significantly improved students engagement and experiential learning activities through Design Dayz and use of newly created models to demonstrate physical concepts. CEE is proud of their student design teams; the teams experienced excellent success in national and international design competitions.

CEE has identified development areas for the coming year. The Department will continue to construct a clear branding and career path strategy for ENVE and GEOE. These programs offer unique career opportunities that will be better communicated to potential and current students. The Architectural Engineering program is expected to reach its final stages of development in the next year. CEE is pleased to see this endeavour moving forward.

Graduate studies will remain a major focus for CEE. The Department recently developed a new MEng diploma program aimed at further increasing CPR and international graduate enrolments. CEE will review the PhD comprehensive exam process and make recommendations for improvements as required.
Finally, the Department has developed strategies to ensure faculty recruitment is successful. It is expected that 3 new faculty will be recruited in the next period. The hiring of these individuals will ensure a complete faculty complement and improve future research funding opportunities.

A. FACULTY AND STAFF PLAN

- During the reporting period, there were no changes to the faculty complement. Four faculty searches were held in 2016/17, three of which were failed searches. A strong candidate, in the geotechnical area, has been identified in the fourth search.
- 2 positions remain open; new searches will be initiated in late 2017.
- We anticipate 40.75 FTE in complement by May 1, 2018. This is slightly above the target shown in Figure 37 because the original hiring plan did not anticipate a joint hire (0.5 FTE) made in 2013.
- CEE currently exceeds its target for percentage of women faculty, and continues to seriously consider gender balance in all faculty hires.
- CEE reached 93.4% PEng registration in 2016/17. The trend is increasing towards our target of 95%. New faculty and non-registered current faculty are routinely encouraged to complete the PEng process.

Figure 38: CEE Regular Faculty Complement Plan Performance to Target

Figure 39: CEE Regular Faculty Complement Plan Performance to Target, % Women
A1: Implement Faculty Complement Plan

- CEE is planning to reach its target complement by May 1, 2018. The department continues to search for high quality candidates that excel in the targeted expertise areas.

- It is expected that a new hire in the area of geotechnical energy will begin employment January 2018. The appointment is currently going through the approval process.

- Two failed searches will be re-advertised. A new Departmental Advisory Committee on Appointments (DACA) will be formed, pending approval of the re-advertisement.

- A fourth search was conducted in 2016/17 as part of succession planning for a NSERC IRC. The original search focus was narrow and very specific to the current faculty member’s experience. Renewal of the current IRC is in process. Succession planning and hiring an associate IRC chair will be revisited in 2019; pending successful renewal of the IRC and considering the Waterloo Budget Model.

A2: Implement Staff Complement Plan

- CEE staff complement is aligned with target. Two open staff positions were filled in the past year, Administrative Officer and Electronics Technologist. One staff vacancy occurred but it is being filled on contract.

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, and is currently moving through the final stages of approval. This program will be unique in its studio-based learning and design emphasis. The anticipated start date is Fall 2018.

- Through a generous donation by Dr. Carl Turkstra (UW PhD 1963), an endowed chair, Turkstra Chair in Urban Civil Engineering, has been created. 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; it is anticipated that advertising for the Chair will begin in early 2018.
Grad enrolment is anticipated to increase over the next several years as the AE program begins, and as new MEng Diplomas gain traction.

B. UNDERGRADUATE STUDIES PLAN

- The CIVE intake enrolment experiences only minor fluctuations from target.
- Given the incoming cohort size and considering 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.
- The 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 have been decreasing applications to ENVE and GEOE. Preliminary assessment based on student engagement suggests a lack of clear differentiation between programs within the department. Also there appears to be a perception that market fluctuations are affecting co-op and full-time employment opportunities. In response to these recent insights, CEE is developing strategies to improve department-wide program branding, recruitment, and retention.
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 are 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 the first two years of the curricula. The CEE Undergraduate Studies Committee and Outcomes Assessment Committee have begun to review and reflect on the student and instructor experiences with the new curricula. To date, this has focused on first-year courses, but will continue for all years/levels as it becomes an integral part of the graduate attributes and outcomes assessment process in CEE.

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

B2: Laboratory Equipment Upgrades and Enhancements

- A significant program of upgrading and expanding laboratory equipment in undergraduate teaching laboratories has been undertaken. Laboratory enhancement and upgrades have enriched the hands-on experience of the Department's undergraduate students.

B3: Student Retention

- The improvement of student retention in the ENVE and GEOE programs is an important goal for the CEE department moving forward. Meetings with students who requested to transfer into CIVE from ENVE or GEOE consistently revealed that the students initially believed that CIVE offered better career training and employment opportunities. Thus, it is apparent that the uniqueness of career opportunities afforded by the ENVE and GEOE programs must be better communicated within and outside of the University.

- Several efforts related to student retention were noted. Briefly, these include:
  - Extensive revision of recruiting materials to better differentiate between and describe unique aspects ENVE, GEOE and CIVE programs.
  - Revision of course prefixes and descriptions 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 and student experiences.
  - 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.
• 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 2016/17).

• The Capstone Design Symposium and the Design Pitch competition, which focuses on industry engagement and includes sponsorship by MTE Consultants Inc. continues to be well received by students. Awards of $2,000, $800, and $200 are given to top presentations in each stream.

• Students in the CEE Department were successful in a number of design competitions. A CIVE capstone design team was awarded first place in the CSCE National Capstone Design Competition. Student teams also participated in the ASCE Steel Bridge Competition and the Water Environment Association of Ontario Student Design Competition; the teams won third and fourth place respectively.

• The number of student initiatives continues to increase and is at a level where they are competing for the limited CEE funding. We continue to initiate discussions with students with the goal of providing sufficient support, but do 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 Canadian Society of Civil Engineering. ECSCE Conference in June 2017.

B5: Architectural Engineering (AE) Program

• The Architectural Engineering Program is expected to commence Fall 2018 as discussed in section A3.

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. Student feedback to date has been very positive, and indications are that student engagement and learning have been deepened.

• Use of models to demonstrate physical concepts were developed with the IDEAS Clinic. 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. This opportunity allowed for community based learning in the context of a design project. 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 concepts that students learn in first year civil, environmental and geological engineering. The videos provide learning reflection opportunities, ultimately helping with student knowledge retention.

• In conjunction with the IDEAS Clinic Faculty initiative, CivE Design Dayz were implemented. This is a two-day event where students work in groups to propose a solution to a design problem. The project is designed to horizontally integrate the course concepts from the 2A term. During the event, students are excused from their regular coursework and classes. Although the proposed design solutions will be evaluated as part of the competition, the project carries no weight in the related course grading schemes. The goal is to create a learning environment where there is no risk of failure, so that the students can completely immerse themselves and are free to explore creative ideas without consequence. This is expected to enhance student deep learning.

• CEE faculty members who have been involved in the development and implementation of these novel teaching methods routinely share their experiences with CEE through presentations at departmental meetings, and through consultations and mentorship of colleagues. As well, CEE faculty members have published and presented several of these initiatives, including the related assessment of student learning outcomes.

B7: Use of TAs

• A formal process for CEE TA evaluation that includes both student and instructor feedback has been implemented. Efforts to improve feedback rates continue.

• Outstanding CEE TAs continue to be recognized each term with monetary awards and certificates. In 2016/17, a new award was implemented; the Certificate for Continuing Excellence in Teaching was created to recognize continued outstanding performance by TAs and graduate student sessional lecturers.
• An analysis of TA spending is underway to identify the reason behind recent changes in spending. Recommendations will be finalized and discussed at the department level in Fall 2017.

C. GRADUATE STUDIES PLAN

• Intake into the graduate program in 2016 was below target for CPRs in the PhD and MSc programs largely reflecting a nation-wide reduction in the graduate enrolment.

• The increase in 2017 applications in the MASc program is perhaps related to the CEE and FOE efforts in promoting graduate studies to our upper-year students.

• The total number of MEng student in 2017 is above target because of the acceptance of International students in the program as of Fall 2017.

Figure 48: CEE Graduate Intake Plan Performance to Target

Figure 49: CEE Graduate Intake Plan Performance to Target, Visa Status

C1: Graduate Growth and Quality

• Increasing overall graduate student quality is an ongoing goal. The department is working with the CEE association of graduate students to increase the recognition of voluntary work done by graduate students.

• Additional growth in the MEng (course-based) program will be promoted through strategic changes to the structure of the MEng program.

C2: Graduate Course Offerings

• CEE has added a note to its internet web-page clearly indicating that not all the courses listed in the Calendar are offered each academic year. In addition, CEE has established a core set of graduate courses that are normally offered at least once in each Fall, Winter, and Spring cycle. The Department will request an update to the graduate calendar in Fall 2017 to remove courses that are no longer offered and to update the description of courses that have changed.

• The average number of graduate courses offered remained consistent. It is expected that with the increase in the MEng program additional courses can be offered by sessional lecturers.

C3: MEng Program(s)
Strategic changes to the structure of the MEng program are required. The graduate studies committee is working on a set of recommendations for the improvement of the MEng program. The department has approved the proposed main structure of the MEng diplomas.

C4: Graduate Student Experience

- A “Research Methods” course is now a compulsory milestone for all new research graduate students.
- Opportunities for PhD students who have completed the CTE Certificate in University Teaching program to teach undergraduate courses as a sessional lecturer is ongoing.
- A process to select an outstanding CEE TA each term has been implemented. This award will encourage and reward excellence in TAing. The following CEE graduate students received this award: Michel Cohen and Kyle Balkos.
- A Special Recognition Certificate to recognize various sustained achievements in TAing was created. The recipients of the award were Dan Pickel, Michele Cho Colin VanNiejenhuis and Kevin Goorts.
- CEE is working through a series of renovations to graduate student office space; the renovations are expected to improve student experience.
- Various opportunities for socialization among the graduate students, faculty and staff are organized each year. To encourage the participation, a recognition process to select three outstanding volunteers has been implemented in consultation to the CEE graduate student association. The first recipients of these awards and certificates will be selected and presented in the Spring term 2018.

C5: Graduate Student Progression

- Since Winter 2016, the graduate office has set meetings every term with all students receiving an unsatisfactory evaluation in the Activity Report. A new format of the Activity Report has been revised by the graduate studies committee and will be implemented in Spring 2017.

C6: Final Oral Examination in the MASc Program

- This has been approved by a department vote and will be implemented in the Fall 2017 term.

C7: PhD Comprehensive Exam

- It has been recommended that changes be considered to the CEE PhD Comprehensive Exam to split it into two parts (background/proposal) that will be held separately. The CEE Graduate Studies Committee will develop a proposal for consideration once lessons learned from the ECE initiative are more definite.

D. RESEARCH PLAN

- A notable contributing factor to decreasing research funding may be changing demographics in CEE; several active researchers have retired and others are beginning to reduce their research activities as retirement approaches. The effect of this is compounded by difficulties in hiring new faculty in a timely manner. Several new hires in recent years are gaining traction, and will help to reverse this trend in the coming years.
- CEE formed a Research Committee in 2017. The Committee will be reviewing initiatives to support CEE researchers with identifying funding opportunities and review/advise on proposal writing and grant applications in an effort to increase success rates. Increasing research funding is a priority item for CEE.

Figure 50: CEE Research Funding Plan Performance to Target
D1: Identification of Emerging Research Areas

- The newly formed Research Committee is tasked with identifying emerging research areas within and related to CEE. This information will help to guide and advise funding opportunities, as well as for the development of strategic hiring plans.

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

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

D3: Improve Research Collaborations

- Our observation is that it is difficult to force collaborations and that these happen better organically. As such, this goal is no longer a priority.

D4: 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.

With the new AE program, additional space is required. This includes two design studios, a Maker’s space, and a complementary number of faculty and staff offices. The majority of space required for this program has been identified in CPH.

E1: Space Renovations

- Space planning and renovations are well managed by the CEE Space Committee and its Chair, with regular consultation with the CEE Chair. The Space Committee Chair regularly reports space planning and renovation updates to CEE at departmental meetings.

- Major space renovations have continued since the last reporting cycle.

- 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.

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 provides consistent University of Waterloo branding. This effort is intended to facilitate more current web content with consistent formatting.

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

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 has been developed for consideration/approval by CEE in the Fall of 2017. With approval, the Board would be initiated in early 2018.

Conrad Business, Entrepreneurship & Technology Centre

Mark Weber, Director

Over the past year, Conrad has continued its steady growth in impact and scope as it leads the academic entrepreneurship programming efforts at University of Waterloo. What comes next will be even more exciting.

This has been a year of consolidation and positioning for Conrad’s next stage of growth. Curricula at both the graduate and undergraduate levels were revisited and refined to positive effect. New faculty have established themselves, winning grants and getting grounded in their exciting new courses. A new faculty member was found to further refine online course offerings, which have the potential to play a bigger role in Conrad’s future. MBET student numbers are up and climbing, and Conrad positioned itself to market and recruit for its new Weekend MBET program.

Conrad continues to work to develop even stronger relationships with groups across campus to better enhance entrepreneurship education and support for all UW students. In particular, Conrad has engaged more actively with the School of Accounting and Finance, the Faculty of Science, and the Faculty of Arts on various initiatives and potential initiatives. In the future, Conrad continues to see itself as a potential strategic partner for all faculties in the entrepreneurship space.

Going forward, Conrad anticipates the need for 2-3 new faculty hires in the next 18 months as it creates more sustainable teaching arrangements under the Waterloo Budget Model (WBM) and positions itself to become a school within the Faculty of Engineering, serving the entire campus community.

The anticipated move from North Campus to E7 on the main campus in the next plan year will be positive and transformational for Conrad and entrepreneurship education at UW.

A. FACULTY AND STAFF PLAN

Conrad took a cautious approach to staffing in 2016/2017 as the details of the new Waterloo Budget Model were being sorted out. This has meant we found temporary ways to cover expanded teaching without engaging in full-time hiring.

We arranged to welcome Roopa Reddy on a one-year teaching contract to both cover for a maternity leave and to take over our foundational BET 100 course in the coming plan year. It is anticipated that a long-term full-time lecturer hire will be required this year to cover this and related activities.

In its appropriate caution about long-term commitments with absent financial clarity, Conrad now finds itself over-stretched on several fronts. In addition to a long-term full-time lecturer hire, we anticipate one or two tenure-stream hires in the next plan year.

In the coming plan year, 27% of full-time faculty will be women. Though this will be ahead of plan, we aspire to have better representation in the future.
A1: Transition to a Model with a Core of Tenured/Tenure-Track Faculty Supplemented with Sessionals Who Bring Professional Experience to the Classroom

- This objective has been achieved, as noted last year.

A2: Hire an IT and Online Learning Support Manager to Support Growth and Launch of New Programs

- This has not been necessary. We anticipate needing new staff to support our growth and emerging strategic objectives, but not specifically in this domain.

A3: Convert Enterprise Co-op Coordinator Position from a Contract to a Continuing Appointment (Once Permanent Mandate to Run E Co-op is Secured)
• This mandate, with related funding, was renewed for 3 years. With that renewal, a new 3-year contract was extended to the Enterprise Co-op Coordinator. We hope clarity around the potential for permanence will emerge as the WBM is more fully implemented.

A4: 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

• As our core faculty has grown, these part-time positions have shrunk in size and scope, while allowing us to employ more people with diverse skills in more focused domains. For example, we have secured an outstanding “social entrepreneur in residence” on a very part-time basis.

B. UNDERGRADUATE STUDIES PLAN

B1: Secure Permanent Mandate to Run Enterprise Co-Op

• A new 3-year mandate has been secured. A permanent mandate will be addressed as greater clarity around the Waterloo Budget Model is achieved.

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

• BETS and E Co-op continue to be highly successful. Indeed, CECA has featured them as exemplar programs in a number of ways, including on the national stage.

B3: Explore Opportunities to Create Undergraduate Entrepreneurship Options/Specializations

• Conrad now offers both an undergraduate Option in Entrepreneurship (Engineering) and a Minor in Entrepreneurship (anyone in any faculty).

• A number of changes have been made to streamline these offerings in ways that made them easier for everyone to understand. Those changes have been approved and will appear in the next university calendar.

• Three new undergraduate courses (electives to the option and minor) have been approved for delivery in the 2017/2018 plan year: Sales, Leadership, and Customer Experience Design.

B4: Provide Support for Capstone Entrepreneurship Awards

• A number of awards are now available, most notably those funded by the Esch Foundation.

C. GRADUATE STUDIES PLAN

• As anticipated in last year’s report, MBET numbers improved over the 2015/2016 plan year – up 12%. However, this was still far behind target. In anticipation of the 2017 intake, we have developed and executed several new strategies and approaches. It is clear those have been successful. It is expected that the 2017 class intake will be around 49 full-time MBET students.

• In the latter half of 2016/2017 Conrad designed a new 3-year Weekend MBET program, and began recruiting. Uptake has been remarkable, with a 2017 intake of 27 new students into a new program.

• Although 2016/2017 total graduate numbers were far behind plan, in the next report we should actually be at or slightly ahead of plan in FTE terms.

• Though we continue to work hard at CPR recruitment, we believe future full-time MBET growth will skew toward international students, while the new Weekend Program will be 100% CPR.
C1: Enhance MBET Program
- Changes made earlier through a comprehensive programmatic review continue to have positive effects.
- We continue to work to refine the practicum experience through an iterative design process. Each iteration improves on the last.
- All Certified Management Consultant content is now offered in-house by certified faculty. This has allowed more event program integration.

C2: Launch a Part-time MBET Program
- The design and marketing of a Part-time MBET program is now underway. It is expected that the uptake will be significant and impressive. Early estimations indicate that the first cohort will exceed the targeted number of students.

C3: Offer Diploma in Business and Entrepreneurship to Students in MEng Degree Programs
- This Diploma, and a related Certificate (3 courses instead of 6), is now offered to MEng and MASc students. There were approximately 300 course enrolments in the current year. The courses are well-received and highly regarded by students.

C4: Develop a Strategic Marketing Plan to Ensure Graduate Intake Targets are Met
- Comprehensive strategic marketing plans are now developed on an annual basis, with strategic investments in data-driven recruitment methods and supporting video materials.

C5: Explore Opportunities for Additional Taught Master’s Programs to Launch in 2015-2020 period
- Conrad continues to focus on MBET as its flagship program. With the launch of the part-time MBET program, we are unlikely to consider additional taught master’s programs in the near future.

C6: Plan for Introduction of Research-based Master’s and/or PhD Program in the 2015-2020 period
- With the increase in the number of researchers on Conrad’s faculty, it has become clear that we need to explore the development and launch of a PhD program. A leading researcher has been given course release to work on that project.

D. RESEARCH PLAN
- As noted in the past, Conrad’s research dollar numbers look very strong against plan. However, that has historically been heavily influenced by a single very large multi-year grant that will conclude in 2017. No comparably large project is anticipated in the next planning cycle.
- Conrad’s researchers have been very successful in SSHRC competitions, with every SSHRC-eligible researcher being funded.
D1: Grow Conrad’s Research Capacity and Reputation

- Conrad’s two most recent tenure-stream hires have been executing on their promise, alongside their colleagues. They have both won recent, significant SSHRC grants. Conrad’s name has been attached to several new publications in excellent journals. Further growing this capacity requires new hires.

D2: Develop Opportunities for New Faculty to Supervise Research Master’s and PhD Students

- This has proven more difficult than anticipated. No graduate research program on campus is squarely in the space of Conrad’s faculty, although some opportunities in Management Science for co-supervision have emerged.
- Difficulties with this objective are accelerating our work on establishing our own program.

D3: Encourage Collaboration with Researchers in Other Disciplines

- This is an ongoing effort. An initial attempt to create a cross-campus inter-disciplinary group was met with modest success. The diversity of approaches and disciplinary orientations made it difficult to establish clear value to the group as a whole.
- Conrad has hosted research talks with broad invitation lists with some success, and plans do more in the future.

D4: Identify a Senior Faculty Member to Champion Research Development

- Shavin Malhotra is now championing our research graduate program development process.

E. DEVELOPMENT PLAN

E1: Establish a Development Committee as a Sub-committee of the Conrad Advisory Council

- Conrad had a development committee. Changes to the use of the Advisory Council and the development of Conrad as a unit have led to the disbanding of this committee. Developing a new approach to development and advancement will be central to the coming two years.

E2: Establish an Alumni Committee

- We do not have current plans to establish an alumni committee. However, Conrad has taken significant initiatives to increase alumni engagement with great success.
- Conrad now hosts multiple “ConradConnect Live” events each year, and alumni are invited to attend. Two alumni-focused events are also held, and social media has been a successful mechanism for re-engaging alumni at the margins.

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

- Conrad continues to participate actively in all such efforts as invited.

F. GOVERNANCE, ADMINISTRATION AND LEADERSHIP PLAN

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

- Discussions on this subject have been ongoing with key stakeholders and constituencies. A proposal will be put forward in 2017/2018.
F2: Launch “Conrad” Brand and Develop a Distinctive Identity for the Centre as an Academic Unit within the Faculty of Engineering

- Conrad’s brand identity continues to develop and strengthen. Built on a distinctive approach to high quality classroom experiences, it is supported and promoted by a strong web and social media presence and a growing number of live-event community activities.

F3: Clarify Role of Advisory Council

- Important conversations with long-time Advisory Council members have advanced considerably in the current year. A plan to evolve the Advisory Council is in development, and should be executed in the coming year.

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

- Following a review, the role of the EIR has been significantly reduced as full-time faculty have assumed aspects of the role. Further, an expanded number of EIRs with smaller time commitments and more diverse networks and backgrounds are being deployed.

F5: Encourage Adoption of Administrative Processes in Line with Other Departments in Engineering

- Conrad uses the same administrative processes as other departments in Engineering. Transition to school status will further formalize this.

Department of Electrical & Computer Engineering

Vincent Gaudet, Chair

In 2016-17, 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 93 regular faculty members and 49 instructional, research laboratory, and administrative staff. ECE has over 2,300 undergraduate students (including our pro-rated share of four collaborative programs), 560 graduate students, and 12,600 alumni. The department raised $19.7M in annual external research funding, representing a year-over-year increase of 11%.

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

At the undergraduate level, our plan focused on admissions and recruitment, student retention and engagement, infrastructure, and teaching quality. Our intent was to admit more international students while keeping overall intake steady. At present, over 20% of our incoming undergraduate students are international. We have also made continued progress in the fraction of female undergraduate students. 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, to be deployed beginning in Fall 2017.

At the graduate level, the Strategic 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. In 2015, the ECE department introduced a Research Stimulation Grant (RSG) program to provide financial resources to help selected faculty members build up their research capacity. After gaining two years of experience, the RSG program is being revisited, with an updated focus on providing targeted stimulus and support for faculty who are preparing proposals for large grants. ECE has also started to put greater effort into nominating its faculty members for external research and professional awards. In early 2017, Profs. Kankar Bhattacharya and Amir Khandani were both elevated to the grade of Fellows of the Institute of Electrical and Electronics Engineers (IEEE), increasing the number of Fellows to 18 among our active faculty.

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

Two new faculty members started in 2016-17, and two administrative staff and three lab instructors were recruited. Additionally, four technical/research staff members were hired, including the new position of Lab Director, Research and Special Projects. Over the past few years, several external factors (research, immigration, safety, etc.) have contributed to increase the department’s 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. Other initiatives have been the re-organization of the graduate studies team to provide one point of service for Masters students' graduate funding, as well as additional support for management of the growing number of graduate studies applications. The department is relying on the increased use of technology to manage administrative staff workload.

As the department continues to grow, its space requirement is becoming an issue. The department will have two floors in Engineering 7, a new building currently under construction and set to open in 2018. There will be five large classrooms providing home rooms to all ECE undergraduate students. In addition, there will be two smaller classrooms for graduate courses and technical electives, as well as office and research lab space to alleviate our space shortage. The plan is to move the undergraduate academic support staff to E7 for better service and accessibility for our students.

A1: Implement the ECE Faculty Hiring Plan

- ECE hired two faculty members: Arie Gurfinkel (Associate Professor, software engineering) and Nachiket Kapre (Assistant Professor, digital hardware), thus expanding our complement to 93 regular members. In 2016-2017 we also conducted faculty searches for three positions: computer software, computer systems, and high-voltage/power systems. The searches are still on-going. We also expect to start a search for a faculty member in biomedical engineering circuits and devices in 2017-2018.

- 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. Several faculty members either registered for PEO or wrote the professional practice exam in 2016-2017, and we therefore expect an improvement in licensing rates for 2017-2018.
A2: Implement the ECE Staff Hiring Plan

- The department filled two administrative staff positions (Lynn Skelly and Karina Aragon Gaxiola), three Laboratory Instructor positions (David Bell, Yushi Hu, and Charles Pope), as well as the Lab Director Teaching (Trevor Smouter). A new Lab Director Research & Special Projects (Bill Jolley), two research lab managers (Luis Guiterrez and Joseph Thomas), and one research technical specialist (Czang-Ho Lee) were recruited. During the same period, two staff members retired, two promotions occurred, and two positions were vacated. In addition, there were four administrative staff secondments.

B. UNDERGRADUATE STUDIES PLAN

At the undergraduate level, the department is responsible for 2,377 students (pro-rating for shared programs). ECE manages three combined cohorts of students enrolled in Electrical Engineering (EE) and Computer Engineering (CE); the typical intake has been greater than the projected 120 students per cohort envisioned in the Strategic Plan. ECE
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 11% share of students.

**Figure 61: EE&CE Undergraduate Intake Plan Performance to Target**

**Figure 62: EE&CE Undergraduate Intake Plan Performance to Target, Visa Status**

**Figure 11: SE 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 the overall admission target. Currently, the ratio of EE to CE is approximately 1:2.5, with a trend towards greater imbalance that is requiring attention to scheduling and teaching resources. As planned, we have been gradually increasing the proportion of visa students.

- ECE is very well represented by Faculty members in various promotional events to attract students, such as the Ontario University Fair (OUF), and Fall and Winter Open Houses. For example, at OUF, we had the largest number of faculty members present of any engineering department.

- We are developing promotional videos on what the fields of Electrical and Computer Engineering entail, what opportunities Waterloo ECE provides to the students, and how students can succeed in our program. These videos will be uploaded on ECE site by Fall 2017. The videos are intended to attract students that have a growth mindset.

B2: Improve Student Retention Rates and Enhance Student Engagement

To enhance student engagement, ECE started many different initiatives:

- We piloted ECE Design Days in collaboration with the Ideas Clinic, where 1B students solved open-ended problems over two days. Classes were suspended during this time and lab schedules were adjusted. The pilot for the Design Days was highly successful with overwhelmingly positive student feedback. A video of the event can be watched at: https://www.youtube.com/watch?v=RI1WishIT7s&t=90s

- An issue we have identified in our program is the low level of interaction between students from different years. To break these barriers, we are focusing on events which encourage inter-cohort friendships and networking. Class event funding is now directed towards joint events. For example, in Winter 2017, there was an off-campus, trivia night with approximately 120 students attending.

- To help students deal with stress and mental health related issues, an email is sent to all students at the beginning of the term, midterm week, and before the finals. The email directs the students to the various counselling services available in the campus and how students can use them. The students are also asked to contact the ECE undergraduate office if they are having issues or cannot get in touch with the Counselling Services.

- It has also been mandated in ECE that the Associate Chair, Undergraduate Studies will be running the class-professor hours and talk to the students about the courses they are taking and how they relate to the future terms and career goals. The goal is to make students more invested in their own education.

B3: Enhance the Undergraduate Student Experience through Infrastructure Improvements

- ECE will have two floors in the upcoming E7 building, expected to open in 2018. The ECE space will include five large lecture theatres and additional tutorial rooms, to provide home rooms to all EE and CE undergraduate students, as well as open areas with exterior views. There will also be “makerspace” available for departmental projects.

- The department is concerned that in the absence of a permanent lab budget, lab infrastructure may soon become obsolete. However, we plan to use the transition to the new Waterloo Budget Model and the greater control that each Engineering department will have over its finances as an opportunity to revisit this issue.

B4: Improve Overall Teaching Quality

- The department has made progress in implementing an outcomes-based assessment process, as mandated by the CEAB. An initial process was implemented as of 2013/2014, but was found to be lacking in many respects, albeit not for lack of effort. To improve our process, we hired an Outcomes Lecturer and an Accreditation Assistant. These positions are collecting data on every course.

- Our Teaching Quality Coordinator (TQC), Prof. David Wang, works closely with instructors and others in the university (including the Associate Dean of Teaching and experts at Center for Teaching Excellence) to determine best practices for teaching and to help out 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 the sessional instructor selection process to keep teaching quality a significant portion of the hiring criteria.

- ECE has started modernizing its laboratory exercises based on open-ended design problems and more hands-on activities. The laboratories are being designed to not only reinforce the materials taught in courses but also introduce the students to the applications and further supplement their knowledge. We have identified at least 1 lab every term where critical thinking and problem solving skills will be emphasized in the labs.
B5: Increase and Enhance Communications with Students

- ECE has enacted a policy of at least one townhall meeting with every cohort in each academic term. In recent townhalls, students were presented with the changes ECE was making in the curriculum and student feedback was gathered. Besides helping us improve our program through feedback, it also engaged our students and made them feel that they are an important part of ECE. Our new curriculum starting in 2017 was guided by student feedback. We have already started seeing very positive results from our continual communications with the students. 4B exit surveys demonstrate the positive changes in student engagement with the Department all across the board.

C. GRADUATE STUDIES PLAN

- The ECE graduate program is one of the largest in the country, with 599 graduate students (261 PhD, 158 MASc, 170 MEng, and 2 non-degree) in 2016-2017. The growth in annual intake in the PhD and MASc programs has stabilized at around 1.1%, and that of the MEng program at around 1%. In 2016-2017, ECE had 96 CPR and 165 visa PhD students, and another 150 CPR and 186 visa MASc/MEng students. The ECE Department is continuing with its efforts to meet its CPR graduate student targets.

Figure 71: ECE Graduate Intake Plan Performance to Target

![ECE Graduate Intake Plan Performance to Target](chart1)

Figure 72: ECE Graduate Intake Plan Performance to Target, Visa Status

![ECE Graduate Intake Plan Performance to Target, Visa Status](chart2)

C1: Increase the Rigour of the PhD Examination

- 2016/2017 marked one year since the oral Comprehensive Background Examination was instated. The impact of the initiative has been reviewed by the Department. There is a general consensus that the PhD Comprehensive Background Exam has been beneficial for students and served its purpose of identifying their weaknesses and addressing them early in the program to improve the overall quality of ECE’s PhD candidates.

- Spring 2017 will be the first term in which the PhD Comprehensive Proposal Exam will be held. The transition to this second Comprehensive Exam milestone is anticipated to be quite seamless as faculty members are more familiar with the structure.
C2: Provide High-Quality PhD Supervision and Support Timely Degree Completion

- The new PhD Milestone structure ensures that PhD Committees will meet at least once per year with their PhD candidate over their four-year program. This is a two-fold increase over the previous practice of meeting twice over the course of the PhD program, namely at the Comprehensive Exam and at the PhD Defense.

- The use of online Term Activity Reports (implemented in Spring 2015) has continued to ensure a dialogue between the graduate students (MASc and PhD) and their supervisor(s). Students must complete a report that outlines their previous term’s accomplishments as well as goals for the current term. The supervisor(s) must, in turn, provide feedback on the student’s performance and identify the areas of growth, improvement, and/or concerns.

C3: Increase Recruitment Efforts to Attract CPR Students and Improve Graduate Funding

- ECE actively participates in all Faculty of Engineering recruitment efforts, including the faculty-wide Graduate Studies Information Reception, Graduate Recruitment Working Group, and the implementation of SalesForce software to track potential applicant inquiries and leads.

- Each term, the Associate Chair for Graduate Studies, the Graduate Studies Manager, and the Graduate Admissions Coordinator makes a presentation to the upper-year undergraduate students during their Class-Prof hours to promote graduate studies at UW and outline the various scholarship opportunities available to top domestic applicants.

- The ECE Department also recognizes the importance of timely admission offers in order to increase our new admit acceptance rate. To this effect, in Spring 2017, the Department will create a new position of Graduate Research Program Coordinator who is, in part, responsible for improving the admission practices from the side of the faculty members.

C4: Restructure the MEng Program with a Focus on Quality

- With an ever-growing pool of MEng applicants, entry into the program has become increasingly more competitive. As a result, students entering the MEng program have strong academic background, which has been increasing the overall quality of the program. The MEng Program Coordinator has also helped improve the overall quality of the ECE MEng program.

- In Winter 2017, the ECE Department began the development of three new MEng Diploma options. These diplomas include Robotics and Control, Nanoelectronics, and Embedded Systems. With an anticipated launch in Winter 2018, these new diplomas options will help increase the appeal of the ECE MEng program to prospective students.

C5: Improve Graduate Student Experience

- Through 2016/2017, the ECE Department has continued to offer FoE awards valued at $1500 each term for exceptional student performance in a term, based on their Term Activity Reports. An average of 30 awards were given out each term.

- Five teaching assistantship (TA) awards are distributed each term to the top 5 TAs in the ECE Department to promote teaching excellence.

- The fourth edition of the Graduate Student manual was released in January 2017 and includes updates on the new PhD split comprehensive exam, changes to enrolment, teaching assistantships, and student funding.

- ECE continues to support the ECE Graduate Student Association (GSA) by providing funds for social events and initiatives. In 2016/2017, the GSA hosted several guest speaker lunches, 2 ice cream socials, 3 coffee hours, and purchased 4 Bunn coffee pots to be used by the GSA.

C7: Addition of New OCGS Approved Area of Research

- In Spring 2017, ECE will introduce its 14th OCGS approved area of research, Biomedical Engineering. After almost two years of planning, the Biomedical Engineering research group has 18 affiliated faculty members and 5 active graduate students in its first term. This research area covers several inter-related aspects of biomedical technology. The addition of this research area will further expand the ECE’s research scope and help attract more top quality students to our graduate programs.

C8: Future Initiatives

- The quality and number of research-based graduate students in ECE is a cornerstone of research output. We are committed to a realistic and sustainable improvement plan that includes reducing the application-to-acceptance time, while operating in a challenging global environment. The Graduate Research Program Coordinator, looking at ways to improve the quality of research-based students admitted to the program by
establishing a review committee which will review all incoming applications and grade their suitability in various orders of priority. As part of this initiative, the Graduate Research Program Coordinator is looking at adopting the Odyssey platform, to help faculty members in the admission applications review process.

- In 2017/2018, ECE is also planning to have all program extension requests/approvals completed online.

D. RESEARCH PLAN

- ECE received over $19.7 million in research funding in 2016-17, a 10% increase with respect to the previous year. This trend accelerates our recovery from the drop seen between 2012 and 2014. Although the department is still below the target, ECE has a strong, diversified, and supportive research environment that helps faculty members increase productivity and fund research. The department is developing and increasing funding for initiatives aimed at attracting more government and industrial research funds. Also, the department has put special emphasis on promoting productive faculty members through professional and research awards, as explained in more detail below. This effort will certainly increase ECE’s research visibility and ranking across various indices.

Figure 73: ECE Research Funding Plan Performance to Target

Figure 74: ECE Research Funding Plan/TTS Performance to Target

D1: Increase the Department’s Research Visibility

- The ECE Distinguished Lecture Series (DLS) invites internationally renowned experts to lecture to the Department. Recipients of Honorary Doctoral Degrees at the Spring Convocation, Dr. Chunli Bai (President of the Chinese Academy of Sciences and World Academy of Sciences for the Advancement of Science in Developing Countries) and Professor Goran Andersson (ETH Zurich) delivered very well attended lectures. Dr. Simon Haykin, Emeritus Professor from McMaster University also lectured in Waterloo as part of this series. In addition, ECE researchers invited 12 IEEE Distinguished Lecturers to Waterloo in the current period. These lectures are widely advertised and attract many attendees from other departments and local companies.

- We are continually improving our communication outreach to our own students and staff. Research achievements are displayed on a wall-mounted interactive computer placed at the ECE department reception area. Particular emphasis has been placed on announcements highlighting research accomplishments by faculty members.
D2: Improve Research Quality

- The ECE department funds 2 ECE Department Research Awards annually to acknowledge and reward excellence in research. Recipients are given a reduced teaching load for one year, based on a selection made by the Merit Committee.

- The department aims to attract and secure the best and brightest graduate students to our programs through improved communication and more efficient and effective admission processes. By stimulating participation and dissemination of research results produced by these Masters and Doctoral candidates at conference and in follow-up journal articles, we expect that the quality of our research output will continue to improve.

- The department is actively involved in promoting collaborative research within our faculty and across disciplines. For example, over 50 faculty participated in a speed networking event aimed at increasing collaboration between disciplines in ECE held at our department retreat.

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 such as IEEE fellowships. Royal Society of Canada fellowships and NSERC prizes (e.g., E.W.M. Steacie Award). Examples of success include a faculty member who received an IEEE-Canada Medal (Canizares) in 2017 and Weihua Zhang was nominated and elevated to RSC Fellow. All nominees receive full and unconditional support from the department when developing and preparing a nomination and supporting documents.

- Communication of ECE achievements continues to develop and hone our research profile. Our webpages, Facebook page and Twitter feed announces significant research accomplishments, such as research grants, best paper and professional awards.

D4: Increase Research Funds

- ECE is eager to stimulate faculty participation and improve the yield in collaborative research programs funded by frameworks such as the ORF, CFI, NSERC Strategic Projects, and the Federal Supercluster program. In 2016, the department began contributing funding directly to proposals at the federal and provincial levels. A $3M CFI grant to a research team led by Professor William Wong (PI) is an example of early success by ECE researchers taking advantage of this initiative. Department funding is also available to support preparation of proposals (e.g., support for writing) and provides expert advice to faculty preparing research applications via members of our Research Committee.

- 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 Bridget Moloney (Office of Research) and Ken Schultz at OCE to improve our outreach to local industry, with the aim of increasing industry funding and participation in our research projects (e.g., NSERC CRD, direct funding by companies, OCE and Mitacs projects, etc.). ECE is also a partner in a proposed Microelectronics Supercluster, which is a strongly industry-biased research consortium.

- The ECE Research Stimulation Grant (RSG) Program has provided 13 ECE faculty members with additional financial resources. The grants are awarded through a competitive process based on documented increase in department research. In 2016, seven grants were awarded (7x$22,000 for a total of $154,000 of department support) These grants, combined with other Department Research Awards, add up to close to $400,000/year allocated by the department to fund ECE research initiatives.

D5: Improve Research Environment

- Improving the efficiency and yield from our graduate admissions process will assist researchers aiming to recruit the most talented applicants to our programs. ECE is adopting new software and processes (in cooperation with the FoE office of Graduate Studies) that will improve the efficacy of our graduate screening and admissions process. We aim to generate offers to the best and brightest applicants earlier than our competitors at other research schools.

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 2016-2017, ECE 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.

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 to discuss various departmental issues, including ECE's progress on our 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. We also held a research mixer where faculty members were expected to give 3-minute introductions on their research interests to colleagues, in an attempt to promote more collaborative projects and grant proposals.

Department of Management Sciences

Samir Elhedhli, Chair

The Management Engineering program continues to progress as planned. We welcomed the 10th incoming class this Fall (2017). Now that the program is well established, we are increasing targets to 80. The exit survey reports that 70% of students agree or strongly agree that the Management Engineering program has met their expectations.

Considerable progress was made on Departmental goals. In the current reporting period, changes were made to the graduate professional and thesis programs (MMSc, MASc, PhD) to serve the needs of each program; new courses and specializations were introduced. Also, this year, a Recruitment & External Relations committee (RER) was established. It is responsible for all matters related to undergraduate and graduate recruitment, department outreach, and promotion to external audience, including pre-secondary students, alumni, and industry. Finally, in anticipation of increased undergraduate enrollment, we acquired and furnished a new classroom that can seat 90 students, moved to a new bigger fourth year design studio, and are in the process of moving to a bigger lab.

A focus for the future period will be to improve the faculty complement. During the past year and half, we lost 3 faculty members to other universities due to family reasons. No replacement hiring was completed in 2016/2017. Advertisement and hiring has been put on hold due to the newly introduced Waterloo Budget Model. Another activity for future periods is to complete the program-level indicator and comparison for the Canadian Engineering and Accreditation Board (CEAB). It is also expected that further graduate studies improvements will be completed in the next year. The Department intends of reviewing the online MSCI Master’s program; the intent is to reconfigure the program to attract more qualified students.

A. FACULTY AND STAFF PLAN

• As mentioned above, there were significant changes to the faculty complement during the year. The total is below target because of the following changes: 2 recent resignations, 2 earlier resignations, and 2 retirements. The Department is targeting to fill 4 positions during 2017/2018
The department currently exceeds the target for female faculty members and considers gender balance seriously in its hiring.

We are almost on target with respect to PEng registration and application. The Department continues to actively encourage faculty members to register as professional engineers. As new hires are brought on board, it will be important to encourage them to start the application process as applicable.

Figure 75: MSCI Regular Faculty Complement Plan Performance to Target

Figure 76: MSCI Regular Faculty Complement Plan Performance to Target, % Women

Figure 77: MSCI Regular Faculty PEng Status Performance to Target

It is anticipated that we will replace our Accreditation Assistant who resigned in the reporting period.
A1: Faculty High Performance

- We continue to target top faculty and offer them the best of conditions for success. We recently lost three faculty members who went on to join other Universities. The departures were for family reasons.
- We provide extensive mentorship to set new faculty up for success. Each new faculty member is assigned a mentor. We also hold regular mentorship meetings to discuss topics such as student supervision, grant writing and teaching.

A2: Staff High Performance

- We continue to review and update job procedures and descriptions to reflect changes in duties. These activities are expected to continue into the next reporting period.
- The Department is exploring ways by which a strong relationship can be developed between faculty and staff. MSCI values the contribution of their entire team.
- Developing clear performance expectations and providing staff with training opportunities contributes to high performance. Staff are encouraged to take courses and workshops available through the university’s Organizational & Human Development and Information Systems and Technology offices to update their skills.

A3: Department Information Tracking Tool Development

- We continue to receive support from ECE for updates to Filemaker Pro. We plan to continue with improvements to the system.

B. UNDERGRADUATE STUDIES PLAN

- In Fall 2016, the Department exceeded the target by 4 students. The 2018 target has been increased to 80 (previously 75) students. It is expected that 5 additional international students will be admitted in that year.
B1: Implement Outcomes-based Program Evaluation

- We have successfully completed a full year of program evaluation data collection and begun the preliminary analysis. With our process now established, we continue to collect data from each course each term.

- We are near to finalizing program-level indicators and have mapped all course level indicators to a program level indicator. These different levels of indicators allow us to report on outcomes at different degrees of granularity. This also provides the ability to trace performance from the attribute down to specific assessments in all courses.

- Initial analysis of program indicators compared to CEAB attributes has identified areas of potential improvement. This will be addressed through curriculum changes.

B2: Reduce Student Attrition by Increasing Student Admission Averages

- We continue to emphasize student success in the introductory Management Engineering concepts (MSCI 100) course. Additionally, the Department has reduced the fraction of “deflection” applicants admitted in first year whose first choice Waterloo program is not Management Engineering. Finally, MSCI has increased admission averages to the median of those of other Waterloo Engineering programs. Due to these intervention, Management Engineering retention rates have been higher for a second year in a row.

B3: Increase the Average Teaching Quality of Faculty and TAs

- We continue to enhance faculty and TA teaching quality by encouraging feedback from students as well as making all instructors aware of potential teaching issues across the whole cohort of students.

- As part of OBA, we are succeeding in getting all instructors to provide a course outline that includes intended learning objectives (ILOs). The ILOs help instructors better craft assessments and help students better understand the goals of the course.

B4: Enhance the Social, Professional, and Intellectual Experience of Our Students

- We have moved into a new dedicated lecture room (CPH 3681). The new room offers improved audio-visual, better viewing of the whiteboard, multiple whiteboards for group work, and bright lighting with large amounts of natural light. The new classroom is also close to all department offices. Work is underway to expand the computer lab, which will permit more students to attend lab at the same time and reduce the number of sections that need to be scheduled.

- The Management Engineering undergraduate laboratory continues to improve and now offers a complete mini-factory experience that will allow for students to gain experience with the complexity of real world processes.

- The Management Engineering exit survey reports that 70% of students agree or strongly agree that the Management Engineering program has met their expectations. Only 8% of students disagree. These results are similar to the results obtained in 2016. We continue to solicit whole cohort feedback each term.

- The Management Engineering Fourth Year Design Studio was moved from an outdated classroom in E2 to a new, high ceiling space in CPH. The move improves the space as well as brings the students close to the department’s offices in CPH.

- Management Engineering students continue to actively participate in the student chapter of the Institute of Industrial and Systems Engineers (IISE). https://www.facebook.com/UWaterlooIISE/
B5: Expand MSCI Option Course Offerings
- The MSCI Option is quite stable, and has not had any significant changes. We continue to work to maximize availability of courses via scheduling and regular offerings.

B6: Comprehensive Review of the Undergraduate Program
- The Management Engineering curriculum changes have been approved and should appear in the upcoming calendars. The changes have been met with approval from current students who agree that the changes will improve the program for future students.

C. GRADUATE STUDIES PLAN
- Demand continues to be strong for our professional Master’s program. We exceeded our targets for both CPR and Visa students. The will continue to explore options for improving the intake rate of the PhD program.

Figure 81: MSCI Graduate Intake Plan Performance to Target

Figure 82: MSCI Graduate Intake Plan Performance to Target by Visa Status

C1: Excellence in Graduate Programs
- During the period, graduate student engagement was notably improved by the reduction a class size. This has increased the experience of MSCI graduate students.

- The Department increased the number graduate course available. Two new graduate courses in Data Analytics were offered. In Fall 2017, it is anticipated that yet another 2 new graduate courses will be introduced and added to the Graduate Calendar.

- In January 2017 a new MMSC specialization was introduce. Diploma in Data Analytics started and we are seeing strong demand for the option.

- The Department targets excellent students in the MMSc, course work program. Once identified, scholarships are offered to encourage the transfer into the MASc thesis program.

C2: Enhanced MMSc Online Program

C3: Increase the Number of Electives Offered Annually
We are investigating potential tactics to increase electives, including possibly increasing the number of combined online and on-campus courses and sharing courses with other online programs in Waterloo.

D. RESEARCH PLAN

- In 2016/17, the Department of Management Sciences received $1,216,512.00 in research funding, which exceeds the target level.
- The Department will continue to promote research excellence and to encourage faculty members to apply and receive more research grants.
- All NSERC discovery grant renewal were all successful. Also, one of our faculty received an Early Researcher Award. We now have two.

![Figure 83: MSCI Research Funding Plan Performance to Target](image)

![Figure 84: MSCI Research Funding Plan/TTS Performance to Target](image)

D1: Increase Research Funding Level

- The department continues to support faculty who are actively applying for grants, especially for junior faculty members.
- The department continues to work more closely with the different support offices in the Faculty of Engineering and the University to make sure our faculty are aware of funding opportunities and potential collaborations with industry, and that they get the support needed to explore them.
- The department continues to support and encourages graduate student to participate in the co-op program. This helps establish and strengthen ties with industry and increase the awareness for our programs.

E. EXTERNAL RELATIONS PLAN

E1: Strengthen Existing Industry Relationships

- The Department is working on establishing an Industrial Advisory to build a stronger relationship with key industry representatives.
The 2017 Management Engineering Capstone Design Symposium and the alumni and industry post-symposium event were well-attended by industry representatives, especially from sponsoring companies.

The Deloitte sponsorship of the Capstone Symposium was unfortunately not renewed as the company reduced hiring targets this year.

The Department continues to seek opportunities to connect with industry through alumni and students in our online master’s program, the majority of whom are employed full-time in industry.

E2: Create New Industry Partnerships

- A detailed webpage on our website that outlines main research interests and relevant faculty members, especially as it applies to industry, has been completed.
- We continue to promote department research. One forum for doing so is through the “featured research strengths” portion of our website.
- As planned, capstone projects were solicited from alumni, resulting in a new project with UPS.

E3: Strengthen the Relationship with Our Growing and Diverse Alumni Body

- Efforts are being taken to automate the tracking of and communicating with MGTE alumni. The project has been taken on by a group of 4th year MGTE students. When completed, the tool will allow us to better draw and manage employment and other alumni statistics.
- About 20 alumni attended the 2016 Management Engineering Capstone Design Symposium and the alumni/industry post-symposium event was held again in 2017. The event has become an important milestone that attracts MGTE alumni back to campus each year.
- Informal conversations have occurred with various alumni about improved communication between the department and the alumni body, including through newsletters, social media, and targeted events. A sustainable means of regular communication has not yet been determined.
- Engineering Advancement was consulted with regards to targeting alumni for fundraising for the new Management Engineering Design Studio. No suitable alumni to kick-start the fundraising have been identified yet.

E4: Better Communicate the Department, Mission and Relevant Information to a Variety of Audiences through Our Web Presence

- A new website committee has been formed to streamline website governance.
- All website content is being reviewed and updated wherever necessary, with the goal of ensuring that content is accurate, informative, and professional.
- The type and frequency of news and events posted to the website has significantly been increased to better reflect the activities and accomplishments of the department.
- Google Analytics are being used to track traffic to and within the website to ensure more targeted promotion of our programs and researchers.

Department of Mechanical & Mechatronics Engineering

Amir Khajepour, Acting Chair

The Department of Mechanical & Mechatronics Engineering (MME) has gone through several hiring rounds to fill its faculty openings in the reporting period. This is a result of the expansion of the undergraduate Mechatronics Engineering (MTE) program, the new Biomedical Engineering (BME) program, retirements and IRC positions. The hiring will continue in the coming year to fill all our current openings. The Department has also restructured and expended its admin and technical staff to better address its current and future needs.

Admissions to the Mechanical (ME) and Mechatronics (MTE) program exceeded targets in 2016. The initiatives to improve the learning experience at the undergraduate level have focussed on the MME Clinic. The Department is reviewing the Clinic activities to better tie them to our ME and MME undergraduate programs. This will better provide hands-on experiences to all our undergraduate students and link practice to theory in some of our core courses.

Our total graduate admissions did not meet the target. That said, in some categories we exceed the targets. The Department expects to meet and exceed the targets in the next year as a result of several large successful funding programs, new Department initiatives to encourage faculties to increase their graduate students, and plans to increase the MEng intake. The Department has also taken initiatives to increase and improve graduate students’ offices. The
graduate seats in EC4 were increased by 25% by reconfiguring students’ cubicles, and renovations were conducted in other Department buildings to better accommodate the surge in the number of our graduate students in 2017 - 2018.

A. FACULTY AND STAFF PLAN

- To fill our faculty openings in the Department due to the expansion, retirements, and IRC positions, two new faculty members have already joined the MME and three more have been given offers. The recipients of the offers are expected to start employment by the end of 2017. The Department has seven more openings and is expected to fill all of them by the next reporting period. In addition, the Department is reviewing its number of sessional lecturers to re-evaluate its definite and continuing lecturer positions.

Figure 12: MME Regular Faculty Complement Plan Performance to Target

Figure 86: MME Regular Faculty Complement Plan Performance to Target, % Women

Figure 87: MME Regular Faculty PEng Status Performance to Target

- Although the number of MME faculty holding a PEng license has increased since last year, the Department has not meet the target. This is mostly due to the number of new faculty members joining the Department in the past year. Efforts will be made to assist and encourage new faculty members in applying for their PEng.
Although the number of MME faculty holding a PEng license has increased since last year, the Department has not meet the target. This is mostly due to the number of new faculty members joining the Department in the past year. Efforts will be made to assist and encourage new faculty members in applying for their PEng.

A1: Hire New Faculty to Support New Initiatives
- Hossein Sojoudi joined the Department as Assistant Professor on July 1st. This is a new position in support of the Biomedical Engineering program.

A2: Replace Faculty Retirements with Positions in Emerging Areas
- Stewart McLachlin joined the Department as Assistant Professor on July 1st. This is a replacement position for John Medley who retired in 2017.

A3: To Better Support the Department’s New Activities, Increase FTE Staff Complement
- The administrative staff organization structure was changed to better meet the university budget model needs. Jennifer Peng was hired as the Financial Officer. In addition, Meaghen Winfield was hired to replace Debbie Collins who left the Department.

A4: Provide Professional Development and Training for Our Staff
- 13 administrative staff took a total of 113 courses or 481 hours. The average number of training courses per administrative staff was 7.5 with an average of 32 hours per staff member. All staff took at least 1 course with one member taking as many as 26 courses
- All staff are encouraged to seek out professional development to enrich their current roles and growth opportunities. Cross functional training is highly encouraged within the Department.

B. UNDERGRADUATE STUDIES PLAN

Figure 139: ME Undergraduate Intake Plan Performance to Target

- Although the number of MME faculty holding a PEng license has increased since last year, the Department has not meet the target. This is mostly due to the number of new faculty members joining the Department in the past year. Efforts will be made to assist and encourage new faculty members in applying for their PEng.

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- All staff are encouraged to seek out professional development to enrich their current roles and growth opportunities. Cross functional training is highly encouraged within the Department.
B1: Establish an Engineering Clinic within our Undergraduate Programs

- Extensive use of WATiMake hardware prototyping tools (laser cutter, 3D printers, CNC mill, electronics and hand building tools) was noted during the reporting period. The prototyping tools were used by 300+ individual MME students/term since W15 and continued growth in demand each term has been experienced. Every active MME cohort has participated in at least 1 clinic activity.

- Integration of WATiMake clinic support for class activities continue from both programs for core courses each semester. Students continued to deeply engage in MME Clinic activities. Participation in the Clinic for the past term was 3 cohorts (2 ME, 1 MTE) and 294 students.

- Staff engineers and coops extensively supported cornerstone and capstone prototypes for both MTE and ME students in Winter term.

B2: Improve the Undergraduate Experience

- Our Department continues to review the Clinic activities for improved integration of the program with our undergraduate courses.

- The development of new projects for ME 380 and MTE 380 is going. These projects will integrate content throughout multiple 3B courses. The MME Clinic will continue to provide support in the development and delivery these projects.

B3: Undergraduate Lab Renewal

- In the reporting period, MME created a new fully-instrumented lab in E3-3178. The improvements will provide deeper learning opportunities for student. This facility will serve undergraduate courses in both ME and MTE programs. The lab has a seating capacity of 40 students.

- To facilitate experiential learning, MME created a Mechatronics engineering capstone studio in DWE 2524. The studio will allow students to develop design skills in a well-equipped environment.

- MME prioritized the reorganization E3X-3155. This space now houses labs for several MME technical elective (TE) courses.

- Hardware upgrades for computing platform used in MTE544 and MTE545 were completed in the reporting period.

B4: Increase Admission to Mechatronics Engineering

- The admission target for Mechatronics was again exceeded. MME is pleased to see that the program continues to be attracting an abundance of applications from high quality students. Mechatronics Engineering is evidently a well-regarded undergraduate program.

C. GRADUATE STUDIES PLAN

- Our graduate intake did not meet the target in the last year. With the new successful grants and also new initiatives in encouraging the faculty members to hire more graduate students, we expect to exceed our target next year. Furthermore, we will continue to actively take steps in increasing our MEng program intake.
C1: Increase Graduate Student Funding

- The Department has increased the minimum RAs for MASc and PhD students to reduce financial burden.

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

- The Department is closing the gap between the target and actual total research funding. It is expected to exceed the target in the next reporting period. We have however, exceeded the target for funding per faculty member in this reporting period. Evidently, the overall funding target was developed assuming a greater faculty complement. As the number of faculty in MME continues to increase, it is expected that the total research funding will also increase.

Figure 96: MME Graduate Intake Plan Performance to Target by Visa Status

Figure 97: MME Research Funding Plan Performance to Target
D1: Increase Research Funding
- Research funding is expected to increase in the coming year due to some large successful funding grants and the increase in faculty complement.

D2: Promote Identified Focus Areas
- The Department has identified target areas and will go through a review process considering the new university budget model. The review is expected to take place in the next year.

E. PHYSICAL SPACE PLAN

E1: Create New Space and Explore Rental of Off-Campus Space
- In the reporting period, an off-campus space was rented for our autonomous research activity. In addition, we have taken steps in renovating some of our current spaces. With the addition of E7, expected to open Fall 2018, space allocation will be less of an issue in the Department.

E2: Rationalize and Actively Track Space Utilization
- A laboratory space utilization data-base has been implemented for all faculty members. The data-base will be used to evaluate faculty research outputs compared research space allocation. This will ensure appropriate allocation of resources.

Department of Systems Design Engineering

Paul Fieguth, Chair

The 2016/17 academic year has seen a great many developments in Systems Design Engineering (SYDE), and we are highly optimistic of our plans for the coming year. This document will report on a variety of goals, some of which saw progress and others not. The development of the Biomedical Engineering program necessarily took priority, and remains a priority, although in many cases the Biomedical Engineering program is very much related to parallel goals of hiring and space.

Major strategic success for this year was the full funding provided by the Provost for the laboratory facilities of the Biomedical Engineering program. Significant faculty and staff hiring occurred due both to the new Biomedical and expanded Mechatronics programs. Space plans and developments continued to progress, particularly the complete occupation of EC4, the completion of laboratory plans for DWE, and details plans for E7. Finally, SYDE was pleased with renewal of the substantial donation by an alumna has allowed the continued enhancement of lab and design facilities within Systems Design.

The Department is considering next steps in complete the current priorities. E7 space assignments and plans need to be essentially completed by December 2017. With the anticipated opening of E7 in 2018, all plans must be finalized to ensure all timelines are met. SYDE intending to create a Maker Space; the donation by a SYDE alumna has allowed for a variety of plans, many of which are still underway. Graduate studies improvements continue to be a priority for the Department. The frequency and variety of graduate courses will continued to be reviewed. Additionally, the development of the Biomedical Engineering Graduate program is moving forward; proposal has been prepared, and other departments are largely on side, however the entire approvals process remains ahead of us.

At this time, SYDE has reflected on potential new priorities moving forward. The Department will be considering possible specializations or partnerships in the Graduate Studies program. Significant progress was made in this process right
towards the end of 2016/17, and we need to continue this momentum into 2017/18. The 3A/3B design courses have needed a clearer purpose/intent; we have some ideas in place, but more detailed plans are needed. The introductory Design Dayz activity was highly successful at the 1A level. The Department is considering whether we can develop a parallel activity, with similar success and enthusiasm at an upper year level.

A. FACULTY AND STAFF PLAN

- Four positions (Borland, Boger, Shelley, Mohtaram) were filled in what was a very busy hiring year. It is anticipated that hiring activities will continue into Fall 2017. The following activities are likely to take place: one additional position will be filled, two additional positions will be interviewed and one position will be advertised. The four filled positions are as follows:
  - Dr. Jennifer Boger was hired into the Schlegel Chair in Aging, an exceptional new position in partnership with the RIA (Research Institute for Aging), not included in the faculty targets on the following page.
  - Dr. Matthew Borland was hired into a lecturer position (MCTR 1) associated with the Mechatronics program expansion.
  - Dr. Cameron Shelley, who has taught full time for many years in CSTV (the Centre for Society, Technology, and Values) was formally hired into a continuing lecturer position.
  - Dr. Nima Mohtaram was hired into a lecturer position (Bio 6), bringing substantial expertise to the Biomedical Engineering program.

- There had been a planned tenure-track position in the Department of Biology (Bio 1). Although not related to the complement within Systems Design, the plan had been for this position to contribute to the participation of Biology in the Biomedical Engineering program. However activity-based budgeting has significantly changed how salaries are paid, and for the time being this position is on hold.

- We are slightly behind target with respect to female faculty, in large part due to two resignations in 2016. Continued efforts are required in order to encourage a strong applicant pool. PEng registration remains ahead of target for 2017.

Figure 99: SDE Regular Faculty Complement Plan Performance to Target

![Figure 99](image)

Figure 100: SDE Regular Faculty Complement Plan Performance to Target, %Women

![Figure 100](image)
Our staff complement has consolidated, in that 2016/17 saw no departures or additions. The most significant changes in terms of staff are:
- Finances: Both Concur and Unit4 are relatively new, and there are significant challenges in the use of Unit4, particularly in purchasing.
- Biomed: With each year there is an additional Biomedical Engineering cohort, which requires support, class / instructor / exam scheduling, and laboratory development.

A1: Faculty and Teaching Assignments
- Significant progress has been made. Although not completed, we have developed a much clearer map of teaching tasks expectations between the undergraduate and graduate programs. Although the number of graduate courses remains inadequate, we now have a fairly detailed plan in place, which can be met by current departmental resources. These plans will lead to graduate teaching growth for the next five to six years.

A2: Staff Restructuring
- Past restructuring is complete. There are further staff positions in both the technical and administrative sides, possibly this next year, but more likely one further year out.

B. UNDERGRADUATE STUDIES PLAN
- Undergraduate intake continues to be very satisfactory.
- The Biomedical Engineering continues to see huge demand. The apparent constant class size for 2015 and 2016 is misleading, and there was not at all any lack of interest or demand. The admission for fall 2017 is much larger and very much on track.
- The number of Systems Design applicants have been satisfactory, and indeed the class size increased significantly for 2016.
- As in previous years, the lack of name recognition is clearly visible in the difference in international applicants in Systems Design relative to Biomed / Mechatronics. It would be desirable to have a modest increase in the number of international students applying to Systems Design however, this is not a priority for 2017.
Figure 103: SDE Undergraduate Intake Plan Performance to Target

Figure 104: SDE Undergraduate Intake Plan Performance to Target, Visa Status

Figure 105: BME Undergraduate Intake Plan Performance to Target
B1: Teaching Quality

- The plan for 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, eight Systems Design faculty have taken part in one of these. Our target is to have one participant in one of these programs every year, a target which was met for 2016/17.

B2: Laboratory Program

- By far the largest laboratory effort this year was in developing a detailed plan and budget for the Biomedical expansion labs in DWE. The plan was submitted to the Provost and funding was approved, which completes the proposed support for the program. All of the equipment purchases will be taking place in 2017/18.

- The update of the SYDE 292L lab remains a goal, but was delayed due to attention to the Biomedical labs. The Department will continue to examine options for the lab development in the future.
B3: Other Curriculum Components

- We are very nearly at the point of appointing a full-time Graduate Attributes Lecturers (GALs) to finally focus on course assessments and curricular improvement. A retreat was held in April to look at the curriculum, as a whole, and committees dedicated to focused streams of courses have been struck for design and mathematics. The findings of the committees will be review for implementation in the coming period.

C. GRADUATE STUDIES PLAN

The graduate student intake at the MASc and PhD levels continue to be reasonably close to target. Notably, there was a solid improvement in 2016 over 2015. The CPR targets were very nearly met, and numbers are quite encouraging for the research graduate degrees (MASc, PhD). The MEng numbers for 2015 continue to be baffling, as 2016 was very strong. It is anticipated that 2017 will be another strong year for MEng intake.

Figure 14: SDE Graduate Intake Plan Performance to Target

![Graph showing SDE Graduate Intake Plan Performance to Target](image)

Figure 110: SDE Graduate Intake Plan Performance to Target by Visa Status

![Graph showing SDE Graduate Intake Plan Performance to Target by Visa Status](image)

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. Indeed, we have worked on a dedicated Biomedical Engineering graduate program, plan item C3 (below).

- The terrible drop in the MEng program in 2015 is still not understood, however the strong increase and 2016 (and further anticipated increase in 2017) suggest that the 2015 event may have been a statistical anomaly, rather than a systematic concern. However the MEng drop in 2015, and subsequent large increase, have motivated us to take a serious look at our graduate offerings and to propose changes, as discussed in C4.

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. One key component of quality is to ensure a reasonable distribution of graduate courses by topic area. To achieve this, a list of graduate courses has been proposed, by year, and needs finalizing in in the coming year. Effective communication is a key aspect of
program quality. Providing a complete list of outline course availability well in advance, will ensure graduate offerings are understood by current and prospective students.

- A number of steps have been taken towards the development of program identity:
  - Periodic graduate lunch sessions, on a variety of themes (social, research talks, career planning etc.)
  - More deliberate encouragement for the formation of a graduate student association
  - Plans for “core” courses at the graduate level, SYDE 600 and SYDE 660. The courses will be core (mandatory) for MEng students, but also open to MASc / PhD students. These courses will need to be reassessed in 2017 and 2018.

C3: Biomedical Engineering Graduate Program

- There has been a significant interest in forming a Biomedical Engineering graduate program for several years. A proposal was completed in 2016, and conversations about the program were held with other department chairs and the graduate associate dean. The key challenge is that the program is intended to not be a standard collaborative program, because of flaws in that model, and yet needs to be open to participation by departments other than Systems Design. The successful definition and further approval of this program are key goals for 2017.

C4: Graduate Program Options / Diplomas

- As part of the increased number and distribution of graduate courses, as mentioned in C2, it was felt that the graduate program, in general, but particularly the MEng program, would be significantly strengthened and be more attractive (and explicit in intent) if it offered a targeted set of foci. The following graduate diplomas were developed in 2016/17, approval is anticipated in 2017/18, with the diplomas taking effect in 2018:
  - Diploma in Biomedical Systems
  - Diploma in Design
  - Diploma in Systems Design Entrepreneurship
  - Diploma in Human Factors and Ergonomics
  - Diploma in Machine Learning and Intelligence
  - Diploma in Mechatronic and Physical Systems
  - Diploma in Vision, Image, and Signal Processing

D. RESEARCH PLAN

We continue to be near target for 2016/17. The performance for 2014/15 was not expected to be extrapolated, since almost all of that spike represented a one-time very large equipment grant (the CFI funding for the GAIA automotive project). The hiring at more junior levels, driven by the hiring associated with the Biomedical Engineering program, does mean that the department, as a whole, has a higher proportion of junior professors, and so it is expected to take a few years before these faculty members have developed and grown their research program and associated funding.

Figure 111: SDE Research Funding Plan Performance to Target
D1: Research Directions

- We continue to follow the longer-term hiring plan of the Biomedical program. We have completed the first cycle of three hires (Biosignals, Biodevices, Biomechanics) and are beginning the second such cycle now.

D2: Research Funding

- The construction of E7 will allow for further research space expansion. Planning for the facility is well underway.

E. BIOMEDICAL ENGINEERING PLAN

The third, larger cohort of Biomedical Engineering students arrived in Fall, 2016. As in the previous year, there were exceptionally large numbers of applicants, so the accepted students are academically very strong.

E1: Biomedical Engineering Undergraduate Program

- With every year, an additional year of undergraduate curriculum, syllabi, and course details need to be developed and put into place. This process has been very successful, and overall course evaluations and instructor satisfaction are very good. As in the previous year, there continue to be adjustments to heavy terms and lab course sequencing which have led to curriculum revisions.

E2: Biomedical Engineering Graduate Program

- Please see Section C3.

E3: Biomedical Engineering Undergraduate Laboratories

- As discussed in Section B2, a Biomed Lab Equipment budget and plan was submitted to the Provost and funding was approved; approximately $420,000. These funds complement funding from donors, plus earlier lab funds for the Digital/Circuits/Controls lab, which completes the proposed support for the program. All of the equipment purchases will be taking place in 2017/18.

F. DESIGN PLAN

F1: Design Sequence

- The design experiments have been overhauled, learning from last year’s experiences.

- The two-day Design Dayz worked outstandingly well last year, and was repeated with even greater success this year.

- A two-day optional design activity is being planned for 2A/2B, as a trial test. The role and scope of this activity will be the subject of continued planning.

- Changes are planned to the 3A/3B pair of design courses. Of the entire design sequence, these two courses needed a clearer purpose and rationale. Some changes were made in 2016/17, which we hope to complete in 2017/18.

F2: Ideas Clinic

- The Ideas Clinic planning was stalled in 2016/17, due to the resignation of Graduate Attributes (GA) lecturer Michele Bristow. She had been instrumental in leading the planning. With the upcoming appointment of a new GA lecturer, we anticipate renewed attention in 2017/18.
F5: SYDE Maker Space

- The substantial gift from a Systems Design alumna was renewed, extending this activity into a second year. The focus this year has been to complete the Maker Space area, started last year, and to more substantially support the hands-on and design aspects of the program: 1A Design Dayz, 2A/2B design, Biomed design, and 4A/4B design.

G. ADVANCEMENT PLAN

We have, as a department, in general not been very good at maintaining or nurturing ties to alumni. Two main developments this past year:

- Two years ago we invited alumni to the design showcase / black tie event in March, for which attendance was disappointingly modest. It was decided to keep the black tie event explicitly undergraduate focused, and instead to have an alumni event on the same day as the design symposium. This change was successful in 2016/17, and we would like to continue that in 2017/18.

- As mentioned in goal F5, the substantial donation was renewed for 2016/17. We still need to do more planning on how to promote and showcase the Maker Space and related opportunities for alumni involvement.
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 IV. A-H. For data definitions and sources, please refer to the alpha-numeric code in parentheses at the end of each figure title and the corresponding entry in Appendix IV.I.

A. Faculty and Staff

*Figure 113: Regular Faculty 2007-2017 (A1)*

Since 2017, the regular faculty complement in Waterloo Engineering has grown by 67 (27%), and the number of women faculty has increased by 21 (60%).

*Figure 114: Regular Faculty, 2017 (A1)*

As of May 1, 2017 Waterloo Engineering’s regular faculty complement was 310, comprised of 280.51 tenured/tenure-stream faculty and 29.49 lecturers (definite-term and continuing).

The proportion of faculty who are women ranged among departments from 11% to 40%, with a faculty-wide average of 17.91%.
Our complement includes faculty members who have earned PhDs from a wide range of schools (see Figure 115). 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 116, 79% of faculty in engineering disciplines are registered or have applied for the PEng (including some limited licences). This ranges from 72% to 93% among departments.

As of May 1, 2017, 35% of our faculty members are 55 years old or older, which is an increase of 2% over last year. The proportion of faculty members under the age of 40 also remains stable at 19%, as does the largest group (46%), aged 40-54 (see Figure 117).

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

In the area of Research, 21% of our total faculty budget is derived from external sources, with the largest portion from the Natural Sciences and Engineering Research Council (NSERC).
The staff complement in Waterloo Engineering has grown by 51 (28%) since 2017. As of May 1, 2017 there were 233 regular FTE staff members in engineering: 154 FTE (81 technical staff and 73 administrative staff) in our academic units and 79 (59 administrative and 20 technical) in our administrative units. The current distribution of staff is shown in Figure 119 and Figure 120.

**Figure 119: FTE Staff in Academic Units, 2017 (A7)**

**Figure 120: FTE Staff in Administrative Units, 2017 (A7)**
The current age distribution of our staff complement points to a need to plan for increasing staff renewal in the coming years: The proportion of our staff complement that is 55 years of age and older has increased to 26%. An additional 32% is aged 45 to 54 years old. Fortunately, staff renewal over recent years has also resulted in a large cohort of staff (42%) under the age of 45.

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 2016.

As of May 1, 2017, 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 shows the distribution of this ratio across academic units, which varies among disciplines, largely due to their varying technical intensity.
Since 2007, our undergraduate enrolment (head count) has increased by 33%, to a record total of 7,630 students as of November 1, 2016. Over the same time frame, international student enrolment grew by over 800 students and the enrolment of female students increased by over 700 students. We now have the highest enrolment of female undergraduate students in the Faculty of Engineering ever (2,058).

Figure 15 shows the distribution of the Fall 2016 undergraduate enrolment in the Faculty of Engineering by program, including our newest program, biomedical engineering, which launched in fall 2014.
Figure 126: FTE Undergraduate Students per Regular Faculty Member, 2005/06-2016/17 (B6)

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 shows a gradual increase in this number since a low point in 2006/07, reaching 19.3 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 new biomedical engineering program and the expansion of our highly sought-after mechatronics program, both of which began 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.

For 2016/17, this ratio at the faculty level is 19.3. The distribution of this ratio by department is shown in Figure . Management sciences is anomalous here because it was home to an established graduate program and undergraduate option before launching the undergraduate management engineering program in 2007.

Figure 127: FTE Undergraduate Students per Regular Faculty Member, 2016/17 (B6)

Figure 168: Undergraduate Year One New Admissions, 2007-2016 (B4)

From 2007-2016, first-year intake into the Faculty of Engineering has increased by 349 students or 26%. Over the same time period, international admissions have increased by 116% and the number of female students admitted to the first-year class has increased by 124%, to a record high of almost 525.

Figure 17 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%. The record high in 2016 indicates that 87% of entering students had a final high school average of 90% or higher, an affirmation of the exceptionally high quality students we attract to our renowned undergraduate program.

Figure 179: Undergraduate Admissions by Final Entering Grade Averages, 2007-2016 (B5)
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 2016, the number of required work terms reached an all-time high of 8,686. This is an increase of almost 2,500 work terms (40%) over the number required a decade ago (see Figure ). Despite this substantial increase, our students maintain excellent employment rates. In 2016, the overall employment rate was 98%, consistent with performance that has ranged from 96% to 98% since 2007. Employment rates for 2016 range by program from 96.1% to 99.4% (see Figure ).

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. As shown in Figure 3, over the past decade the number of work terms completed outside of Canada has increased by 77%, reaching a record total of 1,519 in 2016.

In addition to international work terms, another valuable global experience available to Waterloo Engineering undergraduates is international exchange. In 2016, outgoing exchange terms rebound to 116.
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 24%. In 2016, Waterloo Engineering awarded 1,209 degrees.

Figure shows the distribution of undergraduate degrees granted in 2016 by program and Figure provides a normalized indicator of degrees granted per regular faculty member. Management sciences is anomalous here because it was home to an established graduate program and undergraduate option before launching the undergraduate management engineering program in 2007.

To better understand the extent to which the increase in degrees awarded over time is related to increasing faculty complement, Figure shows an increase in the number of degrees granted per regular faculty member over the past seven years.
C. Graduate Studies

Figure 138: Graduate Enrolment, 2006-2016 (C1)

Over the past 10 years, our graduate enrolment (head count) has increased by 31% or 443 students to 1,872 on November 1, 2016. Over that period, PhD enrolment increased by 27% and the number of female students enrolled increased by 61%. The number of students who are Canadian or Permanent Residents decreased by 10%. This is a significant decrease given that the overall enrollment rate increased by 31% (reflecting the increasing proportion of our graduate student body that is comprised of international students).
Figure 139: Graduate Enrolment, Fall 2016 (C1)

Figure shows the distribution of fall 2016 graduate enrolment by department, visa status and gender. Figure 141 normalizes that data to tenured-tenure/stream faculty. In Figure, 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 2016/2017. The addition of professional master’s students to this ratio results in more variability.

Figure 140: FTE Graduate Students per TTS Faculty Member, 2005/06-2016/17 (C5)

Figure 141: FTE Graduate Students per TTS Faculty Member, 2016/17 (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). 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. Figure 142 shows this proportion. In 2016/17, the graduate proportion of total FTE student enrolment ranged across departments from 17.6% to 28.5% (excluding Conrad, which is comprised entirely of professional master’s graduate students).
Figure 18 shows the trend in engineering graduate admissions by program type over the past five years, during which time total admissions were relatively stable but the distribution among programs varied slightly and the proportion of admitted students who are Canadian or Permanent Residents decreased. Figure 19 provides department-level detail of the most current year’s admissions.

We monitor average graduate student support (as shown in Figure 20 and Figure 21) 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 227 degrees or 60%, reaching 603 in 2016.

Figure 2348 and Figure 249 shows that ratio of degree granted per TTS Faculty member. This year noted a decrease in the ratio for both research and total students. As faculty total was consistent compared to the prior year, the decrease in the ratio is attributed to the decrease in degrees awarded.

* graph excludes Conrad, which awarded 6.18 professional master's degrees per TTS faculty member in 2016/17.
D. Research

Figure 150: Research Funds by Sector ($M) and per TTS Faculty Member, 2008/09-2015/16 (D1&D7)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
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<td>15.43</td>
<td>16.04</td>
<td>15.70</td>
<td>17.44</td>
<td>16.22</td>
<td>18.69</td>
<td>20.44</td>
<td>22.65</td>
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<tr>
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<td>14.00</td>
<td>9.60</td>
<td>6.90</td>
</tr>
<tr>
<td>Provincial</td>
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<td>12.69</td>
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<td>15.46</td>
<td>10.26</td>
<td>10.34</td>
<td>8.30</td>
<td>10.51</td>
</tr>
<tr>
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<td>7.04</td>
<td>8.45</td>
<td>10.83</td>
<td>9.09</td>
<td>8.84</td>
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<td>8.92</td>
<td>10.17</td>
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<td>Funds:TTS Faculty</td>
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<td>$199,850</td>
<td>$236,216</td>
<td>$262,428</td>
<td>$235,044</td>
<td>$204,795</td>
<td>$250,935</td>
<td>$219,272</td>
<td>$239,326</td>
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</tbody>
</table>

In 2015/16, research funding to Waterloo Engineering faculty members reached $64,447,044 or $239,326 per tenured/tenure-stream faculty member. This represents a 37% increase in total research funding and a 29% increase in funding per tenured/tenure-stream faculty member since 2008/09, and a 10% increase over the previous year.

Figure 152: Research Funds by Type ($M) 2008/09-2016/17 (D1)

Distribution of total funding by sector is shown in Figure 2551. Figure 52 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 53% since 2008/09, reaching an all-time high of $22.6M in 2016/17. This growth is further explored in Figure 2653, by NSERC program type. In 2016/17, 35% of research funding came from the Federal Tri-Council granting agencies, mostly NSERC. The distribution of Tri-Council funding and of NSERC funding by program in 2016/17 is provided in Figure 27.

Figure 2653: NSERC Funding by Type ($M), 2008/09-2016/17 (D3)
As noted above, industry research funding increased by 136% between 2008/09 and 2016/17. As seen in Figure 28, a significant proportion of this growth results from investment from outside Canada; however, the amount of industrial funding from Canadian sources in 2016/17 increased by almost $2.8M over the previous year.

Funding cannot be our sole measure of research success. Another indicator of research excellence can be seen through major research chair holders. As shown in Figure 29, 49 Waterloo Engineering faculty members (16% of the tenured/tenure-stream complement) hold major research chairs.

A selection of bibliometric indicators (Figure 30 to Figure 31 and Figure 36) has also been included here to provide additional insight into our scholarly output and research impact.

Figure 30 to Figure 31 and Figure 36 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 30 shows the increasing number of documents published by Waterloo authors between the 2002-06 period and the 2012-16 period, in publications classified by Thomson Reuters as computer science (25% growth), materials science (241% growth) and engineering (64% 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 30: University of Waterloo* Documents in Thomson Reuters-indexed Publications Classified as Engineering, Materials Science or Computer Science (D10)

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Figure 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 30. 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 158: Category Normalized Citation Impact (in Engineering, Materials Science or Computer Science Categories) of University of Waterloo* Publications in Thomson Reuters-indexed Publications (D11)

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As shown in Figure, 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 and in computer science have been relatively stable with a notable decline in the current year. In materials science, Waterloo’s category-normalized citation impact saw a significant increase in the 2006-2010 period and has remained quite
stable since. It is likely that faculty hires in support of new undergraduate programs in nanotechnology and mechatronics are contributing to this increase.

A similar pattern is seen in the proportion of materials science 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 31): from 2002-2006 to 2012-2016, this has increased from 11% to 15%. In publications classified as engineering, Waterloo’s performance on this measure has declined compared to the prior year. In both the engineering and computer science classifications, Waterloo has consistently maintained more than 10% of its papers in the top 10%.

Figure 319: % of University of Waterloo* Documents in Thomson Reuters-indexed Publications Classified as Engineering, Materials Science or Computer Science in the Top 10% (based on citations) (D12)

*Because the data presented in Figure 30 to Figure 31 and Figure 36 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

Figure 160: Women in Engineering and Architecture, 2009-2016 (A1&B1&C1)

The total number of women students and faculty in the Faculty of Engineering has increased by 65% since 2009 to reach 2652.

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 has increased since 2009: undergraduate students have increased 96% to 1,833; graduate students have increased 21% to 447; and faculty have increased 62% to 48.

Figure and Figure 32 provide details of the current participation of women in our engineering programs and in our School of Architecture separately.
F. Internationalization

Since 2009, international student enrolment in undergraduate programs has increased by 169% to 1011 and in graduate programs by 65% to 919.

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 13% (see Figure ). International students now account for 49% of graduate students.

Our efforts to increase international opportunities for undergraduate students have proven successful, with the number of international co-op terms growing by 139% (to a record 1519) and outgoing exchange students ranking from 74 to 116 from 2009 to 2015 (see Figure 34).

Figure 35 shows the composition of our industrial research funding in 2016/17, with 22% 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 36) allows us to observe that an increasing proportion of those documents are published with at least one international co-author. During the 2012-2016 period, 49% of documents by Waterloo authors in publications classified as engineering, 50% of documents under materials science and 56% of documents in those classified as computer science involved international collaboration.
G. Space

Waterloo Engineering space holdings have increased by 22,785 nasm (60%) since 2006/07, to reach 60,596 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, 2016 Waterloo Engineering had graduated a total of 42,924 alumni, for 91% of whom the Office of Alumni Affairs had at least one method of contact. Of those, 5% made a donation to the University of Waterloo in 2016. Figure 38 shows the proportion of alumni for whom we have a method of contact and the proportion choosing to make a donation to Waterloo in each year over the past ten years.
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 2015, 39% of all Waterloo Engineering alumni had done so (see Figure 39 for departmental distribution).

Alumni donations are part of the overall picture of philanthropic support that helps move Waterloo Engineering forward. Figure 171 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 40 shows we have reached 105% of the campaign goal of $70M since May 1, 2013.
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. Appendix IV. I provides the definitions and sources used to create these data.

A. Faculty and Staff Data Tables

1. Total Regular Faculty, 2016/17

<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>
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<td>Chemical</td>
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<td>10.0</td>
<td>4.0</td>
<td>1.0</td>
<td>35.5</td>
<td>4.0</td>
<td>11.3%</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
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<td>3.0</td>
<td>37.8</td>
<td>5.5</td>
<td>14.6%</td>
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<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>
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<td>Electrical &amp; Computer</td>
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<td>28.0</td>
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<td>6.5</td>
<td>92.5</td>
<td>12.0</td>
<td>13.0%</td>
</tr>
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<td>Management Sciences</td>
<td>6.3</td>
<td>10.0</td>
<td>6.0</td>
<td>3.0</td>
<td>25.3</td>
<td>8.0</td>
<td>31.7%</td>
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<td>31.0</td>
<td>16.0</td>
<td>6.0</td>
<td>3.5</td>
<td>56.5</td>
<td>10.0</td>
<td>17.7%</td>
</tr>
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<td>Systems Design</td>
<td>12.5</td>
<td>8.0</td>
<td>6.0</td>
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<td>30.5</td>
<td>5.0</td>
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<td>2.5</td>
<td>1.0</td>
<td>39.8%</td>
</tr>
<tr>
<td>TOTAL</td>
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<td>98.0</td>
<td>45.5</td>
<td>29.5</td>
<td>310.0</td>
<td>55.5</td>
<td>17.9%</td>
</tr>
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</table>

2. Distribution of Regular Faculty by PEng Status, 2016/17

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<thead>
<tr>
<th>Department</th>
<th>Registered</th>
<th>Applied</th>
<th>Not Applied</th>
<th>Not Eligible</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Chemical</td>
<td>23.0</td>
<td>4.0</td>
<td>8.5</td>
<td>0.0</td>
<td>35.5</td>
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<tr>
<td>Civil &amp; Environmental</td>
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<td>37.7</td>
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<td>25.0</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
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<td>22.0</td>
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3. Distribution of Regular Faculty by Age, 2016/17

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<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>
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<td>53</td>
<td>45</td>
<td>48</td>
<td>48</td>
<td>39</td>
<td>24</td>
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4. Distribution of TTS Faculty by PhD School, 2016/17

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<th>School</th>
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<tr>
<td>TTS Faculty</td>
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<td>42.5</td>
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</table>
### 5. Total Non-regular and Non-faculty Appointments, 2017

<table>
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<tr>
<th>Department</th>
<th>Adjunct Pros</th>
<th>Lect (Adj/Special)</th>
<th>Rsch Pros</th>
<th>Post Docs</th>
<th>Rsch Assocs</th>
<th>Visitors</th>
<th>Def-term Pros</th>
<th>Total</th>
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<td>17</td>
</tr>
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<td>0</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>33</td>
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<tr>
<td>Administrative Units</td>
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<td>0</td>
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<tr>
<td><strong>TOTAL</strong></td>
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<td><strong>56</strong></td>
<td><strong>11</strong></td>
<td><strong>190</strong></td>
<td><strong>83</strong></td>
<td><strong>106</strong></td>
<td><strong>0</strong></td>
<td><strong>656</strong></td>
</tr>
</tbody>
</table>

### 6. Selected Major Faculty Awards and Honours, January 2016 – May 2017

<table>
<thead>
<tr>
<th>Department</th>
<th>Faculty Member</th>
<th>Award</th>
</tr>
</thead>
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<td>Chemical Engineering</td>
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<td></td>
<td>Budman, Hector</td>
<td>Faculty of Engineering Teaching Excellence Award</td>
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<td></td>
<td>Chen, Zhongwei</td>
<td>International Automotive Lithium Batteries Association (IALB) Young Investigator Award</td>
</tr>
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<td></td>
<td>Chen, Zhongwei</td>
<td>Royal Society of Canada College of New Scholars, Artists and Scientists Member</td>
</tr>
<tr>
<td></td>
<td>Croiset, Eric</td>
<td>Outstanding Performance Award, UW</td>
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<td></td>
<td>Elkamel, Ali</td>
<td>Engineering Research Excellence Award</td>
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<tr>
<td></td>
<td>Elkamel, Ali</td>
<td>Faculty of Engineering Excellence in Graduate Supervision Award</td>
</tr>
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<td>--------------------------------</td>
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<td>Gzara, Fatma</td>
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### 7. FTE Staff, 2016/17

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</tr>
<tr>
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<td>11.0</td>
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<tr>
<td>Engineering International Office</td>
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<td>Engineering Machine Shop</td>
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<td>11.0</td>
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<td>Engineering Student Design Centre</td>
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<td>101.0</td>
<td>233.2</td>
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8. Distribution of FTE Staff by Age, 2016/17

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<th>Age Range</th>
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<th>35-39</th>
<th>40-44</th>
<th>45-49</th>
<th>50-54</th>
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9. Staff Awards and Honours, 2016

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<th>Award</th>
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<tr>
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<tr>
<td>Engineering Computing</td>
<td>Martin Macleod</td>
<td>Dean of Engineering Outstanding Staff Performance Award</td>
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10. Faculty:Staff Ratios, 2016/17

<table>
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<th>Department</th>
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<th>Faculty to Tech Staff</th>
<th>Faculty to Total Staff</th>
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<td>1.97</td>
</tr>
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B. Undergraduate Studies Data Tables

1. Total Undergraduate Enrolment (head count), Fall 2016

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<tr>
<th>Program</th>
<th>Total</th>
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<th>% Female</th>
<th>#Int'</th>
<th>% Int'</th>
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<tbody>
<tr>
<td>Architecture</td>
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</tr>
<tr>
<td>Biomedical</td>
<td>144</td>
<td>84</td>
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<tr>
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<tr>
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<td>209</td>
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<td>103</td>
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</tr>
<tr>
<td>Computer</td>
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<td>125</td>
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<tr>
<td>Environmental</td>
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<td>58.7%</td>
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<td>6</td>
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### 2. FTE Undergraduate Enrolment, 2016/17

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<th># Int'l</th>
<th>% Int'l</th>
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### 3. Undergraduate Degrees Granted, 2016

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### 4. Undergraduate Year One New Admissions, Fall 2016

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5. Undergraduate Admissions by Entering Average Grade Range, 2016

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6. Undergraduate Students:Faculty Ratio, 2016/17

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7. Undergraduate Degrees Granted:Faculty Ratio, 2016/17

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9. Co-op Earnings, 2016/17 ($ millions)

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## C. Graduate Studies Data Tables

### 1. Total Graduate Enrolment (Head Count), Fall 2016

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<th>Prof Master</th>
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<th>% Female</th>
<th># Int'l</th>
<th>% Int'l</th>
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### 2. FTE Graduate Enrolment, 2016/17

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<th>% Female</th>
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### 3. Graduate Degrees Granted, 2016

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<th>% Female</th>
<th># Int'l</th>
<th>% Int'l</th>
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### 5. Graduate Students:Faculty Ratio, 2016/17

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<th>Rsch Students</th>
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## 6. Graduate Degrees Granted: Faculty Ratio, 2016/17

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<th>Rsch Students</th>
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## 7. Graduate Proportion of Total FTE Enrolment, 2016/17

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<td>Electrical &amp; Computer</td>
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</tr>
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<td>Management Sciences</td>
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<td>Mechanical &amp; Mechatronics</td>
<td>19.3%</td>
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## 8. Graduate Student Financial Support, 2016/17

### Research Master’s Students

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<th>% of FTEs Supported</th>
<th>Avg $ Supported FTEs</th>
<th>% FTEs with GRS</th>
<th>% FTEs with TA</th>
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*excludes Architecture

### Doctoral Students

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## D. Research Data Tables

### 1. Total Sponsored Research Funding by Source, 2016/17

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<th>Provincial</th>
<th>Industry</th>
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### 2. Total Sponsored Research Funding by Type, 2016/17

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### 3. Total Tri-Council Funding, 2016/17

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</tbody>
</table>
### 4. NSERC Funding by Type, 2016/17

<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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<tbody>
<tr>
<td>Architecture</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Chemical</td>
<td>$1,163,000</td>
<td>$258,832</td>
<td>$547,223</td>
<td>$1,386,719</td>
<td>$155,000</td>
<td>$3,510,774</td>
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<tr>
<td>Civil &amp; Environmental</td>
<td>$815,525</td>
<td>$72,233</td>
<td>$605,133</td>
<td>$1,501,722</td>
<td>$0</td>
<td>$2,994,613</td>
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<tr>
<td>Conrad</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>$2,758,026</td>
<td>$597,541</td>
<td>$1,759,974</td>
<td>$3,015,362</td>
<td>$0</td>
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<tr>
<td>Management Sciences</td>
<td>$388,565</td>
<td>$0</td>
<td>$0</td>
<td>$246,456</td>
<td>$0</td>
<td>$605,021</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>$1,420,000</td>
<td>$176,222</td>
<td>$151,300</td>
<td>$2,673,186</td>
<td>$0</td>
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<tr>
<td>Systems Design</td>
<td>$701,800</td>
<td>$297,619</td>
<td>$0</td>
<td>$378,076</td>
<td>$0</td>
<td>$1,377,495</td>
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<tr>
<td>Administrative Units</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$3,350</td>
<td>$555,000</td>
<td>$558,350</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$7,246,916</strong></td>
<td><strong>$1,402,447</strong></td>
<td><strong>$3,063,630</strong></td>
<td><strong>$9,204,871</strong></td>
<td><strong>$1,010,000</strong></td>
<td><strong>$21,927,864</strong></td>
</tr>
</tbody>
</table>

### 5. Share of NSERC in Engineering Subject Groups, 2016/17

<table>
<thead>
<tr>
<th>Faculty of Engineering</th>
<th>Share of Awards</th>
<th>Share of Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7.28%</td>
<td>9.76%</td>
</tr>
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</table>

### 6. Provincial Funding by Type, 2016/17

<table>
<thead>
<tr>
<th>Department</th>
<th>OCE</th>
<th>ERA</th>
<th>ORF:RE</th>
<th>ORF:RI</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Chemical</td>
<td>$457,380</td>
<td>$134,726</td>
<td>$0</td>
<td>$100,000</td>
<td>$0</td>
<td>$692,106</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>$0</td>
<td>$73,034</td>
<td>$0</td>
<td>$50,000</td>
<td>$929,946</td>
<td>$1,052,983</td>
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<tr>
<td>Conrad</td>
<td>$71,640</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$71,640</td>
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<tr>
<td>Electrical &amp; Computer</td>
<td>$578,250</td>
<td>$132,580</td>
<td>$953,070</td>
<td>$125,000</td>
<td>$151,448</td>
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<tr>
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<td>$56,000</td>
<td>$22,158</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$78,158</td>
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<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>$326,500</td>
<td>$102,456</td>
<td>$2,139,737</td>
<td>$2,892,843</td>
<td>$6,256,936</td>
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<tr>
<td>Systems Design</td>
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<td>$53,516</td>
<td>$12,600</td>
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<td>$40,000</td>
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<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$1,797,270</strong></td>
<td><strong>$518,400</strong></td>
<td><strong>$1,761,070</strong></td>
<td><strong>$2,414,737</strong></td>
<td><strong>$4,014,240</strong></td>
<td><strong>$10,505,787</strong></td>
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</table>

### 7. Industry Funding by Source, 2016/17

<table>
<thead>
<tr>
<th>Department</th>
<th>Canada</th>
<th>USA</th>
<th>Int'l</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>$5,000</td>
<td>$12,600</td>
<td>$0</td>
<td>$17,600</td>
</tr>
<tr>
<td>Chemical</td>
<td>$1,880,212</td>
<td>$60,814</td>
<td>$331,983</td>
<td>$2,273,009</td>
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<tr>
<td>Civil &amp; Environmental</td>
<td>$757,263</td>
<td>$101,941</td>
<td>$0</td>
<td>$859,204</td>
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<tr>
<td>Conrad</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>$25,400</td>
<td>$0</td>
<td>$0</td>
<td>$25,400</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>$3,377,901</td>
<td>$820,509</td>
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<td>$4,198,410</td>
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<td>$190,654</td>
<td>$196,020</td>
<td>$905,963</td>
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<tr>
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<td>$0</td>
<td>$0</td>
<td>$0</td>
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<td><strong>TOTAL</strong></td>
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<td><strong>$1,505,400</strong></td>
<td><strong>$1,197,430</strong></td>
<td><strong>$12,487,307</strong></td>
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</table>
8. Total Sponsored Research Funding: Faculty Ratio, 2016/17

<table>
<thead>
<tr>
<th>Department</th>
<th>Research Funding/TTS Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>58,681.28</td>
</tr>
<tr>
<td>Chemical</td>
<td>253,359.81</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>211,390.59</td>
</tr>
<tr>
<td>Conrad</td>
<td>72,124.00</td>
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<tr>
<td>Electrical &amp; Computer</td>
<td>229,397.26</td>
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<tr>
<td>Management Sciences</td>
<td>54,650.13</td>
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<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>380,832.08</td>
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<tr>
<td>Systems Design</td>
<td>161,990.49</td>
</tr>
<tr>
<td>TOTAL</td>
<td>224,455.88</td>
</tr>
<tr>
<td>Excluding Architecture &amp; Conrad</td>
<td>239,326.00</td>
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</table>

9. Total Sponsored Research Funding: Budget Ratio, 2016/17

<table>
<thead>
<tr>
<th>Faculty of Engineering Total</th>
<th>Excluding Architecture &amp; Conrad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Funding:Budget</td>
<td>0.71</td>
</tr>
<tr>
<td>Excluding Architecture &amp; Conrad</td>
<td>0.74</td>
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</tbody>
</table>

10. Research Chair Holders, 2017

<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>
</thead>
<tbody>
<tr>
<td>Architecture</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
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<tr>
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<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
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<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
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<td>4</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
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<td>0</td>
<td>4</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>12</td>
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<tr>
<td>Systems Design</td>
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<td>0</td>
<td>0</td>
<td>1</td>
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<td>8</td>
<td>0</td>
<td>13</td>
<td>4</td>
<td>49</td>
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</table>

Research Chair Holders, 2017

**Canada Research Chairs, Tier 1**

<table>
<thead>
<tr>
<th>Chair Holder</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carl Haas, CEE</td>
<td>CRC in Infrastructure Construction and Management</td>
</tr>
<tr>
<td>Amir Khajepour, MME</td>
<td>CRC in Mechatronic Vehicle Systems</td>
</tr>
<tr>
<td>Amir Khandani, ECE</td>
<td>CRC in Wireless Systems</td>
</tr>
<tr>
<td>John McPhee, SDE</td>
<td>CRC in Biomechatronic System Dynamics</td>
</tr>
<tr>
<td>Michael Worswick, MME</td>
<td>CRC in Light Weight Materials under Extreme Deformation: Forming and Impact</td>
</tr>
<tr>
<td>Weihua Zhuang, ECE</td>
<td>CRC in Wireless Communication Networks</td>
</tr>
</tbody>
</table>

**Canada Research Chairs, Tier 2**

<table>
<thead>
<tr>
<th>Chair Holder</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hossein Abouee Mehrizi, MSCI</td>
<td>CRC in Health Care Operations Management</td>
</tr>
<tr>
<td>Zhongwei Chen, CHE</td>
<td>CRC in Advanced Materials for Clean Energy</td>
</tr>
<tr>
<td>James Craig, CEE</td>
<td>CRC in Environmental Modelling and Analysis</td>
</tr>
<tr>
<td>Ehab El-Saadany, ECE</td>
<td>CRC in Energy Systems</td>
</tr>
<tr>
<td>Lukasz Golab, MSCI</td>
<td>CRC in Analytics for Sustainability</td>
</tr>
<tr>
<td>Frank Gu, CHE</td>
<td>CRC in Nanotechnology</td>
</tr>
<tr>
<td>Sriram Narasimhan, CEE</td>
<td>CRC in Smart Infrastructure</td>
</tr>
<tr>
<td>Carolyn Ren, MME</td>
<td>CRC in Lab-on-a-Chip Technology</td>
</tr>
<tr>
<td>Luis Ricardoz-Sandoval, CHE</td>
<td>CRC in Multiscale Modelling and Process</td>
</tr>
<tr>
<td>Stephen Smith, ECE</td>
<td>CRC in Autonomous Systems</td>
</tr>
<tr>
<td>Lin Tan, ECE</td>
<td>CRC in Software Dependability</td>
</tr>
</tbody>
</table>
Chair Holder | Title
--- | ---
Alexander Wong, SDE | CRC in Medical Imaging Systems
John Yeow, SDE | CRC in Micro and Nano Devices

### NSERC Chairs

<table>
<thead>
<tr>
<th>Chair Holder</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanjeev Bedi, MME</td>
<td>NSERC Chair in Immersive Design Engineering Activities</td>
</tr>
<tr>
<td>Adrian Gerlich, MME</td>
<td>NSERC/TransCanada Industrial Research Chair in Welding for Energy Infrastructure</td>
</tr>
<tr>
<td>Peter Huck, CEE</td>
<td>NSERC Chair in Water Treatment</td>
</tr>
<tr>
<td>Kaan Inal, MME</td>
<td>NSERC Chair in Modelling, Simulation and Finite Element Methods</td>
</tr>
<tr>
<td>Amir Khajepour, MME</td>
<td>NSERC Chair in Mechanical Systems and Instrumentation</td>
</tr>
<tr>
<td>Amir Khandani, ECE</td>
<td>NSERC/Nortel Chair in Advanced Telecommunications Technologies</td>
</tr>
<tr>
<td>Mahesh Pandey, CEE</td>
<td>NSERC/UNENE Chair in Risk-Based Life Cycle Management of Engineering Systems</td>
</tr>
<tr>
<td>Ali Safavi-Naeini, ECE</td>
<td>NSERC/Research in Motion Chair in Intelligent Integrated Radio/Antenna Systems</td>
</tr>
</tbody>
</table>

### Endowed Chairs

<table>
<thead>
<tr>
<th>Chair Holder</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claudio Canizares, ECE</td>
<td>Hydro One Research Chair</td>
</tr>
<tr>
<td>Sujeet Chaudhuri, ECE</td>
<td>Val O’Donovan Chair in RF/Microwaves and Photonics</td>
</tr>
<tr>
<td>Jatin Nathwani, CEE/MSci</td>
<td>Ontario Research Chair in Public Policy and Sustainable Energy Management</td>
</tr>
<tr>
<td>Susan Tighe, CEE</td>
<td>Norman W. McLeod Professor in Sustainable Pavement Engineering</td>
</tr>
<tr>
<td>Zbig Wasilewski, ECE</td>
<td>Waterloo Institute for Nanotechnology Chair</td>
</tr>
</tbody>
</table>

### University Research Chairs and University Professors

<table>
<thead>
<tr>
<th>University Research Chairs</th>
<th>University Professors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pu Chen, CHE</td>
<td>John Long, ECE</td>
</tr>
<tr>
<td>Duane Cronin, MME</td>
<td>Mark Matsen, CHE</td>
</tr>
<tr>
<td>Rick Culham, MME</td>
<td>Ravi Mazumdar, ECE</td>
</tr>
<tr>
<td>Xianshe Feng, CHE</td>
<td>Michael Tam, CHE</td>
</tr>
<tr>
<td>Shesha Jayaram, ECE</td>
<td>Ehsan Toyserkani, MME</td>
</tr>
<tr>
<td>Fakhri Karray, ECE</td>
<td>Norman Zhou, MME</td>
</tr>
<tr>
<td>Xianguo Li, MME</td>
<td></td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Engineering</th>
<th>Materials Science</th>
<th>Computer Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indexed Documents</td>
<td>2077</td>
<td>901</td>
</tr>
</tbody>
</table>

12. Category-Normalized Citation Impact of University of Waterloo Documents in Engineering, Materials Science or Computer Science Publications Indexed by Thomson Reuters, 2012-2016

<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>1.22</td>
<td>1.45</td>
</tr>
</tbody>
</table>

13. Percentage of University of Waterloo Documents in Engineering, Materials Science or Computer Science Publications Indexed by Thomson Reuters that are in the Top 10%, 2012-2016

<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>11.90%</td>
<td>15.20%</td>
</tr>
</tbody>
</table>
A. Percentage of University of Waterloo Documents in Engineering, Materials Science or Computer Science Publications Indexed by Thomson Reuters with International Collaboration, 2012-2016

<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>48.90%</td>
<td>49.70%</td>
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</table>

E. Women in Engineering Data Tables

1. Women in Engineering, 2016

<table>
<thead>
<tr>
<th>Category</th>
<th>#</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate First-year Class</td>
<td>504</td>
<td>29.2%</td>
</tr>
<tr>
<td>All Undergraduate Students</td>
<td>1833</td>
<td>25.2%</td>
</tr>
<tr>
<td>Undergraduate Degrees Granted</td>
<td>211</td>
<td>18.6%</td>
</tr>
<tr>
<td>All Graduate Students</td>
<td>447</td>
<td>26.0%</td>
</tr>
<tr>
<td>All Graduate Degrees Granted</td>
<td>129</td>
<td>23.0%</td>
</tr>
<tr>
<td>PhD Degrees Granted</td>
<td>30</td>
<td>20.8%</td>
</tr>
<tr>
<td>Faculty Members</td>
<td>48</td>
<td>16.8%</td>
</tr>
</tbody>
</table>

2. Women in Architecture, 2016

<table>
<thead>
<tr>
<th>Category</th>
<th>#</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>Undergraduate First-year Class</td>
<td>51</td>
<td>67.1%</td>
</tr>
<tr>
<td>All Undergraduate Students</td>
<td>225</td>
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</tr>
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<td>Undergraduate Degrees Granted</td>
<td>41</td>
<td>56.2%</td>
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<tr>
<td>All Graduate Students</td>
<td>89</td>
<td>57.4%</td>
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<tr>
<td>All Graduate Degrees Granted</td>
<td>26</td>
<td>61.9%</td>
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<tr>
<td>Faculty Members</td>
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<td>45.0%</td>
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</table>

F. Internationalization Data Tables

1. International Students, 2016

<table>
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<tr>
<th>Category</th>
<th>#</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>Undergraduate New Admissions</td>
<td>229</td>
<td>13.5%</td>
</tr>
<tr>
<td>All Undergraduate Students</td>
<td>1011</td>
<td>13.3%</td>
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<tr>
<td>Undergraduate Degrees Granted</td>
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<td>11.8%</td>
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<tr>
<td>Undergraduate Co-op Work Terms</td>
<td>1519</td>
<td>17.8%</td>
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<tr>
<td>Outgoing Exchange Terms</td>
<td>116</td>
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<tr>
<td>Incoming Exchange Terms</td>
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<td>n/a</td>
</tr>
<tr>
<td>All Graduate Students</td>
<td>919</td>
<td>49.0%</td>
</tr>
<tr>
<td>All Graduate Degrees Granted</td>
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<td>42.1%</td>
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G. Space Data Tables

1. Space Holdings (nasm), 2016

<table>
<thead>
<tr>
<th>Category</th>
<th>Existing</th>
<th>Additional</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016/17</td>
<td>57,357</td>
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<td>15.20%</td>
</tr>
</tbody>
</table>

H. Advancement Data Tables

1. Waterloo Engineering Total Alumni, 2016

<table>
<thead>
<tr>
<th>Program</th>
<th>#</th>
<th>% reachable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>2,330</td>
<td>88.5%</td>
</tr>
<tr>
<td>Chemical</td>
<td>5,334</td>
<td>89.9%</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>7,437</td>
<td>88.5%</td>
</tr>
<tr>
<td>Conrad</td>
<td>534</td>
<td>98.9%</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>12,639</td>
<td>92.1%</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>2,084</td>
<td>87.3%</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>8,889</td>
<td>90.4%</td>
</tr>
<tr>
<td>Systems Design</td>
<td>3,676</td>
<td>87.3%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>42,924</td>
<td>90.6%</td>
</tr>
</tbody>
</table>

2. Engineering Alumni Donating to University of Waterloo, 2016

<table>
<thead>
<tr>
<th>Program</th>
<th>#</th>
<th>% of reachable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>54</td>
<td>2.6%</td>
</tr>
<tr>
<td>Chemical</td>
<td>230</td>
<td>4.8%</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>346</td>
<td>5.3%</td>
</tr>
<tr>
<td>Conrad</td>
<td>7</td>
<td>1.3%</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>461</td>
<td>4.0%</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>91</td>
<td>5.0%</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>418</td>
<td>5.2%</td>
</tr>
<tr>
<td>Systems Design</td>
<td>212</td>
<td>5.7%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,819</td>
<td>6.2%</td>
</tr>
</tbody>
</table>
3. 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>636</td>
<td>30.8%</td>
</tr>
<tr>
<td>Chemical</td>
<td>1947</td>
<td>40.6%</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>2952</td>
<td>44.9%</td>
</tr>
<tr>
<td>Conrad</td>
<td>46</td>
<td>8.7%</td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>3935</td>
<td>33.8%</td>
</tr>
<tr>
<td>Management Sciences</td>
<td>555</td>
<td>30.5%</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>3512</td>
<td>43.7%</td>
</tr>
<tr>
<td>Systems Design</td>
<td>1506</td>
<td>44.6%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>15,089</td>
<td>35.2%</td>
</tr>
</tbody>
</table>

4. Funds Raised for the Faculty of Engineering, 2016/17

<table>
<thead>
<tr>
<th>Cash Received ($M)</th>
<th>New Pledges Received ($M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funds Raised</td>
<td>$12.1</td>
</tr>
<tr>
<td></td>
<td>$7.5</td>
</tr>
</tbody>
</table>

5. Educating the Engineer of the Future Campaign Progress to May 1, 2017

<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>$37.1</td>
<td>82.4%</td>
</tr>
<tr>
<td>Graduate Scholarships</td>
<td>$3.5</td>
<td>$1.4</td>
<td>40.0%</td>
</tr>
<tr>
<td>Chairs</td>
<td>$10.0</td>
<td>$7.1</td>
<td>71.0%</td>
</tr>
<tr>
<td>Student Experience</td>
<td>$11.5</td>
<td>$14.2</td>
<td>123.5%</td>
</tr>
<tr>
<td>Other</td>
<td>n/a</td>
<td>$13.5</td>
<td>n/a</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$70.0</td>
<td>$73.3</td>
<td>104.71%</td>
</tr>
</tbody>
</table>

6. Alumni Attending Selected Class Reunions, 2016

<table>
<thead>
<tr>
<th>Department</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical</td>
<td>0.0%</td>
<td>1.9%</td>
<td>14.6%</td>
<td>2.1%</td>
<td>15.5%</td>
<td>52.6%</td>
<td>12.2%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>55.0%</td>
</tr>
<tr>
<td>Civil &amp; Environmental</td>
<td>0.0%</td>
<td>8.9%</td>
<td>0.0%</td>
<td>1.3%</td>
<td>10.6%</td>
<td>32.5%</td>
<td>22.0%</td>
<td>14.2%</td>
<td>14.3%</td>
<td></td>
</tr>
<tr>
<td>Electrical &amp; Computer</td>
<td>0.3%</td>
<td>0.0%</td>
<td>0.5%</td>
<td>11.0%</td>
<td>11.9%</td>
<td>35.3%</td>
<td>4.0%</td>
<td>11.9%</td>
<td>7.8%</td>
<td>25.9%</td>
</tr>
<tr>
<td>Mechanical &amp; Mechatronics</td>
<td>0.4%</td>
<td>4.3%</td>
<td>0.0%</td>
<td>19.0%</td>
<td>16.7%</td>
<td>9.8%</td>
<td>9.6%</td>
<td>23.5%</td>
<td>0.0%</td>
<td>5.4%</td>
</tr>
<tr>
<td>Systems Design</td>
<td>2.9%</td>
<td>6.3%</td>
<td>4.3%</td>
<td>8.3%</td>
<td>42.7%</td>
<td>6.3%</td>
<td>5.3%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>OVERALL PARTICIPATION</td>
<td>0.3%</td>
<td>3.3%</td>
<td>2.3%</td>
<td>8.6%</td>
<td>15.9%</td>
<td>25.9%</td>
<td>11.1%</td>
<td>15.9%</td>
<td>2.3%</td>
<td>20.6%</td>
</tr>
</tbody>
</table>

7. Alumni Events, 2016

<table>
<thead>
<tr>
<th>Event</th>
<th>City</th>
<th>Date</th>
<th>Attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterloo Engineering Alumni &amp; Friends Reception at TRB</td>
<td>Washington, DC</td>
<td>12/01/2016</td>
<td>106</td>
</tr>
<tr>
<td>Waterloo Engineering Alumni Ski Day</td>
<td>Collingwood, ON</td>
<td>22/01/2016</td>
<td>285</td>
</tr>
<tr>
<td>Waterloo Engineering Alumni Reception at Eventbrite</td>
<td>San Francisco, CA</td>
<td>02/02/2016</td>
<td>129</td>
</tr>
<tr>
<td>Waterloo Engineering Alumni Reception at Medallia</td>
<td>Palo Alto, CA</td>
<td>04/02/2016</td>
<td>124</td>
</tr>
<tr>
<td>TronCon event</td>
<td>Waterloo, ON</td>
<td>19/03/2016</td>
<td>50</td>
</tr>
<tr>
<td>Grad Class Toast</td>
<td>Waterloo, ON</td>
<td>30/03/2016</td>
<td>275</td>
</tr>
<tr>
<td>The Black Tie Event (Systems Design alumni event)</td>
<td>Waterloo, ON</td>
<td>01/04/2016</td>
<td>8</td>
</tr>
<tr>
<td>Waterloo Engineering Alumni Beer Tasting Reception in Calgary</td>
<td>Calgary, AB</td>
<td>12/04/2016</td>
<td>42</td>
</tr>
<tr>
<td>MBET Alumni Event - Spring Mixer</td>
<td>Toronto, ON</td>
<td>25/05/2016</td>
<td>83</td>
</tr>
<tr>
<td>Engineering Class of 2016 Post-Convocation Receptions</td>
<td>Waterloo, ON</td>
<td>18/06/2016</td>
<td>3575</td>
</tr>
<tr>
<td>Waterloo Engineering Alumni Reception at Microsoft</td>
<td>Seattle, WA</td>
<td>22/09/2016</td>
<td>112</td>
</tr>
</tbody>
</table>

*attendance includes alumni and guests
## I. Data Notes

### Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Name</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>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

A1. 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

A2. 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

A3. 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.

A4. Distribution of TTS Faculty by PhD School
   - Source: Dean of Engineering Office | As of: May 1
   - Excludes faculty who do not hold a PhD

A5. 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)

A6. Selected Major Faculty Awards and Honours
   - Source: Dean of Engineering Office | As of: Dec. 31

A7. 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

A8. Distribution of FTE Staff by Age
   - Source: Waterloo Human Resource | As of: May 1

A9. Staff Awards and Honours
   - Source: Dean of Engineering Office | As of: Dec. 31

A10. 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

B1. 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
FTE Undergraduate Enrolment
Source: Waterloo Institutional Analysis and Planning Office | As of: March 1
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 undergraduate students registered in the fall term on MAESD count date. 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 ¼ of nanotechnology students; mechatronics students are allocated 3/5 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 ¼ of nanotechnology students; mechatronics students are allocated 3/5 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 & Career Action Office | As of: Dec. 31
Excludes students who advised CECA 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 & Career Action Office JOBMIN | As of: May 1
Estimate of total earnings by all co-op students on work terms for a fiscal year each 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) on MAESD count date.
Nanotechnology students are counted in the department in which they are registered; 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.
Nanotechnology students are counted in the department in which they are registered; count by first major (double-major degrees are counted only once).
C4  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; coursed-based master are included with professional master prior to 2012

C5  Graduate Students:Faculty Ratio
FTE graduate students/tenured and tenue-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

C6  Graduate Degrees Granted:Faculty Ratio
Graduate degrees granted/TTS faculty members

C7  Graduate Proportion of Total FTE Enrolment
FTE graduate students/(FTE graduate students+FTE undergraduate students)

C8  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.

D1  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.

D2  Total Tri-Council Funding
Source: Waterloo Office of Research | As of: May 1

D3  NSERC Funding by type
Source: Waterloo Office of Research | As of: May 1
Discovery includes Accelerator Supplements; Partnerships was formerly called Industry

D4  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&Electronic 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)

D5  Provincial Funding by type
Source: Waterloo Office of Research | As of: May 1
Other includes Ministry, FedDev and Ontario Research Chair funding

D6  Industry Funding by source
Source: Waterloo Office of Research | As of: May 1

D7  Total Sponsored Research Funding:Faculty Ratio
Sponsored research funds/tenured and tenure-stream faculty members

D8  Total Sponsored Research Funding:Budget Ratio
Sponsored research funds/permanent recurring budget

D9  Research Chair Holders
Source: Engineering Research Office & Dean of Engineering Office | As of: May 1

D10  University of Waterloo Documents in Engineering, Materials Science or Computer Science Publications Indexed by Thomson Reuters
Source: InCites™, Thomson Reuters. Report Created: 17-June-15 | Data Source: Web of Science ® 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 proceeding papers).

D11  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
Source: InCites™, Thomson Reuters. Report Created: 17-June-15 | Data Source: Web of Science ® 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.

D12  % 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.**

**D13**

<table>
<thead>
<tr>
<th>% of University of Waterloo Documents in Engineering, Materials Science or Computer Science Publications Indexed by Thomson Reuters with International Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Source:</strong> InCites™, Thomson Reuters. <strong>Report Created:</strong> 17-June-15</td>
</tr>
<tr>
<td><strong>% of total Waterloo documents in the given subject area that contain one or more international co-authors.</strong></td>
</tr>
</tbody>
</table>

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**Women in Engineering Disciplines and Women in Architecture**

**E1**

Undergraduate year one new admissions excludes continuing students, Nov. 1

**E2**

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

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**International Students**

**F1**

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

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**Space Holdings**

**G1**

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

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**Total Alumni**

**H1**

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

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**Funds Raised for the Faculty of Engineering**

**H4**

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)

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**Campaign Progress to Date**

**H5**

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.

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**Alumni Attending Selected Class Reunions**

**H6**

Source: Engineering Alumni Office | As of: Dec. 31

Includes only departments with an undergraduate program in the given reunion year

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**Alumni Events**

**H7**

Source: Engineering Alumni Office | As of: Dec. 31

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**Dean’s Advisory Council Members**

**H8**

Source: Engineering Advancement Office | As of: May 1