5. Research Foci

The tremendous impact of research at U of T Engineering is felt at all levels of society – local, national, and international. Engineers are known as creators and innovators. As Albert Einstein said, “Scientists investigate that which already is, engineers create that which has never been.” The exciting research taking place in our Faculty attracts brilliant researchers and students to join our ranks, and enables us to attract the funding and partnerships necessary to continue our groundbreaking work.

One of the key goals of our Academic Plan respective to our research portfolio has been to increase our Tri-Council funding to $25-million per year by 2015. Through our collective efforts, we have surpassed this goal three years early by reaching $26.3-million in 2012-13 and have established a new goal of $32-million in Tri-Council funding by 2015-16. The importance of this funding is underscored by the fact that the national reallocation of Canada Research Chairs (CRCs), which occurs every two years, is based on the proportion of Tri-Council and Networks of Centres of Excellence (NCE) funding that each university receives. In 2012-13, CRCs represented $3.5-million of revenue for the Faculty. This progressive growth in Tri-Council funding translated into U of T Engineering receiving an additional four Tier II equivalent CRCs in the 2013 reallocation.

Engineering received 17 grants through the Canada Foundation for Innovation’s (CFI) John R. Evans Leaders Fund. These were matched by Ontario Research Fund – Research Infrastructure grants for a total to $3.4-million. They will be applied to developing infrastructure that will help to advance research in areas ranging from improving air quality, to creating superior renewable energy technologies.

The Ontario Centre for Characterization of Advanced Materials (OCCAM), which began development in 2012, received $20-million in funding through a combination of funding from CFI, the Ontario Ministry of Research and Innovation (MRI), and Hitachi High-Technologies Canada, and officially opened in July of this year. This facility enables researchers to explore and develop new materials that can be used in several diversified applications such as electronics, renewable fuels, and medical treatments. A joint initiative between the Department of Materials Science & Engineering and the Department of Chemical Engineering & Applied Chemistry, OCCAM emphasizes the development of collaborative and multidisciplinary projects, and is available to both academia and industry.

We continue to receive strong support from the Natural Sciences and Engineering Research Council (NSERC) for our innovative and impactful research. Earlier this year, we were awarded six Strategic Projects Grants (SPG), as well as an NSERC Collaborative Research and Training Experience (CREATE) grant. This brings our Faculty to eight CREATE programs (out of 11 at U of T). This new CREATE will support student training
in environmental remediation, such as investigating new methods for decontaminating groundwater, through the Remediation Education Network (RENEW). The 42 funded doctoral stream graduate students and postdoctoral fellows participating in the RENEW program will dedicate 20 per cent of their time toward working within partner companies, which will not only provide valuable practical experience for the participants, but will also serve to strengthen our ties with our industrial partners.

U of T Engineering develops and fosters a thriving multidisciplinary and collaborative environment. In 2014, we expanded our network of research centres and institutes with the addition of two new Extra-Departmental Units (EDU:Cs), the University of Toronto Transportation Research Institute (UTTRI) and Toronto Institute of Advanced Manufacturing (TIAM), which will further enhance the Faculty’s profile in key research areas central to our region and economic growth.

All major urban centres face the challenge of developing and maintaining a transportation infrastructure that will both meet the needs of their citizens, and enable their growth and prosperity. The University of Toronto Transportation Research Institute (UTTRI) builds on the Civil Engineering department’s leading strengths in this area through bringing experts from engineering, economics, policy, urban geography and planning, computer science and others disciplines together for collaborative projects. UTTRI aims to solve some of the most pressing problems facing our cities today. Topics include dynamic real time control of road and transit systems for capacity maximization, improved urban logistics systems for goods movement, and improved urban design for walking and cycling.

Canada’s manufacturing sector is vital for economic growth and innovation. The new Toronto Institute of Advanced Manufacturing leverages the strength of our research and partnerships in this area and will create and scale up advanced manufacturing technologies and develop innovative practices for the 21st century. This multidisciplinary partnership includes researchers from across the Faculty and will explore new technologies, and advanced materials.

Support from and partnership with industry is crucial to our fiscal stability. It helps us to leverage funding opportunities, and facilitates the commercialization and translation of innovative research to market. Our Faculty now has two directors of corporate partnerships to strengthen connections between industry and academia, enable NSERC partnerships funding opportunities, and assist our faculty members in developing lasting relationships with companies in key sectors.

The creation of a flexible and customizable corporate brochure that highlights the benefits of partnership with U of T Engineering, and showcases specific research strengths, is one of the tools we are now using to communicate with potential and existing partners. Our annual industry partners networking event, held in November of each year, also facilitates introductions that lead to vibrant idea generation and collaborative projects.
Through the collective efforts of the Faculty and our departments, we have pursued and attracted more support for our research programs. This is evident, in part, by our 7 per cent year-over-year increase in NSERC funding. Each department and institute now has a peer review or mentorship program in place to support and guide faculty members in the development of their NSERC Discovery Grants (DGs), Discovery Accelerator Supplements (DAS), and Research Tools and Instruments (RTI) grant applications. We once again hosted panel sessions on DG and the RTI program. This year we continue our Best Practices in Research lunch sessions covering a range of dynamic topics such as impactful research and best practices for junior faculty in their pursuit of the Early Research Award. We also awarded the second annual Research Leader Award to Professor Javad Mostaghimi for leadership in interdisciplinary and multiple investigator initiatives that have enhanced the Faculty’s research profile within the broader community.

These initiatives, among others, provide encouragement and support to our faculty members at all stages of their careers and ensure our continued success as we progress on our path in pursuit of excellence in research.

**5. RESEARCH FOCI: YEAR 3 PROGRESS HIGHLIGHTS**

5.1 **Create new and support current research centres around strategic research themes that make significant, relevant impacts on society.**

- Established the University of Toronto Transportation Research Institute (UTTRI) in February 2014
- Launched the Toronto Institute of Advanced Manufacturing (TIAM) in April 2014
- Revitalized the Centre for Healthcare Engineering (CHE) (formerly the Centre for Research in Healthcare Engineering)
- Built and implemented a process to review and encourage EDU:Cs and EDU:Ds in their development and research

5.2 **Increase our Tri-council funding level to $25-million per annum by 2015.**

- Met and surpassed goal, reaching $26.3-million in 2012–13

5.3 **By 2015, increase the number of Canada Research Chairs by eight (to a total of 30), increase Industrial Research Chairs by six (to a total of 10) and increase Endowed Chairs and Limited Term Chairs by 13 (to a total of 40).**

- Increased number of CRC Tier-II equivalents by 4 to 39 in 2013-14
- Actively working to identify new IRC and endowed chair prospects (currently we have 7 IRCs and 30 endowed chairs)
- Shared best practices in fostering growth of sponsored research, which in turn impacts the Faculty’s CRC allocation over time, through the Faculty’s Research Committee
5.4 Develop additional funding sources through the Social Sciences and Humanities Research Council (SSHRC), the Canadian Institutes of Health Research (CIHR), corporations, industries and international granting agencies.

- Focused on industry-sponsored research and matching Tri-council and Ontario partnerships funding
- Hosted second annual Industry Partners Networking Reception in November 2013
- Actively pursued opportunities with top corporate prospects
- Increased awareness of and built partnerships among faculty for opportunities in technologies for health

5.5 Support junior faculty members and emerging research leaders to ensure that they successfully secure external research funding from industry, federal and provincial sources.

- Research Committee and Directors of Corporate Partnerships worked with junior faculty to identify and pursue industry partners
- Continued lunchtime panel series entitled *Best Practices in Research* to raise awareness and support emerging research leaders
- Established a peer review or mentorship program in each department to support and guide faculty members in the development of their NSERC Discovery Grant (DG) and Research Tools and Instruments (RTI) grant applications

5.6 Raise awareness and promote our research contributions and breakthroughs with peers, funding agencies, industry and the public.

- Developed a corporate brochure that highlights our key research strengths, and the benefits of partnering with U of T Engineering; it is fully customizable, and can be tailored to target specific audiences, or to feature a specific department or research area
- Awarded the second annual Research Leader Award for leadership in interdisciplinary and multiple investigator initiatives that have enhanced the Faculty’s research profile within the broader community

5.7 Generate synergistic research partnerships with peer institutions within Canada, and strategic international partners, while taking on leadership roles at the national and international levels.

- Enhanced collaboration and partnership with the Vice-President of University Relations and the Vice-President of Research Innovation on international partnership development
- Ensured Faculty participation on U of T collaboration with the University of Sao Paulo on Global Cities, as well as visits from École Polytechnique Fédérale de Lausanne and Skolkovo Institute of Science and Technology
- Created a NSERC Strategic Network in partnership with Concordia University and the University of British Columbia

5.8 Increase participation and provide leadership on external review committees in granting agencies such as the Natural Sciences and Engineering Research Council
(NSERC), Ontario Centres of Excellence (OCE), and the Ontario Ministry of Research and Innovation (MRI).

- Worked with NSERC representatives to make the case for NSERC Strategic Project Areas of interest to FASE, UofT, and Canada
- Met with several ministers and Tri-Council leadership, for example with Minister Reza Moridi, Minister of Research and Innovation, where we discussed entrepreneurial advances and research infrastructure in FASE
- Liaised with OCE representatives to foster entrepreneurship among graduate students

5.9 Enhance multidisciplinary, collaborative research endeavours.

- Attracted a new NSERC CREATE project to establish the Remediation Education Network (RENEW)
- Established the University of Toronto Transportation Research Institute (UTTRI) and Toronto Institute of Advanced Manufacturing (TIAM)
- Enabled 14 collaborative research centres and initiatives through the Dean’s Strategic fund, including the Institute for Research into Exposomics Based Assessment (IREBA) and the Initiative for Global Urban Shelter (IGUS)
- Hosted the Connaught Global Challenge Symposium – Bio-inspired Ideas for Sustainable Energy
- Awarded six NSERC Strategic Projects Grants

Attracted 4 grants from Grand Challenges Canada