

WATERLOO | ENGINEERING

2022-2023

PROGRESS REPORT

uwaterloo.ca/engineering/about/strategic-planning



UNIVERSITY OF
WATERLOO

DEAN'S REPORT

Dear Waterloo Engineering community,

LAND ACKNOWLEDGEMENT

WATERLOO ENGINEERING ACKNOWLEDGES THAT WE SHARE KNOWLEDGE ON LAND THAT HAS SEEN HUMAN ACTIVITY FOR THOUSANDS OF YEARS. WE RESIDE ON THE TRADITIONAL TERRITORIES OF THE NEUTRAL, ANISHINAABEG AND HAUDENOSAUNEE PEOPLES. WE HAVE DEEP GRATITUDE AND APPRECIATION FOR THE CARE THEY HAVE GIVEN TO THIS LAND.

OUR WATERLOO AND CAMBRIDGE CAMPUSES ARE SITUATED ON THE HALDIMAND TRACT, THE LAND GRANTED TO THE SIX NATIONS THAT INCLUDES SIX MILES ON EACH SIDE OF THE GRAND RIVER. AS ENGINEERS AND ARCHITECTS, WE ARE COMMITTED TO MEANINGFUL ACTION TOWARDS TRUTH AND RECONCILIATION; IT IS ONLY THROUGH THIS PROCESS THAT WE CAN WORK TOWARDS BUILDING A BETTER FUTURE FOR GENERATIONS TO COME.

I am thrilled to be able to share with you the final progress report for our 2020–2025 strategic plan. I believe this document definitively proves that we can accomplish great things when we leverage our strengths as a community.

Outlined in this report, you'll see that our researchers and facilities have continued to deliver results that elevate our profile as a research powerhouse for global good. In the past year alone, we've made plans to strategically leverage our growing world-class core facilities for broader research, industry and student-learning impact. The Multi-Scale Additive Manufacturing Lab (MSAM), Waterloo's first off-campus research lab, is a recent example – where its new, expanded home in downtown Kitchener allows it to further its reputation as one of the world's largest university-based metal additive manufacturing facility and a solid training ground for talented students and researchers. We are excited to integrate this facility within our local community, for global impact.

Alongside delivering high-quality education, improving the overall student experience was a significant priority identified for our 2020-2025 plan. We could never have anticipated how important this goal would become after a global pandemic required us to rapidly shift to online learning.

Now, back on campus, I'm immensely proud of how our faculty and staff have prioritized building back a better, more inclusive community.

Our recently introduced Waterloo Engineering pin tradition exemplifies our commitment to upholding community, responsibility, innovation and excellence as our collective values.

In our efforts to re-imagine how our graduate programs can best serve our students, we are focused on offering personalized, integrated learning opportunities to our graduate students. We have returned to our institutional roots – work-integrated learning. Thanks to the hard work of many, Waterloo Engineering now delivers six Master of Engineering and Master of Management Sciences Programs with co-op options. We are also offering more interdisciplinary programs to allow our graduate students to define new frontiers in engineering and design. Finally, to support our students in bringing transformation from the lab to the world, we have piloted a PhD program that supports students in pursuing a Master in Business, Entrepreneurship and Technology in parallel with their doctoral degree.

As we look forward to our next strategic plan, I am confident that we can build on the success detailed in this report to achieve our new goals. With a solid institutional Waterloo at 100 strategic framework in place, our work as the Faculty of Engineering is well positioned to elevate the University of Waterloo's impact on the world's societal, health, sustainable, technological and economic futures.

We will need each and every one of you to ensure we can continue this momentum forward. Thank you for being an engaged member of our Waterloo Engineering team.

Sincerely,



MARY A. WELLS
PhD, FEC, FCAE, FIMMM PEng
DEAN, FACULTY OF ENGINEERING

OUR STRATEGIC PRIORITIES

VISION

Waterloo Engineering will inspire leaders to define new frontiers. Upholding our tradition of co-operative education, we will continue to stimulate our entrepreneurial spirit and research imagination. Above all, our engineers and architects are committed to serving society, and building a better future for generations to come.



**UNDERGRADUATE
LEARNING:
EXPERIENCE**



**GRADUATE
LEARNING:
WORK-
INTEGRATED**



**OPERATIONS
AND RESOURCES:
COLLABORATIVE
COMMUNITY**



**REPUTATION
AND OUTREACH:
CONNECT**



**RESEARCH:
IMAGINATION**

UNDERGRADUATE LEARNING: EXPERIENCE

ASPIRATION

Offer the single best engineering and design education experience in Canada

34+ design teams that allow students to apply and integrate their knowledge

39% new admits as of November 1, 2023 identify as female

8,000+ student groups were supported by first-year TAs during the Fall 2023 term

BUILDING COMMUNITY

The wellbeing of our students matters. We know that a sense of belonging and connection defines the experience of a Waterloo engineer and architect. Together we have improved their experience through listening to their concerns and acting in the following ways:

- › The inaugural Waterloo Engineering Pin Ceremony – defining our commitment to shared values: community, responsibility, innovation and excellence.
- › Improving student spaces through our music wellness project and the installation of well-used ping-pong tables in E7 and the Cambridge campus.
- › Building dialogue with leadership: weekly coffee and conversations with Dean Wells. These are open to all students and serve as an opportunity for the Dean to hear directly from students.

LEARNING EXPERIENCE

It is our responsibility to equip graduates with the knowledge needed to build a better future for generations to come. We instill in them the desire for continual learning and improvement. In that same way, we must continually improve. We are committed to reinvigorating our curriculum, policies, and processes to reflect the needs of the next generation of engineers and architects. A few highlights from this year's activities are:

- › The creation of a new Sustainable Development Capstone Design Award – encouraging a focus on the United Nations Sustainable Development Goals
- › Increasing reduced load study term flexibility and improving access to electives.
- › Developing a new calendar system that standardizes content and clearly communicates program requirements.
- › Improving cohort feedback mechanisms through class representatives and divisional meetings.
- › Launch of inaugural summer research fellowship program for undergraduate engineering students – Waterloo Engineering Rising Stars Fellowship Program

FOUNDATION OF SUCCESS

The transition to campus life can be challenging for even the most prepared student. We know our students can optimize their experience at Waterloo Engineering when they have a supportive foundation. The first-year experience has been improved with the following initiatives:

- › Integrating the First Year Engineering office with the admission cycle – creating early connections.
- › Waterloo Engineering Endowment Foundation (WEEF) space improvements – supporting first-year tutors.
- › Adding additional advisors to the first-year team.
- › Integrating counselling within the Undergraduate Office.
- › Tracking student group interactions with Undergraduate Student Services to better understand usage trends and needs.
- › Expanding service hours in the Undergraduate Office – providing consistent reliable access to students.



TRENDS AND ANALYSIS

FIGURE 1. CLASS GENDER IDENTITY

This chart visualizes the annual new admissions to undergraduate programs from 2017-2023, categorizing the data by gender. It offers a comprehensive view of enrollment trends over the years.

New Admissions by Gender

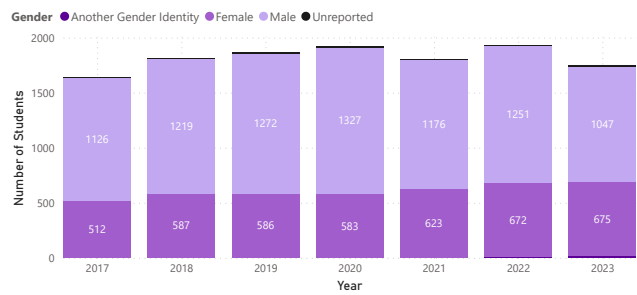


FIGURE 2. PROGRAM DISTRIBUTION

An overview of program enrollment by gender for 2023. The visualization enables a focused understanding of the scale of each engineering discipline and gender distribution.

Number of Students by Program 2023

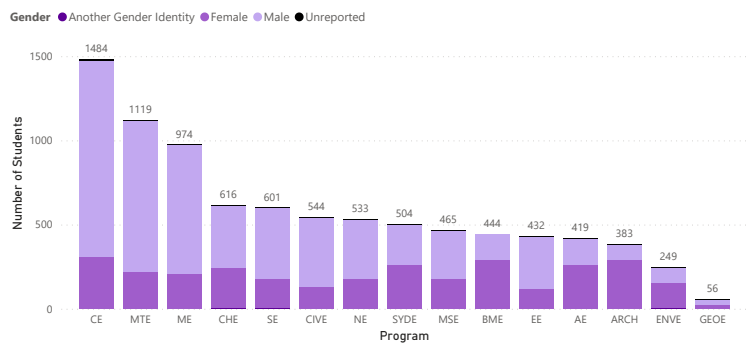
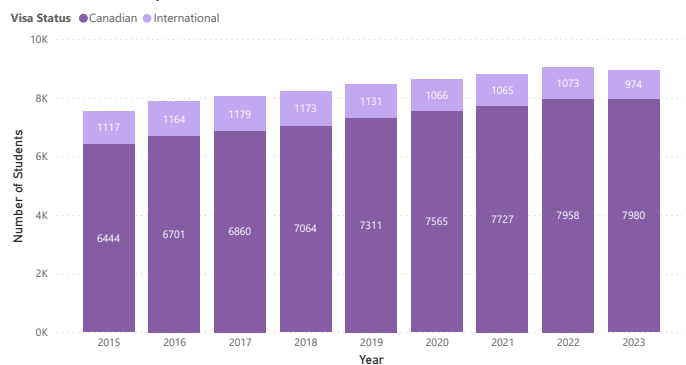


FIGURE 3. NUMBER OF INTERNATIONAL STUDENTS

Examining the enrollment dynamics between Canadian and international students from year to year, this chart sheds light on the composition of the undergraduate student body.

Number of Students by Visa Status



GRADUATE LEARNING: WORK INTEGRATED

ASPIRATION

Become the world leader in work-integrated graduate studies in engineering and architecture

1ST graduate from innovative Collaborative Aeronautics program

19 MEng specializations that range across all departments

6 graduate programs that offer a co-op option in 2022-2023 academic year

WORK-INTEGRATED LEARNING

Waterloo Engineering is building on our institutional strength, work-integrated learning. At the graduate student level, work-integrated learning comes in a variety of forms: co-op programs, research opportunities with industry partners, career pivots and skill enhancements. Below are notable accomplishments in further work-integrated learning opportunities for graduate students:

- › Two new graduate level co-op programs since the start of the strategic plan in 2020.
- › Total of 147 students participating in graduate student co-op programs, as of November 1, 2023.
- › A total of 19 MEng programs providing skills for the workforce of the future.

PERSONALIZED EDUCATIONAL EXPERIENCE

The greatest challenges facing humanity and the planet will require graduates with passion and purpose. For some, this could mean a breadth of knowledge that spans multiple fields of studies, for others, deep technical expertise will ignite their enthusiasm for knowledge development. Below are some ways we have enhanced the graduate student experience to allow for a more personalized academic journey:

- › Our Electrical and Computer Engineering department has significantly increased the specialization opportunities for MEng students – now offering eight specializations.
- › Collaborative Aeronautics Program launched with four degrees now offered in the Faculty of Engineering. Systems Design Engineering was the first department to have a graduate from the program in Fall 2023.
- › Our Faculty is working diligently to develop inter-disciplinary graduate level programs in the fields of Biomedical Engineering and Health Technology.

REIMAGINING GRADUATE STUDIES PATHWAYS

University of Waterloo is a leading, global research-intensive university. The faculty of Engineering is committed to enhancing this expertise through reimagining graduate studies pathways. Our students will drive the fields of architecture, engineering and design to new frontiers, creating a more equitable, resilient, and sustainable future. We have recently undertaken these initiatives to enhance graduate studies career pathways:

- › The Faculty is redesigning PhD funding to support students through their educational journey.
- › We have continued our commitment to the IBET Momentum Fellowship. The program supports Indigenous peoples and Black researchers in achieving their rightful place and respected inclusion in academia. The Faculty of Engineering currently has eight IBET fellows.
- › We are piloting an entrepreneurial PhD fellowship program that supports current PhD students in pursuing an MBET degree in parallel with their doctoral studies – currently we have six students in the program, one of whom was named in Forbes' 2024 Top 30 under 30.



TRENDS AND ANALYSIS

FIGURE 4. GRADUATE STUDENT PATHWAYS

This bar graph depicts the number of students pursuing various degree types (Diploma, Professional Master's, Research Master's, and PhD) over academic years.

Number of Students by Degree Type

Plan Map ● Non-Degree ● PhD ● Prof Master ● Rsch Master

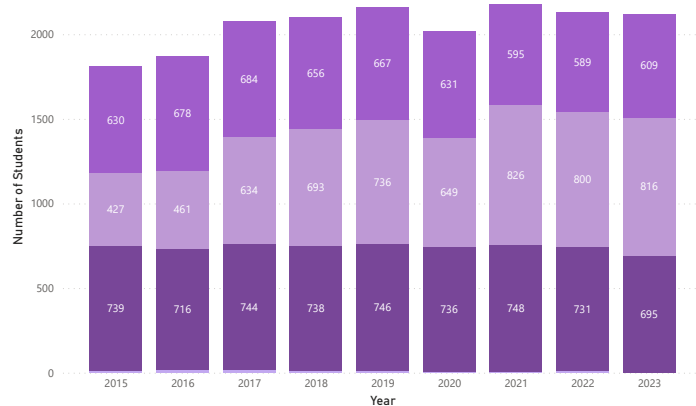


FIGURE 5. GRADUATE STUDENT GENDER IDENTITY

Graduate Student degree trends with gender breakdown seen through this bar graph. It showcases the number of degrees awarded over time.

Trend of Degrees by Gender

Gender ● Another Gender Identity ● Female ● Male ● Unreported

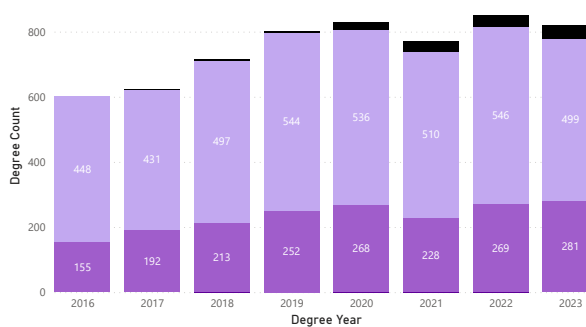
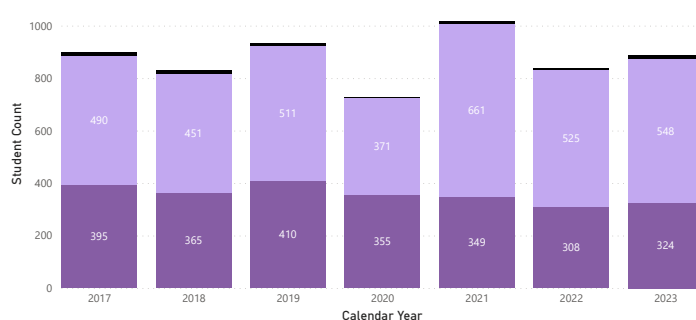


FIGURE 6. NUMBER OF INTERNATIONAL STUDENTS

Examining the enrollment dynamics between Canadian and international students from year to year, this chart sheds light on the composition of the graduate student body.

Trend of Intake by Visa Status

Visa Status ● Canadian ● International ● Not Available



RESEARCH: IMPACT

ASPIRATION

Become unmatched in bringing transformation from the lab to the world

EXCELLENCE IN SUSTAINABILITY RESEARCH

Our researchers embrace a spirit of curiosity as they explore and discover within the three pillars of sustainability: environmental, social, and economic. Together, our academics are understanding how we can build a resilient, equitable, carbon neutral world. [Researchers across the University of Waterloo are working together to build a sustainable future.](#) Highlights from the year are outlined below:

- › [Researchers representing many departments across our faculty](#) are collaborating through the Waterloo Institute for Sustainable Aeronautics to create a sustainable future for aerospace and aviation.
- › Notable research clusters in sustainability include:
 - Sustainable transportation, urban infrastructure, multimodal transportation.
 - Energy research (Batteries, energy grids, geothermal, fuel cell, and storage).
 - Water resources and systems.
 - Circular economy and sustainable construction practices.
- › Waterloo Engineering continues to support an entrepreneurial ecosystem that brings sustainable research from the lab to the world. [Autonomous airline Ribbit will increase food security to remote communities starting in 2024.](#)

>3.9%

increase in faculty research funding through the 2022-2023 award year

\$14M

in industry research funding in 2022-2023

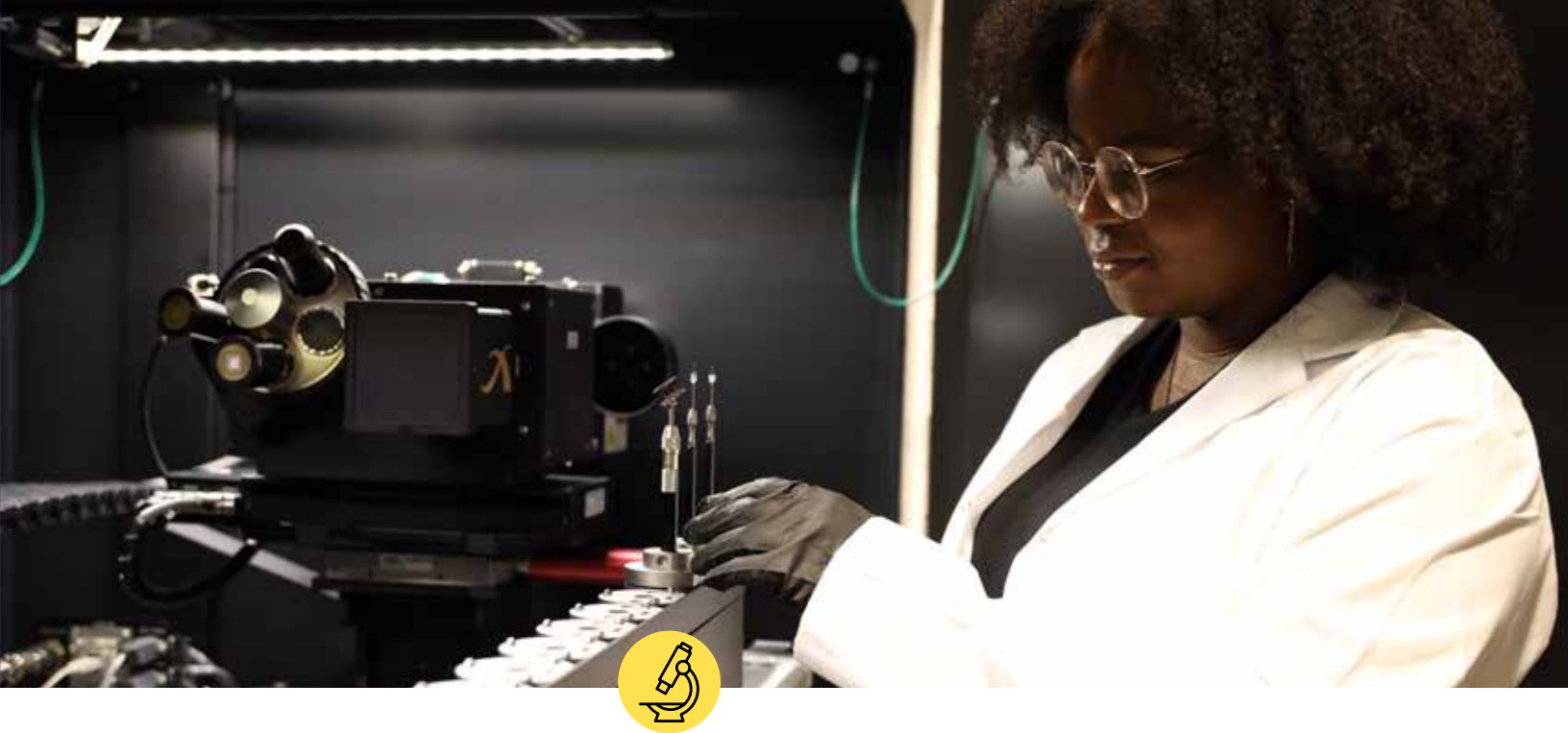
THE LARGEST

Additive Manufacturing Lab (MSAM) in Canada

BUILDING OUR RESEARCH COMMUNITY

Our engineers, architects and entrepreneurs are called to understand and design for the biggest problems facing humanity and our planet. Knowledge networks must interact to meet the complexities facing our generation. We are growing our research community to inspire imagination and mobilize impact through the following activities:

- › Creation of the Engineering Research Impact Fund (ERIF). Together, the Faculty and Departments will invest in innovative research for social good.
- › Professionalization of space management through data informed decision making.
- › Developing new operating models for shared research facilities.
- › Building trust within the research community by supporting the [TRuST Scholarly Network](#).
- › Mobilizing knowledge to reach a broader audience through the [Art of Engineering and Architecture Research competition](#).



PARTNERSHIP FOR THE FUTURE

Our community of researchers design for impact through industry partnerships. By upholding our history for business-driven solutions, we are investing in a productive future for generations to come.

- › Our Multi-scale Additive Manufacturing (MSAM) lab successfully launched its new facility in Waterloo Region. Canada's largest Additive Manufacturing lab is now imbedded in the local community to enhance Canada's manufacturing capabilities for global impact.
- › Waterloo Engineering is leading the Canadian Advanced Manufacturing Network (CAN AMN). The initiative is a multimillion, multi-institutional CFI funded program that will enhance precision tooling for industry developments.
- › Through a holistic research approach, the Canadian Alliance in Cold Spray Technology will define new frontiers in Cold Spray Innovations. This is a multimillion, multi-institutional CFI initiative lead by the Faculty of Engineering.

TRENDS AND ANALYSIS

FIGURE 7. TOTAL RESEARCH FUNDING

Representation of total research funding award to the Faculty of Engineering over time, by sponsor type. Research program has rebounded slightly from previous year. Provincial support in 2022-2023 is 50.6 per cent of the 10-year average provincial support.

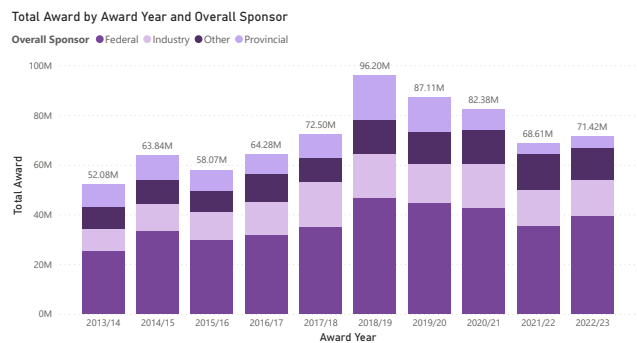
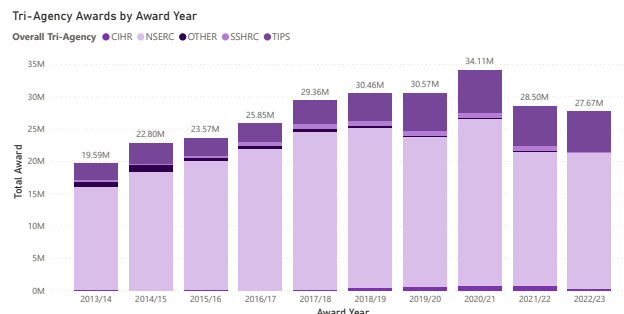


FIGURE 8. TOTAL TRI-AGENCY FUNDING

Tri-Agency funding by program type for the Faculty of Engineering over a 10-year period. Current Tri-Agency funding is at a six-year low, while TIPS funding remains strong.



OPERATIONS AND RESOURCES: COLLABORATION

ASPIRATION

Foster a collaborative culture of wellbeing, empowerment, and sustainability

INCLUSIVITY AND BELONGING

We are creating a more inclusive community for our engineers, architects, and entrepreneurs. Diverse perspectives and ways of knowing are critical to approaching the greatest problems of our generation. We strive to create an environment where people feel included, a sense of belonging and know that their contributions are valued. The below activities are recent initiatives that support an inclusive culture:

- > The June Engineering Faculty Assembly (EFA) was held on Indigenous Peoples Day. The morning started with a Haudenosaunee Thanksgiving Address at the white pine outside E5/E7, opening remarks by Indigenous leaders at the EFA meeting, and was followed by a lunch done in the tradition of an Indigenous feast.
- > Two departments, Mechanical and Mechatronics Engineering and Systems Design Engineering, are exploring how to incorporate Indigenous Ways of Knowing into their work and across the curriculum through Indigenous Relationship Circles that meet regularly.
- > Indigenous Sky Garden has been installed on the 4th floor of E5. The garden is a relaxing space for employees and students and allows for Indigenous teachings and learnings to be shared.
- > Gender equity initiatives included the development and delivery of the Male Allyship certificate program and improving access to menstrual products in our buildings.
- > We continue to support student designed programs through, Women in Engineering (WiE), UWaterloo EngiQueers, National Society of Black Engineers (NSBE), and American Indian Science and Engineering Society (AISES) in Canada.

85+ in-depth employee wellness interviews completed: faculty, staff, post-docs and sessionals

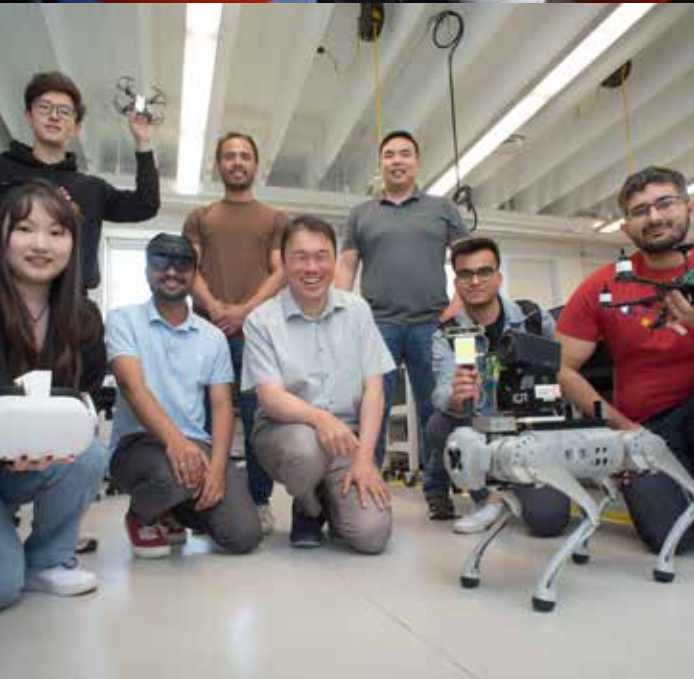
6 undergraduate and graduates wellness student focus groups completed in 2022-2023 at the Waterloo and Cambridge campuses

NEW Indigenous Sky Garden cultivated in E5 in consultation with the Elder in Residence, the new space allows for knowledge sharing and learning

STUDENT AND EMPLOYEE WELLNESS

The Faculty of Engineering is committed to improving the well-being of employees and students. Wellness is embedded in all components of our academic and career experiences; it is crucial to developing a thriving intellectual community. The below activities take steps towards improving our well-being:

- > Centralizing online resources for undergraduate students, graduate students, post docs and employees on one [website](#).
- > Standardizing practices regarding wellness communication.
- > Delivering wellness workshops for employees and students. Workshops have been run to reach 1,000s of people.
- > Understanding the changing wellness needs of our community requires in-depth data gathering. A few ongoing data collection projects of note include:
 - Employee interviews – over 85 completed, including staff, regular faculty, post docs and sessionals.
 - Six student focus groups – undergraduate and graduate students from Waterloo and Cambridge campuses.
- > Researching and implementing new wellness resources such as light therapy lamps and robotic therapy pets.



ENABLE OPERATIONAL IMPROVEMENTS

Management systems are the engine behind all strategic plans. Without operational support, a strategic plan cannot be implemented effectively. The below initiatives are steps taken by the Faculty to move the strategic plan forward:

- › Creation of career development opportunities through new job grades that allow for growth within a role.
- › Website improvements managed by Engineering Advancement to support migration to a new format.
- › Strategic staff hires to align with implementation of strategic plan focuses, including Director, Undergraduate Operations, Director, Integrated Planning, and Director, Infrastructure and Safety
- › Improvement to computing systems to support faculty appointment administration.
- › Dean's Innovation Fund for Student Experience and Operational Excellence launched to catalyze and encourage experimentation led by employees.

REPUTATION AND OUTREACH: CONNECT

ASPIRATION

Become the epicentre of the
world's technology talent

7.1B+ potential impressions
from media reach in
64 countries worldwide

\$10.4M

in philanthropic contributions
to the Faculty of Engineering

23,000+

youth participating in
free STEM programming

BUILDING MOMENTUM AND EXCITEMENT

Our community has now been reunited on campus for a full academic cycle. Camaraderie and connection have brought life back to our buildings. We continue to leverage our world class facilities to bring excitement to our community. Below are a few examples from the year:

- › The recruitment cycle returned to in-person events including the Ontario Universities Fair, Fall Open House, March Break Open House, Discover Women in Engineering sleepover, and You@Waterloo Day.
- › Distinguished lecturers and industry leaders connected with our community to build knowledge sharing pathways. These include visits from Airbus Canada CEO Benoît Schultz, Rogers Communications Chief Technology and Information Officer Ron McKenzie, Noble Prize Winner Donna Strickland, and many more.
- › Our community was invited to participate in the Waterloo Engineering Pin Ceremonies. The Faculty hosted 21 ceremonies on campus, supporting people as they committed to four fundamental principles – community, responsibility, innovation and excellence.
- › Waterloo Engineering has redesigned the swag offerings to enhance our brand.
- › The Department of Management Sciences changed its name to Management Science and Engineering – better encapsulating the unit's distinctive, interdisciplinary approach to education within the engineering field.

ELEVATING OUR INTERNATIONAL PROFILE

The Faculty of Engineering continues to inspire learners, researchers, and educators to think unconventionally and dream boldly. To optimize impact, knowledge is disseminated broadly. By enhancing public engagement, we can expand the reach of ideas and innovations. The stories are shared to ignite curiosity, demonstrate excellence, and promote knowledge sharing. The media highlights from the year include:

- › Waterloo Engineering achieved 7.1B potential impressions from reach in 64 countries worldwide.
- › Waterloo Engineering top five stories for 2022-2023:
 - Q and A with the experts: Health risks posed by wildfires – Total potential audience reach: 497,796,820
 - AI can predict the effectiveness of breast cancer chemotherapy – Total potential audience reach: 415,071,270
 - Robot helps students with learning disabilities stay focused – Total potential audience reach: 99,446,170
 - Tiny new climbing robot was inspired by geckos and inchworms – Total potential audience reach: 45,060,822
 - Engineers tap into good vibrations to power the Internet of Things – Total potential audience reach: 42,859,779



INSPIRING THE FUTURE

We are inspiring the leaders of tomorrow through our Outreach programs. We ignite the natural curiosity of young people while helping them imagine themselves as engineers, architects, and entrepreneurs. Our programs create pathways for a more inclusive STEM community in the future. Some notable accomplishments from our outreach programs are as follows:

- › [Travelling STEM](#) brought activities to rural and northern communities in Ontario, reaching 11 Indigenous Communities.
- › This year we welcomed over 5,000 grade four students through our Kids on Campus program. We continue work closely with local school boards to achieve the ambitious goal of reaching every fourth-grade student in our community.
- › Through our [STEMPowered](#) program, we have reached 421 Black Youth.
- › In total, with the help of our generous donors and committed staff, we have provided over 23,000 youth with free STEM programming.



ADDITIONAL RESOURCES

UNIVERSITY OF WATERLOO STRATEGIC PLAN

uwaterloo.ca/strategic-plan

FACULTY OF ENGINEERING STRATEGIC PLAN

uwaterloo.ca/engineering/about/strategic-planning

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