ENGINEERING

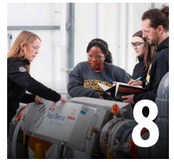
TEACHING. RESEARCH. ENTREPRENEURSHIP. ENGINEERING WITH IMPACT.

18 | SPRING 2024

Building Solutions for Change

DALHOUSIE UNIVERSITY | FACULTY OF ENGINEERING

ENGINEERING



CONTRIBUTORS

EDITORIAL
Theresa Anne Salah, Philip Moscovitch
Megan LeBlanc, Meredith Murray, Jessica Farrell

PHOTOGRAPHY Nick Pearce, Daniel Abriel

DESIGN Jill Caldwell

CONTACT Theresa Anne Salah, Editor
tasalah@dal.ca

DalEngineering
FacultyofEngineering
Dalfacultyofeng

Dean's Message

Greetings to our engineering community. This year marks the beginning of my second term as Dean of Engineering, I am honoured to have the opportunity to continue leading the Faculty of Engineering on its path of excellence.

As we collectively work towards a better future, one of our key focuses has been to align our goals and priorities with the critical challenges we face as a province, country and world.

Together, we are training students and undertaking research with a mindset of building solutions for change.

This year's issue of our Engineering magazine exemplifies the innovative strides our researchers are making in a world that is rapidly changing. From advancing healthcare outcomes, to innovating clean solutions and technologies, to protecting and sustaining our oceans, our professors and students are pursuing the most advanced research to ever come out of our Faculty.

Engineers create solutions to some of the most pressing social, economic and environmental challenges we face as a society. However, ensuring that the engineering profession reflects the communities it serves is essential to future growth and success. Diversity encourages more critical thinking, alternative approaches and more effective solutions. Increasing diversity in the profession starts in the classroom.

To achieve this goal, we have appointed our new Assistant Dean of EDIA, whom you will meet in this issue of the magazine. We are also investing in additional programs, resources and inclusive learning spaces where students of all backgrounds can thrive.

A key example of our commitment to fostering inclusivity is the launch of our new Inclusive Pathways to Engineering Careers Program; an initiative designed to remove barriers and increase access to an engineering education for individuals from equity-deserving communities. In Partnership with the Ulnooweg Education Centre, we are introducing the Indigenous stream of the program. We are excited to share more about the program in our magazine.

I'd like to take a moment to acknowledge and pay gratitude to all of our supporters and donors, without whom ground-breaking initiatives such as the Pathways Program would not be possible. Your generosity enriches the learning experience of our students and together we are inspiring future ready leaders and lifting our communities.

We are excited to share these initiatives and more in this year's edition of Engineering and we look forward to staying connected with you in the year to come.

Sincerely,

Dr. John Newhook, P.Eng., FCAE, FCSSE
Dean, Faculty of Engineering

1,868 UNDERGRAD STUDENTS

602 GRADUATE STUDENTS

2,470 TOTAL ENROLLMENT

23% FEMALE UNDERGRADS

77% MALE UNDERGRADS

27% FEMALE GRAD STUDENTS

73% MALE GRAD STUDENTS

72% CANADIAN

28% INTERNATIONAL

107 FACULTY

19,300 ALUMNI

49% FROM NOVA SCOTIA

471 SEXTON SCHOLARS

25 SEXTON LEADERS

94% CO-OP PLACEMENT

12 RESEARCH CHAIRS

Building futures for all: Dalhousie Engineering program set to transform the face of engineering

In pursuit of a more representative and inclusive engineering profession, Dalhousie Engineering has embarked on a transformative journey. Through strategic partnerships and dedicated initiatives, we are breaking down barriers to postsecondary education, particularly for equity-deserving communities.

Last summer, Dalhousie Engineering proudly announced the launch of the Inclusive Pathways to Engineering Careers Program (Pathways Program); an initiative designed to close the gap in the representation of students from all equity-deserving groups. The program will create new learning opportunities and initiatives that will attract the brightest to the engineering field, regardless of background.

Breaking Ground: Cultivating Inclusive Pathways for Indigenous Youth

In collaboration with the Ulnooweg Education Centre (UEC), Dalhousie Engineering has launched the Indigenous stream of the Pathways Program.

The powerful collaboration aims to introduce tailored supports and resources to Indigenous youth by empowering them with opportunities in engineering. In doing so, the program seeks to honor diverse Indigenous perspectives, including the principle of "Two-Eyed Seeing," which blends Indigenous and Western knowledge learning.

The program's vision aligns seamlessly with UEC's mission, an Indigenous-led organization dedicated to advancing education and empowering Indigenous communities through the advancement of education.

Dalhousie Engineering and UEC have begun laying the groundwork for the program. Spearheading the initiative is the Faculty of Engineering's new Assistant Dean of Equity, Diversity and Inclusion and Accessibility, Sherida Hassanali. Over the past year, Hassanali's team has grown to include an Advisory Council dedicated to providing guidance and direction to the program.

In addition, specialized wrap-around supports, mentorship initiatives and a Bridging Program will be available. The Bridging Program is designed to equip aspiring engineering students with the necessary courses for success. Indigenous youth interested in pursuing a degree in engineering, but do not meet recommendations for the degree, can apply to enter the Bridging Program. Successful completion of the program guarantees students entry into the engineering undergraduate program.

The first cohort of Indigenous students will begin the Pathways Program in September of 2024.

These initiatives reflect Dalhousie Engineering's commitment to holistic support and inclusive practices, ensuring that equity-deserving students feel welcomed and empowered within the engineering community.

Forging Partnerships

Initiatives like the Pathways Program rely heavily on the support of donors and partners. Collaborations enable opportunity, growth, and inclusion, and serve as a testament to the collective commitment towards building a more equitable and diverse engineering profession.

Since its launch, the Pathways Program has garnered support from local donors and partners eager to build a more dynamic engineering profession, including CBCL Limited, Pomerleau, EverWind Fuels and Dalhousie Engineering donor and alumnus Dr. Bernard MacIsaac and his wife, Ann MacIsaac.

"We have the opportunity to drive our profession forward by supporting a unique engineering education. By making engineering accessible to more Indigenous youth, we're making a better, more diverse future," said John Flewelling, President and CEO of CBCL Limited at last July's launch event.

A founding partner of the Pathways Program, CBCL are long-time supporters of the Faculty of Engineering. The company plays a valuable role within the engineering community, embracing differences in backgrounds, perspectives, and experiences, and striving to create a positive and lasting impact on the people they serve.

Last December, the Pathways Program received further financial support from Pomerleau, one of Canada's largest constructions companies.

"Becoming a partner in the Inclusive Pathways to Engineering Careers Program is an exciting and concrete way for Pomerleau to demonstrate its commitment to offer everyone an equal chance to progress," said Vivek Tomar, Director of Strategic Proposals and Pursuits at Pomerleau.

With industry support, Dalhousie Engineering and UEC can continue to build on the progress they've made since announcing the Indigenous Stream of the Pathways Program.

Admission to the **Inclusive Pathways** Program

The program will include a bridging year for students who are interested in pursuing a degree in Engineering, but may not meet all the requirements of admission. Completion of the Bridging Program will guarantee entry into the Engineering program.

Indigenous Pathways Program

FIRST COHORT BEGINNING SEPTEMBER 2024

Admission to Bridging Year

Classes may include (but are subject to change):
University Prep Chemistry, University Prep Physics, University Prep Pre-Calculus, University Prep Writing Skills for Academic Study, University Prep: What you need to be successful in university

Upon successful completion of Bridging Year students will have guaranteed admission to the Engineering Program

YEAR 1
Students should begin to ***think about specialization*** *for years 3 & 4*

YEAR 2
Students should begin to ***think about co-op opportunities*** *beginning in year 3*

YEAR 3
Students ***begin specialization*** *and* ***co-op****, depending upon the specialization*

YEAR 4
Second year of specialization *and/or* ***co-op****, depending upon the specialization*

YEAR 5
Co-op*, depending upon the specialization*

IRON RING CEREMONY & GRADUATION

Meet Dalhousie Engineering's New Assistant Dean of Equity, Diversity and Inclusion

Sherida Hassanali is stepping into her new role as the Assistant Dean of Equity, Diversity and Inclusion with a keen determination to drive change at Dalhousie Engineering.

Her leadership exemplifies the University's dedication to driving diversity and inclusion within engineering education.

Today, she's shedding light on her position and the pivotal role it plays in advancing the Faculty's Inclusive Pathways to Engineering Careers Program.

Describe your role and how it helps advance the Inclusive Pathways Program.

My role is multifaceted, working broadly and collaboratively with academic, administrative, and student communities to build inclusive pathways to engineering careers program. I provide a strategic lens, direction and guidance for the development of EDIA initiatives across the Faculty of Engineering. This program aims to increase representation from equity-deserving communities, including Indigenous, Black, and women students, fostering a more diverse and inclusive engineering profession.

Why are partnerships and collaborations with donors and supporters so important to advancing initiatives such as the Inclusive Pathways Program?

You've probably heard the African proverb "it takes a village to raise a child". It will take a great many in the proverbial village to create and develop this Program. Partnerships, and community-building are about relationships. This Program is about building relationships. It's about creating space for healing relationships to be nurtured.

Donors, and supporters have an essential role to play in this relationship-building process.

What does an initiative such as the Inclusive Pathways Program mean for equity deserving groups?

Those who are part of equity-deserving groups have very long histories of being marginalized, and living on the periphery. Pathways Programs seek to change this. Pathways Programs help to move people from being excluded or not having access to professions to a place of inclusion. Research has continuously shown that for all students to succeed, they must feel safe. Students taking part in the Inclusive Pathways Program need to feel safe, so they may thrive, not just survive in engineering. This program is creating a space of belonging. It is about seeing themselves, not just in the Program, but in the profession. I heard a saying recently... you cannot be, what you cannot see. This Program is about students being seen, heard, valued, accepted, and respected for who they are.

How will this program advance the engineering profession?

The Inclusive Pathways Program will change the profession of engineering for the better. The strength of diversity is a gift. The more gifts of talent we have in the engineering classrooms, labs, offices, and worksites, the stronger the field. Dalhousie University and the Faculty of Engineering are committed to the principles and practices of Equity, Diversity, Inclusion, and Accessibility (EDIA). We are dedicated to providing opportunities for students to bloom.

"It is about seeing themselves, not just in the Program, but in the profession."

COVER STORY

COULD UV LEDS BE THE FUTURE OF WASTEWATER TREATMENT?

Dalhousie Engineering Professor Dr. Amina Stoddart specializes in wastewater treatment. When the COVID-19 pandemic emerged, like many others, she actively sought out ways to utilize her expertise to aid in the crisis.

Monitoring local wastewater levels, Stoddart played a key role in the development of a rapid and highly efficient test for detecting SARS-CoV-2, the virus responsible for COVID-19. Additionally, when high-quality masks were in short supply, she worked on a technique to disinfect N95s using UV LED lights.

That project has led to exciting new research focused on using UV LEDs for municipal wastewater treatment. If the lights could disinfect masks, what about water?

Mechanical wastewater treatment uses several steps. The last stage in the process involves using UV lights to eliminate micro-organisms by disrupting their DNA. However, standard UV lights come with drawbacks. They contain mercury, posing an issue if they break. Stoddart says if the bulbs heat up, "some of the contaminants still in the wastewater can bake onto the bulb" and diminish its efficacy. "They are huge lights that are on all the time, so they require a ton of energy," she adds.

Enter the UV LEDs. “The light on your phone is an LED. If you think about that from an engineering perspective — wow! You’ve got so many more design capabilities.” In contrast with long, fragile, energy-intensive mercury based lights, LEDs can be clustered together, and don’t generate heat in the same way as conventional lights.

Stoddart is currently running a study using the lights in a reactor at Halifax Water's Eastern Passage wastewater plant, which can treat about 450 litres of water a minute, or 648,000 litres a day. (The full plant treats 25 million litres daily.)

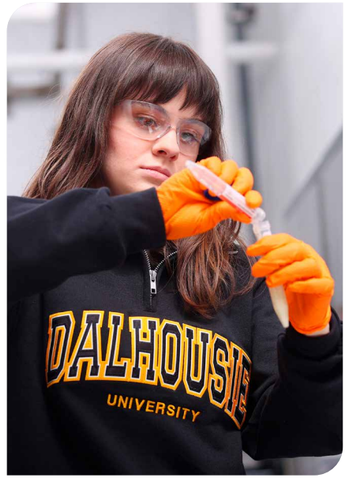
"Halifax Water have attached this reactor for us, which is kind of a side stream. It pulls water into our reactor right before it hits their UV lights," where it is exposed to the LEDs, Stoddart says. So far, data shows the UV LEDs are "better or the same as conventional treatment."

Graduate student Bailey Reid is leading the analysis of treatment results. She says Stoddart encouraged her to pursue graduate studies, and she's glad she was persuaded. "I'm really liking what I do. There are so many opportunities. I'm working with a reactor that's the first in the world... I don't know anyone doing this scale of stuff. It's incredible."

Another of Stoddart's students, Esther Osei-Ampong, is conducting research into the use of UV LEDs at Halifax Water's Dartmouth Wastewater Treatment Facility.

Osei-Ampong already has a master's in wastewater resource and environmental engineering, from the Kwame Nkrumah University of Science and Technology, in Ghana. She chose to continue her studies at Dalhousie, because the school "has the facilities and resources to help me achieve my aims... I want to be one of the best researchers and go back and help my country. At Dal, there is always hands-on practice," she says. "They make everything practical."

Her research involves working on a smaller scale than Reid, playing with different light intensities and chemical oxidants to remove organic matter from



wastewater through advanced oxidation.

"We are doing this in the lab on a bench scale to see how it will work, and then we can maybe try it on a larger scale," she says.

Preliminary results show that, used with the UV LEDs, hydrogen peroxide works well at lower doses, while chlorine is most effective at higher doses, she notes, adding: "It's not conclusive yet, but it looks very promising."

Wastewater treatment is serious business, and new treatments have to be backed by solid evidence before going into use. Stoddart says the research is promising, but there is still a lot of work ahead to see if approaches involving UV LEDs can be ramped up to a larger scale. "You must control effluents into the harbour, it's very serious. Things have to work. It can't just be trial and error kind of stuff."

When the permafrost thaws: Wastewater treatment challenges in the Arctic

The North is warming much faster than the rest of Canada, with far-reaching consequences in many areas — including wastewater treatment.

Dr. Rob Jamieson, a Professor in the Department of Civil and Resource Engineering and member of the Centre for Water Resource Studies, has been working on wastewater treatment in the North for 15 years. It's a region where natural treatment systems like lagoons, wetland systems, or infiltration trenches are more common than the mechanical approaches familiar in the South.

But many of these systems are affected by permafrost. Some lagoons rely on permafrost to contain wastewater. If it thaws, that could lead to uncontrolled seepage. Conversely, the presence of permafrost creates challenges for the operation of wastewater infiltration systems, as it limits the depth of soil that is available for treatment.

"Back in the 70s and 80s, communities might have identified a small lake or depression... they would start to dispose wastewater in. It would discharge through that lagoon system into a natural wetland, and flow through the landscape," Jamieson says. Those practices would not be allowed today, so "there's a need to invest in building engineered lagoon, wetland or infiltration systems that would meet our current standards."

Natural wastewater treatment systems in the North also have different hydrological and biological challenges. "Many of these lagoons are pretty much frozen for 8 to 10 months of the year. So you have a much shorter time window to actually treat wastewater during the summertime, when they thaw out." explains Jamieson. "Temperatures only get up to between 5° and 15°C and therefore biological activity in these systems is generally lower than what you would see within lagoons in a southern climate."

Where possible, it's important to utilize natural treatment systems, because the harsh environment, shipping costs, and a lack of local expertise make mechanical systems much more expensive and challenging to operate.

Débora Boratto is one of the graduate students working with Jamieson and his colleague Dr. Barret Kurylyk on a project funded through an NSERC Alliance Grant. She is studying the wastewater treatment system in Fort Good Hope, Northwest Territories. The only one of its kind in the region, it relies on soil-based infiltration.

"It's been operating for a long time, but they don't have complete knowledge on whether it's removing all the contaminants," says Boratto, who has visited the site twice and has one more research trip planned. In addition to gauging the effectiveness of the current system, she is also studying whether it will continue to serve the community as the climate changes — and if it does, whether it would work in other locations.

Boratto is from Brazil, and she largely chose Dalhousie for the opportunity it presented to work with Jamieson on real-world, community-based projects like this one. "Both the community and territorial government identified issues and challenges with wastewater treatment and reached out to the university. I think this is really nice, because it's a bridge between academia and society," she says, "and that sometimes doesn't happen."

"Many of these lagoons are pretty much frozen for 8 to 10 months of the year. So you have a much shorter time window to actually treat wastewater."

— DR. ROB JAMIESON

Monitoring the world's wildest ocean

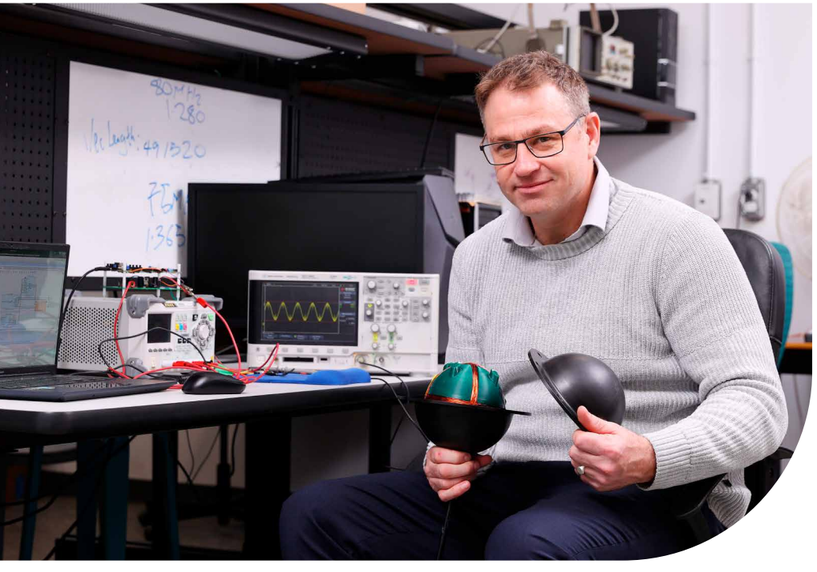
Ice. Saltwater. Remote locations. Building a communications network to study environmental conditions in the harsh North Atlantic comes with its challenges.

As Associate Scientific Director of the Ocean Frontier Institute's (OFI) Transforming Climate Action Research Program, Dalhousie Engineering Professor Dr. Jean-François Bousquet is optimistic about meeting those challenges.

Based at Dalhousie University, the OFI is carrying out the most intensive investigation ever undertaken into the ocean's role in climate change. Part of the project involves developing a network called the North Atlantic Carbon Observatory, studying the western North Atlantic to "understand and mitigate the impact of climate changes on the ocean, which is a major carbon sink," says Bousquet.

There are major challenges to collecting data in that environment though: "It's a chaotic area of the ocean. The surface does destroy your equipment. You want to keep your equipment below the surface. It's safer down there, and it's going to last longer."

The team is looking to potentially deploy drones to collect data underwater between an area near Iqaluit and the Greenland coast. Communicating underwater is feasible — low-frequency acoustics are very reliable. But Bousquet, an expert in low-power underwater communications, notes that data "cannot cross the water interface. Whatever goes underwater, stays underwater."



The solution? A "quantum enhanced magneto-inductive communication link that's going to be able to cross the ice in the Arctic." The system works by using magnetic fields to communicate between the drones and active nodes at the surface. It also will allow underwater buoys covered by ice to communicate their findings, when they are unable to reach a satellite link.

"The network we're trying to establish includes experts in sensing, experts in platforms, and autonomous systems, and in modelling," he says. "So, with this big team, we can actually achieve our objective of being able to acquire the data and extract meaningful conclusions out of it."

With plans to grow to over 170 researchers, the OFI will have plenty of opportunities for grad students. But Bousquet is also committed to giving undergrads the opportunity to solve real-world problems. Second-year students in his design course "are learning to develop micro-electronic systems and use cases related to the ocean," he says. In conjunction with the ocean climate monitoring project, students work on building a variety of monitoring technologies, such as anemometers, wind vanes, flow meters, and an array of sensors.

"We're asking them to be creative," he says. *"We're asking them to solve an important problem in the world."*

It puts them a little bit out of their comfort zone. They have to do research on their own, and they usually come up with really original solutions, and they all come up with a design that will solve a piece of the puzzle."

Harnessing the winds and combating the ice

Canada's extensive coastlines make it a prime location for offshore wind energy development. However, the country also contends with strong winds, consistent precipitation, and cold winters, leading to significant challenges for offshore wind turbines (OWT).

Despite being certified to operate in temperatures as low as -40°C, wind turbines in Canada still face issues with interruptions in power generation due to icing. Factors such as temperature, humidity, wind speed, and water droplet characteristics influence the amount of ice that can accumulate on the blades. That's where Dr. Baafour Nyantekyi-Kwakye and his team at Dalhousie Engineering's Turbulent, Ice and Marine Energy (TIME) lab step in.

Nyantekyi-Kwakye, a new addition to Dalhousie's Department of Mechanical Engineering team, is no stranger to the "blade icing phenomena" as he describes it. "Blade icing on OWT is one of the major problems that negatively affect their energy generating capacity and efficiency," he explains. "It not only distorts their aerodynamic profile and increased surface roughness, but it also increases and reduces the imposed drags and lift forces, respectively, which subsequently reduces the power output of the turbine."

TIME lab solutions

Although the development of effective mitigation techniques is ongoing, Nyantekyi-Kwakye says one of the challenges is that many solutions are unable to be applied to current OWTs due to their locations and the harsh environmental conditions they face.

The TIME lab is now working on an innovative solution to mitigate ice accumulation by using superhydrophobic coating (SHC) and incipient thermal energy through experimental and numerical approaches. Nyantekyi-Kwakye says these coatings, designed to repel water, coupled with targeted heat application, aim to keep blades clear and efficient.

The research, in collaboration with Memorial University of Newfoundland, is pushing new boundaries. "The first phase of the project will be to explore the efficiency of different SHC at the tip section of the blade under iced conditions," says Nyantekyi-Kwakye. "The major expected outcome from this phase of the research project is to develop an innovative technology that will harness heat generated within the nacelle and evenly distribute it to targeted sections of the blade susceptible to icing."

Student learning

Driving the research forward are Dal Engineering students at both the undergraduate and undergraduate level. This includes Mechanical MASc student, Emmanual Quayson-Sackey who has been working on the project since September 2023.

"I also expect two new additions (one MASc and one PhD graduate student) to join the TIME lab to continue work on other related research projects associated to OWT icing," says Nyantekyi-Kwakye. He adds that at the undergraduate level, students will have the opportunity to "conduct research in marine energy, exploration, interfacial ice melt, layer flow and more."

The research will take place in a brand-new state-of-the-art lab slated to open on Dalhousie's engineering campus by the end of 2025.

The impact of the work will extend beyond wind turbines, contributing to the shift towards decarbonized energy production and laying the foundation for Canada's ambitious 2050 Net-zero target.

"Students who conduct research at the TIME lab will become the next generation of leaders in the renewable energy field," says Nyantekyi-Kwakye. "They will be great resources for the Canadian offshore energy industry."

UNLOCKING THE POWER OF GREEN HYDROGEN

Standing amongst an array of appliances, Dalhousie Engineering PhD candidate, Theodore Street adjusts the controls on a gas stove and watches as the blue flame begins to burn.

This particular stove is running on a blend of natural gas mixed with 5 per cent hydrogen. It's one of a dozen different appliances that will be tested in Dalhousie's new Hydrogen Applications Research Laboratory.

In collaboration with local energy provider Eastward Energy, the lab will test the limits of blending hydrogen into Eastward Energy's natural gas system as well as the use of hydrogen-enriched natural gas in household appliances.

Eastward Energy has contributed $200,000 through an in-kind donation to support Dalhousie researcher Dr. Michael Pegg and his team in the Department of Process Engineering and Applied Science as they investigate low-carbon solutions for its distribution system, including the distribution of hydrogen-enriched natural gas. The partnership could assist Nova Scotia in its efforts to achieve net-zero greenhouse gas emissions by 2050.

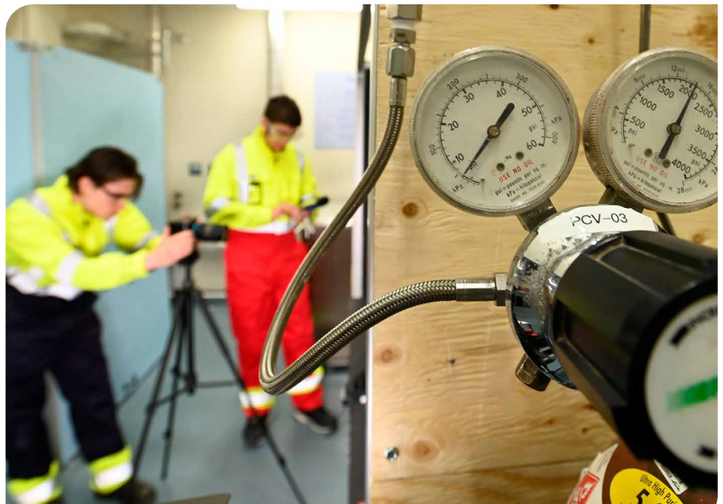
Nova Scotia's Green Hydrogen Action Plan, released in December, lays out guidelines for government and industry in the province in the development of green hydrogen — an alternative clean energy source.

What is green hydrogen?

While traditional methods for producing hydrogen use fossil fuels and emit greenhouse gases, green hydrogen is produced using renewable electricity and when it is burned emits only water and heat.

"Whenever you burn hydrocarbon flames such as methane/natural gas, oil, or anything with carbon in it, it produces CO2, which is a greenhouse gas. If you burn hydrogen in air, you don't produce any CO2," explains Street. From undergrad co-op programs to PhD candidates, Street is one of several students working side by side on this ground-breaking initiative.

Within the lab, Street points out several different types of appliances designed for natural gas including water heaters, a gas fired barbecue, gas stove, patio heater and more.



"We are going to be testing appliances that haven't been tested before, and we're looking primarily at operability limits" he says. Their team is ready to push the boundaries, searching for that "sweet spot" where the most hydrogen can be seamlessly integrated into the natural gas network without disruption or consequence to daily lives.

Testing hydrogen blends

They'll start with a modest 5 per cent hydrogen blend, monitoring factors such as appliance temperatures and gas compositions to ensure everything runs smoothly. Slowly, they plan to increase hydrogen levels, pushing appliances to their limit. The goal is to find that balance where efficiency meets safety.

"We are standing here by a water boiler that would be used for underfloor heating or baseboard radiators," says Street as he points out a row of boilers sitting along the back wall of the lab. "Previously published literature says there's quite a wide range depending on the unit. Anywhere from 10-90 per cent hydrogen can be mixed in," he continues. "So we have to test all sorts of different types of boilers and water heaters."

While innovative, the research comes with many challenges. Hydrogen, for example, with its high flame speed, presents unique problems.

"One of the biggest issues with hydrogen and natural gas is that at really high blends sometimes the flame can be unstable," says Street. "Hydrogen flames are a little bit hotter and they sit a little bit closer to the burner tip. If you turn off the burner, sometimes the hydrogen flame can travel back into the burner tip."

That causes something they call flashback; a sudden pop which could signal trouble.

"Flashback is mostly a concern when you have a pre-mixed fuel air mixture. If you have air and fuel and the flame flashes back, it can flash back for as long as there's air and fuel and it could cause detonation," says Street. "For most natural gas appliances, it wouldn't flash back that far because it's not pre-mixed. The air is injected into the appliance burner quite late. But for modern high-efficiency boilers and water heaters they use pre-mixed burners which are more prone to flashback. That's an area we're very interested in researching"

As the lab continues blending hydrogen with natural gas one appliance at a time, Street is excited to play a role in such a transformative initiative.

"What interests me about this is the chance to focus on research that actually makes a difference in the here and now in the world," he says. "The research that is being done on climate change is amazing, but so much of it won't be seen until five or ten years down the road. What we really want to do is to do something right here, right now that can lower emissions."

A smooth process: Capstone team works on reducing vibration for core sample imaging machine

A Halifax-based startup is hoping to help prospectors and mining companies identify minerals in core samples better and faster. For their Capstone Project, a group of senior Mechanical Engineering students from Dalhousie are working to improve the process.

Dalhousie Capstone projects connect teams of engineering students with companies facing real-world challenges. An integral part of the undergraduate experience, the program is designed to give students the chance to put their academic knowledge into action by tackling genuine industry problems.

Scient Analytics, based at Dalhousie's Emera ideaHUB, has developed a workstation to scan core samples and identify the minerals they contain. Engineering students Avery Opalka, Melanie Worobetz, Alexander Watters, and Bianca Bocancea are prototyping a tool to improve that process.

The sophisticated cameras doing the imaging should move as smoothly as possible for the length of the core sample boxes, to avoid blurred images. But “part of the issue with [Scient’s] initial design was too much vibration,” says Opalka .

After meeting with Scient in September, Worobetz said the team worked together to rethink every aspect of the company’s scanning tool.

“We considered the drivetrain system and all the attachments, the frame design, and the focal length of the cameras, which is very important to the size... We benchmarked the solutions against each other and against the current prototype to see where we could improve, and if our solutions were better than the one that they've already implemented,” she says.

The final design they chose was the one most compatible with the current system. It was also affordable, because it could be built with off-the shelf components.

Speaking a few weeks before building the prototype, Opalka explained its features. “The original drivetrain was based around a linear bearing, which is one way of doing translational motion. But the version we decided to go with uses V-slot rails, with wheels that fit onto it. This is a lot like a T-slot rail, except it has a bit of an angle to it. This is made to minimize the friction, and with less friction there's going to be less vibration.”

Watters says their Captone team did a good job working on their strengths. “I have been kind of helming the assembly models for the 3D CAD, and Avery and Bianca have been helping out with the part design. Mel has been doing a great job with project planning and formulating the reports and presentations. Avery has also been great at speaking with the vendors and the clients, and figuring out focal lengths with the client for testing the cameras.”

Worobetz, who came to engineering after earning a degree in fashion design, agrees. “We pretty much divide everything based on our strengths and what we're excited to work on — and then we help each other out.”

While unforeseen circumstances may present a challenge, Opalka says they are also part of what makes Capstone so valuable. “It puts you in situations that are almost uncomfortable, where you realize there are different challenges you hadn't planned on. In school you kind of know what's coming up —you know the challenges that are ahead. But when you're in a project, there's always something that's going to go wrong, and you have to figure out how you're going to deal with it. It’s an opportunity to learn.”

Dalhousie international students collaborate on CSA satellite project

A team of Dalhousie Industrial Engineering students have their eyes set on the cosmos; in particular, five distinct satellites orbiting above earth.

Each from diverse cultural backgrounds and countries, the team of international students came together for a common purpose: a senior year Capstone Project in collaboration with the Canadian Space Agency (CSA).

“The CSA is launching a constellation of five satellites for image retrieval,” says MJ Funsho, one of four members on the student team. “Our task is to develop a program that automates the scheduling of tasks for these satellites, determining when to retrieve images and perform additional tasks, and coordinating the download of images to ground stations."

Dalhousie Capstone projects connect teams of engineering students with companies facing real-world challenges. An integral part of the undergraduate experience, the program is designed to give students the chance to put their academic knowledge into action by tackling genuine industry problems.

While excited to collaborate with the CSA, Funsho and his teammates, Jhanos Rolle, Omesiri Godstime Erhekpaine and Chidiebere Eddy-Okafor knew that this particular Capstone project would come with a steep learning curve.

"None of us were experts in satellite systems, so extensive research was necessary to grasp the complexities of the project,” explains Funsho. “Moreover, the technical requirements pushed us out of our comfort zones, necessitating growth in coding and modeling skills."

Designing solutions from the ground up

Immersing themselves in the intricacies of satellite systems, the team made significant strides in designing solutions for their project. Utilizing Python programming, they developed a tool to query satellite orbit data and determine satellite positions relative to desired coordinates. Additionally, they also formulated a Linear Programming model to represent scheduling constraints, while optimization tools such as Gurobi and AMPL to aid in generating solutions for satellite schedules.

"At every stage where we felt like we had a good understanding, we would run into a problem," admits Funsho. “And that’s because this isn’t a project that any of us have worked on before.

While out of their comfort zone, Funsho is quick to point out that the team had plenty of support along the way, including the guidance and expertise of their Faculty supervisor, Dr. Pemberton Cyrus.

"Collaborating with industry leaders and our advisor has been invaluable. We're not only learning, but also exploring potential career paths in modeling and systems development” He adds that the project sparked a new passion for space exploration and the opportunity to work on similar network problems in the future.

“Apart from having a job, the Capstone project is probably one of the best real-world environments where you can expose yourself to the sort of structure and the sort of workflow you use to dissect problems and develop solutions in the engineering field,” he says. “Capstone is probably the single greatest real-world exam that you use to test your own skills, knowledge and problem solving against a real-world engineering problem.”

FORCE SEVEN SAILING SETS SAIL FOR ENGINEERING EXCELLENCE

A new force has emerged at Dalhousie Engineering; a multidisciplinary student design team rippling with innovation and driven by a passion for sailing. Their name: Force Seven Sailing.

The team is unique to Dal Engineering as students from Dal have joined forces with students from Memorial University of Newfoundland (MUN). Boasting a diverse roster of over twenty participants from both institutions, the team comprises students from a variety of disciplines including Mechanical Engineering, Chemical Engineering, Environmental Engineering, Electrical and Computer Engineering, Commerce, Recreational therapy, Ocean Sciences and more.

The students have come together for a common goal: to compete in the prestigious Foiling Sumoth Challenge. It's an international competition held each year at Foiling week at Lake Garga, Italy. Inspired by the goal of sustainability, university teams are tasked with designing, building and racing fully-class-legal Foiling Moth class sailboats while also considering the environmental impacts of their designs.

At the heart of Force Seven Sailing's mission is their captain, first year Dalhousie Engineering student Finley Nakatsu.

Charting the course

Born in Halifax, Nova Scotia, Nakatsu grew up with a passion for racing Laser sailboats on both a national and international level. A two-time provincial champion, his love for sailing steered him towards the Ocean and Naval Architectural Engineering Program at MUN.

"There, I was a part of a student design team called "MUN Sailboat" which designed and built a 2-meter long, 5-meter tall remote controlled sailboat for the International Robotic Sailing Regatta," he explains. "But the competition was focused mainly on naval architecture and mechanical engineering, and the scoring was focused mainly on robotics and computer engineering."

When he transferred to Dalhousie Engineering in the Fall of 2023, Nakatsu wasted no time in immersing himself in student leadership roles. Drawing from his experience with the MUN Sailboat team, he recognized an opportunity to bridge the gap between disciplines and universities, merging the expertise of MUN's Naval Architecture program with Dalhousie's Mechanical Engineering program. Together, the two groups would design, build and race high-performance sailboats.

Sailing into the future

Today the Force Seven Sailing team is gearing up for competition in 2025. "A two year timeline is much more realistic for a first time entry to the challenge," explains Nakatsu.

There's a lot to do in that timeframe including actively recruiting more students from across both universities, seeking industry partnerships to support their endeavours, and designing and building a fully class legal Foiling Moth class sailboat.

"The moth class sailboat is one of, if not the most high performance sailing dinghy in the world, using hydrofoils to reach speeds in excess of 65 km/h," says Nakatsu. "Similar to Formula One, the moth class uses a "box rule" to govern the design of boats. The class organisation creates a set of dimensions that every boat must comply to, but within those dimensions designers are free to innovate and adapt to gain an edge over their competitors."

Utilizing the expertise of MUN's Navel Architecture program, Nakatsu says the sailboat's hull and foils will be built in Newfoundland, while the wingbars and other components will be built in Nova Scotia. Once complete, the boat will be assembled in Halifax for testing and showcasing.

"Our team's biggest strength and challenge is our diversity," says Nakatsu. "Being split between two universities allows us to have access to the joint resources of both schools. Of course this split also adds complexity in communication between schools, and shipping the boat between them. However, we believe the benefits far outweigh the drawbacks."

Opportunities anchored in learning

For Nakatsu, the thrill of a new design team lies in the intersection of passion and engineering. Force Seven Sailing not only offers a platform to pursue his love of sailing but also translates classroom learning into real-world challenges. From communication to budgeting, team members gain invaluable skills that will shape their future careers.

"In my eyes, design teams like Force Seven Sailing, exist to teach students applicable real-world skills that they will be able to apply once they start their careers," he says. I believe that joining an engineering team is something that every student should consider. Even if Force Seven Sailing doesn't interest you, at least one of the amazing engineering teams at Dalhousie should hopefully pique your interest."

With a strong focus on sustainability, Nakatsu says participation on the team should appeal to students hoping to learn how they can foster a more environmentally conscious world.

"The success of this team hinges not only on me, but on the whole team. We have a very strong foundation of motivated students, from our Media, Logistics, and Finance Teams, to our Materials, and Design Teams. Myself and Linus (our Memorial Co-Captain) are here to steer the ship, but Force Seven Sailing's largest strength comes from our dedicated sub team leads, and members."

Turning Coffee Waste into Sustainable Solutions

Quinn Cavanagh (BEng'22) is the founder of RFINE Biomass, a clean tech company addressing the problem of spent coffee grounds in the Quick Service Restaurant (QSR) market.

When large vendors such as Tim Horton's produce vast quantities of spent coffee grounds, there is a high cost for disposal, but there is an equally impressive opportunity to reduce environmental impact by developing alternative solutions.

In our exclusive Q&A session with Quinn, he shares his journey as an entrepreneur and RFINE Biomass' mission to redefine sustainability in the industry.

How did you find inspiration for your venture? What was the problem you identified?

As a chemical engineer, I have always loved food and food science. My curiosity led me to investigate biomass valorization, looking at byproducts like post-consumer food waste. When I explored options for summer work, I decided to join a start-up instead of a traditional business, because I wanted to learn about entrepreneurship. This food delivery start-up exposed me to the problems associated with food waste challenges faced with the quick service restaurant industry, and it planted a seed for me. When I returned to my fourth year of undergrad, I started to study coffee grounds specifically, built a relationship with a mentor in the private sector that I met while working with the start-up, and entered some pitch competitions to test the idea.

How is your current Master's degree related to your business venture?

I had a supervisor as an undergraduate because I was exploring Master's work. Dr. Su-Ling Brooks really exposed me to a whole other side of chemical and process engineering. I set out on my Master's journey last winter and my thesis is about enzyme hydrolysis to valorize spent coffee grounds into food additives. This has to do with fermentation as a means to process coffee grinds into human-grade food ingredients. We also have a post-doctorate fellow that is carrying forward my research to address biological fermentation processes that can be applied to coffee grinds to make value-added food ingredients.

Tell us about your business model. What shifted your focus from product innovation to commercial opportunity?

I learned from my summer start-up experience that we needed to look at the customer's need to get the right product solution. QSR operations pay up to $15k annually to haul away wet waste, and we have looked at how to reduce the cost of this by-product. We have developed a proprietary in-store appliance called KAFFIKA that reduces the weight and volume to reduce fees, because we remove the water. But we also collect the material waste and make it useable for human and animal feed applications, and our business model includes the revenue from this component. We partner with brands who want to benefit from both the fee reduction and the opportunity to use the waste material.

You're now a full-time Resident at the Emera ideaHUB. What role does the HUB play in your entrepreneurial journey?

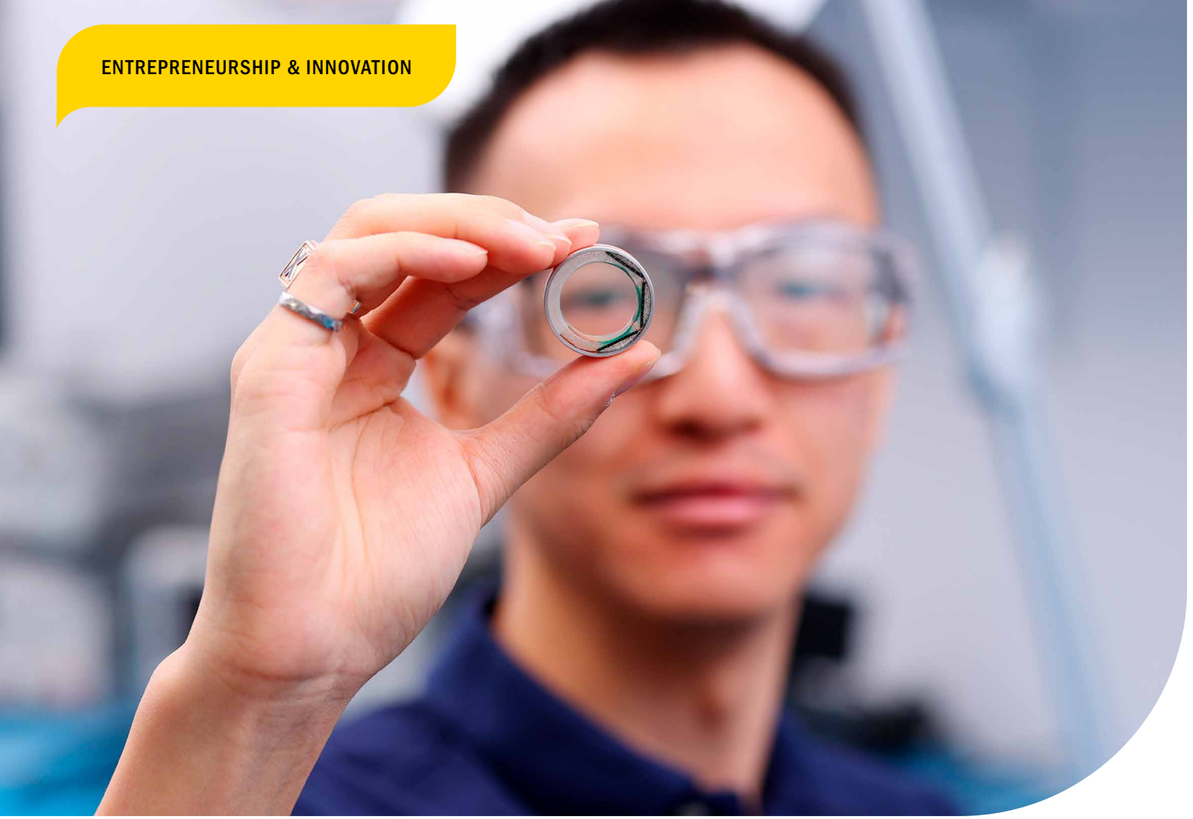
I noticed the HUB as a Dal Engineering student, but when I had it recommended to me by profs and at pitch competitions in the start-up ecosystem, I realized it could be a great home for my work. I was given a Venture Coach, which is an experienced entrepreneur who has gone through the whole process of bringing a deep tech or hardware product to market. I also applied to Creative Destruction Lab this fall and was accepted, so I now have a massive group of experts providing guidance and investor connections to me. As of this week we have 14 people working on our venture in various roles, including students. We can work on the product and the business in the HUB spaces and even have investors come to meet with us.

What has surprised you the most about being a start-up founder?

I'm surprised that people have embraced my venture despite my age. I was self-conscious initially, thinking that I'd be expected to have all the answers. It is also a lot of work – it's all-consuming. It's definitely a balance between the academic space which is methodical, with established processes and practices, and entrepreneurship, which is less so! Entrepreneurship is throwing stuff against the wall, doing 10 different jobs, and seeing what works. But what I did expect was that this would be fun and exciting – and it is.

What do you wish you knew when you started out?

I wish I knew that things would take longer than I imagined; it's probably twice as long and twice as expensive, especially because it's hardware. With hardware, what you put out in the world must work – it's not like software in that sense. There is a ripple effect of one thing affecting so many other things, and investors expect results. But we have done so much in a short amount of time. We try to realize our progress and feel good about that. There are more good days than bad, and I'm proud of what we've done.



XO Technology's Smart Ring: Revolutionizing Early Detection of Hand Disorders

XO Technology's Founder and CEO, John Wang (BEng'16, MASc'23), is advancing early-stage detection of hand degenerative disorders through the creation of a smart ring that precisely tracks finger motions and dexterity levels.

"By tracking finger dexterities with our smart ring, we will be able to link those dexterities to fine motor skills, to reflect newer degenerative disorders and old movement disorders" Wang explains.

We had the opportunity to sit down with John and delve deeper into his ground-breaking device.

What gaps in the market have inspired you to develop this innovative technology?

There isn't an easy way to test or monitor finger dexterity levels on your own when early-stage symptoms present as part of degenerative disorders. Current practices require individuals to see a physician to perform traditional tests, such as finger tapping.

Since early symptoms of hand degenerative disorders are fairly minor, most people ignore them until they are in greater discomfort, resulting in further degeneration. Research shows that early interventions can have significant impacts on slowing the progression of degenerative disorders. With early detection of degenerative disorders, we hope to help individuals maintain higher functionality of their hand mobility for a longer period.

How did your undergraduate and master's degree at Dalhousie support your desire to start your own business?

When you are young, there are so many things you are interested in but do not necessarily have the knowledge or skillsets to fully understand or interact with. It was in my undergraduate degree in electrical engineering at Dalhousie University, where I built the fundamental skillsets of an engineer, and that included the mindset to collect and solve problems. When I decided to continue my studies with a master's in electrical engineering, I was able to focus on very specific areas of research and design experiments to validate ideas and prove scientific hypotheses. The research I performed in my master's degree were the beginnings of XO Technology, looking closely at human and finger motion. My master's supervisor, Dr. Jason Gu, has been key in supporting my scientific research and encouraged me to pursue my business idea and bring the technology to market.

"With early detection of degenerative disorders, we hope to help individuals maintain higher functionality of their hand mobility for a longer period."

Why did you choose Emera ideaHUB programming to support your product development?

Once I decided I wanted to further my master's research into a business, the Emera ideaHUB ideaBUILD program was an exciting progression to make. With the HUB located on Dalhousie's engineering campus, it was an easier transition to make and kept me in close contact with academic supports.

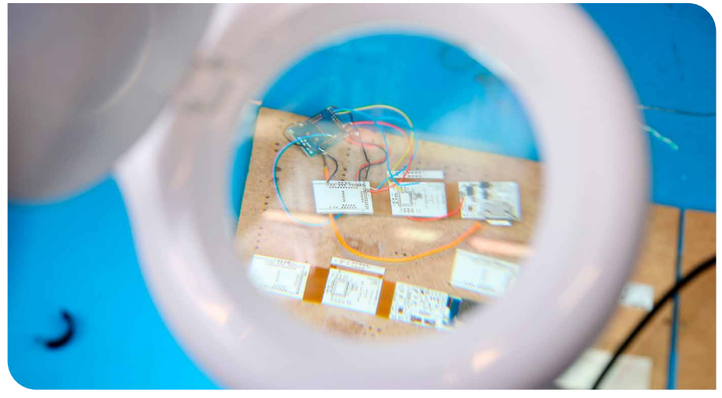
The Emera ideaHUB has been a beacon of support for XO Technology. I gained access to a creative workspace within the HUB and essential funding for material procurement, as well as the mentorship to guide prototype development.

It also brought me face-to-face with industry experts for professional advice on product market opportunity. What I had researched in human and finger motion could be translated into a range of consumer products. Earlier on, I had considered athletic performance applications using motion capture. But as I worked through the ideaBUILD program, I was able to determine the most viable market opportunity for my innovation, thanks to collaborating with coaches and mentors at the HUB and in our tech ecosystem.

Additionally, the networking opportunities have connected us with potential partners and investors, laying a strong foundation for our future growth and collaborations. The Emera ideaHUB's comprehensive aid transformed our concept into a viable prototype, fueling our journey forward.

What advice would you give future entrepreneurs?

The entrepreneurial journey isn't easy, I encourage those that are thinking of starting their own business or are in the early stages to not fear to be wrong. You'll receive a lot of great advice and viewpoints along the way, remember to focus on the things you love and enjoy the moment.



Blending the magic of engineering at the happiest place on earth

In a world of timeless tales and Cinderella's castle, a young Dalhousie engineering graduate is doing her part to put smiles on the faces of millions of people in Florida at the Walt Disney World Resort (WDW).

Flo Park (BEng'18) is not your typical Disney character in this enchanting world; she's an Industrial Engineer (IE), tirelessly working behind the scenes to make magic happen.

Her mission: to enhance park efficiency to improve Guest experience.

On the walk to her office at Hollywood Studios, she listens to the echoes of laughter as Guests embark on the famous Tower of Terror attraction. Her days are far from ordinary; as the Park IE for EPCOT, she regularly collaborates with park operators, entertainment teams, and project managers, using data to inform teams on how to streamline Guest flow, implement efficient practices, and optimize attraction queues.

On this particular day, she is about to depart for EPCOT to meet with operations teams at "Frozen Ever After" and "Guardians of the Galaxy: Cosmic Rewind", two popular attractions where Guests can set out on their own adventures with the beloved characters from the movies "Frozen" and "Guardians of the Galaxy".

"We're going to walk the attractions with some of the leaders to identify pain points at attraction load and unload, with the ultimate goal of improving their throughput and wait time goals," she says.

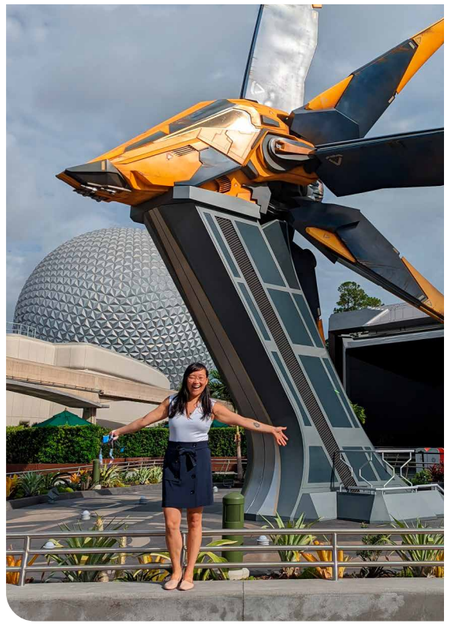
"Being an IE here is unique because our work directly impacts Guest experience," she explains. "As a Park IE, my work on attractions heavily involves what we call 'Guests Carried', or the throughput, of an attraction. I ask questions such as, how many Guests can ride in an hour? How does that affect wait time? What is Guest behaviour at different times of the day?"

Her responsibilities extend beyond rides and attractions, focusing on broader park dynamics from parking impacts to food and beverage capacities, nighttime spectaculars to character meet and greet locations.

Hired in May of 2022, her current focus area is EPCOT Park Operations. However, she notes that the IE team operates on a rotational program, allowing IEs to support several areas around the company.

The journey from the classroom to the most magical place on earth has been nothing short of fairy tale for Park. She attributes her good fortune to her time at Dalhousie Engineering, particularly the opportunity to explore different engineering disciplines during her first year of the program before making a commitment to one.

Immersing herself in Dalhousie's tight-knit community and the chance to engage in diverse extra-curricular activities such as the Dalhousie Theater Society, Park eventually became president of the



Institute of Industrial and System Engineers' Dalhousie chapter. Through her active participation, she forged connections that would ultimately pave the way for her into the enchanting realm of Disney.

"I know it's sometimes rare to truly love your job, but I truly love mine," she says. "I think there's such a cool aspect of being an Industrial Engineer at Disney. "Honestly, sometimes my job doesn't totally feel real. I've thoroughly and genuinely loved it.

Meet Emran Billah: A visionary engineer building a better world

Emran Billah received his electrical engineering degree from Dalhousie in 2019, after completing a computer science degree at SMU, and immediately put his skills and knowledge to work to help build a better world.

"I think we need to contribute at the professional level, economic level, personal and social levels," explains Billah. "My ultimate goal is to be able to solve at least one of the biggest challenges in the world, be it poverty, be it corruption, be it hunger, whatever it is."

After graduation, Billah co-founded and became Chief Technical Officer of Bluethumb Technologies – a fintech startup focused on socially innovative financial technologies. He also joined the team at Drinkable – a company that was based in the Emera ideaHUB on Dalhousie Engineering's Sexton Campus, developing the world's firsthand held water purifying device. Access to safe drinking water is one of the many problems that Billah – the company's Lead Electrical & Software Engineer – is working to solve.

"Ensuring access to clean water has always been a passion close to my heart, stemming from my upbringing in Dhaka, Bangladesh," explains Billah. "Growing up in an environment where water pollution posed significant challenges, I personally experienced the impact of waterborne diseases. It's staggering to consider that one in three people worldwide lack access to safe drinking water, with over 2 billion residing in water-stressed regions."

Crediting discipline and a healthy lifestyle that includes competitive weightlifting and circus training to keep his energy levels high, Billah also serves as Director of Software Engineering with Spiri Robotics based in Halifax. Through this work, he applies his technical knowledge and problem-solving skills to develop robotics technologies that aid in defence and environmental monitoring.

"Continuing to rely on conventional methods in the face of evolving challenges is a recipe for stagnation," he says. "We must embrace innovation and fresh perspectives to chart a new course forward. By harnessing the power of creativity and ingenuity, we can pave the way for transformative solutions that address the complexities of our modern era. It's imperative that we adapt and innovate to confront the obstacles that stand in the way of progress."

To help foster the next generation of entrepreneurs and change-makers, Billah volunteers his time mentoring students, organizes hackathons, serves as the local lead in Nova Scotia for the NASA Space Apps Collective Cohort and is the Global Amplification Collaborator for the Space Apps Collective Cohort.

Named a 'Top 30 Under 30 Innovator' by Atlantic Business Magazine, and a finalist in 2023 for both 'Role Model' Digital Nova Scotia Tech Forward and 'Emerging Professional' Discovery Awards, his efforts have not gone unnoticed as he inspires future engineers to grow the economy, create healthier communities and impact real change.

"Innovation thrives in an environment where collaboration and knowledge sharing are paramount," says Billah. "Investing in the growth of others is just as essential as honing one's own skill set. By nurturing a culture of mentorship and continuous learning, we lay the foundation for collective progress and drive innovation to new heights."

Shaking things up: Hybrid simulation research helps strengthen buildings against earthquakes

Some retrofits are easier than others. If your home is too drafty, you can insulate it. But retrofits can get a lot more complicated — like if you're trying to increase resistance to earthquakes.

"That's where Dalhousie's Structural Assessment and Retrofit Research Team comes in. Led by Professor Dr. Fadi Oudah of the Department of Civil and Resource Engineering, the team's mandate includes developing innovative and efficient retrofit techniques — including seismic retrofits.

"We focus on developing new methods for analyzing existing structures, assessing their safety, and optimizing the retrofit, if they need a retrofit," says Oudah.

One of the innovative approaches used in the lab is hybrid simulation. It involves building a scale computer model of a building, selecting the element of the building to test, building it in real life in the lab, and then connecting it to the computer with a hydraulic load actuator.

"If I subject the building that I designed on my computer to an earthquake, the software speaks to the actuator in real time, applies the forces seen in the computer model in real time, and then feeds back the response from the experiment to the computer in real time," explains Oudah.

Almothanna Karfoul and DeZhen Chen are two of the Structural Engineering Master's students working in the lab.

Chen's work focuses on retrofitting older precast concrete structures. "Most precast concrete structures have weak points... especially in joints," he says. Shear cores provide strength, but thickening them to improve earthquake resistance comes with all kinds of other structural costs.

So, Chen is working on a different approach, using superelastic shape memory alloys (SMAs) —materials that can return to their original shape after being deformed. He is involved in a project to develop a device using SMAs, and inserting it on beam-to-column joints, to help buildings withstand the shaking of a quake.

"That means the structure ideally should not sustain permanent damage after the earthquake"

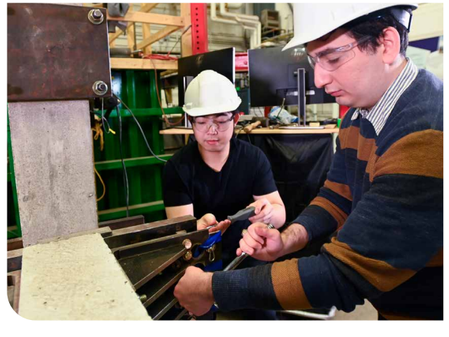
— DR. FADI OUDAH

"That means the structure ideally should not sustain permanent damage after the earthquake, because that device will pull back the structure, to some extent, to its original position," explains Oudah.

Karfoul's research is related. He's working on using SMAs in buckling-resisting bracing systems. When a building's braces are compressed, they can buckle, "like when you press down a ruler on both sides," he says.

To prevent that, buildings are braced, but in protecting the building, those braces can be damaged. Enter SMAs. Because they revert most of the way back to their original shape, "you essentially have an element that's yielding, that's dissipating earthquake energy, helping your structure survive an earthquake. And then, after the earthquake, it should theoretically get back to its original shape," he says.

While these are two of the most advanced projects in the group, Oudah says there are a lot of exciting possibilities ahead for hybrid simulation research: "We are working to further utilize the infrastructure we have, working with industry on projects that are relevant to the assessment of existing structures... We're keen on practical research in marine, bridge, and building engineering."



Optimizing health care

Before her Fall 2023 co-op term with the Nova Scotia Health, fourth-year Dalhousie Industrial Engineering student Hayley Cowan wasn't sure what kind of role industrial engineering could play in health care. She soon realized the sector provides plenty of opportunities for industrial engineers to "optimize and improve things wherever they can."

Her co-op was funded through a $1.4 million research partnership between Mitacs and the Nova Scotia Health Innovation Hub. Overseen by Dalhousie Engineering Professor Dr. Peter Vanberkel, the five-year project — the largest ever undertaken by Mitacs with a health authority in Canada — sees the university embedding top industrial engineering interns and post-doctoral fellows within Nova Scotia Health, to solve some of the province's biggest health care problems.

Cowan worked closely with Vanberkel, often meeting weekly.

She focused on two very different problems for the health authority — analyzing data to improve blood collection scheduling for cancer patients, and looking at how to improve use of space at a growing pre-natal clinic.

Before the pandemic, people needing bloodwork could walk into a clinic and wait their turn. With COVID came appointment scheduling. But that led to complications.

Patients would arrive at the hospital, realize they couldn't get same-day blood collection, and sometimes find the earliest available appointment was three weeks away.

"We were wanting to make that more accessible for them," Cowan says. "So, they have their scheduled cancer care appointment, they can come to Halifax, have that appointment, and then they can also get their blood collected easily."

The pre-natal clinic project involved site visits to the Cumberland Regional Health Care Centre in Amherst, Nova Scotia. Working with a project supervisor and an industrial engineer, Cowan interviewed staff and analyzed how the clinic was using its space. "They had initially thought they needed to add another examination room," Cowan says. "But we noticed they weren't using the two exam rooms in the clinic to their fullest capacity."

Her team also made recommendations on reorganizing space to accommodate new administrative staff, and how that would affect flow within the clinic. For the most part, "they were receptive to the recommendations," she says.

In addition to applying the industrial engineering skills she had learned in class, Cowan said the co-op also helped improve her people skills.

"A lot of people think of engineers as people who just sit down at their desks and do the work... But I would meet with the team and stakeholders," she says. "It was a really good experience being in situations where your communication is really vital to the project."

Crafting a Legacy: Ispeeta Ahmed's Journey as a Schulich Scholar Leader

Ispeeta Ahmed is not just pursuing an engineering degree; she's crafting a legacy.

The proud recipient of the Schulich Leaders Scholarship, the vibrant and dynamic student is now in the second year of her electrical engineering degree. With a keen desire to make a lasting impact, Ahmed hopes to do more than merely create waves in the field of engineering. She hopes to utilize the scholarship to become a beacon of inspirations and guidance for future Dal engineering leaders.

Her academic journey so far is a testament to the transformative impact of the Schulich Leader Scholarship program. Freed from the financial constraints of higher education, Ahmed has seized the opportunity to not only propel her own academic endeavors but to also support and enhance the academic experiences of her peers. She's quick to note that her passion and drive to help others is fueled by the inspiring stories of former Dal Engineering students, in particular, Sierra Sparks who was awarded a Rhodes Scholar in 2020.

"While academics are crucial to focus on as a student, it is the leadership and outreach roles one does that positively affect your undergraduate experience" She says.

"It's rewarding to learn to become a leader, but it is equally exciting to be in a position to impact, enhance and give others the resources to lead."

With plans to continue on to graduate studies following her undergraduate degree, Ahmed hopes to one day pursue a career in academic and research where she can create tangible solutions that improve people's lives. Her vision is a shining example of how Schulich leaders exemplify academic excellence, leadership, and charisma.

The Schulich Leader Scholarship program is awarded annually to 100 high school students from across Canada, recognizing exceptional individuals with promising potential in science, technology, engineering, and math (STEM). Recipients, known as Schulich Leaders, become part of a distinguished community of scholars dedicated to making substantial contributions to their respective fields and inspiring positive change in the world.

Choosing her path

Growing up with an interest in math, physics, and biology, Ahmed recognized the transformative power of electrical devices, and a calling to explore opportunities within the diverse field of engineering.

"As a kid, I was interested in those beginner robotics kits that my mom bought for me, and I was excited when I realized that I could one day do this as a job. Not only as a job, but as a gateway into creating and innovating solutions to help people," she explains. "With an engineering degree you can quite literally create any product or device that can help humanity."

A high school student in the small town of Antigonish, Nova Scotia, Ahmed's decision to pursue electrical engineering at Dalhousie was fueled by the desire for diversity and a strong sense of community. "Dalhousie Engineering was my first choice, and the scholarship was just the cherry on top," she says. The sense of belonging she found within her engineering program, affirmed her decision.

STUDENT FEATURE

"I had always heard really good things about Dal Engineering's program and now that I'm in it, I can see how much of a community it is," she adds. "I can see it compared to my peers in any other undergraduate program. Here I know everyone in my class, I know upper year students, and staff. Sexton is much more of a community."

Actively involved in that community, Ispeeta has taken on several leadership roles. Currently the VP Academics of the Diploma of Engineering Society (DES), she leads initiatives to enhance education and curriculum, supporting students with their academic struggles. She was also involved with the Dalhousie Women in Engineering Society in creating its annual Go Eng Girl Conference, engaging young female high school students around Nova Scotia interested in exploring the field of engineering.

This year, Ahmed became a starting member of Dalhousie's Tetra society, an initiative that showcases her commitment to fostering innovation and inclusivity within the engineering community.

"I'm very passionate about engineering and its societal impacts, and the Tetra Society at Dalhousie is a new society that is very community oriented. We get requests from people in the community with disabilities or other issues that they are having, and as engineers, we come up with solutions to solve those problems," she explains."

Journey of Resilience

Reflecting on the pressure she initially felt to prove herself within the university community, Ispeeta admits that the weight of winning prestigious awards such as the Schulich Leader Scholarship program and Ingenium-NSERC STEM Horizon Awards sometimes brings about "imposter syndrome." However, Ahmed, who is also a Sexton Scholar, an NSERC USRA award winner, and a 3-Minute Thesis Summer Research Contest winner, says within the nurturing community of Dalhousie Engineering, she found a supportive environment that alleviated those doubts and allowed her to embrace opportunities, showcase her passions and overcome insecurities that lingered from her high school self.

"I want to thank Dalhousie for allowing me to have that kind of growth. Now when opportunities come up, I don't have a hard time saying yes, even if it scares me. Even it seems way out of my realm," she says.

Less than halfway through her degree, Ahmed says she looks forward to the multitude of opportunities ahead and the potential to influence the lives of her peers and future Dal engineering students, much like Sparks did for her.

> *"With an engineering degree you can quite literally create any product or device that can help humanity."*
>
> **— ISPEETA AHMED**

HARVESTING EXPERIENCE

Manika Sahu's Work Term at McCain Foods.

"My decision to pursue engineering abroad came as a surprise to my teachers and friends, considering my artistic background," says Manika, "However, my father has consistently been a source of encouragement and confidence, guiding me towards a STEM education and obtaining a technical engineering degree, while emphasizing the importance of a well-rounded education.

Manika recently completed a co-op term with McCain Foods at their Coaldale facility in Alberta. The facility primarily produces and exports frozen French fries to Japan and North America.

"I began with the Quality and Sanitation department in the 21 Day Line Validation project," says Manika, "This project aimed to rigorously test and confirm the maintenance of sanitary conditions across the production line throughout a complete 21-day cycle. During this, I revamped the data collection spreadsheet with automated Excel functions for improved user-friendliness." Manika didn't have previous experience with microbiology environmental swab collection; however, she quickly diversified her skillset as she processed various samples to check air quality and the presence of mold and E. coli.

Her next project, of which she was given the opportunity to take on a leadership role, focused on Piece Count and Length Optimization for various French fry products, each with unique production specifications. The primary objective of this project was to identify the specific locations in the production and packaging processes where French fry length was being compromised due to breakage.

"I constructed my dataset and identified the drop points and possible breakage locations within both the processing and packaging areas. Subsequently, I developed a detailed plan for collecting samples at each of these identified locations.", she says. Impressively, her dataset amassed over 15,000 data points and paved the way for high-level analysis.

"Believe in yourself and challenge gender stereotypes and biases. Be an advocate for diversity and inclusion in STEM by pushing boundaries. Share your journey and experiences with others, especially young girls. You can be a source of inspiration for the next generation of women in STEM"

— MANIKA SAHU

We spoke to Manika's manager, Josiah, who discussed her development throughout the work term. "A big area of growth for Manika this summer was difficult conversations. It is something all young professionals struggle with. Manika exhibited growth in the way she approached, handled, and executed these conversations throughout her work term Parsing and analyzing data," he says, "She also learned several tools that

helped her not just collect data for us but interpret it and paint a story that provided value to our operations."

Josiah also had exciting news to discuss—McCain Foods has a 600-million-dollar expansion planned for the Alberta facility. "We are making the largest investment in company history and will double our production capacity," he says, "The project will also have a heavy focus on environmental sustainability. It includes plans for wind turbines and solar panels to provide 100 percent renewable electricity to the facility, as well as the use of renewable biogas generated at the site's wastewater treatment facility to offset natural gas demand. We are very excited!

McCain Foods extended a full-time job offer to Manika, commencing after graduationin the spring. She discussed her academic achievement, "I am proud to share that I will be the first woman in my family to acquire an engineering degree," says Manika, "This achievement holds special significance for me and my parents, and I hope it can serve as an inspiration to future generations within my family and beyond."

WORKING IN THE FAST LANE

John MacIsaac's Work Term with the Aston Martin Formula One® Team

John MacIsaac always had a special interest in cars and engines. "Any maintenance large or small my dad would walk me through, and I would be encouraged to understand how the mechanism works and to research a solution," he says. This hobby paved the way for his interest in high-performance vehicles.

The third-year Mechanical Engineering student had the opportunity of a lifetime this past fall, completing his first work term at the Aston Martin Aramco Formula One® Team factory in England.

Through a contact made at the Canadian Grand Prix, John was able to connect with Aston Martin Aramco Formula One® Team's head of talent and recruitment. After applying for a position and completing the interview process, John was hired as a placement student in the Research and Development department.

When John arrived, the organization had just moved into a state-of-the-art factory. Initially, he was anxious to be working in such an advanced environment as a new engineer. His nerves soon diminished as his team welcomed him and gave him the chance to join projects and contribute.

During his time at the organization, John worked with his supervisor, who was responsible for most of the R&D and testing of the F1 cars' cooling systems. He was able to develop his skills by working with different types of software and running tests in the labs with the help of technicians. John noted that it was easy to develop relationships and receive input whenever it was required. "My supervisor was comfortable allowing me to run tests on my own, which was invaluable for my personal development," he says, "My supervisor would also walk through every intricate detail of why a test is required; this allowed me to further analyze and explain our findings in our weekly team meetings. I found this to be the perfect work environment to grow professionally."

The projects John worked on took a lot of patience and attention to detail, and he was grateful to contribute and make an impact on the organization. "Knowing that my projects and tests will have a potential impact on the cars' performance makes them all incredibly special," he says.

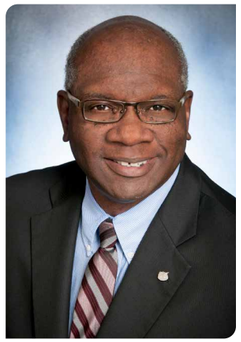
"It was an overall great experience to work and live in England and I was excited every day to go to work with such a world-class team."

— JOHN MACISAAC

14 Dalhousie Engineering varsity student-athletes achieved U Sport Academic All-Canadian status during the 2022-2023 year. Their hard work and success was celebrated at the 25th annual Academic All-Canadian Celebration. To qualify as an Academic All-Canadian, student athletes must maintain a GPA of at least 3.50 over the academic year while competing in a varsity sport. Hard work, dedication, sacrifice and support are crucial for success.

The Wilson Family's legacy of innovation continues at Dalhousie Engineering with the John Wilson Heavy Structures Lab. Named after John Wilson, founder of Atlantic Industry Limited (AIL), this space fosters hands-on learning and ground-breaking research. In November, we honored the Wilson family and the team at AIL for their generous gift, enhancing learning at Sexton Campus. This partnership has provided invaluable opportunities for students, including co-ops and post-grad placements, fostering innovation and sustainable solutions.

On December 6th, Dalhousie Engineering remembered the victims of the 1989 Montreal Massacre. A vigil, hosted by the Dalhousie Women in Engineering society, was held on Sexton Campus. The ceremony payed tribute to the 14 women who were shot and killed at l'École Polytechnique in Montreal in 1989. The vigil also celebrated the resilience of women today and a national movement to end gender-based violence.



Leading researchers and innovators from across Nova Scotia were celebrated at the 21st annual Discovery Awards, including two members of the Dalhousie Engineering community.

Dr. Noreen Kamal was awarded the Emerging Professional Award for her work to reduce disparity in access and optimize time to stroke treatment. Dr. Kamal has had an incredible impact on the Nova Scotia Healthcare system and on women in Engineering.

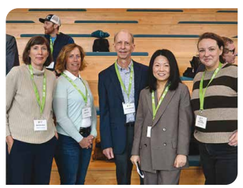
Dr. Pemberton Cyrus was awarded the Science Champion Award for his leadership in outreach to Black Nova Scotian populations through the Imhotep's Legacy Academy. His transformative work empowers African Nova Scotian students in STEM, creating pathways to success.

Further congratulations to Dr. Cyrus on receiving this year's Engineers Nova Scotia Citizenship Award. The Award honours professional engineers who have showcased outstanding service and leadership to the community.

Dalhousie Engineering continues to lead the way in Additive Manufacturing.

In the Spring of 2023 we were pleased to share news about new infrastructure within our Advanced Manufacturing Hub that now houses some of the most prestigious equipment in Canada. This includes a pilot scale gas atomizer for the production of customized metal powder feedstocks such as copper alloys.

Last Fall we were excited to announce that researchers in the Hub have secured one of the largest NSERC-based funding award ever received within the Faculty of Engineering. The $3.7 million grant, funded by NSERC, the CFI, Defence Research and Development Canada, and a multitude of industry partners, will help advance additive manufacturing technologies for copper alloys critical to Canada's marine defence sector.



One of the greenest academic buildings in Canada has a nice ring to it. Two of the greenest sounds even better. Dalhousie Engineering can now lay ownership to such claims after its Emera IDEA and Richard Murray Design buildings on Sexton Campus achieved LEED Platinum status last Fall. This is the first time the university has received such a lofty certification.

This Platinum certification from the globally recognized Leadership in Energy and Environmental Design (LEED) program vaults Dal into a new orbit with a small group of other post-secondary peers in Canada leading the way in green building.

The Dalhousie Undergraduate Engineering Society and the Dalhousie Commerce Society joined forces twice this year for vital causes. Their inaugural blood drive in October, in partnership with Canadian Blood Services, emphasized the importance of saving lives through blood donations. In March, the students hosted their second annual Eng vs. Comm charity hockey game, raising funds for the Canadian Cancer Society. These collaborative efforts highlight their commitment to community engagement, showcasing their incredible impact beyond the classroom.

In March, Dalhousie Faculties of Engineering, Computer Science, and Science University held their 6th annual Women in STEM networking event. Esteemed young female alumni across various STEM disciplines came together to discuss the unique challenges and opportunities faced by women in STEM fields. Among the distinguished speakers was Chelsea McLean, a Dalhousie alumna from the field of Engineering (BEng'15), who currently serves as the Senior Energy Manager at EfficiencyOne.

DALHOUSIE UNIVERSITY

FACULTY OF ENGINEERING

Return undeliverable Canadian addresses to:

Faculty of Engineering
Dalhousie University
5217 Morris St.
4th Floor O'Brien Hall | P.O. Box 15000
Halifax, NS B3H 4R2 Canada

CANADA POST / POSTES CANADA

Postage paid / Port payé
Publications Mail / **Poste-publications**
40065040