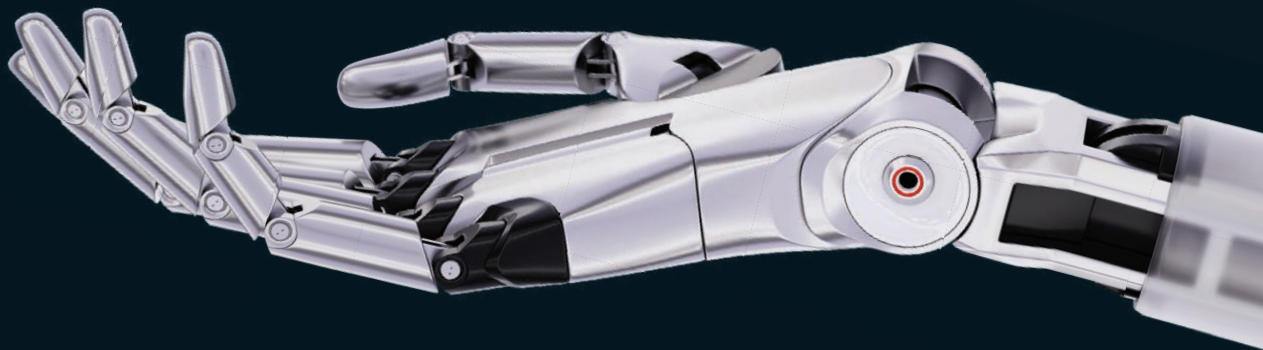


Ingenious



WHERE NO *HUMAN* HAS GONE BEFORE

CARLETON'S ALEX ELLERY
LOOKS TO SPACE ROBOTICS
AS OUR KEY TO UNLOCKING
THE FINAL FRONTIER



AND THE OSCAR GOES TO

Carleton grad wins big on
Hollywood's biggest stage

MID-CENTURY MILESTONE

Azrieli School of Architecture &
Urbanism celebrates 50 years

SMOOTHING THINGS OVER

Unique asphalt roller paving the
way to more resilient roads



Reaching New Heights

From developing technologies that will enhance the search for life on distant worlds, to solving everyday problems here on Earth, our Faculty's researchers, students and alumni perpetually find ways to push the limits of innovative thinking.

Our current students continue to utilize their fourth-year projects to address the needs of the present and future, as demonstrated by industrial design students Ben Kaufmann and Andrew Ferrier, whose submissions took the top prizes at this year's highly prestigious International Housewares Association's annual Student Design Competition.

Also focusing on real-world impact, civil engineering professor Abd El Halim looks to pave the way to longer-lasting roads with a uniquely designed asphalt roller that is capable of producing pavement which better resists the elements and is less susceptible to everyday wear and tear.

Looking towards the skies, aerospace engineering professor Alex Ellery has begun developing numerous space robotics technologies that may one day enable us to venture deeper into the unknown than ever before by laying the groundwork for sustainable space exploration.

Despite keeping his feet firmly on the ground, architecture alumnus Paul Austerberry nonetheless found himself rubbing elbows with the stars this past spring at the 90th Academy Awards, where he ultimately took home the Oscar for Best Production Design for his work on Guillermo del Toro's, *The Shape of Water*.

Thanks to the financial support of our alumni and industry partners, our Faculty has been able to enhance the educational experience of students by means of establishing scholarships and bursaries, and creating opportunities for experiential learning.

Lastly, while Carleton's 75th anniversary has now officially drawn to a close, our Faculty celebrates another important milestone this fall as the Azrieli School of Architecture & Urbanism turns a half-century old. To mark the occasion, I invite and encourage every one of the School's alumni to return to campus for 'Forward 50', a special two-day celebration of past and future that will be held on October 4 and 5.

Fred F. Afagh, PhD, P.Eng, SMAIAA
Interim Dean, Faculty of Engineering and Design

Ingenious

Editor: Adam Landry
Contributing authors: Ainslie Coghill, Adam Landry, Joseph Mathieu, Ellen Tsaprailis
Photography by: Ainslie Coghill, Ashley Fraser, David Woodruff
Additional photos and imagery courtesy:
Paul Austerberry, Rich Deboer, Abd El Halim, Gordon Hicks, Dave O'Malley, Peter Stenger
Supplemental photo and image credits:
Adobe Stock Images, NASA/JPL/ESA/SSI

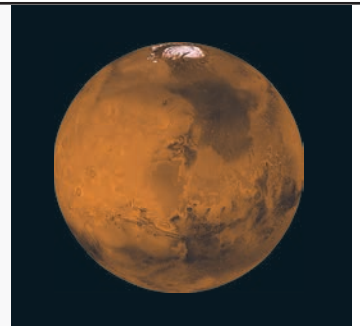
Newsletter Mission Statement

Ingenious is published for alumni, faculty, staff, friends, and partners of the Faculty of Engineering and Design. The newsletter is intended to communicate the Faculty's goals, strategic direction, and activities in order to connect alumni to each other and the university.

On the cover

Aerospace engineering professor Alex Ellery's efforts in space robotics aim to enhance the future of planetary exploration and the search for life beyond Earth.

Photo/Image: NASA, Adobe Stock Images



The Department of University Advancement protects your personal information. It is used by the university to inform you about programming, events, and offers from our affinity partners, to communicate Carleton news, and for fundraising purposes. To update your name or address or stop mail, please contact Advancement Services at 1-800-461-8972.





FORWARD ▶ 50

Carleton's School of Architecture Celebrates a Milestone Anniversary

The fall of 2018 marks the 50th anniversary of architectural education at Carleton University. On October 4 and 5, the Azrieli School of Architecture & Urbanism will welcome alumni to join faculty and current students on campus for Forward 50 – a celebration of things past and the shape of things to come. The two-day event includes stories and interviews, an auction, time in the design studios, receptions and a signature “Dinner in the Street,” held on the main level (or “lower street”) of the beloved Architecture Building.

Established in the fall of 1968, the School of Architecture began with twelve students and four faculty under the directorship of Douglas Shadbolt. The purpose-built architecture building followed four years later as the program grew in size and significance. Designed by architects Carmen and Elin Corneil in partnership with Jeff Stinson, the building has shaped many generations of architects and continues to play a crucial role in the School's programs and pedagogy.

“The experience of being in that building is something we all share,” says Janine Debanné, Associate Professor and Associate Director of the School. “It's a rough and tumble building without fancy finishes, but it's all about spaces that are transformative, in which people can meet each other.” Before joining the

“ “

There's a tie between this little old structuralist building and what happens in the country at large. That's the power of this place.

” ”



faculty in 2001, Debanné was a student at the School in the late 1980s.

“The community is very connected,” she says. “Going through the program is intense. There is a shared memory of that arduous but powerful experience – and togetherness. And it’s a building that behaves much more like an urban space, with a lot of overlap and flow.”

Mirroring the characteristics of the building, Debanné says that the School’s ethos encourages an understanding of thoughtful, fluid and productive relationships: between buildings and their site, inside and outside, public and private spaces – and in her words, “the relationality of things.”

With a generous donation by alumnus David Azrieli in 2008, the School changed its name to the Azrieli School of Architecture & Urbanism. The Azrieli Endowment has been instrumental in the School’s growth and diversification. Having begun with a handful of students and a single degree program, some 500 students now study architecture and urbanism at Carleton each year, divided among four degrees and eight different programs. In addition, the School now offers continuing education courses for professionals and several summer programs for students interested in exploring architecture. The School’s alumni practice architecture around the globe and are represented in a wide range of creative disciplines.

Travel has always played a key role in the study of architecture at Carleton. The ethos of the School’s Directed Studies Abroad (DSA) program, which began with a full-term abroad during the fourth-year of the Bachelor of Architecture program, now infuses all aspects of the

School’s pedagogy. Over the past two years, groups of students have travelled to India, Japan, Europe, Istanbul, Madrid, London, Lisbon and Barcelona. With a grant from the Azrieli Foundation in 2018, a group of students and faculty travelled to Israel and then to a small town in northern Nunavut, as part of a graduate studio on Extreme Landscapes.

Moving forward, current Director Jill Stoner is excited to broaden these opportunities to include places like South Africa, Brazil and Serbia. Her vision is “to reach out beyond the walls of our building and our home institution, to encourage our students to engage in the most pressing global issues of our time.”

The School is also involved in connections closer to home. Through Carleton’s Immersive Media Studio (CIMS), there’s a potential to be a think tank for Canada within its capital city. “CIMS Lab is currently doing parliamentary work, forging a connection between our School and the seat of democracy in Canada. There’s a tie between this little old structuralist building and what happens in the country at large,” says Debanné. “That’s the power of this place.”

The Forum Lecture Series, established in 1968, is perhaps the School’s most recognized means of bringing Carleton’s architectural community together with leading thinkers of the day. Through the contributions of corporate and individual donors, the Forum Lecture Series continues to introduce students, faculty and the wider Ottawa community to a host of leading practitioners and critics of architecture.

As Barry Hobin, Principal of Hobin Architecture and founding sponsor of the series has observed, “The



In 2018, architecture students visited Barcelona through the School's Directed Studies Abroad (DSA) program.

importance of the Forum Lecture Series cannot be stressed enough. It has tremendous opportunities to be a catalyst for better design in the Ottawa area — including the Carleton campus.”

Under the leadership of Director Stoner, thoughtful restorations and upgrades to the Architecture Building, which is now over 40 years old, are underway.

One such upgrade – the Nan Griffiths Memorial Seminar Room – will be a tribute to former faculty member Nan Griffiths, who passed away in 2018. Professor Griffiths was the sole female tenured faculty member for several of her 22 years teaching at the School, beginning in the mid-1970s. In her “Morphology of the City” class, notes Debanné, Professor Griffiths opened students’ eyes to beautiful cities and public squares around the world. “From Bath to Edinburgh; from the medieval walls of Lucca to the Place des Vosges in Paris ... with Nan, we discovered that cities can be enchanted.”

The memorial space, located within the School, will house several book collections, and will be the setting for academic conversations about the past, present and future of architecture and urbanism. The room has been designed by alumnus Henri Cleinge (BArch/91). “It is an honour to

be able to design a room within the school that shaped my architectural sensibility, and to commemorate the teaching of Nan Griffiths, who made such a significant contribution to my identity as an architect,” says Cleinge.

“I really hope, with my colleagues here at Carleton, that many alumni will join us on October 4 and 5,” says Debanné. “When I run into people from my early years, I get a spark of joy. Whether it’s an old teacher or someone who was a few years ahead or behind me, there’s a joy about our youth and our years here. It will be lovely to be a part of this happy moment of reunion, and also a great opportunity to share in our love for the School and our love for architecture.”

“I’m so looking forward to welcoming former students back to the School in the fall,” says Stoner. “Not only to reminisce about the past fifty years, but to help us shape our future for the next half-century.”

.....
For a full list of event programming, visit Forward 50 online at carleton.ca/architecture/forward50.



A member of the Boys and Girls Club of Ottawa takes part in hands-on STEM activities with Virtual Ventures staff during a visit to Shopify's headquarters.

Link<ed>: Connecting the Wires Between Ottawa Youth and Digital Literacy

Not all youth in our community have the same access to technology, but an exciting collaborative venture between three Ottawa institutions has set out to change that.

In the summer of 2017, Christine Riddell, Director of Carleton's Virtual Ventures Summer Camps and Programs, met with Brittney Oberfeld, Outreach Producer at Shopify, to develop a pilot project aimed at creating digital literacy programming for youth members of the Boys and Girls Club of Ottawa (BGCO). By the end of the year, a set of skill building workshops, aptly named Link<ed>, were ready to be delivered to the first group of BGCO members.

Link<ed> is part of Shopify's broader Dev Discover program, says Oberfeld.

"Created to bridge the gap between youth and technology exploration, Dev Discover focuses on actionable steps that bring youth from their first experience in technology to the possibility of pursuing post-secondary education in STEM, to an impactful career in technology," she explains.

For participating BGCO members, aged 6-14, Link<ed>

introduces the concepts of computational thinking and digital skills development.

The program includes an introduction to coding, game development, 3D modeling, and more. According to Adam Joiner, Director of Programs with BCGO, most members don't have access to functioning computers, electronics, or internet unless they are in the Clubs or at school.

Fully funded by Shopify, Link<ed> sessions are hosted weekly at BGCO locations, with programming delivered by experienced Virtual Ventures staff and motivational mentors from Shopify. A culminating visit to Shopify headquarters in the final week gives members a taste of what digital literacy initiatives can mean for their future.

"Digital literacy is so important in much of today's workforce," says Riddell of Virtual Ventures, who is no stranger to organizing kids clubs, camps and other outreach activities offering stimulating experiences with computers, information technology, engineering, and science.

"Often, kids don't view these fields as an option unless



As part of the Link<ed> program, Boys and Girls Club of Ottawa members are provided with opportunities to develop beginner-level coding skills.

“ I love that it’s a new program we have never done before and each week we do something new and fun. ”

they have adults in their lives with a background in them. Providing mentorship and exposure to these technologies can open doors down the line in a school setting and ultimately lead to employability in the tech fields,” she adds.

The long term goal for Link<ed> is to reach all of the seven Boys and Girls Club locations in Ottawa, to give kids across the city the same opportunities.

“This type of programming has never been provided to our members before, which makes it a first of its kind. Their attitude toward technology has shifted from seeing it as a tool to perhaps an opportunity for their future,” says Joiner.

“I love that it’s a new program we have never done before and each week we do something new and fun. I can’t wait to do the Virtual Ventures summer camp; my mom already signed me up!” says BGCO member Valerie, age 10.

“It’s fun to be able to work on laptops and learn something I didn’t know I was interested in. Now I love it and can’t wait for it to start up again!” says Thabisa, age 11.

While on tour at the inaugural Link<ed> visit to Shopify’s

headquarters, a group of BGCO members got a sneak peek into the office of Shopify founder and CEO, Tobias Lütke. With eyes wide, they admired his fireplace, a skateboard in the corner, and a row of gleaming, colourful snowboards mounted on the wall. Lütke became interested in technology at a young age. He was gifted a home computer at age 6 and began writing code by age 11. He is now a prominent advocate for coding education.

“I know first-hand how these experiences can create unique opportunities which otherwise wouldn’t be available for the youth in our communities,” says Stephen Beckta, BGCO Board Chair. Beckta has fond childhood memories of his time as a BGCO member and is now one of Ottawa’s top restaurateurs. “The partnership with Shopify and Virtual Ventures is really a game-changer for our members, and their trajectory in our community.”

Four Industry Leaders Give Back To Their Alma Mater

An abundance of opportunities exist to support students in Carleton University's Faculty of Engineering and Design (FED). With donor support, exceptional educational experiences and out-of-the-classroom initiatives help produce stronger, well-rounded graduates. These graduates go on to become leaders in industry, so it's no surprise that companies recognize great value in supporting them from the early days of their degrees, whether it be through scholarships, bursaries, gifts to student funds, or co-op and internship opportunities. Four FED alumni, on behalf of the companies they've gone on to lead, have recently made generous endowed gifts to help Carleton engineering students succeed for years to come.

Richard Deboer (BEng/88, Computer Systems Engineering), is the CEO and founder of Rianta Solutions, an IP integration and full chip verification company. The company employs many Carleton engineering graduates, and has taken on several co-op students.

"Rianta has had a great experience with Electronics, Computer Systems and Engineering Physics co-op students and new grads and we look forward to working with future generations," says Deboer.

Deboer, aware of a shortage of engineering graduates in the field of semiconductor design, cites this concern as one reason for Rianta's recently established gift - the Rianta Scholarship in Electronics. This scholarship will enable more Carleton students to pursue a career in the semiconductor industry.

Gordon Hicks (BEng/88, Mechanical Engineering) is the CEO of Brookfield Global Integrated Solutions (BGIS). In 2016, in an effort to mobilize the real estate industry to reduce greenhouse gas emissions, Hicks founded the

Building Energy Innovators Council (BEIC).

And now, his commitment to a sustainable, low-carbon future extends to his alma mater. On behalf of BGIS, Hicks established the BGIS Entrance Bursary in Sustainable and Renewable Energy Engineering.

"BGIS is committed to environmental sustainability in our business operations and creating an endowment for the Sustainable and Renewable Energy Engineering Program is in total alignment with our vision and values," says Hicks.

Co-Presidents and Principals of Uniform Urban Developments, Peter Stenger and John MacDougall pursued their undergraduate degrees together at Carleton (BEng/80, Civil Engineering). At that time, there were fewer experiences for students outside of the classroom.

Their substantial gift to the Civil and Environmental Engineering Student Experience Fund aims to further the department's mission to provide students with access to beyond-the-classroom learning opportunities, preparing them for the unique challenges they will one day face in their careers.

"We are happy to be able to give back and help Carleton engineers. The civil engineering program is a great education that can open doors for employment in many fields," adds Stenger.

Donor-funded awards and investment in student experience funds represent a 'win' for all involved. Students are recognized for their exceptional achievements and are inspired by the continued involvement of alumni and industry in their education.

To learn more about the impact donor support can create, connect with Jennifer Wolters at jennifer.wolters@carleton.ca.



Left to right - Gordon Hicks (BEng/88), John MacDougall (BEng/80), Peter Stenger (BEng/80) and Richard Deboer (BEng/88).



Paul Austerberry (center) celebrated his big win at the 90th Academy Awards with his parents Peter and Deanna Austerberry.

Carleton Grad Paul Austerberry Wins Big at Oscars and BAFTAs

This past awards season, Carleton architecture grad Paul Austerberry (BArch/89) scored a double feature for his work on Guillermo del Toro's *The Shape of Water*. After a big win at the 2018 British Academy of Film and Television Awards (BAFTAs) in February, Austerberry went on to walk the red carpet at the 90th Academy Awards in March, ultimately taking home the Oscar for Best Production Design.

Photos courtesy Paul Austerberry

Where were you when you first learned you had been nominated for your work on *The Shape of Water*? How did you react when you received the news?

I was actually in Ottawa at the time, as I had been in town for a panel discussion with (Carleton's) School of Architecture as part of its 50th anniversary. I was in a hotel lobby waiting for a taxi to the airport when the news broke and was super excited as you can imagine, but I was sitting in a public place so I couldn't really jump up and down!

Did you expect the film would receive so much attention at this year's Academy Awards?

When we were first designing and prepping the film I don't think I could have predicted it, as the storyline is so strange and our two heroes don't speak (and one of them is a fish man!). However, when I saw Sally Hawkins' work on the first day of shooting I knew it was going to be great. Still, I wouldn't have expected a genre film to be so well received by the academy.

How did you feel when your name was called and you realized you had won? What was it like to walk up on stage and accept your Oscar?

It was incredibly nerve-racking for the first hour while we were sitting in our seats waiting for our category to come up. When they finally listed the nominees there was a slightly bigger cheer from the audience for our film, which we thought was a good sign. When we actually heard our names it was both exhilarating and terrifying, since we knew we were about to get up and speak in front of a massive audience.

How did you first break into the film industry?

After graduating from Carleton, I moved to Toronto to work at an architectural firm and happened to make friends with a number of people who were involved in the film industry. Over the course of the next two years, I worked within that firm before deciding to do some travel in Asia for about eight months. When I returned, there was a recession in the building industry, so I decided to volunteer in an art department on the recommendation of one of my friends. Four days into that, a paid job became available and I was in.

Where do you begin after you've read a script?

The first thing I always do is break down the script into all the different locations it describes. Then you can decide which ones might be able to be found as a practical location, which ones could be created by heavily modifying an existing location, and those that need to be entirely constructed in the studio.

In a recent interview with the LA Times, you mentioned how the Brutalist-style architecture of certain buildings at Carleton influenced your vision for elements of the film, such as the government lab where the creature is held captive. Can you elaborate?

I was referring to the style of architecture that Carleton's Architecture Building was built in and was very common in the 1950s, '60s, and '70s for institutional buildings. I had wanted to contrast the more romantic world of Sally Hawkins' character's apartment above an old theatre-turned-movie-house from the 1890s with something that featured harder lines and harsher materials like concrete.



Austerberry notes how the Brutalist-style design of Carleton's Architecture Building influenced his vision for numerous elements of the film, such as the government lab where the creature is held captive.

Has your time at Carleton impacted your other projects? Were there influential professors or memories that you've drawn from?

I think that my time at Carleton has impacted pretty much all of my film projects, as the skills we learned there were really about how to look at the world around you and the visualization of three-dimensional space. We had a lot of inspirational professors, as well as an amazing array of world-renowned visiting critics such as Frank Gehry and Zaha Hadid shaping our education.

What was it like working with legendary fantasy director Guillermo del Toro? How were you able to translate his vision to the big screen?

It was a joy to be able to work with Guillermo, as he is such a visual director. He really celebrates the art direction in a film and it becomes an essential part of the storytelling. It was a difficult task to translate his vision as written on the page, as this film had a pretty small budget for the number of sets we had to generate. We shot for almost 60 days and all but 18 of them were on location – and even those locations required a substantial amount of modifications to suit the script and the 1960s time period.

How can the look of a film affect its narrative and how has your understanding of architecture helped you in establishing visual themes?

The look of a film can affect its story by creating a mood or feeling through the use of colour or texture and shape. Warm versus a cool colour palette, for instance, can accentuate a friendly versus a harsh environment. Softer architectural spaces can be more welcoming versus angular, sharp-lined architecture, which can sometimes feel more oppressive or aggressive. These are the kinds of tools we can use to help set the mood and enhance the story.

What kinds of challenges did you face once you had seen the screenplay for *The Shape of Water*?

One of the biggest challenges we faced once we read the screenplay was how to tackle the four main underwater sequences. In the end, we resorted to only submerging one small bathroom set in a specially constructed tank and using a “dry for wet” technique. Essentially, the old-fashioned method involved suspending the furnishing and actress by wires while filling the set with light smoke. Then we used multiple projectors to impose the caustic light, which travels through water onto the smoke and slowed it all down a bit.



Paul Austerberry (right) on the set of *The Shape of Water* with legendary fantasy director Guillermo del Toro.

Elisa's hair and nightgown were then animated digitally by our visual effects team, who also added particulate in the water, along with a few fish.

You've worked on films from a number of blockbuster franchises, including Resident Evil, Twilight and X-Men. How different is it when taking on smaller projects like *The Shape of Water*?

Every scale of film has similar problems and there never seems to be enough time or money to do what you initially plan. Often it takes a lot of thinking outside the box to make it all work. I think one of the things that made *The Shape of Water* successful is that everything within the film works so cohesively. The lighting, the props, the costumes and sets all work harmoniously colour-wise and a big part of that is that we didn't have that many different locations or sets so we were able to control it all.

***The Shape of Water's* Canadian connections are well-known, especially with it having been shot in Toronto and Hamilton. What do you think the film's success says about the state of the industry here in Canada?**

I think it shows that there's a lot to be proud about when it comes to the industry north of the border. Almost all of the crew members for the film were Canadian and everyone was very excited that we were able to compete with the best in the world this past awards season. I'd like to point out that on this film alone there were actually four Carleton grads working in the art department, including David Fremlin and William Cheng (first assistant art directors), Nigel Churcher (art director) and myself. There are plenty more throughout the industry in general as well.

Where does your Oscar live? Does he have a permanent home on display or is he stored away for safekeeping?

I don't currently have a fireplace or a mantle, so Mr. Oscar sits in my living room on a live-edged walnut bench I made a few years back.

What has this Oscar meant to you personally or professionally? Have you gotten used to the title of "Academy Award Winner"?

Personally, everything still hasn't fully sunken in yet. There were some incredibly well crafted films this year and it was very fulfilling just to be able to stand alongside them. Professionally, I know it's an amazing achievement and honour, as it represents the pinnacle of recognition within the Hollywood film industry. Hopefully that means I'll get the opportunity to work on more prestigious films in the future that I otherwise wouldn't have had the chance to.

You currently have some exciting films in pre-production, including the follow-up to last year's wildly successful reboot of Stephen King's *It*. Is there any added pressure in working on the sequel to a highly acclaimed film?


There is definitely a lot of excitement surrounding *It: Chapter 2*, so there's a bit of pressure from fans to deliver an even better sequel. We know we have to recreate a lot of what was in the first film, but we also get to develop that world even further for the finale, which is fun.

How do you go about choosing the films you work on?

Ideally, you pick a project because you love the script and the people behind it. If I know about a particular film long enough in advance, as was the case with *The Shape of Water*, I'll try to wait and stay busy working on commercials so that I'm not locked into other long term projects. That said, more often than not, a script shows up at the last minute and you have to decide quickly whether to make a pitch for it or pass. Often you read a script one week, have a meeting the next and a week later, you find yourself boarding a plane to another part of the world where you'll spend the next six to ten months... just like that.

Two weeks before his Oscar win, Austerberry (center) also took home the British Academy of Film and Television Award (BAFTA) for Best Production Design.



A portrait of Daniella Briotto Faustino, a young woman with long, wavy brown hair, smiling at the camera. She is wearing a blue and white vertically striped button-down shirt. The background is a warm, out-of-focus orange-brown color.

Information Technology master's student Daniella Briotto Faustino placed second at the Ontario Three Minute Thesis (3MT) provincial finals for her research presentation on using flexible devices as a means to create accessible passwords for persons with visual impairments.

Photo: Ashley Fraser

Carleton Places Second at Ontario 3MT Competition

"Please raise your hand if you have never forgotten a password," said Daniella Briotto Faustino as she began her presentation at Carleton's sixth annual Three Minute Thesis (3MT) competition this past March.

Embarrassed laughter rippled through the room as no one raised a finger.

Roughly 180 seconds later, the second-year Information Technology master's student in Human-Computer Interaction had recapped over a year's worth of research, securing a first place finish for her insights into the use of flexible devices as a means of providing accessible passwords to those who are visually impaired. Having netted the top prize at Carleton, Briotto Faustino moved on to the provincial 3MT finals in April, ultimately placing second among students from across Ontario.

Originally founded by the University of Queensland in Australia, 3MT aims to celebrate graduate research around the world while helping students enhance their communication and presentation skills.

As her presentation noted, there's no denying passwords have become a challenge for us all in a world that has become increasingly dependent upon connected technologies. From managing our finances online, to checking out the latest updates on social media and even accessing the systems we routinely use for work, each of us is now confronted with login after login on a daily basis.

While the majority of us inevitably end up clicking the "forgot my password" link more often than we would like to

admit, Briotto Faustino illustrated how, for those with visual impairments, digital authentication presents a far greater challenge than simple memory recall.

"Imagine if while typing your password you couldn't see the keys or the screen to make sure you are typing into the password field," she said. "For more than 250 million people around the world who are blind or have low vision, that's how passwords have to be dealt with – with no visual cues or feedback."

Using only a single slide as per competition rules, Briotto Faustino showcased a bendable silicone device she designed under the supervision of Information Technology professor Audrey Girouard. Featuring a flexible middle and corners that have been outfitted with sensors capable of capturing physical user input, the device can be unlocked by bending or folding various areas in a specific order, thus providing an alternative to the traditional PIN (Personal Identification Number) password.

While Briotto Faustino understands that there is still much to be done in order to ensure everyone is provided with equal opportunities to protect their digital assets, she hopes her device's proof of concept will help to fuel future innovations in accessible technology.

"My research is the first to explore bend passwords for those with vision impairment," she said. "I hope it will encourage the creation of more accessible methods to unlock devices, so in the future everyone can feel fully able to protect their digital information."

Where No *Human* Has Gone Before:

In July of 1969, a five-year-old Alex Ellery watched in awe alongside the rest of the world as he witnessed humanity take its first steps on the Moon.

Today, the longtime professor in Carleton's Department of Mechanical and Aerospace Engineering and former Canada Research Chair in Space Robotics and Space Technology is looking to supply humanity with a number of tools that may help us take our next giant leap into the final frontier.

As part of a three-year joint-initiative with McGill University, Ellery has begun developing a specialized drill and instrumentation system that will allow planetary rovers to extract core samples from Mars' polar ice caps and ultimately test for evidence of life.

"I'm currently working to roboticize and robustify several drill instruments that will be able to discern the presence of DNA and amino acids within a sample," he explains. "Finding either of these beyond Earth would be a defining moment in planetary exploration, as they have proven to be the essential building blocks for all life as we know it."

With additional support from the Canadian Space Agency (CSA) and satellite partners in the United States and United Kingdom, Ellery hopes to adapt, enhance and combine the latest in DNA sequencing technology into a unified system

that can be used to detect life on other worlds, beginning with the Red Planet.

While existing technologies are being used as a basis for the drill's instrumentation kit, Ellery notes that optimizing and integrating everything into a single package presents numerous challenges.

"Here on Earth, we're able to use a variety of specialized devices to extract and examine core samples," he says. "On Mars we won't have that luxury. Everything must instead be consolidated into a single apparatus that can be outfitted onto a rover or lander."

Extreme cold will also be a factor on Mars, as its polar regions are believed to experience temperatures as low as -150°C (-238°F). As a result, Ellery's technology will undergo extensive testing at McGill's Arctic research station in Nunavut in order to optimize its performance under similarly harsh conditions.

Despite knowing that eventually he too will have to brave the cold in order to take part in field tests, Ellery understands it will be a small price to pay if his device one day helps to find the answer to one of humanity's oldest questions.

"Discovering extraterrestrial life at any level would confirm that we are not unique and that we are not alone," he says. "If living organisms could be detected simply by exploring

CARLETON'S ALEX ELLERY LOOKS TO SPACE ROBOTICS AS OUR KEY TO BOLDLY GOING BEYOND

our own backyard, chances are the universe must be teeming with it."

While Ellery's initial goal is to adapt the drill's instrumentation package for deployment on a Mars rover, he also intends to refine the technology even further to aid the search for life on more distant worlds, beginning with Europa, the smallest of Jupiter's four Galilean moons, and Enceladus, the sixth-largest moon of Saturn.

"At present, Europa and Enceladus are considered the top prospects to harbour extraterrestrial life within our solar system," he notes. "While they are much too far from our sun for life to exist on the surface, both are believed to contain global oceans beneath their frozen exteriors as a result of a gravitational phenomenon known as tidal flexing, which generates heat within their cores."

Having recently been awarded a unique research opportunity with Magellan Aerospace in conjunction with the CSA, Ellery has now begun to assess the viability of miniaturizing his instrument package for a device known as a micro-penetrator, which could be used to infiltrate the hidden waters on both moons.

"Essentially, we're looking to integrate the technology into a projectile which would be able to puncture the crust of each moon at its thinnest point," he explains. "By targeting

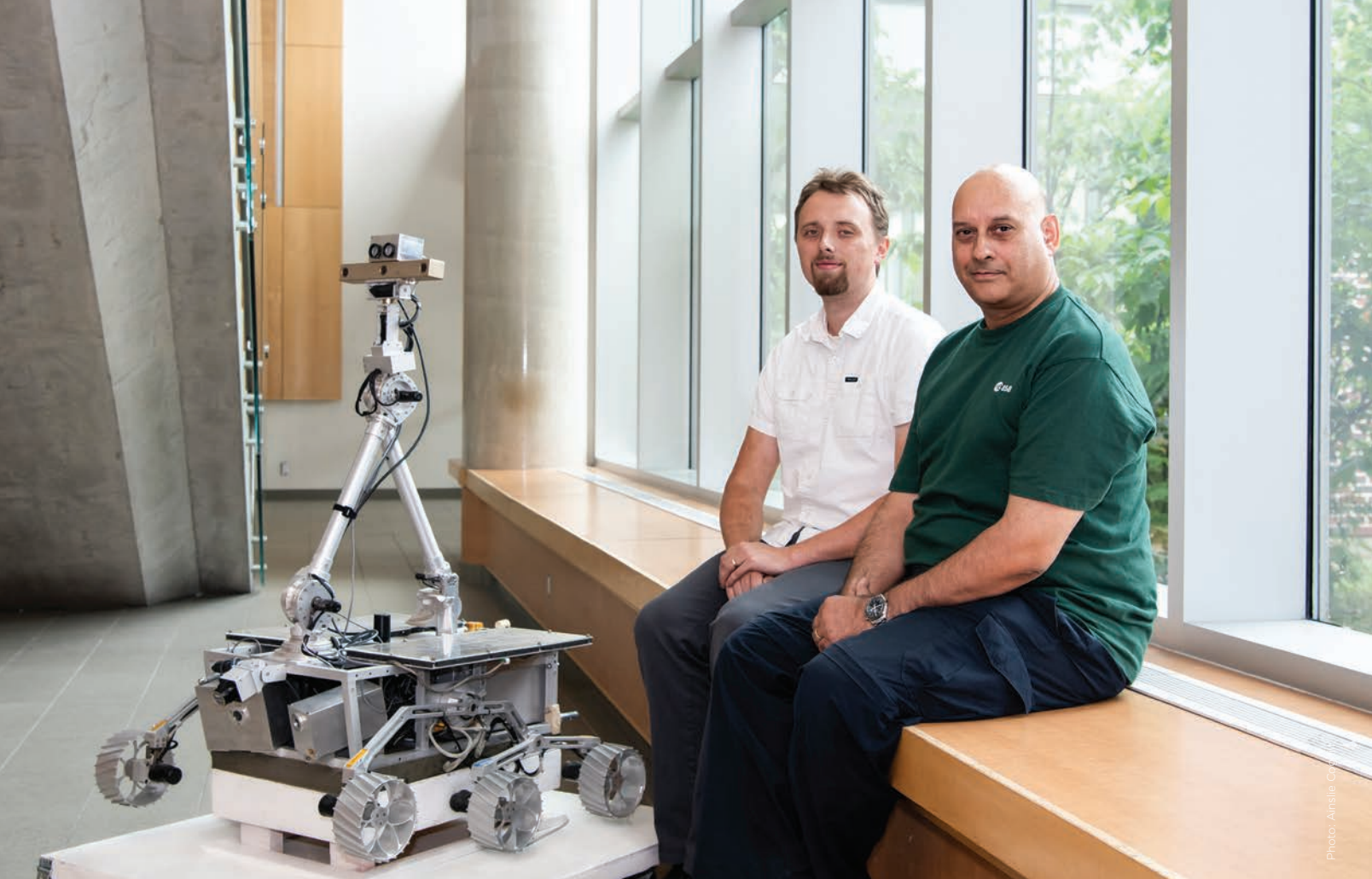
either surface cracks on Europa or one of the many fissures on Enceladus, we believe it's possible to navigate our way through the ice and rock in order to assess whether life exists in the oceans below."

While micro-penetrator technology could prove to be a game changer in how we search for life on distant worlds, Ellery understands that rovers remain far more versatile in that they can be outfitted with a broader array of research instruments and have the ability to journey across alien landscapes.

With that in mind, he's also working with the Natural Sciences and Engineering Research Council (NSERC) to equip future rovers with a form of artificial intelligence that would enable them to make certain science-based decisions autonomously.

"By providing rovers with the tools to determine what's worth investigating, they can spend more time actively exploring Mars' terrain instead of waiting for humans to plan their next move," says Ellery.

While today's rovers already function autonomously in some respects, largely by means of preinstalled commands, independent activities are currently limited to recurring tasks such as self-diagnostics and day-to-day operations. Ellery instead plans to put rovers in the metaphorical



Professor Alex Ellery (right), pictured alongside PhD student Alexander Tettenborn, was also the technical lead behind Carleton's Kapvik micro-rover, a fully functional prototype developed for the Canadian Space Agency.

driver's seat by integrating their onboard systems with advanced image processing capabilities.

"In utilizing the latest image processing techniques, rovers will be able to identify different types of rock, such as those which are sedimentary and could possibly contain fossils or other evidence of past life," he notes. "They will also be able to detect anomalies in the Martian landscape that may merit further investigation."

While machine learning powers the bulk of artificial intelligence systems here on Earth, Ellery warns that equipping rovers and other space robotics with these types of algorithms could pose significant problems, since they are based largely upon trial and error.

"As soon as you give a machine the ability to learn, you lose control of it," he explains. "If a rover decides to explore something interesting and, for instance, tumbles down a cliff, well it's certainly learned not to do that again, but unfortunately there's no way for us to reset or repair it and a significant investment would be lost."

Instead, the rover's decision-making capabilities will be based upon a series of filters which classify visual data in order to narrow down priority targets, such as particular rock patterns or formations. That same system will also allow a rover to change its mind while approaching a research target if, upon closer inspection, it believes it to be unremarkable.

While humans will still be keeping tabs on the rover's activities and be able to take control if needed, one of Ellery's

goals is to reduce the volume of operational data currently being sent back and forth, given that communicating over such great distances has proven to be a complex affair.

Since the distance between Earth and Mars can fluctuate by a staggering 346 million km depending on where the two planets are in their respective orbital cycles, signals being transmitted between them require roughly 4 to 24 minutes to travel each way. Adding to that delay, since each planet is constantly changing position as it circles the sun, mission control must also wait for a line of sight to be established between Earth and the rover (or orbiting spacecraft) in order to send or receive data.

Toss in additional factors such as the time of day, power limitations onboard the rover and the reality that everything being sent back to Earth must be analyzed, and it's not difficult to see why a typical command cycle can take up to 4 days to complete. With such a lengthy turnaround, Ellery hopes that future communications will revolve primarily around potential discoveries.

"By only transmitting data that is likely to be scientifically valuable, we can ensure that our resources are being utilized as efficiently as possible," he says.

As humanity looks to increase its mark upon our solar system and beyond, Ellery has also begun work on an ambitious project to develop self-replicating machines that could help to provide a shortcut in establishing infrastructure on other worlds.



Aerospace Engineering PhD student Alexander Tettenborn assisted Ellery in developing an early prototype of his core-sampling drill, which is set to undergo preliminary testing in Canada's Arctic during the summer of 2018.

Photo: Ainslie Coghill

While 3D printers may initially come to mind, Ellery's devices would instead be more like high tech factories, which would be capable of extracting and processing native materials from the Moon or Mars in order to manufacture and assemble individual components.

"Self-replicating machines offer the prospect of sustainable space exploration," he explains. "They will likely be the key to developing off-world colonies, which would eventually enable humanity to extend its reach past our solar system."

Powered by solar energy, Ellery believes a single self-replicating machine would be able to produce over 2 million copies of itself in only 13 generations. Once a baseline quantity has been established, units would then begin constructing a variety of essential technologies such as solar panels or mining equipment that would otherwise have to be transported from Earth.

While certain technologies may prove too complex for a single unit to manufacture, Ellery notes that these machines could also be used to construct enhanced facilities that would be capable of building virtually anything from rovers to spacecraft.

"Once a self-replicating machine is delivered to its destination, the entire operation becomes fully self-sustaining," he says. "All you would need is that initial investment."

Although significant startup costs could be seen as a barrier, Ellery emphasizes the potential of self-replicating technology to provide lucrative returns over the long term by means of developing infrastructure that could harvest solar energy or mine valuable mineral resources.

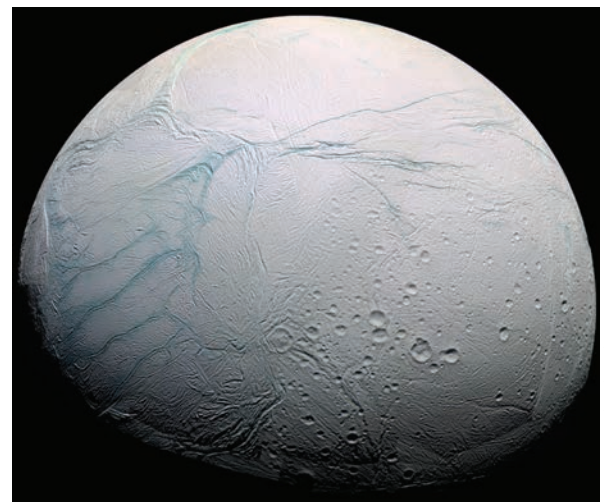
He also explains that establishing a foothold beyond Earth would provide humanity with a cost-effective base of operations to explore our solar system.

"Here on Earth, fuel costs alone can run millions of dollars

per launch," he says. "Since the Moon only experiences 16.5 per cent of Earth's gravity and has virtually no atmospheric drag, lunar launches could be facilitated there for a fraction of that price tag."

While the technology required to achieve his vision will likely require decades to fully develop, Ellery is confident that the prospect of transforming planetary exploration into a revenue-based enterprise will keep the project moving forward.

"This technology has the potential to revolutionize our entire funding model for space exploration," he says. "By investing the profits generated by these missions into other initiatives, we would be able to sustain and expand our spacefaring efforts indefinitely."



Credit: NASA/JPL/ESA/SSI

Saturn's sixth-largest moon, Enceladus, has shown evidence of hosting a global ocean beneath its icy surface, making it a top prospect in the search for life beyond Earth.



Photo: Ainslie Coghill

Ben Kaufmann's *BIO Water Distiller* shared the top prize at this year's International Housewares Association Student Design Competition.

Problem-Solving Designs Top International Competition

Fourth-year industrial design students Ben Kaufmann and Andrew Ferrier's innovative solutions landed top prizes at this year's International Housewares Association Student Design Competition, which challenges students to create a concept for a new product or redesign a current housewares product to meet the needs of the future.

The esteemed competition, celebrating its 25th year, included over 200 entries from 29 design schools, with winning projects being selected for their innovation, material quality, and understanding of production and marketing principles.

Kaufmann's *BIO Water Distiller*, which removes toxins, bacteria and heavy metals from drinking water, shared the top spot with a team from Arizona State University, while Ferrier placed second with a specialized child-proof marijuana container, known as *Botany*.

In addition to cash prizes, the pair received an all-expenses-paid trip to Chicago to attend the 2018 International Home + Housewares Show in March, where their design concepts were placed on display in front of

roughly 60,000 attendees from around the world.

Professor Bjarki Hallgrímsson, director of Carleton's School of Industrial Design, believes the wins reaffirm Carleton's reputation as being among the top industrial design programs in North America.

"We are extremely proud of what Ben and Andrew have accomplished in winning first and second prize at this highly prestigious contest," he says. "Their success reflects our students' commitment to solving complex and meaningful problems that affect people's lives – a key element in our School's holistic and user-centered philosophy."

Kaufmann's decision to design a water filtration device was partly in response to a tragic story that began unfolding roughly 90km northeast of his hometown of Kenora, ON in the early 1960s. For nearly a decade, an upstream pulp and paper mill leached over nine metric tonnes of mercury into the Wabigoon River, ravaging the local water system and poisoning the people of Grassy Narrows First Nation, ninety per cent of whom continue to experience symptoms of mercury poisoning to this day.

By providing remote communities such as Grassy Narrows with a cost-effective alternative to importing potable water, Kaufmann hopes to ensure that everyone in Canada will have access to clean drinking water.

“Over 160 remote Indigenous communities across Canada are currently under ‘do not consume’ water advisories, meaning water must be trucked or flown in,” he explains. “Hopefully this project will help to improve things.”

While Kaufmann’s distillation system utilizes an integrated biomass stove, its unique design can also be adjusted to work on virtually any heating surface, such as a cooking stove, wood stove or even a hotplate, enabling users to take advantage of whatever energy source best suits their needs.

Botany, designed by second place winner Ferrier, aims to address a number of emerging needs for Canada’s budding cannabis industry. With legalization of recreational marijuana usage set to roll out across the country this coming October, many households will soon face the

problem of where to safely store their supply.

With edible cannabis products also on the rise, many of which are indistinguishable from everyday candy and sweets, parents must also consider the added risk that children may ingest marijuana’s active THC and CBD ingredients accidentally.

To address these concerns, Ferrier focused on a holistic design that integrates child safety, humidity control and portability into a single contemporary device which is intended to blend into the home environment without attracting attention.

“*Botany* came about to solve the many issues surrounding cannabis storage,” he explains. “Through various forms of research, testing, reiteration and coaching from my professors, I was able to create a solution that provides a childproof and climate-controlled environment for cannabis in a low-cost and efficient way.”

“ “ We are extremely proud of what Ben and Andrew have accomplished in winning first and second prize at this highly prestigious contest. ” ”



In response to the incoming legalization of cannabis throughout Canada, second place winner Andrew Ferrier developed *Botany*, a specialized child-proof marijuana container.



Photo courtesy of Abd El Halim

Paving the Way for Longer-Lasting Roads

After facing decades of roadblocks in development, a revolutionary asphalt roller designed by Carleton civil engineering professor Abd El Halim finally appears to be picking up steam.

Originally conceived in the early 1980s as the Asphalt Multi-Integrated Roller (AMIR), Halim's alternative design aims to improve the longevity and resilience of our roadways by preventing cracking at its source.

"As conventional rollers move forward, the asphalt in front of them is pushed ahead, causing a pulling force in the pavement behind the drum," he explains. "These opposing forces cause the asphalt to crack as it is being compacted, resulting in less durable roads."

In studying this inherent design flaw, Halim discovered that cracks could be prevented by distributing a roller's weight over a larger surface area. In 1983, the idea gained support from the Ministry of Transportation of Ontario (MTO) and by the early 1990s, AMIR was developed into a full-scale prototype that featured a track made of specially designed

rubber in place of traditional steel drums.

While the technology showed promise and demonstrated Halim's proof of concept, the need for additional enhancements to AMIR's internal mechanics led to a shortfall in funding in the early 2000s, forcing its development to be put on hold indefinitely.

After the project sat dormant for nearly a decade, MTO renewed its interest in AMIR in 2010, leading to an agreement between the ministry, Carleton and Ottawa-based transportation infrastructure firm R.W. Tomlinson Limited to upgrade AMIR's technology for widespread use (with additional support from the City of Ottawa, the National Research Council, and the Natural Sciences and Engineering Research Council).

"We're very interested in the potential of this unique Canadian technology to improve the performance and longevity of asphalt pavements" says Frank Pinder, area contracts engineer at MTO's Eastern Region Operations Office. "In general, if asphalt pavement could last even one

“ We’re very interested in the potential of this unique Canadian technology to improve the performance and longevity of asphalt pavements. ”

year longer, that would translate into an average savings of around \$50 million per year in Ontario alone.”

While the savings AMIR can provide are significant, Halim has long understood that resistance from industry has partially stemmed from the fact that commercial paving companies actually benefit from roads that deteriorate faster. Since much of their revenue is generated through maintenance contracts, fewer potholes are typically considered bad for business.

However, with MTO having recently announced a plan to roll out mandatory minimum water permeability standards for all future road contracts across Ontario, suddenly an industry is finding itself under pressure to develop longer-lasting pavement, opening the door for AMIR to take center-stage.

With that in mind, Halim has been working with Tomlinson to develop a retrofit kit that can be used to modify virtually any roller to an AMIR-like design for less than half the cost of purchasing a new unit. Known as TRAK (Tomlinson-Russ-Amir-Kit), the technology has already been used to modify one of the company’s existing rollers to include AMIR’s signature features.

TRAK will also reduce the number of rollers needed for paving jobs. While traditional paving methods require a combined total of roughly 20 passes from three different types of rollers, TRAK’s streamlined design rolls all three into a single unit that can get the job done in only 6-8 passes.

Having seen TRAK’s results first-hand, Vice President of Heavy Civil Engineering at Tomlinson, Russ Perry, believes the kit holds immeasurable potential for the commercial paving industry.

“This technology will improve the lifespan of asphalts around the globe by establishing a higher standard,” he says. “Setting the bar higher will ultimately lead to the phasing out of substandard compaction techniques.”

In addressing concerns that TRAK may impact paving companies’ bottom lines by decreasing the demand for repairs, Halim explains that reduced maintenance costs will enable governments to invest more towards infrastructure enhancements.

“With less upkeep required, more resources can be directed towards developing new infrastructure projects,” he notes. “This means paving companies will have just as many, if not more contract opportunities in the future.”

Carleton Professors Remembered Fondly

In 2018, the Faculty of Engineering and Design at Carleton University was saddened to learn of the passing of four former faculty members. Many of their contributions have gone on to shape the framework of this Faculty, and their dedication to the Carleton community and the students they inspired will continue to live on.

Margaret Ann (“Nan”) Griffiths (1933 - 2018), at age 85. Nan joined Carleton in the mid-70s and taught for 22 years in the School of Architecture. For many of those years, Nan was the sole tenured female faculty member, and was a formidable role model to generations of students. Her intellectual legacy is broad, but perhaps most significant in the area of urban design.

Geza Kardos (1926 - 2018), at age 91. Geza taught at Carleton University from 1971-1995. He will be remembered for his contributions to engineering design education as a professor of mechanical engineering and as a founding member of the School of Industrial Design. His annual Student Design Test Day is fondly remembered for celebrating the accomplishments of his students.

Tadeusz Kwasniewski (1951 - 2018), at age 66. Born in Poland, Tad and his wife made Canada their home in 1982. Tad began his position as a professor in the Department of Electronics in 1985. He was widely recognized for his research on frequency synthesis and design of circuits for wireline communications. He was passionate about sharing his knowledge and experiences with young people who cherished his insightful guidance.

Julius (“Luke” or “Julek”) Lukasiewicz (1919 - 2018), at age 98. Luke and his wife immigrated to Canada from Poland in 1948. One of Luke’s signature achievements (while with the National Research Council) was co-designing the world’s first Mach 4.5 trisonic wind tunnel. From 1971-1997, he was a mechanical and aerospace engineering professor at Carleton University where he founded the groundbreaking interdisciplinary program “Technology, Society and Environment”.



Flex's First Pick: Carleton's Co-op Program Shows its Strength

Carleton students from electrical and mechanical engineering, along with students from the Sprott School of Business have been granted exclusive access inside multinational technological manufacturer Flex, thanks to the Carleton co-op program's partnership with the company's Ottawa location. We last checked in with Flex – known then as Flextronics - back in 2015.

Under a new name, and a new roof, the company's latest facility opened this year in the heart of the Kanata North Business Park. The state-of-the-art space has been custom designed to allow the company to co-innovate with multiple customers while protecting everyone's intellectual property, says Jeff Tilton, Site Leader and General Manager of the new location.

With approximately 200,000 employees in over 30 countries, Flex has worked with high-profile clients like Google, Nike, and NASA, and has a remarkable depth of industry expertise. The company's trademarked "Sketch to Scale" business model dictates that from conception and prototyping to engineering and advanced manufacturing to reverse logistics, Flex helps customers build and scale products for the global marketplace.

According to Tilton, who was originally an electrical engineer with the company, Flex is a great fit for co-op students.

"We think Flex is an ideal company for students to gain experience because of the very broad exposure to multiple products and markets that our students participate in over the course of their co-op term," says Tilton.

"One of the things that attracted me to Flex was their global scale and the opportunity to get involved with such a wide breadth of projects," says Michael Heffer, an electrical engineering student nearing the end of his co-op term with the company. "Even as a student, I've been exposed to a number of different industries including telecommunications, automotive, and health. This kind of versatility allows me to gain experience in several areas of electrical engineering," Heffer adds.

Whether it be debugging circuits or getting a chunk of code to simulate, Heffer says the ability to work on projects from conception to end result has given him a better understanding of the "big picture" while expanding his problem solving skills and creativity.

"Students are embedded into the design team and receive a realistic view of how projects are executed," says Orlando Arnone, Director of Engineering and Operations at Flex. Formerly employed with Nortel Networks, Arnone began working with Flex in 2004.

Arnone's role with the company includes grooming the



Students in Carleton's co-op program are granted exclusive access to Flex's Kanata-based location.

Photo: Ainslie Coghill

local team in hopes of developing “the next set of technical and people leaders” for the Kanata site. He also recognizes there is a great amount of talent coming from Carleton co-op students, and personally oversees the group of engineering students.

“They bring a spark of curiosity and excitement, and their eagerness shows from the day they arrive. These students demonstrate a solid technical foundation, ask lots of questions and also learn from each other,” says Arnone.

Flex has hired four past co-op students at the Kanata location, and Arnone says they’ve been excellent additions to the team. He also has glowing reviews for the on-going assistance behind the scenes from Carleton’s co-op program team.

“The Flex-Carleton co-op program has been an excellent partnership. Resumes received are bundled by discipline to make for easy vetting of candidates. The interview process

is simple and effective with Carleton providing the option of holding interviews on campus or at the Flex site. Once offers are made, the co-op office issues the offers in a timely manner. Working with Carleton couldn’t be easier,” he says.

Electrical engineering student Nicholas DiPaolo’s co-op work term with Flex is off to a great start.

“At Carleton, I learned many technical aspects of electrical engineering including analog, digital, and power electronics. Flex is now giving me the opportunity to apply these skills to real world applications,” says DiPaolo, adding that he now has experience with soldering and building prototypes and test fixtures, and has been exposed to all stages of a product’s life cycle.

Heffer, with almost 16 months at Flex under his belt, agrees that the industry experience has been indispensable, and that seeing the practical application of class material in the workplace has helped solidify the theory he’s learned at Carleton.

“My circuit analysis courses have proven to be very useful with many PCB (Printed Circuit Board) modifications, and I’ve now had the opportunity to employ my analytical skills to debug real circuit issues,” says Heffer. “I have also implemented my knowledge of digital circuit design by coding FPGAs (Field Programmable Gate Arrays) in Verilog.”

From its beginnings in 2010, the partnership between Flex and Carleton’s co-op program shows no signs of slowing down.

“Each year, over the 16 months that our students are with us, we see a progression from young academics to competent, contributing and innovative professionals that are ready to enter the workforce,” says Tilton.

Are you an employer looking to find out about Carleton’s co-op program? Feel free to contact Robin McLaughlin at robin.mclaughlin@carleton.ca for more details.

“ One of the things that attracted me to Flex was their global scale and the opportunity to get involved with such a wide breadth of projects. ”

GET INVOLVED WITH THE FACULTY OF ENGINEERING AND DESIGN

COMMUNICATE WITH US

- Help us share great Carleton stories
- Keep your contact information up to date with us by emailing advancement@carleton.ca
- Be a proud alum—include your alma mater on your online profiles and bios

SUPPORT OUR STUDENTS

- Alumni mentorship: alumni.carleton.ca/mentorship
- Hiring a co-op student: carleton.ca/coop
- Donate to a project/program that is significant to you: futurefunder.ca

CONNECT WITH US ONLINE

- Find the latest news, events, and insights on our social media channels!
- Follow us on Twitter: [CarletonU_Eng](#)
- Like us on Facebook: [CarletonUniFED](#)
- Network with us on LinkedIn: [Carleton Engineering](#)
- Follow us on Instagram: [Carleton_FED](#)

JOIN US AT UPCOMING EVENTS

- Kanata North Alumni Night | Sept 12, Ironstone Grill, The Marshes Golf Club
- Ingenious Talks Lecture Series | Oct 3 - Nov 7 - Dec 5, Ottawa Library, Sunnyside Branch
- CU Explore, for prospective students | Nov 24, Delta Hotels Toronto Airport & Conference Centre
- Women in Engineering Info Session, for prospective students | Feb 2, 2019, Carleton University
- Engineering and Design Innovation EXPO | Mar 11-15, 2019, Carleton University Galleria

For a full events listing, visit carleton.ca/engineering-design/events

Return undeliverable Canadian addresses to:

Department of University Advancement
Carleton University
1125 Colonel By Drive
Ottawa, ON K1S 5B6 Canada

Publication Mail Agreement
No. 40063314
ISSN 0226-5389

Mail To:

PM40063314