

ENGINEERING

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ADVANCING OCEAN RESEARCH

IDEA PROJECT MAKES IMPACT
ON EAST COAST



DALHOUSIE
UNIVERSITY

FACULTY OF ENGINEERING

FROM
THE DEAN



The past year has been an extremely exciting one for Dal Engineering thanks to the tremendous generosity of our alumni and friends. Because of you we have embarked on a complete transformation of Sexton Campus.

The project includes the construction of two new buildings, the complete rebuild of our chemical and materials engineering building, and the creation of three world class research facilities; The Oceans Hub, The Advanced Manufacturing Hub, and The Clean Technology Hub.

The final piece of the project is renovations to our Civil Engineering Building. The projects are all scheduled to be complete by April 30th, 2018. This rebuild will create some of the very best research and teaching spaces in Canada.

Over the past two academic terms, we've continued to grow both at the undergraduate and graduate level. We have brought on 2 outstanding new professors, and between now and July 2018, we will see 10 new faculty members join us.

In this issue of THE ENGINEER we hope to give you a sneak peek of what Sexton will become as well as introduce you to some of the exciting work that is currently going on.

Joshua Leon,
Dean, Faculty of Engineering

ON OUR COVER

The future of Oceans Engineering: Dr. Mae Seto, Dr. Robert Bauer, and Dr. Ya-Jun Pan will help lead Dal's new Oceans Engineering Hub

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Building the Future of Oceans Engineering at Dal

With files from: Ryan McNutt and Matt Semansky

FROM UNDERWATER COMMUNICATIONS TO SONAR TECHNOLOGIES, THERE'S A GREAT DEAL OF RESEARCH THAT TAKES PLACE ON THE OCEAN, AND A LOT OF IT IS HAPPENING AT DALHOUSIE UNIVERSITY.

Over the years, Dal has solidified its position as a global leader in ocean research, driving breakthrough discoveries, and attracting students, researchers and industry partners from around the world.

Among the top researchers at the university are members of Dal's Faculty of Engineering. With the development of the IDEA Project on Sexton campus, comes a promising future for oceans engineering research within the Faculty.

The IDEA Project, which stands for "Innovation and Design in Engineering & Architecture", is a \$64-million investment on Dal's downtown campus which will not only revitalise the look of Sexton campus, but also transform the campus into the heart of Halifax's emerging innovation district.

The IDEA Project will include R&D infrastructure renewal to create research and outreach hubs around three sectors: clean tech, oceans tech and advanced manufacturing.

The new Oceans Hub facilitates applied research; commercialization and innovation in underwater sensors, and autonomous marine robots which include autonomous underwater vehicles (AUV), unmanned surface vehicles (USV), and unmanned aerial vehicles (UAV). The Hub will also provide faculty, students and industry with space and facilities to unlock their creative potential and build a stronger culture of innovation in Atlantic Canada.

The Hub will serve as a key resource for several oceans-related research centers including the Centre for Ocean

Ventures and Entrepreneurship (COVE) as well as an important link to ocean technology companies.

Located on the first floor of Dal's Mechanical Engineering Building, the 5000-square foot state-of-the-art space will include a 15 ft long x 10 ft wide x 6 ft deep trim tank, and a designated area for unmanned ground vehicles as well as a motion capture system to fly and track UAVs. The new facility is scheduled to open in the Fall of 2017.

At the heart of its potential will be a trio of the Faculty's top Oceans Engineering researchers: Dr. Mae Seto, Dr. Robert Bauer, and Dr. Ya-Jun Pan. All three are part of Dal's Department of Mechanical Engineering.

KEYS TO SUCCESS

The team has been working together for over five years, continually seeking better and innovative methods to survey oceans using autonomous marine robotics. Since beginning their partnership, their research has focused on areas such as AUV and USV dynamics, simulation and control, adaptive path-planning, simultaneous localization and mapping (SLAM) and acoustic transmissions amongst collaborative AUVs.

"At Dal we have an international, multi-disciplinary ocean research platform addressing one of the difficult problems in ocean science: being able to accurately sample massive areas," says Darrel Doman, Head of Dalhousie's Department of Mechanical Engineering. "In engineering, we're not focused on just the sampling or observation, but also the infrastructure, tools and

machinery so that scientists can acquire that critical data.”

Doman says in many situations harsh ocean conditions make it virtually impossible for humans to conduct oceanographic research on their own. Instead, Seto, Bauer and Pan have been working collaboratively to advance the field of autonomous marine robots to gather data under and above the water, processing the data into information, and transmitting the information to satellites, surface ships, or shore-based stations. Such robotics often include the use of AUVs, USVs, and aerial drones.

“One of the major challenges that these three are working on are fundamental problems such as, how do we get these marine robots to navigate and be controlled both under and above the water?” says Doman.

While Pan’s area of expertise focuses on integrating multiple cooperative autonomous vehicles, Bauer’s area of research involves improving the depth and trim control of AUVs.

For her part, Seto, who recently joined Dal’s Department of Mechanical Engineering as an Associate Professor, looks at the on-board intelligence and autonomy of the robots and getting them to work together. This is an area she has worked in for over a decade.

“They (Pan, Bauer and Seto) are the foundation of Ocean Engineering at Dal,” says Doman. “They are the pillars of what we would see the Oceans Hub research becoming down the road. These three are attacking many of the fundamental gaps in the field collaboratively, and we are building a group that can really push marine robotics forward.”

Over the years, the team has worked with several industrial partners: Rolls-Royce, Ultra Electronics Maritime Systems, Deep Vision, and Defence Research & Development Canada among others.

In an on-going collaboration with the Massachusetts Institute of Technology (MIT), Seto researches Underwater Mapping and Localization; a tool to help autonomous robots recognize objects they detect underwater, and generate geo-localized maps without the use of a global localization system, like GPS.



From left: Dr. Ya-Jun Pan, Dr. Robert Bauer and Dr. Mae Seto prepare equipment for testing at the Aquatron Lab at Dal.

“The AUV needs to go into the water and make its own way and think for itself,” says Doman. “So, the robot keeps a record of everything it sees, and it says ‘ok there’s a rock or hydrothermal vent at this location.’ the next time it sees the same hydrothermal vent or rock, it recognizes it as something it’s seen before and therefore can figure out its location. So, it’s building its own map without the use of a GPS as it goes through an area that it has no prior information on.”

Seto says that use of Underwater Mapping and Localization will assist oceanographers in pin pointing the exact location of objects at sea. A challenge given that air and water currents often push objects off course and there is no global localization system underwater.

Construction for Dal’s new Oceans Hub is currently underway, and Seto says she hopes the facility will help launch the Faculty of Engineering’s position on a different type of map.

“This is something engineering should be a part of, especially with the large Oceans Frontier Institute

endeavors. The Oceans Hub will be a place where people can bring their ideas, and we can work through those ideas,” she says “It’s a good coming together of purposes because we now feed directly into the oceans engineering community, not just in Nova Scotia, but up and down the eastern seaboard and internationally.”

With Seto, Bauer and Pan, along with collaborators in electrical engineering, Doman anticipates the new Hub will be well positioned to offer industry collaborators with a full complement of expertise in autonomous marine robots, though he says that down the road, he would like to see a few key components added to the mix.

“Our researchers are very successfully, individually and as a team, but there are three right now,” he says. “We’d like to see that number grow to 8 or 9 researchers across mechanical and electrical engineering. At that size, we can start engaging industry at a very large level. We want industry to know that you can come here as a one-stop shop. I think that would be a great place to be in five years.”



Saving Lives Through Rescue Research

FOR RON PELOT, HIS RESEARCH IS MORE THAN JUST SAVING MARINE LIFE AND THE ENVIRONMENT; IT'S ABOUT SAVING THE LIVES OF REAL PEOPLE.

For over twenty years, the Dalhousie Industrial Engineering professor has been developing tools and methods to enhance decision making procedures in Maritime search and rescue planning (SAR). From boating accidents, to coastal zone planning, oil spills and more, Pelot and his team use various tools and computer models to predict the likelihood of accidents taking place at sea.

Although Pelot says his work doesn't have a direct impact on search and rescue efforts as they happen, it has played a role for planning the resources in place to respond to search and rescue incidents.

"Do you have enough vessels to respond to these incidents? Do you have the right kind of vessels? Where are the

vessels?" he says. "Those are strategic decisions. But by examining how the Coast Guard is prepared for responding to incidents, our analysis can help them be more efficient."

"The fundamental part of our research is to use data on accidents at sea and to figure out where they largely happen, because they move around each year to different locations," he adds. "It's like modeling for firetrucks or modelling for ambulances. You have to know where most of the fires are taking place. Are there more fires in downtown Halifax or more in the suburbs?"

Pelot has been working with the Canadian Coast Guard since 1995 and over the years, his collaborations have led to a variety of enhancements on the water including the improvement of

"EVERY EFFORT TO MAKE THE OPERATIONS MORE EFFICIENT AND EFFECTIVE MAY HELP SAVE MORE LIVES."

search and rescue response times based on the allocation of SAR vessels. But he says that as his models have become more intuitive, his team has been able to analyse more complex issues associated with location modeling.

"As our models get better and better, it's not just how many vessels you have and where you put them. You also have to consider taking the vessels out for maintenance periodically, so you want to try and do that at a good time for each location so that it helps maintain good coverage," he says. "Trying to make such decisions intuitively is very difficult as one can't figure out all of the trade-offs that we do with the computer models."

Pelot says a lot of work has gone into developing the various information layers that determine such decisions, and most of that research is done using geographic information systems using spatial maps.

"The good part about the models is that they're pretty comprehensive about the vessel activities and incidents," he says. "The drawback is that, like any model, you can only capture so many aspects of the operating environment. So, for example, we assume that you can get from point A to point B in a certain amount of time based on distance and the speed of the vessel, but there are always delays due to other factors, such as weather."

Pelot says this is an especially exciting time to be working with the Coast Guard as they are currently in the midst of a fleet renewal process.

"Every effort to make the operations more efficient and effective may help to save more lives," says Pelot.

"In collaboration with the Coast Guard, our maritime risk models can help achieve this."

Improving Underwater Communications

Since joining Dalhousie University in 2013, he's devoted his time to monitoring the impact of ocean activity, and exploring new technologies that can improve underwater communications. Over the years he says he's developed a deep fascination to the secretive world under the sea.

"It's so difficult to understand the physical behaviour of underwater ecosystems," he says. "Because we can't see what's going on below the sea surface, we deploy instruments to get a better understanding of the level of underwater activity."

In his latest research project, Bousquet and his team of students are collaborating with local industry partners Vemco and Turbulent Research to design a series of low powered acoustic receivers capable of gathering oceanographic data that will transmit information to a remote user. The receivers will be deployed for testing this summer off the coast of Peggy's Cove in Nova Scotia.

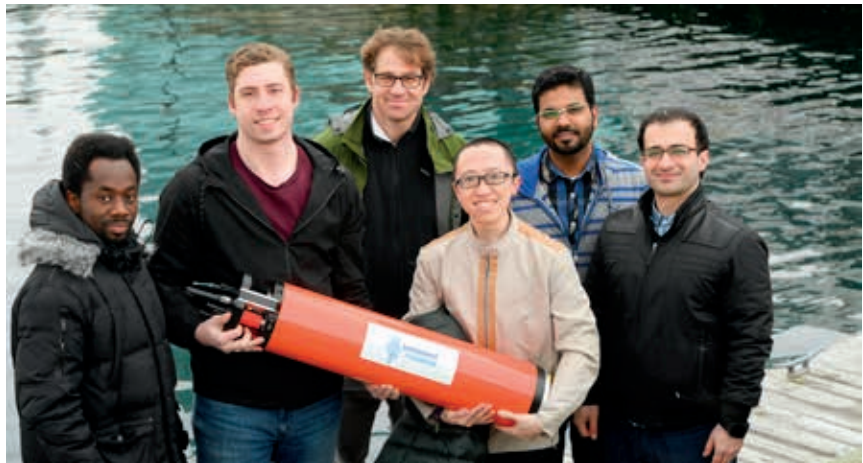
"The testing will help support the development of innovative algorithms to enable multi-static sonar networks," he says. "These networks are developed in Nova Scotia by major companies such as Ultra Electronics and General Dynamics. Our research will help both organizations develop next generation solutions to underwater surveillance."

The low-power receivers are also intended to be deployed for extended periods of time to acquire specific information that is transmitted back to the surface for remote monitoring.

"These remote sensors will allow us to detect the presence of ships or other objects such as marine mammals," he says. "They could also detect foes such as underwater submarines or AUVs. These days there are more and more illicit activities going on underwater. Small underwater autonomous vehicles are roaming around the Canadian littoral and navigating in our seaports,



**DALHOUSIE ENGINEERING
ASSISTANT PROFESSOR
JEAN-FRANCOIS BOUSQUET
HAS ALWAYS BEEN INSPIRED
BY THE OCEAN.**



From left: Afolarin Egbewande, Andrew Dobbin, Jean-Francois Bousquet, Sri Padyath Ravindran, Hossein Ghannazedraii, and Xiao Liu.

so we're looking for them using the devices that we're building."

Bousquet says the sensors will also help monitor the status of underwater instruments in the oil and gas industry and help run scientific experiments in collaboration with other oceanographers.

Following this summer's deployment, Bousquet says that's when the exciting work will really begin.

"We'll be able to confirm whether our actual models of the system are realistic," he says. "This will allow us to confirm the reliability of the communication performance, and allow our partner companies to integrate new algorithms into their product line."

He says a prime example of how these algorithms will help improve

operations will be enhancing underwater shipping activity in the arctic by enabling Autonomous Underwater Vehicles (AUVs) to communicate under the ice and help monitor subsea activity in the area.

"As an engineer, my research approach is to develop practical systems that can help address a particular need for my industry partners," says Bousquet. "Working in this environment has proven to be very exciting because of the amount of ocean related activity in the Halifax area. While my background has been fundamental wireless communication this type of research has allowed me to apply my knowledge to help improve technical expertise in Nova Scotia."

Robotic Boat to Set Sail Across the Atlantic

Sailing their way into the Guinness Book of World Records could be a challenge, but it's certainly the goal for an engineering group at Dal. The team has custom built an autonomous, robotic sailboat capable of piloting itself from the coast of Nova Scotia to Europe.

Piotr Kawalec and Graham Muirhead are hoping to launch the team's 2-meter vessel this spring as part of the Microtransat Challenge: A difficult race that many universities have attempted to accomplish, but failed to finish.

With help from a group of students and faculty from Dal's departments of Electrical and Mechanical Engineering, it took approximately 5 months to build the sailboat. The team includes professors Rob Warner and Jean-Francois Bousquet, students Andrew Dobbin, Thomas Gwynne-Timothy, Julia Sarty, and George Shannon, and other staff members.

The goal is to have the small sailboat leave the waters off the shores of the Halifax Harbour and travel across more than 3,500 kilometers of Atlantic Ocean to France.

The start line is 200 kilometers off the shore of Newfoundland, with the finish line about 200 kilometers off the western shore of Europe along the French coast.

As per the rules of the challenge, the vessel cannot exceed 4 meters in length and can use only wind power to make its sixty-day long journey.

Kawalec says that even though the Microtransat Challenge has been around for ten years, no one has ever designed an autonomous boat of this scale capable of sailing across the Atlantic Ocean.

DISASTER AT SEA

This isn't the first time Dal's Faculty of Engineering has competed in the Microtransat Challenge. Their first attempt was in 2015 in partnership with Ensta Bretagne, a naval architecture school in France. The school supplied Dal's team with the vessel that was used in the challenge. From there, the team equipped the vessel with appropriate controls necessary to make its sail across the ocean. Unfortunately, failure occurred about 500 kilometers into the boat's journey.

"On our first attempt we lost it somewhere near Sable Island and never recovered it," says Kawalec. "We had GPS tracking on the vessel and could see that it had started going around in circles. It just drifted around Sable Island for a couple of weeks and then we lost communication."

Kawalec and Muirhead say the boat either sank or the batteries eventually died; A common occurrence for these types of small vessels that take part in the challenge.

This year, Muirhead and Kawalec are hoping to break tradition and set sail on a new path. The first step was building their sailboat from scratch.

CRAFTING A NEW DESIGN

To start, the team spent a great amount of time considering all possible scenarios their boat could face on the Atlantic. This included how much battery power the boat required and what would happen if the vessel took on water.



From left: Andrew Dobbin, Piotr Kawalec, Jean-Francois Bousquet, Thomas Gwynne-Timothy, Graham Muirhead, Julia Sarty.



Above: Thomas Gwynne-Timothy (left) and Julia Sarty (right) examine wiring inside the autonomous sailboat. Below: Andrew Dobbin (left) and Jean-Francois Bousquet (right) work on the mechanics of the autonomous sailboat.

“We can’t predict what we’re going to hit out there because it’s open ocean, but anything we could think of to implement that was feasible for us, we did, which was key for this boat,” says Kawalec.

The number one issue was the durability of the boat’s hull. The vessel used in the 2015 Microtransat Challenge had a hull that had been built of foam with a thin skin. The new sailboat however, is made out of Carbon Kevlar composite laminate.

“You can probably hit it with a hammer and it would be fine,” says Muirhead. “Making a strong boat was one of the biggest priorities”.

Muirhead says the other problem with the design of the 2015 vessel was that it had a fin keel; a long narrow plate that projects from the bottom of a vessel to give it greater lateral stability.

“The weight that keeps it upright was a long way down and it was catching quite a few weeds,” says Muirhead. “So we wanted to go with a full keel design that’s a little smoother along the water.”

The next step was trying to ensure that the boat was waterproof. To achieve that, the new hull has been built with a tightly secured lid that will prevent water from penetration. Though, Kawalec says if that should happen,

all the electronic components inside the vessel have been individually waterproofed as well.

Finally, communication with the boat itself was a key concern.

“The first boat had a GPS that could send its coordinates so we could track it, but we had no way of getting any other data out of it,” says Kawalec.

“And that was one of the biggest problems with the first boat,” adds Muirhead. “When the boat failed we didn’t really know why. We saw where it was, but that was all. To know more would have been very useful. This year the team has implemented a satellite-based communication system that will provide them with data on the boat’s current condition.

“We’re hoping to do some monitoring as far as battery consumption, and we have sensors inside that can tell us if there is a hull breach or water taken on,” says Kawalec. “The vessel can also send back wind speed and other conditions. This way we can better understand what the boat is going through so that we can improve for next time.”

TESTING AND LAUNCH

The team had the opportunity to test their vessel last September, taking it out a few times in light to moderate wind conditions and watching as the sailboat bobbed up and down in the Halifax Harbor.

“There’s always this question of what conditions we should expect on the ocean and should there be changes in programming if there is a storm event,” says Muirhead.

Although he and Kawalec are hoping that their boat reaches the finish line, they admit that Europe is a long way from Halifax.

“We’re at the stage where we’re just trying to make gains on the previous attempt. That’s our big focus. How can we make this better than the last one?” says Muirhead.

“The Dean did promise that if the sailboats makes it to Europe, we’re getting a trip to France to recover the boat,” adds Kawalec. “I think if it did make it across that would probably qualify for a Guinness World Record.”

Real-time Data Makes all the Difference for MetOcean

WHEN YOU HEAR ABOUT A SHIP LOST AT SEA OR A PLANE LANDING ON WATER, CHANCES ARE THAT METOCEAN TELEMATICS PRODUCTS AND SERVICES ARE BEING USED IN THE SEARCH AND RESCUE EFFORT.

That is something in which company president Tony Chedrawy (BEng '93 Industrial) takes considerable pride.

"Our products are proven to save lives," Chedrawy says. "There have been many instances of that over the years, and that has consistently encouraged us to be very meticulous and take great care in all that we do."

Such commitment made MetOcean Telematics a world leader in the field of data acquisition and telemetry. Its products and services are used in a wide range of applications, both at sea and on land, enabling better monitoring and protection of our environment, our wildlife and our national and international security. The significance of that is not lost on Chedrawy or his colleagues.

"From assessing and responding to an oil spill in the middle of the ocean to tracking an endangered species, the applications are virtually endless," Chedrawy says. "But the constant theme is how our products and services help make a difference by delivering vital real-time data from remote locations so that people can better manage anything from our resources to emergency situations."

Each new application has been an impetus for MetOcean to grow, taking it from a pure hardware-oriented company when it was founded in 1983 to one that delivers end-to-end telemetry systems following a 2016 merger with sister company jouBeh Technologies. The company has also developed several new products along the way that are recognized as game changers.



Tony Chedrawy (BEng '93)

"Our search and rescue beacon, without question, has proven to be a valuable asset to coast guards around the world," Chedrawy says.

"Our marine location beacons are also used internationally. And we've created plug-and-play M2M satellite modules that have enabled us to expand into new markets such as aviation and wildlife tracking. I think we've been particularly innovative in exploring new ways to do what we do."

Integral to that innovation is Dalhousie's Faculty of Engineering. "A lot of what we do requires a high level of expertise in mechanical and electrical design," Chedrawy observes. "Having the ability to collaborate with the department, and with people such as Dr. George Jarjoura and Dr. Kamal El-Sankary, has been a tremendous asset."

Having access to the department's students and graduates has proven equally advantageous for MetOcean in its continued growth and innovation. Rami Nassif, an electrical engineering student who is currently on his third work co-op with the company, says working there has been particularly beneficial for him.

"THE CONSTANT THEME IS HOW OUR PRODUCTS AND SERVICES HELP MAKE A DIFFERENCE BY DELIVERING VITAL REAL-TIME DATA FROM REMOTE LOCATIONS SO THAT PEOPLE CAN BETTER MANAGE ANYTHING FROM OUR RESOURCES TO EMERGENCY SITUATIONS."

"I've done everything from writing software and validating hardware to conducting a system trial on a naval ship in the United Arab Emirates," Nassif says. "Most of the engineers here are Dalhousie graduates, so they know what I am studying and have been giving me advice to help me with my academic performance and beyond. It's been a very rewarding experience."

"We're all impressed with Nassif," Chedrawy says. "He's very smart and it's good to be able to help prepare students like him for a long and successful career, possibly with us."

Regardless, there appears to be plenty more opportunities for collaborating with and hiring from the Faculty of Engineering. Chedrawy has plans to open offices in the United States and Asia, and to launch more telemetric solutions, among other initiatives. "The overall plan is to continue to evolve," Chedrawy explains. "But the aim is to stay here and stay the course as we keep growing and working all around the world."

Dartmouth Firm First Name in Undersea Surveillance Technology



Fred Cotaras (BEng '81)

Being involved in the world of submarine surveillance may strike you as intriguing and exciting, and it is. But when it comes to manufacturing and delivering those products, Dartmouth-based Ultra Electronics Maritime Systems, a world leader in undersea surveillance technology, finds that 'boring works best.'

Fred Cotaras (BEng '81), vice president of sales and marketing, explains that "in order to make something work well time after time, you have to invest a lot of effort upfront in design engineering. We aim for 'Look, it all worked well—again.' If people are running around in a panic, someone somewhere didn't do their job."

If that is being boring, it has certainly worked out very well for Ultra Electronics Maritime Systems. Owned by the Ultra Electronics Group, the company is celebrating its 70th anniversary this year and has become perhaps the most trusted name in its field. Its air-launched sonobuoys were in high

demand during the height of the cold war for submarine surveillance and are still used extensively by the Royal Canadian Navy and Air Force. It has also developed a new generation of towed arrays and underwater acoustic projectors that are used in defence applications all around the world.

"Our sonar equipment is used in systems towed by Naval Forces around the globe: Canadian, German, British, Australian, Netherlands, Turkish, Indian and Thai," Cotaras says. "Over the years, we have worked closely with research labs in Canada, the UK, the Netherlands and South Korea; they all use our equipment. A large percentage of our business is export."

Cotaras says the demand for Ultra Electronics Maritime Systems' surveillance solutions comes down to a couple of factors. For one, their sonar projectors are some of the largest bandwidth devices on the planet, and they deliver exceptional loudness at low frequencies. But Cotaras believes that their sonar receivers are also the quietest on the market, which is particularly important in a marine environment.

"Imagine trying to have a conversation with someone in a moving car if you stick your head outside the window," Cotaras explains. "All the wind noise makes it hard to hear anything. When you're trying to build a sensor that can work in a moving fluid, or that is suspended from the

surface, you need to be able to muffle out flow noise and surface vibration, which are mechanical filtering skills. The result is a solid piece of engineering and that has been a real winner for us."

Cotaras also cites access to the research capacity and graduates of the Faculty of Engineering as central to the company's continued success. "Being able to capitalize on organically developed talent is just good economic sense. If we hire from away, it is more expensive and there is no guarantee they will stay in the long run. That Dalhousie continues to attract good students and produce great graduates gives us the intellectual capital we need to grow."

As for what shape that growth will take, Cotaras says the company is focusing more on surface-ship based sensors, and is making a significant investment in further developing that technology with support from Industry Canada. He is also excited at the potential business the \$26-billion naval warship replacement initiative could bring to Ultra Electronics Maritime Systems.

"Under the National Shipbuilding Procurement Strategy, the Royal Canadian Navy is undergoing a significant regeneration," says Cotaras. "We believe that we could contribute our homegrown understanding and expertise to the projects. We really want to be part of that."

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THE IDEA PROJECT: Transforming Sexton Campus

With files from: Ryan McNutt and Matt Semansky

EVERY GREAT ADVANCE, EVERY BIG STEP FORWARD, BEGINS WITH AN IDEA — OR, IN THE CASE OF DALHOUSIE'S DOWNTOWN HALIFAX CAMPUS, AN "IDEA."



A rendition of the exterior of one of the two new buildings of the IDEA project, dubbed the "Emera IDEA Building," as viewed from behind Gerrard Hall.

The acronym — which stands for "Innovation and Design in Engineering & Architecture" — is a familiar one to many in the Dal community. For several years, it's been used to describe planned future development on Sexton Campus to support Dal's Faculties of Engineering and Architecture & Planning.

Now, the IDEA Project has grown into a massive \$64-million investment in Dal's downtown campus, thanks to support from donors, industry and the Government of Canada.

The IDEA Project, which began construction in the Fall of 2016, will not only revitalize Sexton Campus but truly

transform it, making it the heart of Halifax's emerging innovation district.

Dalhousie President Richard Florizone calls it an "historic" initiative that will elevate design-oriented technical education and research at Dal to a global standard.

"The best university projects support our entire threefold mission — teaching, research and service — and this addresses all three so well," says President Florizone. "It strengthens engineering, architecture and planning education. It offers new, state-of-the-art space for research. And it's really going to make a huge impact on our

ability to provide important support to entrepreneurs, local companies and NGOs, and our surrounding community in general."

THREE PILLARS FOR TRANSFORMATION

There are three core elements to the full scope of the IDEA project: new buildings; research and outreach hubs; and sustainability investments.

Two new academic buildings, totaling 86,000 sq. feet, will stretch across Sexton Campus from Morris Street towards the Halifax Central Library. The first, called the "Emera IDEA Building", will feature five



A rendition of the exterior of one of the two new buildings of the IDEA project, dubbed the "Design Building."

state-of-the-art, student-centred workshops (including machine, working and prototyping shops). It will also be home to the Emera ideaHUB, a working space designed to equip students with creative and entrepreneurial skills while also providing support to local start-up companies and small businesses. The Emera ideaHUB is a collaborative endeavour that links universities (including Acadia and NSCAD) with the corporate sector, entrepreneurs, venture capital and government.

The second, known as the "Design Building," will include a 450-seat auditorium and four new design studios for Architecture and Planning students. It will also be the future home for Dal's master's programs in Landscape Architecture (Halifax) and Community Design. The buildings will also support technology diversity programs.

The IDEA Project will also include R&D infrastructure renewal to create research and outreach hubs around three sectors: clean tech, oceans tech and advanced manufacturing. These hubs will provide faculty, students and industry/entrepreneurs alike with space and facilities for applied research, product development, collaboration and commercialization. The three areas not only align with the

skills of Dal's researchers, but are all key sectors for Nova Scotia and the region: advanced manufacturing, for example, represents the largest output of any goods-producing sector in Nova Scotia (\$2.7 billion in GDP), while revenues from the province's ocean tech sector has doubled in recent years.

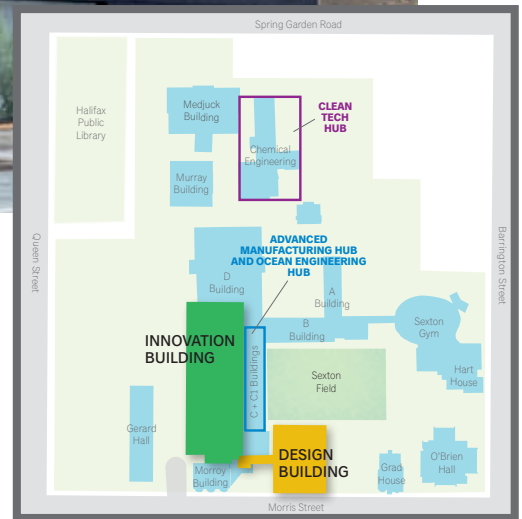
"It'll mean complete rebuilds of our infrastructure in areas where we're national research leaders like environmental and materials engineering," explains Josh Leon, Dean of the Faculty of Engineering.

The final element of IDEA is a set of sustainability programs that will enhance and support research opportunities while reducing greenhouse gas emissions and improving efficiency. These include a geothermal energy field to provide heating/cooling, solar PV installations, a green-roof teaching lab and more.

"Every building on the campus is going to be touched by this construction," adds Dr. Leon. "It's very exciting."

SUPPORTING INNOVATION IN HALIFAX

Just like with most good ideas, the extra time IDEA has had to germinate has made it stronger. With the increased scope, it's not just about



new buildings for students and faculty, but spaces to allow those students and faculty to have a greater impact on their community. IDEA will double the amount of prototyping space Dalhousie provides local businesses, for example, and introduce cutting-edge incubation space to better link students and faculty to industry and entrepreneurs.

This makes IDEA part of an even larger idea: an "innovation district" in the heart of downtown Halifax.

"You've got this beautiful Central Library next door," says President Florizone. "Nearby, you have local IT startups, Halifax's downtown business district, new residential development and research hospitals. And then there's IDEA. You can start to picture this vibrant precinct around lower Spring Garden Road — built on youth, energy, public engagement and innovation. And that's incredibly exciting for this city and our region."

A targeted completion date for the IDEA Project is spring 2018.

Building a Better Future for Engineering Students

With files from Fallon Bourgeois, Matt Semansky, Elizabeth MacDonald, Ryan McNutt

Marjorie Lindsay (LLD'16) understands the power of a great idea. In her 91 years, the philanthropist has seen ideas transform the world around her many times over. More than a decade ago, her late husband John (DipEng'49, BEng (NSTC)'51, DEng'91), founder of the successful Lindsay Construction company, returned from a meeting with the then new dean of Engineering Joshua Leon (BSc'80, MSc'82, PhD'88) and fellow alumni about the possibility of a new building on the Sexton Campus. He exuded an excitement that was palpable to Marjorie.

That first discussion planted the seed of what would become the Innovation and Design in Engineering and Architecture (IDEA) Project.

Even after John's death in 2006, Marjorie has remained a steadfast supporter of the IDEA Project, contributing a \$1-million donation and serving as its honorary campaign chair. She's also one of many stakeholders who have guided a project that serves as a testament to the value of collaboration.

Through funding partnerships linking students, alumni, corporate and individual donors, and the Government of Canada's \$32-million infusion from the Post-Secondary Institutions Strategic Investment Fund, collaboration has been critical in bringing the full IDEA vision to life.

THE POWER OF PARTNERSHIPS

Local energy company Emera is also investing \$10 million in the IDEA Project, supporting the Emera IDEA Building and the Emera ideaHUB. Bob Hanf, executive vice president of stakeholder relations and regulatory affairs with Emera says it's an exciting partnership with huge potential.

"It's not every day a project comes along that will make such an incredible difference in the way new ideas are



fostered and developed in this province. We're very proud to be part of this collaborative effort... it's one I know will make an important difference for Nova Scotia students," says Hanf.

As one of the founding partners of the Emera ideaHUB, Emera is working alongside organizations like Volta Labs, Innovacorp, Clearwater, Micco Companies and Build Ventures on the initiative.

While Dalhousie is still actively fundraising, the Emera ideaHUB vision has already attracted significant support from Nova Scotia's business community, including donations from a trio of Nova Scotian entrepreneurs — John Risley, Colin MacDonald and Mickey MacDonald. They were among the very first to respond to the call for further private sector support, committing a combined \$2.5 million in additional funds.

BUILDING WITH STUDENTS IN MIND

For Joy (BEng'79) and Diego Romero (BEng'79), their shared lives in engineering have come full circle.

The two met and married as students at Nova Scotia Technical College (NSTC), now the Dal's Faculty of Engineering. Now with their gift to the IDEA Project

Above: Dalhousie Engineering Alumni and father and son duo Marshall Williams (left) and Peter Williams (right).

Campaign, Joy and Diego are helping prepare the next generation of engineers for the work world.

"Education is the foundation not only for a career, but also for life," says Diego, a project director with Teck Resources Limited. "That's why we wanted to give back by helping Dalhousie create a more effective learning environment for the students."

From Joy and Diego's perspective, the Emera IDEA Building's student-centred design will do exactly that. So they're directing their gift to one of the new student workshops.

Engineering today is an increasingly collaborative profession. "By learning how to work and problem-solve together, Dal engineers will be better prepared for the realities of the work world," explains Joy, vice president, Technology & Innovation, Canada Natural Resources Limited in Calgary.

CREATING OPPORTUNITIES

Dalhousie University President Richard Florizone is quick to note that, while the



Dalhousie Engineering Alumni and husband and wife Joy Romero and Diego Romero.



Dalhousie President Richard Florizone with Bob Hanf, Executive Vice President, Stakeholder Relations and Regulatory Affairs with Emera.

new and improved facilities will be impressive in their own right, their value lies in the human potential they will unlock. The upgraded facilities will give students more hands-on learning opportunities.

"This project isn't just about space," he says. "It's about people. As an engineer myself," says Dr. Florizone, "I know that half the education takes place in the laboratory."

Which was exactly the impetus for Marshall Williams (BEng'47, MEng'49, DEng'78 (NSTC), LLB'07) and Peter Williams (BA'77, LLB'81) support of the project. The father and son duo are jointly funding one of three large student workshops for the new Emera IDEA Building.

"Dad has always felt strongly about innovation and finding ways to encourage engineers to think creatively, and credits his success (as former TransAlta chairman) to the education he received

at Dal," says Peter Williams, Managing Partner and CEO of Calgary-based Annapolis Capital.

"We have not forgotten the opportunities Dalhousie created for us. Now we want to help create these opportunities for others."

DECADES OF SUPPORT

For almost four decades, Michelin North America (Canada) has been a dedicated partner with Dal's Faculty of Engineering, helping support co-op, research and employment opportunities for students and graduates. Among their senior management staff, you'll find more than 60 Dalhousie Engineering alumni — including Jeff MacLean, its president.

In addition to the many job opportunities the company has already provided Dalhousie students, they recently announced a \$500,000 investment in the university's IDEA Project.

The funding will go towards the Michelin Creation Lab, a new state-of-the-art engineering machine shop that will enable larger projects, greater precision and program expansion.

"Every day, Dalhousie engineering graduates bring their skills and leadership to our business," says MacLean "As a global business leader, I cannot stress the importance of having Dalhousie here... Dalhousie engineers allow us to not only compete, but we exceed in the world."



Dalhousie President Richard Florizone, Michelin North America (Canada) President Jeff MacLean.

PARTNERS IN AVIATION AND INNOVATION

For Joe Randell, President and CEO of Halifax-based Chorus Aviation Inc., it's simple: "Initiatives like the new IDEA Project help create the opportunities and infrastructure needed to keep our best and brightest minds here, in Nova Scotia."

The Corner Brook native, who graduated in 1976 with his degree in industrial engineering from Nova Scotia Technical College, believes passionately in the region, its potential and its future. That's why Jazz Aviation Inc. — a Chorus subsidiary and one of Canada's leading regional airlines — has partnered on research with Dalhousie Engineering for close to ten years.

"The talent inside our organization focuses on production," adds Randell. "For research, however, we need to source this talent elsewhere. Fortunately, we don't have to go any further than the engineering students and faculty at Dal."

Chorus Aviation Inc.'s generous gift to the IDEA Campaign will fund a collaborative meeting space for students. Randell, a 2015 Honorary Degree recipient, has also made a personal gift to the campaign in appreciation of the engineering school that launched his career.

"Our vision is to deliver regional aviation to the world. To do so, we need to keep our talent here," says Randall. "That's why we're investing through Dalhousie to create a prosperous future for NS and Canada."

THE IDEA PROJECT

EMERA IDEA BUILDING



▲ EMERA IDEA BUILDING

1. A bird's eye view of the building site, April 17.
2. Handling the concrete shoot to pour the first footings, February 2.
3. Pouring the building's first walls, with a 42 m pump truck, February 24.
4. The foundation walls are formed with a preinsulated system called Thermomass, March 30.

CLEAN TECH HUB



DESIGN BUILDING



1



2



3



4



▲ DESIGN BUILDING

1. The 450 seat auditorium is taking shape, April 17.
2. Extending the pump arm to pour the first walls, February 24.
3. The walls for the core stairwell are half formed, March 7.
4. Site preparation for the foundation of the new 450 seat auditorium, March 13.

▲ CLEAN TECH HUB

1. Down to the bare brick on the first level of F Building, March 30.
2. Asbestos abatement level 1, February 2.
3. Main entrance of F Building without the stairs, April 28.
4. Deconstruction of level 2, April 28.



2



3



4

Up Close and Personal with the IDEA Project

STUDENTS FROM IMHOTEP'S LEGACY ACADEMY LEARN ABOUT THE SEXTON CAMPUS RENEWAL AND A FUTURE IN ENGINEERING.



More than 50 students from across Nova Scotia traded backpacks and books for hard hats, safety glasses and steel-toed boots over March Break 2017. They donned safety gear to get a first-hand look at how buildings are being put together for the IDEA Project: a transformational \$64-million investment to Dalhousie's Engineering and Architecture campus.

"This is a very interesting challenge given the number, spread and complexities of the projects within an operational campus," says Peter Coutts, Assistant Vice President of Capital Construction who is overseeing the ambitious project. "It's a unique chance for the students to witness some of the educational and career opportunities that exist within the Architectural, Engineering and Construction disciplines."

Construction for the IDEA Project was kicked off in September at a public event.

Coutts had a chance encounter at that event with some students and Sidney Idemudia, the executive director of Imhotep's Legacy Academy (ILA). ILA is an innovative university-community partnership that uniquely mobilizes university/college students,

faculty and community leaders to help improve student success and bridge the achievement gap for Grades 7-12 students of African heritage in Nova Scotia. ILA provides its participants with an enriching blend of real-world learning projects, skill-building and leadership development activities as well as tutoring support.

Coutts and Idemudia put their heads together and decided that introducing students to the project and then bringing them back several times through construction was another way to help engage them in considering a Science, Technology, Engineering and Math (STEM) studies at Dalhousie for their future.

"This immediately appealed to me as a great idea and a way to connect students with the transformation happening on campus," says Idemudia. "We do a lot of work to engage African Nova Scotian learners at their schools through our After School Program and Virtual School Tutoring Program and I thought taking them out of their classrooms and getting their hands dirty would be a great touch to a wonderful STEM experience."

The March Break tours took place over two days. On Thursday March 16, 18 students and their mentors from Halifax came for the morning tour session. They were all from the Black Business Initiative's Business is Jammin' camp.

On Friday, March 17, 39 students from HRM, Truro and Annapolis Valley came to Sexton. They were all from ILA's After School Programs that build self-confidence, self-discipline and the mastery of concepts related to STEM fields. The programs operate within several regional school boards across Nova Scotia

Along with a tour of the active construction zones, the students visited some of Engineering's specialized construction-related research labs. There, students learned about studying fire progression through buildings in the Process Engineering Department's Fire and Explosion Research Lab. They then capped things off by visiting the Civil Engineering Department's Heavy Structures Lab, where they learned about, and witnessed, the destructive testing of building materials and rock samples.

Celebrating 50 Years of Teaching, Research and Success



Corinne MacDonald, P.Eng. '89

Not long after Alexey Leonov became the first person to undertake a walk in space in 1965, Malcolm Matthews made history himself as one of 24 students to enter the newly launched Industrial Engineering program at the Nova Scotia Technical College.

At that time, Industrial Engineering was a new option for students entering their final two years at the college.

"It (learning) was totally classroom dependent," Matthews recalls. "There were virtually no teaching aids, no machinery, no computers, and the discipline was not yet very well defined. But we were keen to try something that was obviously brand new, and the things that we learned were things we really wanted to study."

This fall, 20 of those students will make history again, becoming the first 50th anniversary class to graduate from Industrial Engineering. To celebrate that milestone, and the evolution not only of the profession but also the program, Matthews and fellow alumni Jon Miller and Paul Benoit are planning a Class of '67 reunion, taking place on campus this fall.

"It was just an obvious thing for us to do," Matthews says. "We're all getting older, so we thought we'd like to reconnect, mark our celebration,

find out what the Industrial Engineering program is all about today and, since we are spread out across North America, attract a speaker who can give alumni an update on what is going on in Nova Scotia."

Department head and associate professor Corinne MacDonald (P.Eng. '89) has been working with Matthews and his colleagues to organize the reunion. She says there is a real interest in arranging events that include current students.

"Alumni have proposed an evening meetup where they can share perspectives," Dr. MacDonald says. "But there is also strong interest in attending a lecture to see just how much classes have changed over the years."

Most of those changes will be immediately obvious to the Class of '67. For one, enrolment has increased significantly, with an average incoming class size of 70 students. There is also more diversity in the classroom; approximately 30 per cent of students are international in origin. And computers, which were still something of a novelty when Dr. MacDonald began her studies in 1986, are part of everyday learning.

"We had a computer lab which consisted of two PCs and four Macs," Dr. MacDonald recalls. "You had approximately 90 students jockeying for access to them, but we did not do much programming. Mostly, it was typing."

Yet one of the biggest differences the Class of '67 may note is that today's students have more employment opportunities in the region. A significant percentage of graduates now find work here upon completing the program, and many more return to Nova Scotia after getting established in their careers. Dr. MacDonald says the improved career prospects not only demonstrate the

growth of the practice but also the department's dedication to providing a well-rounded learning experience.

"Other programs tend to focus more on the analytical side of the profession," Dr. MacDonald says. "We made a concerted effort to incorporate other topics such as ergonomics and how to deal with issues on the production floor. This sets our graduates up for a wide variety of fields where they can work, such as hospitals, airlines and utilities."

As a result, Dalhousie's Industrial Engineering graduates have been innovators in both their practice and in the sector, and that, says Joshua Leon, Dean of Engineering, may be the program's greatest success.

"When I came to Nova Scotia, I noticed a sharp focus on process efficiency among companies province-wide and that speaks to the strength of the program," Dr. Leon says. "The department has managed to stay completely relevant, turning out students that are being hired constantly by some of the world's largest companies."

Dr. MacDonald hopes that the Class of '67 reunion will serve as the impetus for ongoing 50th and, perhaps, 25th anniversary reunions. But more than that, she hopes that such celebrations will create opportunities for the Industrial Engineering department's continued evolution.

"I see great potential for growth for the department, and to get involved in innovation initiatives in the province. Industrial engineering, at its heart, is about designing solutions to complicated problems. By celebrating what our alumni have done, and their impact, we can generate interest and attention that lead to more opportunities for the next generation of graduates to do the same."

Three Wheels that Travel

ENGINEERING STUDENT BUILDS ONE OF A KIND BIKE IN CANADA



“POIRIER SAYS THE EGO’S UNIQUE SERIES HYBRID CONTROL STRATEGY ALLOWS THE TRIKE TO FEEL LIKE A REGULAR BICYCLE — BUT ONLY REQUIRES NOMINAL EFFORT TO CYCLE.”

From left: Dalhousie Engineering Professor Lukas Swan, student Cohen Poirier and entrepreneur John Ross.

Meet the eGo, Canada’s first series hybrid electric tricycle.

There are only a few of these environmentally friendly trikes in the world, and one of them was built at Dalhousie University by Mechanical Engineering student Cohen Poirier.

With funding support from the Natural Sciences and Engineering Research Council of Canada (NSERC), Dal Faculty of Engineering Professor Dr. Lukas Swan and Halifax entrepreneur Dr. John Ross teamed up

to design a bike that would provide a more efficient and active means of electric transportation.

The eGo, which Poirier built as part of his fall 2016 co-op term, was a finalist in this year’s NSERC Science, Action! video contest. The competition challenged postsecondary students across Canada to film a 60-second video about how their NSERC funded research and innovations are transforming Canadian lives.

While Poirier’s video placed second at the competition. He says creating the video was never about winning.

“It’s about getting the word out there, and encouraging people to start thinking about moving away from fossil fuels and moving towards a more active and clean form of transportation,” he says.

IMPROVING THE LIVES OF CANADIANS

In four months Poirier, Ross and Swan designed and built a hybrid electric trike that would enable cyclists to overcome many of the challenges they face on the road including harsh weather conditions, strenuous uphill battles and a lack of luggage space. The key to their design involved creating a series hybrid drive train unlike any other in the world.

“This is something that isn’t even on the market right now,” says Poirier. “I think in Japan they have a series hybrid bike that they’re selling and it’s a big secret as to what’s inside, but we know what’s inside. We’ve figured it out for ourselves and ours may be even better.”

Poirier says the eGo's unique series hybrid control strategy allows the trike to feel like a regular bicycle — but only requires nominal effort to cycle.

“When you're pedalling up a hill on a regular bicycle, it's harder to pedal, but the eGo's unique drive train allows the pedalling resistance to remain constant no matter if you are going uphill, downhill or on level ground,” he says.

Unlike a regular bicycle, which uses a chain to drive its back wheel, the eGo's chain has been removed. Instead, it uses a pedal driven generator and a hub motor at the drive wheel, with a unique control strategy to map pedaling input onto motor output.

“This is also what differentiates the trike from something like a moped, which uses a throttle to control its motor,” says Poirier “The eGo requires the user to pedal in order to get the motor to actually work, which means the user has to be active.”

As for riding the eGo in harsh weather conditions, Poirier says the trike's design will eventually include a hood over the vehicle, shielding it from rain or snow.

In 2011 Statistics Canada released a study indicating that on average, it takes Canadians 30-minutes to drive to work. Most of that time however, is spent in gridlocked traffic. Although Poirier says the eGo won't solve all traffic issues, it would certainly appeal to people looking for environmentally friendly ways of getting to work.

“If you use the eGo, you can pass by traffic in the bike lane and remove one idling car from the mix who's burning useless fuel,” says Poirier. “Obviously, it's not for big road trips with the family. It's only has room for maybe one person and some groceries. But you could cut down on your fossil fuel usage by using the trike and you could be active.”



Above: Dalhousie Engineering Professor Lukas Swan and student Cohen Poirier examine the eGo.



Left: Engineering Professor Lukas Swan, student Cohen Poirier and entrepreneur John Ross add final touches to the eGo.

Poirier says they are still exploring new technologies, but are confident that the eGo's drive train could be beneficial to a wide variety of Canadians.

“Since the video came out, people have suggested that the technology could be applied to multiple areas, such as aiding those with disabilities,” he says.

FUTURE PLANS

The eGo is the first prototype for Ross' new start-up company, ActEV Rider Co. The business focuses on finding new and environmentally efficient

ways for Canadians to benefit from electric vehicle transportation.

Poirier says he'll be returning to the company this summer for his next co-op term. From there, Poirier, Ross and Swan hope to further develop the eGo's control strategy and build more prototypes.

“We need to listen to the public about how they feel about the eGo,” says Poirier. “If people have ideas and want to get involved we are open to suggestions. Our main goal is to aid the transition into electric vehicles. We just want people to start talking about this and moving away from fossil fuels.”

Dalhousie Engineering Hosts Capstone Conference

MARCH IS NATIONAL ENGINEERING MONTH IN CANADA, AND ENGINEERS FROM COAST TO COAST CELEBRATED THE IMPORTANCE OF CAREERS IN ENGINEERING.

As part of Engineering month, senior students from Dal's Faculty of Engineering got a chance to show off their future career potential at this year's Dalhousie Engineering Capstone Conference (DECC). The event was hosted on March 22nd.

The Capstone Conference is the largest event for the senior year classes, incorporating all engineering disciplines within the faculty. The conference gives students the opportunity to showcase how their Capstone Projects integrate course work and engineering design skills to provide innovative solutions to local industry partners.

Originally known as the Design Expo and Poster Competition, the event revolutionized this year with a new name and a new venue location.

"When we began planning for this year's Design Expo, the newly begun campus renovation meant there was some uncertainty about the availability of Sexton Gym, where we usually hold the event. This led to a brainstorm of how we could change the event, and we realized that by moving offsite we could make the event bigger than before," says Sandra MacAulay Thompson, member of the Faculty of Engineering's "Engineers in Residence", and one of the co-organizers of this year's Capstone Conference. "We decided to add formal student project presentations to the day so that it had the look and feel of a day-long conference."

All engineering students participate in an eight-month Capstone Project in their final year of studies. At the beginning of the academic year, students are placed into teams and are assigned industry



Dalhousie Engineering senior students showed off their design skills at this year's revolutionized Capstone Conference.

or community based projects. Each team works with their client or mentor to solve specific real-life challenges. Most projects are sponsored by clients from industry.

"Industry-sponsored capstone projects give our students a chance to apply their engineering skills to problems that are similar to what they will face as practising engineers," says Thompson. "These are open-ended problems with many technical and economic factors to consider. Tackling these types of projects build student confidence and exposes them to the challenges of working in industry."

This year Dexter Construction Company Limited partnered with a group of industrial engineering students to look at improving their snow removal operations.

The team of students, which consisted of Tate Linzel, Angus Nelson, Matt Shannon and Matt

Lytle, worked together to improve operations in areas such as scheduling, shift change processes, routing and resource utilization.

"Organizations get to see, firsthand, the abilities of students, and gain from their innovative thinking and sharp skillsets with minimal cost or risk," says Michael Parrott, a Project Manager at Dexter Construction. "The opportunity is equally beneficial for students to contribute and gain experience on a real-world project as they prepare to enter the workforce as junior engineers."

The Dexter Snow Removal Project was one of approximately 98 projects that were on display at this year's Capstone Conference. Like past years, the conference included a poster competition where 48 industry judges assessed each student project based on a variety of criteria including detailed project analysis,



student professionalism and overall presentation.

As judges moved from project to project, hundreds of other members from the engineering community squeezed into the Westin's largest ballroom to learn more about how the next generation of engineers were making an impact on their community.

Student posters ranged from the "Dartmouth Cove Master Plan Project," a project designed to establish streets and sewer infrastructures for the new development of a Halifax Regional Municipality neighbourhood; to a group of students set to power a single family home using a fuel cell and ethanol reforming.

"The Capstone Conference is an exciting way for students to showcase their work to their fellow students, faculty, industry and the public. By highlighting these projects, we hope to generate interest in the Capstone Program: creating new opportunities for companies to support engineering education, and in turn helping those companies solve some of their toughest engineering problems," says Thompson.

With the launch of the IDEA Project set to transform Dal's Sexton Campus and Halifax's emerging innovation district, the Capstone Program is another great example of how Dalhousie's Faculty of Engineering is growing strong ties with local industry, and developing partnerships that enhance and strengthen the future of the Halifax community.

Interested in getting involved?

Do you have a design problem that needs a solution? If you or your organization would like more information about the Capstone program, please contact Dr. Clifton Johnston at Clifton.johnston@dal.ca or 902.494.8985

2017 CAPSTONE CONFERENCE POSTER WINNERS

The Faculty of Engineering would like to thank all the companies and supporters that provided the projects and exceptional learning experiences for our senior students. Below are the winners of this year's Capstone Conference Poster Competition.

DALHOUSIE UNIVERSITY FACULTY OF ENGINEERING AWARD OF EXCELLENCE FOR BEST CAPSTONE POSTER IN CIVIL ENGINEERING: "6-Storey Wood Building" by Spencer Collier-Jarvis, Zachary Henry, Lindsay Kehoe, Keith Porter

NSERC CHAIR IN DESIGN ENGINEERING AWARD OF EXCELLENCE FOR BEST CAPSTONE POSTER IN ELECTRICAL & COMPUTER ENGINEERING (01): "Improved Noise Shaping Digital Delta Sigma Modulator" by Brett Chaisson, Brendan Lane, Paddy Quinn

NSERC CHAIR IN DESIGN ENGINEERING AWARD OF EXCELLENCE FOR BEST CAPSTONE POSTER IN PROCESS ENGINEERING AND APPLIED SCIENCE: "Dartmouth Fish Passage Between Sullivan's Pond and the Halifax Harbour" by Sarah Borden, Sabrina Heifer, Marie Adrienne Imperial, Yujie Lang – "Expanding Nova Scotia's Sustainable Energy Development by Utilizing Decommissioned Quarries" by Caroline Forbes, Mitch Gammon, David MacDonald, Nicole Westeinde

SHELL AWARD OF EXCELLENCE FOR BEST CAPSTONE POSTER IN INDUSTRIAL ENGINEERING: "Process Automation and Standard Operating Procedures"

by Ahmed Rayyan, Amer Hussein, Arsalan Ali, Sudarsan Adhikari

SHELL AWARD OF EXCELLENCE FOR BEST CAPSTONE: "Preliminary Scoping Study of a Au-U-Y Straitiform Paleoplacement Quartz-Pebble Conglomerate Deposit, Shubenacadie Area, Nova Scotia" by Eric Pushie, Mark Webb, Michael Forsyth and Mitchell Carter

MICHELIN AWARD OF EXCELLENCE FOR BEST CAPSTONE POSTER IN ELECTRICAL AND COMPUTER ENGINEERING (00): "Inertial Based Fall Detection Device"

by Frederick Porter, Joel Atkinson, Mason Baker and Miguel Morales

MICHELIN AWARD OF EXCELLENCE FOR BEST CAPSTONE POSTER MECHANICAL AND MATERIALS ENGINEERING: "Automated Ring Removal Device" by Patrick Hennessey, Mason Landry, Brad MacKeil, Cal Thompson.

Female Engineers Stand Out During National Engineering Month

In March, women around the world celebrated International Women's Day; a time to recognize women achievements. March also represents National Engineering month; a celebration of engineering excellence, and an opportunity to showcase the value and benefits of a career in engineering.

At Dalhousie University, two women in the Faculty of Engineering were recognized for their impact on the faculty and their promise of a bright future in engineering.

KELLY SERVICES INC. FUTURE ENGINEERS AWARD

For the first time, ever, a Canadian engineering student has won the Kelly Services Inc. Future Engineers Scholarship.

Dalhousie third year Engineering student, Cathleen Lupien accepted the honour at an award presentation on Sexton Campus on March 10th.

The \$5,000 scholarship is presented each year to one eligible undergraduate student in either Canada or the United States. To be considered, applicants must be full-time engineering students with a minimum of a 3.0 cumulative grade point average (GPA).

The award money can be used towards tuition, fees, books, and room and board expenses for the 2017 calendar year.

"I feel extremely honoured and grateful that Kelly Engineering has chosen me as the first Canadian to win this award," says Lupien.

Since 1946 Kelly Services Inc. has been a global leader in providing workforce solutions, and a leading provider of engineering resources to customers in industries such as chemical, medical, pharmaceutical and more.

The Future Engineers Scholarship was established fourteen years ago

Globally women make up less than 30 percent of the workforce in fields such as engineering and computer science.



Third year Engineering student, Cathleen Lupien, accepts her award from members of Kelly Services Inc.

to encourage students interested in the field of engineering, and to build awareness of engineering as a career path. Lupien hopes her achievements will help inspire other women to also pursue a career in engineering.

"As an engineer, I hope to be a positive influence on society. I feel that it's an extremely fulfilling profession if you are interested in sciences and the application of them," says Lupien. "This field is overlooked, especially by women because of its reputation of being extremely difficult as well as a man's profession. I believe that you do not have to be a genius to become an engineer, as long as you believe in yourself and have a good support system around you, you can do anything."

AMELIA EARHART FELLOWSHIP

Another female student in Dal's Faculty of Engineering is making a significant impact in her field of work. Ph.D. student Zohrehsadat Asaee has been awarded the 2016 Amelia Earhart Fellowship.

The prestigious fellowship was established in 1938 in honour of a famed pilot and Zontian, Amelia Earhart. The \$10,000 (US) Fellowship is awarded each year to thirty-five females around the world pursuing Ph.D. doctoral degrees in aerospace-related engineering or aerospace-related engineering.

Asaee, whose area is in Civil and Resource Engineering, will use her fellowship to improve crashworthiness in aircraft. This is the ability to decrease the number of related injuries in aircraft collisions.

Asaee will be studying advanced composite materials and investigating fiber metal laminates (FML). FML is composed of lightweight metal sheets within layers of a 3D Fiberglass. Little research has been done on these materials. By conducting experimental and computational studies, Asaee hopes to characterize the impact response of these new materials to help increase the safety of aircrafts.

Faculty of Engineering Honors Sexton Scholars

Dal's Faculty of Engineering celebrated the accomplishments of 165 of their brightest students at this year's Sexton Scholars Reception in March.

The Sexton Scholar designation, named for Frederick H. Sexton, PhD, is unique to the Faculty of Engineering. Students who achieve a GPA of 3.85 or higher, and maintain a full course load in one or more academic terms during the calendar year, are honoured as a Sexton Scholar. Students who maintain this caliber of performance throughout their entire engineering degree receive a "Sexton Distinction" on their diploma at graduation.

3rd year Civil engineering student, Meaghan MacGillvray had many reasons to celebrate at this year's Sexton Scholars Reception. In addition to being one of the students to received their designation, she also received another big surprise. Her mother, Beth MacGillvray, unexpectedly flew in from Qatar to surprise her daughter at this year's reception.



Although originally from Halifax, Beth says she's been living in Doha Qatar for the past eleven years. And although she's now resides on the other side of the world, Beth says the Sexton Scholar Reception was an event and milestone she couldn't miss.

"I think for her to be receiving this award is such an incredible academic achievement and it indicates how dedicated and disciplined she is," she says. "I also think it's a positive reflection on the university that they will take the time, the effort and put



Above: Faculty of Engineering Sexton Scholars 2017; Bottom: Beth MacGillvray and Sexton Scholar Meaghan MacGillvray.

resources into recognizing these students. So I thought the least I could do was travel from Qatar and spend one night with my daughter to make sure she feels supported and recognized by her family as well as the school."

Dalhousie Engineering Professor Dr. Jeremy Brown Awarded \$2.7M in ACOA funding

Dalhousie Engineering Professor, Dr. Jeremy Brown, has been awarded \$2.7 million from the federal government for a cutting edge surgical probe that'll improve cancer diagnostics and therapeutics within the brain.

Dr. Brown's technology is the world's first high-resolution, endoscopic surgical and imaging probe. The miniature endoscope will be used for cardiac and cranial procedures, and will be inserted into a patient's brain to diagnose and treat conditions such as blood clots and brain tumors.



The probe will be developed by a team of researchers including Dr. Brown, Dal's Dr. Rob Adamson,

and Canadian industry partners Synaptive Medical Inc., Conavi Medical Inc. and Daxsonics Ultrasound.

Dalhousie Industrial Engineering students “RIISE” to the Challenge



More than 400 Industrial Engineering (IE) students showcased their talents in January at the 37th Canadian Student IISE (Institute of Industrial and Systems Engineers) Conference in Halifax. The three-day conference was hosted this year by Dalhousie University, and gave the brightest IE students from across Canada and the United States the opportunity to take part in a series of inspiring competitions and network with industry professionals.

While this year's conference theme encouraged delegates to “RIISE to the challenge,” a group of students from Dal's IE program had already exceeded those expectations.

Kyle Gillan and Logan Baillie, both fifth-year Dal IE students, co-chaired the committee who planned this year's IISE conference. The annual event is held in a different location each year, and the host committee typically has two years to plan and execute the elaborate event. But this year, a last-minute change saw Dal students rise to the challenge.

Comprised of 21 IE students ranging from third year to fifth year, the planning committee also had the full support from the Department of Industrial Engineering.

From hotel bookings, to sponsorships, keynotes and more, there was a lot of work to do. The challenge proved even more difficult with many of the committee members, including Kyle, away on co-op for four months.

Eleven universities from across Canada

and the United States sent teams of up to 50 students to this year's IISE Conference. Participants competed in a Simulation Competition, a Technical Competition, a Theoretical Exam and a Case Study, but the conference offered more than just the opportunity to see how students match up against their peers.

Both Kyle and Logan admit that planning the event in such a short amount of time was demanding, but the benefits of having taken on the role were more than they expected to gain.

“In co-ops you may work on a big project but you never have near as big of a role as something like this,” says Logan. “We got to practise communications plans, run meetings, learn how to manage volunteers, and negotiate contracts. That's something I've never done. You probably can't even touch on everything that we've learned.”

“It's been a rollercoaster of emotions over the past year,” adds Kyle. “When you take a step back and look at all the work that's been completed it's just incredible.”

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Inaugural Dalhousie Top Co-op Awards

Top Engineering Co-op Student of Year Award winner

The inaugural Dalhousie Top Co-op Awards and Appreciation Reception took place on March 22 during National Co-op Week 2017. Nearly 140 guests gathered to honour Dalhousie's Top Co-op Employers and Top Co-op Student of the Year. The awards ceremony showcased the impressive work term experiences that are made possible by the commitment and support that employers provide. Dalhousie's Co-op offices facilitate connections that support, student learning, engages employers and serves the community regionally, nationally and internationally.

A total of six students received the honour of being named Top Co-op student of the Year in their faculty. Catherine MacDougall, was named the 2016 Top Engineering Co-op Student of the Year award winner.

Catherine completed her third and fourth work term with ExxonMobil. She shares that her father had

worked on the Sable Offshore Energy Project from 1999-2004, making her role on the Sable Decommissioning Team an exciting one for her. "My dad was involved with early project development and was the first Offshore Installation Manager (OIM). In fact, my family lived in the UK while the topsides were being built in Teeside, UK. Working as a co-op student on the Sable Decommissioning Team was a special opportunity."

Catherine's supervisor, Freidrich Krispin, shared that she proved to be a strong asset to the team. "Catherine worked on some very real-world challenges and developed effective, efficient, and executable solutions. She has excellent technical and interpersonal skills and was a great addition to the Sable Decommissioning team and ExxonMobil Canada."

Catherine also felt that during

her work term at ExxonMobil she grew as an aspiring engineer, developed meaningful workplace relationships and applied countless engineering concepts learned in school. "My co-op term at ExxonMobil was extremely rewarding. Not only was I able to work on incredibly interesting engineering projects – I worked on a team driven to succeed. The Sable Team pushed me to become a better engineer, and took the time to teach me valuable lessons. When I make my transition into the work force this June I will be equipped to thrive as a Chemical Engineer."

In 2016 over 1,960 work terms, across five faculties and 26 disciplines were completed by Dalhousie students.

If you are interested in learning more about hiring an engineering co-op student for your organization, please reach out to the Science, Information Technology, Engineering Cooperative Education (SITE) office. Contact us at 902-494-4353 or coopjobs@dal.ca

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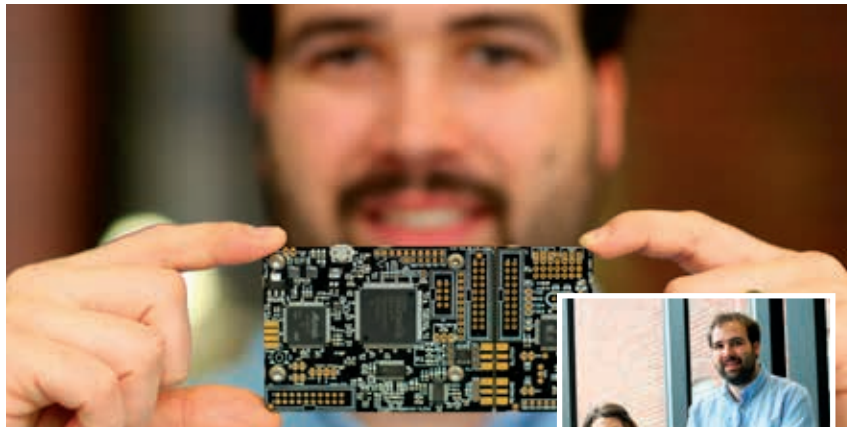
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The ChipWhisperer



When you hear of the word “Whisperer” you may immediately think of a person who silently shares secrets with another individual. For Dalhousie University Engineering Alum Colin O’Flynn (B.Eng ’09), that was the idea he was aiming to achieve when he invented the ChipWhisperer.

In 2012, while working on his Ph.D in engineering at Dal, O’Flynn developed a small little device with powerful capabilities. Coined the ChipWhisperer, this tiny gadget can flag huge security vulnerabilities in chips and designs used in everyday items such as cars, planes and smartphones.

O’Flynn says there is only one other company in the world who sell this type of technology, and their product go for over 50,000 Euros.

At such a steep cost, O’Flynn took matters into his own hands.

“I was still in school at the time and couldn’t afford to buy this type of device, so instead I built similar equipment that was very cheap for my own research purposes,” he says. “Then I ended up presenting one or two papers on the device and that’s when other researchers started asking if I could build them one as well.”

From there, NewAE Technology Inc. was created. O’Flynn and his co-partner, and wife, Hilary Taylor (B. Comm ’08) launched their company in 2013.



O’Flynn however had been using the name NewAE Technology Inc for quite some time.

Since their launch, O’Flynn says about one third of his cliental are academics using the device to run undergraduate classes. The other portion of his customers are commercial clients and government agencies.

“People doing research on embedded security, like the air force for example,” he says. “If you’re deploying embedded systems on a plane, they have so much networking and communication between them, they want to be very careful that there are no problems.”

The ChipWhisperer works by measuring tiny emissions of electronic devices as they operate. However, O’Flynn says these devices always “leak” tiny amounts of information during operation.

“Sometimes it’s very strong, like your cell phone signal causing a noticeable sound on a nearby radio, but we are focusing on very weak signals,” says O’Flynn. “The specifics of using this leakage to hack into otherwise secure devices was published in 1999 (and a similar type of work has been known since the 1970’s), so the fundamental

Top: The ChipWhisperer can flag huge security vulnerabilities in chips and designs used in everyday electronics.

Bottom: Dal Alum Hilary Taylor (Left) and Dal Engineering Alum Colin O’Flynn (Right).

ideas aren’t new. But the lack of readily accessible tools meant the research hasn’t gone into industry as quickly as you might expect – even 18 years later many engineers aren’t aware of these attacks.”

O’Flynn says the device is not a generic tool used for testing every type of security vulnerability, but there are some specific ones that can be very dangerous. And while O’Flynn says he’s very proud of the product he’s created, for him, his greatest achievement is the ability to help students and other researchers who struggle in securing the necessary hardware required for their own embedded design work.

“Since starting the company, the really interesting thing for us, and the one major thing that we’re doing differently, is that we are open-source. So the design for this (the ChipWhisperer) is fully posted on the website,” he says. “And people have built their own of these, so they don’t have to buy them from us.”

Despite access to his designs, O’Flynn says licenses have been put in place preventing people from taking the design of the ChipWhisperer and selling it themselves.

“You can take the design and modify it and make your own product, but then you have to release changes back,” he says. “If you make an improvement, that’s great, but you have to give it to everyone else.”

“When I was a student I couldn’t afford anything really fancy, so for me open source really made a big difference,” he says. “Now it’s nice seeing the other side of that. People will come up to me and thank me for the open source.”

NEWAE Technology’s website can be found at www.newae.com

Join the Dean's Coffee Club

For over ten years, the Faculty of Engineering has been hosting a series called the Dean's Coffee Club. Each month, Dalhousie Engineering alumni are invited to join Dean, Joshua Leon for breakfast, learn more about faculty research projects, and catch up with friends.

This year's presentations included:

MARK GIBSON FROM THE DEPARTMENT OF RESOURCE AND CIVIL ENGINEERING:

Presentation on the background and preliminary results of atmospheric measurements made on Sable Island as part of the "North Atlantic Aerosols and Marine Ecosystems Study (NAAMES)".

GHADA KOLEILAT FROM THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING:

Presentation on how emerging optoelectronic technologies seek to push the boundaries of both efficiency and cost-effectiveness by using flexible platforms and novel material systems.



Dal Engineering alumni Larry Godon, Errol Pierce and Gary Cooke enjoying a cup of coffee at February's research presentation at the Dean's Coffee Club.

KEVIN PLUCKNETT, ASSOCIATE DEAN OF RESEARCH IN THE FACULTY OF ENGINEERING:

Presentation on the microscopy of advanced materials. A wide variety of microscopy techniques are used to evaluate the microstructure of advanced materials at very high magnifications.

DEAN JOSHUA LEON AND JULIA CAIRNS, partnered for a presentation on the IDEA Project and a construction

tour of the new buildings on campus. Cairns, a Senior Project Manager on the project, guided an enthused group of alumni through the sites of both the Emera IDEA Building and Design Building.

The next season of the Dean's Coffee Club will begin this Fall. Check out our website (www.dal.ca/faculty/engineering) for upcoming dates and presentation topics.

See you this fall

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