

Innovation

Biomedical engineering provides
more than a 'Band-aid' solution

Bone Adhesive

Repairing bones with glue

PUSH Strength



Faculty of Engineering
engineering.dal.ca

From the Dean

As the 2013-2014 academic year winds down, we would like to wish our 2014 grads all the best in the future. We have over 500 students graduating, which makes this our largest graduating



class to date. Demand for our programs continues to grow, with applications up by 25 per cent – over 1900 have been processed for 360 spots.

With growth can come challenges, but our high caliber students, faculty, and staff definitely make up for that. In March we held the First Annual Engineering Design Expo. The poster competition and expo gave students an opportunity to have their senior year design projects evaluated by judges from industry.

The past year has been very busy here at Sexton Campus. In November, we went through the accreditation process and are awaiting the results. The Faculty has successfully gone through accreditation since 1965. In addition, we are currently in the middle of our Senate Review, which is conducted every seven years. Both our undergraduate and graduate programs are reviewed.

We hope you enjoy this issue of *The Dalhousie Engineer*, and we wish you a safe and happy summer.

Dr. Joshua Leon, P.Eng.
Dean of Engineering

On our cover:

Biomedical engineer Dr. Paul Gratzler is developing advanced tissue products. (Story page 4.)

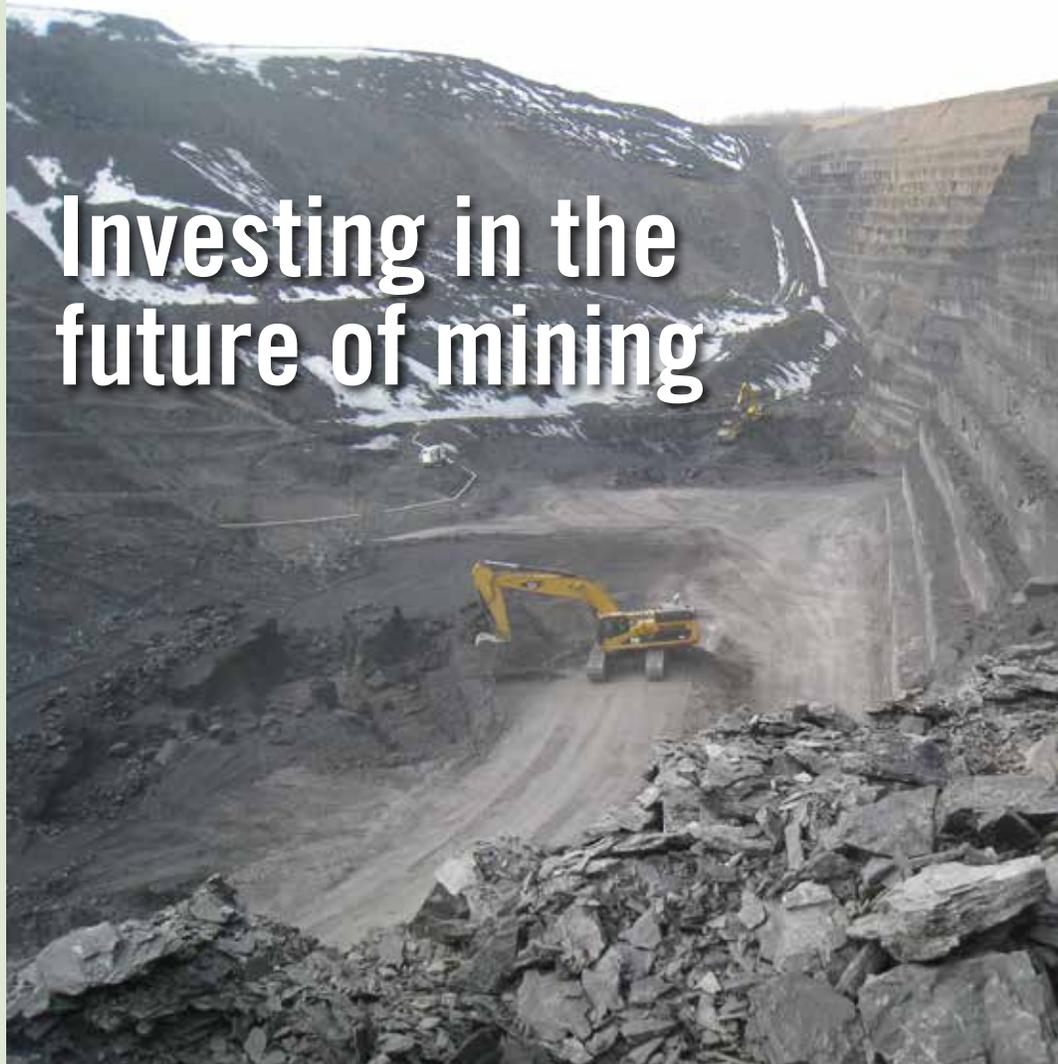
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Investing in the future of mining



Goldcorp supports Dal's Mineral Resource Engineering program

The mining industry faces a looming skills shortage – according to some estimates, a need of up to 50,000 skilled workers by 2020.

“The case for supporting the development of talent in our industry is clear,” explained Peter Day, speaking on behalf of Vancouver-based mining company Goldcorp at an announcement in April at Dal's Faculty of Engineering.

To help support that cause, Goldcorp is donating \$300,000 to Dal's Mineral Resource Engineering program. The funding will establish the Goldcorp Professorship in Mineral Engineering, to be held by senior professor Donald Jones. The position will focus on curriculum

design in particular, expanding the program's emphasis on health and safety and environmental aspects of mining engineering.

“Having people who've worked in industry, as many students will appreciate – having professionals who are practically minded and have that practical experience, being exposed to real-life challenges – that provides a great opportunity to influence and inform our own education and research,” said Dal President Richard Florizone, speaking at the event.

The lobby of Sexton Campus' Morroy Building was filled with students who came out for the announcement,



reflecting just some of the ripples Goldcorp's gift is already causing across the department and the Faculty.

"This is the start of the rebirth of our Mineral Resource Engineering program," said Dean of Engineering Josh Leon, noting that the department has been able to make two new hires building on the momentum of Goldcorp's support. "It's a real day of growth."

New opportunities

Goldcorp is one of the world's fastest growing senior gold producers, employing 18,000 people in eight countries around the world, and frequently hires Dal co-op students and graduates.



"Goldcorp is one of the biggest companies in this industry, and Dal is one of the best universities in Canada so it makes sense for them to join forces."

Dey, a Dal law alum (LLB'66) and chair of Goldcorp's Governance and Nominating Committee, explained that the company sees education as "a fundamental building block to creating opportunity."

"At Goldcorp, we do more than just operate gold mines," he continued. "We're in many communities and we want to contribute to the long-term social and economic benefit of those communities."

Dr. Jones, whom Dr. Leon celebrated for his years of commitment to the program and its students, noted Goldcorp's leadership in community and sustainable development and thanked the company for its support.

"I think it will lead to greater things, and I think we can really leap forward," he said. "We see ourselves contributing a lot of new talent to the

industry," noting possible future areas for collaboration in terms of R&D and technology development.

Some of that new talent is already getting experience in the industry. Dylan Morgan, a fourth-year student originally from Barbados, has completed one co-op term with the Goldcorp and is returning this summer to work in the company's Misselwhite mine in Northern Ontario.

"It prepared me really well," he said, when asked about his education at Dal. "I found the skills I learned in Mineral Resource Engineering fit perfectly with what was expected of me."

He's also excited about what the company's support for Dal might mean for his program.

"Goldcorp is one of the biggest companies in this industry, and Dal is one of the best universities in Canada so it makes sense for them to join forces."

Developing advanced tissue products

Innovative technology addresses unmet needs

Dr. Paul F. Gratzer does not mince words when it comes to the use of amputation as a means of treating chronic diabetic wounds.

“In this day and age of modern medicine and technology, it really is unacceptable,” he says. “This is an issue that hasn’t had a good solution to it.”

Thanks to Dr. Gratzter, that may be about to change. For more than a decade, the associate professor with the School of Biomedical Engineering has been developing advanced tissue products for use in wound healing and surgical reconstructions. His work has resulted in a groundbreaking process that removes the cellular components – the source of tissue graft rejection – from donated human tissue. The result is a safe, sterile, effective scaffold that promotes tissue regeneration when the processed tissue is implanted on patients.

“People have been trying to conduct decellularization of tissues for years, but it’s difficult to achieve a high level of removal of the cellular component and maintain the other components of the tissue that you want,” explains Dr. Gratzter. “It’s like trying to remove the white and the yolk from an egg without damaging the shell.”

Through his company, DeCell Technologies, Dr. Gratzter has been very successful in achieving that aim, having developed a patent-pending technology that removes up to 95-97 per cent of cellular material from donated human skin. Competing processes, he notes, remove significantly less

cellular materials – as little as 50 per cent. Given that cellular material can impede or prevent tissue regeneration in patients, the more you can remove without altering the structural matrix of the original tissue, the better.

“By maintaining the structural components of tissues and removing all of the donor cells, after implantation in animal trials, we found we were able to get cells from the recipient to grow back in and start to repopulate and regenerate tissue. Ultimately, you can get the recipient’s body to replace the implanted material, turning it into tissue that is 100 per cent of the recipient’s tissue.”

It isn’t just the amount of cellular material removed that makes Dr. Gratzter’s technology innovative; it’s also the fact that it is fully automated. “Other companies rely heavily on manual processing of the tissue. Once we put the donated tissue into our system, it’s treated, sterilized, packaged and not touched again until the patient receives the graft. Also, the process is simple enough that we can do the decellularization treatment and sterilization at the same time. As a result, there are some significant safety and cost advantages there.”

Dr. Gratzter’s decellularized skin product has other significant advantages over competing products in that it doesn’t require re-hydrating or thawing. Many competing products require freezing or dehydration to increase shelf-life. “Freezing and dehydration require considerable forethought for the clinician in terms of preparing products for use since it takes extra time to rehydrate or





thaw. Also, if you don't use the tissue after rehydrating or thawing, it can't be kept and is wasted. Most significant is that freezing and dehydration can alter tissue properties and impede wound healing. We've been able to produce our tissue so that it can be stored in a hydrated state at room temperature with an anticipated five-year shelf life."

This spring will see the biggest test to date of Dr. Gratzner's technology: a Canada-wide clinical trial involving 40–60 patients with diabetic foot ulcers. There were many reasons he chose foot ulcers for the first major human trial. For one, diagnoses of diabetes are on a sharp rise worldwide, with 550 million people expected to have the disease by 2030 – approximately 10 per cent of the world's adult population. Up to 25 per cent of people diagnosed with diabetes will develop a foot ulcer in their lives, and 20 per cent of those wounds will eventually result in amputation.

"If you look at amputations that are done in a therapeutic way – to prevent the loss of life – the majority of these are done on diabetic patients who have had a chronic ulcer," says Dr. Gratzner.

"Some tissue products on the market

do well, but they're expensive, require multiple applications to heal, and are utilized as last-case salvage before amputation comes into play. What we're trying to do is encourage people to use our decellularized tissue early in treatment in order to minimize the risk of infection and give patients the best care from the start. That way, you

"We want to provide the best quality solution that we can, taking into account the needs of the healthcare system, the clinician and the patient so we deliver something highly effective, but also with limiting costs to the healthcare system in mind."

get better outcomes with faster healing and that means less expense for our healthcare system."

Ironically, Dr. Gratzner has a vested interest in the outcome of this trial, having been diagnosed with diabetes himself over the course of his research. "I would be happy to know that, if I did have a problem like this, there would

be an effective method of treating and healing the ulcer. That's reassuring."

The next year is likely to be a busy one for Dr. Gratzner. In addition to the clinical trial, he is preparing to set up a for-profit manufacturing facility at the Innovacorp Enterprise Centre. He's beginning a Pilot Clinical Trial this spring to demonstrate the effectiveness and safety of the product. Once completed, he will be securing more grants and equity investments to conduct a larger patient treatment trial in healthcare centres across North America to obtain approval for product reimbursement by public and private insurers. He's also been chatting with clinicians about applying his technology to meet other tissue needs – everything from treating burns to surgical reconstructions.

"The possibilities are limitless," says Dr. Gratzner. "But the key as always is to do it well. We want to provide the best quality solution that we can, taking into account the needs of the healthcare system, the clinician and the patient so we deliver something highly effective, but also with limiting costs to the healthcare system in mind."

Researcher, faculty bond

for bone adhesive clinical trials



A Nova Scotia developed adhesive could soon offer surgeons and patients a faster, easier method for repairing cranial and facial bone fractures, thanks to clinical trial researcher **Mehdi Kazemzadeh-Narbat** and the Faculty of Engineering at Dalhousie University.

Created by Dartmouth Medical Research Ltd., the hot melt bone glue marks a stunning advance over the traditional method of repairing such fractures – titanium plates and screws. According to Kazemzadeh-Narbat, the conventional titanium fixation systems pose problems for surgeons and patients because they are time consuming and difficult to apply, they interfere with diagnostic imaging and they have to be removed after healing, resulting in a second round of surgery.

“There are biodegradable fixation systems available, but they are very expensive,” notes Kazemzadeh-Narbat, who received a two-year, \$50,000/year Mitacs Elevate post-doctoral fellowship to help fund his research. “In talking to surgeons, we learned they didn’t like to use them for that reason and preferred the titanium system.”

But the surgeons he’s talked to are very excited about the hot melt bone glue, mainly because it is easy to apply and sets quickly. “Usually the time required to apply a titanium system is almost 30 minutes. With this glue, it’s eight minutes, so surgeons save a lot of time.”

Not only is the adhesive non-toxic, it is fully biodegradable, meaning there is no need for any additional surgery.

It is also MRI and CT scan compatible, and it can be easily applied on uneven surfaces. Yet the biggest advantage of the adhesive as a fixation system is that it promotes faster healing over plates and screws, which can impede bone growth. “That’s good news for patients because it means less recovery time.”

Kazemzadeh-Narbat says it was Dartmouth Medical Research that approached him to conduct pre-trials on the adhesive. At the time, he was completing his PhD in Biomedical Engineering at the University of British Columbia. “It fits with my background (Biomaterials), which is why I moved here from Vancouver. Moreover, there’s also a huge market for it and it will help a lot of patients once it receives FDA approval.”

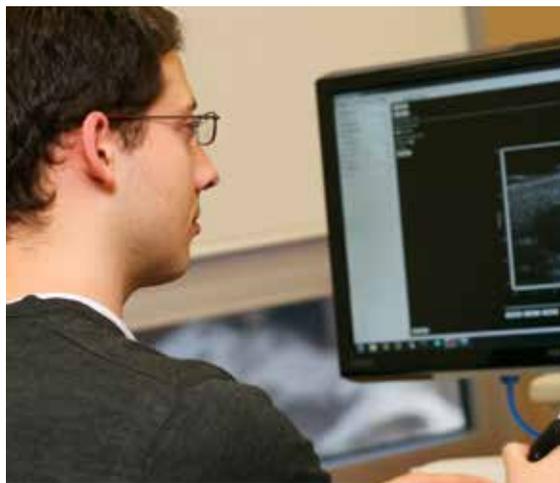
According to Amyl Ghanem, an associate professor of Process Engineering and Applied Science who is supervising Kazemzadeh-Narbat's research, there are 300,000 neurosurgeries performed worldwide annually, with an expected growth of 15 per cent per year. She says Dalhousie and Halifax are well suited for the cutting-edge research Kazemzadeh-Narbat is conducting.

"We have all the state-of-the-art equipment and world-class people here to see this work through, but it's also a small enough community that you can easily access the facilities and expertise you need when you need them. It's a very friendly, accessible research environment."

In vivo studies are expected to get underway this summer through Dalhousie's animal care facility, according to Kazemzadeh-Narbat. "Basically, we'll be looking at the biomechanical properties of the adhesive, the time it takes for biodegradation, which we expect will be one year, the bone healing process and the change in adhesive strength."

If all goes well, the adhesive could be in use in hospitals across North America by 2016. "It's based on materials that are already approved and have been in use biomedically for decades," says Ghanem. "So it's expected to follow a more rapid regulatory pathway because of that, and Kazemzadeh-Narbat is helping to make that happen."

Ultra-small ultrasounds



Andre Bezanson is still working on his PhD, but he's already making waves in the field of ultrasound imaging. Bezanson, a biomedical engineering student, is conducting research that allows scientists and clinical researchers to image smaller objects with a higher resolution using ultrasound technology – and at a lower cost than with traditional high frequency ultrasound devices. His work recently earned him the Mitacs Award for Outstanding Innovation, an award given annually to five Mitacs-sponsored innovators chosen out of thousands of nominees from across Canada. Mitacs is a Canadian not-for-profit organization that offers funding for internships and fellowships at Canadian universities for international undergraduate and graduate students. Bezanson was also a recipient of Dalhousie's Marble Prize and an attendee at the 2013 IEEE Ultrasonics, Ferroelectrics, and Frequency Control Society conference in Prague.

"I did a work term where I had additional funding through Mitacs," Bezanson says. "I partnered up with

Daxsonics, which is a startup ultrasound company here in Halifax. During the work term, we focused on producing a high resolution ultrasound system primarily focused on scanning small animals."

The device that Bezanson and Daxsonics came up with is different

than other high resolution ultrasound systems because it replaces expensive and bulky electromagnetic motors with a piezoelectric bimorph – a simple, credit card-shaped object that bends under an electrical field and costs only about \$20.

Labs that are unable to afford an imaging device to use for small animals must breed large sample populations and employ dissection as a primary imaging technique. With an affordable ultrasound device, labs can dramatically cut down on the sample size needed and non-invasively track physiological changes, such as tumor growth. This saves researchers time and money, and saves the lives of many lab animals as well. Though it's currently being viewed as a preclinical research tool, the device may be used in other research labs such as biology or neuroscience. "The more people who get to use it, the more people coming out with interesting, relevant data," Bezanson enthuses.

As for his own future, Bezanson says he hopes to stay in Halifax after wrapping up his PhD and work on growing a startup company.

Inventors give athletes added PUSH

with new device



There is no question that **Mike Lovas** (BEng'05 Mechanical, MASC Biomedical'07) has a passion for product and healthcare design. The Chief Designer of PUSH hardware has been working with the company's CEO and co-founder Rami Alhamad, and their team, to launch the first-ever fitness tracking device that measures strength.

Paired with an elastic armband that is worn during workouts, the PUSH device has a motion sensor, orientation sensor, Bluetooth 2.1, a rechargeable battery that lasts between six and eight

hours, and a button for LEDs for basic input and display. It feeds data to an app that features an exercise database, motion analysis, sharing and tracking, as well as visual reporting of the data.

"What sets PUSH apart from other fitness tracking devices is that it is specifically aimed at athletes who want data about general activity levels," explains Lovas.

"It's intended for athletes who depend on informed workouts to push themselves further."

PUSH uses an accelerometer and gyroscope to capture motion and orientation data that are then processed by custom algorithms in your smartphone or computer. The result is understandable and actionable information you can use to keep improving results safely.

It was Alhamad who first had the inspiration for this technology. A mechatronics engineer from Waterloo, he'd injured his knee and realized he had no objective way of knowing what he was doing, how hard he was working, or if he was even doing his exercises correctly. After combing through available literature, he discovered a scientific rationale for tracking an athlete's force, power, and velocity to help optimize training and enhance performance. Together with Lovas, he began to build PUSH.

The Toronto-based startup's office is located in the MaRS Innovation building and has grown from three co-founders to a team of 12. They are currently looking to add three more employees. "We started with an idea, a basic prototype,

and a founding team," explains Lovas. "We were accepted into an accelerator called JOLT, raised some seed funding, and started building out our team."

Since then, the PUSH team has been extremely busy. "We're now in beta-phase, where we are testing our product with pro, collegiate and varsity teams around North America. We're focused on shipping a solid, accurate, user-friendly weight-training device for athletes, as well as a team system that will cater to groups of players training together with a coach, this summer."

Lovas attributes his success in developing PUSH to his engineering education. "My analytic problem solving skills gave me a broad foundation in biomechanics, ergonomics, and the language to liaise with contractors and manufacturers. My engineering degree from Dalhousie, combined with a degree in Industrial Design, has given me a more creative and human approach to product development."

Individual users can preorder the device for a one-time payment of \$139. There is also a subscription software and service product for coaches and teams that features a dashboard so they can compare and track results regularly.

Lovas sees a bright future for PUSH. "We would like to eventually move into sport-specific applications and look at working in the physiotherapy and rehabilitation space. I think there are lots of areas that PUSH can tap into."

Alumni spotlight: Janice Marsters in Hawaii

Honouring the past, protecting the future

Growing up in Hantsport, N.S., **Janice Marsters** (BEng'83 Civil, MEng'86 Civil) had a strong desire to experience new surroundings and try new things. So when she received an offer to assist a professor at the University of Hawaii with geophysics work, she accepted it.

That was 26 years ago. Marsters not only completed her PhD in marine geology and geophysics, she made Honolulu her home, establishing a successful engineering career in one of the world's most breathtaking places.

Recently, Marsters had an opportunity to explore Hawaii's splendor further. She and her employer, Kennedy/Jenks Consultants, were contracted for a project at Hawaii's Kalaupapa National Historical Park. It involved engineering design and environmental consulting for the emergency repair of the Kalaupapa dock and structures.

Access to the Kalaupapa peninsula is tightly controlled and extremely limited. "The project site has incredible natural beauty and a rich history," says Marsters. "The peninsula is situated on the north shore of the island of Molokai and isolated by 2000-foot cliffs to the south, and treacherous seas to the west, north and east. It is simply one of the most remote and beautiful places on earth."

It is also a place of great significance to Hawaiian culture and history, serving as a Hansen's disease (leprosy) colony, during the late 1800s to the mid-1900s. Over 8,000 people were exiled to Kalaupapa. Most were native Hawaiians, who had no immunity to the disease. For years the conditions were very harsh, and the dignity and pride shown in



Engineering design and environmental consulting for dock repairs at Hawaii's Kalaupapa National Historic Park has been one of TUNS grad Janice Marsters' most challenging – and satisfying – projects.

the face of suffering at Kalaupapa are now significant in Hawaiian culture. Approximately one dozen patients still live there, sent to Kalaupapa as children back before a treatment was discovered in the mid-1900s.

Kennedy/Jenks has a contract with the US National Park Service, which has taken over management of the peninsula. Their projects for the Park Service have included the dock repair which Marsters says was challenging to design and construct. Environmental resources had to be safe-guarded, as did the historical and social significance of the site's facilities.

"The dock repair was essential as the majority of supplies come to Kalaupapa by barge once a year during the summer when the sea state is calmer," she explains. "The dock is the community's lifeline."

It was the perfect project for Masters, who is passionate about helping clients manage overwhelming environmental challenges. "There were many isolation and logistical challenges. The pristine

ecological setting, including sensitive corals and endangered monk seals required significant protection measures during construction. The Park Service engaged the community early on in the project, and often. They provided a lot of wisdom, which was essential to the success of this project."

In 2013, Kennedy/Jenks Consultants won an American Council of Engineering Companies – Hawaii (ACECH) Engineering Excellence Award for the success of the Kalaupapa project. This past January, Marsters received the first ACECH Koko'o Award. Created this year for the organization's 50th anniversary, the award recognized Marsters' extraordinary service in improving the business landscape for Hawaii's engineering firms.

When asked about the most valuable lesson learned at TUNS, Marsters replied, "I always felt encouraged to try new things and to do whatever it was that I wanted to do." And that is exactly what Marsters has done.

Rebirth of Drilling in Nova Scotia

Sandy MacMullin (B.Eng'81) saw the writing on the wall, and it wasn't good.

It was 2007, and Nova Scotia's offshore oil and gas industry was in sharp decline. Just seven years before, the Sable Offshore Energy Project held the promise of a bold economic future for the province. Yet the majority of the wells drilled since that project came online had come up empty or were deemed uncommercial. The industry's major players were losing interest in the offshore and its exploration potential.

"We started wondering what we could do to bring that back," says MacMullin, Executive Director of Petroleum Resources with the Province.

What MacMullin and the province did was pretty groundbreaking. Seeking to reverse that decline, they commissioned

a comprehensive atlas of Nova Scotia's offshore resources and geology, and made it available to industry for free – an unprecedented step for a government – much less a provincial government – to take. Released in July 2011, the 350-page atlas ('Each page is like a piece of artwork in terms of the detail,' says MacMullin) generated more than \$2B in exploration commitments from Shell and BP to date.

"That's not bad for a \$15M investment," notes MacMullin.

The atlas may have been a big risk for the provincial government at the time, but the bigger risk would have been to do nothing, according to MacMullin. "We had a consultant look at how big oil saw Nova Scotia as a place to invest. What we hoped we wouldn't

hear was that the risk associated with our geology was so high that exploration was economically unfeasible. And that's exactly what we heard. Companies were telling us 'until you can convince us that there's a good case to go back into offshore Nova Scotia, we're not coming back any time soon.'"

Determined to make that case, MacMullin and the province engaged former BP employees for their advice. "It was important for us to get people who did this for a living successfully, who knew what was needed to sell an investment opportunity. They came back and said we needed to do a Play Fairway Analysis (PFA) because it's fundamental for the industry majors."

Analyses are nothing new for industry or government. They've been conducting



them for years to try to assess the potential and mitigate the risks of exploration. But governments have tended to be selective or piecemeal in those assessments, and industry players like Shell and BP always kept their exhaustive analyses internal. MacMullin and the province saw an opportunity to be innovative and create an atlas that combined the best of both worlds.

“We decided to do the PFA in the way that a major company would do it – to put together a comprehensive assessment of the potential, which no government has ever done before. Then, we decided to give it away so the BPs, Shells and Chevrons would know what a super major-standard PFA looked like for offshore Nova Scotia.”

Giving it away was the real innovation, according to MacMullin. “These companies are responsible for identifying new exploration opportunities. By making this kind of analysis available publicly, we knew they’d have to look at it, and that they’d have to make a decision: ‘Is anyone else there? Maybe we should swoop in and pick up as much as we can.’”

MacMullin adds that the researchers and academics selected to work on the atlas, under the direction of the Offshore Energy Research Association, currently chaired by Dr. Josh Leon, Dean of Engineering at Dal, were all industry recognized experts, and the content was peer reviewed. “We wouldn’t have been able to deliver the level of detail we were able to provide in the PFA if it weren’t for the university community in Nova Scotia, particularly Dalhousie. Specialists like Chris Beaumont and Keith Loudon provided hugely invaluable advice to this effort as did researchers from St. Mary’s University.”

With projections of 120 trillion cubic

feet of gas potential and 8 billion barrels of oil, it didn’t take long for the atlas to reignite interest in Nova Scotia. In the first call for bids following its release, Shell was awarded four deep water parcels for a combined bid of \$970M. In the second round, BP was awarded four parcels for a combined bid of \$1.05B, while Shell was awarded another four parcels valued at \$32M.

Although there were no bids on the Northwest Shelf area in 2013, MacMullin isn’t concerned. For one, those parcels are targeted to a different type of investor, and he believes it will take a bit more time to bring those companies online. Also, he and his colleagues are continuing to work on the atlas, adding new data to fill in gaps while expanding the geographic area covered by the PFA into areas such as the Sydney Basin and the Laurentian sub-basin. He’s expecting interest in the 2014 call for bids to be strong and says we only have to look at the economy of Newfoundland and Labrador to see what renewed exploration and production activity can ultimately mean for Nova Scotia.

“They went from a have-not to a have province. That’s just on royalties. There are also taxes, employment and fabrication opportunities to consider, so oil and gas can be a huge game changer for us.”

He continues: “I think the future of oil and gas is very bright, but I don’t think any of us can afford to be complacent. We need to see the results of the next phase of exploration activity and see what that tells us. But until that happens, we need to follow the blueprint we’ve developed since 2008 – to continue with a program of very focused research tied to competitive bidding opportunities so that industry sees this as an attractive place for investment.”



The Rowan Gorilla III in Halifax Harbour in 2009. The rig is currently stationed off Trinidad.

Education that **changes the world**



Third-year Electrical Engineering student **Alex Harding** is passionate about the role of international students in higher education – particularly, refugee students coming to Canada to seek a better life.

“I believe these students are one of Canada’s greatest assets,” he says of the students he’s connected with through the World University Service of Canada (WUSC) organization. “They are my heroes. When you realize the obstacles they’ve overcome to get to Canada, it is incredibly inspiring.”

Harding’s volunteer work with WUSC is one of the many accomplishments that led to his being awarded a 3M National Student Fellowship. He’s the

first ever Dalhousie student to receive the fellowship, and one of two ever in Atlantic Canada.

The fellowship is awarded each year to 10 full-time college and undergraduate university students who have demonstrated outstanding leadership and taken their academic experience beyond the classroom.

Thinking globally

For someone only in his third year of university, Harding’s accomplishments are quite impressive. In 2013, while completing his Certificate in Applied Science portion of his Engineering studies at Acadia before coming to Dal, he served as president of the Acadia’s

WUSC chapter. Under his leadership, the chapter brought in more funding and immigration support for local sponsored students from international refugee camps than ever before in the university’s history.

This international commitment to helping others succeed is the driving force behind Harding’s education, and he’s always looking for ways to integrate it into his studies. For example, as part of a school project, Harding created a \$90 dual-axis solar stove prototype, which is currently in post-development to be deployed to Kenyan refugee camps. He’s also published a mathematical model to reduce power estimation error on wind turbines by up to 30 per cent

– again, with an eye to international development opportunities.

He credits his can-do attitude to the inspiration of his brother, younger by five years, who was born with autism.

“Christopher has taught me that intelligence isn’t one dimensional. He faces learning hurdles that you or I could never even dream of, and yet still breezes through Calculus before he’s even old enough to drive.”

“The human mind is a very curious thing,” he continues. “Sir Isaac Newton had difficulty commanding a class, let alone an army. Napoleon would probably write the worst symphony ever heard, and Beethoven didn’t derive a single equation. Yet still, each was brilliant in their respected field.”

Unlocking potential

As part of the fellowship, Harding has been invited to join other award winners at the 33rd Annual Society for Teaching and Learning in Higher Education (STLHE) conference at Queens University in June. The conference’s theme is “transforming our learning experiences.”

“We’ve grown up in a post-secondary system that we must adapt to in order to survive,” says Harding, reflecting on the theme. “It’s time for that system to also be able to adapt to us. For the first time, we have the technology and the resources to take on the first steps in truly tailoring our learning experiences to each unique student in a way that finally begins to unlock their hidden potential.”

In preparation for the conference, Harding has set up discussions and interviews across campus to consolidate the ideas and desires of his fellow students.

“My goal is to build a solid knowledge base and understanding of how we as students transform the way we learn. Having Dalhousie represented in STLHE’s student branch is a terrific opportunity, and I can’t wait to bring our ideas to the spotlight.”

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From classroom to industry

Senior Design Expo showcases projects from all disciplines



The Faculty of Engineering held its **First Annual Engineering Design Expo** in March at the Sexton Memorial Gymnasium.

The poster competition and expo showcased senior design projects from all engineering disciplines. "The students put a tremendous amount of work into their senior design projects. An important part of the expo was having their design projects evaluated by judges from industry. The opportunity to receive valuable feedback on their work, from industry professionals, is an excellent opportunity for them," said Dr. Clifton Johnston, Associate Professor and NSERC Chair in Design Engineering.

The senior year design projects, integrate course work and engineering design skills, the projects provide innovative solutions for many local industrial partners, and is a great example of the Faculty of Engineering's commitment to good engineering and design.



Photos at right: (top) Chevy Phillips (partnered with Billdidit) displays his Base Drum Pedal project to Joshua Leon, Dean of Engineering. (middle) Hilary Sears (partnered with Satlantic) demonstrates the Hypergun (a Hyperspectral Radiometer) to an expo judge. (bottom) Justin Pruss and Justin Wong (partnered with Thermo Dynamics Ltd.) are pictured with their project the Micro Combined Heat & Power for single-family homes.



Minister of State (Science and Technology) visits Engineering

The Honourable Ed Holder, Canada's new Minister of State (Science and Technology), dropped in on Sexton Campus in April. Dalhousie's President Richard Florizone, AVP Research John Newhook and Dean of Engineering Josh Leon led the minister on a Faculty tour.

Two Industrial Research Chairs, Graham Gagnon and Stephen Corbin, hosted Minister Holder in their labs. They took the opportunity to talk about their research programs and introduce the minister to some of their students.

Dr. Gagnon holds the Natural Sciences and Engineering Research Council of Canada/Halifax Water Industrial Research Chair in Water Quality and Treatment. Results from his team's research are being applied by the water industry to create sustainable water treatment infrastructure throughout North America. The team has held research partnerships with First Nation communities, federal and provincial agencies, private industry and municipal agencies like Halifax Water.

Dr. Corbin holds the Natural Sciences and Engineering Research Council of Canada/Pratt & Whitney Industrial Research Chair in Structural Brazing and Processing of Powder Metallurgy Superalloys. His team is working on developing more cost effective gas turbine engine manufacturing methods that use less energy, result in less waste and reduce the overall impact on the environment. Dr. Corbin's team also conducts research on light weight metals in partnership with the automotive industry.



The Honourable Ed Holder chats with Dr. Stephen Corbin, Dr. Graham Gagnon and PhD student Yamuna S. Vadasarukki on his Faculty tour.

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Campus News



Supermileage team competes in Houston

The Dalhousie Supermileage team had a great finish at the Shell Eco-marathon Americas competition this past April in Houston. The team came in 4th overall out of 41 teams. They completed 99 kilometres over ten sessions without any sign of reliability issues. The team's final result was 2191 mpg (970Km/L) achieved. This was over double the team's previous car.

The Shell Eco-marathon Americas is a unique competition that challenges teams to go further rather than faster and strive for the highest fuel-efficiency



Engineering salutes Sexton Scholars – The Sexton Scholars Reception was held in March at the Lord Nelson Hotel. The Sexton Scholar designation, named for Frederick H. Sexton, PhD, is unique to the Faculty of Engineering and is bestowed upon students who achieve a GPA of 3.85 or higher with an average of 85 per cent or above. In addition a full course load must be maintained in one or more academic terms during the calendar year. Each award recipient deserves our hearty congratulations for a job well done.

Events & Highlights

Winning ways



Dal Engineering had first place teams in two categories at the 29th Annual Canadian Engineering Competition (CEC) – pictured are the Re-engineering Team (above) and the Consulting Engineering Team



IIE Annual Student Conference – Dal's delegation earned first place in both the technical paper and theoretical competitions.



Dalhousie Engineering Graduate Society (DEGS) awarded Best Departmental Society.

Sexton Campus Alumni Events

On Saturday May 3, a tradition continued with our annual taste of the Maritimes Lobster Dinner in Calgary. This annual event brings together alumni and friends of Tech, TUNS and Dal Engineering. Guests enjoyed a delicious meal, laughter with friends and a lobster auction.

Our Dal Engineering Alumni Chapter has been hosting this event for over twenty years. Some members of the chapter have been friends since their undergraduate days in 1975! The group organizes and hosts an excellent dinner, and also takes care of cooking of the lobsters themselves. Guests enjoyed two-pound lobsters, what a treat! A big thank you to our alumni: Sid Isnor, Bill Ellsworth, Ralph McNeil, Jon MacConnell and Ken Bahadur for hosting another successful event.

Now's the time to make plans for Homecoming 2014 in October. Visit engineering.dal.ca to keep up to date about alumni events across the country and around the world..



From lobster in Calgary to Spring skiing in Banff, Sexton Campus alumni are always ready for great times together.

HOME COMING 2014

*Bring out your
Black & Gold!*

OCTOBER 16-18

Join the fun on campus this fall.

Faculty of Engineering events:

Dean's Coffee Club, Sexton Tour and Welcome Reception, Class of '64 50th Reunion

PLUS, The Dalhousie Alumni Dinner, President's Reunion Class Social, Tiger Family Fun Run and post-run brunch

dal.ca/homecoming2014



Class Notes



Some of Dal's newest engineers celebrate at this Spring's Iron Ring ceremony.

1960s

Eric Jerrett, BEng '64 (NSTC civil), Eric and his wife Elizabeth (Betty) were recently presented with the Queen's Diamond Jubilee Medal. Both had previously received the Queen's Golden Jubilee Medal as well as other community, regional, and provincial awards for their work in volunteerism and preserving heritage and culture. Additionally, Eric has received the TUNS Alumni Achievement Award and the MUN Lifetime Achievement Award and the Order of Canada. Before retiring, Eric was the only person in Canada licensed to practice engineering, architecture, and land surveying, and a Notary Public. They continue to reside in Bay Roberts, NL.

Paul Marriner, BEng '66 (NSTC mechanical), owner of Gale's End Press, recently published his tenth book. *Mahone Bay Mornings* is a collection of 81 images shot in the Mahone Bay area on the southwest coast of Nova Scotia. All were taken in the morning, many at or before sunrise, and encompassing all seasons.

Images include local wildlife, wildflowers and activities, but are primarily land and seascapes. He can be reached via his website at www.galesendpress.com

Brian Warnock, BEng '69 (NSTC chemical), continues to practice law in Arizona, where he has lived since 1984. He is managing partner of a multi office law practice focusing on Plaintiffs' injury and insurance issues. His youngest daughter is a partner in the firm, while his oldest daughter is a physician in Barrie ON. Brian and Wanda have been married for 45 and have 7 grandchildren. The couple splits their time between Arizona and a home in Montana where they enjoy pheasant hunting with their bird dog and fly-fishing. And thanks to the miracles of engineering he can still practice in Arizona in the summers via the web and teleconferencing. If any classmates are traveling in either area, please get in touch: bwarnock@lawwmc.com

2nd ANNUAL ALUMNI PHOTO CONTEST

Where in the world is Dalhousie Engineering?



Where has Dal Engineering taken you? Has your engineering career taken you to interesting places? Have you worked on interesting projects? Show us where you've been, what you've been up to or the people you've met along the way – the only limit is your imagination!

For full contest rules and more information on how to enter, please visit: dal.engineering.ca/alumni and click on Alumni Photo Contest.

Contest is open to alumni of NTSC, TUNS and Dalhousie Engineering, and current Dal Engineering students and faculty.

Deadline for entries: 4 pm, September 26, 2014.

1980s

Denise Trim, BEng '87, MEng '99 (TUNS), After close to 24 years with Public Works and Government Services Canada, Denise is excited to be moving on to the position of Corporate Management Officer, Atlantic Region, with the RCMP.

1990s

Lori Andrews, BEng '99 (TUNS environmental), has joined Waste Diversion Ontario (WDO) in Toronto as their new Data Manager. Lori will be responsible for the overall management of data and information for WDO. This includes administration, development, implementation verification and analysis of the annual Blue Box Municipal Datacall (an online survey of Ontario municipalities) and for management and analysis of data and information from other sources that WDO may require in its oversight of the Waste Electronic and Electrical Equipment (WEEE) Program, the Used Tire Program, the Municipal and Household Special Waste (MHSW) Program, and any Industry Stewardship Organizations (ISOs).

KEEP IN TOUCH

We welcome news and updates from our alumni around the world, and would love to hear from you!

Class notes can be sent to media.engineering@dal.ca or you may submit via class notes on the alumni website alumni.dal.ca/class-notes. Please be sure to include your year of graduation and discipline.



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Remembering J. Clair Callaghan



Dr. J. Clair Callaghan (1933-2013), will be remembered for his lasting contribution to Engineering in Nova Scotia and particularly for the contribution he brought to the Sexton Campus.

Dr. Callaghan was a dynamic individual with a unique combination of skills and abilities, making him a powerful visionary. In addition to his interest in the specialties of engineering, he was passionate about literature and fine arts and held a Bachelor of Arts from St. Dunstan's University (now a part of UPEI). His study in humanities provided a nontechnical knowledge base allowing him a platform to forge relationships within the private, legal and political sectors. These relationships, in turn, contributed to the success he achieved during his twelve years as president of TUNS.

Dr. Callaghan's strong engineering leadership and deep grasp of all engineering disciplines allowed him to champion high standards in education and in the teaching of engineering, through which he largely shaped the

curriculum and the landscape at Sexton Campus. The profile of engineering education was raised under his direction as enrolments more than doubled during his tenure. The curriculum was enhanced with the addition of a computer science program and Sexton Campus developed into a major engineering research center.

Influential outside of education as well, he was instrumental in developing tidal power in Nova Scotia with the creation of the Annapolis Tidal Station. He established the Nova Scotia CAD/CAM Centre and held patents for the HAUL-Down system (Bear-Trap) used in the Canadian Navy. In addition to being a consultant for most of his life, Dr. Callaghan was also a volunteer and served on numerous committees such as the National Science Library, Nova Scotia Research Council and CBC.

He was confident that engineers could do a great deal to enhance the quality of life for others, and was passionate about their potential to achieve and create. He believed that the possibilities were endless. To ensure the future of engineering education, Dr. Callaghan was proud to champion a very successful fundraising campaign on the Sexton Campus.

In his memory the Faculty of Engineering has established the **Clair Callaghan Memorial Fund** and welcomes contributions from those who wish to honour and remember their friend and colleague. For more information please contact: Terri Mann, Alumni and Donor Relations Officer at terri.mann@dal.ca or 902-494-1378.

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Glen Arbour Golf Course

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For more information, and to register, contact:

Terri Mann · Tel: 902.494.1378 · Email: terri.mann@dal.ca



Co-hosted by
Sheldon MacDonald, BEng'05, (Electrical)
and **Len White**, BEng'75, (Civil)



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