NEW FLU MASK
uses salt to kill bugs

FEMTOSECOND LASERS
can weld neurons & boost research

ATHLETE BRODY CLARKE
our own all-Canadian baller

UOFA ENGINEER

Keeping in Touch with Alumni Spring 2017

3 Paths to cool jobs at iconic tech companies

Meet Geeta Belas, the UN's intentional civil servant

Take a trip on Alberta's ring roads with the builders

Entrepreneur + Much More

Hemi Thaker occupies quantum states in Texas

Alberta's first spacecraft
PAGE 10

WE'RE BUILDING FUTURES

You may recall from your days here as a student that things are always changing at the Faculty of Engineering. Because we've seen almost continuous growth during the past couple of decades, it might seem as if something's wrong if we aren't opening one new building or another. But the growth of the past has positioned us to provide even stronger learning experiences to our students and to expand our research capabilities. We're doing this today by changing the shape and nature of new student workspaces and providing new learning opportunities.

By this time next year, our students will have brand new design studios, an engineering garage and a student-run maker space, located on the second level of ECERF and ETLC, and in the shop area of the Mechanical Engineering Building.

Students today need access to well-equipped spaces where they're able to dive into the creative side of engineering using the best tools and technology available. We already provide an outstanding foundational education and with these spaces, we're expanding on that. It's increasingly clear that our students need more experiences and more places where they can just build something.

To paraphrase one of our current students, spaces like this are all about experience and engagement. By providing them the opportunities to design, build and market their own products, we're ensuring that University of Alberta engineering students continue to be the graduates of choice for industry. We are giving them the tools to write their own future, to make their own mark.

The excitement about these projects is as palpable as the renovations now underway to create these opportunities. We aren't building walls, we're tearing them down. We aren't building facilities, we're building futures.

We can't do this alone. We're partnering with other faculties and other universities to enrich the educational experience and to empower our students, breaking out of silos and groupthink. And for the support of our alumni family and other partners who support these activities, thank you.

J. Fraser Forbes PhD, PEng
Dean of Engineering

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Spring 2017 Issue 41

Dean of Engineering
J. Fraser Forbes PhD, PEng

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UNIVERSITY OF ALBERTA

FACULTY OF ENGINEERING

12 GEETA BELAS

She worked in post-combat field locations in Sudan and Iraq before heading to UN headquarters in New York.

Photography: Jeff Weiner

FEATURES

DEPARTMENTS

Computer engineering alumnus Hemi Thaker is planning his next entrepreneurial venture at his home in Austin, Texas. Photo: Sarah Wilson.

ENGGNEWS

MEET THE NEXT GEN

NEW VOICES: Kairi Pawlick is the inaugural chair of the Young Alumni Council at the Faculty of Engineering.

Photography: Curtis Comeau

My name is Kairi Pawlick and I graduated from civil engineering at the U of A in 2005. I work as a senior associate and project manager in land development at Stantec Consulting and I'm also part of the faculty's newly formed Young Alumni Council, an organization whose time has come.

Dean Fraser Forbes told me it isn't uncommon now to have graduating classes of more than 800 people at the faculty. And alumni who have graduated in the last 10 years currently represent one-third of living alumni—a figure that will quickly approach half. The faculty wants to do a better job of engaging these graduates.

I confess I'm a serial hand-raiser. I've been involved with Edmonton's NextGen Committee for three years now, I volunteer with APEGA's outreach program and I act as a mentor in Stantec's emerging leaders program. I spend time thinking about developing the next generation of leaders in our community and I'm excited to carry this experience forward with U of A engineering grads of the past 10 years.

First, our council will establish who we are, what we plan to do, why it's important, and how we'll achieve it. We'll identify gaps in programming and services and we'll provide direction to the faculty for how to meet the needs of young alumni, and we're looking for your ideas. The best way to stay in the loop is through social media (@kpawlick on Twitter) or by emailing the council at enggyac@ualberta.ca. I look forward to hearing from you.

Students at Work

They Had a Blast

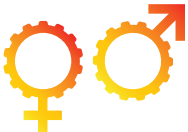
Students John Grey and Darian Van Paridon, in fourth-year engineering physics, and Henry Su, in fourth-year chemical engineering, went to Norway and successfully launched a sounding rocket, entering the world of international space research as part of the Canada-Norway Student Sounding Rocket (CaNoRock) exchange program.

Beyond the Pump

After winning first place at a competition in the U.S., the 2016 EcoCar team represented Canada at a clean-energy race in London, England. And members of the student team competed in the Shell Eco-Marathon Europe and the Drivers' World Championships racing Alice, their hydrogen-fuel-cell-powered car. On March 30, 2017 EcoCar team unveiled its latest car, called Sofie, and later took both cars to Detroit for another Shell Eco-Marathon. Sofie performed exceptionally well on the first two attempts, until loaned parts recouped from Alice created a safety warning that forced Sofie to the sidelines. Look for a triumphant return next year.

Dean's Research Award

This year's suite of Dean's Research Awards projects included a different kind of undergraduate research project. Engineering undergrads Juliana Dobbie and Natasha Pye looked at gender diversity in the Faculty of Engineering. Among their discoveries, the number of women studying engineering at the U of A has hovered at about 20 per cent for several years. But historically, women have had a strong presence in student leadership, with a steady representation of female vice-presidents in the Engineering Students' Society, at about 40 per cent.



Diverse Work

A new student-led initiative created the Diversity in Engineering (DivE) Group, whose purpose is to identify and address gaps in engineering curricula, student services, student culture and life. One way the group hopes to increase the number of women studying and practising engineering is by equipping students with the tools to face and overcome social and systemic barriers in school and the workplace.

SUPERLOADS

Dilip Dasmohapatra (MEng Civil '73) built many bridges during his career. This one, over the Athabasca River, was notable because it had to be able to carry a heavier load. Dasmohapatra designed it jointly with J.C. Yih and managed the two-year project. It was built in collaboration with Alsands, and funded by the Government of Alberta and Shell Canada. It opened to traffic in 1981.

A few years ago, this vessel, which is used in the petroleum extraction process, was built near Red Deer and needed to be moved to the oilsands. Because it was oversize and over-capacity, before the so-called superload could hit the road, engineers first had to determine if that bridge over the Athabasca (near Fort McKay on Highway 63) could withstand the weight.

Verdict: no problem.

A Tall Task

Third-year civil engineering student Brody Clarke was the only player from the Canadian university league selected for the U19 FIBA World Championship in 2015, where he helped the Canadian team finish fifth. He has earned multiple scholarships for athletics and engineering and, now a seasoned international player, Clarke has moved into a starring role on the Bears' lineup.

In the 2015-16 season, Clarke was named Canada West Rookie of the Year and this year he is a first-team Canada West All-Star who mentors his junior teammates.

Clarke is an Academic All-Canadian, meaning he maintains an average of at least 80 per cent during the academic year.

"Brody is the perfect example of a Golden Bear," said Barnaby Craddock, head coach of the men's basketball team. "He excels on and off the court, constantly working to become the best version of himself."

From a family of NCAA players, he's a forward who stands six-feet, seven-inches.

Clarke was drawn to Edmonton by the strength of both the athletics and engineering programs.

This year Clarke averaged 14.4 points per Golden Bears game, and he led the team with 7.1 rebounds per contest.

He sat out his first year at the U of A in recovery from surgery on both knees, and came back stronger.

Photography: Ryan Whitefield

Top 2 Alumni

BOMB SUITS: Marc Evans designs and tests life-saving suits at Med-Eng.

SAFER SKIES: Logan Jones is a runway expert at work for Airbus.

Two notable Faculty of Engineering alumni made it as far as the Canadian Space Agency's 32-person shortlist of astronaut candidates from an initial list of nearly 4,000: Marc Evans (MEng Mechanical '12) and Logan Jones (Mechanical '06). "It's a notable accomplishment," says Dean Fraser Forbes. "The faculty is so proud to count them among our alumni."

Evans is a successful program manager at Ottawa's Med-Eng, a company that designs, builds and tests life-saving bomb suits and remote-operated bomb-disposal robots. He applies his education and, he says, "the dos and don'ts of planning and conducting experimental research" in his career. He got his first taste of outreach and mentoring while he was in school. "I owe a lot to Renee Polziehn, the grad studies professional development and outreach director, and the outreach team," he says. As an outreach co-ordinator, Evans organized and participated in educational events for K-12 students.

As a summer student at the U of A, Logan Jones worked with mechanical engineering professor Carlos Lange, designing experiments for the tools aboard the Phoenix Mars Lander. Now Jones develops and implements new aviation safety systems, related to takeoff and landing, for the safety department of Airbus. Jones, too, is a big believer in mentorship. Recently, from his home in Miami, he spoke to U of A mechanical engineering students via Skype and later took questions from more students and young alumni in a live Facebook event.

Extreme Cryo

Photography: Supplied

This January, the Extreme Cryo Symposium at the U of A celebrated a milestone 15th meeting. An interdisciplinary effort, Extreme Cryo meets almost every year and offers research groups the opportunity to share expert perspectives in such broad areas as biopreservation and technologies that allow better use of tissues and organs for clinical transplantation and regenerative medicine and research. This year, more than 40 researchers and students attended.

"Our university is a strong centre for cryobiology," says Janet Elliott, professor in the Department of Chemical and Materials Engineering and a Canada Research Chair in Thermodynamics. "And the symposium, which is organized by graduate students, offers students and researchers the opportunity to work alongside other disciplines."

Led by Elliott and professors in the Faculty of Medicine & Dentistry (Jason Acker, Locksley McGann and Nadr Jomha), the U of A's cryobiology expertise lies in the study of biology at low temperatures. Cryopreservation of tissues and organs is a tool to save lives and improve the quality of life for many more.

WARM SMILES: Extreme Cryo student organizers from the faculties of Engineering and Medicine & Dentistry (L-R) Luciana Da Silva Cavalcante, Betty Kipkeu, Nadia Shardt and Ruqayyah Almizraq.

THIS RESEARCH MIGHT MAKE YOU SICK

THE THING WE ALREADY KNOW: A water droplet, when it freezes, will form a little peak, making its profile resemble that of an upside-down peach. Scientist call it the "freezing drop tip singularity" and the peak is always at the same mathematical angle. Mechanical engineering professor Prashant Waghmare's iSSELab demonstrated this effect in a recent article published in the *Applied Physical Letters*. This angle forms under all known conditions.

THE THING WE WANT TO KNOW: Right now, no one knows if a droplet will form that little peak when it freezes in the near weightlessness of outer space. But in the first week of August, Waghmare and a team of students from the Faculty of Engineering will find out. This project was selected by Students for the Exploration and Development of Space (SEDS-Canada) to conduct experiments aboard the National Research Council of Canada's Falcon 20 aircraft.

THE PUKE PLANE: Two members of Waghmare's group, called Team iSSELab, will conduct experiments as the Falcon 20 makes 12 parabolic manoeuvres simulating the microgravity astronauts experience on the International Space Station. And yes, nausea is common.

GOOD TO KNOW WHEN FLYING TO MARS: Students will study the way liquid crystallizes in near-zero gravity, which will be important when it comes to 3D printing in space. 3D printing is revolutionizing the approach to keeping an inventory of parts—a major logistical challenge to space travel. If something breaks on a long trip to Mars, astronauts could make replacement parts using 3D printing, instead of relying on ingenuity and duct tape.

SOUND FAR-FETCHED? Rapid prototyping for repair and replacement of old components is part of the Canadian Space Agency's 2016-2017 Report on Plans and Priorities. "This is the first step," says Waghmare. "And space is where a lot of students will direct their careers."

Low-Cost Flu Fighter

It's an engineering thing, to turn an undesirable result in one application into a victory in another. Hyo-Jick Choi, a professor in the Department of Chemical and Materials Engineering, has developed a new way to treat common surgical masks so they are capable of trapping and killing airborne viruses. His research findings appear in Scientific Reports, published by Nature Publishing Group.

He has been trying to develop a lozenge-type oral flu vaccine that would store and ship easily, allowing health officials to direct the doses where and when they are needed. But the hurdle researchers face is that when the liquid solution dries, sugar crystals form and destroy the deactivated virus used in vaccines, rendering the treatment useless.

Choi flipped the problem on its head, turning obstacle into opportunity. If crystallization is a bug buster, maybe he could use it to kill active viruses.

Choi and his team used another well-known crystal, salt, and applied it to the filters in common surgical masks, thinking it would destroy the influenza virus.

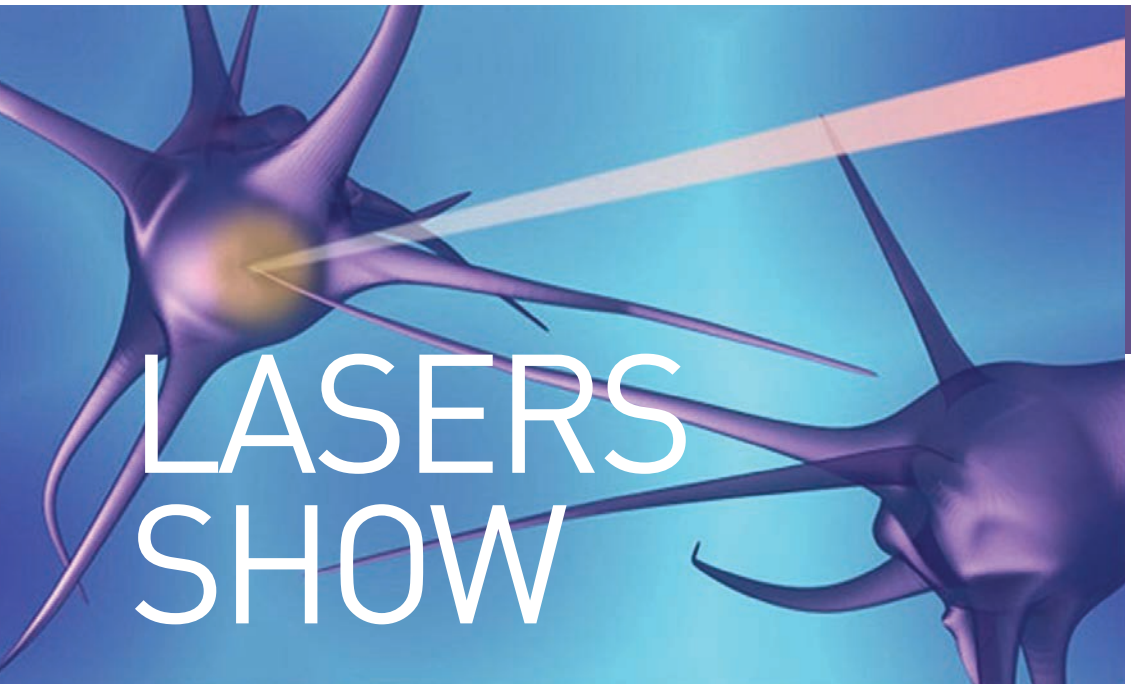
The mechanics of simple chemistry make the treatment work. When an aerosol droplet carrying the influenza virus contacts the treated filter, the droplet absorbs salt on the filter. The virus is exposed to continually increasing concentrations of salt. As the droplet evaporates, the virus suffers fatal physical damage when the salt returns to its crystallized state.

"Surgical masks were designed to protect the wearer from infectious droplets in clinical settings, but it doesn't help much to prevent the spread of respiratory diseases such as SARS or MERS or influenza," says Choi.

Airborne pathogens like influenza are transmitted in aerosol droplets when we cough or sneeze. The masks may well trap the virus-laden droplets but the virus is still infectious on the mask: handling it opens avenues for infection.

Masks capable of killing viruses would save lives, especially in an epidemic or pandemic situation. During the 2014-2015 flu season nearly 8,000 Canadians were hospitalized. That same year, Canadian flu deaths reached an all-time high of nearly 600.

"We realized that we could use that to our advantage to improve surgical masks," said Choi, noting that the masks are inexpensive and common. In a series of experiments Choi's team arrived at a perfect treatment that improves the efficacy of the fibre filter inside the masks. By using a safe substance—table salt—to improve an existing product, Choi (who holds a provisional patent) sees few roadblocks to the innovation.



LASERS SHOW

"I was really interested in the nervous system—if you have a severed nerve, you can't repair it," said Nir Katchinskiy, a PhD student in electrical engineering. "My thought was, what if we could 'weld' it back up right after it's injured?"

It turned out he could, using a device called a femtosecond laser, which generates ultrashort laser pulses, and research by his team earned it publication last year in the flagship scientific journal Scientific Reports, published by Nature Publishing Group. Until now, there was no way to mend neurons, the cells in the nervous system responsible for transferring information between the brain and the body.

"You may not be able to go in and treat the human spine with this yet, but it brings you closer," said electrical engineering professor Abdul Elezzabi, Katchinskiy's research supervisor and co-author of the paper.

The immediate application is for researchers—it's a new tool to work with. It's a breakthrough technique, and now the team is applying it to other medical research and treatment.

Elezzabi hopes to prove that he can use the laser to treat age-related macular degeneration, zapping the fatty deposits inside the eye that are the hallmark of AMD, while leaving the overlying healthy tissue undamaged. A leading cause of blindness, AMD lacks treatment options. Beyond AMD, Elezzabi says femtosecond lasers will provide researchers new avenues for study and treatments of disease in prostate, brain and ocular cancer.

HOW DOES IT WORK?

To conduct the study published in Scientific Reports**, the team put two neurons in a special solution and brought them into contact with each other.**

Then they delivered femtosecond laser pulses—each ultrashort pulse occurring every 10^{-15} seconds (that's 1/1,000,000,000,000,000th of a second)—to the meeting point of the two cells.

The laser compromised the outside layer of the cells, but the inside protective layer remained intact.

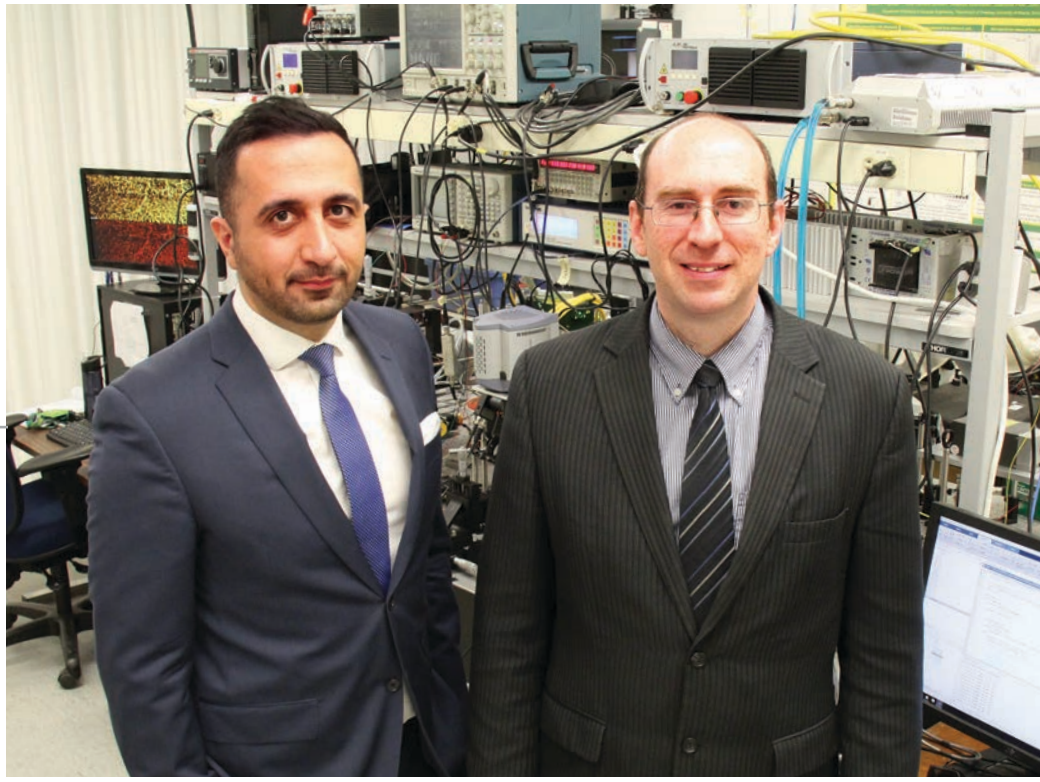
The result? The two cells formed a common membrane at the targeted area.

Throughout multiple experiments, the cells remained viable and the connection strong. It took the neurons 15 milliseconds to stick to each other, a process that would normally take hours.

If at First You Don't Succeed, You May be onto Something

New technology illuminates tumour development

By Mifi Purvis



LIGHT LABOUR: Paying attention to an unusual finding led Parsin Hajireza, left, and his supervisor Roger Zemp, right, to a photoacoustic discovery.

It was a bit of a coup, getting published in Nature's *Light: Science & Applications*, a top-ranked journal about optics, and for Parsin Hajireza and Roger Zemp, it almost didn't happen. But by investigating a puzzling anomaly, these Faculty of Engineering researchers have devised new non-contact medical imaging technology that will be able to deliver razor-sharp pictures to health-care practitioners.

Three years ago, Hajireza was more than a year into his PhD in biomedical engineering under the supervision of Zemp, investigating a technique called photoacoustic imaging. He was at his lab bench aiming a couple of laser beams set to different wavelengths through an ultrasound transducer at some carbon fibres. To his surprise, he saw a signal on his monitor after he had backed the transducer away from his target.

It must be some kind of environmental noise, he thought. He repeated the steps and came up with the same signal. He kept coming back to one idea: the signal represented a non-contact detection of photoacoustic signals. He took the idea to Zemp.

"That doesn't make sense," his supervisor told him, for good reason.

In 1888, Alexander Graham Bell discovered the photoacoustic effect, in which laser light is absorbed and converted to ultrasound waves. Anything that absorbs light, such as blood or even DNA for example, generates an ultrasound wave. Photoacoustic imaging generates high-resolution contrast but, like the more familiar ultrasound, it requires the imaging device to be in contact with the subject. Hajireza was seeing signals that were generated photoacoustically from centimetres away, through the air.

Zemp and Hajireza devised experiments to explain the mechanism behind the mysterious signals, developed a model to describe it, and built a system around it. They called the technique Photoacoustic Remote Sensing (PARS) microscopy. The system trains two laser beams at a target: one a visible pulsed beam to generate reflectivity, the other a near-infrared beam to detect it.

"It's like double-bouncing a friend on a trampoline," says Zemp. "Our pulsed beam creates a change in the reflectivity of a sample, which creates a large bounce. Our near-infrared beam detects it. The effect is much larger than we anticipated."

The new system allows them to see stunning images. They can follow a single red blood cell through a capillary in real time. It lets them see structures that absorb light, rather than scatter or emit light, providing them previously unavailable information.

Zemp and Hajireza, with co-authors Wei Shi, Kevan Bell and Robert Paproski, published the work in *Light: Science & Applications* earlier this year.

The technique, which Zemp and Hajireza are commercializing in a company called illumiSonics, will be useful in clinical applications where traditional imaging isn't possible, in cases such as wounds, burns, tissues during surgery, brain imaging, dental cavity imaging and early cancer detection, when small tumours are building their network of blood vessels. And new developments are enabling them to see deeper into tissues, letting them measure the oxygen in blood and allowing them to glimpse gene expression.

"Sometimes scientists focus on what they expect to see and don't consider other possibilities," Hajireza says. "I think we were successful because we took what I saw seriously and with open minds. Then we spent two years building a system around it."

Anatomy of an Alberta Spacecraft

On April 18, Ex-Alta 1 launched from Cape Canaveral aboard a NASA rocket, docking four days later at the International Space Station. AlbertaSat student club members built Ex-Alta 1 as part of the QB50 mission, a swarm of 38 cube satellites studying space weather in the lower thermosphere. Each the size of a loaf of bread, satellites in the QB50 swarm show that building viable spacecraft can be done quickly and cheaply. The research will help us learn how we might protect Earth's delicate infrastructure from damage caused by solar storms. Ex-Alta 1 was deployed from the ISS on May 26, and the team has begun the commissioning process. The cubesat will also test some specialty equipment designed at the U of A. It's an opportunity for the students, the university and the province to demonstrate a capacity for space technology. Here's a look under the hood of Ex-Alta 1. – *Illustrated by Andy Kale*

DIMENSIONS	30 x 10 x 10 cm
MASS	2.64 kg
PAYLOAD	Fluxgate magnetometer Multi-needle Langmuir probe Radiation dosimeter
ORBIT ALTITUDE	415 km
ORBIT INCLINATION	51.6 degrees

MAGNETOMETER BOOM

The magnetometer is mounted on a 60-cm boom to reduce interference from the spacecraft. While stowed, the magnetometer is secured by the lower boom.

SOLAR PANELS

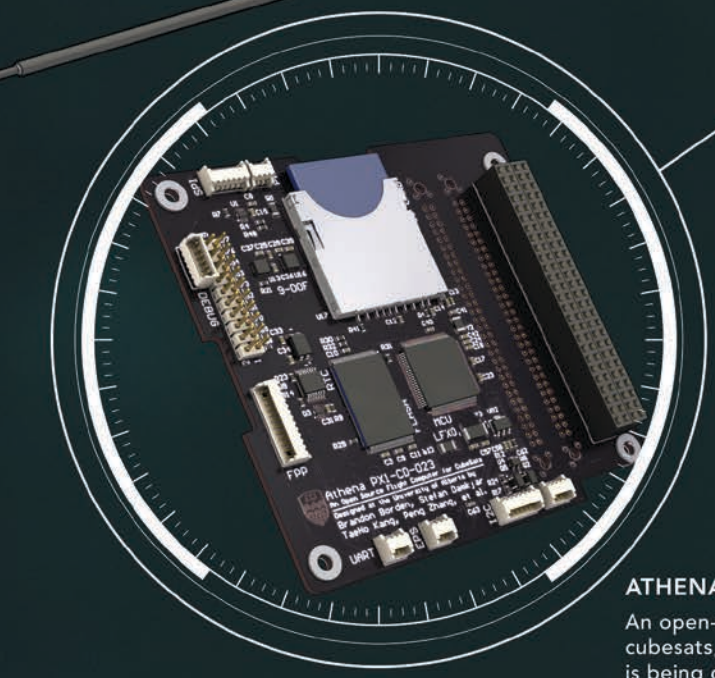
Nine solar panels, each with two photovoltaic cells with 28.3% efficiency, generate power with a peak output of 1.23 W per cell.

MULTI-NEEDLE LANGMUIR PROBE

Four needle probes on the satellite's leading face measure the current, deriving the plasma electron density with high temporal precision.

COMMAND AND CONTROL

The onboard computer stores telemetry and scientific instrument data, transmitting it to the ground station.



POWER STORAGE

Four Li-ion batteries—heated to prevent freezing—store power, providing a reserve capacity of 38.5 Wh.

RADIO TRANSCEIVER

The transceiver provides full duplex communication with the satellite on the 70-cm UHF band. The downlink rate is 9600 baud with a radiated power of 1 W.

MAGNETOMETER CONTROL

Digital control for the fluxgate magnetometer enables higher sampling rates of 100 S/s with 50 pT resolution.

RADIATION DOSIMETER

The dosimeter measures the total ionizing dose, enabling routine radiation monitoring of the spacecraft.

ATHENA

An open-source, onboard computer for cubesats, designed and built at the U of A, is being demonstrated for use in future space missions.

MAGNETOMETER SENSOR

U of A-designed and built scientific fluxgate magnetometer accurately measures magnetic signatures in space weather.

STOWED CONFIGURATION

(underside view)

DEPLOYED CONFIGURATION

(underside view)

DRIVE COIL

Alternating current periodically drives a ferromagnetic core through magnetic saturation, modulating the sensor's magnetic field.

SENSE COIL

Modulated field induces a signal proportional to the ambient magnetic field. Three orthogonal components reconstruct the vector measurement.

EX-ALTA 1 DONORS

U of A's nanoFAB facility etched this silicon chip with the names of donors whose contributions helped launch the cubesat.

VIDEO

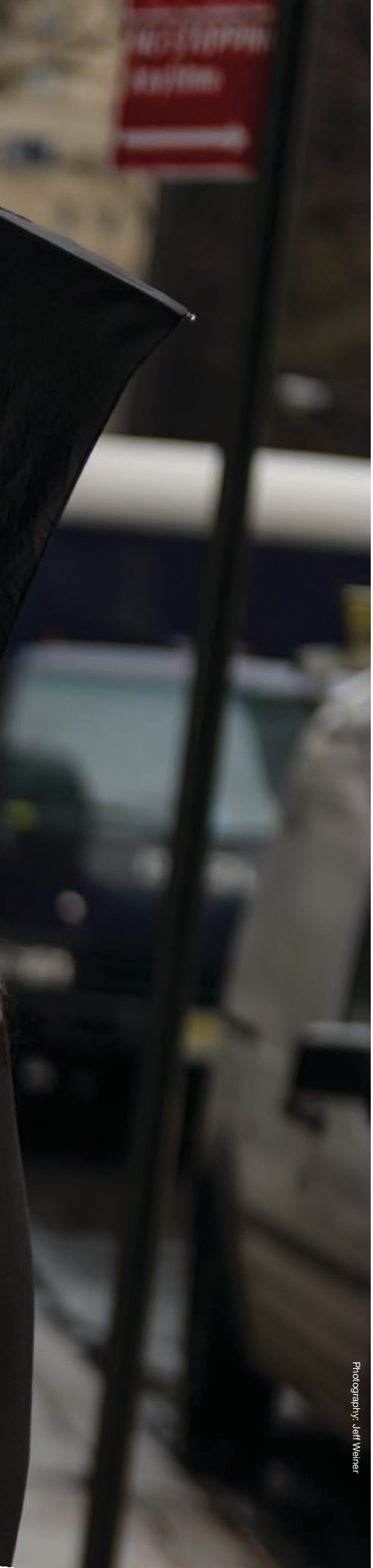
Search YouTube for "Ex-Alta 1" to see the deployment, assembly and a 360° view of the satellite. Follow its progress at AlbertaSat.ca.

ADCS SYSTEM

Attitude determination and control system stabilizes the spacecraft using magnetorquers, a momentum wheel, sun sensors, magnetometer, rate gyros and Sun-Earth cameras.

RADIO ANTENNA

A crossed dipole antenna provides a circularly polarized, omnidirectional signal, insensitive to the orientation of the spacecraft.



Photography: Jeff Weiner

THE INTENTIONAL CIVIL SERVANT

Geeta Belas's profession as a civil engineer and her desire to help make the world better intersect nicely at the United Nations

By Mifi Purvis

In Arabic, El Genenia means "the garden."

It's a city on the western side of Sudan's Darfur province, where the country abuts Chad. And it's where Geeta Belas (Civil '96 and MEng '07) arrived in March 2009.

"I had spent the first three months in El Fasher, the capital of Darfur. In the first month my supervisor asked me if I wanted to go to the field. I thought that he meant supervise fieldwork, so I said 'yes,'" Belas said, "but he meant moving to a deep field location—El Genenia."

Locally, her colleagues called El Genenia "the Wild West" and it became her second duty station in her first United Nations civilian deployment. Belas flew there from El Fasher, a two-hour journey on a UN Mi-26 helicopter. A tank of a thing, an Mi-26 can't fly very high so Belas, wearing a headset to protect her ears from the engine's noisy churn, had the chance to view the desert up close: sand in every direction.

"El Genenia had literally the worst airport," she said, and she has seen her fair share. Collecting her bag, she saw a couple of dusty donkeys amble onto a gravel runway. The supposed garden didn't look much different from the arid plateau surrounding it. But the things you can't see sometimes underlie the character of a place.

Conflicts in the region often boiled up between nomadic herders and farmers over access to land and water, and between the mostly Arab north and the mostly African south. And rebel groups in Darfur regularly conflicted with the government in Khartoum. The year Belas arrived, 300,000 Darfuris were displaced due to conflict. Kidnappings of several UN, NGO and Red Cross staff had taken place, and robberies

Belas and her team built protective barriers in Foroboranga, Sudan.

Geeta Belas on a visit to Mournei, Sudan.

UN workers lived in compounds like this one in Baghdad, Iraq.

Photography: Supplied

and carjackings were frequent. UNAMID staff had to check in daily and observe a 5:30 p.m. curfew.

And Geeta Belas, arriving at the worst airport, was tasked with overcoming logistical challenges in order to facilitate peacekeeping.

"I wasn't sure what kind of engineering I wanted to do at the University of Alberta," Belas said. "I went to a career fair in 1992, where they described types of engineering. There was a display for civil engineering and it said 'Designing the quality of life,' and that phrase really stuck with me.

"Civil was a very demanding program," she said. So she made an effort to participate in extracurriculars for balance. She volunteered with a campus group to speak to junior high girls about careers in science and technology. "I was a member of the civil engineering student society and, in my fourth year, I was part of the Great Northern Concrete Toboggan Race team." About 20 students participated that year. They all went to the competition in Winnipeg and ended up winning the spirit award. "Twenty years later, I still have friends from my undergrad," Belas said.

A year after she graduated in 1996, Belas went to Red Deer to work for Thurber Engineering Ltd., an Alberta company that works with a variety of industries to provide geotechnical, environmental and materials engineering and testing.

"I worked on the Joffre 2000 project," Belas said. An expansion project of Nova Chemicals Corp, it was a $1.4-billion (U.S.) investment. "At the time it was one of the largest polyethylene plants in the world." Belas inspected the piles and worked on the foundation, notable because she oversaw a logistically challenging 24-hour concrete pour.

"I wound up managing the materials testing lab," she said. "It was apparent I had a talent for managing and completing paperwork." Belas stayed at Thurber for five years and, with the encouragement of her employer, started a master's degree at the U of A in construction engineering management.

Eventually, she left her job to work for the Government of Alberta's Department of Transportation as a surfacing standards design engineer. "I loved Thurber and I was proud of my success, but I liked civil service," she said. She continued with her master's, studying part time and working full time at Alberta Transportation as a tender administration and claims specialist and a contracts engineer. "I focused on coursework, and did my assignments," she said. "I found the group work greatly satisfying."

Belas thought she might like to do international development work, but not at the cost of leaving her profession. "I am a civil engineer," she said. "These skills are not common, and I didn't want to give up on engineering." She wondered where she would find the intersection of her skills and interests.

On campus, Belas discovered the local chapter of Engineers Without Borders. EWB aims to facilitate human potential in sub-Saharan Africa by investing in social enterprises and local innovators to eliminate the causes of poverty. In EWB she found a group of like-minded students.

"You know, the United Nations is looking for Engineers with master's degrees," one of her Department of Transportation colleagues, a friend since undergrad, told her.

"It seemed like a good fit," she said. "Six months later I had an interview and they offered me a job in Darfur, giving me a week to think about it. Of course I said yes." She attended civilian pre-deployment training in Brindisi, Italy, in December 2008, where she learned about UN structure, as well as practical skills from how to use a radio to what to do in a hostage situation. Then she was deployed to Darfur.

Her job there was to make sure infrastructure was ready when UN troops, police and staff moved in. "We built everything from the ground up on greenfield sites," Belas said. "A compound, prefab offices and living quarters." About 75 per cent of the crews she worked with were African. She was one of two women in her section of 250 international and national staff.

"One of my achievements in El Genenia was to get six female Sudanese

individual contractors hired to work in the engineering section." She worked with human resources and local NGOs and UN agencies for greater inclusivity.

"Before I took the UN job, more than one person said that I wouldn't do very technical work," she said. But she knew it was important work. Darfur was her first posting and—at less than two years of her nine at the UN—it's a snapshot of her work. "I wanted to go someplace completely different next," she said. Iraq proved to be that.

"It was more dangerous. The first night I arrived—while I was rolling my suitcase into the compound looking for my accommodation—an alarm for an RPG (rocket-propelled grenade) went off in the international zone," she said. She took cover in a bunker until the danger passed.

"There were RPGs overhead, bombings nearby and the constant threat of IEDs (improvised explosive devices)," she said. "Overhead protection was always required."

Most of her time was spent in the compound, behind four-metre-high concrete T-walls. "That's what I saw most of in Iraq. A maze of concrete walls." The size of the mission was smaller and, not surprisingly, most of her engineering efforts went into security refurbishment and construction. The work was different as the engineering section hired contractors instead of carrying out the work themselves.

"We worked under harsh conditions," said Nina Antonias, Belas's colleague from the Iraq deployment. The two met in pre-deployment training and became close friends during the time they worked together, Antonias as a programs and budget officer. "At work she was meticulous and thorough," she said of Belas. They found out they shared a love of travel as the two got know each other on the daily armoured-car commute, accompanied by American and later Iraqi soldiers, between the compound where they lived and the one in which they worked.

For Belas, her year and a half in Iraq was followed by a position at the UN headquarters in New York in the engineering section of the Logistics Support Division of the Department of Field Support. "How can you support a field mission if you have never worked in the field?" she said. She knows because she's done it. Last fall she presented some of her experiences working in the post-conflict zones of Darfur and Iraq to the Society of Women Engineers international conference in Philadelphia.

Since her last field mission, she's lived a calmer and safer life in New York City. She has held a few different positions in the Department of Field Support, including administration management and recruitment for the field missions. In that time, she has travelled for short assignments to Uganda and Italy, and undertook one three-month mission in Bogota, Colombia, her first with the amenities of a modern city.

Last March she returned to the engineering section at headquarters. As on her field missions, she is making the most of New York, learning from co-workers and making friends. "I love Broadway shows and I try to go once a month," she said. She is a cyclist and music lover, and makes the most of living in an air travel hub.

"It's great going places with Geeta because she does so much research in advance," said Antonias, who wound up at headquarters, too. "She finds out all the details about a place—it's a benefit of travelling with an engineer!" Between work and leisure Geeta Belas has been to more than 40 countries and countless airports, including "the literal worst" one, in El Genenia.

From the air, there are things you can't tell about a place. Once, while she was stationed in Darfur, Belas took an R&R break. After her holiday, she climbed on the Mi-26 at El Fasher for the two-hour flight back to El Genenia. She put on her headset and closed her eyes. "I had already taken this flight several times and the landscape is just sand," she said.

"When I woke up I thought something had gone wrong and the helicopter had diverted to Uganda," she said. It was the first time she had seen the transformation of West Darfur in the rainy season, after the brief, intermittent deluges of cartoon-big raindrops.

"All I saw was green below."

AFTER DARFUR, BELAS WANTED TO GO SOMEPLACE COMPLETELY DIFFERENT FOR HER NEXT UN MISSION. IRAQ PROVED TO BE THAT.

Photography: Jeff Weiner

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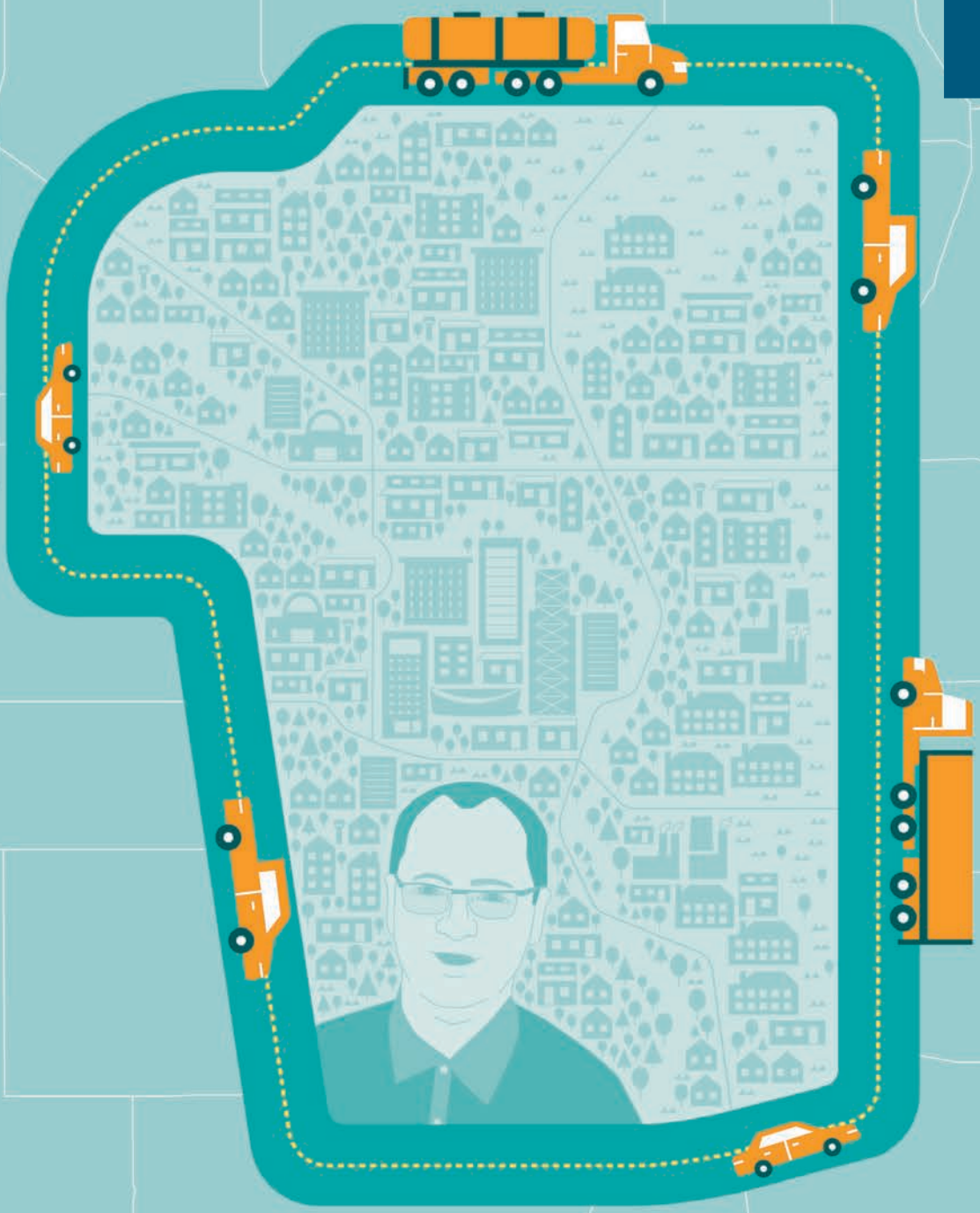

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The next time you drive around Edmonton on the Henday, or the first time you zip from Calgary's Highway 8 to Macleod Trail, spare a thought for the builders. BY CURTIS GILLESPIE

There is something deeply satisfying about a circle. We've known this for millennia and it's why we use them as symbols of wholeness and belonging. Not that Jay Ramotar or Sheldon Foley were thinking these things over the last two decades as they worked on the ring roads that encircle Edmonton and (one day) Calgary, although they do both wear the iron rings that symbolize their status as engineers. They've travelled different paths but their routes converged for a time on Alberta's major ring roads.

Illustrations: Andrew Wedman

Jay Ramotar (Civil '75, MEng '76) was born and raised in Guyana, and after high school his father sent him to Edmonton to help his cousin and his wife with their newborn while the young parents got their careers underway as post-docs at the U of A.

"Every night at their house," Ramotar says, laughing, "I would get lectures from these two PhDs that I had to go to university. I kept asking why. Finally my cousin said to me, 'I get it, you're scared of competing with these Canadian kids.' Well, that did it."

Ramotar got off diaper duty and into engineering. He graduated, worked briefly with a pipeline company, completed a master's, and was successful in an interview with the Alberta government's Department of Transportation. His first day on the job was December 1, 1976. "I didn't want a government job," he says. "My plan was to find a private sector job before too long, but I stayed in government for nearly 37 years! I still can't believe that."

Ramotar stayed because it wasn't just one job. After a couple of decades of moving up the chain in Transportation, he became deputy minister. After performing to the satisfaction of then-minister (and later premier) Ed Stelmach, Ramotar was deployed in various departments as a kind of fixer. Ramotar became deputy minister of Infrastructure, Transportation, the Treasury Board, then Health and Wellness, later stepping in at both Justice and Service Alberta.

Ramotar's big-picture thinking was a major factor in how the ring roads of Edmonton and Calgary came to be. It started in the late 1990s when the City of Edmonton floated the plan to undertake major repairs to the Whitemud Drive's Quesnell Bridge over the North Saskatchewan River. Ramotar knew from his time in Transportation that the province had a semi-dormant ring road plan, and he instantly spotted a problem and an opportunity.

"I knew the province, pre-Lougheed, was buying the land it needed for a TUC (transportation and utility corridor) and ring road. In 1999, when I heard the city was going to widen the Quesnell Bridge, I went to (then-city manager) Al Maurer and said, 'Al, you're going to get slaughtered politically. Those cars won't have anywhere to go during three years of lane closures.' I told him I had an idea."

He realized if they wanted an Edmonton ring road, this was the moment. He got Maurer to agree to hold off on the Quesnell repair if he could make something happen with a ring road. Ramotar and Stelmach went to the Treasury Board to request funds to build the first section of the Henday, the southwest leg. The plan was logical and timely.

"But Treasury Board threw us out," Ramotar says, laughing. "They told us to find the money in our own budget."

He had another idea. The province had been accumulating land for the TUC and ring road for decades; surely they didn't need it all. He directed his team to work with colleagues at Infrastructure to sell the land that would be surplus to a ring road. It still wouldn't be enough, so he embarked on another exercise in problem-solving. "I locked a bunch of my best guys and some private sector engineers in a hotel for three days and told them to take the initial design for that leg and find $25 million in savings with no compromise in safety or quality. They called me three days later and said they could only find $23 million in savings. I didn't tell them I was hoping for $15 million."

The southwest portion of the Henday broke ground in 2000, under conventional funding and delivery methods (the province funded the project and handled contracting and oversight). The project came in on budget and on time, and the city went ahead with the Quesnell Bridge repair and expansion. The first piece of dedicated ring road in Alberta was a success.

But what is it, exactly, that defines success when you're talking about ring roads? Amy Kim is a professor of transportation engineering at the University of Alberta. I asked her via email why she thought ring roads have become a more common feature of modern cities and what makes them advantageous—or not. She says the first ring roads appeared in Europe in the 19th century. In North America, segments of what would eventually become ring roads were initially constructed as


Jay Ramotar


Sheldon Foley

Photography: Supplied

bypasses around cities. Complete rings started appearing around cities during the Eisenhower freeway era in the 1950s and '60s. A ring road can be advantageous, says Kim, for cross-city journeys "when you need to travel longer distances, since it provides a high-speed, access-controlled alternative to city streets. It benefits travellers who want to bypass the city centre, and it allows for greater suburban access. There can also be economic and environmental benefits," she says, "such as directing pollution from the dense urban core, and easier freight movement."

If the number of cars is anything to go by, people like ring roads. But it's not that simple, and there are disadvantages. The number of cars on the road could be a sign of success or simply a sign that people are driving the road because it's there. Amy Kim sees both sides. "In conjunction with other policies," she says, "ring roads can help reduce vehicle traffic in city centres, but on the other hand if there aren't policies to support alternate transportation modes, ring roads can encourage urban sprawl and car-centric development."

Sustainability advocates argue that encouraging more efficient modes of transportation, such as public transit, is better for a city's health. Kim says it takes vision and co-ordination at the municipal and regional levels in terms of land use and planning policy, and transportation engineering. "It's a difficult job," she says, "one that many cities struggle with because of institutional structures and divergent viewpoints."

Sheldon Foley (Civil [Co-op] '98) has spent the better part of his career working within those structures and talking to people with different points of view. During his educational work placements he forged strong relationships with Edmonton's PCL group. After he completed his undergraduate degree, he joined a Denver, Colorado, engineering and construction company called Flatiron Construction. Flatiron transferred Foley to San Francisco to retrofit bridges compromised in the 1989 earthquake.

Next he moved to Charleston, South Carolina, and worked on the largest cable-stayed bridge in North America, after which he moved back to Alberta, eventually landing back at Flatiron in 2009, where he stayed until 2016. "Those were fantastic projects," recalls Foley. "In Edmonton, we built the northwest leg of the Henday, then I was the project manager on the underground LRT station right under Rogers Arena. After that, I was the design build manager for the northeast, final leg of the Henday."

The northwest and northeast legs of the Henday were financed with the P3 model, a public-private partnership, and by the time Foley worked on it, P3 was an efficient process. Jay Ramotar had a hand in that.

A decade earlier, when Ramotar and Stelmach realized there was no way to complete the Henday using conventional financing, Stelmach tasked Ramotar to find solutions.

"I told him something about these things they were using in Europe called P3s," Ramotar says. Ramotar's team created a P3 model, made for Alberta, using what he calls "the best contracting process in the world." Totally transparent, it allowed the province to attract private financing and get value for money.

Like a lot of engineering, the P3 concept is simple but the execution isn't. In the P3 process, a government ensures proponents pass through several gates before taking bids from companies on major infrastructure projects. These companies assume the responsibility to finance, design, build, maintain and partially own the project (often over 30 years). They take more risk than conventional delivery because it means work for their company, and profits for a job done on budget and on time. The government cedes a measure of control in exchange for savings in efficiencies and economies of scale. When a company is contracted to build 20 bridges with the P3 process instead of conventional financing, the company can, for example, push suppliers for a better deal.

The Southwest Calgary Ring Road will have 30 kilometres of six- and eight-lane divided highway, 14 interchanges, one road flyover, a railway flyover, three river crossings and 47 bridges. The northeast leg of the Henday has 27 kilometres of six- and eight-lane divided highway, nine interchanges, two flyovers, eight railway flyovers, two river bridges and (in a quirky coincidence) also has 47 bridges.

There are also risks to the P3 model. Companies can have competency problems or they can push or even sue governments for a better deal as economic circumstances change. Ramotar's group found that the sweet spot for a government's equity position in a project was 55 per cent. It meant a company's failure wouldn't doom a project, yet the company would also have enough invested that they wouldn't walk away. The government benefits from the company's efficiencies and innovation.

"Which is why," Ramotar says, holding up an index finger, "it's key to have a solid agreement. I made sure the Auditor General was in all the meetings, as well as people from Justice and Finance departments. It

was crucial to get these agreements tight. That's the only way P3s can work."

Every segment of the Henday except the first was built using the P3 model. A Government of Alberta report (available on the Department of Transportation website) noted that auditors Deloitte and Touche estimated the P3 cost savings for the Henday's northeast leg alone to be $371 million, realized through life-cycle optimization, economies of scale, construction efficiencies and innovation, risk sharing, and a fixed-price contract.

"That's a lot of money Albertans didn't spend," Ramotar says.

Sheldon Foley oversaw the construction of the northeast leg of the Henday, and when that project was complete he was lured back to his hometown of Calgary to work on the Southwest Calgary Ring Road (SWCRR).

He works for Mountain View Partners, and the title Foley has with the SWCRR project—technical director—is both impressive and vague. I said I didn't know if it meant he runs the whole thing or is in charge of gassing up the dump trucks. He laughed.

"My main job is client relations, to work with the owner, to shepherd design changes through the system if they're not in strict compliance. I also work closely with the design build team. I oversee constructability reviews and review the construction schedule to make sure things are done in the right order. I'm a sounding board for engineers executing technical components of the job, anything to do with girders, walls and foundations. I've built pretty much everything related to transportation infrastructure in my career. I'm in a good position to make sure our team is communicating properly."

Not unlike Jay Ramotar, Foley is an example of how engineers—unfairly stereotyped as poor communicators—frequently find themselves talking clearly across disparate fields.

Foley likes the breadth of civil engineering. You get to build cool stuff like bridges and ring roads but at higher levels you also have to be able to speak as lucidly to a politician as to the guy working the backhoe. "Engineers have a huge hat rack. Your university education puts you through fantastic exercises, but the real learning starts when you jump into industry."

A perfect example of that hat rack is the SWCRR. There are the complexities that come with building roads and bridges, but before that can even start there are considerations Foley's team has to take into account, considerations the public might never hear about. With co-ordination and permitting, come stakeholder relations. Part of the SWCRR passes through Tsuut'ina Nation. Part of the agreement with the Nation is around artifacts—if something of archeological or historical or cultural value is unearthed, there are strict protocols to consult the Nation and protect the object.

"And then there's the unexploded ordnance," says Foley.

The what?

"Part of the ring road crosses through an old Currie Barracks firing range. So we have to move through the whole corridor using magnetic resonance first."

Foley told me of a situation that was just as complex in the final section of the Henday. From about 1850 to 1920 the outer northeast quadrant of Edmonton was mined for coal. The construction zone was cross-seamed with mines, making the subsurface unstable. Foley convinced the province to use spread footings for the bridges, which would allow them to be safely adjusted during the inevitable settling and shifting.

Part of the SWCRR passes through Tsuut'ina Nation. Part of the agreement with the Nation is around artifacts—if something of archeological or historical or cultural value is unearthed, there are strict protocols to consult the Nation and protect the object.

The scope and scale of the work is staggering. The SWCRR will have 31 kilometres of six- and eight-lane divided highway, 14 interchanges, one road flyover, a railway flyover, three river crossings and 47 bridges. The northeast leg of the Henday has 27 kilometres of six- and eight-lane divided highway, nine interchanges, two flyovers, eight railway flyovers, two river bridges and (in a quirky coincidence) also has 47 bridges.

Foley sees the complexity as a blessing because no two days are ever alike, but it can be a curse if you're a young engineer. "Even as an experienced engineer, I still sometimes wake up in the middle of the night. And if you're just starting out, it can be overwhelming."

Which is why Foley has taken co-op students since 2009. It's one thing for students to sit in a classroom experimenting with formulas on moving girders, but it's another thing altogether when a 200-ton girder is dangling from a crane over a bridge deck in high winds and the operator shouts, "Now what?"

Foley gets satisfaction from helping students. "These kids might be on a high wire—we can act as a safety net," he says. "And the experience they get is invaluable."

Jay Ramotar, too, takes pride in his portfolios in the civil service and in the vision and execution of Alberta's ring roads. But the variety of things an engineer can do, he says, is limitless. Including operating at high political levels.

"I've always said there should be more engineers in higher office, because you can involve an engineer in any issue." He pauses and thinks about it a moment further. "Solving problems is in our DNA."

Save the Date

for these upcoming alumni events

For more information, contact the Engineering Advancement Office at 780-248-1673 or enggalum@ualberta.ca.

June 27-28
Graduate Student Research Symposium

Come to this annual faculty-wide event in which graduate students from all five departments share their research results, build interdisciplinary collaborations, network with sponsors and develop professional skills.

June 21
Montreal Alumni and Friends Breakfast

Join us in the Mansfield Room of the Hotel Le Germain in Montreal. Catch up with fellow alumni and listen to expert Nir Katchinskiy talk about his research with femtosecond lasers. (See page 8 for more details about this exciting engineering research.)

June 21
Toronto Alumni and Friends Reception

Join us at the Canoe Restaurant and Bar, TD Bank Tower, 54th Floor. Catch up with fellow alumni and listen to expert Nir Katchinskiy talk about his research with femtosecond lasers. (See page 8 for more details about this exciting engineering research.)

July 12
Calgary Stampede Breakfast

Join us at LOCAL Public Eatery for the Faculty of Engineering's first-ever Stampede Breakfast. Bring your partner—personal or professional—and start your day off the right way.

September 22-23
Alumni Weekend 2017

We celebrate this year's golden grads, the class of 1957, with a luncheon on Friday. In the afternoon, head to Memory Lane before the Dean's Reception to check out the memorabilia. On Saturday, visit Engg Expo to see the latest research and education at the faculty.

Randy Marsden's fight against infection caught Apple's attention.

How I Got This Job

Three engineers talk about the unlikely influences that led them to iconic high-tech companies in Silicon Valley

By Olga Ivanova and Mifi Purvis

Photography: John Ulan

Randy Marsden (Computer [Co-op] '89) returned to his hometown of Edmonton for a visit from his digs in Saratoga, California, earlier this year. It was a homecoming during which he took his teenaged son to an Oilers game. The team was young and trying to find the sweet spot between the frisson of youthful talent and the discipline to make it effective. That night against the Red Wings, with Marsden and his son cheering, the Oilers pulled it off.

A lot of undergrads work hard to channel their own youthful creativity into solving problems. In the late 1980s and onwards, Marsden delivered computer engineering innovations that eventually caught the notice of tech granddaddy Apple. More recently, Steve Harasym (Mechanical [Co-op] '14) parlayed his student club experience into a job with the electric car company Tesla. And Bertie Chen (Electrical [Co-op] '17) is headed for Silicon Valley to a job with Keysight Technologies, an electronic measurement company delivering wireless communications solutions. People are always asking them how they wound up with these notable gigs.

Randy Marsden
manager, iOS Keyboards, Apple

It started as a student project. A friend of mine, Si Peterson, was a paraplegic from a fractured vertebra in his neck he suffered as a teenager. He couldn't speak but he could touch a switch with his lip. I thought, "How can we take that input and make it so he could control a computer?" We mounted a computer on his wheelchair—this is in 1987 and it was the leading edge of digitized audio—and it helped him communicate. A student project changed his life, and it changed mine. Or it was a student project, until Si asked me one question: "Who are you going to help next?" While I was still in university I started a company to aid people with disabilities.

In my work, I've met some interesting people, including Christopher Reeve and Muhammad Ali, both of whom had disabilities that meant they couldn't use their hands. But I also worked with thousands of other people not as famous, such as artist Bill Miller. Bill thought his MS meant he couldn't paint anymore, so we developed a motion-tracking system that allowed him to move cursors on a screen by moving his head. Computers are enabling devices and our technology helped thousands of people.

We developed the solution to help people who couldn't use their hands type faster; it later came to be known as Swype.

A person with limited use of their hands can use their head to draw a path from one "key" to another on an on-screen keyboard. It almost always turns out that what's useful as an assistive technology is useful for everyone. We sold Swype in 2011 and it has been installed hundreds of millions of times on smartphones around the world.

One day we got an order for our motion-tracking software from a dentist in France. I emailed him and said, "You are the only quadriplegic dentist I've ever heard of." Of course he didn't have quadriplegia! Dentists were required to re-glove and clean the computer every time they touched it while treating a patient. He wanted a hands-free system. I looked deeper into the problem and figured we were trying to put a square peg into a round hole. We needed to rethink the keyboard, not the mouse. We developed a flat glass screen keyboard that could be completely and easily disinfected and we started selling to dentists and then hospitals.

And that's around the time when my friend Gil Allen's dad died of a hospital-acquired infection. After strokes, heart attacks and cancer, hospital-acquired infection is the leading cause of death, killing about 100,000 North Americans a year. And you know what the most contaminated surface in a hospital is? Keyboards. So we took our technology, which we called Cleankeys, and made some changes.

Being able to easily disinfect a keyboard is half the battle. Studies showed hospital handwashing and surface cleaning rates go up where hygiene is monitored. So we built monitoring into the keyboard. We programed it so it won't work for the next user until it's cleaned with the right liquid. It can produce a report that will allow administrators to troubleshoot solutions where there are frequent keyboard shutdowns.

Around the time we were selling Cleankeys to hospitals, tablet computers started to take off. With Cleankeys, we'd figured out how to allow people to rest their hands on the touch surface while they were typing—just like they do on a mechanical keyboard. When tablet computers, such as the iPad, came along, it was obvious that our technology could be applied to that paradigm. So we invented Dryft—an onscreen keyboard that automatically forms under the user's fingers, wherever they are on the screen.

Photography: Supplied

Steve Harasym still has a screenshot of his job offer with Tesla.

Dryft caught the notice of Apple, which bought it and hired me. Now I have a boss for the first time (not counting shareholders) and I don't have to worry about payroll. I manage the Apple engineering team responsible for typing on iPhones and iPads.

Today I would advise students and alumni to not be afraid to take action—think creatively about problems whose solutions will help people. Who are you going to help next?

Steve Harasym mechanical design engineer, Tesla

When I started my degree in mechanical engineering in 2010, I imagined I'd end up in oil and gas. People would ask: "What do you want to do when you graduate?" and I'd say, "Well, automotive or Formula One," but those are often stretch goals for people at the Formula SAE student group.

I spent four years in Formula SAE—two years designing the suspension, and two years as team leader. Every year we designed and built a Formula-style race car and every year there was a ground-up design, which involved lots of modelling, stress analyses, full analysis for aerodynamics and vehicle modelling.

Formula SAE piqued my interest and it gave me the background for automotive engineering. Part of the Formula SAE competition is judging, where industry professionals meet with you to discuss your design. If they like what they see, they might book an interview or, in some cases, offer a job.

In my final competition, the judges could see that I had good answers and good reasons for a lot of the things in my design. Also, I had a firm grasp of the basics of engineering.

There were two job interviews I was really focused on. One was with Tesla.

After Formula SAE finished up, I moved back home to Winnipeg. I interviewed with other companies and hoped to hear from Tesla. I went to catch a movie—*Jurassic World*, I think. Sure enough, my phone buzzed in the theatre and I saw an email from HR offering me a position with Tesla. The first thing I did was take a screenshot of the email, which I still have, and sent it to my parents. My mind wasn't on the movie.

At Tesla, I'm in the chassis dynamics group. We're responsible for everything from the tires to the wheels, suspension, steering, brakes, dampers and some structural elements.

I'm working on things that other people in the auto industry haven't brought into a production environment yet. It's exciting and a good fit for me. I always want to jump

at a challenge and no day at work is slow or easy, but that's what keeps it interesting and that's what keeps me growing in my career.

For this job, I need to be able to juggle a lot and keep a bunch of things in my mind, but also be able to focus on tasks. I learned that from student projects, and I learned how to do more with less. We called it "being scrappy" if you were feisty, didn't take no for an answer and just figured it out.

You don't end up with a fantastic job in Silicon Valley without at least a bit of luck. But hard work, and demonstrating you can do more, is more important. If you're not in the co-op option, some extracurricular experience gives you the upper hand, especially considering the economic climate. If I had to say what got me this job at Tesla, I would chalk it up to my experience with Formula SAE.

Bertie Chen
engineering rotational program, Keysight Technologies

I came to the U of A thinking, "I'll be a chemical engineer," because my parents are both in oil and gas. By the end of first year, I realized I've always been more interested in technology. I picked electrical engineering as my major, but had no clue where to go in the field.

I am not a person who can focus on just one area, so I joined the First Year Engineering Club to see what other people were up to. In second year, I did a bit of graphic design and photography for my student residence association. I realize now how that experience helped me: research posters look nicer with good design, and you develop an eye for detail. In fourth year, I played saxophone with a chamber music ensemble of music majors. We performed difficult music multiple times at the Winspear Centre. It wasn't work-related, but it was fun and taught me that I cannot compromise my love for music.

I started thinking about what I wanted to do, and a friend suggested I take a course in high-frequency circuits. I fell in love with it and everything fell into place. I did my fourth-year capstone project in the RF engineering field, and it helped me land a co-op placement at Telus Communications.

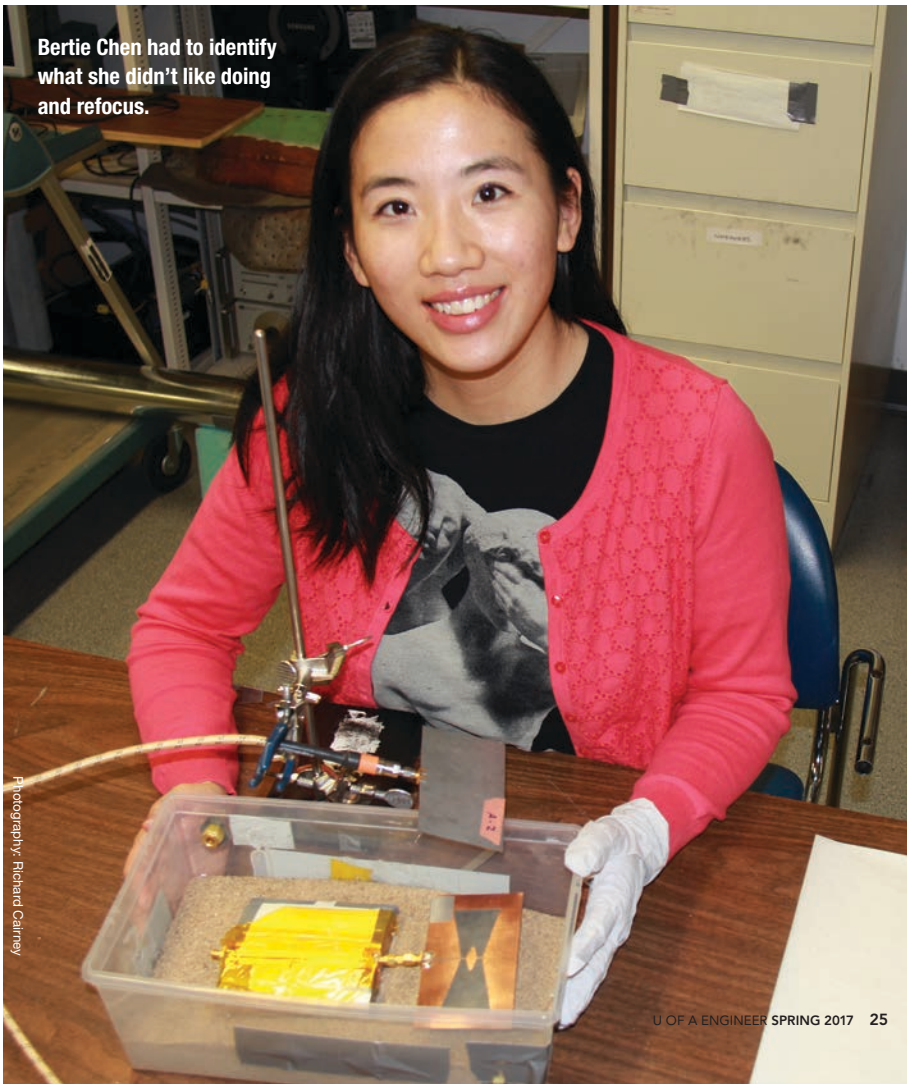
At Telus, they put me in a co-op position I hadn't considered before, in wireless transmission of data and telecommunications. After the work term, I made sure all my courses were in wireless technologies! I talked to everyone at Telus—anyone who could teach me anything. Engineering is like any other job in that you need to work in groups. Throughout my co-op placements, I learned not to be selfish, to take one for the team, and to be there to learn.

Last year, after I had forwarded my resumé to all of my co-op contacts, the hiring manager from Keysight Technologies, a company in Silicon Valley, called me and said: "Someone sent me your resumé. I'm starting this rotational program. Are you interested?" It's a leading wireless technology company so, yes.

After phone interviews, the company flew me to California, where I had difficult interviews that lasted all day. I got stuck in one of them and I was honest about what I didn't know. Many times I was thinking out loud, walking them through my thought process. I was ecstatic when Keysight offered me the job. To get a job in Silicon Valley, or anywhere, you have to show you're passionate and put in the effort. Being self-motivated is what gets you through long days and long nights.

I've proven to myself that I can get through busy times and accomplish a lot. For any student or young alum I would say just try a bunch of things, and the opportunity will show. After I pivoted I realized what I liked, let go of what I didn't and started fine-tuning. Even though my last five years have been scattered, I've prepared myself for anything. I've developed my technical, interpersonal and leadership skills, as well as my character.

I went from thinking I'd work in oil and gas to working in the tech industry, so who knows what's next—maybe space!



Bertie Chen had to identify what she didn't like doing and refocus.

Photography: Richard Cairney

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Hemi Thaker learned—from his successes and successful failures—how to engineer a business that works

BY CHAD SWIATECKI

Photography: Sarah Wilson

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BINARY LOGIC: Engineers like Hemi Thaker (Computer '86) love either/or situations.

Distilling everything to a yes or no—or a one and a zero, in Hemi Thaker's engineering world—makes it possible for scientists to test their theories and state plainly what they find.

That binary thinking and disciplined approach has served Thaker well in his professional life, helping him generate new telecommunications devices and patents and build two successful start-up companies that later sold for more than $200 million combined. He works the lean start-up credo of build/measure/learn into easy conversation—marking him as much businessman as engineer. But how does he see himself?

"Engineer, in a heartbeat," Thaker said. "I like to build things and solve problems. Building a company is solving lots of problems. I'm an accidental entrepreneur, but an engineer at heart."

I met Thaker at an outdoor coffee shop on the banks of an expansive arm of the Colorado River in west Austin, Texas, where he lives. His wife Mita and their miniature poodle Cookie were riding shotgun.

An engineering alumnus and founder and former executive of four companies, Thaker is many things at once: husband, father and dog walker, and an emerging philanthropist and an occasional adviser and investor. Add to that, he's fit and lean at 53, and loves Austin living and the opportunities it affords. He likes the outdoors, culture and music, and when we spoke in early March he and Mita were planning their menu of music at Austin's famed festival, South by Southwest.

It might be convenient to look at him in that binary either/or way, but it's more apt to use metaphors borrowed from quantum mechanics. Quantum theory says it's possible for any system to occupy multiple states at the same time. Indeed, it improves that system's manoeuvrability. In this metaphor, Thaker is the system occupying different states, moving in multiple directions at once.

The Entrepreneur

Thaker grew up in the 1970s and '80s in St. Albert, Alberta, where his family had settled after leaving India in 1968, when he was four. A dual love of engineering and computing led him to degrees from the universities of Alberta and Waterloo, but in 1992 he took his first step in the business world with a team that successfully developed a credit card-sized calorie counter intended for health-conscious customers. It was miles ahead of its time.

And they sold exactly zero units.

"That was my first lesson in business. It cost more than we could sell it for," Thaker said of the Ottawa-based company with neither a name nor marketing strategy. "That little calorie counter is still the thing I'm proudest of, but we were scared of our own shadows when it came to finding channels to market."

Business and expensive learning experience No. 2 came with a venture into computer-assisted design, creating and selling software packages. By 1995 Thaker realized that venture didn't excite him, being more of a tinkerer, interested in physical products.

He found success and confidence as a leader in his third business, which made semiconductors in the telecom industry, contracting the fabrication to keep costs low. Founded in 1997 in New Jersey and Ontario, Sybarus Technologies was started for around $20,000. He and his partners sold it to Lucent Technologies in 1999 for more than $50 million before the dot-com bubble burst.

"Had we sold six months later we'd have made 10 times the sale price, and 18 months later, zero," he said, flashing a Cheshire Cat grin.

His fourth and longest-operating company came in 2002, this time in the test and measurement sector. Anue Systems, which Thaker co-founded and served as CEO for nearly a decade, was started with an $8,000 investment and purchased by California-based technology company Ixia for just over $150 million in 2012.

Through early stumbles and big wins, Thaker became an enthusiastic student and teacher of business. He's apt to spout sets of business rules, such as his three rules for starting a company: 1) get to revenue as fast as possible, 2) build/measure/learn, and 3) pivot quickly so customers can lead you to the best market.

He admits there were rough spots where the either/or engineering mentality conflicted with the demands of managing a workforce of talented, idiosyncratic people.

"One lesson is learning how to motivate people, which means you have to treat them right, pay fair and make the work meaningful to them," he said. "And then get out of the way. Trust them to get it done."

"He's very hungry and wants to be successful again," Thaker's business partner said. "He has the drive, he always wants to build things."

The Engineer

Earlier this year Thaker returned to Edmonton to deliver the Ross and Muriel Cheriton Distinguished Visitor Lecture. In attendance was the man who introduced then-14-year-old Thaker to the university, and opened the door to computer engineering. Thaker beams when he talks about his Grade 9 teacher, Barrie Schulha, who secured him scarce programming time in the university's primitive computers lab in 1978.

"He saw something in me," Thaker said of Schulha, "and took me to the lab to teach me how to program. That sparked my imagination—it was so cool, I was in geek heaven."

Thaker had inspiring parents, teachers and training, but it took him a while to learn to seize adventure and risk in business.

"At the Cheriton Lecture I asked students, 'Why not take more risk?' Engineers tend to be risk averse," he said. He recalled his own difficulties with overcoming perfectionism. "I was an introvert and every company is hard. There are moments you second-guess yourself, times you wish you'd stayed an engineer, hunkered down to do your job."

Mita, also an engineer, seconds that sentiment. "Lots of us are introverts and we like to be geeks—be alone and build," she said. "And some don't know how to get out there and interact with business people."

"Treat people right, pay fair and make the work meaningful," Thaker said. "And then get out of the way."

The Man

Thaker took three years away from entrepreneurial life after selling Sybarus. Starting, growing and selling that company had taken a toll on the then-young father and kept him away from his sons Akash and Avi (now 21 and 23).

"With company No. 3, I was an absent parent," he admits. The sale of Sybarus and the move to Austin gave him the time he needed for family life, allowing them to enjoy kayaking, hiking and travelling.

"You don't want to give that up. So we went to Cub Scouts, camping, and after-school events," he said. Thaker kept that balance after starting Anue Systems, exposing his sons to the business world, and giving them a chance to make a difference in the world.

That goal is apparent in the creation of Waterloo Springs, a non-profit the Thakers and friends created after a chance meeting with the founder of a charity that drills wells in Ethiopia. He told them about the lack of transportation devices to get the water from the wells to the homes of people who need it.

Waterloo Springs applied frugality, creativity and innovation to solve the problem. Thaker and his sons engineered rigid plastic "water wheels," tire-like containers that make it so women and young girls tasked with fetching water from wells don't have to carry 20-kilogram buckets for kilometres but roll the container like a wheel instead.

"My sons live in a privileged world, and it felt great to see them thinking about problems people face," Thaker said. "We can frugally solve problems and change lives—seeing that light bulb go on was really cool."

The Return

Thaker has enjoyed his time away from the day-to-day business world since stepping away from Ixia in 2013—but Mita confirmed he's had difficulty with his decompression period. The entrepreneurial wheels are turning again on a company likely to launch by the end of 2017.

Thaker couldn't disclose much, other than that he's talking to potential customers about the technology problems they want solved. And he knows he'll need the expertise of others to complement his technical and executive skills.

One of them is Kevin Przybocki, a co-founder and former senior vice-president at Anue who recalls wanting to partner with Thaker almost immediately after their 2001 meeting at a YMCA camping trip with their sons. Przybocki said he was intrigued by Thaker's business mind and energy, and it didn't take long for the two to begin hatching the idea that became Anue Systems.

"We both enjoyed talking about entrepreneurial ideas," Przybocki recalled. "He's a technologist who understands business, and there are lots of opportunities out there. That combination is special."

Przybocki said it's easy to feed off of Thaker's business instinct. "He's very hungry and wants to be successful again," he said. "He has the same drive that he had with Anue, he always wants to build things."

Hungry? Maybe so. But, enjoying the Texas sunshine on the banks of the Colorado River as husband to Mita and chief executive dog walker to Cookie, Thaker also occupies a state of contentment.

Inspired Leaders

Muriel Cheriton
(ELECTRICAL '46)

She was the University of Alberta's second female engineering graduate. She served as a leader in her profession and a strong supporter of "engineering for all" who encouraged and inspired generations of students. She and Ross Cheriton were married in 1947 and Ross became one of Canada's foremost forensic engineers. David Cheriton, a Stanford University computing science professor and one of their six children, hosted the inaugural Ross and Muriel Cheriton Distinguished Visitor Lecture in 2014. Muriel died in 2016.

Alumni Weekend 2017

September 22 to 25

They can't wait to see you! If you missed last year's Alumni Weekend, chances are your Faculty of Engineering classmates have forgiven you. But they're hoping you'll make it this year. Here are a few of the places you might find them:

Class of 1957 Engineering Luncheon
Friday, September 22
11 a.m. to 2 p.m. at the Faculty Club

Who's coming? Faculty of Engineering grads of 1957 or earlier and their spouses and guests will be there.

Memory Lane
Friday, September 22
2:30 to 4:30 p.m. on the main floor of the Donadeo Innovation Centre for Engineering

What's it all about? It's a space for alumni and guests to relax and visit before the Dean's Reception, while they peruse our memorabilia and other displays.

Dean's Reception
Friday, September 22
4:30 to 7:30 p.m. in the Fred Pheasey Engineering Commons

Will I know anyone? Probably. It's open to all graduates of the Faculty of Engineering, and their spouses or guests.

EnggExpo Welcome Room
Saturday, September 23
10 a.m. to 3 p.m. in the Maier Learning Centre (ETCL Solarium)

Why should I go? You'll want to check out DiscoverE activities, look at some display items from Memory Lane, have some snacks and relax and visiting the EnggExpo displays.

NEW THIS YEAR!

The ESS and Student Project Member Reunion
Saturday, September 23
1 to 3 p.m. in the Maier Learning Centre (ETCL Solarium)

What's this new event? It's one in which you can catch up with past executive members of the Engineering Students' Society as well as past members of student vehicle project teams. If you worked on a student vehicle project or held a role in the ESS, don't miss this chance to reconnect!

FIND OUT MORE:

Contact the Engineering Advancement Office at 780-248-1673 or enggalum@ualberta.ca.

OTHER CAMPUS EVENTS:

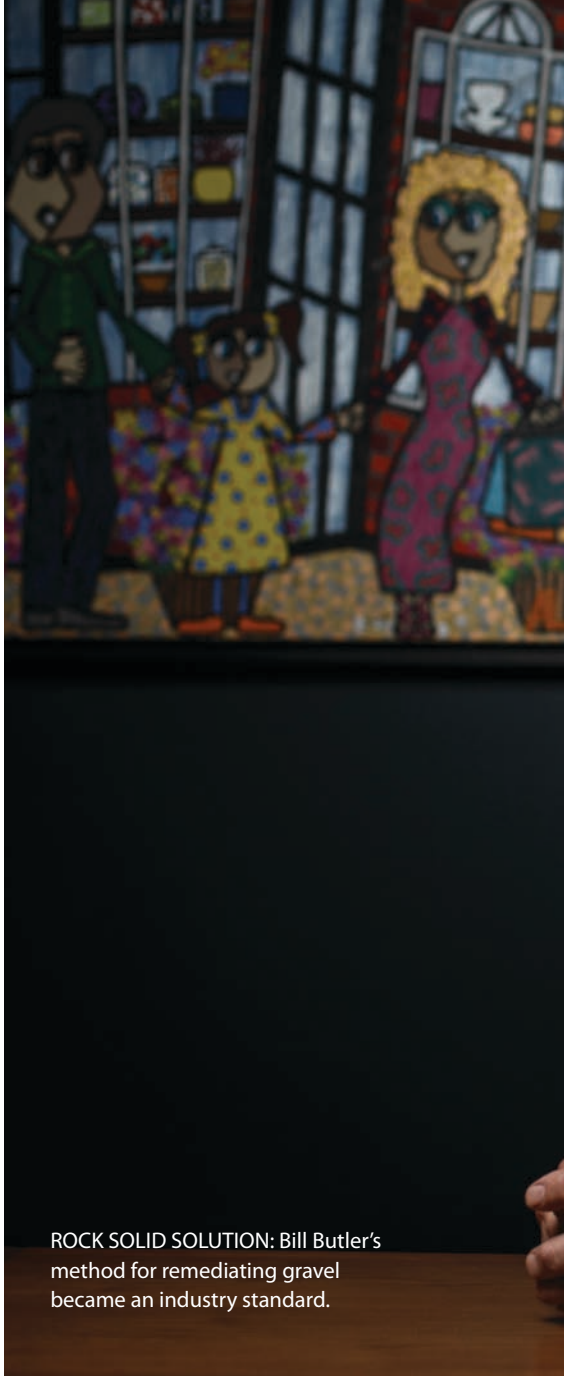
- Information event
- Class of 1957 Cap 'n Gown Ceremony
- Campus Tours
- Golden Bears Football
- Golden Grads Dinner
- Turkey Trot Fun Run
- U of A Music Concert
- Alumni Awards
- Planned Giving Seminar
- Free Drop-in Recreation Classes

+ MORE:
Search "Alumni Weekend" at ualberta.ca

Of Obstacles and Best Practices

Bill Butler remembers the pain of the recession in the 1980s. Good thing—it meant he wasn't burned a second time in 2008

By Richard Cairney



ROCK SOLID SOLUTION: Bill Butler's method for remediating gravel became an industry standard.

It started with a snowball fight. Bill Butler (Civil '70) was walking outside between sessions at a conference in Whistler, B.C., in the early 1990s, when he spied a snowball ambush in progress. A group of conference-goers was under direct fire from their boss, seeking shelter behind a snowbank. Butler sprang into action, commando-style, and tackled their assailant. Later, the group bonded over the frosty heroics, forming an enduring partnership that changed the face of retail development in Alberta.

"We became the de facto real estate company for Walmart," Butler says of the relationship his company formed with representatives of the U.S. retail giant that snowy day. Butler and his team were tasked with finding properties in markets to which Walmart wanted to expand. They'd also develop the store site and the area around it. Butler's Springwood group of companies carried on its own development deals and developed more than a dozen big-box sites with the American retailer.

The relationship has been profitable all around. But overnight success, as the saying goes, doesn't happen overnight. Butler's own journey through property development in Alberta began during the late 1970s and collapsed during the global recession that struck in the early 1980s.

"I was in my early 30s and thought I'd made enough money that I'd never have to work again," he says. He wasn't the only one thinking that way, back in those days. Butler says he "stumbled into development" in the mid-1970s when he and a friend bought a house with the intention of renting it out. The just kept going, buying houses, then apartments and then office buildings and larger joint ventures. The economy, however, was out of control. Interest rates in 1981 hit 21 per cent and inflation was running at 12 per cent.

"Suddenly you realized the interest rates were staying high and the value of real estate was falling, and tenants were moving out and the banks were knocking at your door."

Over a period of seven years, Butler worked with his creditors to avoid bankruptcy, to maintain his credit and begin anew. With painful lessons learned, he developed The High Street, a small shopping centre on the far west boundary of Edmonton's downtown, and eventually struck up his relationship with Walmart.

But even that wasn't all smooth sailing. One location in particular sounds like an environmental engineering case study—and it could fill chapters of a business textbook. In 2004, Walmart wanted to set up a shop in Cochrane, Alberta, a scenic town on the eastern slopes of the Rocky Mountains. In the heart of town was a site once used to store railway ties and telephone poles. The ground was contaminated with creosote. The owner was on the verge of losing the land in lieu of unpaid taxes. Butler cut a deal for the property, planning to develop it.

But residents and politicians in the town were opposed to the corporate big-box retail model, and fought against rezoning applications—almost as if they preferred a vacant, heavily polluted lot in the middle of their town.

"They were hanging me in effigy," Butler says. "I was the bad guy."

Through difficult negotiations, the rezoning was approved and Butler's team focused on cleaning the site. Once again, they ran into major difficulties. One method of cleaning the site would be to

Photography: Jason Franson

remove the contaminated soil and haul it to a landfill. Butler describes this approach a "simple, Neanderthal approach," because it merely moves an environmental problem somewhere else.

The economics didn't work either. The cost would have far surpassed the property's market value. Working with a U.S.-based consultant, the team determined that some parts of the land were so dirty that they could only be used as parking lots. This would dictate a departure from the standard layouts for retail areas.

The team progressed with an ambitious and innovative program to restore as much of the land as possible. "We dug right down to the bedrock—nine or 10 metres deep," Butler recalls. "We brought in gravel crushers and dug thousands of cubic metres of gravel and piled it into windrows, 250 metres long and six metres high.

The relationship between Butler and the retailer has been profitable. But overnight success, as the saying goes, doesn't happen overnight.

"We added nitrogen fertilizer and air pipes and covered everything in tents and had huge compressors blowing air through it," he says. "And in two years, we bioremediated that gravel to the point that it didn't leach any more. You could put it into the ground and not worry about leaching."

The story didn't end there. By this time it was 2008 and the global economic meltdown changed everything. Walmart backed out of the development and Butler was stuck with a parcel of land in which he'd invested heavily—financially, and personally.

But Butler had taken some lessons from that earlier recession in the 1980s,

and learned to avoid the impact of seismic economic crashes.

"One thing I had learned—and young people need to know this today—is to stop giving personal guarantees. Secondly, we have 50 different companies, so if one gets into trouble the other 49 are untouched."

In time, Walmart returned to the project, albeit with a smaller outlet, and the retail district is shaping up nicely. In fact, Butler speaks of it as one of the projects he's most proud of, because the remediation process they developed resulted in changes to provincial regulations, paving the way for others to adopt the technique.

You can clean a site by hauling contaminated soil to a landfill, but Butler says that just relocates the problem.

"We decontaminated more than one million cubic feet of material and almost took nothing off the site. The material that left the site we shipped nearby and used to build the Stoney Trail. We did it because it made sense.

"We're in year 13 of this project because I had the capital, yes, but also the engineering skills and an attitude—not arrogance, but an attitude that there was a way to do this," he says. "It's the best thing we've ever built, and we've built a lot of stuff. It's a great, funky project and it's right in the centre of Cochrane."

How a gift of securities works

"I have set up a charitable foundation, mostly supporting families and children," Bill Butler says. But on a personal note, with his own personal asset base, Butler also wanted to recognize institutions that have had a positive influence in his life.

A planned gift like Butler's can take many forms: a dollar amount or a percentage of the donor's estate, insurance, real estate or a gift of securities.

A donation of appreciated publicly traded securities to the faculty presents a cost-effective way of supporting a program that is meaningful to a donor. Securities can be stocks, bonds, mutual funds, warrants and options. As a result of the 2006 federal budget, donors aren't taxed on the capital gain that results from transferring these securities to the university. By comparison, if a donor sells securities to donate to the university, they'd be taxed on 50 per cent of the capital gain.

Donors also get a charitable donation receipt for the full market value of the gift. Donors have six years after donating their securities in which they can claim their receipt amount, allowing them to be strategic and maximizing the benefit of the donation.

If a donation is given through a bequest (directions in a will), the donation will result in a tax credit that may be used to offset up to 100 per cent of the taxable income on the terminal tax return. Donors can carry any excess back into the preceding year, too.

Example: June Park bought stock four years ago for a total value of $12,000. Today, the stock is valued at $50,000. Park decides to make a gift of securities to the Faculty of Engineering in support of the endowed Engineering our Next Generation (ENG) Fund.

By transferring securities that have a fair market value of $50,000 to the university, she:

- **Receives a charitable tax receipt for $50,000**
- **Receives a tax credit of $25,000**
- **Avoids $9,500 in capital gains tax*** (assuming a combined federal and provincial tax rate of 50 per cent)

*$50,000 - $12,000 = $38,000 capital gain
$38,000 x 50 per cent =
$19,000 x 0.50 = $9,500

*Tax rates are current as of date of publication and subject to change. The actual combined tax rate depends on level of income. This information is for illustration purposes only. Please consult a qualified financial adviser.

For more information about gifting securities or any other planned gift, please call 780-248-1673 or email givingEN@ualberta.ca

Women in Engineering

Shell Canada supports U of A efforts to attract a variety of qualified engineers to the field

By Shelley Williamson

STRENGTH IN NUMBERS: Each year, a UA-WiSE executive (the 2016-17 executive is pictured here) co-ordinates events, mentorship and outreach opportunities on and off campus.

Sahar Banisoltan graduates with a PhD in civil engineering from the University of Alberta in 2017, with a focus on water resource engineering. It's an accomplishment she credits in part to the WISER (Women in Science, Engineering & Research) network—supported by Shell Canada—which collaborates with industry, government and academia to create programs that increase diversity of voices in these fields. Now one of those voices is Banisoltan's.

Banisoltan noticed a lack of female mentors in engineering, and set about to address it. She initiated and led a mentorship program (called UA-WiSE/WISER) at U of A to help young professionals—many of them women—network and gain support. In its founding year in 2015, the program grouped an undergraduate student, a young professional or graduate student and an experienced professional together to learn from each other. For Banisoltan, it meant networking with young professionals as well as finding a more senior mentor, who helped her complete her PhD. As she embarks on her engineering career, she plans to mentor other women.

"It empowered me," said Banisoltan of her experience with the network. "I knew what I wanted to do but this gave me the opportunity to evaluate myself and figure out what skills I needed to work on." It also gave her access to other networking opportunities for women. "For me it was very eye-opening. I loved the enthusiasm; it's a great community."

Denise Hemmings, academic co-chair of WISEST, the umbrella network for WISER and UA-WiSE, lauded Shell Canada for its support. "The money from Shell has made a huge impact on our undergraduate group," said Hemmings. "Until now, UA-WiSE has never had substantial funding so anything they have done they've had to piece together." The Shell funding established a stronger program in other ways, too.

In addition to supporting UA-WiSE, Shell Canada's substantial, three-year (2014-2017) investment in U of A also includes contributions to Aboriginal initiatives, geoscience field schools and the Shell Enhanced Learning Fund (SELF), allowing students to attend conferences, field trips and complete projects that focus on sustainable energy, the environment and the economy.

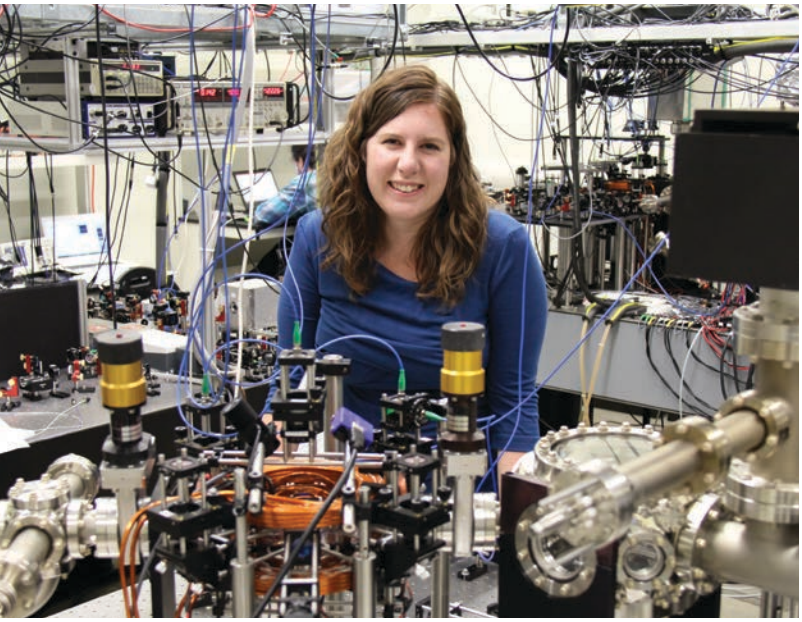
Rob Lyon, Shell Canada's university and college relations adviser, said the company selects initiatives based how well they benefit students and how well they align with Shell's core values of honesty, integrity and respect. An added bonus is that the commitment helps build a vibrant future workforce.

"The U of A has high-calibre talent," Lyon said. He adds the programs U of A offers have direct relevance to Shell Canada's core business in Alberta's oilsands.

UA-WISE gave Sahar Banisoltan access to other networking opportunities for women. "For me it was very eye-opening, it's a great community."

Sam Pearson, director of corporate and foundation relations in U of A's Office of Advancement, says corporate gifts are crucial to students' overall experiential learning and success, and they elevate the university's role as an academic leader.

"Shell Canada is a great partner to the university," she says. "Supporting field schools and initiatives such as UA-WiSE allows us to increase the number and diversity of students we support."



the homecoming

We met Lindsay Leblanc (Engineering Physics '03) when we profiled her in 2008. At the time she was a PhD student at the University of Toronto with a near-perfect academic record. Her 2003 Governor General's Award and C.D. Howe fellowship were already old news and she was stretching her wings as an independent researcher. In 2013 she came back to the University of Alberta, this time as an assistant professor in the Department of Physics (and holder of the Canada Research Chair in Ultracold Gases for Quantum Simulation, and as a fellow in quantum materials with the Canadian Institute for Advanced Research). Now she runs her own lab, looking into quantum gases of ultracold atoms in her quest to find out more about fundamental quantum physics questions.

Your lab is capable of creating Bose-Einstein condensate (BEC). How does this technical capability move your research forward?

It offers us a few different paths to study how the quantum nature of matter affects the world around us.

One path is to study "many-body physics," in which we take this BEC and look at how the behaviour of many quantum particles is different than individual quantum particles and how this leads to things like magnetism, superconductivity, and other (perhaps so-far unknown) effects that are evident on larger, meso- or macroscopic scales.

A second path is to use this medium to store and manipulate pulses of light for quantum information applications, like storing "qubits" of quantum information for long enough times to allow quantum computers to do their job.

A third path is to use this medium to interact with other quantum devices to hybridize the quantum nature of the two systems. We want to pull out the best of the quantum natures of both while leaving the disadvantages of each kind of technology behind.

How does your engineering physics background prepare you to be a quantum physicist?

The engineering physics degree was excellent preparation for a career in experimental quantum physics—much of the day-to-day work involves hands-on design, construction, and operation of optics and electronics. Doing experimental physics research relies on developing a lot of custom equipment that doesn't yet exist commercially, and optimizing it to perform state-of-the-art research. Without being able to develop custom tools, we would not be able to perform research that pushes the boundaries.

What made you decide to come back to teach and conduct research at the U of A?

The U of A offered wonderful support for the infrastructure I needed. Support came from the CFI program, the Faculty of Science and the university, and it included new, well-designed lab space. Additionally, the offer of the CRC chair was attractive. I was very pleased to come back to Alberta (my parents and siblings are in Calgary), and back to the university where I started my education in quantum physics.

I like the Canadian system of public education at the post-secondary level, which offers a consistently high quality of education and a much more level playing field. I can perform top-level research at a public institution in Canada and the students come from all walks of life.

You graduated from engineering physics with perfect grades. As a professor, what advice do you have for students when it comes to the value they assign to grades?

Grades are important as an external metric when it comes to getting scholarships and awards, but understanding and digesting the material at hand is more important in the long term. As I assign grades, I see that these things usually come hand-in-hand, but there are cases where students have a bad day in an exam and the two don't match. Reference letters are more important in terms of career success, and I would recommend students take the chance to get to know their professors, to ask questions about course material and other things that interest them. These connections are important in the long run. One of my keys to success was figuring out what the professor thought was important in a class, then focusing on learning it.

You love literature. What do you recommend for summer reading?

The Luminaries by Eleanor Catton. I discovered only after reading it that the structure of the book, such as the number of pages in each chapter, is based on some astrological mathematics. And *The Book of Negroes* by Lawrence Hill—I am hoping to read his more recent book, *The Illegal*, this summer.

CARTER, JIM PEng, LLD
(Hon '04)

Has been inducted to the Canadian Mining Hall of Fame. Having begun his career as the oil sands were in their early stages of development, Carter dedicated himself to life-long learning and innovation, continuously devising new and better ways to mine the oil sands. Under his leadership, operating costs at Syncrude were reduced to $12 to $13 per barrel and the firm negotiated royalty payments on oil produced in order to set up the oil sands as positive investments.

CHALATURNYK, RICHARD PEng
(Civil '84, MSc '88, PhD '96)

Has been inducted as a Fellow of the Engineering Institute of Canada for exceptional contributions to engineering in this country. Chalaturnyk is a recognized leader in engineering education and carbon capture and storage research. He leads the Department of Civil Engineering's Geomechanical Reservoir Experimental Facility (GeoREF) and holds the Foundation CMG Research Chair in Reservoir Geomechanics for Unconventional Resources.

ELLIOTT, JANET PEng

Has been awarded the APEGA Summit Award for Excellence in Education. A professor in the Department of Chemical and Materials Engineering and a Canada Research Chair in Thermodynamics, Elliott teaches thermodynamics in a highly effective manner. For the past four years, students have ranked her courses at 4.9 or five out of five, placing her among the top-ranked professors in the Faculty of Engineering.

FAULKNER, GARY PEng
(Mechanical '63 MSc Mechanical '66)

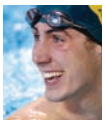
Has been awarded the APEGA Centennial Leadership Award, the highest distinction for a career in engineering teaching and service. Over 50 years Faulkner has provided leadership as a volunteer, researcher, teacher and mentor. He has represented APEGA at the national level and, since 2009, has served as the director of rehabilitation research and technology development at the Glenrose Rehabilitation Hospital. He is a pioneer in robotics, virtual reality, and other innovations. His work has improved recovery and quality of life for many patients.

FILIPCHUK, DAVID PEng
(Civil '84)

Has been appointed the eighth president and CEO of PCL Construction in the company's 110-year history. Filipchuk has been with PCL for 32 years. Prior to his appointment, he served as the company's chief operating officer of Canadian and Australian operations, then as deputy CEO. PCL operates worldwide, in Canada, the U.S., the Caribbean and Australia.

FREY, DICK
Has been awarded the Julian Smith Medal from the Canadian Society of Senior Engineers for "for achievements in the development of Canada." Frey served as managing director of utilities with ATCO Group. Frey was a supporter of the Engineering Co-op program and made invaluable contributions to developing the power systems of Alberta, the Northwest Territories and Yukon. He played a key role in designing and building the Sheerness Generating Station and was a member of the Alberta Electric Utilities Planning Council for 15 years.

GIOVANETTO, STEPHEN
(Electrical '16)



Has been awarded the Salute to Excellence Sports Performance Individual Award. He adds this to numerous other accomplishments in competitive swimming, including the 2016 Canadian Interuniversity Sport (CIS) Swimming Championships, Quebec City, QC Gold, 50m Breaststroke (Men's 17+).

GROZIC, JOCELYN PEng
(Civil '94, PhD '99)

Has been inducted as a Fellow of the Engineering Institute of Canada for exceptional contributions to engineering in Canada. Grozic is associate dean, research at the Schulich School of Engineering at the University of Calgary. She is recognized nationally and internationally for her contributions to gas hydrates research.

HAKIM, ANTOINE OC, MD, PhD, FRCPC
(MSc Chemical '67)

Has won the prestigious Canada Gairdner Wightman Award for outstanding leadership in medicine and medical science. The award recognizes his body of breakthrough research in understanding, prevention, and treatment of ischemic strokes. Hakim left the oil and gas industry in the early 1970s in favour of biomedical engineering and later, medicine. An officer of the Order of Canada, he has become a leading figure in an era in which stroke treatment was revolutionized and improved dramatically.

PAWLICK, KAIRI PEng
(Civil '05)

Has been appointed to the University of Alberta's Faculty of Engineering Young Alumni Council. She will take a leadership role, creating the means by which the faculty will better engage with its alumni of the last five and 10 years, a cohort that will approach 50 per cent in the coming years.

RAHMAN, NOOR M. PEng
(PhD Petroleum '98)

Has been awarded the 2016 Middle East Regional Reservoir Description and Dynamics Award from the Society of Petroleum Engineers for his outstanding contributions to the field. He is a petroleum engineering consultant at Saudi Aramco's Well Testing Division under the Reservoir Description and Simulation Department. Previously he worked for Bangladesh University of Engineering & Technology, University of Alberta, Schlumberger and Fekete Associates. Rahman has developed a number of pressure-transient solutions to characterize petroleum reservoirs from well tests.

SHI, YANG PhD
(PhD Electrical and Computer '06)

Has been named an IEEE Fellow, being recognized for contributions to networked and distributed control systems. The title is conferred by the IEEE Board of Directors upon a person with an outstanding record of accomplishments in any of the IEEE fields of interest.

SINEX, KATHERINE PEng
(Mechanical [Co-op] '03)

Has won a 2016 Young Women in Engineering Award for her leadership and impact. Sinex has had several roles with Chevron Canada Limited and now works as an Alberta Regulatory Affairs Advisor with the company. She served as the company's lead for the recent Alberta Royalty Review and was the youngest leader of nearly 1,000 global members of a Chevron technical group, developing a wiki and launching a series of monthly, international meetings so she and her colleagues could share ideas and information.

WATTS, BRYAN PEng
(Civil MSc '81)

Has been awarded with the Engineering Institute of Canada's K.Y. Lo Medal in recognition of his international impact as an engineer. A geotechnical engineer for 40 years, Watts is a recognized authority on mine tailings dams, and he works on technical review boards around the world. He has participated in forensic investigations of several major international tailings dam failures and has worked across Canada and around the world. He is a significant force in the geotechnical engineering community.

Send your news to **engineer.alum@ualberta.ca**

IN MEMORIAM

The Faculty of Engineering sincerely regrets the passing of the following alumni and friends.

Bate, Thomas Edward, Electrical '44, in May 2017

Bigg, Gordon Walter, Mechanical '61, in May 2017

Cary, William Lucius, Chemical '48, in December 2016

Condrotte, Edward James, Electrical '69, in December 2016

Cormier, Jeffrey Roger, Mechanical '83, MBA '85, in September 2016

Crawley, Edmund Julian Michael (Lee), Electrical '50, date unknown

De Simon, Antonio Benevuto, Civil '61, in November 2016

Dingwall, Robert Alexander Saunders, Eng Physics '48, in February 2017

Ellyin, Fernand, Professor Emeritus, in March 2017

Fildes, John William, Civil '61, in December 2016

Frindt, Robert Frederick, Eng Physics '60, in March 2017

Gallupe, John Allan, Civil '76, in December 2016

Gourishankar, Vembu, Professor Emeritus, in May 2017

Graham, Terry Ray, Electrical '62, in April 2017

Graves, James Thomas, Mechanical '78, in April 2017

Hawreliak, Leonard, Electrical '71, in February 2017

Jenkins, John Robert, Chemical '53, in December 2016

Jimenez, Jaime Ivan, Electrical '78, in March 2017

Kellerhals, Rolf, MSc Civil '63, in August 2016

Kulak, Geoffrey Luther, Civil '58, in March 2017

Lawrence, Norman Alexander, Civil '41, in November 2016

Litchfield, Ernest Leroy (Roy), Chemical '51, in March 2017

Maxwell, Jim, Chemical '67, in November 2016

McCarthy, Joseph Weeden, Electrical '50, in February 2017

McGuffin, Gordon Albert, Chemical '47, in November 2016

Millar, James Bruce, Civil '63, in March 2017

Morin, Rene (Moose), Mining '59, in May 2017

Morison, William Gordon, Eng Physics '48, in December 2016

Munkholm, Gordon Earl, Chemical '66, in December 2016

Mutter, Roy James, Mining '57, in September 2016

Nixon, Ralph Stephen, Electrical '48, in February 2017

Oszust, Bernard Eugene Vincent, Petroleum '52, in October 2016

Pond, Roy, MSc Mechanical '66, in September 2016

Rae, Donald Allan, Electrical '56, in February 2017

Rawe, Lawrence Edward, Mechanical '78, in March 2017

Reil, Fritz Gerhard, Chemical '66, in April 2017

Roshko, Anatol, Eng Physics '45, in January 2017

Schultz, Dale Frederick W., Mining '56, in April 2017

Smith, Grant McKinlay, Eng Physics '60, in February 2017

Spencer, Robert Arthur, Mining '48, in January 2017

Stodalka, Allan Arthur, Electrical '50, in August 2016

Thomson, Stanley, MSc Civil '55, PhD Civil '62, Professor Emeritus, in October 2016

Toller, William Ernest, Electrical '51, in August 2016

Walker, Lloyd Arthur, Civil '45, in August 2016

The Faculty of Engineering was recently made aware of the passing of the following alumni more than a year ago:

Forsythe, Marshal Anthony, Electrical '37, in September 2004

Kondrosky, Victor, Electrical '60, in November 2015

Scraba, Jerry William, Civil '62, in May 2002

Sundquist, R. Wayne, Electrical '69, in December 2015

A Stop on the Journey

The day prejudice became an obstacle for me, my colleagues and my profession

By Parsin Hajireza, PhD

I live in Edmonton and have travelled to the United States several times for leisure and for my work as an engineering post-doc. I planned to travel to San Francisco earlier this year, a trip that was particularly important as I'd just been published in *Light: Science & Applications*, along with my supervisor in biomedical engineering, Roger Zemp, and two other colleagues. Representing the University of Alberta, I was set to present our research about a breakthrough we had made in photoacoustic imaging (see page 9) at the flagship conference for the photonics industry. Our international colleagues were looking forward to it, and I had planned to meet with several international companies to discuss the commercialization of our technology. Edmonton is my home, my academic home, and the home base of my future business.

Scientific conferences, too, are a kind of homecoming for academics. Science is a universal language, connecting people around the world. Academics can easily connect through scientific discussion, and we enjoy sharing ideas and solving problems. We share a passion for helping others and improving their quality of life. I have friends from around the world and I don't think science and technology know any border, race or faith.

But let me put my San Francisco trip in context: I was planning on travelling to the United States on the first day of Donald Trump's controversial travel ban targeting citizens of seven predominantly Muslim countries. I am a permanent resident of Canada and an Iranian citizen.

The scene at the airport was chaotic. With the stroke of a pen in the United States, suddenly airline employees were enacting policy as well as dealing with confused and humiliated travellers. Unfortunately, I was not allowed to travel. Roger went to San Francisco without me to present to our international colleagues—except those who, like me, were turned away at airports.

I am an engineer. We can find a solution to almost any problem, as long as we understand the problem and keep an open mind. No problem is solved by sticking to a few pages in a textbook. Sometimes we must create our own formula.

If we close our eyes and forget our labels, we all come to a similar point. We are human beings: engineers, presidents, soldiers, taxi drivers, bartenders. At the end of the day we're people, all a little unsure about the future. We share many values. We innately hate slavery, hunger and insignificance. We fall in love, laugh and shed tears alike. We believe in love and faith. We tend to forget how much we have in common. Nothing is more dangerous for our world than hate; it's a disease that spreads into people's hearts.

I am proud of my roots and the people with whom I share my first language. I know so many amazing people from Iran who want love and peace for everyone. But I cannot claim to represent any race or faith because love, like science, doesn't know borders or race.

My experience being denied travel was not a crisis, but it was limiting for me and my colleagues. Scenes like the one I experienced repeated across airports around the world, sometimes with higher stakes. You can see how the situation separates us, diminishes us. No one deserves to be judged based on things they haven't chosen like gender, skin colour, first language, country of birth and more. We should be judged on our choices, our work and who we are right now. But if we can't even stand up to represent ourselves, fair judgment becomes impossible.

With understanding and an open mind we engineers can find solutions to most problems.

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You found your people

You remember that aha moment? It was your first team meeting. The excitement was contagious. Your brain was racing. The people were amazing!

Together, you pulled a few all-nighters in the shop, agonizing over problems, inventing new ways of doing things, learning things your professors hadn't even covered yet.

It felt like home.

Come back to the place it all started. Reunite with your teammates at the inaugural **U of A Engineering Club Reunion**, in conjunction with Engineering Expo and Alumni Weekend.

Catch up with old friends and find out what the next generation of engineers is up to.

September 23, 2017

1 to 3 p.m. in the Maier Learning Centre (ETCL Solarium)
ualberta.ca/alumni/events/alumni-weekend

FACULTY OF ENGINEERING