

# ENGINEERING IN CANADA

THE GLOBE AND MAIL

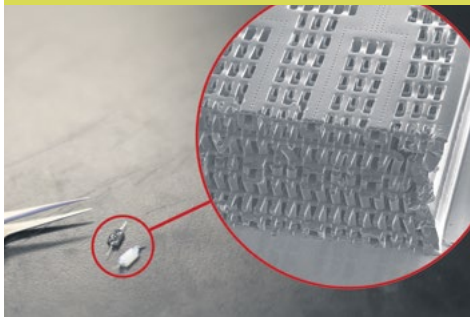
FRIDAY, MAY 20, 2016

SECTION EC



**SENSOR TECHNOLOGY:** Entrepreneur Andrea Palmer, a UBC engineer who minored in business, founded Awake Labs, an autism health company, which has developed a sensory device called Reveal that uses a child's heart rate, skin temperature and perspiration level to predict an impending meltdown, giving the caregiver time to intervene.

**REGENERATIVE MEDICINE:** This microscopic scaffold, developed by Prof. Milica Radisic and her team at the University of Toronto, allows heart and liver tissues to be grown outside of the body. Used to test drugs for potential side effects, it could one day lead to growing artificial organs to replace damaged ones.



**SUSTAINABILITY:** Stuart Linley, doctoral candidate at Waterloo Engineering, is developing new techniques for nano-based wastewater treatment.



**TECHNOLOGY:** Waterloo engineering alumnus and professor Chris Elias has built the world's largest model of a simulated brain.

**SOCIAL CHANGE:** When brightly coloured ramps show up in a neighbourhood, people don't just notice their presence but also their absence. StopGap Foundation raises awareness and effects social change by delivering key messages around outreach, design solutions, and ensuring that society's collective understanding of accessibility continues to grow.



Across the country, Canadian engineers and engineering students are developing innovative solutions in a range of fields, including health care, the environment, technology and social sectors, to improve our quality of life. SECOND FROM LEFT, BOYANG ZHANG/KEVIN SOOBRIAN/TYLER IRVING; ALL OTHERS, SUPPLIED

## For the greater good

Imagine a profession dedicated to identifying problems or needs and carefully divining solutions that not only meet societal conditions, but also ensure the answers are free of inadvertent harmful impacts. It's a tall order, but it is a job that Canada's engineers undertake daily, adding untold value across virtually all aspects of our society and national economy.

"Engineering is a profession that is becoming more and more integrated into the fabric of our society," says Kim Allen, CEO of Engineers Canada. "There are endless possibilities for engineering applications that go beyond or expand on the traditional things like infrastructure, buildings and products, to include areas people usually don't associate with engineering, like the medical field."

Many new medical advances – from hip replacements and artificial limbs, to new ways of restoring and regenerating tissue and nerves – are coming out of engineering innovations, says Mr. Allen. Sensor technology, for example, enables the monitoring of health parameters, such as heart rate, blood pressure and blood glucose

levels, which are then relayed for determining when and what kind of intervention is needed. He adds that such tools can improve accuracy of diagnosis as well as patient care.

Sensor technology can also play a role in finding a solution for food waste, says Mr. Allen. "Today, over one-third of our food supply goes to waste due to gaps along the supply chain. With the right engineering solution, we can reduce that number significantly."

For Mr. Allen, the three foundations of engineering are safeguarding citizens, safeguarding the economy and safeguarding the environment – and they are all connected. "Our economy, health and security are all dependent on having reliable infrastructure that guarantees access to clean water, energy and food where and when we need them."

George Comrie, president of Professional Engineers Ontario (PEO), agrees. "Engineers play a key role in developing modern technology and materials to enable sustainable growth," he explains. "Whether this work involves building climate-resilient

infrastructure or increasing the supply of green, renewable energy, engineering ingenuity and an engineer's duty to maintain protection of the public benefits society tremendously.

"This is why it is imperative that engineers be involved in the public policy process to ensure that innovative technology is maximized and unintended consequences are minimized," Mr. Comrie adds.

Sandro Perruzza, CEO of the Ontario Society of Professional Engineers, also underscores the importance of involving engineers in the policy-making process. Their practical approach to problem-solving and their ability to take a range of factors into consideration make them invaluable assets in policy discussions, he explains. "Often, you only hear about engineering when there are problems that need to be fixed. A far more effective way of involving engineers is to include them in the discussion early on."

For example, Mr. Allen says engineers play a key role in climate change adaptation. "For meeting the COP-21 goals, we'll have to rely heavily on engineers to come up with the tech-

nical solutions that will permit us to reduce our impact on the environment while maintaining our standard of life," he states.

Engineers are already key players in the work that is underway for responding to the effects of climate change. In addition to developing resilient infrastructure and building materials that can withstand the impacts of changing weather patterns, they're also looking at broader climate ramifications to areas like soil and water.

Jeanette Southwood, vice-president, strategy and partnerships at Engineers Canada, explains that Engineers Canada has pioneered a valuable tool – called the Public Infrastructure Engineering Vulnerability Committee (PIEVC) Protocol – for engineers to assess future climate risk in their designs, operations and maintenance of infrastructure.

"Our PIEVC Protocol has been applied across Canada and globally," she says. "We are ready to leverage this tool to provide the evidence base to inform policy- and decision-making. As engineers, we have a duty to protect the public, and the PIEVC tool

allows us to factor in future climate risks in today's decisions to do just that."

The protocol is one example of the methodical and thoughtful approach that makes engineers' input into discussions about policy with broad societal implications so valuable, says Mr. Allen. And the profession's contribution to the greater good virtually touches every aspect of society.

Mr. Perruzza mentions the example of Luke Anderson. He says, "Luke is a professional engineer who was in a bike accident out west and is now using a wheelchair. He set up the StopGap Foundation, which has built 800 portable brightly coloured ramps and counting to make retailers and small shops more accessible for everyone."

"Societal needs are immense," adds Mr. Allen. "And the opportunities for the engineering profession are bright."

This content was produced by Randall Anthony Communications, in partnership with The Globe and Mail's advertising department. The Globe's editorial department was not involved in its creation.

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### INCLUSIVENESS

## For smarter teams, add diversity

To Elizabeth Croft, it's no mystery why women traditionally shy away from careers in engineering: no one invites them.

Dr. Croft, a professor of mechanical engineering and associate dean, education and professional development, in the Faculty of Applied Science at UBC, is among a growing number of educators and advocates who are working to rectify that.

Diversity programs that target women, indigenous people and visible minorities are helping to boost

confidence, change mindsets, and stress the significance of applied science in the world and in daily life. They are delivered through workshops, summer camps, after-school activities, teacher training, mentoring and other activities that encourage these under-represented groups to study and work in science and engineering.

"We need to invite them," explains Dr. Croft, a specialist in robot-human interaction who was past NSERC Chair for Women in Science and Engineering

in the B.C. and Yukon region, which started a program that supports the recruitment and retention of women in the field. The efforts are producing results: approximately one-third of students in UBC's first-year engineering undergraduate programs this autumn will be women, an increase from 19 per cent in 2010. And they've set a goal of reaching 50 per cent by 2020. "UBC is showing leadership with its

"Early exposure is critical to turning that switch on for youths to consider these fields, both as future career options and how important they are to our lives."

**Jennifer Flanagan**  
is co-founder and CEO of Actua

goal, so it's encouraging to see what can happen when there's a real commitment to taking steps to effect the change you want to see," says Ann English, CEO of the Association of Professional Engineers and Geoscientists of British Columbia. "Increasing the participation of women in the profession will have a positive impact on the future of engineering in B.C."

**Diversity, Page EC 4**



Showing that science and technology can be fun can spark the interest of youths in the engineering profession. SUPPLIED

### INSIDE

**EDUCATION.** Master's programs that are custom-designed to meet industry needs. **EC 2**

**PANEL.** Experts discuss the contribution of engineers to solving pressing challenges. **EC 3**

**BIG DATA.** How to convert information into knowledge and use it to benefit society. **EC 5**

### BY THE NUMBERS

**75,657**

Number of students enrolled in undergraduate engineering programs in Canada in 2014

**19.1**

Percentage of engineering undergraduate students who are women

**12**

Canada's rank out of 16 peer countries for the proportion of all students graduating in 2010

Sources: Engineers Canada, Conference Board of Canada

**CANADA'S CONSTRUCTION INDUSTRY:**  
Building a stronger tomorrow –  
**TODAY**

**Canadian Construction Association**



## ENGINEERING IN CANADA



UBC Masters of Engineering Leadership students discuss case studies within their collaborative studio space. SUPPLIED

### EDUCATION

# Master's programs custom-designed to meet industry sectors' needs

When UBC was creating its new professional master's degree programs for early- and mid-career engineers, the leaders in the Faculty of Applied Science began with an innovative premise: identify industries experiencing significant growth and then ask experts within those industries about the skills they most needed from their mid-level employees.

"We started with these high-level needs and then designed our programs around them," says Tamara Etmanski, the academic director of the Faculty of Applied Science Professional Masters Programs. "Each program's

"[Graduates] will be technical leaders who understand the diverse engineering aspects of an industry value chain."

**Tamara Etmanski** is the academic director of the Faculty of Applied Science Professional Masters Programs at UBC

project-based curriculum follows the value chain of an industry sector from beginning to end so that students get a multidisciplinary technical perspective on the sector as a whole."

It's a novel approach that appealed to student Alice Kruchten, who graduated with a degree in civil engineering from UBC in 2010 and has worked with consulting company Keystone Environmental over the past five years on projects related to water treatment and civil engineering design.

Ms. Kruchten took a year's leave of absence to pursue the Master of Engineering Leadership (MEL) degree, as she felt "it was designed for what

industry is looking for. My program, in integrated water management, builds on specific skills valuable to me and applicable to my job. Focusing on water issues, and discovering research tools that inform my professional outlook, will be a long-term benefit."

Launched in January 2016, the MEL has 75 students enrolled in seven programs that include advanced materials manufacturing, clean energy engineering, dependable software systems, green bio-products, integrated water management, naval architecture and marine engineering, and urban systems. More programs are currently under development ([mel.ubc.ca](http://mel.ubc.ca)).

The students – who come from 16 different countries – spend 60 per cent of their time on multidisciplinary technical classes in their specialist program and come together to take classes in business skills and leadership offered by the Sauder School of Business.

"No matter which industry employer we spoke with, they all identified the need for mid-career engineers who can communicate with team members from across engineering disciplines as well as the organization as a whole," says Dr. Etmanski.

That balance was a key selling point for student Rushil Vallabh, who graduated in 2012 from the Dubai campus of Scotland's Heriot-Watt University with a degree in engineering and management and worked for several years with Pfizer in a project management role. Although Mr. Vallabh had intended to do a master's degree with a focus on oil and gas, when he learned about research being done at UBC in the field of clean energy, he changed direction.

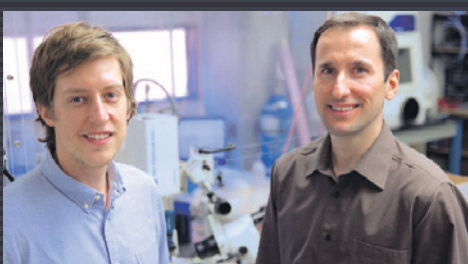
As an MEL student in the clean energy engineering program, he says the technical courses are giving him opportunities "to apply all my knowledge from my undergraduate degree" in a field that he is passionate about. "But this degree is so well rounded – you get in-depth technical courses balanced by some of the learning you'd cover in an MBA program. It's the best of both worlds."

Mr. Vallabh likes the fact that he is taking the business courses alongside students from the other MEL programs. "We're a huge family," he says, adding that the designated studio space for the MEL students provides a natural hub for working on group projects or relaxing after an intense day of classes.

Ms. Kruchten also enjoys the business classes, saying that hearing the perspectives of her peers who have worked internationally in diverse industries and with different areas of focus has been very enriching. "We learn from each other and our varied experiences."

Graduates of the program will be in high demand, says Dr. Etmanski. "They will be technical leaders who understand the diverse engineering aspects of an industry value chain and who are able to communicate with those on the business side of the organization. It's a program that's setting them up to advance their careers while making very meaningful contributions to both their employers and society as a whole."

## INNOVATING FOR SOCIETY



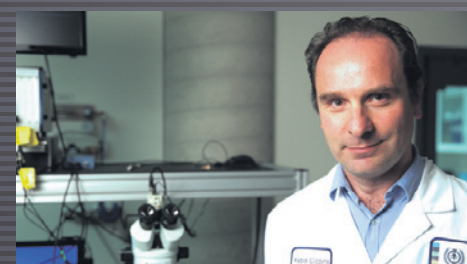
### A THREAD AS TENACIOUS AS SPIDER SILK

Professors Frédéric Gosselin and Daniel Therriault have succeeded in producing an ultra-strong polymer fibre derived directly from the structure of spider silk. There are numerous potential applications: aircraft-engine casings, surgical devices, etc.



### A PLAN TO CLONE MOTOR FUNCTIONS

Did you know that a simple signature could reveal much about your health? In fact, the speed at which you sign your name is indicative of your neuromuscular state, Professor Réjean Plamondon's work has shown. This research results in the creation of very dependable and non-invasive tools used to assess patients' health, such as applications for tablets and smartphones.



### TOWARD THE ORGANIC AND FLEXIBLE ELECTRONICS AGE

Professor Fabio Cicoira and his team are developing manufacturing processes for organic electronic devices printed on flexible circuits or stretch substrates that are compatible with biological tissues. They herald such applications as sensors that adhere directly to biological tissues, cells or organs.

Watch videos of our researchers' projects

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## DISCUSSION

## Rising to the challenge of real-world problems



## GLOBAL RESPONSIBILITY

**Boris Martin**  
CEO of Engineers Without Borders

In the face of global challenges like climate change, a rising population and dwindling resources, engineers – like most other professionals – have to rethink their views and principles in order to make a meaningful contribution to creating a thriving and sustainable world.

Across Canada, over 280,000 engineers solve tough problems every day. Still, socioeconomic challenges persist locally and globally despite their technical expertise and technological advances. What's missing?

Good intentions are not enough. In fact, in isolation they can cause more harm than good, as is evident in failed international development projects that relied on good intentions but addressed the problem too narrowly. Engineering needs to ask tough questions of itself and deepen its understanding of the systems that cause poverty. That means focusing not on its technical expertise, but on serving society in all its complexity. This is imperative because the challenge of ending poverty requires more than Band-Aid solutions – it demands ambitious, thoughtful actions that effect change at a profound, systemic level.

The engineering profession has long been symbolized by the iron ring, a reminder of an engineer's ethical duties. I believe that its meaning should include that the engineer understands his or her place in the complex systems of today's society.

For translating good ideas into action, see <https://www.ewb.ca/ideas/engineering-change-lab>.



## CLIMATE CHANGE

**Leah Lawrence**  
President and CEO of Sustainable Development Technology Canada

Engineers and scientists applying their know-how to clean technologies is all about tackling climate change while meeting the needs of a growing global middle class in a resource-constrained world.

In this, many Canadian leaders come to mind: At the Pictou shipyard in Nova Scotia, Open Hydro and Emera are working to develop the Cape Sharp Tidal project, an effort that will see the deployment of a tidal turbine array in the Bay of Fundy, near Parrsboro. In Salaberry-de-Valleyfield, Quebec, CO2 Solutions is working on an enzyme-enabled carbon capture technology. In Toronto, Ontario, the entrepreneurs at QD Solar are working on ways to use quantum dots to boost the efficiency of conventional solar photovoltaic panels. In Squamish, British Columbia, Carbon Engineering is working on a project that will gather CO2 from the atmosphere and transform it into calcium carbonate, a common substance found in rocks and snail shells.

At Sustainable Development Technology Canada (SDTC), as a funder and supporter of these efforts, we are proud to see these great Canadian ideas transformed into well-engineered demonstration projects each and every day.



## ENERGY

**Kevin Goheen**  
Executive Director, Canadian Academy of Engineering

Engineering skills are an important component of solutions to the exceptionally difficult public policy challenges Canada faces.

In 2015, the Canadian Academy of Engineering (CAE) performed a joint study with the Institute for Research on Public Policy on how engineers and scientists could best do this. The report called on decision-makers to acknowledge that a careful balance must be struck between engineering evidence and other considerations. Of course, evidence should weigh heavily in the balance, but it will not necessarily trump budgets, citizens' concerns, campaign commitments and other considerations. The challenge is to create an environment in which the public debate is appropriately informed by engineering and science.

As an example of how engineers could inform such a debate, the CAE and its partners have recently completed the Trotter Energy Futures Project, a study on Canada's GHG reduction challenge. The study is the first to acknowledge that the commonly stated goal of reducing our GHG emissions by 80 per cent relative to now will be exceptionally difficult, requiring governments and citizens to make difficult choices. Engineers are ready to find solutions to the gaps that we identified.



## INFRASTRUCTURE

**John Gamble**  
President and CEO of the Association of Consulting Engineering Companies - Canada

The Association of Consulting Engineering Companies - Canada applauds the Liberals' first budget for its focus on immediate and long-term growth of the economy through investments in infrastructure and innovation.

Study after study demonstrates a link between infrastructure investment and economic performance;

infrastructure investment grows the economy, strengthens communities and protects the environment. Furthermore, public infrastructure is a core business of government and vital to Canada's prosperity. Infrastructure enhances the economic, social and environmental quality of life of all Canadians. However, it is critical the government resists focusing on short-term "stimulus" spending aimed at so-called "shovel-ready" projects merely for the sake of speed and expediency.

The real value proposition and the greatest return on investment require a long-term, strategic approach.

The key will be picking the "right" investments. We urge the federal government and municipalities to be strategic and focus on projects that are truly productivity-enhancing, long-term in nature and that will boost long-term economic growth. If we are able to accomplish this, the government, and more importantly all Canadians, will reap the rewards.



## NEXT GENERATION

**James Dyson**  
Chief Engineer, Dyson

Engineers learn early on an important skill: failure. Designing something that solves a real problem takes time, careful thought, relentless testing and, inevitably, failure, from which you learn.

Canadian engineers are rising to this challenge. My foundation holds an annual international competition – the James Dyson Award – that invites post-secondary students to design something that solves a problem. The task is vague and the projects that are entered are expansive and thrilling.

Last year, a Canadian team from the

University of Waterloo took home the international top spot with their project, Voltera V-One, a custom circuit board printer that allows a user to go from concept to creation quickly.

These students dedicated two and a half years to engineering the printer, designing dozens of prototypes that spanned three major design revisions. Their perseverance paid off. As an engineer, I understood the frustration of waiting for a circuit board to be printed, and this project elegantly solved that problem.

It's this next generation of engineers and designers who think differently and take risks that will change the world.

## BY THE NUMBERS

Canada has the **5th-largest** non-residential construction sector in the world and is expected to remain in the top 7 through 2025

The construction industry currently contributes **7%** of GDP and employs **1.4 million** workers directly or indirectly, or about 1 in every 13 Canadians

An infrastructure rebuilding program worth **\$50-billion** and rolled out over five years would add \$1.43 to Canada's GDP for every dollar invested in the short term, and as much as \$2.50 to \$4 in the long term

Source: Canadian Construction Association

## CONSTRUCTION

## Infrastructure investment encouraging innovation, creating jobs

The federal government's recently announced infrastructure rebuilding program will boost the economy, create good-paying jobs and renew assets that touch on the lives of Canadians every day, including roads and bridges, fresh and wastewater treatment facilities, schools and hospitals as well as sports, cultural and recreation centres. A lot of these assets were built in the 1950s and '60s and are reaching the end of their useful life, says Michael Atkinson, president of the Canadian Construction Association.

"They got neglected, so we've got some catching-up to do," he says, adding that numerous studies indicate that from an economic perspective infrastructure spending is one of the most efficient ways to supercharge the economy and create living-wage jobs. For example, a Broadbent Institute study indicated that a \$50-billion infrastructure rebuilding program rolled out over five years would add \$1.43 to Canada's gross domestic product (GDP) for every dollar invested in the short term, and as much as \$2.50 to \$4.00 in the long term. That's because as new infrastructure comes on-stream it "leverages" private-sector investment for industries that utilize it. For example, better roads and bridges make it easier to move goods to market, encouraging investment in manufacturing, transportation and trade.

In terms of its overall economic and employment contribution to the Canadian economy, the construction industry currently contributes seven per cent of GDP and employs 1.4 million workers directly or indirectly, or about one in every 13 Canadians. Many of these are skilled trades that exceed living-wage requirements. And new jobs are coming; Mr. Atkinson estimates that in order to meet demand and



**Michael Atkinson, president of the Canadian Construction Association, says when new infrastructure comes on-stream it leverages private-sector investment for industries that utilize it. SUPPLIED**

replace workers going into retirement, the industry is going to need another 260,000 workers over the next decade.

He adds that the construction industry is well positioned to take up the challenge the infrastructure rebuilding program presents. Canada already has the fifth-largest non-residential construction sector in the world and is expected to remain in the top seven through 2025. Its vitality has attracted interest and investment by foreign firms, particularly from Europe. "The result is that our own capacity has been supplemented, plus the industry is very mobile in terms of marshalling and deploying its resources to meet demand," says Mr. Atkinson.

No matter how you look at it, infrastructure spending is a win-win all around. It spurs investment, encourages innovation, creates jobs and renews essential assets. "It's an investment in Canada's future," says Mr. Atkinson.

If we could insure their minds, we would.

**Congratulations** to the 2016 recipients of the Engineers Canada Awards for outstanding contributions to the field of engineering and the lives of all Canadians. It's minds like yours that make us proud to have been supporting these achievements for the past 20 years.

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## ENGINEERING IN CANADA

### PARTNERSHIPS

# Driving progressive, innovative and relevant education

From the comforts of home to the machines and structures that power commerce and communities, virtually every aspect of life is touched by the ingenuity and disciplined thinking of engineers.

These designers and builders are behind most of the objects and infrastructures people use everyday. Even things that are created manually – such as a home-baked cake or a handcrafted table – are often made with tools that have been engineered to ease a specific task.

“When you wake up in the morning and you go through your day, the things you touch and the things you need – like the light switch, your smartphone, the water tap, your car, the streets and our electrical infrastructure – are all made possible by engineering and engineers,” says Robert Hardt, president and CEO of Siemens Canada, a global company that delivers solutions for sustainable energy, intelligent infrastructure, health care – including medical imaging equipment and laboratory diagnostics – and manufacturing. “This is a fact: engineers make our lives very comfortable.”

As technology becomes even more integrated into the built environment, it’s important to ensure that tomorrow’s engineers have the skills and knowledge to shape the future, says Mr. Hardt.

“Nobody knows what the future will be, and this is why engineers must be ready and equipped to define and make a livable future,” he says. “So the question is: how do we educate tomorrow’s engineers in a way that addresses this challenge?”

Akela Peoples, president and CEO at The Learning Partnership, says finding the answer to this question is a collaborative effort between governments, corporations, schools and organizations such as The Learning Partnership, which builds partnerships that drive progressive, innovative and relevant education.

Building the next generation of engineers starts with education in the early years of school, says Ms. Peoples. She points to a number of programs in her organization that aim to do this, including Investigate! Invent! Innovate!



Robert Hardt of Siemens Canada (top right) was named “champion of public education” by The Learning Partnership for his big push to support innovation at every level of the Canadian education system. Google Canada works closely with Actua (right and bottom), a national charity that delivers STEM-focused outreach programs to youth to inspire the next generation of innovators. SUPPLIED

“Nobody knows what the future will be, and this is why engineers must be ready and equipped to define and make a livable future.”

**Robert Hardt**  
is president and CEO of Siemens Canada

– which integrates science, technology, engineering and math (STEM) skills into grades 7 and 8 curricula.

Investigate! Invent! Innovate! challenges students to apply classroom concepts to invent a product or process that solves a problem they’ve encountered in their daily lives. Students then get to show off their inventions at Invention Conventions, which take place in various cities across Canada.

Ms. Peoples points to the critical role played by companies such as Siemens Canada, whose efforts include providing software grants to universities, internships and a work-integrated learning program delivered by the Siemens Canada Engineering & Technology Academy.

Siemens also partners with Canadian colleges to incorporate its advanced Mechatronics training programs into their curriculums. The training is the global industry standard in skills certification for mechatronics systems. Globally, Siemens even invites doctoral students to work on their thesis with technical support from the company.

“Under Robert’s lead, Siemens has been very active in education,” says Ms. Peoples, whose organization inducted Mr. Hardt this year into its Champions of Public Education Hall of Fame.

Siemens isn’t the only company working to advance engineering in Canada. At Google Canada, engaging children and promoting the learning of foundational STEM skills is an integral part of the company’s mandate.

Google Canada works closely with Actua, a national charity that delivers STEM-focused outreach programs to youth through its network of 33 university and college-based members, and through a national outreach team. These programs include summer camps, classroom workshops and clubs.

“We engage with children through Actua and have amazing examples of people who work for Google now who got their start with Actua,” says Steven Woods, senior engineering director at Google Canada.

In addition to working with Actua, many Google employees are also involved in local after-school programs such as LEGO robotics or Lightbot programming.

Mr. Woods says Google has conducted several studies into how kids experience math and science and what causes them to be interested or disengaged.

“We find that one major reason why children move away is because their parents moved them away, and that’s because the parents themselves don’t understand math and science,” says Mr. Woods. “But at Google, we believe that the ability to think logically is a skill that’s important for kids to learn even if they don’t become engineers. That’s why we work so much with Actua and why we put so much of our time and money into outreach – we believe it’s critical to the future of the country.”

### APPOINTMENT NOTICE



## Chris D. Roney, P.Eng., BDS, FEC, UE

Engineers Canada is pleased to announce Chris D. Roney, P.Eng., BDS, FEC, UE, as its president for the 2016-2017 term. In the coming year, Mr. Roney and the Engineers Canada Board will work with the engineering regulators to advance the profession in the public interest.

Chris Roney is a practicing structural engineer, and president of Roney Engineering Limited, a Kingston, ON, consulting firm offering a full range of structural engineering services related to building design and construction, investigations, assessments and restorations throughout Canada. Mr. Roney has practiced structural engineering since graduating with honours from Queen’s University in 1990. He is accredited as a Building Design Specialist and Consulting Engineer, and is a Fellow of Engineers Canada.

Mr. Roney serves as a member of the Ontario government’s Building Advisory Council, and recently served on the Building Safety Technical Advisory Panel and as Chair of the Part 4 (Structural) Technical Advisory Committee for the Ontario Building Code. He provides strategic advice on matters related to on-going policy, administrative and technical issues related to the Building Code in Ontario.

Over the past 18 years, Mr. Roney has served on numerous key committees and task forces with Professional Engineers Ontario (PEO). He was a leading member of, and spokesperson for, PEO’s task force that responded to the tragic collapse of the Algo Mall in Elliot Lake. He appeared at the Elliot Lake Inquiry as an expert and helped draft many of the PEO recommendations that the Inquiry ultimately adopted.

Mr. Roney was first elected to the Board of Engineers Canada in 2009. He recently led a national task force at Engineers Canada studying the lessons to be learned from the Elliot Lake Collapse in Ontario, the Charbonneau Commission in Quebec and the Mount Polley Tailings Storage Facility Breach in British Columbia.

Mr. Roney is a Warden responsible for the Ritual of the Calling of an Engineer, also known as the Iron Ring Ceremony, for Camp #3 in Kingston, ON, and is an Alternate Warden with the Corporation of the Seven Wardens, the body that administers and maintains the Ritual nationally.

Mr. Roney is very much looking forward to the privilege of serving the engineering profession as president of Engineers Canada.

### BY THE NUMBERS

Male engineering membership in Canada in 2012:

**246,472**

in 2013:

**247,854**

Percentage change:

**0.6%**

Female engineering membership in 2012:

**34,033**

in 2013:

**35,534**

Percentage change:

**4.4%**

Sources: Engineers Canada, Conference Board of Canada



Geering Up, UBC engineering’s summer camp, aims to jumpstart interest in engineering or science careers. SUPPLIED

### FROM PAGE EC 1

## Diversity: Outreach sparks interest in STEM fields

The numbers also reflect initiatives by groups such as Actua, a national charitable organization involved in science, technology, engineering and math (STEM) outreach. Its programs include 250,000 Canadians aged six to 26 in more than 500 communities across the country, with a particular focus on girls, new Canadians, indigenous and at-risk youth.

Jennifer Flanagan, co-founder and CEO of Actua, says the key is exposing young people to “hands-on” science and technology, building their skills and competencies, and introducing them to positive role models. In its National Girls Program, for example, women undergraduate students teach girls about engineering and science. The National Indigenous Youth in STEM program works with 200 First Nations, Inuit and Métis communities across the country. Its Go Where Kids Are program partners with local organizations to reach new Canadians, at-risk youth and those facing socio-economic challenges.

“Early exposure is critical to ensuring that switch on for youths to consider these fields, both as future career options and how important they are to our lives,” Ms. Flanagan says, noting that digital skills, coding and other

computer science courses are particularly popular. “Demand is through the roof – we have programs selling out in minutes.”

As well as acquiring critical skills, hands-on training makes science and engineering more relevant to under-represented youths “and allows them to imagine different futures for themselves,” Ms. Flanagan says. “We will not reach our true innovation potential as a country unless there are diverse voices at the table.”

Andrew McLeod, CEO of Engineers and Geoscientists New Brunswick, echoes that. “Engineers are problem-solvers,” he says. “If they’re going to come up with solutions for Canada’s biggest challenges, the profession should better reflect the population it is serving.”

Dr. Croff calls engineering “a team sport” and says “diverse teams are smarter teams.” The key to achieving diversity is to “go about it intentionally,” she remarks. “You have to keep your foot on the pedal.”

For example, she says UBC’s goal of attaining 50 per cent women in their engineering programs by 2020 “is a big, ambitious goal.”

“But if you don’t have big, ambitious goals, you won’t get anywhere.”



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RESEARCH

# Putting big data to good use

There is a good chance that your smartphone is collecting data about you. It may track your movements throughout the day, count your steps, keep track of your networks, log your mobile shopping and banking activities, as well as your Angry Birds scores. More information about you may be coming from your fitness tracker, smartwatch, tablet, computer, TV and even the buildings you frequent.

But how is this information used? How can it be examined, selected and translated into tangible personal, organizational and societal benefits? These are questions Andrea Lodi is working to unlock. "Big data is certainly at the top of everyone's mind," he says. "But in order to see significant outcomes, it requires a certain degree of investment, both in people and resources."

For finding the right environment to advance what he calls "game-changers for the future of research," Prof. Lodi, Canada Excellence Research Chair (CERC) in data science for real-time decision-making – the biggest chair in Canada in the field of big data and operations research – relocated from Bologna, Italy, to Montreal last year.

Prof. Lodi, who has already weathered one winter in Montreal, says a number of favourable conditions prompted the move: the CERC investment, the calibre of his colleagues, and the commitment from Campus Montréal, which includes Polytechnique Montréal, HEC Montréal and Université de Montréal.

"In Montreal, we have this fantastic group that's made up of scientists working in applied math optimization and computer science, especially machine development dealing with data. And there is a strong connection to industry and organizations that are interested in following up," he says. "It's a unique opportunity that's not easy to find [elsewhere]."

While Prof. Lodi says he is still building his team, he has already seen "lots of good activity" towards his goals – which include advancing practical applications for his research.

A field where Prof. Lodi sees considerable potential for utilizing data to improve outcomes – both on the



Prof. Andrea Lodi is looking at utilizing mathematical optimization for extracting information from data. SUPPLIED

"In Montreal, we have this fantastic group that's made up of people working in applied math optimization and computer science, especially machine development dealing with data."

**Andrea Lodi** is Canada Excellence Research Chair (CERC) in data science for real-time decision-making

personal and organizational level – is health care. "We have a project that looks at many aspects, from scheduling operating rooms in hospitals to leveraging medical expertise for the best personalized patient care," he explains.

For coming up with the best strategy of care for an individual, Prof. Lodi suggests looking at essential historical data, such as dosages of drugs and strategies of care that have been applied to different patients, and then integrating the findings with personal data, such as age, past medical history, past reaction to medication, etc. "By interpreting the data that is already there, we can predict what types of strategies are going to be effective," he says. "We start out with a large number of strategies and then apply mathematical optimization to explore the best solutions."

What's new in this model is the sheer amount of real-time information, says Prof. Lodi. An IBM estimate predicts that online data exchange should surpass a zettaoctet – or one billion times the annual capacity of a domestic hard disk – in 2016. He adds that the data arrives from many different sources and platforms. For the medical application, for example, even a person's fitness app could yield data that her or his physician might find useful. "These things were completely out of reach in the past. Now we have the data but are not necessarily able to use it fully yet," he says.

Prof. Lodi and his team are developing models and algorithms that can help to rapidly access – and utilize – this wealth of strategic information. "Machine learning is about extracting information and catching patterns in

the data that humans don't necessarily see because of the complexity. Once you have access to the knowledge, mathematical optimization can factor into the decision-making," he says.

In transportation, for example, big data can be useful for planning traffic flow, such as reacting in real time to traffic congestions or accidents, or helping commuters better co-ordinate their timing and routes through the city, says Prof. Lodi. Another application he and his team are working on provides valuable insights into customers' buying behaviours to the fashion industry for co-ordinating the types of collections available in stores.

The potential for putting big data to good use is vast, says Prof. Lodi, who adds that the outcomes of his team's work can affect every sector of the industry that uses optimization.

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# ENGINEERS CANADA AWARDS 2016

Presented annually since 1972 to recognize outstanding Canadian engineers, teams of engineers, engineering projects and engineering students, the Engineers Canada Awards highlight engineering excellence, as well as the contributions of Canadian engineers to their profession, their community and to the safety and well-being of Canadians.

**AWARD OF JOURNALISM EXCELLENCE IN ENGINEERING**  
**MARK LOWEY**

Mark Lowey is the publisher and managing editor of EnviroLine, a business publication for western Canada's environmental industry. As a journalist, he has garnered numerous awards, including two national science-writing awards from the Canadian Science Writers' Association and a Governor General's Michener Citation. Mr.

Lowey's award-winning article 'Pipe Dream' focused on assessing the risks and potential hazards of two proposed oil sands export pipelines. His balanced and comprehensively researched article offered clear, up-to-date information on the potential risks associated with diluted bitumen when spilled into a marine environment.



**AWARD FOR THE SUPPORT OF WOMEN IN THE ENGINEERING PROFESSION**

**LIANNA MAH, M.Eng., FEC, P.Eng.**

A civil engineering graduate from UBC, Lianna Mah has more than 29 years of experience in engineering consultation, with a specialization in wastewater, water and civil engineering projects. Throughout her career, she has worked tirelessly to support the advancement of women in the profession. Her role as vice-president, Business Development, her appointment to the board at Associated Engineering, and her passionate service to many organizations, including the Canadian Coalition of Women in Engineering, Science, Trades and Technology (CCWESTT), make her an exceptional role model for women and future engineers.



**MERITORIOUS SERVICE AWARD FOR COMMUNITY SERVICE**  
**MARISA E. STERLING, P.Eng.**

Marisa Sterling is currently the assistant dean, Inclusivity and Diversity, at the Lassonde School of Engineering at York University. She has always shown a deep dedication to her profession and to the larger community she serves. Elected as president of the Ontario Professional Engineers Foundation for Education, Ms. Sterling has directly helped 532 undergraduate engineering students address the affordability imbalance of their education costs. She has supported many charitable endeavours, including the North York General Hospital's Emergency and Child & Teen Programs, the Habitat for Humanity's Women Build Program, along with AURA, a local refugee sponsorship facilitator, to name but a few.



**MEDAL FOR DISTINCTION IN ENGINEERING EDUCATION**

**NANCY NELSON, M.Sc.(T), P.Eng.**

Nancy Nelson, professor of Electronic Systems Engineering at Conestoga College, has demonstrated commitment to excellence and innovation in engineering education throughout her career. At every opportunity, Ms. Nelson incorporates new and relevant teaching methodologies into her classroom to engage and motivate her students. After extensive research in the field, she pioneered Project Based Learning (PBL) with

the creation of a highly effective, four-year, Electronic Systems Engineering (ESE) degree program. Collaborating with local primary and secondary schools, and outreach activities such as Go ENG Girl, Day with a Difference and Cyber Olympiad, Ms. Nelson continues to be an unflinching advocate for engineering education and careers.



**GOLD MEDAL STUDENT AWARD**

**ANDRÉ MARCHILDON**

A remarkable, energetic and focused student, André Marchildon is completing his fourth year at the University of Manitoba in the Mechanical Engineering Program. As the senior stick president, he represents over 1,700 undergraduates working with a council of 90 dedicated student leaders, managing a budget of \$250,000. Mr. Marchildon has held leadership positions in several organizations including the University of Manitoba Engineering Society and the Congress of the Canadian Federation of Engineering Students, and was a cabinet minister in the Manitoba French Youth Parliament. He also gives his time to St. Amant, working with those who have developmental disabilities. As busy as he is, Mr. Marchildon has maintained an outstanding academic record – he is a young man well prepared for an exciting career in the field of engineering.



**GOLD MEDAL AWARD**

**DR. DONALD MAVINIC, PhD, FCAE, P.Eng.**

Professor of Civil and Environmental Engineering at the University of British Columbia, Dr. Donald Mavinic is considered to be one of the finest researchers in Canada on wastewater and water treatment processes. Dr. Mavinic was instrumental in the development of the Pearl Nutrient Recovery Process, which recovers nutrients from wastewater, transforming a costly problem into a valuable product, a transformative change in wastewater treatment that is a positive example of what can be achieved through engineering and science. His contribution to the profession, at all levels, nationally and internationally, and at the most senior levels, is exceptional. Through it all, Dr. Mavinic remains well grounded and active in the community, contributing his time and energy to the Greater Vancouver Food Bank, Lower Mainland Bureau Toy Drive and the B.C. Children's Hospital.



**YOUNG ENGINEER ACHIEVEMENT AWARD**

**SELENA WILSON, P.Eng.**

Talented, ambitious and passionate, transportation engineer Selena Wilson has over 11 years of engineering design and project management experience. Ms. Wilson has led design teams for numerous projects, securing increasingly significant roles and key responsibilities. Since her recent promotion to branch manager of the Prince Rupert office of McElhanney Consulting Services Ltd., Ms. Wilson has grown her staff from a team of two to 12. Extremely dedicated to her profession, Ms. Wilson is also involved in Young Professional Groups provincially, nationally and internationally.



**MERITORIOUS SERVICE AWARD FOR PROFESSIONAL SERVICE**

**ANDREW MILL, FEC, P.Eng., Struct.Eng.**

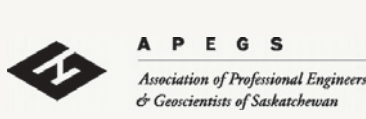
A structural engineer with nearly 30 years of experience in the field, Andrew Mill is a partner at the vibrant multi-discipline engineering and architecture firm, David Nairne and Associates in Vancouver. His area of expertise is in seismic risk assessment and the upgrading of buildings. Mr. Mill chairs APEGBC's Seismic Peer Review Committee, which develops world-class seismic assessment and upgrade guidelines for schools and other high-risk buildings. Mr. Mill's technical expertise combined with his selfless dedication is an invaluable contribution to his profession and the public.



**NATIONAL AWARD FOR AN ENGINEERING PROJECT OR ACHIEVEMENT**

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Initiated by Michel de Spot, P.Eng. of EcoSmart Foundation Inc., SunMine is British Columbia's first grid-connected solar facility as well as the first such facility to be built on a re-claimed mine site. With 4,000 solar cell modules mounted on 96 solar trackers that follow the sun, the site provides about 40 per cent more energy than a traditional fixed system. Owned and operated by the City of Kimberley, B.C., SunMine's success was the result of the exceptional collaboration of its key partners, Teck Resources Ltd., the City of Kimberley, BC Hydro, and EcoSmart. SunMine has also become a centre of excellence, showcasing leading-edge solar technologies.



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