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By Natalya Anderson, Sharon Aschaiek and Michael Mastromatteo

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Cover: University of Waterloo engineering students (clockwise from bottom left) Carlos Wang, Navi Ganti, Leo Koppel, Michael Smart, Ben Skikos and Ian Colwell work on the Autonomous, one of the first self-driving vehicles approved by the province for its automated vehicle pilot program.

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THAT BRILLIANT IDEA

By Nicole Axworthy

ENGINEERING DIMENSIONS

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Despite the romanticized image of the lone researcher suddenly having a eureka moment after a long day in the lab, the reality is that innovation

doesn't happen in isolation. Great ideas come alive through trial and error, and when groups of passionate people work together to inspire, support and collaborate.

Ontario engineers are no different. They are true team builders—they count their colleagues as friends, draw on their diversity and celebrate wins within the community as if they were their own. Oh, and they innovate like mad. It's this mix of culture and talent that's creating some of the best teams for innovative products and processes you'll find anywhere.

Within the pages of *Engineering Dimensions*, we've featured—time and time again—hardworking and creative professional engineers who are putting their talent to good use, making our daily lives smarter, safer and more stimulating.

What has become a biennial tradition, our innovation issue is one of my favourites because we get to explore all the fascinating research projects and startups that are happening right here in Ontario, talk to the great minds behind the work, and discover the process of how their ideas became reality.

In "Welcoming innovation" (p. 36), we introduce you to P.Engs who are—with the talent and support of their

teams—revolutionizing the technology used for medical drug testing, the development of socially interactive robots for people with dementia, and applications in 3-D forensic mapping for crime scene investigations. Others are transforming our daily lives by improving the reliability of software, incorporating ingenious optimal learning techniques in schools, and developing the notorious future of autonomous cars.

You won't want to skip our Profile column this issue (p. 33), where we feature the impressive professional life of military engineer Travis Kelley, P.Eng., who has been able to combine his interest in science and engineering and his desire to help people while carrying out the multitude of roles he's been assigned to in the Canadian Armed Forces.

Please also take a moment to read the inspiring biographies of the 11 engineers who will be recognized this year with Ontario Professional Engineers Awards (OPEA) (p. 13). For tickets and more information on the November 18 OPEA gala celebration, please visit www.opeawards.ca.

Finally, I'd like to thank everyone who took the time to respond to our 2017 *Engineering Dimensions* reader survey (congratulations to Logan Robinson, EIT, whose name was drawn for \$500 Apple gift card) and our annual call for ideas. Your help is very much appreciated! **e**

THIS ISSUE Innovation is a familiar theme in this magazine, but it continues to be a popular draw for readers. Here, we present a brief cross-section of some enterprising practitioners who have developed exciting new devices, systems and instruction methods that shed more light on the profession's solution-finding potential.

LOOKING FORWARD

By Bob Dony, PhD, P.Eng., FIEE, FEC



I hope everyone has had a restful and refreshing summer, despite the weather! As Council has taken a break over the summer, I've had the opportunity to attend a number of events across the province. Two events of note were organized by the Canadian Forces Liaison Council (CFLC): one was an outing on the HMCS Toronto frigate out of Toronto harbour, and

the other was observing the army operations course at CFB Kingston. The CFLC liaises between the Canadian Armed Forces Reservists and their employers, or educational institutions, to help support the reservists and their need for accommodation in serving in the Forces. There, I met a number of reservists who are also members of PEO. They not only see their licence as a key part of their civilian life, but they also see the value it brings to their service in the military. I see opportunities to further strengthen the links between licensure and those serving in the military—both reservists and full-time personnel.

HEALTHY TURNOVER

As the summer winds down, it's time to look towards the new Council year. The first full Council meeting occurred on June 23 (see *Engineering Dimensions*, July/August 2017, p. 49). I was pleased that Council approved the Council Term Limits Task Force's (CTLTF) revised recommendations for term limits and succession planning. The task force was created by Council in support of members' motions at the 2015 Annual General Meeting. Among the recommendations are: a single term limit on president, and a six-year limit on serving as a councillor, after which a six-year hiatus is required before being eligible to serve on Council again, unless the member runs for the vice president or president-elect positions. Council plans to have these limits enacted in regulation in time for the 2019 Council elections.

I have often spoken for the need for change and renewal to be a core value of PEO's leadership so this implementation of term limits is, in my opinion, a healthy first step. Having senior leaders, in all levels of PEO, including Council, committees and chapters, step aside after their time is due allows a new generation of leadership to step forward. As much as I'd like to think I've provided some value in my service as a volunteer over many years, I don't believe for one instant that PEO can't cope without me! In fact, isn't one of the primary responsibilities of any leader to ensure the organization is as healthy, if not healthier, once they have left?

While term limits create opportunities for renewal, Council also recognized that succession planning is an equally important component of such renewal. It struck a Succession Planning Task Force (SPTF), tasked to "develop a detailed implementation plan to implement the recommendations

for succession planning," from the CTLTF. Now, the Human Resources Committee, Central Election and Search Committee, and Regional Election and Search committees all include mandates around succession planning. However, Council agreed with the CTLTF that this issue is "too important to assign to an existing committee." I look forward to helping the task force fulfill its mandate.

I also urge all members to start thinking about the upcoming 2018 Council elections. The call for nominations was published in the last issue (see *Engineering Dimensions*, July/August 2017, p. 42). If you know of any member you think would serve the profession well on Council, let them know. Sometimes all it takes is that personal nudge from a colleague. The 2017 election saw a healthy slate of candidates for most of the positions. I believe the large voter turnout—one of the largest in years—was due in part to the variety of candidates and the resulting healthy debate. The bar was set this year; let's raise it for the next!

IMPORTANCE OF TRANSPARENCY

As the existing Council year unfolds, I'd like to remind members that they can keep up with Council deliberations in a couple of ways. *Engineering Dimensions* regularly publishes a Council update. As well, the PEO website hosts all the details of each Council meeting, including agendas, minutes, audio, attendance and recorded votes. From the main PEO webpage, click through About PEO→How we Govern Licence and Certificate Holders→PEO Council to get to the Council resource page. Equivalently, the direct URL is www.peo.on.ca/index.php?ci_id=1835&la_id=1. The agendas contain all the background material, such as briefing notes and reports, for each agenda item. The minutes contain the final motions and voting results. Occasionally, a recorded vote is called and the votes of individual councillors are shown. While all this information provides a degree of transparency in how Council acts to fulfill PEO's regulatory mandate for the public, I'm the first to admit it's not in the most user-friendly format! I hope we can bring more transparency to the workings of Council and the role each councillor plays in fulfilling its mandate. This transparency is important, not just for our own members, but for the public at large on whose behalf we regulate the engineering profession. **e**

TRIAL IN FATAL STAGE TOWER COLLAPSE COULD BE IN JEOPARDY

By Michael Mastromatteo

PEO will monitor the trial of a contractor, concert promoter and other individuals charged under the *Occupational Health and Safety Act* for their involvement in a June 2012 fatal stage tower collapse at Toronto's Downsview Park.

The collapse, which killed a drum technician employed by the rock band Radiohead, and injured three others, occurred in high winds just a short time before the concert was to begin.

The charges were laid in June 2013, and the trial was originally scheduled to wrap up by January 2017, more than three years after the original incident.

In June, however, a retrial was ordered, when the presiding judge, Justice Shaun Nakat-suru, was appointed to the Ontario Superior Court, and had to withdraw from the case.

The new trial was scheduled to begin on September 5 and continue through to the spring of 2018, but defence lawyers argue the case has seen unreasonable delays that violate their clients' right to a timely trial.

Nakat-suru had previously rejected a mistrial application from defence lawyers on grounds of inordinate delay in the proceedings.

At the time of the incident, PEO offered to assist the Ontario Ministry of Labour in its investigation. As part of PEO's mandate to govern its licence and certificate holders and regulate professional engineering practice to serve and protect the public interest, the regulator can help to determine whether professional engineering work was performed by PEO licence holders in compliance with the regulations under the *Professional Engineers Act*.

"PEO would be pleased to assist the ministry's investigation, if requested, to find out if engineering work was carried out by appropriately licensed people and companies, and establish if there were any issues related to the engineering performed," said Linda Latham, P.Eng., deputy registrar, regulatory compliance at PEO.

Under section 38 of the engineering act, PEO investigators must preserve secrecy and confidentiality of all matters that come to their knowledge in the course of an investigation.

ENGINEERING COMMUNITY APPLAUDS CHOICE OF JULIE PAYETTE AS GOVERNOR GENERAL

By Michael Mastromatteo



The Honourable Julie Payette, ing., seen here in a Canadian Space Agency uniform, was recently appointed Governor General of Canada.

Canada's engineering community salutes the appointment of Quebec-based engineer and astronaut Julie Payette, ing., as the next Governor General of Canada.

The 53-year-old, who is a graduate of McGill University and University of Toronto engineering programs, and the second Canadian woman to take part in the NASA space shuttle program, was announced as the next Governor General on July 13. She succeeds David Johnson, who held the position since 2010 and steps down in September 2017.

Kathy Baig, ing., president of the Ordre des Ingénieurs de Québec (OIQ), says the appointment of Payette as Governor General is a boost to the engineering profession in Quebec and across Canada.

"The appointment of an engineer from Quebec to the prestigious position of Governor General of Canada is a source of pride for the entire profession," Baig told *Engineering Dimensions* July 25. "Julie Payette has always been a great ambassador for engineering. Her outstanding career and accomplishments are a great source of inspiration for young people in science and technology, especially for women. As the new Governor General of Canada, she will be able to continue her work to promote science and technology to Canadians."

Payette joined the Canadian Space Agency (CSA) in 1992. She was a crew member on the Space Shuttle Discovery mission in 1999, and was the first Canadian to board the International Space Station. Her main responsibility on the space station was to operate the Canadarm unit, one of the CSA's greatest contributions to the international space program.

Payette also served as a mission specialist on the 2009 Space Shuttle Endeavour expedition, where she acted as flight engineer and lead robotic operator.

Overall, she has logged more than 610 hours in space before retiring from the CSA in 2013.

Payette has long served as an advocate for women to become more involved in STEM pursuits.

In a July 17 statement, the CSA also welcomed Payette's selection. "Ms. Payette has served the Canadian Space Agency and her country exceptionally well, both on the ground and in space for over two decades," the CSA said. "Throughout her career as an astronaut, she was a tireless ambassador for science and technology. Ms. Payette visited schools across the country, encouraging young Canadians to view science as a means to contribute to society and to our planet."

In a previous interview with *Engineering Dimensions* to discuss engineering contributions to Canada's space program, Payette discussed the profession's versatility: "I often say to young people when I talk about engineering that the profession is very large and encompassing. And what people learn at engineering school, at NASA, and in the aerospace industry translates immediately into a system of problem-solving, designing, looking at situations, and picking out the pertinent parameters. You learn this way of thinking and a way of noting problems and developing solutions. As well, you can apply this almost anywhere in the world, and that's one reason why you can find engineers in hospitals, in business, in politics. It's an approach that is useful practically anywhere."

Payette was made a fellow of Engineers Canada in 2014 for her contributions to the engineering profession. She is also the 1994 recipient of the Engineers Canada Young Engineer Achievement Award and the 2010 Gold Medal Award.

MEMBERS COMMENT ON PEAK KNOWLEDGE REPORTING PROGRAM

By Michael Mastromatteo

PEO members' initial experiences with the Practice Evaluation and Knowledge (PEAK) program have been largely positive, according to an informal survey taken by *Engineering Dimensions*.

Launched March 31, the PEAK program is designed to improve the regulatory profile of PEO licence holders and encourage individual members to pursue continuing knowledge development. PEAK was the main focus of the March/April 2017 issue of *Engineering Dimensions*.

As of August 23, 6580 PEO members have completed the PEAK questionnaire and have received a recommended number of hours of professional development and knowledge activities.

Only members who identify as practising engineers are given a recommended number of continuing knowledge activity hours to complete before their next licence renewal date. Those who self-identify as non-practising need only declare their status and complete an online ethics module.

Engineering Dimensions contacted a number of PEO members who recently completed the PEAK program. Respondents were asked their general impressions of the program and if they had any difficulties finding and reporting on continuing knowledge activities.

Charlotte Bond, P.Eng., a project engineer at WSP-Canada in Mississauga, was typical of the engineers contacted about PEAK. "It has taken no real effort to submit the continuing knowledge activities," Bond said. "I have found that, after two months, I have almost a third of the hours I need without having to put in any additional effort to find continuing knowledge activities. The activities I have submitted I would have done with or without the PEAK program."

It was recommended that Bond take 18 hours of professional knowledge activity. Among the activities she reported was a one-hour webinar and four hours of in-house training presented by her employer.

For Toronto-based engineer Tom Markowitz, P.Eng., chair of the West Toronto Chapter's Environment Committee, the main difficulty with PEAK was determining if he is practising or non-practising.

"It was difficult for me, because I am semi-retired," Markowitz said. "I decided that I am still practising because I still do work that applies engineering principles to protect the safety of the public, economic well-being and environmental quality."

Markowitz, who was assigned 18 hours of PEAK activity, said the overall experience was simple and that the PEAK reporting system is well designed and straightforward.

Rupinder Mann, P.Eng., a software and research specialist with Lawson Health Research Institute in London, Ontario, agreed that the PEAK experience was intuitive and self-defining.

"I'm glad my current position allows me to continue my work in software engineering," Mann said. "Reporting my new knowledge activities is simply a matter of capturing more required details of the work that I already do. Additionally, the PEAK program provides motivation to learn something new."

Mann, who was given a recommended 15 hours of knowledge activity, benefited from previous experience in knowledge reporting. "I am also a project management professional so I have to report professional development units (PDUs) to the Project Management Institute every year," she added. "Another fortunate part was that I had already

continued on p. 10





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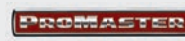
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continued from p. 8
reported all the required PDUs for project management to the institute, but I am still learning more. Now, I can report these more engineering-related activities to PEO."

Senior water resources engineer Jennifer Young, P.Eng., of Stantec Consulting in Waterloo, is registered with PEO and Professional Engineers and Geoscientists of BC (APEGBC).

Because BC already requires its members to track and report knowledge activity, Young had a head start on the PEAK effort.

"I need to track this for my APEGBC membership as well (80 hours, 50 of which are practice), so I already have a tracking system for myself," Young said. "I also work in an emerging sector, so I have a lot of opportunities for learning or teaching."

Young was given 17 hours of activity through PEAK, and fulfilled much of it by way of reporting on conferences, presentations, workshops and other informal information exchanges.

"My only complaint is that the reporting system for actually inputting your experience was not at all user-friendly," Young added. "There was no way to move through it quickly and it was annoying and took a long time."

PEAK's website has a feedback reporting tool and members experiencing problems with input or sluggish operation are encouraged to report them back to PEAK officials.

A PEAK user registered with PEO, Ordre des ingénieurs du Québec (OIQ) and the Association of Professional Engineers and Geoscientists of Alberta (APEGA) is Anna Chan, P.Eng., group manager with HH Angus and Associates in Toronto.

Chan initially had concerns about the activity-reporting deadlines for the first cohort of PEAK users, but otherwise found the experience quite simple.

"It was relatively easy except for the original misunderstanding that I was in the first batch as my renewal date was June 1, but I later found out that the first batch would be those with renewal dates of June 30," Chan said. "There were a few hiccups with my information on the PEO website as the reporting/due dates changed from the first time that I looked at it. I also requested the help desk to allow 0.5-hour increments as it originally only accepted full hours for the online reporting."

Chan is another user to benefit from multiple registrations and the ability to have employer or professional association training credited towards PEAK requirements. "HH Angus provides internal company courses that would

qualify, and I am also already reporting hours to APEGA, OIQ and CaGBC (LEED) that can be used for PEO," Chan said.

Andrew Garland, P.Eng., is a principal and project engineer with B.M. Ross and Associates Ltd., a multi-service consulting firm based in Goderich, Ontario. He completed the PEAK questionnaire in the spring, and was assigned 19 hours of continuing knowledge activity.

As a member of an engineering consultancy, Garland had no trouble determining his practice status through PEAK, but a few of his semi-retired colleagues had questions. "For them, the answer to the practising versus non-practising question required some clarification, but at a PEO information session the answer was readily available," Garland said.

He suggested the nature of consulting engineering work makes it somewhat easier for these engineers to undertake and report on professional knowledge activities. "Between encouragement our staff receive for continuing development, in-house training, and sessions we host with equipment suppliers, the [knowledge reporting] hours will be easily met in most typical years," Garland said.

He also said several B.M. Ross corporate policies helped reduce the baseline number of hours required for PEAK. "We do host some internal workshops, and I attend professional association activities, that can be put toward continuing knowledge activity," he added.

Garland said the rollout of the PEAK effort drew a fair amount of attention at B.M. Ross, and presumably at most consulting engineering firms in Ontario. "We have had a lot of internal discussion at our company regarding the PEAK program," he said. "Generally the response is fairly neutral. The implementation of a program like this is not totally unexpected, nor will it fundamentally change what we already do in a year. The biggest area of concern/question has been verifying what type of activity would be considered acceptable for continuing knowledge, but I think over the past few months this has become more clear."

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COURT RULING ADVANCES NOTION OF MANDATORY CONTINUING PROFESSIONAL EDUCATION

By Michael Mastromatteo

Professional regulatory bodies with compulsory professional development programs (CPD), and those considering the same, may be heartened by a recent Supreme Court of Canada decision upholding the Law Society of Manitoba's authority to impose 12 hours of compulsory professional development on members each year.

In April, the court heard the case of senior lawyer Sidney Green, who challenged the Manitoba law society's CPD program on grounds it has no public interest value and that the society has no authority in its statutes to suspend members for non-compliance with CPD.

In a split decision, the court said the law society's CPD rules are fair, and that it is proper for societies to protect members of the public who seek legal services by establishing and enforcing educational standards for practising lawyers.

"In light of the relevant provisions of the [Manitoba] act and practical concerns related to enforcing educational standards, the provisions of the rules establishing a mandatory CPD program that permit the suspension of a lawyer as a consequence for contravening those rules are not unreasonable," the court said in its ruling.

The court also said the Manitoba law society is merely doing what it is required to do by statute—namely, regulate the education of lawyers in the public interest.

Green, in turn, decided to retire rather than take any CDP programs offered by the law society. In media reports, Green was quoted as saying, "I can't think of a more honourable way to leave the [legal] profession than to resist this program." He had been practising law since 1955.

A number of regulators across Canada have either imposed some form of mandatory professional development for members, or are considering similar programs.

PEO recently instituted its Practice Evaluation and Knowledge (PEAK) program that, while not compulsory, comes in response to pressure that all self-regulated professions require members to undertake life-long learning and professional development, but may eventually consider a mandatory CPD program by way of a member referendum.

Many other engineering regulators across Canada have already instituted some form of mandatory continuing professional education programs for membership.

Lawyer Bernard LeBlanc, LLB, of Steinecke Maciura LeBlanc, who has expertise in regulated professions and administrative law, says the case confirms that such CPD programs have become essential for regulated professions in Canada: "There has been growing political pressure that is probably more effective but I agree that the [Supreme Court of Canada] case certainly is consistent with the trends toward mandatory [quality assurance] requirements."



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PEO MEMBER HELPS POWER AROUND-THE-WORLD CHOPPER FLIGHT

By Michael Mastromatteo



Bob Dengler, P.Eng. (left), and son Steven pose in front of the Bell 429 Global Range helicopter, their vessel for the first father-son around-the-world helicopter flight.

A retired engineer and PEO member put his technical and aviation skills to good use in completing the first father-son around-the-world helicopter flight aboard a Canadian-built Bell 429 Global Range flyer.

Bob Dengler, P.Eng., and his son Steven Dengler set out July 1 on a 38,000 kilometre, 100-stop circumnavigation known as the C150 Global Odyssey.

While organized to celebrate Canada's 150th anniversary, the tour was also set up as a fundraiser for the Southlake Regional Health Centre in Newmarket, and for the True Patriot Love Foundation, a national charity supporting Canadian military families.

Bob Dengler, a Queen's University mining engineering graduate, was founder of Dynatec Mining Ltd. It was eventually taken over by Sherritt International Corp.

His son and co-pilot, Steven Dengler, is married to PEO member Bruna Pace, P.Eng., a former municipal engineer in King City.

In an interview with *Engineering Dimensions*, Bob Dengler said it's difficult to describe fully the engineering inspiration for the journey: "Our trip around the world lasted 48 days, exposing us to modern engineering. However, what stood out in my mind is the flawless performance of our Canadian engineered and built Bell 429 helicopter, equipped with Canadian engineered and built Pratt & Whitney engines."

Bruna Pace said weather was a challenge on the first leg of the around-the-world flight. "They were grounded for seven days, five in Iqaluit and one in Narsarsuaq, and one in Reykjavik," Pace said.

However, the crew stayed the course and made stops in the UK, Czech Republic, Russia, Alaska, Yukon, British Columbia and the prairie provinces before returning to Ontario and Quebec air space.

"They've been taking and posting lots of pictures," Pace added. "People really seem to love them."

The C150 Global Odyssey officially ended August 17 at Montreal-Trudeau Airport.

PEO VOLUNTEERS OFFERED USE OF ONLINE EXPENSE CLAIM SYSTEM

By Michael Mastromatteo

PEO's finance department is expanding its use of Certify software to make it easier for volunteers and staff to submit and be compensated for expenses.

Described as a fully integrated expense report and management solution, the Certify program was rolled out to PEO staff in November 2016. It was made available to volunteers in July, and some senior volunteers have already made use of the new system.

Volunteers can continue using the traditional paper-based expense payment system if they choose. Certify users, however, must be signed up for electronic funds transfer (ETF).

PEO Director of Finance Chetan Mehta says staff members have made positive use of Certify over the last several months, and the experience has allowed the finance department employees to fine-tune the expense reporting and compensation system.

Mehta says Certify allows for a 30 per cent improvement in turn-around time—that is the time elapsed between when an expense is filed and when it's paid out to the claimant's bank account.

Another advantage of Certify is that it eliminates the need for data entry by PEO finance department staff. It also includes enhancements, such as allowing volunteers to snap photos of receipts and submit them directly from their smart phones.

Certify comes with thorough user guides, training materials and customer support, Mehta adds. "It's really a powerful system that supports our efforts to make the expense claiming system more transparent and comprehensive," Mehta says.

ONTARIO PROFESSIONAL ENGINEERS AWARDS CELEBRATE 70 YEARS OF ENGINEERING ACHIEVEMENT

By Duff McCutcheon

This year marks the 70th anniversary of the Ontario Professional Engineers Awards, a program founded by PEO to recognize engineers for their professional achievements in such categories as engineering excellence, research and development, young engineer, and for their community service.

Since 2005, the awards have been presented jointly by PEO and the Ontario Society of Professional Engineers. This year, the following 11 awardees will be honoured at a special awards gala on Saturday, November 18 in Toronto. For ticket information, visit www.opeakwards.ca.

PROFESSIONAL ENGINEERS GOLD MEDAL

Catherine Karakatsanis, P.Eng., FEC, chief operating officer, Morrison Hershfield Group Inc., has been a leader in her professional life, helping lead one of Canada's largest engineering consultancies, as well as her career-long work as a volunteer leader, including heading up both provincial and national engineering bodies. Karakatsanis joined Morrison Hershfield after graduating as a structural engineer, steadily rising through several technical roles to project management, technical director and into senior director and executive roles. Now a C-level executive, she oversees all Morrison Hershfield operations across North America, and leads four infrastructure business units. Karakatsanis is the only engineer in Canada to have led a provincial regulator, provincial advocacy body and national organization. As chair of the Ontario Society of Professional Engineers (OSPE), she worked to increase the number of women engineers. As PEO president, she inspired the organization to become a world leader in self-regulation. And as president of Engineers Canada, she worked closely with the provincial regulators to deliver national programs that continue to have a positive impact on the profession and its public profile.

ENGINEERING MEDAL—ENGINEERING EXCELLENCE

Endre (Andrew) Bakos, P.Eng., C.E.T., project manager, Toronto Transit Commission (TTC), led the implementation of the 20-year Wireless Services in TTC Subway initiative that now delivers wireless services to subway riders on Canada's largest public transportation system. After studying public transit wireless services around the globe, Bakos managed the feasibility, procurement, design and deployment of the massive project, which now delivers free Wi-Fi for subway riders (and anyone else around TTC stations) for at least a one-hour session, as well as cellular service for multiple service providers. Today, the subway Wi-Fi initiative ranks as one of the most appreciated services for TTC riders. Besides his work as a TTC engineer, Bakos mentors young engineers—particularly newcomers to Canada—and he is heavily involved with the Toronto Region Immigrant Employment Council (TRIEC), assisting international engineering graduates in their understanding of professional engineering in Canadian workplace culture.

Nicholas Stark, P.Eng., vice president, HH Angus, has made significant technical contributions to the design and construction of Canadian health-care facilities, particularly in HVAC design. Early in his career, he realized radiant panels were ideal for hospitals as they are cleaner and add planning flexibility by leaving outside walls free of heating elements. They are now widely used in health-care applications. Similarly, during the planning of a new North Bay hospital, his designs provided 100 per cent fresh air for all supply air systems, and recovered over 90 per cent of the exhaust energy using ceramic heat wheels—which avoided the issue of transferring bacteria and viruses back into the new supply air. The design cut equipment and ductwork by one-third, reduced energy consumption and created a much healthier environment. His work with government on hospital HVAC systems are now used as a baseline foundation for a new generation of hospitals.

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ENGINEERING MEDAL—ENTREPRENEURSHIP

J. Paul Santerre, PhD, P.Eng., professor, University of Toronto (U of T), is a leader in biomaterials and polymer science who commercialized his research on medical polymers and regenerative medicine by founding biotech firm Interface Biologics. A professor at U of T's Institute of Biomaterials and Biomedical Engineering, Santerre has led Interface Biologics to become a Canadian success story—particularly with its Endexo family of anti-thrombogenic polymer additives. Medical catheters made with the firm's Endexo-modified polyurethanes captured 45 per cent of Canadian market sales within one year of its launch. More importantly, the technology prevents blood clotting on medical instruments like catheters, vascular grafts and dialyzers—an enormous problem that reduces the service life of these devices and threatens patient safety. The company now boasts \$5 million in annual revenues while employing 26 chemists and chemical engineers at its Toronto facilities.

ENGINEERING MEDAL—MANAGEMENT

Samantha Jane Espley, P.Eng., technical director, Vale Base Metals, has demonstrated exceptional engineering and management expertise leading to significant health, safety and environmental advances, as well as improved productivity and reduced costs through the design of new mining and extraction methods. Throughout her career, including stints at several of Canada's largest mining companies, she has demonstrated an outstanding commitment to the engineering profession and considers innovation as a core business value. Espley's innovations have included new mining methods and designs, new design tools and processes, as well as digitization, Wi-Fi, telemetry, radio-frequency identification tracking, tele-remote mining, automation, ventilation and energy management, along with the emerging short-interval control design process. Recognized as a trailblazer for women in the mining industry, in 2010 she co-authored *Gaining Insights on Career Satisfaction for Women in Mining*, a paper that explores factors that improve and/or inhibit career satisfaction for women in the industry.

ENGINEERING MEDAL—RESEARCH & DEVELOPMENT

Jan Andrysek, PhD, P.Eng., scientist, Bloorview Research Institute, has built a renowned lower limb prosthetics program for children and youth that has improved the lives of young amputees living in low-resource countries around the world. Andrysek's early research laid the

foundation for a new prosthetic knee joint that enabled a greater variety of physical activities for the user. The design earned him the Heffernan/Co-Steel Innovation Award, which provided funding to commercialize the knee joint in the form of two products, the MiniMac and GeriMac knees. He later developed a less expensive solution—the All-Terrain Knee—and established LegWorks, an enterprise focused on making prosthetics accessible globally. Over the past year, more than 500 knees have been provided to amputees via LegWorks. Andrysek's R&D activities have produced 41 peer-reviewed journal articles since 2004. He received the Clifford Chadderton Award for Prosthetics and Orthotics Research in acknowledgement of his international contribution to prosthetics research and innovation.

Craig Alexander Simmons, PhD, P.Eng., professor, University of Toronto, is a pioneer in the emerging field of mechanobiology—the study of how mechanical forces control biological functions—and a world leader in heart valve mechanobiology and microtechnologies. He has made several discoveries that have improved the understanding of heart valve function and disease, including the discovery of heart valve stem cells and elucidation of the mechanisms by which biomechanical forces cause their dysfunction. This basic research is complemented by the development and translation of innovative lab-on-a-chip microtechnologies for cellular engineering, including miniaturized platforms for drug screening and mechanical testing of biomaterials. Simmons spearheaded the Natural Sciences and Engineering Research Council of Canada's Collaborative Research and Training Experience (CREATE) Program in Microfluidics Applications and Training in Cardiovascular Health (MATCH)—a program that's trained over 70 graduate students in biomedical microtechnologies, many of whom have gone on to start their own companies, work in the medical device and health-care sectors, and become professors and doctors.

ENGINEERING MEDAL—YOUNG ENGINEER

Maximilian Albert Thomas Mantha, MBA, P.Eng., vice president, area manager, EllisDon Toronto Civil and Looby Construction, is the youngest EllisDon vice president and has risen quickly as an executive and engineer thanks to his extensive industry knowledge, leadership, team-building skills and dedication. His civil engineering career began with the Canadian Pacific Railway, managing infrastructure projects while ensuring continuous rail service across Ontario and the northeastern US. He then held several roles with Infrastructure Ontario, including heading up construction of Metrolinx's Up Express Spur Line—a rail link between Toronto Pearson Airport and Toronto Union Station. In 2015, Mantha was appointed general manager of EllisDon subsidiary Looby Construction Ltd., and last year became vice president for both EllisDon Toronto Civil and Looby Construction. In the past two years, Looby Construction has experienced unprecedented growth, with Mantha leading the firm to successful outcomes on multiple, complex Ontario Ministry of Transportation design-build projects.

CITIZENSHIP AWARD

Margaret Kende, P.Eng., president, Anteus Enterprises, is a former dean of engineering technology at Centennial College, management consultant, and a lifelong volunteer. After immigrating to Canada from Hungary in 1957, she was among the first female graduates from the University of Toronto's civil engineering program. After 10 years as a structural engineer, she joined Centennial College's civil engineering technology program as a teacher—later becoming Canada's first female engineering dean in 1977. After retiring from Centennial, Kende worked as a management consultant, and later joined the Canadian Executive Services Organization where she helped spread Canada's human rights and gender equity values around the world. As a volunteer,

Kende served as president of Women in Science and Engineering (WISE), as warden of Camp 1 of The Corporation of the Seven Wardens Inc., and as chair and/or member of several PEO committees. As chair of the Education Sub-Commission of the Canadian Commission for UNESCO, Kende used domestic and international platforms to advance gender equity and human rights.

Benny Pang, P.Eng., knowledge domain owner (acoustics), principal engineering specialist, Bombardier Inc., is one of Canada's top experts on reducing aircraft-related noise pollution. Joining Bombardier in 1973, Pang works to ensure Bombardier airplanes are the quietest in the industry. He has transferred his professional passion for reducing aircraft noise to his volunteer work, serving on the International Civil Aviation Organization's Committee on Aviation Environmental Protection, and on Transport Canada's Aircraft Noise and Emissions Committee, helping establish positions on aviation environmental impacts that are balanced, science based and reflective of Canada's needs and realities. Pang also helped create a Canadian R&D program dedicated to airplane and engine noise and emissions reduction called the Green Aviation Research and Development Network (GARDN), now the leader in reducing the environmental footprint of the aviation sector in Canada and worldwide.

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EDUCATION FOUNDATION NEARING \$3 MILLION MARK IN SCHOLARSHIPS

By Michael Mastromatteo

The Ontario Professional Engineers Foundation for Education (FFE) is closing in on nearly \$3 million in scholarships to engineering undergraduates over its 57-year history.

The foundation celebrated its latest achievements June 29 at its annual general meeting at PEO headquarters in Toronto.

Among the guests at this year's annual meeting were PEO President Bob Dony, PhD, P.Eng., FEC, Ontario Society of Professional Engineers President and Chair Matthew Jelavic, P.Eng., Santosh Gupta, P.Eng., FEC, secretary of the Council of Ontario Deans of Engineering, Boris Martin, head of Engineers Without Borders (EWB), and Jocelyn Lee, engineering student and executive member of the Engineering Student Societies' Council of Ontario.

In bringing greetings from the regulator, PEO President Dony said support of the foundation and engineering education in general benefits society by making the profession more secure. "The education foundation can definitely count on PEO's ongoing support as the regulator approaches its 100th anniversary in 2022," Dony said.

Marisa Sterling, P.Eng., FEC, FFE president, and assistant dean, inclusivity and diversity, Lassonde School of Engineering at York University, said the foundation has awarded 3350 student awards totaling \$2.9 million over its almost six decades of operation.

The foundation annually awards entrance and undergraduate scholarships averaging \$1500 per student. It also partners with the EWB in presenting the annual EWB Leaders of the Future Award worth \$2000.

A typical year sees the foundation pass out 30 entrance scholarships, 72 undergraduate scholarships and 15 gold medals for high-achieving graduating students, in addition to the EWB award. The foundation distributed \$153,000 to 102 engineering students in 2016.

The foundation also operates a benevolent fund for Ontario engineers experiencing financial hardship.

PEO members have the option of supporting the foundation by way of an online check-off box on their annual membership renewal form.

Sterling said the scholarships helped hard-pressed engineering students devote more time to their studies and formation by alleviating the need for them to take part-time jobs. "One \$1500 scholarship saves an engineering student up to 130 hours working at a part-time, minimum-wage job," Sterling said. "It represents a lot of time better spent doing their engineering pursuits."

Student winners at the 2017 annual meeting described the honour of being selected and said each scholarship brings a sense of relief from the rising tuition costs.



FFE President Marisa Sterling, P.Eng., FEC (left), presented a Leader of the Future Award to University of Toronto student Christine Bui on June 29 at the foundation's annual general meeting at PEO headquarters. Boris Martin, CEO of Engineers Without Borders, is at right. Photo: Georg Kralik, P.Eng.

"For many international students like me, we have a hard time figuring out success," said undergraduate winner Arnav Goel of the University of Toronto. "I think the recognition from the award really helped me understand that it matters. Someone acknowledges the academic success and the extra-curricular activities I have done in university and sees my determination and passion to learn new things. The money was helpful, too, but I think the confidence it gave me was much more than the monetary value. The opportunity to meet esteemed students from different universities was more important than any prize."

Similarly, Jackson White, a chemical engineering student at Laurentian University, and winner of the foundation's entrance scholarship, was equally gratified. "The \$1500 goes a long way, and it has allowed me to go into my second year of chemical engineering debt-free," he said. "This endowment has now set me one step ahead of where I was prior to its donation, and I am able to continue my education with my mind at ease because the FFE has helped me on my journey."

Besides Goel and White, other students attending the June 29 meeting included undergraduate scholarship winners Farhan Riaz (Ryerson University), Calvin Rieder (University of Toronto), Enakshi Shan (University of Toronto), EWB Gold Medal winners Gabrielle Sebaldt (University of Toronto) and Benjamin Brunson (York University), and leadership award winner Christine Bui (University of Toronto).

STUDENT GROUP LOOKS TO EXPAND SERVICES TO UNDERGRADUATE COMMUNITY

By Michael Mastromatteo

Ontario's engineering student association is hoping to advocate more effectively and expand its services to the province's nearly 28,000-strong engineering undergraduate community.

At an August 14 planning meeting with PEO officials, executives with the Engineering Student Societies' Council of Ontario (ESSCO) discussed how the regulator can assist the student organization in promoting awareness of PEO and its Student Membership and Engineering Intern programs.

ESSCO is an association representing engineering student societies from 15 Ontario universities. PEO has been supporting ESSCO since 1998, primarily by sponsoring an annual student conference, this year scheduled for November 3 to 5 at Ryerson University in Toronto.

The theme for the 2017 conference is "Mission, innovation and ideas."

The ESSCO executive for the coming year includes President Andrew Cook of McMaster University, Vice President of Finance and Administration Cyline El-Bouchi of Carleton University, Vice President of Communications Jeffrey Lee of Ryerson, and Vice President of Services Ram Ganesh also of Ryerson.

Much of the discussion at the August 14 meeting centered on strengthening ESSCO's bonds with PEO and the Ontario Society of Professional Engineers, the profession's advocacy and member services organization.

"My goals for the year are grounded in organizational development," ESSCO President Andrew Cook said in an interview. "I will be focusing on creating platforms for our students to research and prepare strong stances on issues facing engineering students. These topics will come from the council, however, my interests include experiential learning, affordable and transparent tuition, and mental health awareness and support."

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PEO officials met with two members of the ESSCO executive. Left to right are Adeilton Ribeiro, P.Eng., PEO EIT/student programs coordinator; Tracey Caruana, P.Eng., PEO manager, engineering intern programs; Andrew Cook, ESSCO president; Cyline El-Bouchi, ESSCO vice president; and Sami Lamrad, EIT, PEO EIT/student programs coordinator.

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Cook also says ESSCO needs to improve its institutional memory. "I would like engineering students to have a unified and researched voice across the province so we can have a long-term impact that extends past the terms of myself and my colleagues," he adds.

The new ESSCO president also wants to make better use of ESSCO's four directorship positions to provide additional services to the engineering student community.

PEO staff attending the planning meeting included Manager of Engineering Intern Programs Tracey Caruana, P.Eng., and EIT/Student Programs Coordinators Adeilton Ribeiro, P.Eng., and Sami Lamrad, EIT.

During the meeting, PEO staff outlined the regulator's basic functions, and offered details of the Student Membership and Engineering Intern programs. Much of the discussion also focused on preparation for the upcoming PEO/ESSCO Student Conference, and how PEO and ESSCO can continue working together to promote the benefits of student membership.

Other priorities for ESSCO include progress on previous strategic objectives, analyzing the results of a final-year student survey, PEO support of the annual ESSCO essay contest, and how PEO can assist the organization generally with its objectives.

PEO's Student Membership Program website (www.engineeringstudents.peo.on.ca) is an ideal way to maintain contact between the regulator and engineering undergraduates in Ontario. The free program allows students to stay attuned to regulatory and licensing issues, and maintains a firm connection to the province-wide professional engineering community.

As of mid-August, nearly 6600 undergraduates have signed up with PEO's Student Membership Program.

INNOVATING PEO's GLP

By Howard Brown and Blake Keidan

We currently find ourselves in an era of change. Quick and wide-reaching, countries need to confidently inspire innovation in order to be globally competitive. Innovation creates a thriving population and opens the country to new economic, social and environmental possibilities.

Since its election in 2015, the Canadian government has put heavy emphasis on the need to innovate. Minister of Innovation, Science and Economic Development of Canada Navdeep Bains, MP (Mississauga-Malton), was tasked in his mandate letter by Prime Minister Justin Trudeau, MP (Papineau), to create an innovation agenda.

Provincially, similar steps are being taken to propel the province forward. But innovation does not stop with the government—it must be embraced by all industries.

And what profession is more synonymous with innovation than engineering? No other profession is so focused on the continued improvement of its processes and outputs.

PEO's Government Liaison Program (GLP) is an example of that. For over a decade, PEO has been the leading example of a successful government relations program. Through GLP activities, PEO has built strong relationships with MPPs.

Among the other engineering regulatory associations, PEO's GLP has been unique and innovative. MPPs regularly compliment PEO on its work and say other organizations should look to it as an example.

But innovation means not resting on your laurels. With the 2017 changes to the Ontario fundraising rules, the political landscape has changed (see "A new approach to engagement," *Engineering Dimensions*, March/April 2017, p. 32). Preceding the change in 2016, PEO carried out an audit of the GLP with MPPs, PEO Council and chapters to see if the program was meeting its intended objectives.

The audit found that the program was meeting its intended objectives and suggested 32 recommendations for continued improvement. This presented a perfect opportunity for PEO to once again innovate and develop new ways to do its work.

GLP 2.0

Over the last six months, a GLP Audit Implementation Plan Subcommittee worked with the PEO Government Liaison Committee (GLC) to develop a new plan, titled GLP 2.0, in direct response to the recommendations. Some highlights of the new plan are to:

- Continue to build awareness of PEO and develop relationships with MPPs through chapter events and by having chapter members attend MPP events;
- Grow the understanding between MPPs and professional engineers;
- Build the influence of PEO with the government;
- Move to a model with one certified representative for each MPP (the person would either live or work in the riding of the MPP) and provide new training for GLP certification; and

- Work with all of its partners to implement the best program for regulatory purposes.

GLC Chair Darla Campbell, P.Eng., attended the Council meeting on June 22 and 23 to present the plan. She explained a number of new initiatives to enhance PEO's work with MPPs and answered questions from Council. At that meeting, PEO Council approved the plan as presented and directed the GLC to begin immediate implementation.

"We are pleased with the feedback we got from PEO Council," says Campbell. "Our goal is to ensure all parts of the regulation of engineering work to the benefit of the public."

To support its efforts, PEO will be developing:

1. An MPP Interaction Database to track meetings with MPPs, which will create a history we can reference;
2. A training program for GLP representatives for certification to ensure consistency in the messaging and techniques when building relationships; and
3. A tracking system of regulatory issues to monitor proposed legislation in order to detect potential incursions on the self-regulating role of PEO.

The essence of the new plan is to build on past successes while making room for new innovation. As well, PEO is committed to continuing its government liaison work. The government needs to hear engineering voices, and we are stronger presenting a united front. **e**

Howard Brown is president of Brown & Cohen Communications & Public Affairs and PEO's government relations consultant. Blake Keidan is an account manager at Brown & Cohen and PEO's government relations coordinator.

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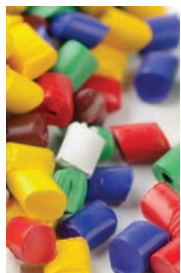
Step 3: Call or email our advertising representative, Beth Kukkonen, 905-886-6641, ext. 306, bkukkonen@dvtail.com.

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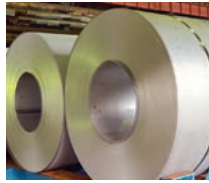


September 2017

SEPTEMBER 13-15
 North American International Powertrain Conference, Chicago, IL
www.sae.org/events/naipc



SEPTEMBER 18-20
 Conference on Smart Materials, Adaptive Structures & Intelligent Systems, Snowbird, UT
www.asme.org/events/smais



SEPTEMBER 15
 Steel Day, across Canada
www.steelday.ca

SEPTEMBER 17-20
 Canadian Society of Safety Engineering 2017 Professional Development Conference, Halifax, NS
www.csse.org/2017_conference

SEPTEMBER 24-27
 Transportation Association of Canada 2017 Conference & Exhibition, St. John's, NL
www.tac-atc.ca/en/conference

SEPTEMBER 17-19
 Canadian Healthcare Engineering Society 37th Annual Conference, Niagara Falls, ON
www.ches.org/conferences-and-events/2017-national-conference



OCTOBER 1-4
 Canadian Geotechnical Conference 2017, Ottawa, ON
www.geoottawa2017.ca



OCTOBER 2-4
 3rd International Conference on Chemical Engineering, Chicago, IL
chemicalengineering.conferenceseries.com

OCTOBER 4
 PEO Queen's Park Day Reception, Toronto, ON
www.peo.on.ca



October 2017

OCTOBER 5
 Green Building Festival, Toronto, ON
sbcanada.org/conferences/green-building-festival-2017



OCTOBER 8-12
 Materials Science & Technology 2017, Pittsburgh, PA
www.matscitech.org



OCTOBER 11
 Design Engineering Expo, Kitchener, ON
www.dexexpo.com

OCTOBER 12
 Canada Green Building Council Greater Toronto Chapter Gala & Awards, Toronto, ON
www.cagbctoronto.org

OCTOBER 11-13
 1st International Conference on Underground Mining Technology, Sudbury, ON
umt2017.com



OCTOBER 22-24
 ACEC-Canada National Leadership Conference 2017, Ottawa, ON
www.acec.ca/events_awards/conference/2017

November 2017

NOVEMBER 2
 Design for Manufacturing Summit, Toronto
dfmsummit.com



NOVEMBER 2-3
 World Water-Tech North America Summit, Toronto
www.worldwatertechnorthamerica.com

NOVEMBER 3-9
 International Mechanical Engineering Congress & Expo, Tampa, FL
www.asme.org/events/imece

NOVEMBER 18
 Ontario Professional Engineers Awards Gala, Etobicoke, ON
www.opecawards.ca



SUMMARY OF DECISION AND REASONS

In the matter of a hearing under the *Professional Engineers Act*, R.S.O. 1990, c. P.28; and in the matter of a complaint regarding the conduct of EHSANULLAH TAWHIDI, P.ENG., a member of the Association of Professional Engineers of Ontario, and EHSAN TAWHIDI AND ASSOCIATES, a holder of a Certificate of Authorization.

The hearing proceeded with the counsel for the association introducing an Agreed Statement of Facts, which included items in summary as follows:

1. Ehsanullah Tawhidi, P.Eng. (Tawhidi), was, at all material times, a professional engineer licensed under the *Professional Engineers Act* (the act). Tawhidi is the holder of a Certificate of Authorization for “Ehsan Tawhidi and Associates” (ETA).
2. In April 2013, Tawhidi signed a Commitment for General Structural Reviews with EnviroEn Inc. (EE) for a solar panel installation on a nine-storey apartment building at 31-35 St. Dennis Drive, Toronto.
3. In June 2013, Tawhidi issued a structural investigation report on EE letterhead and structural drawings for the project for building permit submission.
4. In August 2013, Tawhidi signed and sealed a revised set of drawings prepared by EE to include additional array solar panels.
5. The solar panels were installed under the EE’s supervision in autumn 2013. Tawhidi performed a site review of the installed panels. He issued two review letters on ETA letterhead in November 2013 stating: “As per our visual observation, the work done in general is satisfactory and work has been completed as per city reviewed permit drawings, the requirements of the OBC and all the deficiencies identified during the construction have been corrected.”
6. In January 2014, the largest solar array collapsed, causing property damage.
7. PEO commenced a registrar’s investigation into the collapse under section 33 of the act retaining Daria Khachi, P.Eng. (Khachi), as an independent expert to review the work of Tawhidi and ETA. Khachi visited the site in May 2014 and wrote a report dated July 8, 2014.
8. The report identified deficiencies in the work of Tawhidi and ETA, which included insufficient structural notes on the drawings, a failure to identify additional snow accumulation on the permit documents, a lack of lateral load resisting element for stability, inadequately specified base plate anchorage details, a mismatch between the specified number of anchor rods for each base plate and the observed number seen in the site visit, inadequate anchor bolts, inadequate welds specified for certain column bases, and in general a failure to show the proper structural support system.
9. Tawhidi and ETA admit that the contents of and the conclusions in the report are correct and further admit that they made the errors/omissions referred to above. Tawhidi and ETA admit that, in so doing, they:
 - a) Failed to maintain the standards that a reasonable and prudent practitioner would maintain in the circumstances;
 - b) Failed to make reasonable provision for the safeguarding of the life, health or property of the persons who might, and indeed were, affected by the work for which they were responsible; and
 - c) Failed to make responsible provision for complying with applicable codes and/or standards.
10. It is agreed that Tawhidi and ETA are guilty of professional misconduct, as follows:
 - a) Reviewing and approving the structural design of a photovoltaic solar panel supporting structure without properly accounting for

ENFORCEMENT HOTLINE Please report any person or company you suspect is practising engineering illegally or illegally using engineering titles. Call the PEO enforcement hotline at 416-840-1444 or 800-339-3716, ext. 1444. Or email enforcement@peo.on.ca. Through the *Professional Engineers Act*, Professional Engineers Ontario governs licence and certificate holders and regulates professional engineering in Ontario to serve and protect the public.

wind loads, amounting to professional misconduct as defined by sections 72(2)(a), (b) and (j) of Regulation 941;

- b) Signing and sealing structural drawings for a photovoltaic solar panel supporting structure that failed to comply with applicable codes and/or standards, amounting to professional misconduct as defined by sections 72(2)(a), (d) and (j) of Regulation 941;
- c) Signing and sealing structural drawings for a photovoltaic solar panel supporting structure that inadequately resisted lateral forces, amounting to professional misconduct as defined by sections 72(2)(a), (b) and (j) of Regulation 941; and
- d) Signing and sealing structural drawings that failed to meet the standard of a reasonable and prudent engineer, amounting to professional misconduct as defined by sections 72(2)(a), (b) and (j) of Regulation 941.

PLEA BY MEMBER AND/OR HOLDER

The member and holder admitted to the allegations of professional misconduct as set out in the Agreed Statement of Facts. The panel conducted a plea inquiry and was satisfied that the member's admission was voluntary, informed, unequivocal and without reservation.

DECISION

The panel, having considered the Agreed Statement of Facts and the submissions of the parties, finds that the facts support a determination of professional misconduct and, in particular, finds that Ehsanullah Tawhidi, P.Eng., and Ehsan Tawhidi and Associates committed an act of professional misconduct pursuant to sections 72(2)(a), (b), (d) and (j) of Regulation 941.

PENALTY DECISION

The panel received a Joint Submission as to Penalty that the panel concluded is reasonable and in the public interest. The panel acknowledged that Ehsanullah Tawhidi, P.Eng., co-operated fully with the association in the investigation and concurred with the Agreed Statement of Facts, taking full responsibility for his actions. He has agreed to the proposed penalty. His co-operation avoided unnecessary expense to the association.

The panel considered the proposed penalty to fulfill the requirements of protecting the public, maintaining the reputation of the profession, providing a general deterrence to members, providing a specific deterrence to the member and providing for professional rehabilitation of the member.

The panel orders:

- a) Pursuant to section 28(4)(b) of the act, Tawhidi's licence shall be suspended for a period of five working days, commencing on the day after the pronouncement of the penalty decision by the Discipline Committee;
- b) Pursuant to section 28(4)(f) of the act, Tawhidi and ETA shall be reprimanded, and the fact of the reprimand shall be recorded on the register for a period of one year;
- c) The finding and order of the Discipline Committee shall be published in summary form under sections 28(4)(i) and 28(5) of the act, with reference to names;
- d) Pursuant to section 28(4)(d) of the act, it shall be a term or condition on Tawhidi's licence that he shall, within 14 months of the date of pronouncement of the decision of the Discipline Committee, successfully complete the following examinations administered by PEO: 98-CIV-A1 Elementary Structural Analysis, and 98-CIV-A2 Elementary Structural Design;
- e) Pursuant to sections 28(4)(b) and (k) of the act, in the event that Tawhidi does not successfully complete the examinations listed above within the time set out above, his licence shall be suspended for a period of 10 months thereafter, or until he successfully completes the examinations, whichever comes first; and
- f) There shall be no order as to costs.

REPRIMAND

Following the member's and holder's waiver of their right to appeal, the panel administered the oral reprimand immediately after the hearing.

The Decision and Reasons was signed on March 27, 2017 by panel chair Brian Ross, P.Eng., on behalf of the members of the discipline panel: Rishi Kumar, P.Eng., Anne Poschmann, P.Eng., Nadine Rush, C.E.T., and Warren Turnbull, P.Eng.

DECISION AND REASONS

In the matter of a hearing under the *Professional Engineers Act*, R.S.O. 1990, c. P.28; and in the matter of a complaint regarding the conduct of SOTIROS KATSOULAKOS, P.ENG., a member of the Association of Professional Engineers of Ontario, and MICRO CITY ENGINEERING SERVICES INC., a holder of a Certificate of Authorization.

This matter came for a hearing on February 7, 2017 at the PEO offices in Toronto before a panel of the Discipline Committee of the Association of Professional Engineer of Ontario (the panel), convened pursuant to section 28 of the *Professional Engineers Act*.

THE ALLEGATIONS

It was alleged that Sotiros Katsoulakos, P.Eng. (Katsoulakos), and Micro City Engineering Services Inc. (MCES) were guilty of professional misconduct.

The parties filed an Agreed Statement of Facts, which is set out in full as follows.

AGREED STATEMENT OF FACTS

This Agreed Statement of Facts is made between the Association of Professional Engineers of Ontario and the respondents, Sotiros Katsoulakos, P.Eng. (Katsoulakos), and Micro City Engineering Services Inc. (MCES) (collectively, the parties). The summary is as follows:

1. Katsoulakos is a professional engineer licensed pursuant to the *Professional Engineers Act* (the act).
2. At all material times, MCES held a Certificate of Authorization issued pursuant to the act. Katsoulakos was, at all material times, the person designated under section 47 of Regulation 941 under the act as assuming responsibility for the professional engineering services provided by MCES.
3. Katsoulakos and MCES were retained in or about July 2008 to design a circular manure storage tank (the tank) for the Hogendoorn Dairy Farm (HDF), located in Baden, Ontario.
4. In August 2008, Katsoulakos prepared, signed and sealed a design drawing (the first drawing) for the tank.
5. A building permit was issued on August 6, 2008.
6. On or about August 12, 2008, Katsoulakos prepared a revised design for the tank (the revised drawing) at the request of HDF. The revised drawing was the same as the first drawing in all respects except for the dimensions of the tank, which were changed from 160'x12' to 148'x14'.
7. The revised drawing included the following information concerning the tank:
 - (a) diameter: 148 feet
 - (b) height: 14 feet, including 7 feet above grade
 - (c) 10-inch thick concrete wall
 - (d) 32 MPa concrete
 - (e) horizontal steel reinforcing: 15 m at 8-inch spacing
 - (f) vertical steel reinforcing: 15 m at 16-inch spacing
8. Both the respondents' design of the tank and the revised drawing itself were deficient and failed to comply with the applicable statutes, regulations, standards and codes. In particular, the first drawing and the revised drawing failed to comply with the Ontario Building Code 2006, the *Nutrient Management Act* and the National Farm Building Code (1995), in that:
 - (a) The specified horizontal and vertical steel reinforcing was inadequate;
 - (b) The drawings failed to include, or to make reference to, structural calculations in support of the design;
 - (c) The drawings failed to account for ice pressure;
 - (d) The drawings failed to contain any inlet, or to otherwise make provisions for loading or transfer of manure into the tank;
 - (e) The drawings failed to make provision for a loading ramp for manure agitation and pumping;
 - (f) The drawings failed to specify "the structural systems and surrounding soil conditions that are deemed to provide two layers of protection," as required by the regulation under the *Nutrient Management Act*; and
 - (g) The drawings failed to properly indicate the requirements for proper perimeter and under tank drainage in relation to the geotechnical report.
9. Construction of the tank, in accordance with the revised drawing, commenced on or about September 1, 2008.
10. On or about September 12, 2008, the project contractor, Schoonderwoerd Brothers Concrete Ltd. (SBC), on behalf of HDF, contracted MCES by telephone to request a design change on one side of the tank. The change increased the backfill height

on the barn side of the tank by four feet. The increased backfill height was to serve as a driving ramp up to a location measuring three feet from the top of the tank.

11. Katsoulakos advised Darrell Schoonderwoerd of SBC that he agreed with the change, provided SBC doubled the amount of horizontal rebar on the side where the backfill height would be increased. In addition, Katsoulakos required the rebar on the side with increased backfill height to extend horizontally a minimum of 10 feet past the increased backfill. Despite this additional rebar, the reinforcing steel specified by Katsoulakos remained inadequate.
12. Katsoulakos attended the site, for the purpose of inspection, on September 4, September 10, September 12, September 19 and October 3, 2008. The inspection reports are all dated September 22, 2009.
13. The report for the September 12, 2008 site visit (Interim General Review Letter #3) referred to a “cut-out” at the top of the tank wall, and specified that this was to be filled with concrete, “utilizing a concrete bonding agent between old and new concrete pours.” This instruction was inadequate, in that it failed to specify the concrete bonding material and failed to specify replacement of the steel rebar removed at the “cut-out” section of the tank wall.
14. The tank was investigated in the spring of 2009 as a result of issues unrelated to the respondents. One of those involved in the investigation was the complainant, Tim Morrison, P.Eng. Following the investigation, the tank was drained and removed from service.
15. The association obtained an independent expert report (the report) from Yves Choinière, P.Eng., Eng. Agr., dated July 28, 2015. The report concludes, among other things, that Katsoulakos committed numerous structural design errors, as further particularized in the body of the report: that the steel rebar (reinforcement) called for in the revised drawing was only 40 to 45 per cent of the rebar required to ensure safety; that the revised drawing was deficient in numerous respects, including lack of planning and design for the loading ramp, vehicle loads, selection of the proper structural system in relation to secondary containment, cross-references to other professional work for site drainage, and the design of the repair of the “cut-out”; that were numerous breaches of the applicable standards and codes; that the tank structure, as built, presented high risks of failure, which could result in nutrient leakage in the surrounding environment; that the structure was unsafe to resist the basic liquid manure loads, and unsafe to resist the additional loads for manure transfer, loading ramps, vehicle loads and local ice loads.
16. For the purposes of this proceeding, the respondents accept as correct the findings, opinions and conclusions contained in the report, and the respondents admit that they failed to meet the minimum acceptable standard for engineering work of this type, and that they failed to maintain the standards that a reasonable and prudent practitioner would maintain in the circumstances.
17. By reason of the aforesaid, the parties agree that the respondents, Katsoulakos and MCES, are guilty of professional misconduct, as follows:
 - (a) Their work in connection with the tank was negligent, amounting to professional misconduct pursuant to subsection 72(2)(a) of Regulation 941;
 - (b) Their work in connection with the tank failed to make reasonable provision for the safeguarding of the health or property of the persons who might be affected thereby, amounting to professional misconduct pursuant to subsection 72(2)(b) of Regulation 941;
 - (c) In their work in connection with the tank, they failed to make responsible provision for complying with applicable statutes, regulations, standards and codes, amounting to professional misconduct pursuant to subsection 72(2)(d) of Regulation 941; and
 - (d) Their conduct, as aforesaid, would reasonably be regarded by the engineering profession as unprofessional, amounting to professional misconduct under subsection 72(2)(i) of Regulation 941.

The respondents have had independent legal advice with respect to their agreement as to the facts, as set out above.

Katsoulakos admitted the allegations set out in the Agreed Statement of Facts on his own behalf and on behalf of MCES. The panel conducted a plea inquiry, and the members of the panel were satisfied that Katsoulakos’ and MCES’ admissions were voluntary, informed and given without reservation.

The panel considered that the agreed facts made out acts of misconduct, as alleged, and found Katsoulakos and MCES guilty of professional misconduct as set out in paragraph 17 of the Agreed Statement of Facts.

After the panel announced its findings as to liability for professional misconduct, the parties thereafter filed a Joint Submission as to Penalty and Costs. The parties and independent legal counsel made submissions as to the criteria, which

the panel should apply in determining whether to accept a joint submission as to penalty. The parties submitted that the penalty was in the public interest and within the range of acceptable penalties in all the circumstances.

The joint submission provided for the following penalties to be imposed by the panel:

- (a) Pursuant to section 28(4) of the *Professional Engineers Act*, the defendants shall be reprimanded and the fact of the reprimand shall be recorded on the register for a period of one year. Pursuant to section 28(4)(d) of the *Professional Engineers Act*, it shall be a term or condition on Katsoulakos' licence that he shall, within 16 months of the date of pronouncement of the decision of the Discipline Committee, successfully complete the following examinations administered by PEO: 98-CIV-B1 (Advanced Structural Analysis), and 98-CIV-B2 (Advanced Structural Design).
- (b) Pursuant to sections 28(4)(b) and (k) of the *Professional Engineers Act*, in the event that Katsoulakos does not successfully complete the above-mentioned examinations within the time set out in (b) above, his licence shall be suspended for a period of 10 months thereafter, or until he successfully completes the examinations, whichever comes first;
- (c) Pursuant to subsection 28(4)(e)(iii) of the act, a restriction shall be placed upon Katsoulakos' licence and MCES's Certificate of Authorization, requiring them to accept a practice inspection on the following terms:
 - (i) The practice inspection will be carried out by an independent expert (to be named by the deputy registrar, regulatory compliance), who will provide a report to the deputy registrar, the chair of discipline panel, and Katsoulakos at the conclusion of the inspection;
 - (ii) The practice inspector shall provide written notice to the defendants at least two weeks before attending at the defendants' premises to carry out his or her inspection;
 - (iii) The practice inspection will be limited to not less than five and not more than 10 projects carried out in or after the year 2010, of a scope or nature similar to that

which was the subject of this hearing (as identified by the independent expert named by PEO);

- (iv) The practice inspection shall be completed and the report submitted within six months from the date of release of the penalty decision;
 - (v) After review of the independent expert's inspection report, the deputy registrar, regulatory compliance may, if he or she has opinion of that inspection report evidences incompetence or additional professional misconduct on the part of Katsoulakos and/or MCES, after providing Katsoulakos and MCES an opportunity to respond to this determination, request that the discipline panel order additional penalty action against Katsoulakos and/or MCES;
 - (vi) The discipline panel shall make the determination noted in (v) no later than three months after the receipt of the request by the deputy registrar; and
 - (vii) All costs associated with the practice inspection and the report shall be paid by Katsoulakos and/or MCES.
- (d) Pursuant to section 28(5) of the *Professional Engineers Act*, the findings and order of the Discipline Committee shall be published, with the reasons therefore, together with the names of the defendants, in the official publication of PEO; and
 - (e) There shall be no order as to costs.

PENALTY DECISION AND REASONS

After exhaustive deliberations, a majority of the panel accepted that the Joint Submission as to Penalty and Costs would not bring the administration of justice into disrepute nor would it otherwise be contrary to the public interest. The penalties met sentencing objectives, including: protection of the public, maintenance of the reputation of the profession in the eyes of the public, specific deterrence, general deterrence, and rehabilitation of the member and holder. The panel, accordingly, ordered that the penalties, as set out in the joint submission, be imposed and take effect as of the date of the hearing on February 7, 2017.

The reprimand was administered at the conclusion of the hearing on February 7, 2017.

Kam Elguindi, P.Eng., signed this Decision and Reasons for the decision as chair of this discipline panel and on behalf of the members of the discipline panel: Aubrey Friedman, P.Eng., Tim Kirkby, P.Eng., and Warren Turnbull, P.Eng.

DISSENTING OPINION

(Delivered by: Richard E. Austin, LLB, MBA)

There was a joint submission made by counsel for PEO and the defendants that was accepted by the majority of the panel.

The panel imposed the following penalty (as per the joint submission):

- (a) Pursuant to section 28(4) of the *Professional Engineers Act*, the defendants shall be reprimanded and the fact of the reprimand shall be recorded on the register for a period of one year.

- (b) Pursuant to section 28(4)(d) of the *Professional Engineers Act*, it shall be a term or condition on Katsoulakos' licence that he shall, within 16 months of the date of pronouncement of the decision of the Discipline Committee, successfully complete the following examinations administered by PEO: 98-CIV-B1 (Advanced Structural Analysis), and 98-CIV-B2 (Advanced Structural Design).
- (c) Pursuant to sections 28(4)(b) and (k) of the *Professional Engineers Act*, in the event that Katsoulakos does not successfully complete the above-mentioned examinations within the time set out in (b) above, his licence shall be suspended for a period of 10 months thereafter, or until he successfully completes the examinations, whichever comes first;
- (d) Pursuant to subsection 28(4)(e)(iii) of the act, a restriction shall be placed upon Katsoulakos' licence and MCES's Certificate of Authorization, requiring them to accept a practice inspection on the following terms:
 - (i) The practice inspection will be carried out by an independent expert (to be named by the deputy registrar, regulatory compliance), who will provide a report to the deputy registrar, the chair of discipline panel, and Katsoulakos at the conclusion of the inspection;
 - (ii) The practice inspector shall provide written notice to the defendants at least two weeks before attending at the defendants' premises to carry out his or her inspection;
 - (iii) The practice inspection will be limited to not less than five and not more than 10 projects carried out in or after the year 2010, of a scope or nature similar to that which was the subject of this hearing (as identified by the independent expert named by PEO);
 - (iv) The practice inspection shall be completed and the report submitted within six months from the date of release of the penalty decision;
 - (v) After review of the independent expert's inspection report, the deputy registrar, regulatory compliance may, if he or she has opinion of that inspection report evidences incompetence or additional professional misconduct on the part of Katsoulakos

and/or MCES, after providing Katsoulakos and MCES an opportunity to respond to this determination, request that the discipline panel order additional penalty action against Katsoulakos and/or MCES;

- (vi) The discipline panel shall make the determination noted in (v) no later than three months after the receipt of the request by the deputy registrar; and
- (vii) All costs associated with the practice inspection and the report shall be paid by Katsoulakos and/or MCES.
- (e) Pursuant to section 28(5) of the *Professional Engineers Act*, the findings and order of the Discipline Committee shall be published, with the reasons therefore, together with the names of the defendants, in the official publication of PEO; and
- (f) There shall be no order as to costs.

The panel, in determining whether to accept a joint submission, is obliged to consider the following in assessing whether the proposed penalties are within a reasonable range of acceptability:

- (i) Protection of the public interest;
- (ii) Maintenance of the reputation of the profession in the eyes of the public; and
- (iii) General deterrence.

While the majority of the panel accepted the joint submission, I was unable to do so for the reasons that follow.

With all due respect to the other members of the panel, I am of the view that the fact that the reprimand of the defendants shall be recorded on the register for a period of one year conflicts with, and fails to adequately address, each of the three items that the panel was obliged to consider.

The Concise Oxford Dictionary defines "reprimand" as "an official or sharp rebuke (for fault, etc.)." Noting the reprimand on the register can have only a single legitimate purpose, that is to provide the public, and more specifically other professionals (e.g. architects, other members of the PEO) who rely on the expertise of members of the Association of Professional Engineers of Ontario (PEO), with an official source of information regarding the disciplinary record of its members.

With regard to the protection of the public interest, the register must be seen as a record which one can rely upon, and should rely upon, in determining conclusively whether a member of PEO has been sanctioned for failing to meet an applicable requirement of PEO. Counsel for the defendants suggested that a potential client of the defendants could rely on an Internet search to determine that the defendants had been found in breach of a requirement of PEO and were reprimanded for such breach after the reprimand was removed from the register. I am of the view that the record of a self-regulated organization (an SRO), such as PEO, should be the "official" source of such information, and the public should not be expected to undertake a search or due diligence beyond contacting the SRO itself in determining whether a member of has been sanctioned by the SRO.

While I have not conducted exhaustive research, I can think of no other professional body where a formal reprimand simply disappears with the passage of time and there is an expectation that this sort of information is to be gleaned from an Internet search. If anything, over the last few years, many regulators have taken steps to increase the ease by which the public can find out whether a specific individual or entity, that has been granted a professional licence, or similar qualification, has ever been subject to a disciplinary action and the sanctions imposed.

Further, as Katsoulakos has a permanent reprimand on the register from a previous disciplinary matter several years ago, the removal of the reprimand arising from the matter before the panel in a year's time would leave a member of the public making an inquiry of the register with the impression that he was a "one-time" offender. This is not the case as he is before a panel of the Discipline Committee for a second time, and has admitted his liability.

The reputation of the profession, in the eyes of the public, can only be diminished by acceptance of the joint submission. Katsoulakos has a reprimand on the register from a prior disciplinary matter. The panel has been advised that there is no specified means by which this reprimand can be removed. One can only reasonably conclude that it was envisioned, and intended, that a reprimand in the ordinary course would be permanently recorded on the register. The fact that there is no specific means by which a reprimand can be removed from the register supports the view that a reprimand, being "an official or sharp rebuke," should remain on the register permanently.

Given the involvement of several government agencies once the multiple deficiencies and failings in the structure designed by the defendants that is at the heart of this matter came to their attention, it is evident that the potential harm arising from the deficiencies and failings was significant. There is no question, in my mind, that a reprimand is appropriate in this matter.

If a permanent reprimand was appropriate for Katsoulakos' first offence, how can it be appropriate in the instance of a second conviction that a second reprimand would disappear from the register simply by the passage of time? While one could argue that it might be appropriate for a reprimand to remain on the record for a limited period if the potential consequences of a breach were minor and it was a first offence, this is not the case in the matter before the panel. I can think of no explanation that PEO could offer to the public, any member of PEO, any member of any other profession or any government agency that could satisfactorily explain or reconcile this aspect of the penalty. In the event of such an inquiry, the reputation of PEO would be diminished. Further, it is reasonable to foresee that members of PEO, itself, will question the integrity of the disciplinary process upon reading the findings, order and reasons of the panel once published.

The fact that the reprimand could potentially be removed prior to Katsoulakos successfully completing the courses specified in (b) above, only adds to what is an untenable and unacceptable outcome.

It is commonly understood and accepted that repeat offenders should be subject to increasingly onerous penalties as part of achieving the general deterrence objective. The joint submission provides for appropriate review of the defendants' practice to ensure the safety of the public and, quite rightfully, at the defendants' expense. Unfortunately, the balance of the penalty, specifically the lack of an imposition of costs payable to PEO and the "vanishing" reprimand, do not in aggregate represent an increased penalty in my view, or if were seen as an increased penalty by others, not sufficiently increased given the potential consequences of the defendants' breach.

For these reasons, I was unable to accept the joint submission.

REVISED DECISION AND REASONS

In the matter of a hearing under the *Professional Engineers Act*, R.S.O. 1990, c. P.28; and in the matter of a complaint regarding the conduct of JOHNNY KIN NANG LEE, P.ENG., a member of the Association of Professional Engineers of Ontario.

THE ALLEGATIONS

The Association of Professional Engineers of Ontario (the association) alleged that Johnny Kin Nang Lee, P.Eng. (Lee), was guilty of professional misconduct as defined in the *Professional Engineers Act* and Regulation 941, as follows:

1. Communicating engineering opinions to municipal officials and members of the public that failed to maintain the standards that a reasonable and prudent practitioner would maintain in the circumstances, amounting to professional misconduct as defined by section 72(2)(a) of Regulation 941;
2. Communicating engineering opinions about an alleged public safety risk without making prompt, voluntary and complete disclosure of an interest that might be construed as prejudicial to his professional judgment, amounting to professional misconduct as defined by section 72(2)(i) of Regulation 941;
3. Making misleading statements to municipal officials and members of the public regarding a matter of public safety, amounting to professional misconduct as defined by section 72(2)(j) of Regulation 941; and
4. Engaging in conduct that amounts to harassment, or in the alternative, was disgraceful, dishonourable or unprofessional, amounting to professional misconduct as defined by section 72(2)(n), or in the alternative, section 72(2)(j), of Regulation 941.

Following the start of the hearing and the filing of the Notice of Hearing as an exhibit, one of the members of the discipline panel advised the hearing that he had a family emergency and had to withdraw. Neither party objected to continuing the hearing with a panel composed of the remaining four members. After hearing submissions from counsel for both parties and receiving advice from independent legal counsel, the panel decided that it had jurisdiction to proceed with the hearing with the remaining four members of the panel presiding. Section 27(8) of the *Professional Engineers Act*, R.S.O. 1990, c. P.28, and section 4.4(1) of the *Statutory Powers Procedure Act* R.S.O. 1990, c.S.22 permit the remaining members of a discipline panel to proceed with a hearing where, after the commencement of the hearing, one of the panel members is unable to continue to act. The member withdrew and had no further involvement in this matter.

Counsel for the association advised the panel that agreement had been reached on the facts and introduced an Agreed Statement of Facts, as follows:

1. The respondent (Lee) was first licensed under the *Professional Engineers Act* (PEA) on August 13, 2010. On or about July 3, 2012, Lee requested and obtained “fee remission” status pursuant to section 41.1 of Regulation 941. He remained on “fee remission” status until January 6, 2016. His licence was then cancelled for non-payment. He was reinstated to “fee remission” status on February 1, 2016 and returned to full practice status on July 21, 2016. It was a condition of Lee’s licence, throughout the relevant times, that he not engage in the practice of professional engineering. Lee has never held a Certificate of Authorization under the PEA.
2. The complainant is Bernie Nimer (Nimer) of Mayfair Hotel Development Corporation, which was at all relevant times the owner of a building (the building) located at 11 Young Street and 156-158 King Street West, in Kitchener, Ontario. While the building holds two municipal addresses, it functioned as a single structure because of a common brick masonry bearing wall between the two addresses. The two parts of the building were each registered with “intent to designate” heritage status.
3. On or about April 11, 2015, a municipal water main adjacent to 11 Young Street ruptured, breaching the rubble stone foundation wall and filling the basement of the building with water and sediment. The rupture created a slot in the building wall about 1 to 1.5 m. wide. In addition, the sidewalk slab heaved and a deep void was detected under the sidewalk slab in the worst affected area.

4. Two engineering firms were involved to assess the damage and the impact on the building structure. Blackwell Structural Engineers (Blackwell) were retained by Nimer, and MTE Consultants Inc. (MTE) were retained by the City of Kitchener (the city). According to Blackwell and MTE, the repair of the foundation wall, based on the current condition, could not be undertaken in a safe manner. They recommended demolition of the 11 Young Street portion of the building to mitigate the risk to potential workers and the public.
5. On April 16, 2015, following receipt of the two reports mentioned above, the chief building official (CBO) for the city issued an “Order to Remedy an Unsafe Building” under section 15.9 of the *Building Code Act*. The Order to Remedy required that 11 Young Street be demolished. The CBO also issued an “Order Prohibiting Occupancy of an Unsafe Building.”
6. On April 23, 2015, Kitchener City Council held a special meeting, whose purpose was to consider removal of the “intent to designate” 11 Young Street in order to allow the issuance of a demolition permit. Council voted to remove the “intent to designate.” Nimer consequently applied for a demolition permit for 11 Young Street.
7. Reports from the demolition contractor’s engineer dated May 1, 2015 and May 5, 2015 indicated that demolition of 11 Young Street independently of 156-158 King Street West would pose significant challenges, resulting in delays of demolition of 11 Young Street, leaving the unsafe and unstable conditions unresolved. MTE subsequently provided a supplementary report dated May 11, 2015, which recommended the demolition of 156-158 King Street West. Kitchener City Council placed on the agenda for May 11, 2015 a motion to remove “intent to designate” heritage status for 156-158 King Street West in order to permit demolition.
8. At some point in time between April 23, 2015 and May 11, 2015, Zyg Janecki, a Kitchener city councillor who opposed the demolition, sent a communication to interested residents of Kitchener, including Lee. The communication by Zyg Janecki urged the recipients to attend the council meeting scheduled for May 11 to object to the demolition. The communication requested the recipients to “contact your heritage friends and friends interested in saving heritage buildings to show up in the council chambers on Monday night for the Council meeting.”
9. Lee attended the city council meeting held on May 11, 2015, and spoke against the proposal to remove the “intent to designate.” According to the minutes of the meeting, Lee presented himself as a “structural engineer” and expressed his opinion that, if the foundation were secured, “it should be possible to stabilize the buildings.” He asked that council delay the demolition.
10. Despite the opposition of Lee and others, council voted to withdraw the “intent to designate”; thus, permitting Nimer to apply for a demolition permit.
11. Commencing on May 12, 2015, Lee embarked on a campaign to attempt to stop the demolition and to discredit the opinions of the CBO and the engineers who had recommended demolition. He sent numerous emails to various persons, including municipal officials, association employees, members of the media, and members of the public.
12. On May 15, 2015, the CBO issued the demolition permits for the building.
13. On May 16, 2015, at 8:54 a.m., Lee sent an email to Lisa Harme (an architect he had met in days following the May 11, 2015 city council meeting), expressing his opinion that the demolition plan submitted to the CBO was “invalid,” and stating:

“I will therefore issue an Engineer’s Instruction in my next email addressing [sic.] to the CBO and the Ministry of Labour at my earliest convenience.”

This email was copied to Linda Latham, deputy registrar, regulatory compliance at the association, and to the local newspaper.
14. On May 16, 2015, Lee sent an email addressed to the mayor of the City of Kitchener and the chief building official, and copied to members of Kitchener City Council, the media, the association, and others purporting to order an immediate halt to all work related to the demolition under the power of what Lee called an “engineer’s instruction.” In fact, there is no such thing in Ontario as an “engineer’s instruction,” and Lee had no authority to order a work stoppage.
15. On the same day, Lee wrote to a local architect, Simone Panziera, copying members of Kitchener City Council and others, improperly claiming that failure to comply with the “engineer’s instruction”

- would “carry maximum penalty of the law, including jail time for the offenders.”
16. Demolition commenced on May 19, 2015. On May 20, 2015, Lee sent an email to the CBO, copying others, threatening civil and criminal liability for persons who disregarded the “engineer’s instruction” and proceeded with the demolition.
 17. The demolition, nevertheless, proceeded and was completed without incident.
 18. Lee subsequently:
 - (a) Sought to have Kitchener City Councillor Zyg Janecki persuade the mayor to initiate an inquiry, writing “I hope you can convey to the mayor the seriousness of this case and persuade him to open an inquiry as soon as possible” in an email to Janecki and others dated July 3, 2015;
 - (b) Filed a complaint with the association about the CBO, by way of a letter bearing his signature and seal, a copy of which was sent to the mayor by email;
 - (c) Filed a complaint against the CBO with the Building Code Commission asking that he “be disciplined for his irrational behavior”; and
 - (d) Filed complaints with the association, which he sealed, against the relevant engineers at Blackwell and MTE, and subsequently against David Witzel, P.Eng., the engineer retained to plan and supervise the demolition.
 19. Lee admits:
 - (a) That he had no direct knowledge of the structural condition of the building;
 - (b) That he is not, and never has been, a “structural engineer” but, rather, is a geo-technical engineer;
 - (c) That the opinions he expressed were based solely on his own street-level observations of the exterior condition of the building and its surroundings, reading other engineers’ reports, and the publicly available municipal documents, such as the Order to Remedy Unsafe Building and Order Prohibiting Occupancy of an Unsafe Building dated April 16, 2015 and the City of Kitchener Staff Report dated May 11, 2015;
 - (d) That he had no right or authority to express any engineering opinions, or to attach his seal to any correspondence;
 - (e) That he failed to ascertain whether such a thing as an “engineer’s instruction” exists in Ontario, before sending the communications referred to above;
 - (f) That he engaged in the practice of professional engineering in contravention of section 41.1 of Regulation 941;
 - (g) That his conduct, as aforesaid, fell below the standards that a reasonable and prudent practitioner would have maintained in the circumstances; and
 - (h) That his conduct, including most importantly his attempt to coerce the CBO and others by threatening civil and criminal liability if they failed to follow his “engineer’s instruction,” was disgraceful, dishonorable and unprofessional.
 20. If Lee were to testify at a hearing, he would say that:
 - (a) He acted in what he perceived was the public interest;
 - (b) At no time did he benefit from his actions financially or in any other capacity; and
 - (c) He regrets his actions.
 21. By reason of the aforesaid, it is agreed that Lee is guilty of professional misconduct, as follows:
 - (a) Communicating engineering opinions to municipal officials and members of the public that failed to maintain the standards that a reasonable and prudent practitioner would maintain in the circumstances, amounting to professional misconduct as defined by section 72(2)(a) of Regulation 941;
 - (b) Making misleading statements to municipal officials and members of the public regarding a matter of public safety, amounting to professional misconduct as defined by section 72(2)(j) of Regulation 941; and
 - (c) Engaging in conduct that was disgraceful, dishonourable or unprofessional, amounting to professional misconduct as defined by section 72(2)(j) of Regulation 941.

Lee has had independent legal advice, or has had the opportunity to obtain independent legal advice, with respect to his agreement as to the facts, as set out above.

Counsel for the association advised that the association had withdrawn the allegation in paragraph 2 and of the allegation of “harassment” in paragraph 4 of the Statement of Allegations set out at the beginning of these Decisions and Reasons.

PLEA BY MEMBER

Lee admitted the allegations in the Statement of Allegations, except the allegation in paragraph 4 thereof, which was withdrawn. The panel

conducted a plea inquiry, and was satisfied that Lee's admissions were voluntary, informed and unequivocal.

DECISION

The panel considered the Agreed Statement of Facts and finds that the facts support a finding of professional misconduct and, in particular, finds that Johnny Kin Nang Lee, P.Eng., committed acts of professional misconduct as agreed in paragraph 21 of the Agreed Statement of Facts.

PENALTY

Counsel for the association advised the panel that a Joint Submission as to Penalty had been agreed upon, as follows:

1. Pursuant to section 28(4)(f) of the *Professional Engineers Act*, Lee shall be reprimanded, and the fact of the reprimand shall be recorded on the register for a period of three years;
2. The finding and order of the Discipline Committee shall be published in summary form under section 28(4)(i) of the *Professional Engineers Act*, with reference to names;
3. Pursuant to section 28(4)(d) of the *Professional Engineers Act*, it shall be a term or condition on Lee's licence that he shall, within 14 months of the date of pronouncement of the decision of the Discipline Committee, successfully complete the association's Professional Practice Examination (PPE);
4. Pursuant to sections 28(4)(b) and (k) of the *Professional Engineers Act*, in the event that Lee does not successfully complete the above-mentioned examination within the time set out in paragraph 3 above, his licence shall be suspended for a period of 10 months thereafter, or until he successfully completes the examination, whichever comes first; and
5. Pursuant to section 28(4)(j) of the *Professional Engineers Act*, Lee shall pay costs to the association in the amount of \$7,500, within 12 months of the pronouncement of the decision of the Discipline Committee.

Counsel for the association and counsel for Lee made submissions that the penalty proposed under the joint submissions served the purposes of protection of the public interest, remediation, general deterrence and specific deterrence, and fell within the range of penalties imposed in other matters of comparable severity.

PENALTY DECISION

The panel determined that the penalties set out in the joint submission were appropriate as they fell within a reasonable range of acceptability, taking into due consideration the following items:

- (i) protection of the public interest;
- (ii) remediation of Lee;
- (iii) maintenance of the reputation of the profession in the eyes of the public;
- (iv) general deterrence; and
- (v) specific deterrence.

The panel concluded that the proposed penalty is reasonable and in the public interest. Lee has cooperated with the association and, by agreeing to the facts and a proposed penalty, has accepted responsibility for his actions and has avoided unnecessary expense to the association.

Counsel for the association made oral submissions in support of the Joint Submission as to Penalty and Cost, including a submission that the successful completion of the PPE was appropriate as a measure to ensure the protection of the public interest. The panel noted that the joint submission did not provide for the continuation of the suspension until Lee had successfully completed the PPE. Counsel for the association advised that section 28(4)(b) of the PEA limited any suspension imposed by the panel to 24 months, such that the penalty could not provide for an indefinite suspension until Lee's successful completion of the PPE. Counsel for the association submitted that revocation of Lee's licence (in the event of failure to complete the PPE) was inappropriate and excessive given the nature of the allegations.

The panel accepted the submission that completion of the PPE is of importance in terms of protecting the public interest. If completion of the PPE is remedial in nature as submitted by counsel for the association and intended to ensure the protection of the public interest, it is the view of the panel that

the suspension should, in fact, remain in place until Lee successfully completed the PPE. However, section 28(4)(b) of the PEA prevents such an approach. It is not self-evident to the panel why a suspension imposed pursuant to section 28(4)(b) of the PEA is limited to 24 months, or to any period, particularly where a suspension is imposed to prevent a member from practising until remedial actions have been completed satisfactorily. The panel also noted that many of the other powers of the Discipline Committee that are set out in section 28 of the PEA are not subject to any time limitation.

Despite the concern expressed above, the panel accepted the Joint Submission as to Penalty, recognizing that a joint submission should not be rejected unless the panel is of the view that one proposed penalty would bring the administration of justice into disrepute or is otherwise contrary to the public interest (*R. v. Anthony-Cook, 2016 SCC 43*). The panel, accordingly, orders:

1. Pursuant to section 28(4)(f) of the *Professional Engineers Act*, Lee shall be reprimanded, and the fact of the reprimand shall be recorded on the register for a period of three years;
2. The finding and order of the Discipline Committee shall be published in summary form under section 28(4)(i) of the *Professional Engineers Act*, with reference to Lee;
3. Pursuant to section 28(4)(d) of the *Professional Engineers Act*, it shall be a term or condition on Lee's licence that he shall, within 14 months of the date of pronouncement of the decision of the Discipline Committee, successfully complete the Professional Practice Examination;
4. Pursuant to sections 28(4)(b) and (k) of the *Professional Engineers Act*, in the event that Lee does not successfully complete the above-mentioned examination within the set time, his licence shall be suspended for a period of 10 months thereafter, or until he successfully completes the examination, whichever comes first; and
5. Pursuant to section 28(4)(j) of the *Professional Engineers Act*, Lee shall pay costs to the Association of Professional Engineers of Ontario in the amount of \$7,500, within 12 months of the pronouncement of the decision of the Discipline Committee.

Glenn Richardson signed this Decision and Reasons for the decision as chair of this discipline panel and on behalf of the members of the discipline panel: Richard E. Austin, LLB, Tim Kirkby, P.Eng., and Rishi Kumar, P.Eng.

MILITARY PROVIDES ENGINEER DYNAMIC WAY TO SERVE

Major Travis Kelley, P.Eng., comes from a long family tradition of military service. But it's his views on combining the professional engineer and army roles that give special meaning to serving the greater social good.

By Michael Mastromatteo

As a member of the Canadian Armed Forces, Major Travis Jay Kelley, P.Eng., technically does not have to hold a licence to perform engineering work. The federal government's position is that provincial engineering licensing statutes are not binding on federal employees engaged in activities strictly under federal control, including professional engineers in the armed forces. There may be an expectation that federally employed engineers be licensed if practising in Ontario, but it is not a hard and fast rule.

Despite this, Kelley is a proud P.Eng. and firmly adheres to the longstanding engineering ethic to safeguard public health, safety and the environment as he carries out his multitude of roles. It's an ethic he picked up early on when he recognized engineering's potential to do more than maximize corporate earnings or improve the bottom line.

"I became an engineer because it seemed like a combination of my interest in science and my desire to do things to help people," Kelley told *Engineering Dimensions*. "I believed in high school that any one individual's contribution in modern pure science is difficult to connect to improvement of the human condition. Rare is the scientist today that people could point to and say, 'He or she changed my life.' But engineers, whether the public know it or not, do exactly that."

Kelley—often known as TJ—believes a combined engineer-soldier career can serve the public interest in more than just economic or profit-driven ways. "I became a military engineer because I found that the details of actually doing that (changing someone's life) were abstracted away behind a lot of corporate levels and priorities—at least in the six co-op jobs I did in six different industries during my undergrad. So, with my familial exposure to the military and experience with a former Scout leader who was a military engineer, I decided to give it a shot in the reserves, liked it, and made it my career."

And while he's still only 35 years old, Kelley's career has been full and varied in the 13 years he has been a part of the armed forces. And it's still unfolding.

STAFF POSITION

Kelley recently took up a staff position focusing on counter improvised explosive devices (IEDs) for the Canadian Armed Forces. An IED is the military term for homemade bombs of various sorts, similar to those that constituted the primary threat on the Afghani battlegrounds. Canadian Armed Forces personnel had been involved in the Afghani conflict from 2001 until withdrawing in 2014. Kelley is now part of the Canadian Forces Joint Counter Explosive Threat Task Force, which is a high-level coordination arm for various aspects of military activity to stymie weapons of this sort.

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Major Travis Kelley, P.Eng., in Afghanistan with Haji Baran, at the time the district leader of Panjwayi District in Kandahar Province. Kelley has a dual career as an engineer and as a member of the Canadian Armed Forces, where over the last 13 years he has been involved in mapping, cartography, peacekeeping, administrative work, teaching new recruits, and more recently with a Canadian Forces Joint Counter Explosive Threat Task Force.



A sapper guides a tank across a medium girder bridge (MGB) set up over the Battle River at CFB Wainwright, Alberta. The MGB is Canada's tactical bridging capability, allowing a bridge capable of accommodating 70-tonne Leopard tanks to be built across a 30-metre gap in less than a day. Many times during his military career, Major Kelley has managed sappers in guiding tanks over similar bridge structures. In the background is a combat team, composed of tanks, infantry fighting vehicles and support vehicles, queuing to cross.

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"My new work will involve planning and coordination functions, working with Canadian specialists and our allies to coordinate a coherent national action against the IED threat, emphasizing priorities of the Canadian government, especially those recently released in the defence policy review," says Kelley.

Although this new role is outside Kelley's normal area of specialty, it will still allow him to use his engineering skills and mindset. "A lot of it will be less directly engineer focused than some of the previous work I've done, but still in an engineering milieu," he says.

Kelley has spent the bulk of his 13 years in the armed forces attached to the Mapping and Charting Establishment (MCE), which is part of the Canadian Forces Intelligence Command at National Defence headquarters in Ottawa. During his military career, Kelley has taken part in command and combat roles in Afghanistan, served in a peacekeeping mission in Haiti, and taught reservists and new recruits about geometrics, cartography, and optimizing engineering services in various areas of deployment.

Kelley graduated from systems design engineering at the University of Waterloo in 2005. Prior to graduation, he had become a member of the Canadian Armed Forces Reserve. "My last year of undergraduate studies was spent as a part-time member of 48 Field Squadron of 31 Combat Engineer Regiment, a reserve unit in Waterloo," he recalls. "I spent another year with the reservists after graduation while transferring to the full-time regular force."

He enrolled full-time in the military in March 2006, and was licensed by PEO that same year.

While Kelley is the first of his immediate family to become a professional engineer, he comes from a proud family military tradition.

His father, Michael, was a military police officer with a long career of service in Canada. His mother, Anette, while not a member of the service, for several years served as civilian manager at the base restaurant and store at Canadian Forces Base in Meaford, Ontario.

Kelley's sister, Trisha Morgan, recently completed basic training and now serves as a military supply technician, while his brother-in-law is a soldier in the Canadian infantry.

Kelley was a good fit for his mapping and charting assignments, thanks to his engineering education—systems design focuses on project management and how different components fit together to make a grander whole work. It also considers cognitive ergonomics, an important aspect of cartographic science.

Kelley was one of nearly 40,000 members of the Canadian Armed Forces deployed in Afghanistan since strife erupted there in 2001. He served in a deployed task force headquarters between May 2008 and February 2009.

Kelley's job title in Afghanistan was engineer intelligence officer, with responsibilities to coordinate the flow of information in both directions between intelligence and the various engineer entities in the Canadian Task Force.

"I built a database of culvert locations and helped to design and populate a simplistic web map service on the theatre intelligence database that showed roads, culverts and other engineering features of interest to the operation," Kelley says. "I also worked with geomatics technicians to get data for engineer analysis, and to get analytic support for complex problems. While in Afghanistan I was not yet a cartographic specialist, although I was already interested in pursuing that specialty."

Although the work might seem dry to the civilian or non-specialist, office work becomes engaging when the life-or-death results of your efforts are so proximate in time and space. Kelley found it a rewarding experience in Afghanistan: "The opportunity to deploy is stressful but also

exhilarating in general. My work in the HQ exposed me to a variety of high-level activities, which were interesting to understand, and my actions there had a measurable impact across the area of operations," he recalls.

COMMAND ROLE

For a six-week period in Afghanistan, Kelley took over as temporary troop commander in operations and combat, and provided some technical training to local residents struggling to raise themselves out of poverty and civil instability. "I also helped to establish a road, which may be part of Canada's permanent legacy to Afghanistan," Kelley adds.

Some time after returning from Afghanistan, Kelley was posted to CFB Valcartier, about 25 kilometres north of Quebec City, where he became second in command of an engineering field squadron. This work involved managing training of up to 100 soldiers about various frontline engineering work, such as de-mining, bridge building, demolition and construction.

While serving with the engineer regiment in Valcartier, Kelley's group helped design erosion barriers for a temporary military bridge, and helped plan the tactical operation to establish the bridge under simulated pressure from the enemy.

After working with the field squadron, Kelley left for six months (June to December 2013) to deploy on a peacekeeping mission to Haiti. It was largely an administrative role in Haiti, but Kelley worked with local police, non-government organizations and military to try to bring economic improvement in some regions, particularly in the remote Île à Vache.

On returning from Haiti in early 2014, Kelley was assigned operations officer of a regiment of about 500 soldiers in Valcartier. He then returned to the Mapping and Charting Establishment, taking command of the Canadian Forces School of Military Mapping in 2014. A key role there was helping prepare master corporals to move up the rank of sergeant—a critical rank for senior technical leaders in the geomatics operation.

Now residing in central Ottawa with his wife Chrystal and five-year-old daughter Ember, Kelley is reflective on the two-sided nature of an engineering-military career. But it would be an exaggeration to suggest Kelley has divided loyalties between the two professions.

"I have never encountered a conflict of priorities," he says. "It has always been clear to me when the standards of my military profession applied, and when those of my engineering profession did. There seems, philosophically, to be room for contradiction, but I have not experienced any."

Kelley also had some unique insight on potential conundrum for engineers serving in the military. "Ultimately, the fundamental premise of engineering is preservation of life and property, and the basic mission of the military is to break that," he says. "In theory, they are opposite. But when you go into the details, especially of the military profession, the managed and controlled application of violence distinguishes from the maximum application of violence, and opens the path to reconciling the two mandates."

Kelley also cites the influence of one of his first engineering professors at the University of Waterloo in steering him towards the engineering-military path. "I became a P.Eng. partly due to an inculcated sense of duty inspired by Dr. Carolyn MacGregor, my first-year

engineering principles professor at Waterloo, and partly due to a workplace incentive program for maintaining professional designations. I remember a time, after applying to join the army but before starting, when I was bicycling through the streets. Afghanistan had been in the news again, and the weapons of mass destruction in Iraq were topical at the time. I saw a couple of kids playing in a yard and I thought, 'I can be good at the army, and that will keep [them] safe and give them a chance at a good life. This is worth doing.' So, yes, protecting people—more generally, helping them to have better and more prosperous lives—led me to both engineering and the army."

For her part, Professor MacGregor, PhD, LEL, of the University of Waterloo remembers Kelley from his first year of engineering design studies. "I could always count on TJ to lend a hand, especially if it involved helping younger students," says MacGregor. "TJ was one of the first alumni to volunteer to be an alumni mentor when the professional design engineering program first got started. We were looking for alumni who would be willing to provide advice through online discussion on professionalism and ethics, and connect with students as needed. I knew TJ had gone into the military as I had written one of the letters of reference. I also knew that he was going to be extremely busy, so I really appreciated that he was still willing to make time to help out. Over the years, I have suggested to students who are considering military service to contact TJ to get an engineer's perspective." [e](#)

Do you know a professional engineer who might be a good profile subject? We'd love to hear from you. Email the editor, Nicole Axworthy, at naxworthy@peo.on.ca.



By Natalya Anderson, Sharon Aschaiek and Michael Mastromatteo

Welcoming Innovation

Engineers are inventors and problem-solvers by nature. Whether they're creating self-driving cars or revolutionary medical applications, they're changing—or will soon change—life as we know it. The eight projects we profile here are the work of Ontario professional engineers, and are just a small sampling of vital innovation in action.

Photo: Neil Ta



The Autonomoose is a Lincoln MKZ hybrid sedan that has been modified with artificial intelligence to become a self-driving car.

PUTTING AUTONOMOUS DRIVING RESEARCH INTO HIGH GEAR

In the race to develop a fully functioning self-driving car, Steven Waslander, PhD, P.Eng., is gaining momentum with the quirkily named but very promising Autonomoose.

The Autonomoose is a Lincoln MKZ hybrid sedan that is being modified with artificial intelligence into an autonomous vehicle. The vehicle is being developed by Waslander and several other researchers at the University of Waterloo as part of a three-year research project, one of three approved by the province for its automated vehicle pilot program. The team faces many difficult engineering challenges, but they've made enough progress to test a prototype this fall on Ontario's public roads—a Canadian first.

"It's exciting to be at the forefront of this research in Canada... The complexity and intricacy of this project makes it very rewarding," says Waslander, an associate professor of mechanical and mechatronics engineering and director of the Waterloo Autonomous Vehicle Laboratory.

Waslander has studied robotic autonomy since completing his education—a bachelor's degree in applied math and mechanical engineering at Queen's University, and a master's and then doctoral degree at Stanford University in aeronautics and astronautics. The self-driving car project was greenlighted last November when Waslander and his colleagues received a \$150,000 grant from the Natural Sciences and Engineering Research Council of Canada. With additional financial support from seven industry partners, the team is focusing on how to create an autonomous vehicle that is safe, fuel efficient and can operate in Canada's diverse weather conditions.

The car's development team—Waterloo faculty members from mechanical, mechatronics, electrical, computing and systems design engineering, and from computer science, as well as technicians and stu-



Steven Waslander, PhD, P.Eng., is leading the University of Waterloo's innovative research and development of a safe and fully functioning self-driving car.

“WE’RE INTERESTED IN CONTINUING TO INVESTIGATE THE HARDEST PROBLEMS TO HELP PUSH FORWARD THE DEVELOPMENT OF AUTONOMOUS CARS AND TRAIN THE NEXT GENERATION OF ENGINEERS.”

Steven Waslander, PhD, P.Eng.

dents—are creating, integrating and testing key systems and components. Chief among them are radar, sonar, lidar, inertial and vision sensors that provide comprehensive real-time information about the vehicle’s surroundings, including other cars, pedestrians, lane markings, traffic lights and weather. The vehicle also receives information about the driving environment from the Internet, and all this data is analyzed by powerful computers.

“The hardest part is getting the car to disambiguate what’s going on: Are there one or two cars at the stoplight? Are those pedestrians crossing the street or walking on the sidewalk?” Waslander says. “The dynamic aspects of the driving scene confound the current state of the art, so we are throwing everything we can at improving the detection of objects.”

His team has tested the Autonomoose on an outdoor road test site in all types of weather, including snow and ice. The vehicle has also performed in various simulated road conditions on a dynamometer. The researchers have learned they must continue enhancing the vehicle’s ability to detect the quality and quantity of ice, and to more accurately perceive objects obscured by rain or snow. While the driver can take over the vehicle if needed—a feature required by provincial law—Waslander says the goal is to offer a consistent, safe, automatic driving experience that doesn’t require intervention.

The Autonomoose has been showcased on the *Rick Mercer Report* and *Daily Planet*, and at the 2017 Consumer Electronics Show in Las Vegas. The vehicle is also participating in a North American competition sponsored by General Motors and SAE International to create an autonomous driving vehicle for urban settings by 2020. However, the innovation will not be commercialized, Waslander says, but will continue serving as a research platform for determining the optimal self-driving vehicle.

Says Waslander: “We’re interested in continuing to investigate the hardest problems to help push forward the development of autonomous cars and train the next generation of engineers.”

FORENSIC MAPPING POISED FOR NEW ROUND OF APPLICATIONS



Eugene Liscio, P.Eng., outlines some of the capabilities of 3-D imaging at an Engineering Innovation Forum hosted by PEO.

An Ontario engineer with expertise in forensic mapping and 3-D reconstruction is optimistic that something as basic as a digital camera could lead to improvements in assessing structural safety of buildings and other structures.

Eugene Liscio, P.Eng., president of the AI2-3D company in Woodbridge, Ontario, says that while forensic mapping and related technology is generally associated with crime investigation and accident reconstruction, there is potential application in new areas, including building safety work.

AI2-3D specializes in forensic mapping, analysis and 3-D reconstructions of crime and accident scenes. Its personnel assist police, attorneys and experts with rebuilding a case to test different theories and scenarios. “3-D technologies have played a very important part in the accuracy and level of detail that can be captured for crime and accident scenes or even large disaster scenes such as explosions and building collapses,” Liscio explains. “It’s the kind of technology that merges well with other data types, such as photographs, video, photogrammetry, total station, thermal and alternate



Eugene Liscio, P.Eng., prepares a scan at an underground tunnel to gather data on a mining accident. It was part of an exercise on lighting and digital imaging in extreme environments.

light sources. By combining these data types, it opens the door to new types of analyses that were not possible previously. In some cases, it's simply not possible to do the same types of analysis without 3-D."

Liscio is also past president of the International Association of Forensic and Security Metrology, a US-based organization promoting the development and use of precision measurement systems, techniques and software in the generation of two- or three-dimensional coordinate spatial data.

Liscio believes the technology is poised to take off in other areas, including architecture and construction. For engineers concerned with innovative ways to consider building and structural safety, it could also lead to collection of important new data.

"For example," Liscio says, "ensuring you have captured the 'as built' model of a historical building and being able to check for the flatness and level of concrete can save tons of time and avoid lengthy civil litigation. I wonder if collapses like the [Algo Mall] Elliot Lake event could have been avoided if 3-D tools were employed over time to look for and detect shifting structures."

While the use of forensic mapping and related technology holds promise in terms of preventing disasters, it is still used primarily as a way to determine what went wrong after the fact.

"Most of my work is crime scene related, although I still do civil cases such as accident reconstruction," Liscio says. "We are often called upon by the police to assist on cold cases and during the investigation phase for any number of reasons, but often it's to look at patterned evidence or reconstruct scenes from video."

Liscio is occasionally called on as an expert witness in crime investigation cases, and some of his testimony and investigative work has been featured on *48 Hours* and *Dateline NBC*.

One of the most direct advantages of laser scanning, he says, comes in the areas of crime scene investigation and car accident reconstruction. Liscio said 3-D laser scanning and visualization give a tremendous boost to traditional investigation methods and have become a key tool in documenting and validating evidence. Even bullet trajectories, he says, can be pieced together more accurately based on information obtained via laser imaging.

Although some of the work may be morbid, it still holds fascination for engineers and other investigators in getting to the essential causes of an incident, accident, crime or disaster.

"There is new equipment, which is higher accuracy, and the workflows have been streamlined. There have also been some other technologies that are integrating with laser scanning, such as thermal technologies, panoramic cameras, alternate light sources and even drones," Liscio adds.

LISCIO SAID 3-D LASER SCANNING AND VISUALIZATION GIVE A TREMENDOUS BOOST TO TRADITIONAL INVESTIGATION METHODS AND HAVE BECOME A KEY TOOL IN DOCUMENTING AND VALIDATING EVIDENCE.

CANADIAN SCIENTISTS USE ENGINEERING TECHNOLOGY TO CREATE HUMAN ORGANS



Milica Radisic, PhD, P.Eng., and her team hope to use their "organ-on-a-chip" technology to grow various living organ tissue for use in drug development and testing.

A team of Canadian scientists has applied intricate engineering techniques to create miniature hearts and livers, and these living organs are revolutionizing drug testing globally.

Principal investigator Milica Radisic, PhD, P.Eng., and her team at the University of Toronto's Laboratory for Functional Tissue Engineering have grown swatches of living heart tissue that contain muscle and "blood vessels" and beat like a human heart. Rather than working with traditional, flat-surfaced petri dishes, the team aimed to create an environment that more resembles

the human body. By applying technology commonly used to create computer chips, Radisic began growing heart cells on a chip—a kind of 3-D scaffold comprised of biodegradable polymer that is malleable.

"We call it Biowire, or biological wire, and it's a small piece of human tissue that we build in the lab using micro-fabrication technologies from the semiconductor industry and electrical stimulation," explains Radisic, a University of Toronto professor and Canada research chair in functional cardiovascular tissue engineering. "We rely a lot on techniques that are established in engineering. We build a small, chip-like environment that enables the cells to come together and beat together, like in a real heart."

Radisic and her team saw the potential for a few applications and have quickly produced more platforms for cell maturation. Along with Biowire, which matures heart cells, they have also created AngioChip, which enables the researchers to build a family of vascularized tissues to grow both human liver and human heart.

The implications are dramatic for treating life-threatening diseases in terms of safer, more effective drug development and testing. "All drugs have to go through cardiac safety testing, regardless of their ultimate use," says Radisic, who has won, among a multitude of awards, the 2011 Ontario Professional Engineers Awards (OPEA) Young Engineer Award, and the 2015 Hatch Innovation Award from the Canadian Society of Chemical Engineers. "In the current drug-testing paradigm, a drug encounters human tissues and cells for the first time in Phase I clinical studies. That's when it's given to the human for the first time. With our technology, people will be able to assess effects in human cells much earlier—before a drug is given to a real person."

Radisic says the applications will also enable scientists to discover new medicinal products that are personalized or tailored to specific subsets of patients. She can, for example, work with patient cells and build patient-specific heart tissues—a project that is already underway with her colleagues at Toronto General Hospital. Says Radisic: "We

can build human heart tissue for the patient, and then ask, 'What causes the disease at the molecular level, and how can I use this knowledge to develop better drugs for a specific group of patients?' It's along the idea of precision medicine or personalized medicine. In the past, before these human tissues were available, everything was done in large clinical trials. Now you can tailor the drug to a specific [subset] population. A drug may work beautifully in a subset of patients, but not so well in other patients, and these emerging technologies with human tissues on a chip will enable us to delineate better which genetic backgrounds certain drugs would be good for."

With a company she co-founded, TARA Biosystems, Radisic's innovations are already exploring their lifesaving potential. "This is happening now, right now, through our start-up company, TARA," says Radisic. "Pharma is accessing this human heart tissue, biological wire, and there are projects the start-up is [collaborating on] with pharma companies."

TEACHER LOOKS TO BREAK NEW GROUND IN PREPARING NEXT GENERATION OF ENGINEERS



Professor Nancy Nelson, P.Eng., FEC, has introduced several innovative teaching methods at Conestoga College and is also co-developer of an educational authoring software.

Engineering innovations are often thought of in terms of products, devices, systems or processes, so it's something of a departure to highlight a teaching approach as a form of innovation. But Conestoga College professor and academic coordinator Nancy Nelson, P.Eng., FEC, comes highly recommended as a subject for a discussion of what's new and exciting in preparing engineering undergraduates to make a difference in their professional careers.

A member of the Conestoga teaching staff since 1984, Nelson spearheaded the college's electronic systems engineering program

and introduced a number of innovations in the classroom, including flipped learning, where the focus moves from teaching to learning by changing when, where and how learning occurs; gamification, where elements of game theory are added to the curriculum to help increase student engagement, collaboration, communication and improve knowledge retention; and project-based learning, where students work on authentic projects integrating cross-course and cross-discipline knowledge and skills.

Her teaching efforts have not gone unnoticed. This year, she won CIGan's Gold Award in Leadership Excellence for Faculty, in 2016 she claimed the Engineers Canada Medal for Distinction in Engineering Education, and in 2003 she won Conestoga's top teaching honour, the Aubrey Hagar Distinguished Teaching Award.

But being an innovative educator obviously means more than claiming awards. Nelson is keenly interested in how students—engineering or otherwise—actually learn material,

absorb information and acquire the patience, experience and confidence to perform in the professional world.

It's probably more than coincidence that Nelson wound up on the faculty of the first college (as opposed to a full university) to obtain accreditation of its engineering program from the Canadian Engineering Accreditation Board (CEAB). Nelson was closely involved in accreditation of the school's electrical systems engineering program—she led curriculum review and redesign as preliminary steps in the eventual CEAB accreditation.

Her focus on innovative teaching methods has generated at least one commercial opportunity. She is co-developer of Private School Interactive, an educational authoring software. "This commercial product was the result of my graduate work, which is where I really became interested in the effects that teaching has on learning," Nelson reveals. "My husband, who is also an engineer and professor, and I worked together on this project. He wrote the front end and I wrote the intelligence engine that monitored the way the student approached their learning experience, analyzed these patterns with respect to how well the student mastered the content, and modified the way the computer-based content was presented to the learner to help achieve optimal learning. It also allowed faculty to easily produce learning packages for their own courses."

The software, which won a McGraw-Hill Ryerson Education Innovation Award, has been used to create multimedia learning packages for educators, industry, and even at the US space agency NASA.

Ignac Kolenko, P.Eng., chair of the School of Engineering and Information Technology at Conestoga College, is proud to have Nelson on staff. "From day one, I have witnessed Nancy's passion for quality education, and her innovative approaches to content delivery have taken her into areas like online learning/testing, flipped (inverted) classrooms and our unique brand of project-based learning that we practice in our electronic systems engineering degree at Conestoga," he says. "There can be no doubt that Nancy has been an educational innovator for most of her career, especially in regard to engineering education."

Kolenko adds that Nelson gives back to the educational community regularly and shares her teaching skills and techniques annually as part of the college educator development program. "Our next generation of educators pick up and master some of these same techniques that have made Nancy such a noted innovator in the classroom."

HER FOCUS ON INNOVATIVE TEACHING METHODS HAS GENERATED AT LEAST ONE COMMERCIAL OPPORTUNITY. SHE IS CO-DEVELOPER OF PRIVATE SCHOOL INTERACTIVE, AN EDUCATIONAL AUTHORING SOFTWARE.

The emphasis on improving teaching performance is especially apt as the engineering profession looks to prepare the next generation of practitioners. It's a challenge that innovative educators like Nelson find especially compelling. "This change is absolutely crucial and is the main reason that I'm continuing my studies in engineering education," she told *Engineering Dimensions*. "I've done a lot of work related to faculty development over the last 10 years and it is extremely important that opportunities for teaching-related professional growth are available. Faculty must be encouraged to stretch their comfort zones, be supported during that process, and be recognized for their efforts to improve their teaching practice. Regulatory bodies and accreditation boards must also be willing to recognize and accept the value and richness that innovative teaching strategies and methods can add to the student experience and learning as they prepare for the practice of engineering."

DRONE TECHNOLOGY IMPROVES EFFICIENCY IN CONSTRUCTION INDUSTRY



Enaeria co-founders Daniel Matzeg, P.Eng. (left), and Zachary Feld, P.Eng. (right), are bringing drones to the forefront of the construction industry.

A few brainstorming sessions with his best friend was all it took for Zachary Feld, P.Eng., to realize that aerial surveying and inspection could be achieved locally to reduce the immense time, and financial and environmental burdens of the global construction industry.

"We were thinking about ways we wanted to try our hand at entrepreneurship," explains Feld, who, along with fellow University of Waterloo engineering graduate Daniel Matzeg, P.Eng., founded Enaeria in October 2015.

"Ultimately, we decided we wanted to explore use of

drones—not just for photography or videography, which we knew a lot of people were doing—but more so for an industrial application."

While the concept of using unmanned aerial vehicles (UAVs) industrially is not entirely new, the technology is still in its infancy in terms of what applications might be possible. Feld says this has allowed him and Matzeg to bring the concept to a new wave of contractors in Ontario.

"We'll fly a drone in a particular pattern, depending on what the application is, ultimately to collect data about the environment from a variety of perspectives," explains Feld. "Using the information we collect, we triangulate data points we see from various perspectives to be able to identify where in 3-D space any particular point is located... Just doing that millions of times using a computer algorithm is sort of the brain behind it all."

During the second quarter of 2017, Statistics Canada reported that investment in non-residential building construction totalled \$12.4 billion. Ontario reported the largest

FELD SAYS HE CAN DO SITE SURVEYS IN A FRACTION OF THE TIME OF TRADITIONAL METHODS WITH MORE ACCURATE RESULTS, WHICH TRANSLATES INTO COST SAVINGS.

upturn in spending on institutional, industrial and commercial buildings. For Enaeria, that means more clients looking to reduce cost.

Feld says he can do site surveys in a fraction of the time of traditional methods with more accurate results, which translates into costs savings. "Even more impressive is that instead of getting a data point manually one point at a time, spaced out every five or 10 metres, we can get upwards of—depending on the project—spacing of data samples every four millimetres," says Feld. "So, you're not missing any nuances in the ground because of how coarse your data sampling is."

His approach also reduces safety concerns in undeveloped or more challenging areas. "We've done bridge inspections where we're able to obtain measurements of hard-to-reach areas that would either cost a lot of money or would potentially put someone in a vulnerable position to obtain those measurements," explains Feld.

Minimizing environmental impact is also a benefit, says Feld, because they're not disturbing wildlife or other natural or undeveloped areas when they're flying over them as opposed to walking through them. "Effectively we're able



Daniel Matzeg, P.Eng., holds one of the drones so integral to surveying, mapping and inspections.

to give our clients a more accurate understanding of what they have on their particular sites," says Feld. "That way they can make decisions with a higher degree of accuracy that is less detrimental to the environment."

Inevitably, security and trust are of huge importance to Feld and the company. "The biggest concern people have is flying in locations or in manners where you're not legally allowed—flying close to airports or no-fly zones or flying at altitudes you're not supposed to be flying at," says Feld. "We don't take on projects where we find that what our customer is asking of us would teeter on the side of inappropriate."

With UAV demand on the sharp rise (*Fortune* reported last year that analysts estimate the commercial drone industry will reach \$5 billion US by 2020), companies like Enaeria are in the unique position of being able to evolve organically. "There are tons of applications for this," says Feld. "To be quite honest I don't think we've even scratched the surface."

PUTTING SOFTWARE BUGS ON NOTICE



Lin Tan, PhD, P.Eng., is the award-winning creator of a novel computer program that can automatically detect and fix flaws in software code.

With a breakthrough approach to addressing software defects that has attracted extensive government funding and industry interest, Lin Tan, PhD, P.Eng., is helping to make computing much more effective.

The University of Waterloo professor has created a novel program that can automatically detect and fix flaws in software by analyzing developers' commentary accompanying their code. Her method involves comparing lines of code with their related comments to identify and adjust discrepancies in meaning. Tan is the first researcher to tackle soft-

ware glitches in this way, and her innovative tools have proven more efficient at predicting, finding and repairing bugs, and even at preventing them in the first place.

"Either we can find and fix bugs that other tools cannot, or we can fix them more accurately," says Tan, the Canada research chair in software dependability and winner of the 2016 OPEA Young Engineer Award. "We are helping to push forward the state of the art and offer better solutions to software developers."

It's a topic Tan began investigating for the computer science doctoral thesis she completed at the University of Illinois in 2009, and that she has studied ever since joining Waterloo later that same year. She has learned that often the instruction in a line of code will not match information described in its comment, and this could indicate an error in the software. As well, in software documentation, such as menu pages and bug reports, there are often discrepancies between their instructions and what's in the code. She says developers' unclear use of the English language—spell-

ing mistakes, incomplete sentences, missing or incorrect punctuation—and the inclusion of other languages besides English in the code commentary and documentation make it difficult to analyze computer code commentary.

"Software text is a free form, there is no template for writing it, and English is a complex language. So the quality of the text and its clarity varies a lot from developer to developer," Tan says.

She and her team—faculty members at Waterloo and at academic institutes worldwide, plus many students—rely on natural language processing, machine learning and various program analysis tools to systematically identify and understand these errors. So far, Tan has created dozens of automated and semi-automated software testing tools that can more effectively detect and repair software bugs. She primarily studies open-source software, but has also conducted research for and received funding from Google, IBM and other technology companies. Tan has also received more than \$1.3 million in government research funding from sources such as the Natural Sciences and Engineering Research Council of Canada and the Ontario Centres of Excellence.

Tan understands the high stakes of her research: her efforts could save software companies millions of dollars, ease frustrations for computer users, and even save lives by improving the reliability of software in safety critical systems in cars, airplanes and medical devices.

"If we can improve the dependability of software and make it easier to use," Tan says, "we can reduce security problems and safety failures, and make a better world for everyone."

"IF WE CAN IMPROVE THE DEPENDABILITY OF SOFTWARE AND MAKE IT EASIER TO USE," TAN SAYS, "WE CAN REDUCE SECURITY PROBLEMS AND SAFETY FAILURES, AND MAKE A BETTER WORLD FOR EVERYONE."

ENTREPRENEUR FINDS BUSINESS OPPORTUNITY WITH FIBER OPTIC GAUGES



Nick Burgwin, P.Eng., co-founder of Fibos Inc., developed new fiber optic sensors that he hopes will become the standard for advanced optical measurements and sensing.

Last October, PEO's York Chapter invited members to attend a special presentation on the advances in fiber optic sensors as an affordable and technically advanced alternative to traditional electrical sensors now in use in various industrial and manufacturing settings.

The speaker at the York Chapter event was Nicholas Burgwin, P.Eng., co-founder of Fibos Inc., an exciting new start-up looking to fill a unique niche in the optical gauge sensor and transducer marketplace.

Burgwin was an inspired choice for the presentation because of his

experience in industry and his involvement with Ryerson's Centre for Engineering Innovation and Entrepreneurship (CEIE), a new institution that helps bring engineering and technological innovation to commercialization.

Ryerson's CEIE brands itself as an institution offering students a systematic process to become entrepreneurs. Its "incubation zone" aims to bring engineers together with experts to form start-up companies dedicated to developing innovative products, processes and systems.

After graduating in electrical engineering from the University of Toronto in 2010, Burgwin entered industry where he found work in the consumer electronics, aerospace and automotive sector. During this time, Burgwin worked with a number of traditional sensors and came to understand some of their limitations.

With a determination to research and develop a more efficient sensor product, Burgwin enrolled in Ryerson University's master's degree program with a focus on replacing electrical strain gauges with fiber optic alternatives.

The end result was the creation of Fibos Inc. to manufacture and market the Optical Gauge Sensor and Optical Gauge Amplifier to provide "plug-in-and-play" replacements for traditional electrical strain gauges.

Burgwin and his co-founding partner Michael Bakaic, also a University of Toronto engineering graduate, tout the virtues of optics that provide the technical advantages within their products.

"I recognized how fiber optic sensors are intrinsically safe and offer advantages over electrical sensors," Burgwin says. "Fiber optics are less sensitive to electromagnetic interference, and can be used in harsh environments. These sensors can be applied to measure mechanical forces, such as strain and temperature."

Burgwin suggests the most innovative feature of his company's optical sensing solution is the ability to monitor mechanical forces, such as pressure, temperature, load and vibration in harsh environments. These include extremely high temperature environments, up to 1000 degrees C,

BURGWIN ENROLLED IN RYERSON UNIVERSITY'S MASTER'S DEGREE PROGRAM WITH A FOCUS ON REPLACING ELECTRICAL STRAIN GAUGES WITH FIBER OPTIC ALTERNATIVES.

which is almost doubling any other technology available, intrinsically safe environments or high electromagnetic or ionization radiation areas.

"We're effectively replacing what's now used in the electrical strain gauge area with advanced and affordable optical sensors," he says.

The Fibos main product line to date includes the optical gauge sensor and amplifier. The sensor, or OGS, is what is bonded or attached to a mechanical component that is experiencing a force, such as pressure, load or vibration. The amplifier (OGA) is the device that converts the optical signal into useful data that can easily be integrated into existing data logging systems.

Most often, traditional sensors use foil strain gauges to monitor mechanical deformation. These electrical-based sensing elements cannot survive at elevated temperatures, are susceptible to electro-magnetic interference and ionizing radiation, and are not inherently intrinsically safe.

"Our optical sensors solve all of these issues without sacrificing accuracy, opening up an endless number of new applications in which our sensors can be utilized," Burgwin says.

In addition to researching a new product's technical advantages, Burgwin also had to contend with such marketing constraints as affordability and reliability. To this end, Burgwin's involvement with Ryerson's CEIE paid quick dividends.

"The Centre for Engineering Innovation and Entrepreneurship from Ryerson manages the Norman Esch Awards," Burgwin recalls. "I won all three stages, which totalled \$38,000. It was instrumental towards developing and testing prototypes. For the award applications, I had to develop my business plan and through market research, validate the market fit for the product. Mentors were available to help guide and focus my thoughts."

The Norman Esch Awards support engineering and architectural science students in developing new products or technologies relevant to the Canadian economy.

Fibos Inc. now operates in open space at the Celestica property in Toronto. The partners are now engaged in centralizing manufacturing, design and product testing of their new products, while engaging with potential new customers to install evaluation units in the field.

"Engineers are most definitely on the front line of innovation, as we can take research and apply it to different problems," Burgwin says. "From universities, great new technologies are being developed in Canada, and if schools continue to support, both financially and by offering mentoring, engineers will continue to take research and apply it to industry problems."

PIONEER SEES POTENTIAL IN ASSISTIVE ROBOTIC DEVICES



Goldie Nejat, PhD, P.Eng., builds socially interactive robots that assist dementia patients with everyday activities.

University of Toronto Professor Goldie Nejat, PhD, P.Eng., has long been involved in creating robots and androids to assist seniors and other people with physical or cognitive impairments in completing everyday tasks, like eating meals and getting dressed, helping give them a sense of independence in their own homes.

A member of the university's department of mechanical and industrial engineering since 2008, Nejat is also director of the school's Autonomous Systems and Biomechanics

Lab and Canada research chair in robots for society.

Nejat is considered a world-renowned expert in developing intelligent service/personal robots for applications in health, elderly care, emergency response, search and rescue, security and surveillance, and manufacturing. A major goal of her research is to develop and integrate intelligent, socially-assistive robots for robot-human interactions.

"It's an interesting concept because we're developing a technology where we also need to understand human behaviours," Nejat says. "There's a lot of engineering that goes into the design of the robot, but there's also a lot of psychology and social/behavioural sciences and also health sciences that need to be considered, as the robots have to learn their assistive behaviours. Those assistive behaviours have to be effective, and displayed in a way the user can easily understand them. At the same time, the robot needs to recognize the user's intent in order to react to it."

To provide personalized interactions with a robot, Nejat and her team are working to have the robots display facial expressions and gestures, and even tell jokes, so the user—usually a senior with cognitive impairment—can stay focused on the tasks at hand.

"At meal time, for example, the robot focuses the user's attention on food items such as, 'This is the main dish, here is the fork to bring the food to your mouth.' We add social interactions as it's an important part of meal eating and also helps maintain a user's social networks which, as you age, are important to your health."

The simple fact of an assistive robot telling jokes allows for more interaction, Nejat says.

"Essentially, it's the robot helping them to do those repetitive actions that are needed, but also providing it in a socially engaging environment so they can eat their meal. The robot is non-contact and doesn't do any of the tasks for the person, but rather prompts them through the steps."

A great deal of engineering and creativity is involved in designing and developing the mechanical caregivers. The innovative twist for Nejat and her team of researchers is to include interactive capabilities between robot and user.

"It's very multi-disciplined in that sense," Nejat says. "We learn a lot about how people interact and communicate as

A MAJOR GOAL OF HER RESEARCH IS TO DEVELOP AND INTEGRATE INTELLIGENT, SOCIALLY-ASSISTIVE ROBOTS FOR ROBOT-HUMAN INTERACTIONS.



Goldie Nejat, PhD, P.Eng., with two of her socially-assistive robots.

well as about the diseases so we can try to adapt the robot to the user's needs. People who suffer from dementia have their own set of limitations, and no two people are alike, so the robot learns how to personalize for that specific individual."

Apart from the assistive robots, Nejat is also developing service robotics, which include the time-critical urban search-and-rescue application. The MARP robot, for example, is one mobile robot in the group of rescue robots the team has developed. "Currently, we are working on multi-robot co-operation within a team of intelligent rescue robots that can be deployed in unknown and cluttered disaster environments to explore the environments in order to help find victims. The objective is that these robots can help first responders in dangerous and challenging environments."

Nejat is especially gratified to note the progress in assistive device robots over the last 15 years. "Assistive technologies exist, but the interactive ones are very new," she says. "You are adding a robot that is moving in the same space as the person and has facial expressions and gestures. We're at the stage where we've done a lot of development and then we take out the robots and do user studies with older adults, residents in long-term care facilities, get their feedback and optimize our design and focus on what the needs and wants of the population are." [e](#)

WHEN DISRUPTION MEETS REGULATION

The rapid growth of new digital innovations like Netflix, Uber and AirBnB offer benefits for Canadians and others around the world, but they also pose novel regulatory challenges for governments and, potentially, regulatory bodies like PEO. Here, we review a recent report from the University of Toronto's Mowat Centre on the challenges disruptive technology and its accompanying industries pose on traditional regulation.

By Andrew Tapp

The Mowat Centre at the University of Toronto's School of Public Policy and Governance recently published the report *Regulating Disruption: Governing in an era of rapid technological change* (mowatcentre.ca/wp-content/uploads/publications/147_regulating_disruption.pdf). It examines the challenges that disruptive technology—an innovation that creates a completely new industry or displaces an established technology—and the innovators who make use of it, create for government and regulators. The report highlights several examples in disruptive technology, including video streaming (Netflix), crowd-sourcing (Uber), autonomous vehicles, and blockchain technology (the encryption scheme backing bitcoin), and shows how they avoid or challenge existing regulatory regimes.

CHALLENGES AND STRATEGIES

The report details three main challenges for government regulators when working with disruptive technology: the structure of the government, the way governments engage with stakeholders, and the skills and competencies of government regulatory staff. Government structure can present a problem when coordination from multiple levels of government are needed to properly regulate a new technology—for example, provincial, federal and municipal governments would all need to co-operate to properly regulate autonomous vehicles. Another structural problem is that government regulators traditionally operate in areas where the risk to the public is very high (health care, engineering, etc.). The methods and structures developed for these situations may be too restrictive when applied to new technologies and innovative companies that do not pose a substantial risk to the public. The second major challenge to governments and regulators is how they interact with stakeholders. The timing of engaging stakeholders in the regulatory process can be tricky; too early and the regulator can be unprepared and vulnerable to resistance from the innovator, too late and the lack of input might lead to regulations that don't reflect the real world. Regulators need to make efforts to actively engage and consult with stakeholders. The final major challenge for government is a dearth of staff with the skills and competencies necessary to understand disruptive technologies.

The Mowat report presents four strategies for dealing with these challenges: bringing design thinking into government, building government capacity, reducing regulatory burden and encouraging strong market competition. Design thinking is a way of approaching problems with an experimental mind and from an end-user perspective. We have already begun using it at PEO and, according to the report, other regulatory bodies such as the Toronto Planning Review Panel have had great success adopting this methodology. Building government capacity would directly address the shortage of technically-skilled staff, and the report presents several options for doing this, including bringing outside experts in for government "tours of duty." Reducing the burden of regulations can result in long-term economic benefits, and is something the Ontario government takes

very seriously—PEO has recently contributed comments to the government's Red Tape Reduction Challenge regarding the *Mining Act*. Finally, encouraging strong competitive markets can help prevalent regulatory capture, a strong threat to disruptive industries and they often do not have the resources to lobby "captured" regulators.

The final section of the report provides specific action items for solving the three challenges. Most of these suggestions are directed at governments, but there are a few for regulatory bodies:

- greater emphasis on life-long learning for regulatory staff;
- expand formal pathways for regulators at different levels of government;
- streamline inspections and enforcement inspections;
- rethink consultation approaches to become more user-friendly; and
- sunset clauses and regulatory reviews.

WHAT COULD THIS MEAN FOR PEO?

Overall, this report examines the challenges that disruptive technology and its accompanying industries pose to traditional regulation. As a profession regulator, we can ourselves take advantage of disruptive technology to better regulate our licence holders. For example, PEO may want to investigate if blockchain technology can be used to create a workable electronic seal. Artificial intelligence might be useful to identify potential design or practice risks, or even to produce engineering designs autonomously. PEO might also be interested in disruptive technology since it is often our licence holders who are doing the "disrupting," and emerging engineering disciplines and hybridized disciplines require understanding new technologies and perhaps models of regulation. Disruptive business models may also create different forms or types of engineering practice. For example, the subcontracting of local engineering work to foreign companies and engineers (often via the Internet) can make it difficult for local governments to monitor and regulate engineering that impacts the public to which they are responsible. [e](#)

Andrew Tapp is PEO's policy analyst.

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The deadline for the January/February 2018 issue is November 23, 2017. The deadline for the March/April 2018 issue is January 26, 2018.



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Remaining self-regulated

Wayne Kerr, P.Eng., MA, LLB,
Stouffville, ON

I enjoy reading each issue of *Engineering Dimensions*. I want to take this opportunity to make some comments regarding PEO's status as a self-regulating profession. These comments are based on information presented in the July/August 2017 issue.

On page 24, there was a notice that PEO celebrated its 95th anniversary as the regulator of engineering in Ontario. In the early 20th century, engineering was one of many trades that participated in a "professional" movement that led to the initiation of regulation and licensing. These professions sought to elevate their status and control both the admittance and the conduct of their members. This movement was partly in response to the rapidly changing society of the time; changes

that were the result of the growth of industry and cities, supported by large-scale technical developments (electricity, infrastructure, transportation, etc.).

On page 9, it was reported that a motion was presented at the AGM calling for "PEO to engage an external governance expert to advise Council on modernizing its operations to protect self-regulatory status." This motion will be further deliberated by Council. Our new president (p. 28) is "also concerned about the increasing government scrutiny on all self-regulating professions." Further, a report on the Elliot Lake trial (p. 17) quoted a statement by the Ontario Society of Professional Engineers that says, "We encourage action on ongoing continued improvements that will help reinstate the public's confidence in the profession."

Engineering remains one of the most invisible professions in the province, and I repeatedly hear that the majority of engineering graduates do not apply for a licence as they see little value in the P.Eng. designation as it exists today.

I am not sure what the past 95 years of self-regulation have accomplished.

It is natural for an established community to resist change, but I was wondering if any readers could offer a concise, rational answer to this question: Why, in 2017 or beyond, should engineering remain a self-regulated profession?

Erring on the side of safety

Robert H. Morse, PhD, P.Eng.,
Toronto, ON

Two letters in *Engineering Dimensions* (July/August 2017, p. 53 and 54) argue that catastrophic anthropogenic climate change is not settled science. I agree, but that's no reason for complacency.

The atmosphere is finite. We can't just keep pouring pollutants into it without causing some change. It's not just CO₂ we have to worry about: there's also sulphur, methane and hundreds of compounds, some of which we have not even identified yet. It would be naïve to hope that climate change might be beneficial; this is the atmosphere we and our ancestors have thrived in for hundreds of millions of years and any change in the composition or temperature of the atmosphere could be catastrophic. Whether we will need to deal with this threat within a few years, or a few million years, or if it is already too late to do anything about it, we don't know. A lot of engineering is based on unsettled science and when it does we must err on the side of safety.

The science of climate change is very complicated and politicians don't have a hope of understanding it. Many of their statements and promises are idiotic and dangerous but in many cases provide the best information the public receives. Climate science is also over the heads of most engineers, including myself, but we have to do something. And it doesn't have to cost a trillion dollars.

LETTERS TO THE EDITOR are welcomed, but must be kept to no more than 500 words, and are subject to editing for length, clarity and style. Publication is at the editor's discretion; unsigned letters will not be published. The ideas expressed do not necessarily reflect the opinions and policies of the association, nor does the association assume responsibility for the opinions expressed. Emailed letters should be sent with "Letter to the editor" in the subject line. All letters pertaining to a current PEO issue are also forwarded to the appropriate committee for information. Address letters to naxworthy@peo.on.ca.

Considering all sides

Jason Scott, P.Eng.,
Kanata ON

It is important to consider all sides of an argument, but those sides are only worth reporting if their positions are credible. The arguments against man-made climate change have been disproved countless times, to the point where the science must be accepted. Yes, there are details we still don't understand but the basic physics are really quite simple: CO₂ traps heat and we're generating unprecedented quantities of CO₂ by burning fossil fuels. All other things being equal, we should expect a hotter climate, caused by us. And that is what we measure. To argue against this requires extraordinary evidence, which is not borne out by the sources provided by Stephen Korn ("The other side," *Engineering Dimensions*, July/August 2017, p. 54). In the interests of time and space, let me refute just two.

- As skepticscience.com says in its entry "What do the CERN experiments tell us about global warming?": "Even the CERN scientist who ran the experiment

admits that it 'says nothing about a possible cosmic-ray effect on clouds and climate.'"

- As to whether CO₂ increases lead or lag temperature increases, the ice core record shows that small increases in temperature (due to orbital variations) led to CO₂ increases, which then led to further warming through positive feedback (i.e. CO₂ served as both cause and effect). But, the bulk of the warming lagged the subsequent CO₂ release from warming oceans, even though a small temperature increase was the trigger. But these changes happened over millennia, and have been accounted for, and discounted, in the current warming, which is man-made, as noted above.

I would encourage all members to read widely on the subject, but to question the qualifications, funding and motives of those who deny climate change or profit from the status quo. Engineers have a key role to play in helping the world mitigate and adapt to climate change. If we expect to be treated as specialists in our respective fields, we would do well to respect the expertise of the world's climate scientists. Contributing to climate denial with misplaced skepticism does a disservice to our profession, our children, our communities and our world.

Not just a theory

John Hayles, BSc, MASC, P.Eng.,
FEC, geophysicist,
Winnipeg, MB

The letter entitled "The other side" on page 54 (*Engineering Dimensions*, July/August 2017) is from a climate change denier and I'm surprised you permit misinformation like this in your publication. Just a shallow look into this letter shows clear distortion of atmospheric processes and even a reference to the Heartland Institute. Clearly, this is climate change denial and sowing of doubt where there is little to no doubt. PEO needs to be properly informed by science and not by people with a vested interest in "business as usual." Big changes are needed in our energy-use behaviour.

There are far more fossil fuels on Earth than we dare burn!

Global warming is no longer just a theory. Darwinian evolution is not just a theory. The Earth is 4.5 billion years old and revolves around the sun. Please!

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Beyond our control

Hendrik Borgdorff, P.Eng.,
Barrie, ON

I have just read the letters by Ronald Bradshaw, P.Eng., and Stephen Korn, P.Eng., on pages 53 and 54 of the July/August 2017 issue of *Engineering Dimensions*. I am not an environmental scientist who is knowledgeable about the causes and effects of global warming, but like these two fellow engineers, I have serious reservations regarding the highly flouted conclusion that the emissions of CO₂ are the prime cause of global

warming. My first question in this context is: What caused the CO₂ emissions 10,000 years ago to spell the end of the ice age? Furthermore, with all the moneys that have been spent to combat CO₂ emissions, have any results been verified? In January, I bought airline tickets to fly from Toronto to Edmonton and back. When I saw the charges on the invoice, I was astonished that the “carbon tax” that was added to the ticket price was not much less than the ticket price itself. Those kinds of expenses as well as those we spend at the gas pumps are unbelievable, and it is all based on an opinion that gives us the comfort of thinking that we are doing something useful and necessary, but I read nothing about what is being accomplished with all these efforts.

I don't disagree that the cleaning up of our emissions is a good idea, but that can be done without the hype about reducing the rate of global warming. In my opinion, the phenomenon of global warming is largely beyond the control of humans. My confidence is in the governance of the lord of the universe, Jesus Christ, who controls all things.

Innovative solutions

Tapan Das, PhD, P.Eng.,
Ottawa, ON

The looming crisis of global warming caused by CO₂ in the atmosphere is threatening our very existence. The recent dangerous floods in Quebec and BC, the melting of arctic ice, the alarming rise in sea level, etc. show how fatal global warming is. The sea level is projected to rise 1 to 4 feet by 2100, threatening low-lying areas. The current CO₂ level in the atmosphere is 400 ppm and rising at a rate of 2 ppm/year.

PEO's Ottawa Chapter recently challenged engineers and students in Ottawa to innovate a solution that would quickly eliminate the very high level of CO₂ in the atmosphere in a controllable, economic and environmentally-friendly way.

At an event held at the RA Centre in May, six engineers and graduate students pitched their product ideas and solutions to a panel of six judges. The event was organized by me as chair of the chapter's entrepreneurship program, and assisted by others in the chapter.

A large audience was present. Three winners were selected. The first prize winners (\$500) were David Carter and Sean Wilson. The two winners tied for second place were Ahmad Sharoodi and Mohammad Aghaji (\$250); and Brent Weatherall, Mathieu Tousignant and Phillip Williams (\$250).

David Carter and Sean Wilson proposed to convert CO₂ to ethanol by high-selectivity electrochemical conversion using a copper nanoparticle/N-doped graphene electrode. Ahmad Sharoodi and Mohammad Aghaji proposed adsorption-based air CO₂ capture and application (ABACA) that captures and stores CO₂ in a container that

can be diffused into concrete, making it much stronger. Brent Weatherall, Mathieu Tousignant and Phillip Williams proposed design of solar-powered vertical algae farming using woven nylon membrane with a pore size of 10-180 μm for algae retention. Zachary Jacobson proposed ocean fertilization with volcanic ash stimulating phytoplankton growth that will absorb CO₂ from air, sequestering carbon and releasing oxygen. Sushanth Sankaran proposed electricity generation by piezo electric devices for joggers, walkers, and piezo blankets for highways (cars). Sam Yakoub proposed new tall towers with thousands of wind turbines to generate electricity and storing hydrogen, ethanol and others.

The event was enjoyed by all and we appreciated the approaches to address the challenge of reducing existing CO₂ in the atmosphere. This will not only benefit Ontario, but Canada and the world as well.



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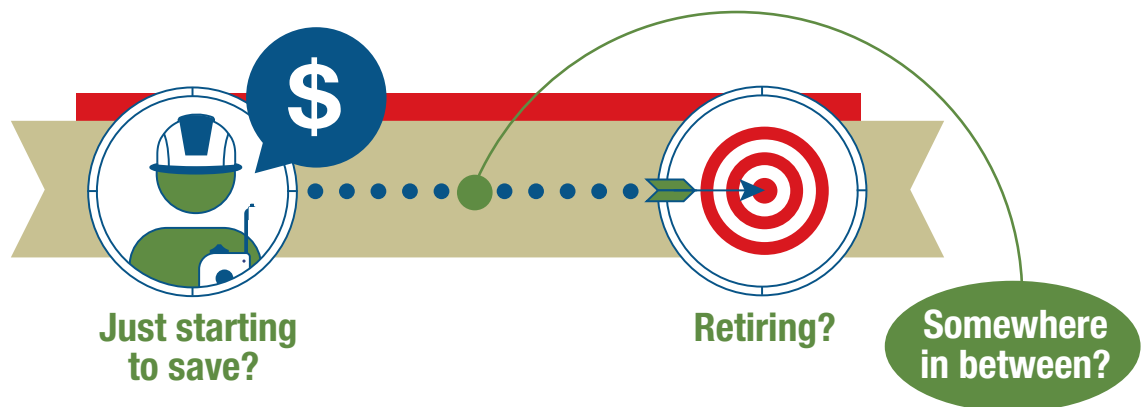
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