

Skulematters

FOSTERING ENGINEERING ENTREPRENEURS

Empowering students to take their ideas from concept to marketplace

BY LAND, BY AIR

Innovative partnerships with industry and government are improving the way we travel

ENGINEERING YOUR HEALTH

Commercializing cutting-edge technology and revolutionizing health care



FROM BRIGHT IDEAS TO GLOBAL IMPACT

How U of T engineers are embracing entrepreneurship and commercialization



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ON THE COVER:
Illustration of the Nanoleaf LED light bulb. **Gimmy Chu**, Nanoleaf's co-founder and CEO, explains on **page 19** how his desire to build a great product led to a full-time career as an entrepreneur.

Concept and illustration by Luke Pauw.

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A MESSAGE FROM DEAN CRISTINA AMON /

On behalf of the Faculty of Applied Science & Engineering, it is my privilege to present Skulematters alumni magazine 2014.

Our cover image, the universal symbol of bright ideas, is no ordinary light bulb. Created by three U of T Engineering alumni in a startup branded Nanoleaf, this innovative device is the most energy-efficient bulb in the world. And its technology and business success also tells another story, one that is closer to home. When we encourage a culture of entrepreneurship and commercialization across our community, we can advance our reach and impact globally. This is a theme we explore in depth in this issue.

At U of T Engineering, we offer collaborative and hands-on learning opportunities to nurture the maker and innovator within the next generation of entrepreneurs. Our curricular and co-curricular programs inspire engineering students to tinker, create, build and test, transforming insights and ideas into working prototypes. In fact, it was in one of these activities, the Blue Sky Solar Racing team, where Nanoleaf founders **Gimmy Chu** (ElecE oT6), **Tom Rodinger** (IBBME PhD oT7) and **Christian Yan** (ElecE oT6) first met and began creating together.

We also motivate students to build on their technical competencies and learn how to launch entrepreneurial ventures. I am proud to share that we have made tremendous progress through initiatives such as The Entrepreneurship Hatchery, our Engineering Business Minor, the ELITE (Entrepreneurship, Leadership, Innovation and Technology in Engineering) Certificate, our Heffernan Commercialization Scholarship Program, and the Institute for Leadership Education in Engineering, also known as ILead. Find out more in the "Fostering Engineering Entrepreneurs" infographic on **page 12**.

Our Faculty continues to bring groundbreaking technologies to market with the support of alumni, industry and government partners. In "By Land, By Air" (**page 20**), we highlight how U of T engineers, together with pivotal partners, are improving how we transport people around the globe. In "Engineering Your Health" (**page 22**), we profile how our professors are commercializing cutting-edge technologies that could revolutionize the state of health care. These ambitious activities are enhancing lives, helping shape our country's innovation agenda and fostering economic prosperity.



The next leap forward to enhance student enterprise learning is the forthcoming Centre for Engineering Innovation & Entrepreneurship (**page 2**). With the generous support of our alumni, this building will be a vibrant new hub for students, faculty, alumni and industry partners to collaboratively address some of the most pressing challenges of our time. It is invigorating to experience such strong support from alumni across the world, whose commitment to our vision will enable us to lead 21st century learning and innovation for decades to come.

Thank you for your unwavering commitment to Skule™ aspirations and for your extraordinary contributions in making these aims a reality.

Cristina Amon

Cristina Amon
Dean

Building Momentum

The Centre for Engineering Innovation & Entrepreneurship heralds a new era for U of T Engineering

Integrating smart building design and state-of-the-art learning technologies, the forthcoming Centre for Engineering Innovation & Entrepreneurship (CEIE) will enable students, faculty, alumni and industry partners to work together across disciplines to address some of the world's most pressing challenges.

The Centre's architectural plans depict a move beyond traditional lecture halls and classrooms toward unique collaborative learning and

hands-on design spaces. The building also provides the emerging space for many of our multidisciplinary research centres and institutes.

Located next to Convocation Hall and facing St. George Street, the CEIE is destined to become a prominent landmark on U of T's downtown campus. It will be a dynamic and vibrant hub that enables U of T Engineering to drive innovation, foster entrepreneurship and cultivate global engineering leaders.

“The CEIE is going to be a hotbed of entrepreneurial activity; our undergraduates and graduate students, post-docs and world-class professors, working together on incredibly important problems.”

—**Professor Ted Sargent**
Vice Dean, Research

“The CEIE will help foster the best in entrepreneurial engineering and we will see many innovative and exciting solutions emerge.”

—**George Myhal**
Chair, Engineering Campaign
Executive Committee

“The new Centre is a fantastic idea and a great vision. It'll create a great new modern space and, more importantly, the programs that it'll house will embody all of those things that are important to a modern engineering education.”

—**John Bianchini**
CEO, Hatch Ltd.



Engineering a new kind of rock music

There's something musical in cracking rocks—or at least civil engineering researchers **Hamed Ghaffari**, **Farzine Nasser** [pictured below] and **Paul Young** think so. They've developed groundbreaking new methods for gathering and interpreting acoustic data released by rocks as they fracture under pressure. This data can then be used to predict earthquakes, locate fossil fuels and more.



PHOTO/ROBERTA BAKER

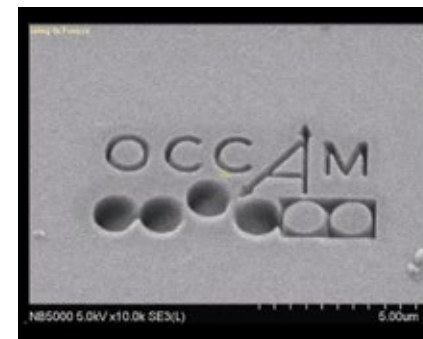


Now you see it, now you don't

Harry Potter's magical invisibility cloak may soon become a reality thanks to two U of T researchers, Professor **George Eleftheriades** (ECE) and **Michael Selvanayagam** (ECE PhD 1T4). Their version [pictured above] surrounds an object with antennae that radiate an electromagnetic field, cancelling out the light waves that would normally be reflected.

Not your average ribbon-cutting ceremony

IndyCar champion Helio Castroneves and Professor **Doug Perovic** (MSE) carved the name of U of T's new \$20-million advanced materials lab into a nanoribbon 1,000 times smaller than a human hair [pictured below] at a recent grand opening event. The Ontario Centre for the Characterization of Advanced Materials (OCCAM) is a state-of-the-art facility that provides powerful tools for research in fields such as biomedical engineering, vehicle design and alternative energy. See **page 30** for more on OCCAM.



Building an engine from scratch

Do you love road trips, but hate the price of gasoline and its effect on the environment? A group of U of T Engineering students are working on a solution. Led by **Jonathan Hamway** (MechE 1T3 + PEY) and **Mengqi Wang** (ElecE 1T3), the team [pictured below] built an engine from scratch that sped to a second-place finish at the Shell Eco-marathon in Houston, Texas, winning two design awards along the way. With fuel efficiency recorded at 1,152 kilometres per litre, their engine could drive from Toronto to Vancouver for \$4.70.



Watch the Junior Jedis in action at bit.ly/JediWars

Junior Jedis fly quadcopters

Flipping, turning and spinning through the air with the flick of a wrist, student-designed quadcopters at U of T's Jedi Wars looked as though they were controlled by "The Force." In reality, it was the result of months of skilled practice and development, as fourth-year ECE students worked in teams to program the flying devices with tricks and moves, wowing spectators and competing for first prize in the competition.



PHOTO/ROBERTA BAKER



Flying head over healing

Those annoying fruit flies that buzz around your compost bin could be more useful than you thought. A group of U of T researchers are studying how fruit fly embryos are able to heal so quickly, leading us to better understand the process of healing in humans. PhD candidate **Teresa Zulueta-Coarasa** (IBBME PhD 1T6) and her advisor, Professor **Rodrigo Fernandez-Gonzalez** (IBBME), have developed unique software to advance the research, and the lab's findings could aid in chronic wound healing, diabetes, cancer care and more.



Read about these stories and more on our website: www.engineering.utoronto.ca

Breaking records: the road to designing the world's fastest bicycle



Bright ideas: turning over a new Nanoleaf



How many U of T engineers does it take to screw in a light bulb? Three: **Gimmy Chu** (ElecE oT6), **Christian Yan** (ElecE oT6) and **Tom Rodinger** (IBBME PhD oT7). But of course they have to completely redesign it first. The result? The most energy efficient light bulb in the world. And now, thanks to new technological developments, it can also dim without using a special dimming light switch.

Skule™ in Photos

Co-trustees of the J. Edgar McAllister Estate Foundation, Robert White and **Mark Ridge** (ChemE 8T4) pictured in front of the portrait of the late **J. Edgar McAllister** (Civil 1895), with the dozens of students who benefited from the McAllister Trust in 2013–14.

PHOTO/ ROBERTA BAKER



Skule™ held a first-of-its-kind panel discussion, aligning with **World Pride**, on the LGBTQ experience in the engineering profession.

PHOTO/ ROBERTA BAKER

(L–R) MARC PILON (MechE 1T2); PROF. SUSAN MCCAHAN (MIE); JUSTIN TOBIA (EngSci 1T5); CAROLINE O'SHAUGHNESSY (MechE 1T1); DEAN CRISTINA AMON, PAUL CADARIO (CivE 7T3), ADITYA SHANKAR, ECE EXCHANGE STUDENT; PROF. DIONNE ALEMAN (MIE); NEIL ORTLIEB (EngSci 9T0)



BizSkule, initiated in 2009, showcases engineering leadership in business through keynote speakers and industry panelists. Our networking-friendly events connect successful, business-savvy alumni at all stages of career development. BizSkule also holds a yearly event in Silicon Valley that highlights the innovation and achievements of Skule™ alumni in California.

PHOTOS/ ELLEY HO & BRIAN SUMMERS

1. (L–R) ALEX GRBIC (CompE 9T4), ECE BOARD MEMBER; RAMI RAHIM (ElecE 9T4); ARSHIA TABRIZI (CompE 9T5), BIZSKULE BOARD MEMBER; YURI SAGALOV (EngSci 0T9)

2. (L–R) DONOVAN POLLITT (MinE 0T3) AND INDI GOPINATHAN (CivE 9T6)

3. (L–R) SONIA DE BUGLIO (ChemE 9T4) AND JOHN EAST, ECE BOARD MEMBER

4. (L–R) MIKE BRANCH (CompE 0T3), FORMER EAA PRESIDENT; PROF. JOSEPH PARADI (ChemE, MIE – EXEC. DIR. CMTE); CLAIRE KENNEDY (ChemE 8T9), FORMER EAA PRESIDENT AND BIZSKULE FOUNDER; YURI LAWRYSHYN (MechE 8T9), BIZSKULE COMMITTEE MEMBER



Over 500 alumni of all ages gathered in May to celebrate their honoured year at **Spring Reunion**. Alumni and their families were invited to attend lectures, departmental lunches, and programs for their children and grandchildren.

PHOTOS/ ADELE DESLOGES, DANIELLE BLANCHER & MICHAEL TENAGLIA

1. (L–R) DAMIAN DURLIK (MSE 1T1); ABHISHEK MATHUR (MechE 1T3); CYRENE WU (CivE 1T1); NAVIN CHARI (UTIAS MAsc 0T9)

2. (L–R) AVIV GLADMAN (EngSci 9T4); KEITH AJMANI (EngSci 9T4); CAROLINE ZYWULKO (GeoE 9T4)—COMING ALL THE WAY FROM AUSTRALIA FOR HER 20TH REUNION

3. (L–R) VIC NIEMELA (ChemE 6T4); ROCKY SIMMONS (ChemE 6T4), CHAIR OF THE ChemE ADVISORY BOARD; JUDITH NIEMELA; KAREN GOODFELLOW, LOUVAIN PIGGOTT; HOWARD GOODFELLOW (ChemE 6T4 – ADJUNCT PROFESSOR IN ChemE)

4. (L–R) PETER NOBLE (ChemE 8T9), INAUGURAL CHAIR OF THE EAA CALGARY CHAPTER, WITH THE LADY GODIVA MEMORIAL BNAD [SIC], PROVING HE STILL HAS IT AFTER 25 YEARS



Every fall **The Entrepreneurship Hatchery** hosts its Demo Day where student teams make their pitch to a panel of alumni judges who deliberate and award the Lacavera Prize to the most promising team. **Gerald Heffernan** (MMS 4T3) and **Anthony Lacavera** (ElecE 9T7) are proud supporters of entrepreneurship.

PHOTO/ ROBERTA BAKER

Alumni and friends joined Dean **Cristina Amon** and the Honourable Heather Grant in Singapore for receptions in November 2013 and May 2014. The latter event was to celebrate the official announcement of the **"Singapore Malaysia Alumni Room"** in the forthcoming Centre for Engineering Innovation & Entrepreneurship (CEIE). The Faculty is very grateful to Ambassador Yong-Guan KOH (not pictured), CK Chang, chair of the Singapore Malaysia Fundraising Campaign, and other alumni who have coordinated the fundraising initiative that surpassed their goal.

PHOTOS/ LUVIN LIM & LEO SIMON

1. (L–R) CASEY KWAN-HO CHAN (EngSci 7T1); ROBERT FU (MechE 7T4); MICHAEL GOUTAMA (CivE 8T6); DEAN CRISTINA AMON, THE HONOURABLE HEATHER GRANT; EVELYN WONG (BSc 7T2); CK CHANG (MechE 6T8); GOOI SEONG LIM (MechE 7T2); GOOI SEONG HEEN (ChemE 7T2); MING SEONG LIM (MechE 7T0)

2. (L–R) CK CHANG (MechE 6T8); MICHAEL GOUTAMA (CivE 8T6); THE HONOURABLE HEATHER GRANT; DEAN CRISTINA AMON; SUI SIM; EVELYN WONG (BSc 7T2)



The Faculty gratefully acknowledges and celebrates the efforts of the **Engineering Alumni Association Hong Kong Chapter** and fundraising committees at receptions in Hong Kong in November 2013 and May 2014.

PHOTOS/ DANNY NG

1. (L–R) LEROY LAM (ElecE 8T5); JOHN LO (ChemE 9T1), FUNDRAISING DIRECTOR; SARAH MAK (IndE 8T6), SECRETARY; HENRY CHEUNG (EngSci 8T5), EXT. VP; WONG WU MING (EngSci 8T6), TREASURER

2. (L–R) DENNIS LEUNG (ElecE 9T0); NICK LO (MechE 9T0); DEAN CRISTINA AMON; ANDREW LO (MechE 9T0); ANDREW CHAN (MechE 8T9)

3. (L–R) MARIS MARTINSONS (EngSci 8T2); DEAN CRISTINA AMON; ANDREW SIT (EngSci 9T5 + PEY), MEMBERSHIP DIRECTOR; NANOLEAF CO-FOUNDERS: CHRISTIAN YAN (ElecE 0T6), TOM RODINGER (IBBME PhD 0T7) AND GIMMY CHU (ElecE 0T6); EMMY CHOI (ElecE 9T5), CHAIR OF THE EAA HONG KONG

Awards

U of T engineers continue to outperform all other Canadian engineering schools in the achievement of awards and honours. We are tremendously proud of all members of U of T Engineering that were lauded for their accomplishments this year.

Selected Alumni Awards

Canadian Academy of Engineering

Fellow

Paul Acchione (MechE 7T1, MEng 7T6)
Clément Fortin (UTIAS MAsC 7T5)
Nancy Hill (CivE 8T1)
Carmine Marcello (ElecE 8T7)
Lloyd McCoomb (CivE 6T8, PhD 8T1)
G. Ross Peters (ElecE 6T2)
Ted Robertson (MechE 7T1, MEng 7T7)
Heather Sheardown (ChemE PhD 9T5)
Jeanette Southwood
(ChemE 8T6, MAsC 8T8)
James Tranquilla (ElecE PhD 7T9)

Engineers Canada

Young Engineer Achievement Award
Michael Branch (CompE 0T3)

IEEE Intelligent Transportation Systems Society

Award for Best PhD Dissertation
Samah El-Tantawy (CivE PhD 1T2)

Ontario Professional Engineers Awards

Citizenship Award
Márta Ecsedi (CivE 7T6)

Ontario Society of Professional Engineers

President's Award, Young Professional
Faizul Mohee (CivE MAsC 1To)

Order of Canada

Raymond Chang (ElecE 7To)
Norman B. Keevil (Geo 5T9)
Anne Sado (IndE 7T7)

Women's Executive Network

Canada's Top 100 Most Powerful Women
Anne Sado (IndE 7T7)

Women in Mining Canada

Trailblazer Awards
Samantha Espley (MinE 8T8)

Selected Graduate Student Awards

Vanier Canada Graduate Scholarships

Miles Montgomery (IBBME PhD 1T6)
Cameron Ritchie (CivE PhD 1T6)
Shrey Sindhvani (IBBME PhD 1T7)
Lorraine Sugar (CivE PhD 1To)

Selected Undergraduate Awards

City of Toronto

International Student Excellence Award
Hargun Suri (CompE 1T3)

Engineers Canada

Gold Medal Student Award
Hanna Janossy (IndE 1T3 + PEY)



Minerva Canada

2013 James Ham Safe Design Engineering Student Award
Sherri Cui (EngSci 1T5) and
Shen Wang (EngSci 1T5)

2014 James Ham Safe Design Engineering Student Award
Larissa Rodo (ChemE 1T3 + PEY)

OntarioGreenSpec.ca

Home Sweet Home Student Challenge
Amanda Cirinna (CivE 1T3) and
Steven Goldstine (CivE 1T3)

Selected Faculty Awards

American Concrete Institute

Robert E. Philleo Award
Doug Hooton (CivE)

American Institute of Aeronautics and Astronautics

Aerospace Guidance, Navigation and Control Award
Bernard Etkin (UTIAS)

American Society for Engineering Education

Sharon Keillor Award for Women in Engineering Education
Susan McCahan (MIE)

Donald E. Marlowe Award for Distinguished Education Administration
Jean Zu (MIE)

Canada Council for the Arts

Killam Prize
Andreas Mandelis (MIE)

Canada Mortgage and Housing Corporation

Excellence in Education Award
Heather MacLean (CivE)

Canadian Academy of Engineering

Fellow
Uwe Erb (MSE)
Ted Sargent (ECE)
Yu Sun (MIE)

Canadian Academy of Health Sciences

Fellow
Paul Santerre (IBBME)

Canadian Institute of Mining, Metallurgy and Petroleum

MetSoc Award
Alexander McLean (MSE)

Canadian Society for Chemical Engineering

Process Safety Management Award
Graeme Norval (ChemE)

Canadian Society for Mechanical Engineering

Robert W. Angus Medal
Cristina Amon (MIE)

Institute of Electrical and Electronics Engineers

Fellow
Wei Yu (ECE)

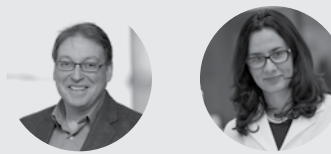
International Society of Edinburgh

Corresponding Fellow
Stewart Aitchison (ECE)

Natural Sciences and Engineering Research Council of Canada

E.W.R. Steacie Memorial Fellowship
Milica Radisic (IBBME, ChemE)

Learn more about the ways that **Paul Santerre** and **Milica Radisic** are engineering your health on **page 23**.



Ontario Professional Engineers Awards

Research & Development Medal
Frank Vecchio (CivE)

Young Engineer Award
Natalie Enright Jerger (ECE)

Pulp and Paper Technical Association of Canada

John S. Bates Memorial Gold Medal
Honghi Tran (ChemE)

Society for Chemical Industry Canada

LeSueur Memorial Award
Grant Allen (ChemE)

Stem Cell Network

Till & McCulloch Award
Peter Zandstra (IBBME)

ILEAD WINS 2014 BLIZZARD AWARD

U of T's Institute for Leadership Education in Engineering (ILead) won the national Alan Blizzard Award for Collaborative Teaching. The Institute was recognized for integrating innovative leadership education into the U of T Engineering student experience. This is the third time U of T has won the prestigious award. Read more about ILead on **page 15**.



2014 Engineering Alumni Association Awards

Engineering Alumni Medal

As the EAA's highest honour, this award recognizes outstanding achievement, superior accomplishments and flair, and excellence in response to challenges.



Arthur Slutsky
(EngSci 7T0,
IndE MASC 7T2)

Arthur Slutsky is a true visionary and a leader among his peers. In an era when scientific disciplines tended to become specialized and segregated, he saw the need for integration and collaboration between engineering and medicine. Under his leadership as division director, the Interdepartmental Division of Critical Care Medicine at U of T was considered one of the top two programs in the world. Over the course of his career, he has authored and co-authored well over 450 peer-reviewed publications and 73 chapters in medical books.

Engineering Alumni Hall of Distinction Award

The EAA is proud to present this assembly of extraordinary alumni selected by their peers for their lifelong accomplishments. Commemorated in a display in the Sandford Fleming Building, Hall of Distinction members are a familiar daily presence in the lives of students and serve as examples to future generations of U of T engineers.



Prabha Kundur
(ElecE MASC 6T5,
PhD 6T7)

Dr. Prabha Kundur is one of the world's foremost authorities on electrical power systems. In addition to an illustrious career with Ontario Hydro and Powertech Labs Inc., he served as a consultant to many power utilities the world over, has been involved in teaching and research as an adjunct professor at U of T since 1979, and has written an award-winning and influential book on the subject. His contributions have been recognized by many top international honours and awards.



Som Seif
(IndE 9T9)

At the age of 28, Som Seif founded and grew Claymore Investments into an innovative asset management firm that changed the Canadian investment industry. He continues that entrepreneurial spirit today as president and CEO of Purpose Investments Inc. But Seif's leadership is not limited to his professional career. He is a member of the Department of Mechanical & Industrial Engineering advisory board and BizSkule alumni chapter committee. An avid water polo player, Seif coached U of T's varsity team to five provincial championships.



Gerry Smith
(MechE 8T7)

As CEO of CiRBA, Gerry Smith transformed the software company from a 10-employee operation with less than \$1 million in sales to a leader in data centre analytics with 125 employees in offices throughout Canada, Europe and the United States. Clients such as Citi Bank, Manulife and Disney have deployed CiRBA's software throughout their data centres.



William Troost
(ChemE 6T7)

William "Bill" Troost, founder and president of Peel Plastics, is an outstanding business leader who has demonstrated innovation and entrepreneurship. He started Peel Plastics in 1978 as a two-person operation. Today, the company employs over 300 people and is a leader in the flexible packaging market. Troost is a member of both the board of advisors of the Department of Chemical Engineering & Applied Chemistry and ILead, and he and his wife Kathleen have generously donated to various engineering Faculty initiatives.

Malcolm F. McGrath Alumni Achievement Award

Recognizes contributions to the Faculty, University or to the community, in honour of Malcolm McGrath, former Assistant Dean, Alumni Relations.



Caprice Boisvert
(MechE 9T3)

Caprice Boisvert has played an active role in the EAA, serving as a member of the EAA Council from 2004-06. In 2005, the Skule™ Mentorship Program was created, matching alumni with third- and fourth-year students. For nearly seven years, Boisvert was responsible for all aspects of the program, and as a result of her efforts it gained the reputation as one of U of T's top mentorship programs.

2T5 Mid-Career Achievement Award

Celebrates an individual who has earned respect within the profession and broader community and attained significant achievement within 25 years of graduation.



Ted Maulucci
(MechE 8T9)

Ted Maulucci is a leader and innovator within the construction industry in Toronto. As chief information officer of Tridel Corporation, he championed the development and promotion of "smart buildings" and was recognized in 2013 with a Queen Elizabeth II Diamond Jubilee medal for his accomplishments. Maulucci co-founded One Million Acts of Innovation, a not-for-profit group that is committed to working with students and others to bring new ideas to market.

7T6 Early Career Award

Recognizes an individual who has become distinguished in their profession and community within 10 years of graduation.



Mathew Szeto
(CompE 0T4)

Mathew Szeto has distinguished himself as a leader at both RBC Capital Markets and throughout Toronto's investment community. As the head of Electronic Sales and Trading, Europe, the Middle East and Africa (EMEA), Szeto was handpicked by RBC to advance their business in those regions. In 2009, he received an Arbor Award for his volunteer commitment to Skule™ and regularly speaks to aspiring engineering students interested in financial services.

L.E. (Ted) Jones Award of Distinction

Honours Skule™ students who exemplify Professor Emeritus L.E. (Ted) Jones' great appreciation of the arts and his love of music.



Christopher Sun
(EngSci 1T3 + PEY)

Christopher Sun's belief in the power and educational potential of music and the arts keeps him passionate about inspiring his peers and building a community for the arts in engineering. In addition to the many performing arts clubs and events he's involved with, Sun co-directed, choreographed and wrote for Skule™ Nite 1T3, the Engineering Musical Sketch Comedy Revue, resulting in five sold-out shows at Hart House Theatre. He was the valedictorian for the engineering class of 1T4.

FOSTERING ENGINEERING ENTREPRENEURS

BY RJ TAYLOR



Whether it's a breakthrough that was years in the making or a brainstorm over breakfast, a new technology or business idea can spring from anywhere. But before it captures headlines, that brilliant spark needs innovators who are highly tuned to solve problems, lead others and transform concepts into prototypes—skills at the core of an engineer's identity.

Today there are more opportunities than ever for U of T Engineering students to leverage their learning and leap into entrepreneurial careers. From new state-of-the-art facilities to hands-on collaboration with industry partners, discover how we're empowering engineering students to get their ideas off the ground.

1 MAKING THE MAKERS

For an idea to grow into a product, it needs makers—those with the skills and experience to construct the first model or write the first lines of code. A variety of courses at U of T, like our final-year capstone program, provide engineering students with new opportunities to transform ideas into problem-solving designs. Students are encouraged to tinker, create and innovate to tackle challenges proposed by industry and other clients.

“Sometimes you find the skills for success only when you learn how to fail. We give students a safe environment to try things out.”

—Professor Emeritus Joseph Paradi (ChemE, MIE)

In 2013–14:

855

STUDENTS IN CAPSTONE DESIGN COURSES

245+

PROJECT TEAMS

60+

INDUSTRY CAPSTONE PARTNERS



FIGHT THE FLIGHT

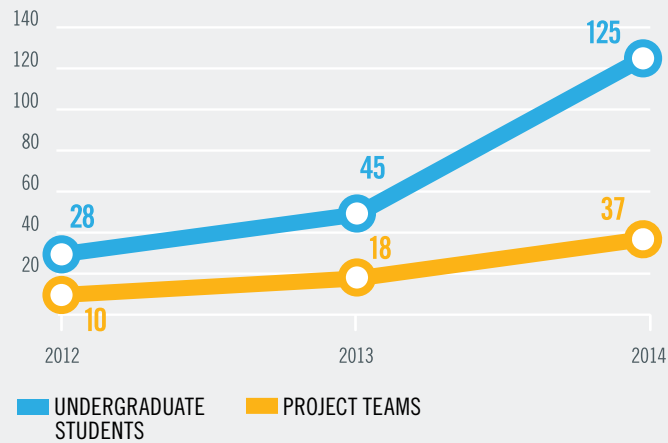
Have you ever wondered how pilots manage jet lag? In the first-ever Multidisciplinary Capstone Projects course, four engineering students collaborated with Defence Research and Development Canada (DRDC) to design software that helps travellers monitor their bodily responses to jet lag. Users track their travel in the smartphone or tablet app, which uses data from seven DRDC research studies, providing advice on sleep times, suggesting melatonin intake and more. DRDC will be working with the students to implement the program as early as next year, while finding new business applications.



2 HATCHING NEW IDEAS

The Entrepreneurship Hatchery, established in 2012, is U of T Engineering's early-stage ideas factory. By hosting collaborative events, competitions and a concept development program, the Hatchery plays a vital role in building the University's vibrant entrepreneurial community.

STUDENTS & TEAMS AT THE HATCHERY



The Hatchery's three stages encourage students to develop new ideas and take action:

ENTREPRENEURSHIP EVANGELISM

The Hatchery believes that inside every U of T Engineering student is an entrepreneur with a big idea. To enable these young thinkers and makers, the Hatchery hosts a weekly Ideas Market and an annual Accelerator Weekend to spark ideation, networking and team building. A popular speaker series also brings alumni, technology and business leaders to share their experiences, successes and failures with the student community.

HATCHERY PROCESS

Undergraduate students accepted into the Hatchery's concept development program are given the tools and resources to define business models for their ideas. Guidance from a growing group of mentors—often alumni—help them refine their concepts. Fellowships, workspace, mentorship and a prototype fund enable the development of a minimum viable product.

STARTUP LAUNCH

Once students have honed their products and business models, they pitch their startup ideas to the U of T community at the annual Hatchery Demo Day. Teams that are ready to incorporate their businesses will receive legal, accounting, marketing and intellectual property services. From here, the Hatchery feeds the wider U of T entrepreneurial ecosystem by launching teams into other accelerators and incubator programs across campus.

59

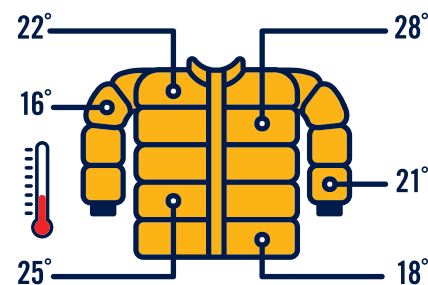
MENTORS
2014

3,709

STUDENTS PARTICIPATED
IN EVANGELISM EVENTS
2013-14

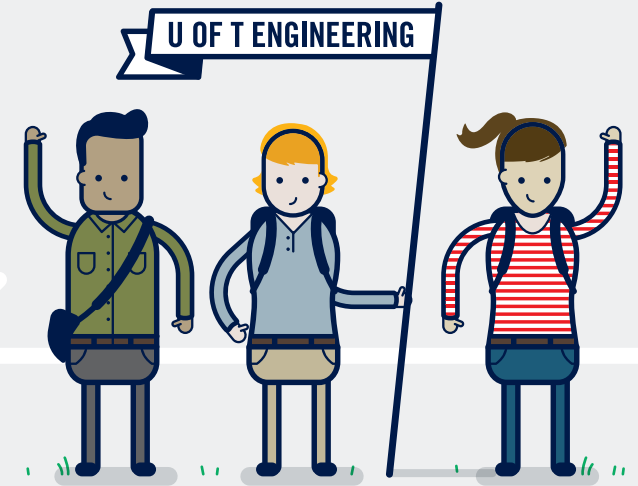
COLD HANDS, WARM HEARTS

When you head outside in January with your winter jacket, do you ever find that your arms are freezing yet other areas are toasty and warm? So have mechanical engineering students **Tammi Hawa**, **Jennifer Rovt** and **Katie Gwozdecky** (all MechE 1T7)—and they've had enough. Joining the Hatchery in 2014, the students are developing a new type of temperature-controlled outerwear that gives the wearer the ability to individually control heating within various parts of the garment.

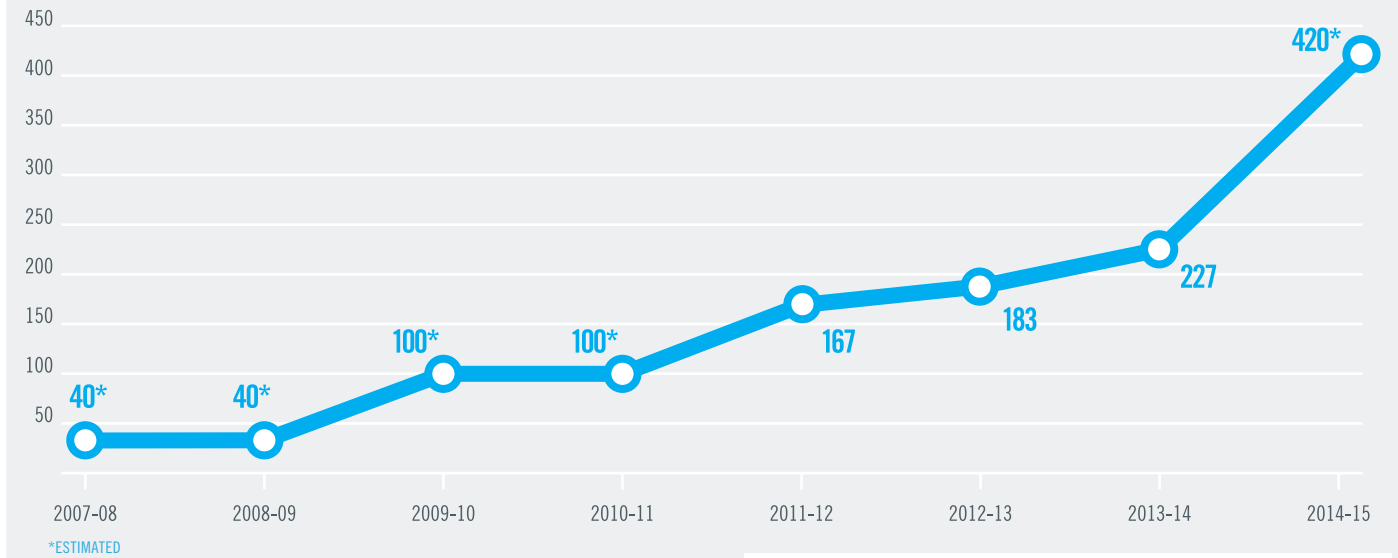


3 ENGINEERING LEADERS

Leading and motivating others are vital skills for every entrepreneur. At the Institute for Leadership Education in Engineering (ILead), students build on their technical engineering knowledge by learning about effective teamwork, self-awareness and emotional intelligence. The Institute offers courses, certificates and events that empower engineering students to have a greater impact on society.



STUDENTS ENROLLED IN CORE LEADERSHIP COURSES



4,341*

TOTAL PARTICIPANTS IN
ILEAD EVENTS, LECTURES,
CERTIFICATE PROGRAMS,
WORKSHOPS AND SEMINARS
2013-14

*INCLUDES REPEAT PARTICIPANTS

10

LEADERSHIP COURSES
OFFERED TO U OF T
ENGINEERING STUDENTS
2014-15

TALKING LEADERSHIP WITH THE TOP

This year, ILead brought together engineering students and 20 senior leaders from engineering organizations—such as the CEO of the Ontario Power Authority and the president of AstraZeneca Canada—to spark intergenerational dialogue on leadership. The takeaway message was loud and clear: developing good leaders on campus cultivates better students and better engineers in the workforce tomorrow.



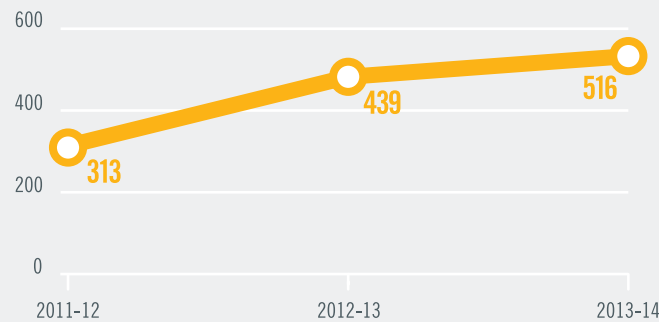
4 ENGINEERING BUSINESS

An engineering education at U of T involves more than technical courses. For aspiring entrepreneurs, the Faculty offers a multitude of courses that foster the competencies, knowledge and experience for students to become entrepreneurs and succeed in technology and business.

ENGINEERING AND BUSINESS FOCUSED

In a partnership between U of T Engineering and the Rotman School of Management, the Engineering Business Minor introduces undergraduate students to the language and concepts of business. Starting just three years ago, the minor offers courses in the fundamentals of finance, marketing, strategy and management.

STUDENTS ENROLLED IN ENGINEERING BUSINESS MINOR



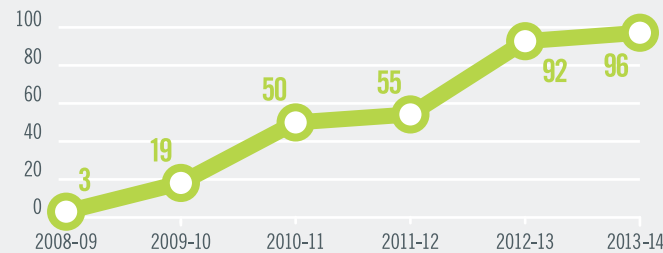
"The economy of the future rests on the startups of today."

—Professor Jonathan Rose (ECE)

ELITE GRADUATE INNOVATION

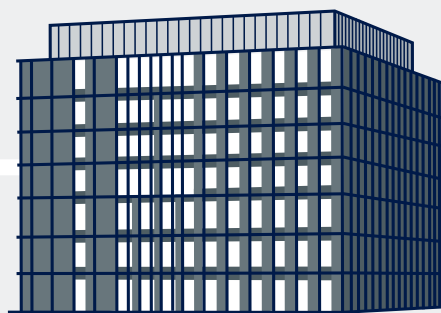
Students in the Master of Engineering program can round out their competencies with the Entrepreneurship, Leadership, Innovation and Technology in Engineering (ELITE) certificate.

ELITE CERTIFICATES AWARDED



"The CEIE will allow us to take the next leap forward in the way we drive innovation, foster entrepreneurship and cultivate global engineering leaders."

—Dean Cristina Amon



THE CENTRE FOR ENGINEERING INNOVATION & ENTREPRENEURSHIP (CEIE)

1,163

2013-14

986

2012-13

STUDENTS ENROLLED IN ELITE CERTIFICATE COURSES

5 A STARTUP IS BORN

337

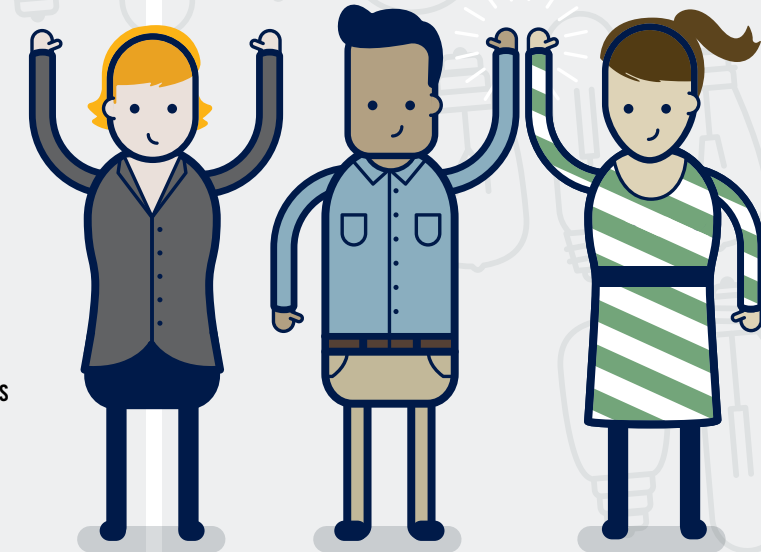
INVENTION DISCLOSURES
2009-2014

51

PATENT APPLICATIONS
2009-2014

105+

SPINOFF COMPANIES CREATED FROM RESEARCH
1970-2014



42%

OF INVENTION DISCLOSURES AT U OF T OVER THE past five years originate with the Faculty of Applied Science & Engineering.

\$2.5 MILLION

GERALD HEFFERNAN'S (MMS 4T3) DONATION IN 2014 TOWARD THE Heffernan Commercialization Fellowship fund, a program that enables U of T graduate students to commercialize research outcomes and spark new technology companies.



For all the latest news on startups emerging from U of T Engineering, visit uoft.me/eng-entrepreneurship.

NO SHAKY STARTS

With the help of a Heffernan Commercialization Fellowship, alumnus **Carlos de Oliveira** (CivE MASc 0T6) built a profitable startup with global impact. Cast ConneX offers earthquake-resistant connectors used in building and bridge design. Already making tectonic shifts in the industry, the company was founded in 2007 to commercialize de Oliveira's graduate thesis and the doctoral work of **Michael Gray** (CivE PhD 1T1), both supervised by CivE professors **Jeffrey Packer** and **Constantin Christopoulos**. The life-saving technology is already being used in structures around the world.

WAVE GOODBYE TO VIDEOGAME CONTROLLERS

Videogame controllers could soon join the ranks of floppy disks, cassette tapes and typewriters if alumnus **Martin Labrecque** (CompE MASc 0T5, PhD 1T1) has anything to do with it. Labrecque has invented a wearable "glove" of sensors to help surgeons, video editors, gamers and those with diminished motor skills interact more intuitively with technology. With the help of a \$32,000 Heffernan Commercialization Fellowship, his precise, early-stage device may rapidly replace a controller, keyboard or remote near you.



Have vision, will innovate

BY JAMIE HUNTER

U of T Engineering produces some of the brightest, most passionate and creative thinkers from around the globe—many of whom apply their education to leading business ideas. Six innovators provide insight into the engineer as entrepreneur.



HANA ZALZAL (CivE 8T8)
FOUNDER
CARGO COSMETICS

www.cargocosmetics.com

CARGO Cosmetics is a professional makeup line used by the industry's top artists. The company has garnered many awards, including a Red Dot Award for product design, and is regularly used by makeup artists for TV and Hollywood films.

What would you attribute as the key to your success?

"Never being satisfied with the status quo. For me, it was all about continually asking myself, 'How can this be better?' It was about the innovation and the innovation that drove [CARGO] to continually seek new ways of presenting product. Sometimes it was in application, sometimes it was in formulation and sometimes it was in packaging."



SOM SEIF (IndE 9T9)
PRESIDENT & CEO
PURPOSE INVESTMENTS

www.purposeinvest.com

Purpose Investments is a Canadian, independent and privately owned asset management firm committed to bringing real value and innovation to all investors with minimal risk and manageable fees.

Has failure ever taught you anything?

"It teaches me everything. Failure is one of the most important lessons in your life. And everyone fails—it's just a matter of how well you fail. What really defined some of the great entrepreneurs was their ability to learn something from their failures and move forward."



IBRAHEEM KHAN (MSE 0T5)
CO-FOUNDER & CEO
SMARTER ALLOYS

www.smarteralloys.com

Smarter Alloys' patented multiple memory material technology makes shape-memory alloys used in automotive, medical device and sporting goods industries smarter, lighter, more reliable and capable of previously unimaginable functions.

What word would you use to characterize your life as an entrepreneur?

"I'd call it a roller-coaster. As an entrepreneur you're always going up one minute and down another. And there are a lot of loops and circles involved, but through the whole experience you find it exhilarating. At the end you just want to get on and do it again."



GIMMY CHU (ElecE 0T6)
CO-FOUNDER & CEO
NANOLEAF

www.nanoleaf.me

Nanoleaf is a green technology startup. The Nanoleaf One and Nanoleaf Bloom LED light bulbs—its first two products to hit the market—are a step toward the company's ultimate goal: to revolutionize the lighting industry while preserving our planet.

Did you plan on becoming an entrepreneur?

"I never started working on Nanoleaf with the idea of being an entrepreneur. It was more focused around building a product. Often, when people think about being an entrepreneur, it's about not having a boss and being able to work on their own schedules. It's just not the right approach. But to me, building something from just an idea, and creating a company that makes a difference, is the best feeling in the world."



INES FERNANDEZ (IndE 1T0)
CO-FOUNDER & CEO
QAPIA LIMA

www.qapialima.com

Qapia Lima is an online company devoted to bringing the finest Peruvian luxury goods to the Canadian market, including hand-made alpaca knitwear. All of Qapia Lima's products are ethically made by local artisans in Peru.

What role can engineering schools play in fostering entrepreneurs?

"If you fail while you are trying something as a student, you have professors and other students, many of whom share your passion, to use as support, and once you graduate you are much more prepared ... University gives you a really good safety net of mentors, friends and networks."



JONATHAN YAM (EngSci 1T3 + PEY)
CO-FOUNDER
FIXO

www.getfixo.com

FIXO is a mobile and web app for property managers and tenants that enables managers to quickly resolve maintenance requests and deliver building-related communications more effectively.

What advice would you offer to entrepreneurs starting out today?

"Take more risks. Not unwarranted risks, but calculated risks. It's often difficult to take that leap of faith outside of something you're comfortable with ... but a lot of times some of the best ideas are the ones that seem very unfeasible at first."



People used to say that the journey was as important as the destination. But that was back when travel was exotic and exciting—before voyagers were so infuriated by gridlock, so concerned about safety and so consumed with their carbon footprint that the journey became something to endure, rather than savour. It doesn't have to be this way.

Researchers from U of T Engineering are collaborating with leading industry and government partners on projects that aim to ease travel worries, minimize delays and reduce our impact on the environment.

Simulation city: solutions for a better urban commute

Transit planning for large urban centres doesn't always involve simulations. But for those interested in evidence-based transit strategies, simulations have become so sophisticated and detailed that they can map commuter behaviour right down to the individual level.

"I'm interested in understanding and modelling travel behaviour," said **Eric Miller**, civil engineering professor and director of the University of Toronto Transportation Research Institute (UTTRI). "I try to simulate the city itself—how the population is changing in terms of the labour market, housing market, demographics and so on. It's *SimCity* for real."

Through UTTRI's Travel Modelling Group, Miller works with city and municipal governments, Ontario's Ministry of Transportation and regional transit organizations such as Metrolinx.

The group has developed innovations like MARLIN, Professor **Baher Abdulhai's** (CivE) "smart traffic light program" that dynamically reacts to local traffic flow, reducing commute times.

Miller's simulations embody a level of complexity and granularity that was unimaginable even a decade ago.

"We're building 'agent-based micro-simulation models,'" he said. "We create a synthetic population: if there are six-and-a-half-million people in the Greater Toronto and Hamilton area, we model every one of these people and say, 'What are you going to do today?'"

Ministries and municipalities use Miller's models to run simulations that inform policy decisions. But he thinks his group could contribute more on the policy front.

"We don't see the agencies necessarily doing as much as they could to ask 'What if...' questions and dig deeply into the possibilities," he said, stating that his data provide insight into not only transportation policy, but also the population itself.

"We've found through these agent-based models that people are more often than not to act fairly rationally," he said. "From a policy point of view, it's encouraging to know that if you do provide people with a better alternative, they will respond to it."

"It's *SimCity* for real."

—Professor Eric Miller (CivE)

How's my driving? Never mind—I'll ask my car

A research-intensive company—say, an automobile manufacturer—tends to keep discoveries secret. It maximizes their competitive advantage. A university researcher, on the other hand, circulates knowledge widely for the benefit of the public.

Which might be why **Birsen Donmez**, industrial engineering professor and driver-safety researcher, still seems so surprised and delighted, two years through her three-year collaboration with Toyota.

"A few years ago, Toyota allocated a chunk of money to support safety research in North America," said Donmez. "They said, 'This doesn't have to be confidential research. We just want to support the study of important problems related to traffic safety.'"

Donmez proposed a single experiment related to speeding and tailgating behaviours, which Toyota requested she expand into a multi-year program, involving a combination of driver-simulation studies and analysis of crash data.

"Toyota wanted us to tell them how to provide feedback technologies that would benefit drivers without distracting them," she said.

Donmez and her team are working on both immediate warnings and post-drive "report cards" that assess a driver's overall performance.

"We can follow people's eye movements in real time and if they take their eyes off the road for longer than two seconds, we can tell," she said. But they've found they must be selective about instantaneous warnings as too many beeps or lights become a distraction unto themselves.

A report card can be much more detailed—documenting risky behaviour, and putting it in the context of both the driver's individual history and also general norms and best practices.

Donmez said the report card is likely most effective for new drivers, who are just establishing their road habits, but that it also has potential benefits for aging drivers.

"Older people who are losing some of their abilities tend to self-regulate," she said. For instance, some people give up highway trips or driving at night when they realize it's no longer safe. "Maybe we can help them regulate better."

How do I leave a footprint when I'm not touching the ground?

Jets, once the epitome of exotic travel, now face a hard truth: lifting a crowd of people into the sky and carrying them a long distance requires a large amount of energy. High fuel consumption and carbon footprints, in part, can temper the thrill of takeoff, burdening it with ecological guilt.

"The environmental impact of aviation is quite broad," said **David Zingg**, professor and director of the University of Toronto Institute for Aerospace Studies (UTIAS). "In addition to flights themselves, there is airport operation, as well as manufacturing and disposal of aircraft."

Researchers from UTIAS's Centre for Research in Sustainable Aviation attack issues like greenhouse emissions on many fronts, from improving aircraft design to developing climate-friendly biofuels. They also work with industry partners like Bombardier and Pratt & Whitney to ensure their work is grounded in the real-life concerns of the aerospace industry.

Zingg's background in computational fluid dynamics means he focuses on innovative aircraft designs that reduce drag. He spent three years working with Bombardier on airplanes that barely resemble conventional "tube-and-wing" models. With names like "box-wing" and "blended wing-body," his designs optimize airflow and reduce fuel consumption and greenhouse gases.

"I benefited more from this collaboration than from any I've ever done," said Zingg. "[Bombardier] gave us funding to advance our algorithms, but they also gave us the opportunity to apply them, which is when you really learn whether your methodology is effective in the real world."

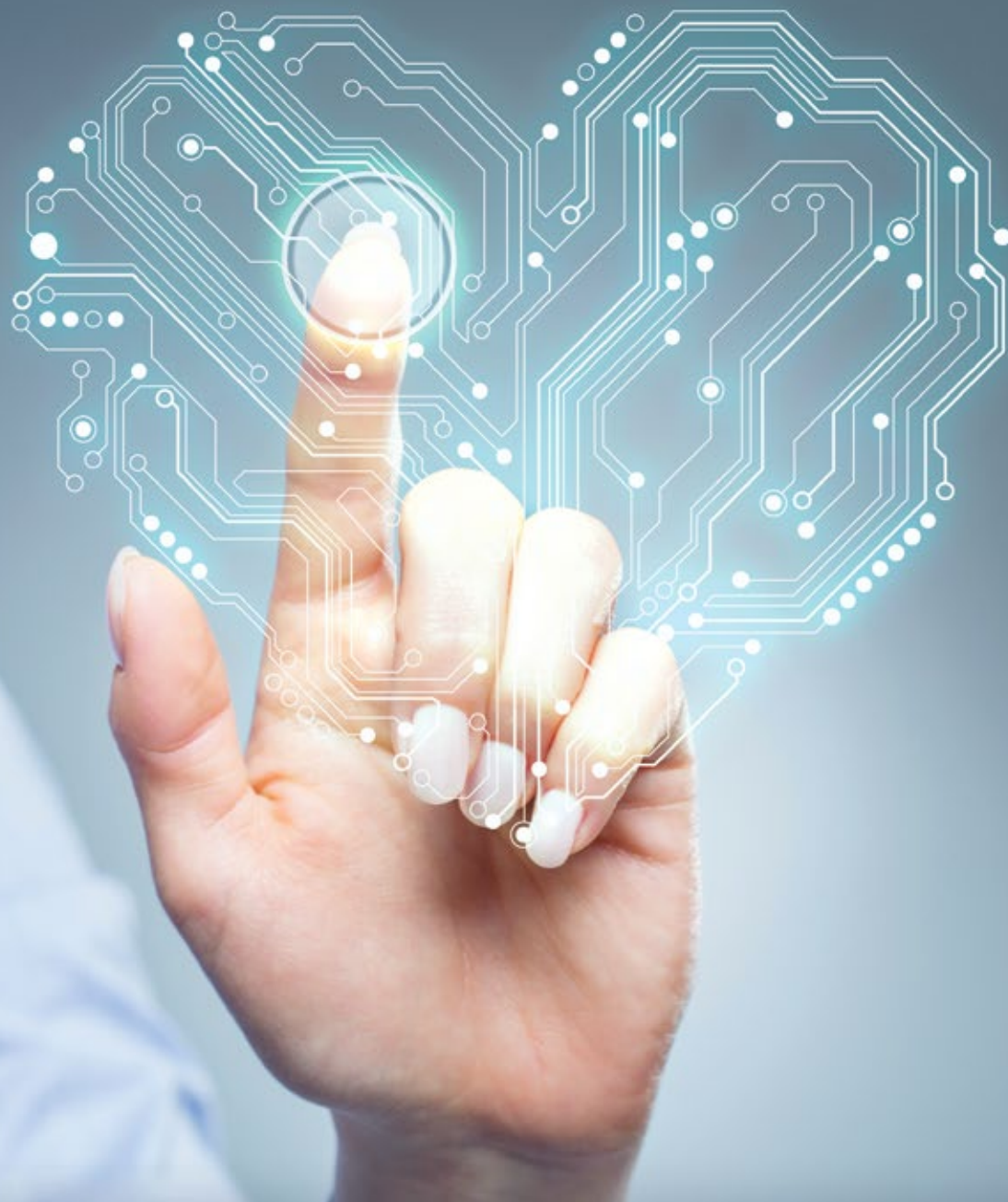
The partnership with Bombardier has helped shape Zingg's next avenue of research—a "truss-braced wing" design that may lead to a new generation of environmentally friendly jets.

"Truss-braced wing models might be the most promising designs for certain classes of aircraft in the next 15 years," he said.

Engineering Your Health

BY ERIN VOLLIK & JAMIE HUNTER

Through startups and partnerships, leading researchers from U of T Engineering's labs, centres and affiliated hospitals are commercializing cutting-edge technology and revolutionizing the current state of health care.



Technology that kick-starts your heart

Like a scene lifted from *Frankenstein*, Professor **Milica Radisic**'s (IBBME, ChemE) "biowire" platform treats immature human cardiac cells, derived from stem cells, to cycles of electric pulses—a process that encourages growth at the same rate as a developing fetus. The result: mature heart tissue that meets a major need in the pharma industry, which, until now, has been unable to test medications on live human heart tissue. Grown along sutures, the heart tissue may also eventually be developed as cardiac patches that, derived from a patient's own cells, won't cause rejection issues. Radisic is currently developing the commercial possibilities of this remarkable technology.

Timing is everything

When you're running a medical facility designed to keep people out of the hospital, flawless scheduling is vital. Last year, when Women's College Hospital was in the process of moving its outpatient operations to a new building in Toronto, the Centre for Healthcare Engineering (CHE), housed within the Department of Mechanical and Industrial Engineering (MIE), helped them to re-think their schedule to see how they could improve their operations. "We developed a new mathematical model that would generate optimized schedules," said Professor **Timothy Chan** (MIE), newly appointed director of the CHE. The resulting software, which improved the effective use of treatment space within the hospital leading to better utilization and fewer cancellations, has the potential to revolutionize hospital operations everywhere.

A little zap goes a long way

Imagine an electrical stimulation therapy for the treatment of arm and hand paralysis after a stroke or spinal cord injury, evidenced to have massive long-term gains over traditional therapies. You've just imagined MyndMove: the premiere product of Professor **Milos Popovic**'s (IBBME) startup MyndTec, founded with Professor **Aleksandar Prodic** (ECE), **Armen Baronijan** (ECE MAsc 9T4, PhD 9T8) and U of T alumna Diana Pliura. In trials, patients consistently reached and sustained the top range of two of the most common motor function and activity of daily living independence tests. MyndTec won a Health Canada medical device license in the spring of 2014, giving the company the green light to advance its product to the market. Next steps: training medical personnel on the device and fine-tuning the product for market readiness before changing the outcomes of millions of patients.

Recipe for regeneration

It's derived from ingredients found in wrinkle creams and eye droplets, but University Professor **Molly Shoichet** (ChemE, IBBME) is cooking up a different recipe: an injectable hydrogel—a water-containing material that is biocompatible—for stem cell transplantations. Studies show that the hydrogel at least doubles the survival rate of stem cells injected with it, and early results show promise of tissue repair. Shoichet aims to commercialize the hydrogel and is testing it in key applications with clinical collaborators.

Tremors? There's an app for that

A common sign of alcohol withdrawal is tremor of the hands and arms—a symptom that can be underestimated, leading to further health problems, or faked to gain access to prescription medication. But a new mobile app, developed by Professor **Parham Aarabi** (ECE), PhD candidate **Narges Norouzi** (ECE MAsc 1T4) and Professor Bjug Borgundvaag of the Faculty of Medicine, aims to provide front-line health-care workers with the objective data they require to guide diagnosis and treatment decisions. To use, patients simply hold an iPhone equipped with the app with both hands for 20 seconds while the device's built-in accelerometer measures the frequency and severity of the tremor. While still a pilot project, the app has immense potential on a global scale.

Let it flow

Endexo is a little polymer making a big splash for Professor **Paul Santerre**'s (IBBME) startup, Interface Biologics, Inc. Blended into medical materials, the biomaterial proves extremely effective at preventing blood clots in catheter applications—from drug delivery to dialysis. Since receiving FDA regulatory approval in 2012, Endexo has been licensed by AngioDynamics for the BioFlo PICC catheter. Used in kidney dialysis catheters, the special biomaterial does away with the need for blood-thinning agents. The product has netted over 30 per cent of AngioDynamic's new revenues in recent quarterly reports, and accounts for a growing margin of U.S. catheter sales. A central venous catheter containing Endexo, for use in long-term medication or fluid delivery, is also now available from AngioDynamics.

DEPARTMENT OF CHEMICAL ENGINEERING & APPLIED CHEMISTRY

www.chem-eng.utoronto.ca

Soft lights, big prospects

Fluorescent lights are energy efficient and inexpensive, yet consumers resist using them because of their cold, unflattering light.

“It’s not just a matter of aesthetics,” said Professor **Tim Bender** (ChemE). “Studies have shown that people in offices with incandescent lighting are more productive than those working under the harsh glare of fluorescent lights.”

Creating an energy-efficient alternative to the warm glow of incandescent bulbs has been an elusive goal, until now. While developing new materials for solar cells, Bender and students **Jeffrey Castrucci** (ChemE 1T0, PhD 1T4) and **Trevor Plint** (ChemE PhD 1T6) discovered a new organic light-emitting diode (OLED). Thanks to their deep knowledge of materials chemistry, they recognized its potential as a substitute for incandescent bulbs.

Because of Bender’s industrial experience—he spent seven years working for Xerox Research Centre of Canada in their Advanced Materials Design Laboratory before joining the Faculty in 2006—he approached the fundamental research with the end goal in mind: an environmentally friendly product that is easy to manufacture. The OLED not only replicates the light of incandescents, but unlike fluorescent bulbs, it requires no expensive rare earth elements or toxic compounds like mercury. It is potentially recyclable and can be manufactured at low temperatures with relatively inexpensive materials.



Along with post-doctoral fellow **Andrew Paton** (EngSci 0T5, MSc 0T7, ChemE PhD 1T1), the team recently won a Heffernan Commercialization Fellowship to develop a commercial prototype—the biggest hurdle on the road to commercialization.

“The potential market for this is, in short, every light bulb everywhere,” said Bender.

The new OLED is a flat film that can be formed into any shape, opening a new world of design possibilities.

Bender is also currently developing new lighting beyond simple light bulbs in collaboration with a local architect.

“Things that we don’t think of as potential lights, like common household objects, could be used to light our homes in fun and creative ways.”

Pictured: Professor Tim Bender (centre) and PhD students Jeffrey Castrucci (right) and Trevor Plint (left) show off some of their new OLED materials.

UNIT OPS 2.0

For decades, the Unit Operations Laboratory (Unit Ops) has been the cornerstone of chemical engineering education at U of T, giving students unique hands-on training on industrial-scale equipment. For the 200-plus students who work in the lab every year, it is one of the most memorable parts of their undergraduate experience.

A major revitalization of the lab is currently underway to expand the facility with new state-of-the-art Integrated Chemical Engineering experiments. To learn more about these innovative new teaching facilities and to share memories of your time in Unit Ops, visit www.chem-eng.utoronto.ca/unitops.

MADE TO MEASURE

How do you take a new process from the lab bench to full industrial scale? You call **David Beckman** (ChemE MSc 8T1), president and CEO of Zeton Inc.

Since forming the company shortly after graduating, Beckman and his team have grown the firm to be the world’s leading designer and fabricator of pilot and demonstration plants specializing in the oil, gas and energy sectors.

Zeton has been recognized with the Bentley Be Inspired Award for Innovation in Process Manufacturing for the design of a modular gas-to-liquids commercial demonstration plant for multinational energy giant Petrobras in Brazil. Beckman and his team also recently completed two multimillion-dollar pilot plants in China.

PHOTO/CHRISTINA HEIDORN

DEPARTMENT OF CIVIL ENGINEERING

www.civil.engineering.utoronto.ca



NSERC invests \$1.65 million in contamination cleanup efforts

From former industrial sites to rail yards and abandoned gas stations, there are over 22,000 environmentally contaminated sites across the country. These areas are polluted with hazardous chemicals that could

impact human health, ecosystems and the drinking water supply.

To help remediate these sites, the University of Toronto has been awarded \$1.65 million from the Natural Sciences and Engineering Council (NSERC) to support student training and research in environmental cleanup. Professor **Brent Sleep**, who chairs the Department of Civil Engineering, will oversee the establishment of the Remediation Education Network with the funds, which come from NSERC’s Collaborative Research and Training Experience (CREATE) program.

More than 40 master’s students, PhD students and postdoctoral fellows will have the opportunity to

investigate remedial technologies at either U of T or one of the partner universities: Queen’s University, University of Waterloo or Western University. Research teams will test different combinations of treatment technologies, both in the laboratory and the field, providing students with the opportunity to learn the professional skills required for their future careers.

Environmental remediation is a growing sector—currently generating \$1.7 billion in revenue per year.

Pictured: Professor Brent Sleep will oversee the establishment of the Remediation Education Network.

PROFESSOR RECOGNIZED BY CMHC

Is there a better way to move people around our city? If so, what is it? These are questions that Professor **Heather MacLean** (CivE) explores in several sustainability-focused courses she’s pioneered at U of T.

MacLean was recognized earlier this year with an Excellence in Education Award for the Promotion of Sustainable Practices by the Canada Mortgage and Housing Corporation (CMHC).



Pictured: Professor Heather MacLean was recently awarded for integrating sustainable community development concepts into the academic curriculum.

LASSONDE MINING BUILDING LAUDED FOR GOING GREEN

Tucked away in one of U of T’s most historic buildings is the home to the Goldcorp Mining Innovation Suite, an eco-friendly design space for mineral and civil engineering students that was recognized this year with a Canadian Green Building Award.

The space, which is located within the Lassonde Mining Building, underwent renovations in 2010 that incorporated advanced sustainability and energy efficiency methods. Some of the highlights include automated “smart blinds” that control temperature fluctuations from direct sunlight and thermal buffer zones that help to naturally vent warmer air from the space without HVAC systems.

The renovation was made possible with the generous support of Pierre Lassonde and Goldcorp.

PHOTOS/ROBERTA BAKER AND MARK BALSON

THE EDWARD S. ROGERS SR. DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

www.ece.utoronto.ca

POET in the Valley

How much do you love and rely on your digital devices? Do you want your smartphone to keep getting faster, thinner, cheaper and more energy efficient? Bad news: our towering digital world is built on a foundation of silicon, and silicon's capabilities are almost maxed out.

"The current understanding is that silicon has run out of room in which it can make improvements," said **Geoff Taylor** (ECE MAsc 6T8, PhD 7T2), a professor at the University of Connecticut. "So we need an alternative."

Enter POET Technologies Inc., the company Taylor founded in Toronto in 2000. POET aims to deliver an improved version of silicon chips to the giants of Silicon Valley—in

the form of gallium arsenide, a compound of the elements gallium and arsenic used in LEDs, laser diodes and solar cells.

The major stumbling block in the hunt for the next generation of chip has been creating a direct replacement, without scrapping existing design and manufacturing infrastructure. Until now, no one has found anything with both of the two crucial device components: n-type, or electron rich, and p-type, or electron poor.

"That's what POET has done," said Taylor. "Now it totally resembles silicon, from a building-block aspect ... and we can offer higher speed, lower voltage and lower power."

POET plans to develop a library of computer tools for chip designers

by early 2015—these blueprints tell designers how to get what they want out of the new material.

But here's where gallium arsenide offers up a world of new capabilities: its optoelectronic properties could bring the best characteristics of light and lasers into historically electronics-based consumer products.

"That, I think, is a really big drawing card these days," said Taylor. "Everyone is looking for a way to bring the integrated circuit industry to a point where the optical capability is no more difficult, in terms of chip manufacture, than what we have today. So our contention is that gallium arsenide is the only way that's going to happen."

Gallium Arsenide Valley does have a certain ring to it...



Pictured: ECE student Shahed Mirmohammadi stands with a plaque for the best project in MSE 558.

HOW TO START A COMPANY IN 10 WEEKS

This winter, **Shahed Mirmohammadi** (ElecE 1T4 + PEY) and her team entered the *Dragon's Den* of engineering—MSE 558, a unique interdisciplinary course designed to simulate the experience of launching a startup.

The team designed the Zero-Emission Combine Harvester (ZECH), a totally green farming machine for harvesting soybeans. ZECH is unlike anything on the market: hydrogen fuel cells and a solar panel run three electric motors, while three lithium-ion batteries store enough energy to power its driving, threshing, storage, emptying and cleaning phases.

In the end, the team had to sell a panel of judges on its business viability, safety and practicality.

BRANCH WINS ENGINEERS CANADA'S YOUNG ENGINEER ACHIEVEMENT AWARD

When ECE alumnus **Michael Branch** (CompE 0T3) founded Inovex more than a decade ago, the fledgling software company only had one staff member: him. Now, under Branch's leadership as CEO, Inovex has grown to become a 10-person operation that offers tangible solutions to clients in the environmental and health care fields.

In May, Branch received the Young Engineer Achievement Award from Engineers Canada, presented to a professional engineer under 35 for outstanding contributions in engineering.

Inovex recently launched Maps BI, a tool that provides visual insight into an organization's geospatial data.

DIVISION OF ENGINEERING SCIENCE

www.engsci.utoronto.ca



Solar-powered proof of determination

Ravi Thuraisingham (EngSci 8T8, ChemE MAsc 9T4) arrived in Canada from Sri Lanka with no financial resources and limited English comprehension. But that didn't stop him from pursuing a career path that has taken him to the top of California's solar energy market.

With a 93 per cent average out of high school, Thuraisingham barely made the cut for U of T's engineering science program.

"I worked hard and struggled to meet the challenges of EngSci," said Thuraisingham, which he compared to the mentality of Navy Seal training, but with a focus on mental rather than physical stamina. "You have to get better at handling failure ... and use it as a learning and improvement opportunity."

He was recruited into Enron's capital and trade group, but eventually found himself among thousands who were casualties of the company's collapse in 2001.

Determined to overcome the setback, Thuraisingham shifted his focus to retail energy and founded American Solar Direct Inc. (ASD), one of the premier residential solar companies

in California. He served as president and CFO at ASD, successfully growing the business from modest roots in 2009 to a \$50 million operation with 400 employees by 2014. He has recently started a second venture as chair and CEO of LightWing Inc., a solar sales and marketing company that provides customers with turnkey solutions for adding solar to their existing businesses.

"Businesses move much slower than technical innovation," he said. "Being a technical person who can speak business is in short supply."

Thuraisingham now lives in Los Angeles and sits on the advisory board for the Division of Engineering Science.

"Knowing that you can do anything, no matter how daunting it may appear at first, is the essence of EngSci training," said Thuraisingham of his drive for success. "You just need to align that training with your passion."

Pictured: Ravi Thuraisingham is making his mark on California's solar energy market.

GETTING GRUUVI IN THE ORBIS DRAGON'S DEN

Do you know what it takes to win top prize at the Orbis Dragon's Den competition? The team behind Gruuvi proved they did, taking home first prize and \$4,000 for their unique headphone design that vibrates to enhance the user's entertainment experience.

The third-annual event, held in April and funded by Orbis Investment Management Limited, saw fourth-year EngSci students from the electrical and computer engineering option developing products with market potential. Six teams presented their business plans in less than five minutes to a panel of judges made up of alumni, faculty and an Orbis representative.

"The fact that the [Gruuvi team] was able to successfully build such a powerful working prototype and come up with such a well thought out value proposition and market segment approach was impressive," said judge **Isis Caulder** (EngSci 8T9, ElecE MAsc 9T1).

The team behind the SWAN Box app, a gaming interface that allows users to connect and play against each other using their smart phone devices, won the second-place prize of \$1,000.

The Division of Engineering Science would like to thank Orbis for their generous support as well as our panel of judges, including **Sep Seyed** (EngSci 0T3).

INSTITUTE OF BIOMATERIALS & BIOMEDICAL ENGINEERING

www.ibbme.utoronto.ca

Developing a market for regenerative medicine

If you want to bring biomedical technology to the masses, sometimes you have to get a little creative. Just ask **Peter Zandstra**, Canada Research Chair in Stem Cell Bioengineering and professor at IBBME and the Donnelly Centre for Cellular & Biomolecular Research.

As co-founder and chief scientific officer of the Centre for the Commercialization of Regenerative Medicine, a private-public partnership hosted at the University of Toronto, Zandstra is well aware of the challenges involved in developing markets for regenerative medicine advances.

“Often the technologies we see are at an early stage, so bundling and adding value is key to moving them forward,” said Zandstra.

For example, one could package an expansion bioreactor from Toronto, a small molecule from Montreal and neutrophil differentiation technology from Australia—all different technologies that would impact the generation and use of blood stem cells in cancer therapies.

The second challenge, he argues, involves “establishing a funding stream for those technologies, weaning the initiatives off public funding towards private support and self-sustainability.”

But Zandstra, who is also a principal investigator at the McEwen Centre for Regenerative Medicine, is optimistic when it comes to Canada’s budding regenerative medicine industry.

“It’s really exciting, actually,” he said. “The quality of the fundamental research programs is very high in Canada, and we’re already seeing important investment by government and industry. This is something we could really be world leaders in.”



Pictured: Elizabeth Munro, and her team, successfully tested their intraoperative imaging system at the Princess Margaret Cancer Centre last year.

ZERO MARGIN FOR ERROR

An astounding 25 per cent of women who undergo lumpectomy for breast cancer treatment require secondary surgeries to remove additional tissue. But if **Elizabeth Munro** (IBBME MASc 0T9) has it her way, surgeons may soon have a new tool to help guide lumpectomies to better outcomes.

As the project management and operations lead at Perimeter Medical Imaging, Munro is finessing the company’s premier product: an intraoperative imaging system for breast lumpectomies, which enters its second clinical trial this fall.

The optics-based device scans specimens just moments after removal, feeding back images that help surgeons visualize how close the cancer is to the surface of the specimen. The imaging procedure takes as little as 15 minutes, and can be safely conducted right in the operating area.

SAFETY FIRST: REDUCING HUMAN ERROR IN BIOMEDICAL TECH

Although biomedical products are vigorously tested for safety before they hit the market, accidents still happen—and often it has nothing to do with technological malfunction.

According to **Patricia Trbovich** (IBBME) and **Tony Easty** (IBBME), two leads from HumanEra—a biomedical product and system safety research team from the University Health Network’s Centre for Global eHealth Innovation—over 60 per cent of accidents involving new products stem from how they are utilized in an increasingly intricate and technological medical system.

The team is studying whether safety can be improved by adopting different learning protocols such as tablet-based simulations or other portable training modules.

DEPARTMENT OF MECHANICAL & INDUSTRIAL ENGINEERING

www.mie.utoronto.ca



Engineering the perfect knuckleball

Professor **David Sinton** (MIE) has always wondered whether a knuckleball pitch—the most difficult ball for players to hit—can be perfectly repeated. Four of his students set out to answer this question with a unique capstone design project.

Typically grasped by the finger nails and raised knuckles, the knuckleball isn’t thrown by many major league players; the Toronto Blue Jays’ Cy Young Award-winning pitcher R.A. Dickey is among the few. A perfect knuckleball can take years to master.

“Mystery has always surrounded the knuckleball pitch,” said Sinton. “Generating truly repeatable and controllable motion from the knuckleball, mechanically, would make history.”

Students **Martin Cote** (MechE 1T3 + PEY), **Alex Gordon** (MechE 1T3 + PEY), **Jessica Tomasi** (MechE 1T3 + PEY) and **Queenie Yuan** (MechE 1T3 + PEY) set out to design a knuckleball pitching machine for their capstone design project, and continued with the research after graduation.

Building their prototype with PVC tubes, motors, an actuator, sensors and a used pitching machine, the team used slow-motion cameras and radar guns to test the ball’s orientation, spin, speed and flight path. They also took particular note of the ball’s seam positioning. The team developed their machine in-house using MIE’s fabrication lab.

While the machine successfully throws breaking and wobbling knuckleballs, they’re still striving for a perfect, repeatable, knuckleball. They also began testing with official Major League baseballs.

“Although our research will continue to focus on repeatability,” said Tomasi, “we do believe that with more fine-tuning and some hardware improvements, the design could feasibly become the first of its kind on the market.”

Pictured: Students Martin Cote, Alex Gordon, Queenie Yuan and Jessica Tomasi stand with their knuckleball pitching machine.

125 YEARS OF MECHANICAL ENGINEERING

In 1890, **Robert Alexander Ross** (1865–1936) was awarded the first BSc/ diploma in mechanical engineering from the School of Practical Science. Throughout 2015, we look forward to celebrating the 125th milestone with a look at the past, present and future of mechanical engineering with special research talks, a capstone showcase and Spring Reunion.

MIE marked the 50th anniversary of industrial engineering in 2011 with alumni support and enthusiasm. Our alumni are encouraged to get involved and share their memories with us. For further information, contact alumni@mie.utoronto.ca.

RISE OF THE MACHINES

How soon will we be living and working side-by-side with robots? It might be sooner than you think. Leading the way is the Institute for Robotics and Mechatronics (IRM), which creates interdisciplinary research initiatives and education programs at U of T in the areas of robotics and mechatronics.

IRM is making significant progress in developing more intelligent, flexible, modular and adaptive robots for a variety of uses—from health-care assistants to lunar rovers—that will improve our quality of life at work and home.

Established by the Faculty in 2010, IRM activities are cross-disciplinary and cross-departmental. Professor **Goldie Nejat** (MIE) is IRM’s current director. To find out more, visit www.irm.utoronto.ca.

DEPARTMENT OF MATERIALS SCIENCE & ENGINEERING

www.mse.utoronto.ca



Beneath the surface: new advanced materials lab opens

Three-time Indy 500 winner Helio Castroneves joined U of T Engineering on July 17 to unveil the Ontario Centre for the Characterization of Advanced Materials (OCCAM)—a high-tech facility that will enable researchers across the Faculty to explore and develop novel materials that could be used in electronics, renewable fuels, construction, disease treatment and even futuristic race car design.

Funded by the Canada Foundation for Innovation (CFI), the Ontario Ministry of Research and Innovation (MRI) and Hitachi High-Technologies Canada, OCCAM will offer highly specialized tools to understand and manipulate matter at the atomic scale. The centre also emphasizes collaborative and multidisciplinary projects, anticipating over 350 different research programs annually involving academic researchers and private companies. The Faculty-wide facility is a joint initiative between ChemE and MSE.

“These novel capabilities will allow us to peer deeper into the inner space of materials and to chart new paths in engineering design,” said Professor **Doug Perovic** (MSE), co-principal

investigator for OCCAM alongside Professor **Charles Mims** (ChemE).

To celebrate OCCAM’s grand opening, Castroneves used one of the lab’s high-power electron microscopes to “cut” the centre’s name into a ribbon at nano-scale. The width of each letter was nearly 1,000 times smaller than a human hair.

The MSE logo was also featured on the front of Castroneves’ race car—part of the Hitachi-sponsored Penske Team—at the Honda Indy Toronto.

“OCCAM is a shining example of how U of T Engineering, in partnership with industry and government, is pursuing innovative solutions to some of world’s greatest challenges in health, city life and energy,” said Dean **Cristina Amon**. “We are profoundly grateful to CFI, MRI and Hitachi for their contribution to the creation of this unique world-class facility.”

Pictured: Indy champ Helio Castroneves (left) and Professor Doug Perovic carve the name of U of T’s newest lab on a ribbon at nano-scale.

ALUMNUS WINS BIG AT AISTECH

Dr. **Johannes “Hans” Schade** (MMS 8T4, MASc 8T6, PhD 9T0) can add yet another award to his trophy case. The esteemed U of T Engineering alumnus was this year’s recipient of the Benjamin F. Fairless Award from the Association for Iron & Steel Technology.

Nominated by his colleagues and peers, the award—named after the former president and CEO of US Steel—recognizes Dr. Schade for advancing the knowledge of clean steel technologies in continuous casting. The award also acknowledges his passion for steel technology, contributions to tundish metallurgy, and his leadership in steelmaking and casting process technology that have had a significant impact on the steel industry.

Dr. Schade is currently the manager of electrical steel technology and the research laboratories at AK Steel Research in Middletown, Ohio. He received numerous awards during his career at U of T and in industry, including the ASTM Charles W. Briggs Award, two AIST Robert W. Hunt Silver Medals and the Frank B. McKune Award from the Iron & Steel Society.

The award was presented to Dr. Schade on May 6 at AISTech 2014—the annual Iron & Steel Technology Conference and Exposition held in Cleveland.

UNIVERSITY OF TORONTO INSTITUTE FOR AEROSPACE STUDIES

www.utias.utoronto.ca

Alumnus elevates UTIAS entrepreneurship with \$1-million donation

Creating a multimillion-dollar company directly out of graduate school may not be rocket science, but for alumnus **Francis Shen** (UTIAS MASc 8T3), a degree in aerospace engineering from UTIAS certainly helped.

This past summer, Shen donated \$1 million to the Institute to develop an entrepreneurship incubator, enabling future engineers with the competencies and opportunities he’s learned over decades in business.

“I want to show graduate students that there are more options than simply finding a job after you graduate,” said Shen. “Instead of working for someone else, you can create jobs for yourself and others, building prosperity within your community and giving back to your economy.”

Shen’s program will provide mentorship, networking and funding to participants with promising ideas, while encouraging collaboration amongst the groups.

“UTIAS is an ideal place for an entrepreneurship program of this type,” said Professor **David Zingg**, UTIAS director. “UTIAS’s cutting-edge research has the potential to be commercialized in so many different areas, both within and outside aerospace, as has so often been demonstrated in the past.”



In 1983, Shen founded Aastra, an R&D consulting firm that rapidly grew to become North America’s largest provider of caller ID units. The firm recently merged with Mitel Networks Corp. for a combined worth of more than \$1 billion and over 60 million customers around the world.

Shen looks forward to being involved with the program and seeing students progress.

“I want to do something meaningful with my time and with my resources,” he said. “I want to give back to the place that helped me get my start.”

Pictured: Francis Shen wants to provide UTIAS students with new career options after they graduate.

A PASSION FOR SPACE, A LOVE FOR COMPUTERS

Brands like Apple, Samsung and LG may steal current headlines when it comes to smartphone technology, but 25 years ago the buzz belonged to an alumnus of UTIAS.

In the early 1990s, Dr. **Rocco Martino** (UTIAS PhD 5T5) had the idea to marry a phone with a computer and a small display. He set to work and invented the CyberFone—regarded to be the world’s first smartphone—and filed the first of many patents in 1995. It has since been cited in patents owned by IBM, Cisco, Hitachi, Siemens, NEC and in 437 others issued or pending in the United States.

Martino graduated from UTIAS with a PhD in astrophysics, part of which involved work on FERUT, the first computer in Canada, purchased by U of T in 1952.

MAXIMUM R&D

With annual export sales of over \$500 million, AB Sciex is a global leader in the R&D of mass spectrometer systems—and it all began at UTIAS. Co-founded in 1974 by Professor **Barry French** (UTIAS) as Sciex, a company formed out of his research at UTIAS, it’s considered to be one of U of T’s most significant spinoff companies. French eventually sold Sciex and went on to co-found Gedex, a company that is currently on the cutting edge of earth-imaging technology based on gravity gradiometry.

Thank you for your continued support



Since joining the Faculty in the spring, I have been overwhelmed by the incredibly generous outpouring of support from our global network of students, alumni and friends. We recently celebrated our most successful fundraising year, and it speaks volumes about the lasting impact Skule™ has had on many of you.

We raised \$21,973,281 in 2013–14—nearly double the funds raised the previous year. More than half of this support was directed towards the Centre for Engineering Innovation & Entrepreneurship (CEIE), which will further inspire creativity and lead 21st-century learning and innovation across our Faculty.

We attracted several major gifts this past year to support research, education and entrepreneurial activities.

Bill Troost (ChemE 6T7) and his wife Kathleen donated \$2 million to support the Department of Chemical Engineering & Applied Chemistry's Unit Ops lab, and the Faculty established new scholarships through the J. Edgar McAllister Foundation-Troost Family Award for Engineering. **Gerald Heffernan** (MMS 4T3) expanded his legacy of support for entrepreneurship at U of T Engineering through a \$5-million gift, half of which will fund the Heffernan Commercialization Fellowships.

In addition to major gifts, we continue to realize growth in our discretionary annual giving. The Skule™ Society remains a significant source of undesignated revenue, and the program generated in excess of \$1 million again this year.

The Honour Roll on the following pages demonstrates the extraordinary level of commitment that hundreds of alumni, friends, faculty, staff and students have made to U of T Engineering. I sincerely thank all of you.

Gillian Sneddon

Executive Director, Advancement

Honour Roll

The collective generosity of U of T Engineering's vibrant community of alumni and friends is nothing short of outstanding. You've helped us to achieve another year of remarkable accomplishments and great progress. We offer our deep thanks for your tremendous support and dedication to Skule™.



"We all understood the impact that alumni had on us when we were still in school, so for us to be able to give back to future generations was really a no-brainer."

—Former Engineering Society (EngSoc) president **Mauricio Curbelo** (CivE 1T4) on EngSoc's generous \$1-million commitment to the CEIE.

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The following donors have made new gifts and pledges to the Faculty of \$25,000 or more between May 1, 2013 and April 30, 2014.

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Planned gifts help fund the work of our students, scholars and researchers through will bequests, insurance gifts, trust agreements and charitable annuities.

King's College Heritage Society

The King's College Heritage Society recognizes alumni and friends who have thoughtfully made a provision for the University. As of April 30, 2014, the following individuals have remembered the Faculty of Applied Science & Engineering in their estate plans.

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Annual fund gifts from alumni, parents and friends are at the heart of philanthropy at U of T Engineering. These gifts—whether unrestricted or designated to a department, program or initiative—provide the Faculty with a base of support upon which it builds.

Skule™ Society Donors

The Faculty of Applied Science & Engineering is grateful to the following members of the Skule™ Society for their generous and ongoing support. Their annual gifts of \$1,000 to \$24,999 (or of \$250 and above for current students and young alumni of the last decade) provide an enhanced student experience, contribute to Faculty excellence and improve our labs and classrooms. Donors listed below have made leadership gifts or pledges to the Faculty between May 1, 2013 and April 30, 2014.

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Back to Skule™

Claire Kennedy: An advocate for engineering

BY JAMIE HUNTER

Ask **Claire Kennedy** (ChemE 8T9) about the most important things she took away from her U of T Engineering degree and her answer is simple: logical thinking and hard work.

For over 15 years, Kennedy has certainly applied these traits to her career as a Canadian tax lawyer, representing clients and providing tax advice on everything from acquisitions to equity funds and all points in between. Currently a partner at the Toronto office of Bennett Jones LLP, she also serves as a director of the Bank of Canada, a position she's held since 2012.

But her contributions to U of T Engineering are equally as impressive as her professional credentials.

It was a serendipitous encounter with a professor at an alumni dinner that first spurred Kennedy's volunteerism. Not long after the event, she was invited to join the inaugural advisory board for the Department of Chemical Engineering & Applied Chemistry (ChemE).

"I was flattered but obviously surprised because I didn't think I had a whole lot to contribute," Kennedy said about the invitation. "Especially since I was not actively practicing as an engineer."

It turns out she would have more to contribute than anticipated. Kennedy eventually chaired the ChemE advisory board, has held positions as both a member and past president of U of T's Engineering Alumni Association (EAA), a member of the Dean's Strategic Development Council and Campaign Cabinet Executive

and is a government appointee to the University of Toronto's Governing Council. She's also the founder and chair of BizSkule, an esteemed speaker series she started as a way to engage alumni who pursued careers outside of engineering.

"Engineering graduates are smart and numerate, which means there's a demand for them in a lot of other places like finance and banking—what we'd call 'Bay Street,'" said Kennedy. "I thought we needed to reach this group of alumni in a way that wasn't purely nostalgia-based... I wanted a different value-added alumni enrichment and engagement experience that appealed to those who no longer identified themselves, first and foremost, as engineers."

Since the first BizSkule panel discussion in 2009, the series has expanded to include annual events in California and Toronto featuring Skule™ alumni and experts in aerospace, cloud computing, mobile technology and more.

Kennedy's 10-plus years of volunteer efforts have not gone unnoticed. She has garnered an Arbor Award for outstanding volunteer service and a Malcolm F. McGrath Alumni Achievement Award for her thoughtful and dedicated involvement with her alma mater.

"I certainly see a broader alumni engagement, and of course I'd like to continue to see more," she said. "There is a growing and welcomed recognition of how essential alumni giving is to the well-being of the school."



PHOTO/ROBERTA BAKER

VOLUNTEER LEADERSHIP

The Faculty of Applied Science & Engineering is grateful for the support and counsel of dedicated volunteers. These leaders give generously of their time and remarkable expertise to enhance advancement activities and initiatives across the Faculty, including alumni relations and development. Visit www.alumni.engineering.utoronto.ca/contribute for a complete list of individuals who have donated their time and service to Skule™.

GET INVOLVED. STAY CONNECTED. MAKE A DIFFERENCE.

Alumni are integral to helping us foster the next generation of global engineering leaders while maintaining our status as the best engineering school in Canada. Whether you're looking for opportunities to volunteer your time, contribute to a fundraising campaign or lend your expertise, there are a variety of ways you can leave your mark at Skule™.

- Donate to Boundless: The Campaign for the University of Toronto
- Contribute toward the Centre for Engineering Innovation & Entrepreneurship
- Join the Skule™ Society (Leadership Giving)
- Hire or mentor a student

For all fundraising and major gift inquiries, please contact Celeste Taylor, Director of Development, Faculty of Applied Science & Engineering, at **416-978-0291** or by email at celeste.taylor@utoronto.ca.

For all volunteer and mentorship opportunities, please contact Megan Murphy, Volunteer Leadership & Recognition Officer, at **416-978-4941** or by email at meganm@ecf.utoronto.ca.

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