A SPECIAL CAMPAIGN ISSUE

Skulematters

University of Toronto | Faculty of Applied Science & Engineering | 2012

BOUNDLESS VISION

ENGINEERING

RESEARCHERS WITH DEEP GLOBAL IMPACT

HEALTH

LEADERS

EDUCATORS + ALUMNI WHO LEAD

ENERGY

SUSTAINABILITY

ENERGY REIMAGINED THROUGH INVENTION

A LANDMARK BUILDING THAT CAPTURES THE BOUNDLESS SPIRIT

ENTREPRENEURSHIP

INNOVATION

INFORMATION + COMMUNICATIONS TECHNOLOGY THAT'S LIGHT YEARS AHEAD

UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

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On the cover: *An engineer-in-the-making,* ***Dimpho Radebe*** *(IndE 1T4) looks out on a bright future through the word cloud of the Boundless campaign. Ms. Radebe is also the 2012 ENGage Program Coordinator and an instructor in the Engineering Student Outreach Office. Photo/Sara Collaton.*

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BOUNDLESS VISION

At a pivotal point for engineering and the world, you can help us realize our best future

U of T Engineering – indeed, the entire profession – is at an important inflection point. The world has never needed more of what U of T engineers can offer, and we have never been more ready to deliver a better future – one which through innovation has to overcome challenges of sustainability, energy, health and the environment.

Engineering's component of the Boundless campaign, which I am proud to highlight in this special issue, is about generating the resources and facilities to truly achieve our potential.

The campaign focuses on the following broad themes:

- Developing top global engineering leaders;
- Revolutionizing human health engineering;
- Reshaping the future of energy, the environment and sustainability; and,
- Nurturing engineering innovation and entrepreneurship, with a special focus on advancing information and communications technology.

Christopher Lawson Photography

This *Skulematters* issue brings our campaign to life, highlighting the remarkable vision, education and research that make us unique and uniquely positioned to move boldly into the future, with your help.

This issue also describes our aspirations for the Centre for Engineering Innovation and Entrepreneurship, a new building on prime St. George campus real estate that, through its multidisciplinary and collaborative intent, captures our campaign goals and future exceptionally well. It will be a beacon of our accomplishments, intentions and aspirations.

I invite you to enjoy *Skulematters*. And, I encourage you to contribute to our Boundless campaign, our boundless vision and our unique opportunity to fulfil U of T Engineering's destiny as innovators, inventors and stewards of a better world.

Cristina

Cristina Amon
Dean

STRENGTHENING SKULE™

An energized and expanded band of alumni can help U of T Engineering ascend

Dear Fellow Alumni,

With the launch of the Boundless campaign for the Faculty of Applied Science & Engineering, we have the opportunity to help U of T Engineering strengthen its position as one of the world's best engineering schools. Our role can take many different forms and address any one of the Faculty's priorities. I would ask each of you to consider how we might individually reconnect and support Skule™.

In preparation for the launch of Engineering's component of Boundless, the Engineering Alumni Association Executive has conducted an extensive program review and planning initiative to position ourselves to best serve our community. In addition to the ambitious financial goal for this campaign – one which reflects the ambitions we all have for Skule™ – we have identified two additional important goals:

- Double the number of alumni actively engaged with the Faculty, be that through volunteering, participation in events or providing financial support for the Faculty; and,
- Significantly expand the opportunities available for networking among alumni, both locally and globally.

We are working hard to reach out and energize our 42,000 alumni around the world. This year, we'll engage regional chapters – from Calgary to the San Francisco Bay Area and across the Pacific to our growing alumni communities in Asia – and we will also employ social media tools like LinkedIn to build an even stronger Skule™ community.

For 139 years, our alumni have used their engineering degrees to pursue both traditional and non-traditional career paths in every corner of the globe – it is indeed a remarkable mosaic. This diversity is an important element in our Faculty's reputation and success. Please join me in strengthening this mosaic at this singular time in history.

Sincerely,

Mike Branch, CompE 0T3
President, Engineering Alumni Association

LEADING INDICATORS:
Developing Global Engineers

U of T Engineering doesn't just graduate innovators, it leads the world in engineering education

Over 100 years ago, when **John Galbraith** was the Principal of what would become the Faculty of Applied Science & Engineering, not everyone was convinced engineering had a place in the University of Toronto, or any university for that matter.

Galbraith's vision for a university-based engineering education turned heads. His students learned engineering fundamentals, drafting, mathematics, architecture, English composition, French and German. They were among the world's first professional engineers, ready to hone their skills in the engineering shops as the First World War shattered a tentative peace. And U of T Engineering began a tradition of educating and graduating the engineers the world needed most.

Professor **Susan McCahan**, Vice-Dean, Undergraduate for the current Faculty of Applied Science & Engineering, says it was the next world war that created a new kind of engineer, one less forged in the crucible of mechanical apprenticeship and more in the mold of a practical scientist. That war and the Cold War that followed focused engineers on using physics and emerging sciences

Photo/ Rebecca Wood

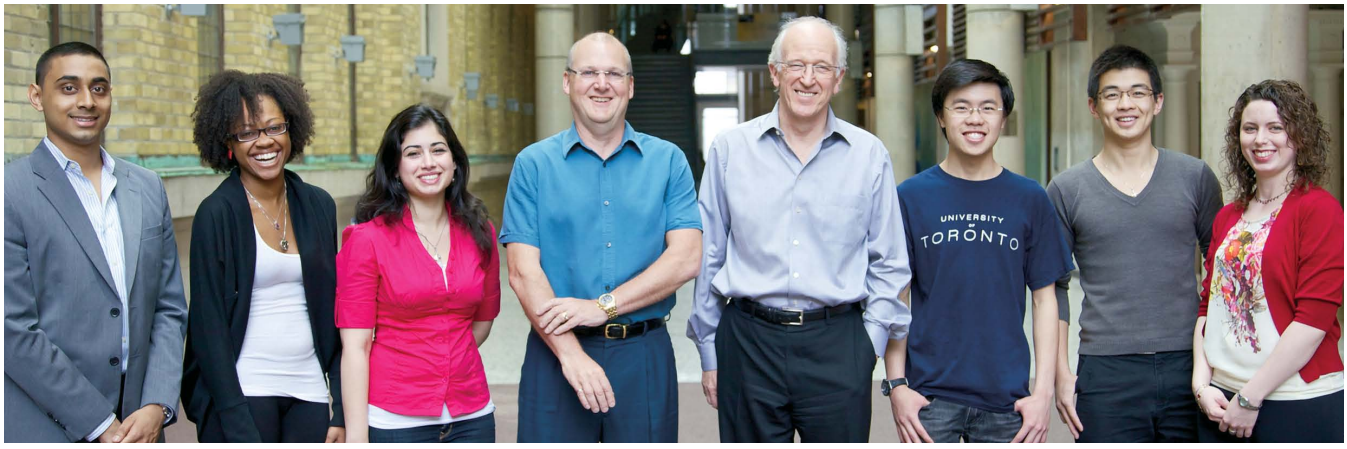
Professor Susan McCahan (MIE), Vice-Dean, Undergraduate, wants to graduate engineers who can communicate, collaborate and lead.

to invent the future. And U of T Engineering offered up some of the finest examples of that, the inventive engineer. Engineers like **Winnett Boyd** (MechE 3T9) who developed the Chinook, the first Canadian jet engine. Or the energetic **Lewis F. Urry** (ChemE 5T0). In 1957, Urry invented the alkaline battery.

Three decades later, the pendulum swung again. "In the '70s and '80s, there was a return to a more holistic understanding of what engineers were about. Engineering education put hands-on design at the core of the curriculum," she says.

Design means creativity and communication – it also means teamwork, problem solving, systems thinking and other graduate attributes that by 2003, became a staple of engineering education at U of T.

A bust of John Galbraith surrounded by U of T Engineering Deans, past and present: (from left to right) Bernard (Ben) Etkin (1973-1979), the late Gordon Slemon (1979-1986), Gary Heinke (1986-1993), Michael Charles (1993-2001), Anastasios (Tas) Venetsanopoulos (2001-2006) and Dean Cristina Amon (2006-present).



Students who will be leaders of tomorrow, from left: Jason Sukhram (MSE 1T1 + PEY), Tameka Deare (ChemE 1T3 + PEY), Negar Mokhtarnia (MechE 1T1 + PEY), LOT Co-leaders Professor Greg Evans (ChemE) and Professor Doug Reeve (ChemE), LOT students Christopher Tee (ChemE 1T5), Zhang Bo (ChemE 1T3 + PEY) and Patricia Sheridan (MechE 0T9, MASc 1T1, PhD candidate in Engineering Leadership).

"Design became the contextual umbrella for a variety of valuable skills," says McCahan. That new emphasis kick-started courses like Engineering Strategies & Practice and Engineering Science's Praxis.

About the same time, U of T introduced the Engineering Leaders of Tomorrow (LOT) program, headed up by Chemical Engineering Professor **Doug Reeve** (ChemE MASc 6T9, PhD 7T1). Reeve had a clear

ROLE MODELS

Paul Cadario

When **Paul Cadario** (CivE 7T3) was an engineering student at U of T in the '70s, "student power" was on the rise. So were the expectations of baby boomers like Cadario to have a hand in the leadership of the university.

And that's where Cadario, now a Senior Manager at the World Bank and the Distinguished Senior Fellow in Global Innovation at the the Faculty of Applied Science & Engineering and the Munk School of Global Affairs, got his first lessons in governance and how to get things done.

"The few of us who took advantage of the opportunities to be involved in Faculty Council and Governing Council got to work beside professors and others at the university and got to see how they achieved results," he says. "It was a powerful experience."

And this experience has served him well. Cadario has spent more than 35 years working in international development at the World Bank, a Washington, D.C.-based international financial institution that works to build prosperity and eradicate poverty around the globe. The majority of his work has focused on development in Africa and Asia, though he has also overseen World Bank activities in central and eastern Europe and the former Soviet Union.

Here at U of T, Cadario has served on the Governing Council from 1985 to 1994 and as President of the University of Toronto Alumni Association from 2007 to 2009.

But his contributions to U of T don't stop there. Recognizing the power of global engineering education within the context of the Boundless campaign, Cadario has generously committed $1 million to the Centre for Global Engineering (CGEN), which is focused on finding solutions to the world's most important challenges. Half his gift will support graduate fellowships there, while the remainder will help build the future home for CGEN in the new Centre for Engineering Innovation and Entrepreneurship, a landmark facility that will bring to life the research, collaboration and educational values of the Faculty.

The 2008 Engineering Hall of Distinction inductee credits his engineering education with his success at understanding complex systems. "I think engineers have an advantage, because engineers see systems," he says. "All the great global challenges of the 21st century, whether it's international finance, the impact of energy systems and consumption on climate change, or the most effective way to deliver health care – all are complex systems issues. And that's what engineers understand best. It's our advantage that isn't in other professions."

vision, one that went beyond the archetypal engineer. He imagined engineering at U of T as, "the liberal education of the 21st century." A profession that attracts future leaders, someone, as Reeve says, "who aims to change the world." In order to do that, in 2011 Reeve drove the launch of ILead — the Institute for Leadership Education in Engineering, a unique program to Canada that is at the forefront of engineering leadership training.

Photo/Sara Collaton

The 2012 President's Teaching Award, U of T's highest honour for teaching, was given to Professor Jim Wallace (MIE) in part for his innovations in teaching with new technologies.

Another new facet of engineering education at U of T is the Engineering Business minor. Launched in 2011, it's the result of a powerful collaboration between the Faculty and the Rotman School of Management. The courses in the minor expose undergraduates to other aspects of engineering, from finance to management, entrepreneurship and leadership – all within a global context.

Educating those future global leaders means using new technologies to teach, something Mechanical and Industrial Engineering Professor **Jim Wallace** knows all about. Wallace received the 2012 President's Teaching

Andrew Forde

Photo/Naz Tana, courtesy of Andrew Forde

Ask 25-year-old entrepreneur **Andrew Forde** (MSE 1T1) what the greatest advantage U of T Engineering gave him and you'll get a single word answer, "Confidence."

"I was surrounded by great minds and taught by fantastic professors. After my education there, I honestly felt like the world was open to me," says Forde, who is the CEO of consulting company Sommerfeld Solutions and the founder of the Forde Foundation.

"Being able to say that I was a U of T Engineering alumnus gave me the gift of confidence. Once I knew what I wanted to do with my life, I had the self-assurance to pursue it," he says.

Forde has chased his goals with passion, not only as a professional jazz and classical violinist, but also as an engineer with a strong social conscience. So much so that he was given the 2012 Harry Jerome Young Entrepreneur Award by the Black Business and Professional Association.

Forde also credits the communication skills he learned at U of T for his ability to lead. "Leaving U of T, I didn't have any problem with walking into a room and explaining my ideas and thoughts to people." He got the opportunity to practise that in Leaders of Tomorrow (LOT) – just one of many programs at U of T Engineering that nurture students' leadership skills and the kind of business acumen that Forde possesses. Whether it be LOT or Professional Experience Year, the Prospective Professors in Training program, the new Engineering Business minor or The Entrepreneurship Hatchery – a new undergraduate business incubator – these programs are crucial to personal and professional development.

What's more, Forde says the supportive environment and networking opportunities he gained at U of T Engineering made rising through the ranks much easier. "Saying I was a U of T graduate opened up doors that otherwise would have remained closed for me," he says.

Award, U of T's highest honour for teaching. He also converted his popular Alternative Energy Systems course into the first online undergraduate course in the Faculty. "Historically, engineers were those with a good understanding of machinery and lots of practical hands-on skills," he says. "Now students are more urban, they are adept at computers, and we need to respond to their new expertise."

These professors agree that U of T engineers can not only lead in the profession, but in a variety of professions.

"I think there was a time when the thought of a student who decided to take their engineering degree and go elsewhere with it, was 'we failed' – we produced somebody who's not going to be an engineer," says McCahan.

"But we have, in fact, enabled someone to be a problem solver, a team player and an independent thinker, dealing with complex challenges wherever they may lie."

For Galbraith, who thought an engineer's final training only came in the rough-and-tumble of the real world, that's a vision that works, nearly a century after his death.

WHAT'S NEXT?

Diversity and Vision at the Heart of a Great City

U of T Engineering is a focal point in the most diverse intellectual centre of Canada, Toronto. And, its faculty, students and alumni represent cultures, opinions and ethnic groups worldwide.

As it educates new leaders and the world's leading engineers, it will depend on that diversity to give it a unique position and competitive edge.

Professor Doug Reeve is optimistic about educating future leaders at U of T. "Dean Cristina Amon has a very long vision for the profession and it reaches into changing human systems," And, into a very bright future.

THE SCOPE OF IMPACT:
From Cell to Globe

A bioengineering and human health revolution

From unravelling the human genome, to improving resource management for hospitals, to reinventing the toilet, U of T engineers are involved in research projects that affect real change at every level of human health and development. This is a quick tour of the scope of impact, from cell to system to global.

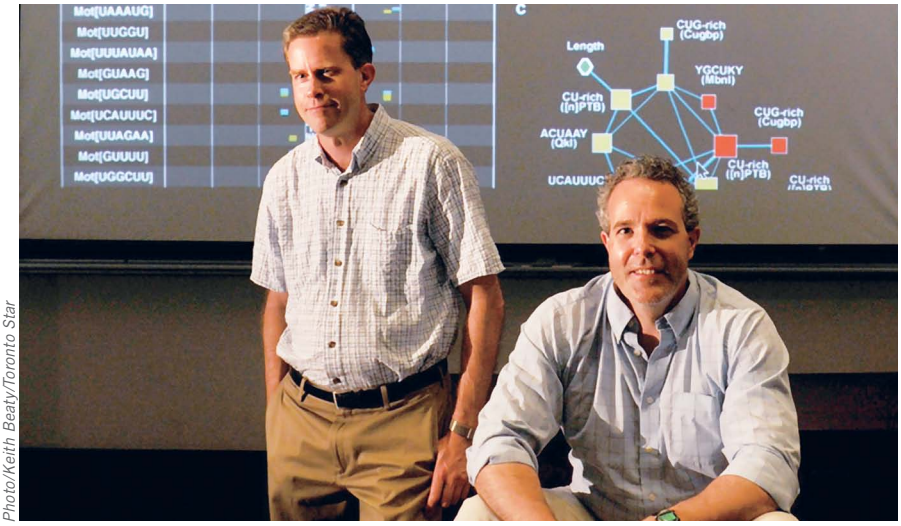
The cell: the essence of who we are

Despite winning international recognition and awards for his discovery of a hidden code for DNA, for Professor **Brendan Frey** (ECE PhD 9T7) the real prize is still to come.

Frey and research partner, Professor Benjamin Blencowe of the Terrence Donnelly Centre for Cellular & Biomolecular Research, discovered a code that solves one of the greatest mysteries of genetic research: how a limited number of human genes could create vast cellular diversity and complex organs.

Frey is now working on developing the code – which he describes as a set of rules or a "mapping of inputs and outputs" — to understand why individuals develop specific diseases. Ultimately, he wants the code to be used as a decision-making tool for practitioners.

Frey believes his research will lead to new treatments and ways of developing prevention tools. He says the 2010 discovery was only the starting point. And the potential applications of his splicing code are seemingly endless.



Photo/Keith Beaty/Toronto Star

Professor Benjamin Blencowe (left) and Professor Brendan Frey (ECE PhD 9T7) (right) cracked the genetic code. Now the hard work of developing new treatments begins.

Modelling for a cure

Mechanical and Industrial Engineering Professor **Timothy Chan**'s work on optimizing radiation to attack cancer cells led him back to one central question: how do you deal with uncertainty — in particular tumour motion during treatment, or errors in the imaging?

Chan's approach? "I take this real-world problem, and I abstract it to a math problem and then I solve it. I then translate the math results back into a real-world application," he says.

Chan's mathematical models take into account several determining factors such as the best angles to treat the cells, duration of treatment and which shapes of radiation beams are the best ones to use.

Chan says the end results are a set of radiation treatments that are desensitized to uncertainty, meaning that "the final treatment quality will still be very good, even if something unexpected occurs like tumour motion."

The work Professor Milica Radisic (IBBME, ChemE), is doing in heart tissue could make recovering from heart attacks a lot less traumatic.

The body: growing hearts

For Professor **Milica Radisic** of the Institute for Biomaterials & Biomedical Engineering and the Department of Chemical Engineering & Applied Chemistry, the importance of heart tissue engineering is obvious. Heart attacks remain the leading cause of death in developed nations and are quickly increasing in the developing world.

Radisic hopes to see her engineered heart tissue on the market for the testing of new pharmaceuticals in three years. "Engineers are problem solvers by training," she says. "We also have a high level of social responsibility, and this is an important problem to which there is no effective solution yet."

A systematic approach

For Mechanical and Industrial Engineering Professor **Michael Carter**, Director of the Centre for Research in Healthcare Engineering, industrial engineers are needed in the healthcare system for one very important reason — their ability to think about, and forecast for, the entire system.

Carter, who describes the healthcare system as highly "siloed," believes engineers have the perfect skill set to find more efficient ways to deliver health services. "Nobody is really looking at the system," he says.

"People don't look at it the way engineers do."

Carter has dedicated the majority of his 30-year career to improving efficiency in health care from the care at patients' bedside, to policies that align systems across entire regions.

Through the Centre, Carter has launched a series of projects including creating the most efficient surgery schedules, applying metrics to monitor and reduce provincial patient wait times and forecasting future doctor shortages. He has also collaborated on various projects, including fellow Mechanical and Industrial Engineering Professor **Dionne Aleman**'s work in pandemic modelling in Canadian urban centres.

Carter, who admits that when he first entered the field, engineers weren't always considered relevant, is now seeing the fruits of his labour with dozens of former students now working in health care.

"If you read between the lines of the Ministry of Health and Long-Term Care's website, you'll see a lot of words

John Hryniuk Photography

Professor Michael Carter and PhD candidate Ali Vahit Esensoy (IndE 0T5, MASc 0T8) take a systems approach to health care, mapping efficiency through software models, and changing the industry worldwide.

like 'performance measurement' and 'efficiency' and 'effectiveness' – they're using words right out of an engineering handbook," he says, "and healthcare engineers are there to provide that support."

Improving our water quality

"New discoveries are being made everyday in terms of what makes people sick and what risks we can associate to drinking water versus other environmental exposures," says Civil Engineering Professor **Robert Andrews**, who is also Senior Natural Sciences and Engineering Research (NSERC) Chair in Drinking Water Research. "It's kind of like the more we know, the more we need to know."

Andrews and team have been working for the last two years with Health Canada and the Ministry of the Environment to assess drinking-water treatment from a risk perspective — a new method that compares the safety of treated water to the source water from which it comes.

This new approach has not been used before in Canada and sparsely in North America, says Andrews.

Andrews says he'd like his research to lead to the establishment of guidelines as new water treatment facilities are being built, and for existing treatment plants as a tool for self-regulation.

Global sanitation: a better toilet for the world

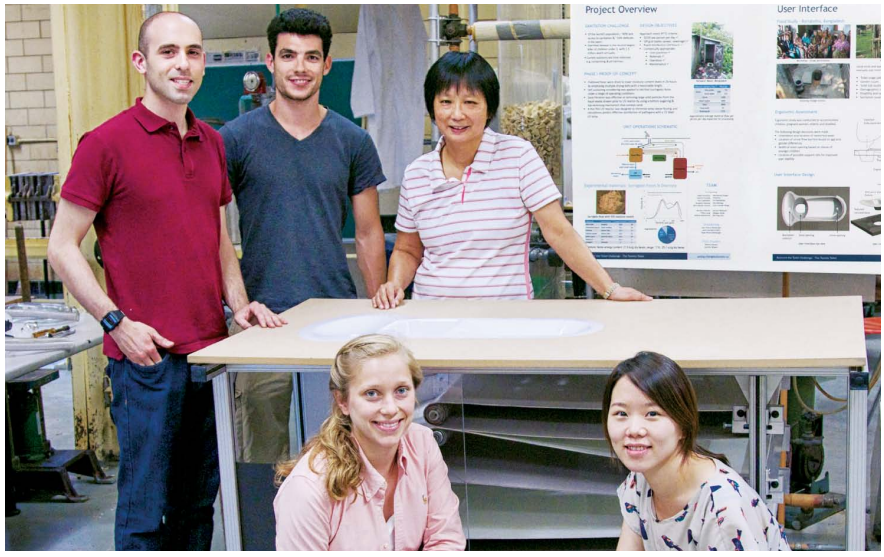
If Chemical Engineering Professor **Yu-Ling Cheng**, Director of the Centre for Global Engineering (CGEN), and her team succeed in redesigning the toilet, they may be helping to meet the sanitation needs of 2.5 billion people in the developing world.

Professor Robert Andrews (CivE) (left) attends August, 2011 water quality funding announcement. He was joined from left to right by: Professor Peter Lewis (Associate Vice President, Research, University of Toronto), The Honourable Peter Kent (Minister of the Environment), Don Aldridge (IBM Canada) and Patrick Draper (Toronto Region Research Alliance).

In 2011, Cheng and her group began the immense task of creating a toilet that worked cheaply, rapidly and completely off the grid — that is, sanitizing human feces and urine with no water, no sewage and no supplied electricity. An estimated 1.5-million children die each year due to diarrhea caused by poor sanitation.

After being awarded funding from the Bill & Melinda Gates Foundation for their initial plans, the team set to work on their prototype. One crucial design element of the toilet is that it must be appropriate in the context of the target communities.

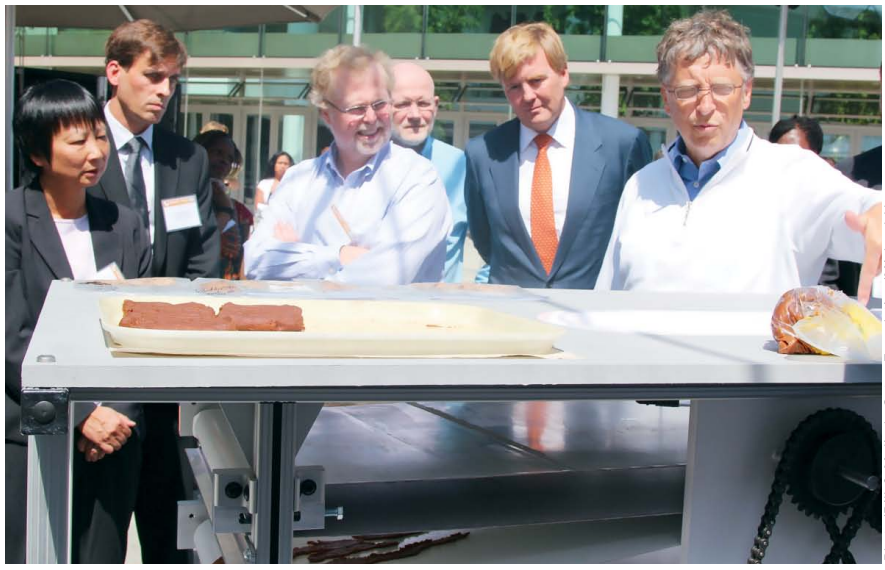
The U of T solution is novel in its simplicity. It uses a sand filter and UV-ray disinfecting chamber to process liquid waste and a smolder chamber, similar to a charcoal barbeque, to incinerate solid waste that has been flattened and dried in a roller/belt assembly. The result is a toilet that is sustainable, easy to



Members of the team behind U of T Engineering's entry into the Bill & Melinda Gates Foundation Reinvent the Toilet Challenge, pose with their entry. Back row from left: ChemE PhD candidate Zachary Fishman, Samuel Melamed (MechE 1TO) and Professor Yu-Ling Cheng, Director, Centre for Global Engineering. Front row, from left: Meagan Webb and ChemE MASc candidate Tiffany Jung.

use and that processes waste while protecting the community from contamination.

U of T was one of eight universities from around the world to receive the initial phase one funding of almost $400,000 each. Their rigorous engineering design was informed by field research in Bangladesh that ensured the team's ideas would be contextually appropriate. They presented their work at the Reinvent the Toilet Fair in Seattle in August 2012 where the Gates Foundation awarded the design third place. The team will further refine their prototype for field use.



Photo/Bill & Melinda Gates Foundation/Michael Hanson

Bill Gates (far right) inspects U of T's entry into his Foundation's Reinvent the Toilet Challenge. U of T Engineering Professors Yu-Ling Cheng and Mark Kortschot look on (far left). 1.5 million children die each year because of poor sanitation.

The reinvented toilet is just one example of what Cheng calls "global engineering" – using creative and sustainable engineering design to solve the world's most pressing global challenges.

WHAT'S NEXT?

A Culture of Responsibility

Whether it's at the cellular level, the system level or the global level, U of T engineers are pushing the boundaries of bioengineering, biomedicine and human health engineering research to remarkable places.

Professor Cheng believes that one thing that binds all U of T engineers, regardless of the nature of their research, is "a fearless approach to problems that are bigger than any one of us."

"Very few of us are working for something that directly impacts ourselves. It's just how far we look in terms of community, or the size of the society, or the geographic reach of that community," she adds. "For me, there's no reason to draw a dividing line." And, one of the reasons so many great researchers have found their way to U of T Engineering.

Photo/David Cooper/Toronto Star

ECE PhD candidate James Dou (right) co-led a team that developed a 'lab-on-a-chip' that can help monitor the blood of HIV patients in developing countries. The device is an example of the impact U of T Engineering research has worldwide.

From left, Dr. Lu Chen, an ECE post-doctoral fellow; Rakesh Nayyar, co-founder of the team start-up company ChipCare Corp. and Lino DeFacendis, Director, Innovations and Partnerships, Office of the Vice President, Research.

But, the Faculty needs to continue to attract the best and most enterprising minds from all over the globe, and it needs to have the technology, facilities and networks that will entice them to make Toronto their home.

That, according to **Jim Dawson**, the Faculty's Executive Director of Advancement, will require a strong base of permanent funding – funding that comes in part from contributions to the Boundless campaign.

"That is the only way the Faculty's leading-edge research and the Skule™ tradition of academic excellence, innovation and impact can continue," says Dawson. Which, in its own way, is something that directly affects us all.

RESHAPING THE BIG THREE:
Energy, Environment and Sustainability

U of T engineers have an opportunity and duty to be global leaders in energy, the environment and sustainability, as Canada surges ahead as a world energy leader

Energy entrepreneurs

"In a global context, Canada is an energy superpower," says Mechanical and Industrial Engineering Professor **David Sinton** (MechE 9T8, PhD 0T3). "There are a lot of opportunities for us to address our energy challenges. Not all of the energy we produce is ideal — that's an understatement."

Sinton is the new Director of the Centre for Sustainable Energy (CSE), which brings together interdisciplinary researchers from across the university, with the goal of increasing energy efficiency and reducing the environmental impact of energy use. As Director, Sinton has made it his mission to advance CSE by increasing research funding initiatives and strengthening student engagement.

His own research explores engineering reactors to boost the productivity of photosynthetic micro-organisms so they can convert large amounts of carbon dioxide and sunlight into fuels. He believes the challenge of finding sustainable energy sources is really, at its core, an engineering problem.

Energy production is "our business," says Sinton. "If you have an energy problem, you look to engineers."

On top of finding the optimal conditions to use micro-organisms to produce carbon-neutral fuels, Sinton also looks at ways to increase the carbon efficiency of current energy operations, as well as ways to safely store carbon dioxide underground.

CREATE-ing a greener future

Professor **David Zingg** (EngSci 7T9, AeroE MASc 8T1, PhD 8T8), Director of the University of Toronto Institute for Aerospace Studies, looks far above ground and to the skies when searching for a way to decrease the world's fuel emissions.

Photo/Sara Collaton

Professor David Sinton (MIE), Director of the Centre for Sustainable Energy, with his student research team. Professor Sinton is kickstarting micro-organisms to make fuel for a world starving for energy.

At top of page: Professor Aimy Bazylak (MIE), the new Associate Director of the Centre for Sustainable Energy.

UTIAS Professors Craig Steeves, Clinton Groth (AeroE MASc 8T7, PhD 9T3), Alis Ekmekci, David Zingg (EngSci 7T9, AeroE MASc 8T1, PhD 8T8) and Philippe Lavoie, who are some of the faculty who have contributed to a new certificate program in Environmentally Sustainable Aviation.

WHAT'S NEW?

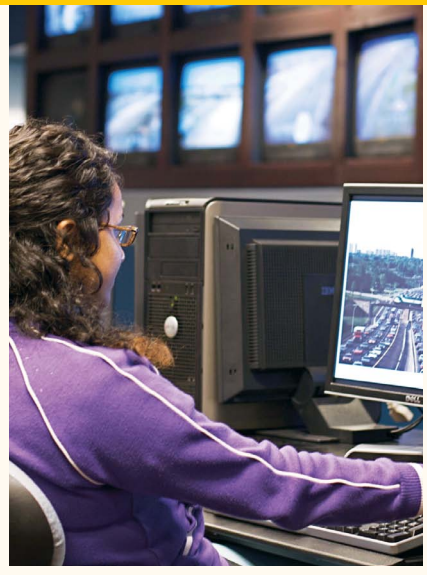
On the CUSP of Greatness

U of T Engineering is on the cusp of an exciting – and historic – venture.

Working alongside top institutions such as Carnegie Mellon, IIT Bombay, University of Warwick and New York University (NYU), the Faculty is bringing its expertise to a global initiative dedicated to cities engineering.

Based at NYU, the Center for Urban Science and Progress (CUSP) will tackle the many challenges an increasingly urbanized planet will face in the coming decades. Whether it is infrastructure, technology integration, energy efficiency, transportation congestion, public safety or public health – CUSP will translate engineering research into market-ready global solutions. This partnership will also ensure that the best thinking on urban engineering is brought home to Canada, where 80 per cent of the population live and work in cities.

"The University of Toronto has a rich history of research into how to build innovative, efficient and sustainable cities. CUSP is an unparalleled opportunity for students and faculty to explore and find solutions to real and pressing urban problems in an excellent network that includes New York City, Toronto, Pittsburgh, London and Bombay," says Cheryl Misak, Vice-President and Provost of the University of Toronto.



Photo/Rebecca Wood

U of T Engineering students use the Integrated Land Use Transportation Environment Modelling System, part of our Intelligent Transportation Systems Lab (ITS) to help understand traffic patterns. It's just one of the urban challenges researchers at CUSP will tackle.

A complementary U of T Engineering educational initiative is the creation of a professional Master of Engineering in Cities Engineering and Management (MEngCEM) slated to start in September 2013. The program will have students from a variety of disciplines researching sustainable growth and development of large urban areas, engaging them with complex city challenges.

Zingg and his research team are working on creating new aircraft designs that reduce their drag and weight, thereby increasing their fuel efficiency. Zingg says his team's designs, some of which could be suitable for entry into service by 2025, could reduce emissions per passenger-kilometre by up to 30 per cent. This is an ambitious challenge but a necessary one, in order to make aviation sustainable.

In combination with other advances, for example in engine technology, this falls in line with the aviation industry's goals to reduce carbon dioxide emissions by 50 per cent by 2050. "You have to keep in mind that planes fly for 30 years. So a plane introduced in 2020 is still flying in 2050," he says. "We do need to make some of these improvements quickly."

That's why U of T Engineering is preparing the next generation of aerospace engineers with the tools necessary to meet the 2050 goal. In summer 2012, the Natural Sciences and Engineering Research Council (NSERC) announced $1.65 million in funding to establish the CREATE Program in Environmentally Sustainable Aviation. This grant will support those studying and conducting research in the field of sustainable aviation, as well as establish a new certificate program. Over the six-year span of the grant, more than 130 undergraduate and graduate students are expected to participate in the program.

"This grant will allow us to capitalize on that expertise by offering new training to our engineering students, which in turn will be taken into industry and put into practice," says Zingg.

Efficient lighting: a new world record

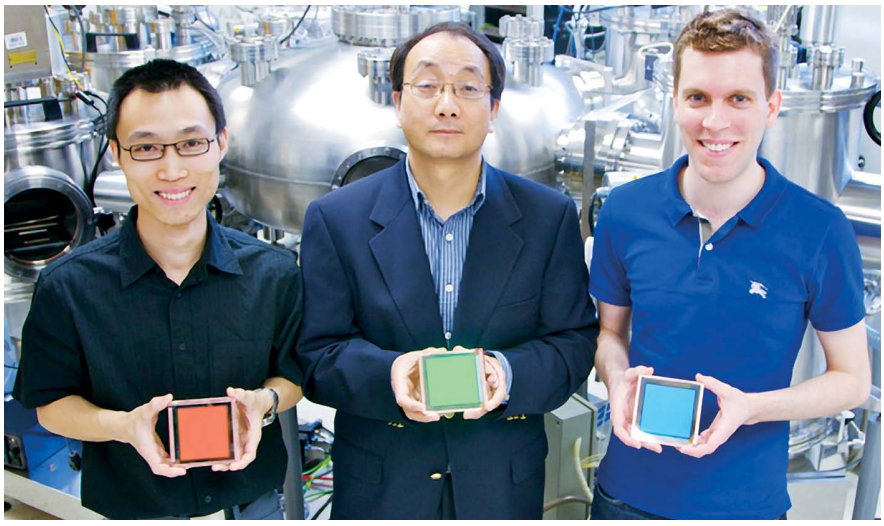
If Materials Science and Engineering Professor **Zheng-Hong Lu** has his way, the world's energy landscape will become significantly more efficient.

Nearly 20 per cent of North America's energy consumption goes to lighting, says Lu. "That's huge," he says. "So any little bit of savings here will be significant."

Lu's work in developing energy-efficient, solid-state lighting led him and his team to set a new world record when a light they designed measured 270 lumens per watt (lm/W). By comparison, most high-grade fluorescent lights on the market measure 70 lm/W.

"It's really a promise of the future — that we can be there," says Lu.

He is now focused on perfecting the colour of his lights so that they give off as natural a colour as possible, while also working with industry to bring the cost of the lights down to a reasonable price.



Materials Science and Engineering Professor Zheng-Hong Lu (middle), and PhD candidates Zhibin Wang (MSE MASc 0T8, left) and Michael Helander (EngSci 0T7, right) show off low-cost organic light-emitting diodes (OLEDs), which could soon make their way into cellphones and homes.

He's encouraged by the shift he sees in ethics towards increased environmental responsibility — something he attributes in part to the maturing of the field.

Cleaning the world's waste

"I've always been interested in the environment," says Chemical Engineering Professor **Elizabeth Edwards**, whose work focuses on bioremediation — the way microbes can be used to break down harmful cancer-causing pollutants that end up in our water.

"Looking around, there's so much waste and so much consumerism and so much dirty water and so much dirty air, it just seems like we could do things better," says Edwards. She was thrilled to see her research put into practice when Guelph, Ont.-based company SiREM bought the licence to her technology which helps to grow a specific type of remediating microbe.

This fairly quick transition from research discovery to industry gives Edwards hope that the will, desire and knowledge to protect the environment is growing. She shares that hope with many other researchers working in BioZone, where she serves as Director. BioZone is where the best of bioengineering research is taking place – it's a centre where engineers such as Edwards, together with biologists, are developing innovative technology to sustain our environment and protect our health, including ways to recover energy from wastewater for the pulp and paper industry, develop biomarkers and detect DNA in water samples.

Photo/Sara Collaton

Professor Elizabeth Edwards (ChemE), Director of BioZone, with engineering students Nancy Li (ChemE 1T4) and Johnny Xiao (ChemE 1T4). Edwards' clean water research was brought to market to improve the environment.

WHAT'S NEXT?

A Sustained Passion for the Environment

U of T engineers are deeply committed to sustainability. It's not just lip service, it's wired into the engineering DNA of faculty, students and alumni.

"Engineers have always had a responsibility to society for anything we invent, anything we do," says Professor Lu. "It's just part of our culture." Some of the world's leading research in sustainability takes place here. That's research that sets us apart from other research institutions in Canada and put us among the leaders in the world.

The Boundless campaign will help to strengthen the Faculty's research in clean and renewable energy, clean water, bioremediation, power systems, sustainable mining practices and urban infrastructure. The results will help preserve our planet and protect our world's diverse species for the benefit of generations to come.

"Many of the big challenges we face are technological in nature," says Professor Zingg, Director, University of Toronto Institute for Aerospace Studies. "So it is really only engineers who can face them."

John Hryniuk Photography

Magdalena Michalowska (MSE 1T2) concisely expresses the desire for engineers to imagine a limitless future.

Photo/Sara Collaton

INNOVATION + ENTREPRENEURSHIP:

From Year One to Light Years Ahead

U of T Engineering pushes nature and devices beyond their limits

As far as Electrical and Computer Engineering Professor **Joyce Poon** (EngSci 0T2) is concerned, electrical and wireless communication hogs the limelight. It's the star in cellphones, laptops and tablets. But when it comes to the really heavy lifting, the vital transfer of terabytes of data between file servers, for example, photonics wins, hands down.

Jason KB Photo

Professor Joyce Poon (ECE), is Canada's leading light when it comes to innovative use of photonics.

"Light transmission isn't constrained the same way as electrical signal transmission in copper wire is," she says. "It can handle so much more data, much more effectively."

Poon should know, she's the Canada Research Chair in Integrated Photonic Devices and was named one of the world's Top 35 Innovators Under 35 by MIT's *Technology Review* in 2012. That puts her at the forefront

A TIMELINE OF INNOVATION

A selection of U of T Engineering inventions and innovations that shaped decades

1906 – THE FACULTY BEGINS
Principal John Galbraith
The Faculty of Applied Science & Engineering was established after operating as the School of Practical Science since 1873. It was overseen by the visionary John Galbraith, who died in 1914. Over a century of innovations have sprung from the Faculty, so far.

1900s

1910s

1910 – CANADA'S FIRST WIND TUNNEL
Professor J.H. Parkin (MechE)
With the support of the Department of National Defence and the then-newly established National Research Council, Professor Parkin acquired Canada's first wind tunnel for his research on aerodynamics. The top wind speed was 60 km/hr.

1925 – THE ROGERS BATTERYLESS RADIO
Edward S. Rogers, Sr. (ElecE 2T1)
Rogers created the world's first radio that could be powered using ordinary household electricity instead of expensive, high-powered batteries.

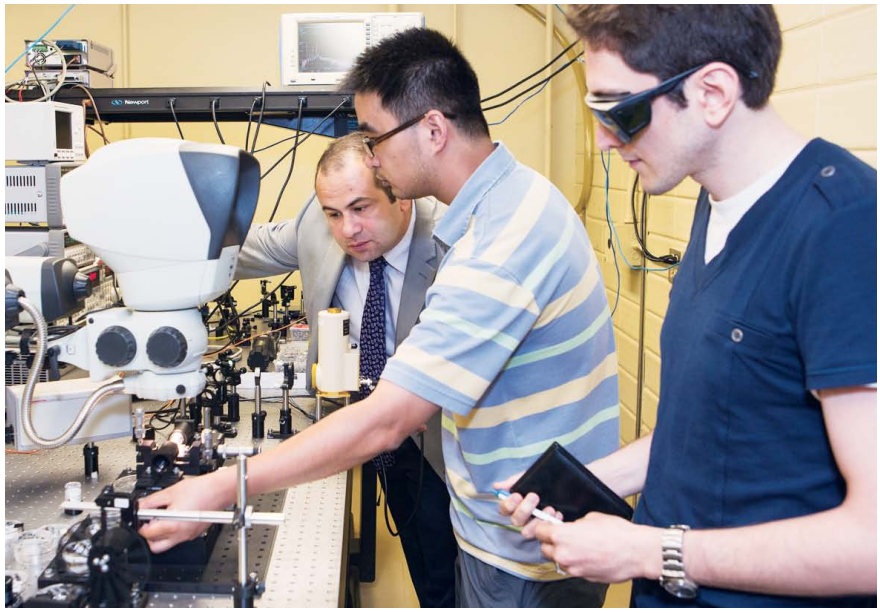
1920s

1927 – THE TECHNICAL SERVICE COUNCIL
Professor H.E.T. Haultain (MinE; CivE 1889)
A non-profit, industry-sponsored placement service to retain engineers in Canada.

of a rapidly evolving field of micro/nano photonics – inventing micro- and nano-metre scale devices for sending, processing and receiving signals with light. And, it's a field Poon and her team are pushing ahead at, well, the speed of light.

Poon's research straddles the world of engineering and science. On the science end, her team keeps track of electro-optical effects in new materials, like the odd behaviours at the borders of dielectrics and metals. They learn how to model and control physical effects, and then engineer compact devices that can turn the effects into a practical solution to vexing communications problems. "Scientists are tasked with examining new phenomena," says Poon. "They don't have to be as concerned with practical applications. Engineers do."

Poon's team has just developed a novel resonance optical switch that allows electrical signals to be imprinted onto a light beam with higher efficiency and speed than was previously possible. They started by completely rethinking how the switch could work and ended up, through a partnership with IBM, fabricating chips containing the technology. From effect, to control, to industrial fabrication – that's innovation that is anything but lightweight.



Photo/Sara Collaton

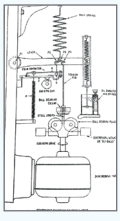
Professor Amr S. Helmy (ECE) (far left) with PhD candidates Dongpeng Kang and Nima Zareian. His group is using the quirky power of quantum computing to take processing to a whole new dimension.

Advancing information and communications technology

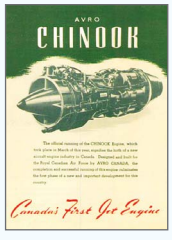
Just next door to Poon, fellow ECE Professor **Amr S. Helmy** and his group are inventing the Duracell of quantum computing.

Quantum computing? That's the kind of computation that takes place when simple, classical bits with two measly states (one or zero) are replaced by qbits, or quantum bits. Qbits can have a number of states at once, some related, some autonomous, and all capable of storing information at a density that puts old-school bits to shame.

But, there's something even more fascinating about the quantum world. Sometimes two or more particles, such as photons, can become 'entangled.' In entangled pairs when the state of one attribute of



1934 – AUTOMATIC FREQUENCY REGULATOR
(installed by Ontario Hydro-Electric Power Commission's Queenston Plant)
Professor H.W. Price (ElecE)
One of the most celebrated devices produced by the academic staff of the Faculty prior to the Second World War, the device used a simple but reliable design to stabilize electrical frequencies.



1945 – THE CHINOOK
Winnett Boyd (MechE 3T9)
The first Canadian jet engine, The Chinook, was the forerunner of the world-leading Orenda jet engine, which powered Canadian-produced fighter aircrafts.

1930s **1940s**

1939 – MAPLE LEAF TRAINER II
Elizabeth "Elsie" MacGill (ElecE 2T7)
The biplane was intended to help train pilots during the Second World War. MacGill went on to lead the production of the Hawker Hurricane, a single-seat fighter aircraft that was designed for Great Britain's Royal Air Force.

a paired photon is detected, it has an instantaneous effect on the associated state of its entangled twin, no matter how far apart the two paired photons are. That sounds like the stuff of Harry Potter, but, in the quantum world, it makes perfect sense.

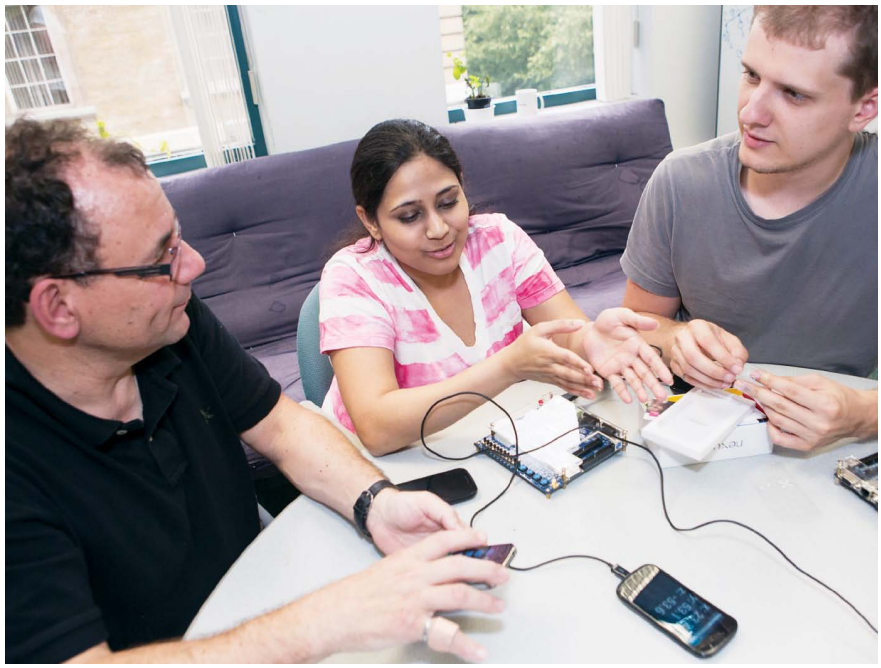
Quantum entangled photons sent along fibre-optic cables can be used to create unbreakable encrypted data. And, other qbits can be used for quantum imaging (creating highly sensitive photon detectors) and quantum computing. They can then be used to solve problems contemporary, classical computers can't even imagine unravelling. In short, quantum computing takes number-crunching, artificial intelligence and even photography into brave new worlds.

That's why Helmy is the Director of the Centre for Quantum Information and Quantum Control (CQIQC), a multidisciplinary U of T group that collaborates in a field that's ripe with boundless potential.

Helmy has the battery everyone needs to get there. Quantum computers require quantum entangled photons. Until Helmy and his team's work, those photons were generated in large, vibration-sensitive light benches in pristine labs. Helmy has put that light bench on a chip. His entire entangled photon factory all fit in a battery-sized unit that can be integrated into other specialized and miniaturized quantum computing gear. But he's not the only professor who's reimagining computing, and the business of computing.

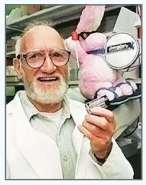
Lego, 'appers' and minor successes

Professor **Jonathan Rose** (EngSci 8T0, ElecE MASc 8T2, PhD 8T6) treats integrated circuits like Lego blocks. Since the mid-'90s Rose has been refining Field-Programmable Gate Arrays (FPGAs). FPGAs are computer chips that can be reprogrammed by engineers after the programmable devices have been manufactured. In 1998, Rose co-founded Right Track CAD Corporation with



Photo/Sara Collaton

Professor Jonathan Rose (ECE) (left) with CompE MASc candidate Niyati Shah and PhD candidate Alex Rodionov. He and his students treat computer chips like Lego blocks and make cellphone apps that serve society.



1957 – THE ALKALINE BATTERY
Lewis F. Urry (ChemE 5T0)
Urry's battery lasted longer than previously available zinc-carbon batteries and soon became the most popular, consumer, portable energy source.

1968 – RECOFLO®
Dr. Phillip (Rocky) Simmons
(ChemE 6T4, MASc 6T5, PhD 6T8, Honorary Doctorate 1T2)
A reciprocating flow ion exchange for treating industrial wastewater.

1950s

1960s

1958 – CLAIRTONE SOUND CORPORATION LIMITED
Peter Munk (ElecE 5T2)
Clairtone created iconic '60s audio equipment. Munk went on to found Barrick Gold in 1983.

Professor **Vaughn Betz** (CompE PhD 9T8), which helped leading FPGA companies create devices and related software. He later sold the company to Altera.

Rose continues to refine FPGAs. He sees a time soon when FPGAs will relieve CPUs and GPUs of some heavy lifting, like vision processing or speech-to-text translation inside cellphones.

But Rose is also interested in getting cellphones to be just as malleable, via apps, small applications he's encouraging his students to explore in his Creative Applications for Mobile Devices course. The project-based ECE course is open to graduate students from all disciplines at U of T. Non-engineering students act as content experts (Rose calls them "appers") and work in collaboration with engineering students to develop practical applications for Android devices and iPhones. He also wants them to get those apps into the market, a desire that comes not only from his own entrepreneurial inclinations but also from his days at Stanford, an environment rich with academic/industrial alliances. It's also why Rose heads up the Engineering Business minor as Director. "It teaches students the language and culture of business," says Rose. "It's a natural for engineering students."

Chairman of the board

Chemical Engineering Professor **Mark Kortschot** (EngSci 8T4, MASc ChemE 8T5) likes taking CT scans of wood. Well, wood-fibre composites, to be exact. Using a microtomograph (an industrial CT scanner), Kortschot and his team take a close-up look inside polymer/natural-fibre mixtures and thermoplastics. The idea is to figure out how the natural fibres should be distributed and aligned to give the composite the desired strength and flexibility. "There's an enormous market for composite materials," says Kortschot. "And using natural fibres like wood, which is incredibly strong, is a green alternative." Kortschot imagines materials his team studies and refines will be used in automobile parts, building products, or anywhere where innovative durable and strong structures are needed.

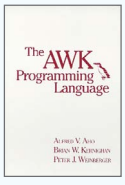
He knows a lot about innovation. Even as a boy, he was a tinkerer and inventor. That creative urge sparked

Professor Mark Kortschot (ChemE), Chair of the Division of Engineering Science. He's leading innovation and entrepreneurship – from skateboards to whole new hybrid materials.

1970 – IMAX PROJECTION SYSTEM
(showcased at the 1970 Expo in Osaka, Japan)
William Shaw (IndE 5T1), *co-inventor*
IMAX is a motion-picture film format that can record and display images of far greater size and resolution than conventional film systems.

1983 – AASTRA TECHNOLOGIES LIMITED
Francis Shen (EngSci 8T1, AeroE MASc 8T3) and **Tony Shen** (EngSci 8T0)
Aastra develops and delivers innovative communications products and applications for businesses in more than 100 countries.

1970s



1977 – AWK PROGRAMMING LANGUAGE
Alfred Aho (EngPhys 6T3) and **Brian Kernighan** (EngPhys 6T4), *co-inventors*
A programming language for UNIX computer operating systems to help extract data.

1980s

1985 – ATI TECHNOLOGIES INC.
Lee Ka Lau (ElecE 7T7, MEng 8T2)
Lau co-founded ATI which produced groundbreaking integrated graphics cards for PC manufacturers such as IBM and Commodore, and was acquired by AMD Graphics in 2006.

Engineering Science students at the 2012 Praxis Showcase show how innovation can outsmart raccoons: their green bin lock uses magnets.

his invention of the Sole Skate™, a three-wheeled skateboard that's easily carried on a backpack. In 2010, the Sole Skate™ won the Australian Toy Association's Outdoor Toy of the Year Award, and was chosen by *Time* as one of the top 10 toys that year.

He brought that same innovation to U of T Engineering. In 2003, he was part of the team that imagined and launched the Engineering Strategies & Practice (ESP) course for first-year students, which has a strong focus on teamwork and engineering design.

Kortschot is now the Chair of the Division of Engineering Science, a program he graduated from in 1984. He lends his expertise to students in the program's Praxis course, where he encourages them to think entrepreneurially about their inventions. "Engineering is a creative endeavour," says Kortschot. "and engineers like to have impact. In the world of engineering design, impact means having your designs manufactured and used." Even if it's just the coolest skateboard on three wheels.

Together, this research and teaching work are examples of the kind of innovative and entrepreneurial work U of T Engineering is championing.

Nurturing big ideas

But, as Praxis and ESP show, innovation and entrepreneurship don't just happen at the upper echelon of research. When you attract the

Adjunct Professor Joseph Orozco nurtures The Entrepreneurship Hatchery's egg as carefully as if it were an undergraduate's fresh new idea.

1994 – ELECTROSLEEVE SLEEVING PROCESS
Dr. Gino Palumbo
(MMS 8T3, MASc 8T5, PhD 8T9)
Electrosleeve™ is a complete pressure boundary repair for steam-generator electrical plants.

1996 – CARGO COSMETICS CORP.
Hana Zalzal (CivE 8T8)
CARGO is an award-winning cosmetics company with makeup sold in five different countries.

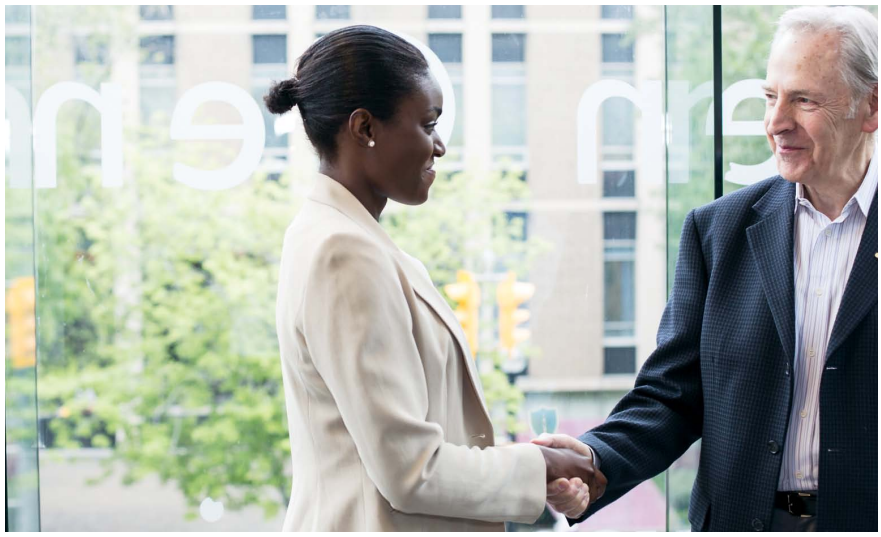
1990s

1996 – eBAY
Jeffrey Skoll (ElecE 8T7)
First full-time employee and President of the online commerce site.
Skoll wrote the business plan that took the company from start-up to legend.

1998 – GLOBALIVE COMMUNICATIONS INC.
Anthony Lacavera (CompE 9T7)
Globalive is a leader in telecommunications, founded by Lacavera. He would later launch WIND Mobile in 2009.

best undergraduates and graduates from around the world, you have to expect innovation anywhere.

That's why Adjunct Professor **Joseph Orozco** of the Centre for Management of Technology and Entrepreneurship helped launch The Entrepreneurship Hatchery earlier this year. The Hatchery brings together undergraduate ideas with mentors, brainstorming sessions and, if the idea is worthy, that means taking it from cocktail napkin, to prototype and beyond. "By creating multidisciplinary teams and helping to commercialize new technologies and ideas, the program will give U of T Engineering students the opportunity to become entrepreneurs," says Orozco, The Hatchery's Acting Director. "That way, they can help improve the economic welfare of their communities."



Photo/Sara Collaton

Engineer and Certified Management Consultant David Green (right) mentors The Hatchery students like Obioma Agwunobi (MechE 1T3) (left) as they learn to take their ideas from the whiteboard to the boardroom.

Preparing the Next Generation of Business Leaders

Budding engineering entrepreneurs (from left) **Kazem Kutob** (IndE 1T3), **Layan Kutob** (IndE 1T2 + PEY), **Tarek El Fadawy** (IndE 1T3) and **Alberto Picard-Ami** (IndE 1T3) took second place at the Wharton Undergraduate Consulting Competition in November 2011, besting teams from Harvard, University of Pennsylvania (Penn), New York University and Rutgers. The Wharton School of Business at Penn is one of the top business schools in North America and the world.

Teams were required to identify strategies to remediate a global financial service firm's regulatory and operational deficiencies, while increasing annual revenues 60 per cent by 2015. "It was such an incredible moment of joy to be a finalist and to be awarded second place after competing against some of the world's most respected and top-rated universities," said Layan Kutob. "It made us, even more, appreciate the education and extracurricular exposure that U of T Engineering gives us."

2000s

2001 – CANADIAN SOLAR INC.
Shawn Qu (MSE PhD 9T5)
Founded one of the world's largest solar energy companies, operating in 11 countries.

2007 – CAST CONNEX CORPORATION
Carlos de Oliveira (CivE MASc 0T6), **Professors Jeffrey Packer** and **Constantin Christopoulos** (CivE)
Cast ConneX is a supplier of cast-steel structural components for use in the steel construction industry.

2009 – KOBO INC.
Michael Serbinis (IndE MASc 0T1)
Kobo Inc. is a global eReading service with millions of eBooks, magazines and newspapers, making it one of the largest eReading catalogues in the world.

2010s

Photo/Rob Vye

2010 – HUMAN-POWERED ORNITHOPTER
Todd Reichert (EngSci 0T5, AeroE PhD 1T2)
Reichert and team design and successfully fly the first human-powered ornithopter, becoming the first ever to achieve flight.

Photo/Liam Sharp

2010 – VIRTUAL MUSIC INSTRUMENT (VMI)
Professor Tom Chau
(IBBME; EngSci 9T2, ElecE MASc 9T4)
The invention of the VMI helps children with disabilities play music.

WHAT'S NEXT?

The Boundless Campaign Embodied

In a few years, the Faculty wishes to find The Hatchery, and other emerging initiatives, a remarkable new home on the last piece of prime real estate on the St. George Campus. Right beside Simcoe Hall and in the heart of the Engineering Complex on St. George Street.

That site will become the Centre for Engineering Innovation and Entrepreneurship – a landmark facility that will bring to life the research, collaboration and educational values of our Faculty. Within its walls, multidisciplinary units, such as the Centre for Global Engineering (CGEN), Centre for Sustainable Energy, Centre for Water Innovation, Engineering Entrepreneurship, Institute for Robotics & Mechatronics and Institute for Leadership Education in Engineering (ILead), will cross-pollinate and thrive.

"It's no coincidence that all the occupants promote multidisciplinary research and innovation activities. That's the future of the Faculty; the clear objective of the building is to bring the best minds within departments and across campus, industry and society to innovate and collaborate," says Professor Emeritus **Ron Venter** (MIE), who is leading up the planning for the building.

The new space will have many integrated facets. The building will provide an innovative, interactive and multifunctional teaching facility for the university. It will also feature clusters of interactive design studios which will serve to promote student teamwork. These facilities will be supported by a light fabrication studio, portable toolkits, dedicated meeting rooms, shared working space and design project rooms that will greatly enhance the student experience.

The building will also house the innovative administrative nerve centres of ten established and emerging multidisciplinary activities within the Faculty, such as ILead, CGEN and others that address technical and social innovation, national and global outreach in the diverse field of multidisciplinary engineering design, critical infrastructure, water innovation, sustainable energy and other endeavours that set U of T Engineering apart. These units will collaborate and will also work with industry-on-site partners. "It's going to be a vibrant environment for innovation and entrepreneurship," says Venter.

"All space is planned to be remarkably reconfigurable, and designed for ad hoc collaboration. It is to be friendly, invitingly bright and interactive – a place where you can and want to participate and where your ideas will grow and flourish," he adds.

The projected $88-million new building will take U of T Engineering well beyond our traditional boundaries. "The profession is breaking exciting new ground in leadership and global impact," says Venter. "So, this is a perfect time to break ground on a new facility that will recognize, consolidate and foster this growth in engineering leadership within a defined range of global challenges."

It's also timely because the Faculty is short of functional and well-serviced space and the consolidation of design, innovation and entrepreneurship within the new building will also allow for the systematic upgrading of inadequate space within existing engineering buildings.

More than a century ago, U of T Engineering's first Principal, John Galbraith said the same thing about the School of Practical Science, and look how far his vision has taken us.

Illustration/Guanghao Qian

The new Centre for Engineering Innovation and Entrepreneurship will rise on the last piece of prime real estate on the St. George campus. It will be in the heart of the Engineering Complex, on St. George Street beside Simcoe Hall and a stone's throw from Convocation Hall. The landmark building will be a showcase for collaborative and multidisciplinary research and education.

Alumni Awards

Engineering Alumni Association award winners and Engineering Hall of Distinction inductees' group photo. Back: EAA Honours & Awards Committee Chair, Professor Barry Adams; John Voss, Malcolm F. McGrath Alumni Achievement Award; Professor Doug Reeve, Engineering Hall of Distinction; Michael Anthony Butt, Engineering Hall of Distinction; Dr. Denis Mitchell, Engineering Hall of Distinction; Dr. Dwayne R. Shirley, 7T6 Early Career Award; Dr. Lloyd Alexander McCoomb, Engineering Hall of Distinction; and Mike Branch, President, EAA.

Front: Wayne Choi, L.E. (Ted) Jones Award of Distinction; Ted Robertson, Engineering Hall of Distinction; Nick Caccavella, 2T5 Mid-Career Achievement Award; Dean Cristina Amon, Faculty of Applied Science & Engineering; Family of the late Davis Doan, Malcolm F. McGrath Award; Professor Emeritus Kenneth Carless (K.C.) Smith, Engineering Alumni Medal; as well as Francis Shen and Tony Shen, Engineering Hall of Distinction.

Engineering Alumni Association Awards

In November 2011, graduates from across all engineering disciplines came together to celebrate the annual Engineering Alumni Awards (EAA) Ceremony.

J. Nicola (Nick) Caccavella CivE 8T6, MASc 8T9

Nick is the recipient of the 2T5 Mid-Career Achievement Award. As Senior Vice President at Holcim (Canada) Inc., he oversees the Ontario and Western Canada regions of one of the country's largest vertically integrated building materials and construction companies, helping to reshape the construction industry through his passion for sustainable practices. As a past Chair of the Ready Mixed Concrete Association of Ontario (RMCAO), he championed 'Eco Certification' in 2009, which will ensure that by 2013, all ready-mix plants should be Eco Certified.

Wayne Choi IndE 1T1

Wayne is the 2011 recipient of the L.E. (Ted) Jones Award of Distinction. Fuelled by his appetite for jazz music, coupled with his drive to help and educate others, he thrived in his role as Director of the Skule™ Stage Band Blue. Wayne later went on to conduct the Skule™ Stage Band, the Faculty's flagship ensemble that was started more than 30 years ago by **Malcolm F. McGrath** (CivE 5T4). He also helped to shape the Faculty's new Engineering Business minor as a student representative on the program's working group.

The Doan Family

Davis Tien Doan CivE 0T7

Davis (1985 – 2010), posthumously honoured with the Malcolm F. McGrath Alumni Achievement Award, was a firm believer in helping those in need. In 2006, he founded the student charity group Eyes of Hope, which aims to enhance student leadership skills while helping children and fighting poverty. There, he mobilized more than two dozen volunteers, raised $20,000+ for three World Vision sponsorships and helped to create a Civil Engineering internship program for Habitat for Humanity.

Dr. Dwayne R. Shirley MSE 0T1, MASc 0T3, PhD 0T9

Dwayne is the recipient of the 7T6 Early Career Award. In his still young career, Dwayne has established expertise in the deformation of lead-free solder, which is used extensively in the electrical connections in computers and microelectronic devices. He is now engaged in materials and package development for the next generation of semiconductor devices at Texas Instruments Inc. Dwayne balances his technical talents with his passion for advocacy through his longstanding involvement with the National Society of Black Engineers (NSBE).

Professor Emeritus Kenneth Carless (K.C.) Smith EngPhys 5T4, ElecE MASc 5T6

K.C. is awarded the Engineering Alumni Medal, the highest honour awarded by the Engineering Alumni Association.

After serving as Chief Engineer at the University of Illinois, K.C. returned to U of T Engineering as Associate Professor in Electrical Engineering and Computer Science. In 1965, he played a major role in shaping the department's curriculum by introducing the teaching of semiconductor circuits at the undergraduate level. At the same time, he launched a novel graduate course called Digital Electronics. These courses inspired a joint authorship between K.C. and one of his students, **Adel Sedra** (ElecE MASc 6T8, PhD 6T9), former Dean of Engineering at the University of Waterloo.

In 1982, this collaboration resulted in a book titled *Microelectronic Circuits*. By 2008, the fifth edition of the book – with many international English versions and translations – reached a million copies sold, having been the world's best-selling engineering electronics textbook for some time. His illustrious career includes serving as Chair of what is now The Edward S. Rogers Sr. Department of Electrical & Computer Engineering.

John Voss ChemE 8T2

John is also a recipient of the Malcolm F. McGrath Alumni Achievement Award.

From 2004 to 2006, John served as President of the Engineering Alumni Association (EAA). During this time, he took on the task of repositioning and reconstituting the EAA to play a more valuable and strategic role for the Faculty. These changes included the development of EAA chapters, from which the very successful Calgary and Biz Skule™ Chapters were born. John led seminars for Engineering Strategies & Practice, a first-year design course.

Engineering Hall of Distinction

Michael Anthony Butt CivE 6T3

Throughout his career, Michael has championed change in industry as a leader. In 1979, he started Buttcon Limited. Bringing strong business and engineering expertise to operations, his company grew to a $100 million per-year entity, and continues to expand today. The company has completed many high-profile projects, including those at Queen's Park, Casino Niagara and U of T.

Dr. Lloyd Alexander McCoomb CivE 6T8, PhD 8T2

Lloyd first made his mark at the World Bank by helping build a computer model that optimized road transportation investment in developing countries. From there, he moved to the Department of National Defence, working in Transport Canada and Air Administration. In 1994, Lloyd became the Airport General Manager of Toronto's Lester B. Pearson International Airport. From 1996 to 2007, he oversaw the $4.4 billion airport modernization and expansion program as Vice President of the Greater Toronto Airports Authority (GTAA). In 2007, Lloyd became the President and CEO of the GTAA.

Engineering Hall of Distinction *(continued)*

Dr. Denis Mitchell CivE 6T9, MASc 7T1, PhD 7T4

When the Concorde Bridge in Laval, Quebec, collapsed in September 2006, Denis was appointed the lead structural engineer, providing experimental investigation and expert testimony. His research has also helped to form the basis of design methods, adopted worldwide, that could withstand catastrophic seismic events.

As a civil engineering professor at McGill University, Denis leads a research team that conducts nearly $800,000 of research per year. For research concerned with public safety rather than potential industry profit, it is an extraordinary feat for a Canadian academic.

Professor Doug Reeve ChemE MASc 6T9, PhD 7T1

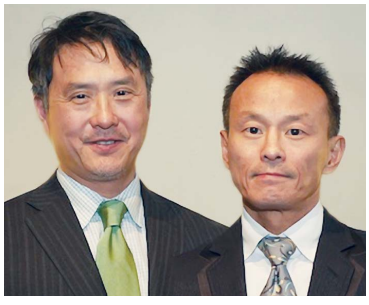
Doug has coupled his talent for industrial innovation with his passion for teaching. Doug developed the Rapson-Reeve Closed Cycle Mill — inspiring more than 25 years of research and advancement in chemical recovery. He served as Chair of the Department of Chemical Engineering & Applied Chemistry from 2001 to 2011 and as Director of the Pulp & Paper Centre from 1987 to 2001. During his term as Director, the Centre created more than $25 million in research programs.

In 2002, he established the Leaders of Tomorrow (LOT) initiative in ChemE. LOT expanded in 2006, and is now a curricular, co-curricular and extracurricular program that helps build leadership skills. LOT's success led to the launch of the Institute for Leadership Education in Engineering (ILead) in 2010, with Doug at the helm as Director.

James (Ted) Robertson MechE 7T1, MEng 7T7

Ted began his engineering career in 1968 at General Motors (GM) of Canada Ltd. There, he rose to become Chief Engineer before moving to the U.S., where he became Chief Engineer at General Motors Corp. In 2002, Ted was awarded the title of Chief Engineer Emeritus upon his retirement, making him the only person to be awarded the title in the corporation's history.

Following his retirement, Ted served as Vice Chairman of ASC Inc., and then President of SAE International, where he was the first automotive leader from Canada in that prestigious role. He then joined Magna International Inc. as Executive Vice President, and later as Executive Vice President and Chief Technical Officer. Ted is now Vice Chairman & President, North America, of Magna E-Car Systems, and Chief Technical Officer – Americas for Magna International.



Francis Shen EngSci 8T1, AeroE MASc 8T3 and **Tony Shen** EngSci 8T0

Francis Shen and Tony Shen are true leaders in the business world. In 1983, Francis and a partner purchased a small aircraft-consulting firm that ultimately became Aastra Technologies Limited.

Tony Shen joined the company in the late 1980s after a successful nine-year career.

Together, they grew the business in the aerospace and defence market. Spotting the decline of the defence market and potential growth in the telecom industry, the brothers started developing and marketing ring-tone devices for fax machines, as well as caller ID units. By 1999, sales grew to nearly $100 million, and they became the largest provider of caller ID units in North America.

By 2003, growth reached the European market, and by 2008, they purchased Ericsson Enterprise Communication Business, their largest acquisition. This move firmly established the company as a major global player in its field. The company now employs 2,000 people and generates more than $700 million in revenue a year.

A Sampling from the Skule™ Events Calendar

For all the latest including Biz Skule™ events, dinners, industry networking and more, visit:
www.alumni.engineering.utoronto.ca

IBBME 50th Anniversary Symposium and Alumni Homecoming

October 9 and 10, 2012

Join us as the Institute of Biomaterials & Biomedical Engineering (IBBME) celebrates 50 years of trailblazing, innovation and collaboration at U of T. For information or to register for these events, visit: **ibbme.utoronto.ca/50th_Anniversary**

Skule™ Comes to Asia Pacific

October 8 and 13, 2012

Join Dean **Cristina Amon** and fellow alumni in Singapore and Hong Kong. To receive details about these events, please contact: **engineering.advancement@utoronto.ca** or +1-416-946-8143.

Calgary Skule™ Alumni Chapter Fall Reception

Monday, November 19, 2012

Professor **David Sinton** (MIE), Director of the Centre for Sustainable Energy, is the speaker. For information: **engineering.advancement@utoronto.ca** or +1-416-946-8143.

San Francisco and Mountain View Alumni Receptions

February 19 and 20, 2013

Engineering alumni unite as Skule™ makes its way to the Bay Area. For information: **engineering.advancement@utoronto.ca** or +1-416-946-8143.

Skule™ Nite Alumni Night

Wednesday, March 13, 2013

Don't miss out on reserving your seat for the highly anticipated extravaganza. For details: **engineering.advancement@utoronto.ca** or +1-416-978-4941.

Skulematters

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