CANADIAN PRAIRIES GROUP OF CHARTERED ENGINEERS

NEWSLETTER

Summer 2016 Edition

2016 Annual General Meeting

Another successful AGM was held this year with a fantastic presentation from STARS, the awarding on the scholarships, and the announcing of the new CGPGE Executive Committee. Look inside for the full details on the event.

IMechE President makes a special visit to the CPGCE

An inside look at the IMechE President's visit and his tour of Alberta, followed by his vision of the future of the institution.

Do not forget to look in the back for a few good jokes and the top scientific breakthroughs of 2016.

ice Institution of Civil Engineers

Institution of Mechanical Engineers

IET The Institution of Engineering and Technology

The Institution of Structural Engineers

Chairman's notes

As a few of you will know circumstances have changed and my wife and I are leaving Calgary, probably, by the time you are reading this. As I reflect back on over a decade in Calgary the CPGCE has played a prominent role in my time here. I suspect this is the case for many of you. Initially it provided a meeting place with like-minded professionals and made the transfer into Canadian professional life easier. From the early years developed friendships to a point where the Secretary felt comfortable inviting me to take on the Secretary's role. I was fortunate to do this at a time when the role was one primarily of Minute taking at meetings and addressing various correspondence from prospective immigrants. Having stepped back from that role our current Secretary, Rick Marshall, took over and while the correspondence from prospective immigrants has all but dried up the demands of social media have increased. The reporting requirements of our sponsoring organisations have also increased. Rick with help from Bob Salt and Mario Micallef have met those reporting requirements ably.

Rick was one of the first of a generational change as new blood started to take over. The Institution of Engineering and Technology's Present Around the World (PATW) competition has introduced several new members, including Committee members. These members have taken on roles of communication (Niamh Ni Chróinín), assistant treasurer (Emily Hicks) and Newsletter producer (Mia Jović). This bodes well for the future of the CPGCE and is good to see. We all need to mentor someone to take over our role for the good of our profession and the CPGCE. The Technical Meetings on the second Wednesday of most months are a mainstay of the CPGCE offerings. Selecting talks can be a challenge some years but in the past year we have had to make some choices of which talks not to accept rather than scrambling for a speaker. This is due to the efforts of Committee members like David Dean, Nigel Shrive, Derrick Stableford, Arun Kumar and Bob Sparrow.

It has also been good to see the sponsoring Institution's regional representatives at the Committee meetings including the IET's Richard Coldbeck. The inclusion of these representatives strengthens the Committee and liaison with the Institutions.

The strength of the Committee was illustrated when we were informed at very short notice of a visit by the Institution of Mechanical Engineer president, Jon Hilton, to Calgary on Canada Day. Thanks to Rick Marshall, Bob Salt and Mario Micallef and others this was a success.

I have been fortunate to have a strong Committee working on your behalf and ensuring the smooth running of the CPGCE. As I have to leave my post early it is with some sadness but in the knowledge that the CPGCE is in good hands and has a healthy future ahead of it. Mohamed Jaffer and Nigel Shrive, as past Chairmen will carry the CPGCE through to the next AGM.

I wish you all well in the coming months and hope you will find time to attend the Technical Meetings and I would encourage you all to consider taking a role on the Committee. Ask any Committee member what it entails and put your name forward at the AGM on February 4, 2017.

Best wishes
Colin Pollard

2016 ANNUAL GENERAL MEETING & DINNER

Another Successful AGM at Fort Calgary

The 2016 AGM was held at our usual location in Fort Calgary on Saturday January 30th 2016 which was attended by about 60 members and guests. The evening began with the CPGCE AGM where the following members were elected to the 2016 Executive Committee:

The 2016 Executive Committee

Chairman:	Colin Pollard
Vice Chairman:	Vacant
Past Chairman	Mohamed Jaffer
Treasurer:	Mario Micallef
Secretary:	Rick Marshall
Communications Officer:	Niamh Ní Chróinín
Members:	Richard Coldbeck
	David Dean
	Mia Jović
	Arun Kumar
	Bob Salt
	Nigel Shrive
	Derrick Stableford
	Bob Sparow

During the meeting, a number of issues were discussed and resolved. After the newly appointed Chair Colin Pollard called the motion to close the meeting, everyone convened to the buffet room where he welcomed members and their guests for the commencement of the dinner proceedings.

Emily H, Mia J, and Niamh N at the AGM

The first order of the evening was for Professor Nigel Shrive to present the 2015 CPGCE Scholarship winners Aliya Lakhani and Jonathan Schoepp, both of the University of Alberta. Upon receiving their respective awards, Aliya and Jonathan thanked the CPGCE for the awards.

Aliya Lakhani receiving her award

Mia Jović then presented Robert Mayall of the University of Calgary, who won the 2016 IET Present Around the World (PATW) held in London. PATW is a global public speaking competition run by the IET. Open to anyone aged between 18 and 30 involved in engineering, it is a global competition for anyone wishing to develop and showcase their presentation skills. Robert, who was the Calgary and America's regional winner, presented *"Ending the Guessing Game for Infectious Patients"*, a piece on the sensor he had been developing as part of his PhD work. In his speech, he said "The sensor can rapidly identify the classification of bacteria in a sample, which could help our doctors in their diagnostic and treatment decisions. I chose this subject because it is something that I truly believe could make a difference in the world around us and I wanted to share that passion with others". Robert who will be delivered this presentation on Wednesday September 14 2016 at the Danish Canadian Club.

Following a sumptuous buffet which Fort Calgary is renowned for, Colin introduced the evening's keynote presentation "Shock Trauma Air Rescue Society (STARS)" by Scott Young, Aircraft Captain and Vice President Aviation and Operations Manager, STARS and Jeffrey Quick, Chief Financial Officer, STARS. A summary of the presentation is in this Newsletter.

Jonathan Schoepp receiving his award

STARS Presentation

The evening concluded with a donation to STARS by Colin on behalf of the CPGCE.

IMechE President Jon Hilton Visits the CPGCE and Celebrates Canada Day

Early in June we found out that the IMechE President Jon Hilton was visiting the "Chartered Engineers Pacific" branch in Vancouver, he was combining the visit with a trip to Seattle to award an Honorary Fellowship to Joe Sutter, a Boeing Airframe Engineer.

CPGCE welcoming the IMechE President

The executive committee quickly decided that having the President of our Sponsoring Institution in Western Canada and not offering a visit to Calgary would be an opportunity lost. After a string of e-mails to London, Jon changed his travel plans and was able to visit us on July 1st and 2nd, he would land in Calgary on Canada Day.

Jon flew into Calgary airport and was welcomed with the traditional Western White Hat Ceremony, this was followed by a lunch with the local members in the Airport Lounge.

With no time to rest, Jon was given a guided tour of the new Airport facilities, including utilities and the state of art baggage handling system, after the tour he was delivered to his Hotel in Calgary.

A dinner had been arranged with the CPGCE Executive that evening. Before the meal the executive ran through a presentation with slides describing; who we are, our history, what we do in the local engineering community, our objectives for 2016, our challenges including the current economic downturn in the energy sector. Finally we asked Jon his advice on how the CPGCE could develop in the future.

Jon was fully engaged, he related his learnings from his visit to the Vancouver branch and encouraged us to continue providing out technical presentations and supporting the Institutions engineers in our region.

He encouraged us to build our outreach with local engineers and especially to develop our links with student engineers in our region.

He stated that the Institution of Mechanical Engineers was committed to support the North American region, although he admitted that the current focus of the institution globally was in the developing regions of the world, notably China, the Far East and India, where the pure numbers of engineers would drive the growth of the institution.

Jon enjoying the Rocky Mountains

With the working element of the evening complete, we enjoyed a great meal with interesting conversation allowing Jon to expand on his experiences, ranging from Engineering at Rolls Royce, through to engine development in two Formula 1 racing teams and his latest business venture where he formed a new engineering company called Flybrid Automotive to develop high-speed flywheel based hybrid systems for automobile application.

After the meal Jon ran through his Presidential address, in which he explained his vision for engineering supported by his vast engineering experience.

The following day, Jon was escorted on a flying visit to the Rockies before being dropped off at Calgary airport for his trip back to London.

We have to thank Jon and his support team at the Institute of Mechanical engineers for changing his travel plans and giving us the opportunity for us to meet him. Also a big thank you to the local members who organized the visit and changed their plans on Canada Day to make the President's visit a great opportunity to showcase what the CPGCE stands for and delivers, overall an enjoyable and successful event.

Jon's bio:

https://www.imeche.org/about-us/our-people/jon-hilton

IMechE Article about the visit:

http://global-professionalengineering-caspianmedia.content-prod.pugpig.com/2016/08/25/president-visits-international-imeche-members-in-canada/pugpig_index.html

Technical Presentations

AGM Presentation: Shock Trauma Air Rescue Society (STARS) Air Ambulance

January 30, 2016

Scott Young - Aircraft Captain and Vice President Aviation and Operations Manager, STARS and *Jeffrey Quick, Chief Financial Officer, STARS.*

STARS arriving at the scene

STARS helicopter

Scott and Jeffrey provided a detailed history of STARS, which celebrated its 30th Anniversary in 2015. STARS is well known throughout western Canada for providing a safe, rapid, highly specialized critical care Helicopter Emergency Medical Services (HEMS) to critically ill and injured patients.

Launched in 1995 in Calgary, STARS has grown to include bases in Edmonton, Grande Prairie, and since 2012, Regina, Saskatoon and Winnipeg. STARS also serves eastern British Columbia. In Alberta, STARS is funded 75% though community and corporate donations, with 25% from Alberta Health Services.


STARS helicopter taking of

The government funding is higher in Saskatchewan and Manitoba, as they are relatively new.

With an average of 8 missions a day across their 6 bases, STARS is a Physician Driven Organization, with a Chief Medical Officer (CMO) & Associate CMO, Base Medical Directors (MD) & MD Portfolio Leads, Transport Physicians, Resident Physicians, Sending Physicians, Receiving Physicians, Critical Care Nurses, Critical Care Paramedic and Specialty teams.


STARS working with Emergency Services

Partnering with Emergency Services, a mission has been accepted by STARS Emergency Link Centre, a STARS helicopter is airborne in 8-10 minutes. The crew comprises of two pilots, flight paramedic and nurse with critical care skills and a physician. Their Annual Mission Volumes are:


Emergency services

	2014/15	Projected 2015/16
Calgary	643	662
Edmonton	800	824
Grand Prairie	408	437
Winnipeg	199	420
Regina	563	565
Saskatoon	483	525

The Aviation team consists of 76 Pilots, 24 Aircraft Maintenance Engineers and Support Staff and they operate a fleet of eight (8) Airbus BK117-B2 three (3) AugustaWestland AW139 helicopters.

Airbus BK117-B2 has a range of 500 kms return trip and speed of 225 km/h, and is fitted with specialized compact medical interior featuring equipment found in a hospital intensive care unit for two patients as well as the essential night vision goggles and powerful search lights.

The Airbus BK117 has two Lycoming (Honeywell) LTS 101-750 B2 engines providing 700 Shaft Horsepower (SHP) and 725 shaft horse power One Engine Inoperative

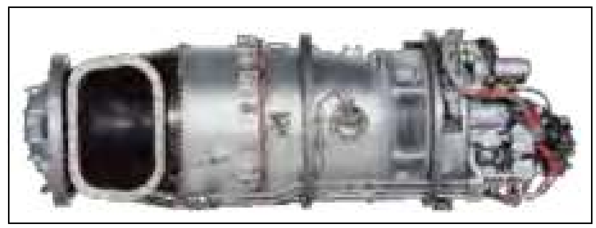
The Lycoming (Honeywell) LTS 101-750 B2 engine

The Lycoming (Honeywell) LTS 101-750 B2 engine

AugustaWestland AW139 is fitted with the same equipment as the BK117 but can fly faster and further and has a larger medical interior workspace with advanced avionics and autopilot systems.

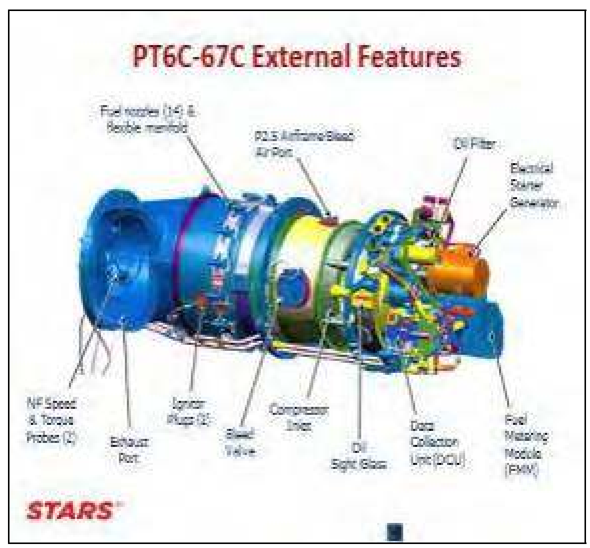
The AW139

The AW139 is able to operate in a greater range of weather conditions as it has an ice detector system and heaters in the rotors and windscreen enabling the crews to visually assess the level of ice build-up with its super-cooled large droplet ice detection system. It has two Pratt & Whitney PT6C-67C turboshaft engines with its pilot and maintenance friendly full authority digital engine (or electronics) (FADEC), a system consisting of a digital computer (electronic engine controller) or engine control unit, and its related accessories that control all aspects of aircraft engine performance.



The AW139 Engine

The AW139's all engines operating (AEO) take off power for continous 5 minutes is 1680 SHP

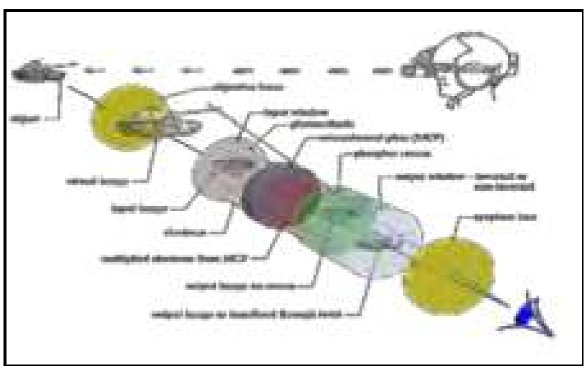


The AW139 Engine

(1253 kW) while its AEO maximum continuous power is 1531 SHP (1142 kW). The critical one engine inoperative (OEI) for 2.5 minutes is 1872 SHP (1396 kW) and for continuous power it is 1680 SHP (1253 kW).

The Night Vision Goggles Generation III
Anatomy of an Image Intensifier

Night Vision Goggles (NVG), used by the pilots, was introduced during the mid-1960 for the Vietnam War. The latest Generation III has a significant improvement equipped with Head-up Display. However it is imperative to have compatible cockpit and external lighting if NVGs are to be used by aircrew. Incompatible light sources will have varied effects from completely shutting down the NVG, to subtly reducing performance to a level not intuitively obvious to the aircrew. Therefore the cockpit is designed to inhibit scanning in certain directions.



The Night Vision Goggles

As mentioned earlier, STARS relies largely on community and corporate funding. The annual STARS lottery is a good source of their funding. The speakers encourage the audience to participate in the annual lottery.

STARS vision

STARS lottery 2016

The Changing Requirements in Engineering Education – Outcomes-based Assessment

February 10, 2016

Dr Bob Brennan, Professor and Head, Department of Mechanical and Manufacturing Engineering, Schulich School of Engineering.

The education of engineers in Canada is evaluated and accredited by the Canadian Engineering Accreditation Board (CEAB). The accreditation process has produced consistency in programs across the country, whilst also allowing programs to different and innovative. Accreditation consisted of counting "Accreditation units" based on the numbers of hours of lectures, tutorials and laboratories, with minimum numbers of these hours being required in various components of programs and an overall minimum. The CEAB has influenced program delivery with certain criteria – for example the requirement that "every program must culminate in a significant design experience", which has resulted in the introduction of capstone design courses in the final year.

There is now a shift in CEAB criteria. To be accredited, programs are still going to be assessed on curriculum content and quality, but are also being asked to demonstrate that their graduates have been exposed to and assessed in twelve "Graduate Attributes". In addition, a quality assurance program has to be put in place, whereby the programs are continually being improved. The new system allows more flexibility, but is much less clear in "what do they want to see?" and "what is the standard to be met?".

The Graduate Attributes now expected to be exhibited by graduates of Canadian Engineering programs are:
A1. A knowledge base for engineering
A2. Problem analysis
A3. Investigation
A4. Design
A5. Use of engineering tools
A6. Individual and team work
A7. Communication skills
A8. Professionalism
A9. Impact of engineering on society/environment
A10. Ethics and equity
A11. Economics and project management
A12. Life-long learning

Review of these attributes suggests that engineering education needs to focus not just on developing depth and breadth of knowledge, with understanding of the methodologies and how to apply them, but also on awareness of the limits of that knowledge, communication skills and autonomy and professional capacity.

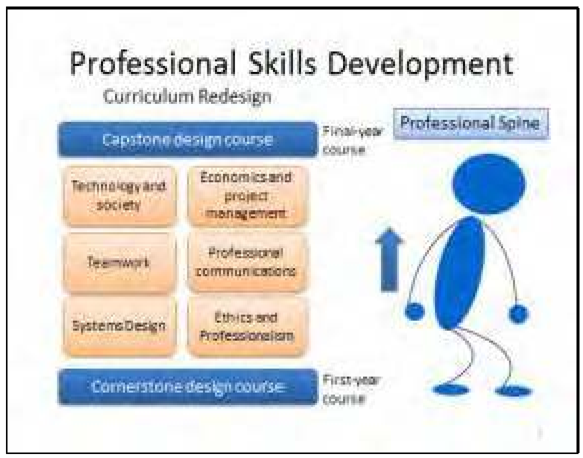


Figure1. Professional skills need to be developed throughout the program.

The development of professional skills has to occur throughout the program (Figure 1).

So, rather than concentrating on the inputs to a program, the CEAB is shifting to assessing the outputs of a program in terms of the generic characteristics of its graduates vis-a-vis the graduate attributes. The idea is to identify the gaps between what professorial staff think they teach, and the actual knowledge, skills and attitudes that students develop from the program. The quality assurance program of continual self-assessment within the faculty is then aimed at closing the gaps (Figure 2). From the inputs of pre-university background, course content, class-size, etc., the measured outputs are to be the attitudes, cognitive abilities and skills of the graduates. The push for broader outcomes-based assessment follows the trends in most industrialized countries, and keeps Canadian accreditation aligned with that of other signatories to the Washington accord (substantial equivalency of engineering education for mobility of engineers between the signatory countries, without the need for examination to practice engineering when moving from one country to another).

The rationale for this shift is that the world is changing and engineering programs now need to prepare students for increasing globalization. Thus programs need to educate students to work in a more interdisciplinary manner, to be more effective contributors and leaders, to be aware of and responsive to environmental changes. Additional effects are that instructors will involve students in more experiential and project-based learning so that they can be more effective in the work-place, and that this will, in turn, enhance university-industry cooperation and knowledge exchange.

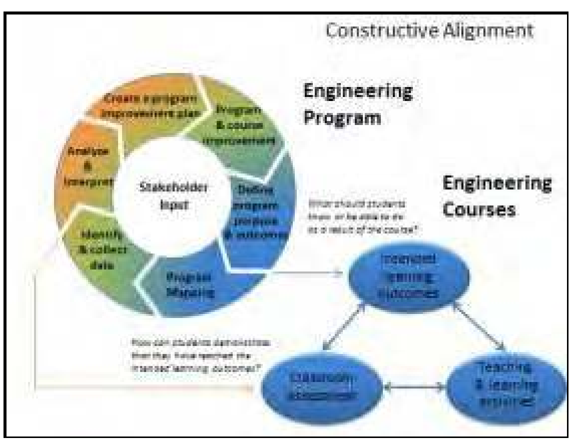


Figure 2. The continual improvement process.

Dr. Brennan then used his own department and its program as an example of how to map the content to what was now being asked in accreditation, and how the courses would change to accommodate assessment of the new attributes. There would be a distinct shift to bridge the gap between classical university education and research, engineering practice, and the broader community, involving the removal of some courses in the traditional format and the introduction of more experiential and project based courses (Figure 3). Calgary does have an internship program, but more industry connection was needed for more practice-like design experiences

Dr. Brennan closed by pointing out that although accreditation was an extremely time-consuming and onerous process, it was having a positive effect on engineering education with the intent of engineering programs graduating students who were more tuned to the needs of industry in the future.

Figure 3. Integration of technical and professional issues by increasing the practice-like experiences during the program.

Canadian Light Source

March 9, 2016

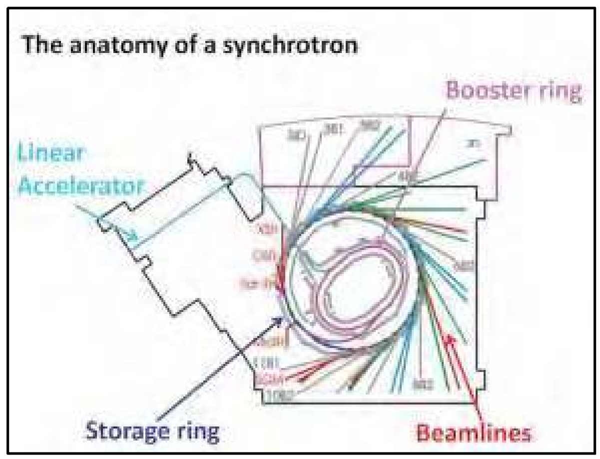
Dr Tom Regier, Beamline Scientist

CLS under construction

Tom Regier gave a fascinating presentation on one of Western Canada's most important research centres (and least known), the Canadian Light Source (CLS) synchrotron. It is located in the University of Saskatchewan grounds at Saskatoon. The name of the facility although descriptive, does not immediately invoke recognition of the exact nature of this futuristic facility. It is a third generation synchrotron (a cyclic particle accelerator), one of about forty in the world. A machine similar in concept to the Large Hadron Collider, CERN, Geneva, Switzerland where the Higgs boson was conditionally confirmed in 2013. The design focus is different; the CLS has been designed as an extreme high intensity light source rather than a particle collider.

Tom outlined the development background for the research centre, which as with all such projects relying on governmental institutions for finance had a long and torturous path to final approval. There were last minute disruptions in the finance plan, which were eventually resolved; the plan included the University, the City of Saskatoon, Saskatchewan Power, National Research Council (NRC) of Canada, the Provincial Government of Saskatchewan, and Western Economic Diversification. The facility was completed in 2004.

Inside the main hall



Anatomy of a synchrotron

The University of Saskatchewan has had a linear accelerator from 1962 for nuclear physics research. This was incorporated into the CLS design, as part of the electron injection system. The graphic 'The anatomy of the synchrotron" presents a schematic of the layout of the CLS and lists the beamlines. The design of a synchrotron involves getting feedback from all similar installations worldwide and incorporates the latest innovations. It is a very complex process as there so few in the world.

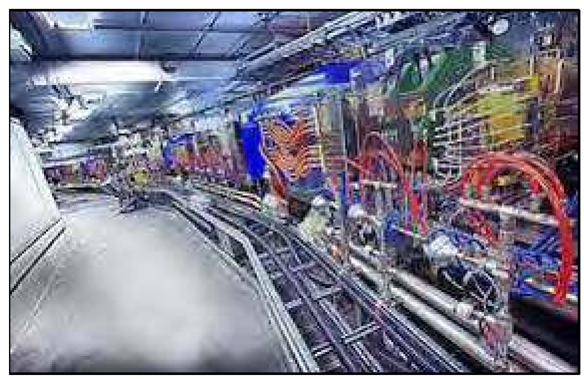
The machine starts with the electron gun where the electrons are generated and then accelerated by the Linear Accelerator through a series of cavities powered by radio frequency fields to 250MeV (2.5 x 10^8 volt potential). The beam is diverted by magnetic fields via an energy transfer line (a metal tube with a near absolute vacuum) to the Booster ring where the energy level is raised to 2.9GeV (2.9 x 10^9 volt potential) by radio frequency cavity and the electrons are travelling at 99.999998% of light speed. The electron beam is then transferred into the storage ring.

Linear accelerator

Once in the storage ring, the electrons will circulate for four to 12 hours producing photons (light beams) every time the dipole magnets change the direction of the flow of electrons. While the ring looks circular, it is a twelve sided (dodecagon) shape with 12 straight sections with twelve 150° bends, each with 2 dipole magnets, and a series of four-pole and six-pole magnets to focus the beam.

Some straight sections also include space for special magnets called Insertion Devices. After each turn there is a photon port to allow the light to travel down the beamlines. Over time, the number of electrons stored in the ring will decline. This is inevitable because the vacuum isn't perfect. Electrons will eventually collide with random air molecules that are present and are lost. As a result, CLS must either empty the ring and re-inject electrons, or add more electrons to maintain the necessary current.

When high-energy particles (electrons) in acceleration, are forced to travel in a curved path by a magnetic field, synchrotron (electromagnetic) radiation is produced, this is similar to a radio antenna. The intense light beams produced by the CLS are a million times (10^6) brighter than the sun. The light beam emitted at each bend on the dodecagon is called a beamline. Beamlines are tunable from infrared through the visible light, ultraviolet, to soft and hard x-rays. Insertion devices and filters are used to manage, focus 'tune', etc the light to the required format for each research project.



Storage ring

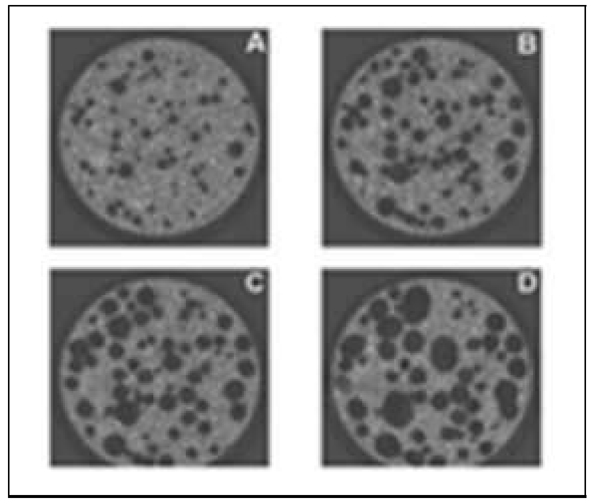
Beamlines carry the synchrotron's light to scientific work stations that operate 24 hours per day, 6 days per week, approximately 42 weeks of the year. For academic research the CSL has a six month planning cycle where anyone worldwide can apply for research time on the synchrotron. There is a peer review process for evaluating potential projects. If a project is accepted there is essentially no cost for time usage with the Synchrotron but there is requirement that all research be published and be in the public domain. The CLS is also available for industrial research where time is charged to the user and the results are confidential.

Every university in Canada has research projects in place at the CLS in Saskatoon alongside a large number of international projects. The CLS uses intense electromagnetic radiation for imaging, diffraction and spectroscopy to host the following research centres based on its beamline capabilities

- Far Infrared Spectroscopy
- Mid Infrared Spectroscopy
- High Resolution Spherical Grating Monochromator
- Variable Line Spacing Plane Grating Monochromator
- Resonant Elastic and Inelastic Scattering
- Soft X-Ray Spectromicroscopy
- Canadian Macromolecular Crystallography Facility
- Very Sensitive Elemental and Structural Probe Radiation from a Synchrotron
- Soft X-Ray Microcharactization Beamline
- Hard X-Ray MicroAnalysis
- Synchrotron Laboratory for Micro and Nano Devices
- Biomedical Imaging and Therapy
- Brockhouse X-Ray Diffraction and Scattering Sector
- Quantum Materials Spectroscopy Centre
- Biological X-Ray Absorption Spectroscopy

Tom Regier outlined some of the ongoing projects.

X-ray technology has developed from a crude picture of the skeleton to the late 19th century to Phase Contrast Imaging (PCI) where the different refractive indices in a material allow an image to be created of the microstructure of an object. A typical finger joint x-ray is illustrated titled synchrotron 2000 and the results with Phase Contrast Imaging with its microfocus provide x-ray with much higher resolution showing the cellular bone structure.

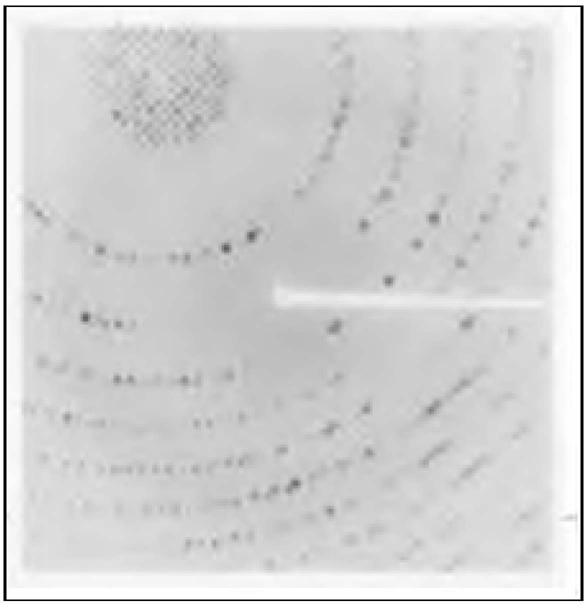


Higher resolution images

Another project is researching the Influence of cellulose on the microstructure of fresh cement pastes (concrete). The nucleation curing of the concrete is photographed with x-rays at regular time intervals. The images labeled A, B, C and D were photographed at 16, 26, 35 and 50 minutes which illustrate the curing process within the cement paste.

Research is carried out on the improvement of antibiotics and this uses x-ray crystallography technology. Highly purified macromolecules are packed into 3D lattice forming crystals. The egg white lysozyme crystals are grown in a small drop placed in chamber containing substances which slowly decrease the water content of the drop until a crystal is formed, typically 0.05-0.5 mm long. The crystals are mounted on the beamline in specially designed loops and exposed to x-rays. Diffracted x-rays are imaged on a detector. Using Bragg's Law the image is then transformed into a three dimensional structure, one of the most famous of which is DNA.

The final research topic reviewed was ice nucleation in the atmosphere, which occurs as condensation trails (contrails) left behind some highflying aircraft. There is concern that persistent contrails increase cloud cover and impact climate change. At the CLS they have built a chamber to simulate stratospheric conditions - temperature, pressure, UV light. A synchrotron beamline is used spectroscopically to monitor the chemical interaction between water and carbon at interface. The objective is to improve the design of the jet engines and aircraft to minimize or eliminate the contrails



X-ray difraction image

Tom Regier completed his most interesting presentation with summary the Canadian Light Source Synchrotron functions, which it is important to reiterate.

- Is a key part of Canada's research infrastructure
- Produces electromagnetic radiation by accelerating charged particles (electrons)
- The light is intensely bright and tunable
- Is used for imaging, diffraction and spectroscopy
- Has important applications across many scientific fields

The CLS in Saskatoon encourages visitors and has a great website www.lightsource.ca

Defence Research and Development Canada, Suffield Research Centre - Chemical-Biological Defence

April 13, 2016
Dr. Scott Duncan, PhD.

Dr. Duncan is an internationally recognized expert in chemical and biological defence research to protect personnel, equipment and infrastructure against highly toxic and pathogenic compounds. He is Head of the Chemical-Biological Assessment and Protection Section at the Defence Research and Development Canada (DRDC) Suffield Research Centre, located 50 km northwest of Medicine Hat), an agency of the Canadian Department of National Defence.

Advanced chemical and biological defence protection products developed from DRDC Suffield research

Dr. Duncan delivered an informative overview of the scientific work done at the Research

Centre with a focus on the chemical-biological defence program.

The presentation provided attenders with insight into the important work that DRDC Suffield undertakes as part of its mandate to collaborate with industry, academia and international defence partners to ensure that the Canadian Armed Forces is enabled to conduct operations with agility and effectiveness in any domestic, continental or international environment where there is a risk or threat of the use of Chemical Biological Radiological Nuclear (CBRN) material.

Dr. Duncan reviewed the mission and roles of the DRDC Suffield Research Centre, and provided an overview of DRDC's national organization and the work done at research centers across Canada.

DRDC Suffield was established in 1941, and today it shares the vast training area at Canadian Forces Base Suffield (approximately 1000 square miles) with the Canadian Army, the British Army Training Unit – Suffield and the oil and gas industry.

Soldier personal protective ensembles (PPE) from WW I to next generation prototypes

Dr. Duncan discussed the use of chemical and biological agents in past conflicts, their impact on humans and the history and progression of protective systems used to protect soldiers from deadly and incapacitating agents.

Dr. Duncan described current systems and testing practice carried out at Suffield highlighting the use of computer modeling and robotic mannequins to develop and test modern, lightweight and highly effective clothing, using advanced technologies such as super-repellent coatings to protect soldiers against chemical and biological threats.

Suffield Mannequin and Mannequin on the robotic test frame in a DRDC Suffield test chamber

Dr. Scott Duncan receiving an Operation Eyesight Certificate in appreciation of his presentation by Colin Pollard, Chairperson CPGCE. (Photo Credit: Major Glen Parent, DND)

Dr. Duncun also provided an overview of the unique testing capabilities at DRDC Suffield, which is recognised as one of the top three allied testing facilities capable of safely handling the chemical & biological pathogens and simulants used in development and testing of advanced detection and protective systems.

International Facilities Project – A New Paradigm in Airport Design for Calgary

May 11, 2016

Rob Adamson, Managing Principal, Dialog Design and leader of their airport design group at the Calgary Studio

The focus of this presentation was the planning and construction of Calgary Airport Authority's new terminal for international flights to the US and the world.

YYC Airport November 2015

Calgary International Airport, or YYC as it is widely known from its IATA airport code designation, has embarked on an ambitious expansion program in keeping with its slogan of "Growing the Hub". YYC is steadily expanding its role as an international aviation hub and constantly adding new international routes in collaboration with major airlines.

The two major phases of this program are the new 14,000 foot long runway 17L/35R completed in June 2014 and the new international facilities terminal currently set to open its doors in October of this year.
The terminal is the subject of this talk, a new green-field international and trans-border terminal at Calgary International Airport named the International Facilities Project.

It is a 1.47 billion dollar, 2 million square foot expansion that comprises two new concourses dedicated to international flights together with new Arrivals and Departures Halls, new automated baggage handling facilities, a new compact transit system to transfer passengers between old and new terminals, a new Connections Centre and system of secure corridors to obviate the need to exit and re-submit to CATSA security checking when transferring between domestic and international terminals and other new 'firsts' in Canadian civilian aviation such as self-service baggage drop-off, comprehensive free wi-fi connectivity, the latest CATSA 'plus' security features and "Call to Gate" for departing passengers.

The concourses of the older existing terminal, renamed A through C are being re-tasked for domestic flights only and Concourses D and E will be dedicated to international flights and US trans-border flights respectively. Notwithstanding this, the design is uniquely functional with several original features.

Perhaps the most innovative feature of this new terminal design is its 'stacked' design incorporating two-levels of departures floors, the 'tri-sector' swing gate system and sterile corridors, and nodal hold room concept.

YYC Airport Expansion

This feature will allow 7 of the 13 new fixed gates to service planes departing or arriving from domestic, international or US airports despite the dedicated nature of the two new concourses. This gives the new terminal great flexibility, minimizing the number of gates required to meet airline demand yet also minimizing the building footprint and gross floor area.

YYC Terminal

The stacking concept saves the Calgary Airport Authority an estimated $100 million in capital costs and as-yet-unmeasured operating savings by optimizing gate use and reducing travelled distances and equipment duplication and maintenance costs.

The tri-sector system vertically separates 'nodal' hold rooms for the different categories of passengers to satisfy rigid security requirements to minimize distances from hold room to plane.

The tri-sector gates can be used to service planes and embark or dis-embark passengers for domestic or international or trans-US border flights in quick succession by directing the different streams of passengers using swinging doors and separated corridors between holding room and airplane.

Conventional design is a two dimensional moving line principle requiring all gates on one side of the 'line' to be dedicated to a single sector. With the stacked configuration, any swing gate can be made available for any sector at any point in the schedule, by opening or closing a single panel. Software controlled by Duty Managers provides the signals to electronic hardware which operates the gates and confirms position and security to the operators. Gate utilization efficiency is improved and peak-shaving of the gate schedule reduces the number of gates needed.

Other special features of this new terminal include fixed gate layouts with two mobile passenger boarding bridges that allow two boarding points for the largest modern aircraft such as the Code "F" Airbus A380, and the "Code "E" Boeing 787 Dreamliner and the Boing 747-800 jumbo jets. These same dual bridges can service two smaller Code "C" jets or smaller aircraft simultaneously.

YYC Termianl New Design

These fixed gates or links are high enough to permit a Head of Stand road, keeping ground service vehicles close to the main building and away from the fragile aircraft.
Another feature of this new terminal introduces the first true new "call to gate" or C2G system in North America, modelled on Heathrow terminal 5. Passengers will be held in the Departures Halls and lounges until shortly before boarding calls. Boarding Gates will not be identified on boarding passes or on Flight Information Display screens until shortly before take-off. These nodal hold rooms will emphasize passenger relaxation and stress reduction with bars, shops and rest areas. Traditional waiting at Gates will be greatly reduced and the passenger travel experience improved.

Other features will improve the efficiency of airport operations. An advanced visual guidance docking system will use laser technology to scan gate bridges and key points on taxing aircraft to bring the two together with minimal risk. Lead in handlers with wands and paddles will no longer be seen except as backup in the worst weather conditions.

A compact transit system has been custom-designed to transport ten passengers per vehicle between concourses, reducing the maximum travel time from one end of the new composite terminal to the other to 20 minutes or less between connections. This features a new fleet of 20 custom electric vehicles and a dedicated corridor, paralleled by moving ways for those who prefer to walk.

Interior of Airport

Other new features: A new fully-automated baggage handling system occupies 2/3 of the floor footprint in the basement or 'Utilities' level. This system extends back into the existing terminal indoors using a widened corridor and complies with the latest security and US customs border protection requirements. Connecting traveler baggage is automatically transferred between concourses and security screened by X-ray.

Connections Centre and a secure baggage identification addition will permit passengers connecting to international flights to do so without exiting the secure area to collect and re-check their baggage and re-submit to a pre-boarding security check. Frequent international travelers will appreciate this feature because it greatly reduces the necessary connection time to allow for between flights.

The Departures check-in hall has a new look to it. It features self-bag drop and many more customer self-service kiosks. Most passengers will use these automated facilities to check in, obtain their boarding passes and baggage tags and drop off their bags on the automated baggage conveyors. The personal touch will still be there. YYC is hiring many Customer Care ambassadors to assist travelers in need of help and encouragement.


Construction Around YYC Airport

Mechanical, electrical and telecom/security services are dispersed in 14 mechanical main air-handling , pump and heating/cooling rooms, 11 electrical distribution and switching rooms and 10 IT router and switching rooms. All remote sensing, controls and operating systems are remotely monitored and governed by building managed system software and operators in a secure location.

The project was planned to be highly sustainable. It has achieved a LEED Gold design rating and certification to this standard is being sought for the construction.

Barrier-free design for handicapped travelers has been combined with long ramps to provide an alternative to elevators and escalators. Despite this, the building still has 87 elevators, escalators and pedestrian moving ways all remotely and individually controlled for security purposes by access control system (ACS) software and for safety by the 25-zone fire alarm system. The ACS also individually controls some 1400 secure doors. The actual number keeps changing as tenant spaces and utility rooms are added or modified.

Sustainability is a strong feature of this new terminal. Geothermal heating and cooling is provided by 581 wells drilled beneath the terminal foundations to a depth of 150m. 50% of all heating and cooling load is met by circulating a mixture of ethanol and water from the wells through a hydronic heating system embedded in half of all floor slabs. The energy balance is made up by natural gas-fired cogeneration backed up by conventional gas boilers. Provision has been made to add solar-generated power to the mix in the future. The hydronic radiant floor heating will create a comfort zone above the floors without conditioning the high vaulted spaces of the Hall roofs.

Solar gain through the large areas of curtain wall is tempered by a double glazed wall space. This buffer zone space is automatically vented to achieve free night-time cooling in summer and closed to trap heat in winter. Solar heat gain is also mitigated by automatically-controlled blinds. Energy consumption is further regulated by lighting controls. Sensors and auto controls adjust the level and duration of lighting to reduce lighting power requirements according to flight schedules and ambient levels of daylight.

Rainwater is collected and stored in two huge underground cisterns. This grey-water is treated and recycled to washrooms for flushing.

The new international facility also has a number of peripheral projects including a new external waste and material handling facility than moves supplies into and waste material out of the terminal via underground tunnels, a new emergency power generation building to back-up 100% of electrical loads, a passenger transfer tunnel and external elevator to connect to existing indoor parking and a new eight-storey Marriott hotel in the terminal itself to name a few.

The design of this new terminal started in December 2006, so from start to finish this has been a ten-year project to bring to fruition. The project design team has made extensive use of BIM technology. During the design development phase, this has been the largest BIM modelled project in Canada.

In all 18 architectural models were developed by Dialog Design, the architect and prime consultant for the project. 14 structural models were developed by Read Jones Christoffersen, the structural engineers, and 11 mechanical and 5 electrical models by AECOM engineers. In total 49 design models were used totaling 5 gigabytes of computer memory. These models translate into 2,800 drawings sheets and their use vastly simplified the change management process, which is just as well because like most airport terminal projects the IFP has suffered about four thousand changes and is still seeing about 100 changes a month.

Chrisplant, the Danish EPCM for the baggage handling system also developed a BIM model to layout and fabricate their three dimensional handling system which uses discrete short lengths of powered conveyor to transport items of luggage in separate addressable plastic pallets or ‘totes’. Each individual item is tracked constantly as it travels through the baggage conveyors. Each item is addressable and can be diverted and retrieved individually without affecting the flow of baggage. The system is monitored and controlled around the clock from Denmark. US CBP and CBSA can interdict and sequester any passenger with his/her baggage without delaying flight departure.

The complete design team includes design studios in Canada (Calgary and Toronto), the USA (Seattle and Washington DC), Europe

(London, Stuttgart and Copenhagen) and Australia (Melbourne).


YYC Airport Exterior

The new international terminal will be Calgary's gateway to Canada and the USA as well as destinations in Europe and Asia

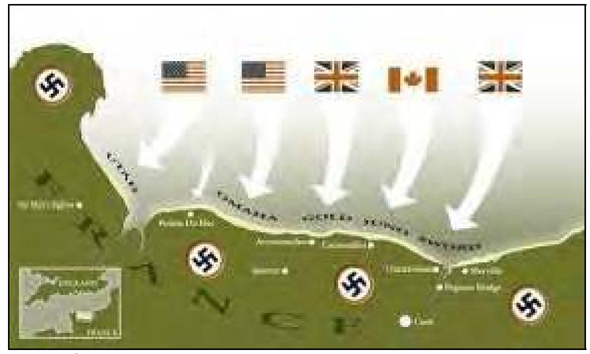
Rob Adamson took us on a virtual tour of the new terminal and then answered questions before concluding his presentation.
The virtual animated tour video cannot be reproduced in this document but a number of still photographs were provided showing the check-in hall on the Departures level, a progression of aerial views of construction and a number of internal and external views of the nearly completed international terminal building. These have been posted on the CPGCE.org website as a PDF of the presentation slides.

And yes, the new terminal will have free WI-FI throughout!

D-Day Engineering Challenges and Solutions

June 8, 2016

Lt-Col. Eppo van Weelderen, Commander
41 Canadian Brigade Group


Map of beach

Lt-Col. van Weelderen indicated there were three areas in which engineering played a significant role in the success of the D-Day landings – in the deception as to the location of the landings, in the landings themselves and finally in the supply of materials immediately after the landings. Lt-Col van Weelderen subsequently expanded on each area.


WWII tank

With regard to deception, the major contribution was in understanding the capability of German early warning radar and thus how to "fool" it into showing the presence of a large flotilla when no such thing existed. The desired effect was produced from the dropping of “window”. This was the code name for small metallised strips, like tin foil, which were dropped in bundles from bombers, resulting in a cloud of metallic strips which floated gently to earth. In the process the strips created confusing signals on German radar screens.

Beach during the invasion

During the night before the D-Day assault on Normandy, five Fortresses and five Lancasters flew back and forth across the Channel, dropping window closer and closer to the Pas de Calais on the journeys, such that the German radar picked up a slowly advancing block of “metal”, which was interpreted as an armada approaching the coast. Just 10 aircraft thus created the appearance on German radar of an invading naval force moving toward the Pas de Calais, diverting the Nazis’ attention from Normandy. The innovation was the creeping advance of the window – window had been used before to confuse detection of bomber streams, but this was the first time window had been used in this way to create the impression of a slowly advancing fleet. The decoy bombers also jammed German radio using on-board transmitters. This helped create an electronic wall, blocking all German communications, for several hours over northern France, masking the presence of 1,000 Allied transport aircraft on their way to drop paratroops at the start of the invasion.

The landings themselves were facilitated by variations on “Higgins boats”, which were able to get close to the shore, off-load troops and hardware, and back off. These boats were improvements of those used on Louisiana swamps. Among the hardware were “Hobart’s Funnies” – special equipment devised by Major-General Percy Hobart to do particular jobs needed on the beaches and inland to clear specific obstacles. Many of the funnies were inspired by the failures observed on the Dieppe raid. The Sherman duplex drive tank was one innovation – a large waterproof canvas housing could be raised up the sides of the tank and once in the water, propellers engaged to drive the tank forward at a maximum speed of about 4 knots. Once on the shore, the canvas housing was lowered and the tank was used as a tank. Unfortunately, many of these were lost on the approaches to the beaches because the higher than designed for waves swamped many of the tanks. Flail tanks (called “crabs”) could advance over minefields, thrashing the ground ahead with a rotating cylinder of weighted chains, causing the mines explode ahead of the vehicle.

Soldiers running on to the beach from a Higgins boat

The “crocodile” was a Churchill tank which had a flame thrower in place of the hull machine gun. This could throw flames forward 120 yards – much further than man handled flame throwers – so the appearance of one of these demoralised defenders, enabling this tank to be particularly effective in attacking German bunkers, trenches and other strongpoints.

Armoured bull dozers were used to clear the beaches of obstacles and to make roads accessible by clearing rubble and filling in bomb craters. A variation of this was created on the Centaur tank to keep up with advancing units. Other tank adaptations were AVREs (Armoured Vehicle Royal Engineers). One was a Churchill tank with the main gun replaced by a mortar which could fire a 45 pound projectile filled with high explosive about 150 yards. These were used to destroy concrete obstacles. Others could lay a bundle of wooden poles lashed together against the beach wall to lower the angle for the tank to climb the wall, or the bundle could be dropped into a ditch to allow the tank to cross. Other additions included the "bobbin", which was a 10 ft wide reel of canvas reinforced with steel poles that could be unrolled over soft ground to allow vehicles to pass without sinking in; and the small box girder bridge which was carried in front of some tanks to span a 30 ft gap in 30 seconds.

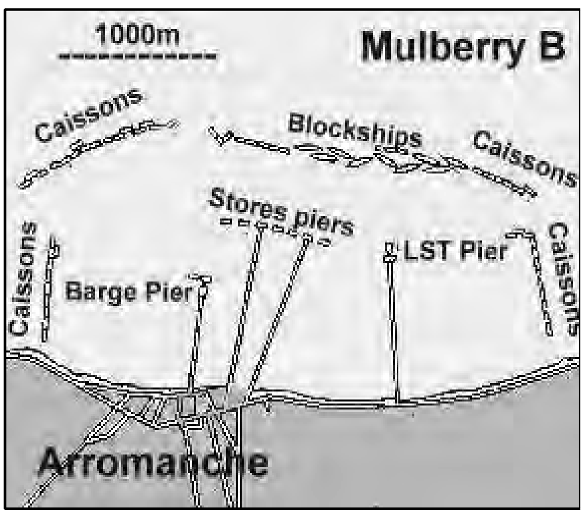

Horsa Glider

The ARK (Armoured Ramp Carrier) was a Churchill tank without a turret that had extendable ramps at each end; other vehicles could drive up ramps and over the vehicle to scale obstacles. Lastly, there were Beach Armoured Recovery Vehicles which were Sherman tanks with the turret replaced by a tall armoured superstructure, allowing the vehicle to operate in water 9 foot deep. This vehicle was not created by Hobart, but by the REME: it was designed to remove vehicles that had broken-down or been swamped in the surf and were blocking access to the beaches. They were also used to re-float small landing craft that had become stuck on the beach.

A different innovation was also essential to the success of the landings, and that was the Horsa glider which could carry up to 30 armed troops along with its pilot and co-pilot. In place of troops or in various combinations, it could transport fuel, ammunition, two jeeps, a 6 pounder anti-tank gun, a 75-mm howitzer or other supplies up to 7,380 pounds for the Mark II model. Its wing-span was 88 feet and its fuselage length was 67 feet. With a shortage of various metals, the Horsa was built of wood, and could be towed by such aircraft as the Stirling, Halifax, Albemarle, or Whitley. The tow rope carried a telephone line along it for communication between the two pilots until the telephone was later replaced with a radio. These gliders were used by the British in their airborne landings, most famously at Pegasus Bridge.

Once the beach-head had been gained, it was necessary to keep those on-shore supplied with food, fuel, munitions and replacement hardware, as well as land more troops and equipment. Two innovations facilitated supply of the armies – the Mulberry harbour, and PLUTO (PipeLine Under The Ocean). Work on PLUTO began in 1942 with a test pipe being laid across the Medway that year. The system was refined with further tests in the Clyde. These revealed that cable-laying ships of the day did not have the capacity to deal with the pipe.

New cable laying equipment had to be designed, fabricated and tested. A big problem for the pipe itself was the couplings – many hours were spent on these. Two distinct pipe systems were pursued: one was a flexible, multi-layered lead-based pipe, while the other was a steel pipe. It was a requirement of both systems that they could be laid continuously and quickly. The flexible cable was manufactured in 40 mile lengths and it weighed 67 tons per nautical mile when filled with water for laying. Practice sessions laying the pipe revealed issues, all of which were dealt with. After the invasion, eventually 11 lead and 6 steel pipes ran from Dungeness to Ambleteuse (near Boulogne) providing 172 million gallons of fuel to the end of hostilities.



Map of Mulberry Beach

Mulberry harbours were to be used supposedly for three months, as that was the estimate of the time it would take to capture a major French port and have it functioning. However, the longest serving Mulberry was used for ten months after D-day with over 2.5 million men, 500,000 vehicles, and 4 million tonnes of supplies being landed through it before it was fully decommissioned. The need for such a harbour was also recognized in 1942, and development again involved a lot of engineering and many trials. One in 1943 on the Solway Firth resulted in the decision to put all future effort into one particular design, which consisted of six different types of concrete caissons and floating roadways. Parts were constructed all around the coast and slowly moved to the south coast ready for towing across the channel. Caissons were typically moved at 3 to 4 knots. Once on the French side of the channel, the caissons were flooded and the temporary harbours assembled. They were supposedly protected by block ships and breakwaters, but these did not protect the harbours from the worst summer storm in 40 years: the one at Omaha beach was basically destroyed and not rebuilt, while the one off Gold beach was damaged, but remained mainly intact. Some 600,000 tons of concrete were used, and there were 10 miles of floating roadways to move personnel and goods off 33 jetties.

Lt-Col van Weelderen concluded by indicating that the engineering behind all three aspects of the D-Day invasion were essential to the success of the operation. It remains the largest sea-borne invasion ever attempted, and the fact it was successful was in no small part due to all the engineering performed beforehand and executed during, and immediately after, the attack.

Scientific Breakthroughs of 2016

The DNA App

What if there was an app that allows you to browse your genes and learn more about yourself? Would you pay $5 for it? Helix, a company based out of San-Francisco is looking to make this available to you for a small fee in 2016. A cheap and easy way to find your predispositions and health risks.

A Self-driving Car for Consumers

While in most countries autopilots do not have many regulations attached to them, Tesla has gone ahead and sent an update package 7.0 that allows for their cars to be virtually autonomous. Drivers are able to sit back while the car fully steers itself. Videos have pooped up all over the internet where drivers are seen drinking coffee, relaxing, and even riding on the roof. The most revolutionary part of the update was the self-steering. No other car company has even made that leap.

Just for fun…

The Engineered Body

Three engineering students were gathered together discussing who must have designed the human body.

One said, "It was a mechanical engineer. Just look at all the joints."
Another said, "No, it was an electrical engineer. The nervous system has many thousands of electrical connections."

The last one said, "No, actually it had to have been a civil engineer. Who else would run a toxic waste pipeline through a recreational area?"

Groceries

A husband asks his wife, a software engineer...

"Could you please go shopping for me and buy one carton of milk, and if they have eggs, get 6!" A short time later the husband comes back with 6 cartons of milk.

The wife asks him, "Why the hell did you buy 6 cartons of milk?" He replied, "They had eggs."

Information on our Sponsoring Institutions

ICE

The youngest of the four sponsoring Institutions, the IET was formed in March 2006 by a merger of the Institution of Electrical Engineers (IEE) and the Institution of Incorporated Engineers (IIE).
Institution of Incorporated Engineers, traced its heritage back to the Volcanic Society founded in 1884

Institution of Electrical Engineers began in 1871 as the Society of Telegraph Engineers

Largest multidisciplinary professional engineering institution in the world.

IMechE

Founded in 1847 in Birmingham, by George Stephenson

Allegedly, Mr. Stephenson was refused admission into the ICE unless he sent in “a probationary essay as proof of his capacity as an engineer”

Moved to 1 Birdcage Walk, London in 1899

George Stephenson became the first President in 1847 with his son Robert in 1849

ICE

Founded in 1818 by three young engineers

The world’s oldest and first Professional Engineering body

Thomas Telford became the first President in 1820

IStructE

Founded in 1908 as the Concrete Institute.

Became the IStructE in 1922, when its interest expanded to cover structures of all kinds

Right Hon. Robert Windsor-Clive, 1st Earl of Plymouth became the first Concrete Institution President in 1908

Ernest Fiander Etchells became the first President of the Institution of Structural Engineers in 1920

Acknowledgements

The Editor would like to express their gratitude to everyone who submitted a story, wrote an abstract for the newsletter, and send a joke in. If you have a story you would like to see included please contact Mia Jović at editor_newsletter@cpgce.org.