

# Canadian Prairies Group NEWSLETTER of Chartered Engineers

Winter 2005



LIAISON

NIGEL SHRIVE



LIAISON

DAVID ELSON



LIAISON

RAY MARSH



LIAISON

ALAN RHODES



LIAISON

TO BE ELECTED

## Chairman's Message

As my term of office draws to a close it is time to reflect on what has transpired over the past two years. I will pass on the duties of leading the CPGCE at the AGM in January 2006 to the newly elected Chairman at that meeting. It has been a period in my career that I will look back on with both pleasure and despair. Pleasure from the Technical and Social Meetings that we have held in Calgary and sadness that we have been unable to stimulate sufficient interest from our members in the Edmonton area to be able to continue meetings there.

Tom Martin has been responsible for Calgary Technical meetings. We have enjoyed a varied and very interesting series of presentations – Thanks Tom. My personal thanks go to Ken Smart who has tried, in vain, to keep the Edmonton meetings going during the past year. Without the support of the local membership these meetings just cannot continue.

After a quiet beginning to the year August proved to be different. It is with great sadness that I report that Liz Elson, wife of past Chairman Dave Elson, passed away tragically on August 5th. She supported him through 5 years of office and will be well remembered for her happy nature and the many functions she (ably assisted by Dave, of course) hosted at their home in Bowness.

Pai Lin Li, an early chairman of the CPGCE, passed away on August 11th. He was still a very strong supporter of the Group and was Involved in the

## IN THIS NEWSLETTER

Pai Lin Li Obituary .....	2
Buried SAGD Flow Lines .....	3
Calgary Technical Calendar.....	3
Data Security .....	4
Edmonton Technical Meetings .....	5
I Struct E President's Tour.....	5
Reconstructing your face .....	6
CPGCE Scholarship.....	7
Privacy.....	8
Executive .....	Back

planning of the IStructE visit due to commence on the 15<sup>th</sup>. My thanks to Ted and Janet Maciag for completing the arrangements at such short notice.

A full obituary is given in this newsletter.

The President of IStructE, Mike Fordyce, and Chief Executive Officer, Keith Eaton visited Calgary from the 15<sup>th</sup> to the 18<sup>th</sup> August. A full report is contained in this newsletter. A full programme was arranged with ample opportunity for them to meet the membership and to visit industry in Calgary.

The meeting with APEGGA was informative and addressed the many aspects of mutual recognition – let us hope we are nearer to that “first step” that will lead to the recognition of CEng as an acceptable qualification for registration as PEng in Alberta and indeed throughout Canada.

Everyone is welcome to attend the Calgary technical presentations.

We meet at the Danish Canadian Club, 727 11th Ave SW at 6:30 pm

Spouses and guests are always welcome.

More details on [www.cpgce.org](http://www.cpgce.org)

I urge you to consider joining the executive next year, new ideas are always welcome and it does not require too much effort. Just let me know if you are interested.

The Christmas season is approaching rapidly. It is a season of good will and happiness no matter what your particular beliefs may be. In the coming years I wish you all the happiness you would wish yourself and may the New Year bring us all a more peaceful, compassionate and tolerant world.

Bill Meadowcroft

## **Annual General Meeting**

**Saturday January 21<sup>st</sup> 2006**

**Provisional details**

**THE Highwood** at SAIT

John Ware Building

1301 16<sup>th</sup> Avenue NW, Calgary.

6.30 pm Reception, 7.30 pm and Dinner

**Cost \$30 per person**

Book your place by contacting

Roger Frayne via telephone 403-287-3051

or email [agm@cpgce.org](mailto:agm@cpgce.org)

Payment must be made in advance by cash or cheque by January 15<sup>th</sup> 2006

Menu and final details will be advised

late December

We would prefer to send your CPGCE Newsletter via e-mail, if possible. Please send your email address to Tom Williams at [tom-williams@shaw.ca](mailto:tom-williams@shaw.ca)

## **Obituary**



**Pai Lin Li M.Bdg.Sc, B.Sc.(Eng), PEng,**

**F.I.Struct.E, F.I.C.E., F.A.S.C.E. 1930 – 2005.**

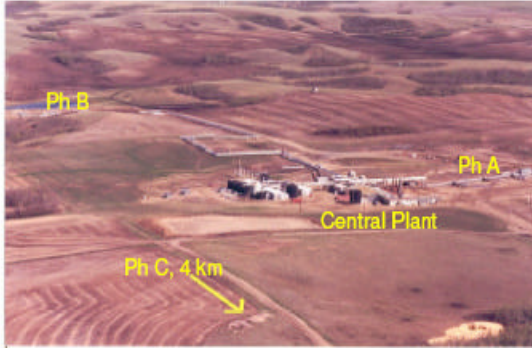
Pai Lin Li passed away peacefully in Calgary on Thursday, August 11, 2005 at the age of 75 years, with his family at his side. Pai Lin was born in Canton, China, in 1930. He received his education at St. John's University in Shanghai and the University of Hong Kong. He then went to Glasgow to pursue professional training as a civil and structural engineer. Until his passing, he continued to celebrate Burns' Suppers and speak fondly of his time in Scotland. He began his career in Hong Kong at the department of Public Works. He went to Australia to complete graduate studies at the University of Sydney, with Pai Lin obtaining a masters degree in building science. He brought his family to Canada in 1967, settling first in Toronto, and then Calgary in 1970. He served as Chief Building Inspector for the City of Calgary during Calgary's boom years. Later he formed his own building and structural engineering consulting practice. He was committed to his professional activities and proud of his affiliations. He was a Fellow of the Institution of Structural Engineers and the Institution of Civil Engineers, both of the United Kingdom.

Until his passing, he served as Alberta Representative of the Institution of Structural Engineers and was recently honoured for his service to the Institution. Earlier, he served as chairman of the Canadian Prairies Group of Chartered Engineers. He was president of the Canadian Building Officials Association and also served on the committee of the National Fire Code. His service was recognized by the Alberta Building Standards Council and the World Organization of Building Officials. Pai Lin was committed to community service and fellowship. He was an active member of the Rotary Club of Calgary and at one time served as a director. He will be sorely missed by his friends at CPGCE and our deepest sympathy goes to his

**Buried SAGD Flow Lines**

by Lance Thomas Senior, Pipeline Engineer, Amec Americas Limited. September 14, 2005

With the continued success of thermal heavy oil recovery comes the problem of connecting distant well pads to the processing plant. During the summer of 2001, PanCanadian Energy (now EnCana Resources) made use of a novel buried piping technology to solve this problem. For the Senlac SAGD project in Saskatchewan the project addressed the problem of piping steam and the recovered oil from the central processing plant to well-head. As in all SAGD projects continuous product expansion from the facility in phases A, B and C and the declining output from the wells requires the phased addition and deletion respectively of interconnecting pipe. The plant was on cattle raising land so the added incentive was there to minimise the footprint of the piping infrastructure. In the traditional design the pipe would be run above ground on support which requires foundations and steel. The decision was taken to bury the piping.



A thick layer of polyurethane was used and great care was taken during the installation to ensure no damage occurred.

As the configuration of the expansion loops is critical to the design great care was taken during the construction phase in the alignment of the conduit and inner pipe.

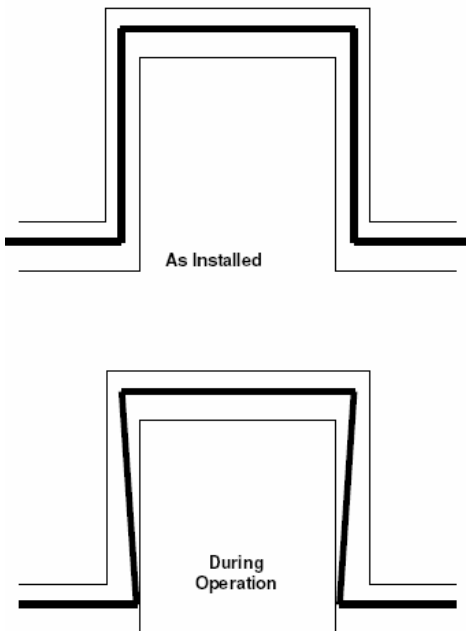
A major concern was water hammer during commissioning and modelling was used to define the Startup procedure.

The system was commissioned and has been in operation now for four years. The line is buried about a metre below the surface

and the insulated line has minimal impact on the fauna. The cows appreciate the slightly higher ground temperature in winter and the line route can always be identified by their position. The estimated savings were 30% on an above ground system

The major issue with burying pipe is how to deal with thermal expansion.

The steam line is 330° C. The three kilometre pipeline system has a thermal growth of approximately 12 metres over its entire length. The design selected is a product used in urban settings for routing steam lines underground in industrial complexes. The pressure containing pipe is carried within a larger diameter pipe (conduit) which allows for expansion and contraction when correctly sized. Oval supports are used to support the inner pipe. A minimum of two conventional anchor blocks are used, typically one at each end. Undulating terrain is handled as per a conventional gas line and the pipe was routed along the fall lines. No isolation gaskets are available for the high temperature so the integrity of the coating of the outer conduit was critical.



During Operation

**Calgary Technical Calendar 2006**

**Wednesday 8th February 2006**

**LNG Terminals**

by **Wolfgang Neuhoff**  
**TransCanda Pipelines**

**Wednesday 8th March 2006**

**Underwater Vehicle and Propulsion Plant Development**

by **Dr Ian Potter** Director, Sustainable Energy Futures, Alberta Research Council

**Wednesday April 12th 2006**

**CO<sub>2</sub> Recovery and Utilization for EOR in the Middle East**

By **Doug MacDonald**, Manager, Studies and Developmental Projects, Chemical and Petroleum Business Unit, SNC Lavalin

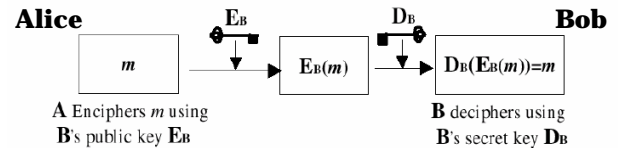
Note: Titles of presentations and any presenters listed are subject to change—check the website for details

## Data Security and Information Theory for the XXI Century

Dr Mario Forcinto gave a lucid technical presentation on the rather esoteric subject to engineers of data security and encryption. For a profession that works in rather more basic elements such as concrete, steel, chemicals, cable, etc. and for the more senior of us who reluctantly use this technology to assist in our work, it was something of a revelation to be advised of the mathematical technological complexities of using a bank card in a cash transaction.

Mario explained the information theory behind this technology using the parallel of sending secret messages. The cryptology behind spies and encoding their secrets has direct parallels in this industry. If a secret message is sent from one person in code to another then the second person needs to have the decryption key to the encryption code used by the sender. To ensure security the use of this code needs to be restricted. In computer systems the encryption and decryption is accomplished by algorithms, a specific kind of mathematical procedure suited to computer calculations.

addressed in the breaking of secret codes. Confusion blocks a potential cryptanalyst from using statistical techniques such as the fact that e, s, t the more common letters in the English language to break a code,



Asymmetric or Public Key Encryption

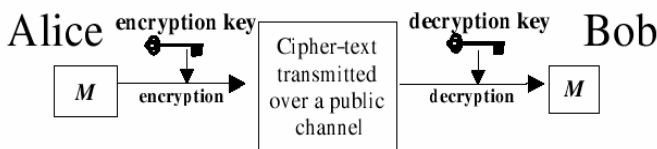
- Encryption and Decryption Keys are different
- Encryption key is public knowledge
- Decryption key must remain secret

substitution is often used. Diffusing is where changes in the unencrypted text cause large changes in the encrypted text. This is enacted by manipulating a string of characters by a mathematical diffusing function.

Perfect secrecy and or security is obtained by using a one time pad where only one message is transmitted using this encoding. This is hard to emulate in computer encryption. In asymmetrical or Public Key encryption the encoding and decoding keys are different. Typically in computer usage the encryption is common knowledge but the decryption is secret. The RSA coding is an example which is commonly used in the industry. Examples were given based on prime numbers which are key in modern computer coding.

The presentation finished with Hash functions and how these are used in encryption. A Hash function takes a long string (or message) of any length as input and produces a fixed length string as output, to make it suitable for use as a primitive in various information security applications

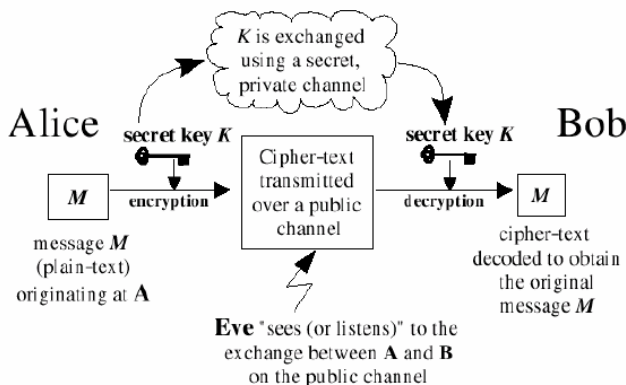
One key issue is that as computers continue to become more powerful, with greater computational ability, the complexity of encryption needs to increase to maintain computer security. In historical code cracking terms, once the early computers and mathematical techniques were developed the Enigma machine code was broken even though it appeared to be impossible at first sight. Nowadays computing which took days on mainframes is executed on one's home computer within seconds. Obviously encryption/decryption is a technology with a limitless potential given the importance of secure and confidential data transmission in the XXI century. It has to keep pace with Moore's Law on microchips. Moore's Law states " the number of transistors on a chip will double every 18 months" and as a consequence computational power increases exponentially.



General Encryption

cipher-text (scrambled message)  $M$  : plain-text (the message)

There are two types of key encryption: symmetrical and asymmetrical. In symmetrical encryption the keys for encryption and decryption are identical. These were used in the early days of computing. The key issues in a good encryption procedure are confusion and diffusion as



advocated by Claude Shannon, the father of Information Theory in 1949. These are the same issues that are

For those of a mathematical bent we attached the basis of the RSA algorithm, one of the key applications used in data security.

### RSA Algorithm

Bob chooses in secret two large primes  $p, q$  with  $p \neq q$  and sets  $N = pq$

Bob chooses  $e$  bigger than 1 with  $e$  relatively prime to  $p-1$  and to  $q-1$  and with  $e < (p-1)(q-1)$ .

Bob calculates the decryption index  $d$  where  $d < (p-1)(q-1)$  is such that the remainder of  $de$  on division by  $(p-1)(q-1)$  is 1. More generally Bob calculates a decryption index  $d$  where  $d < t = (p-1)(q-1)$  is such that the remainder of  $de$  on division by  $t$  is 1. Here  $t$  is any number divisible by  $p-1$  and  $q-1$ .

Bob announces his public key  $[N, e]$  and keeps his private key  $d$  secret.

Alice wishes to send a secret message  $M$  and represents  $M$  as a number between 0 and  $N-1$ . Alice then encrypts the message  $M$  as the remainder  $C$  of  $M^e$  upon division by  $N$  and transmits  $C$  to Bob.

Bob decrypts  $C$  by calculating the remainder of  $C^d$  upon division by  $N$ . This gives the original secret message  $M$ .

### Edmonton Technical Meetings

Two years ago, by popular request from members in and around Edmonton, we welcomed the initiative by Dele Morakinyo to start regular technical meetings in Edmonton. Attendance to the meetings was good to begin with but dwindled as the year progressed. Despite repeated requests for help in organizing the events, it was left to Dele to arrange the events. Dele relocated to Yellowknife late in 2004 and Ken Smart took over the lead of the Edmonton Group.

The response to Ken's efforts with help from Stephen Poole has been extremely poor, so much so that Ken has decided he cannot spend any more time for such a low level of response.

It has been decided, therefore, to discontinue the regular meetings in Edmonton. The executive committee has been reluctant to take this course of action but in the light of what appears to be total disinterest from our Edmonton members we are left with no alternative.

This does not preclude the organization of meetings of special interest. These will be dealt with on a one off basis.

**Moving? Moved in the last 3 months?  
If so, please let Tom Williams know at  
tom-williams@shaw.ca  
(It can take a considerable time before the  
institutions notify your local branch.)**

### IStructE President's tour: Calgary, Alberta

President, Mike Fordyce, and Chief Executive, Dr Keith Eaton, report on the final leg of their North American tour:

We were hosted by Bill Meadowcroft, Chairman of CPGCE (Canadian Prairies Group of Chartered Engineers). At a breakfast meeting with IStructE members and prospective members, we emphasised the considerable changes at IStructE since the previous visit to Calgary in 2002 and had lively discussions about current IStructE activities.

We were particularly pleased to meet Mrs Zeng Qin (Emily Zeng) (M) who had recently moved to Calgary from China, where she gained Institution Membership in 2000 via supplementary tests in accordance with the IStructE and NABER(S) agreement. Mrs Zeng is now seeking registration in Alberta as P.Eng using her MStructE qualification.

On a site visit to the Foothills Medical Centre we were shown round by architect Kenneth Johnson and structural engineer Andrew Boucher from Cohos Evamy. A 38,000m<sup>2</sup> laboratory on four floors and a 24,000m<sup>2</sup> clinic on six floors are linked to an existing three-storey building making the structure very complex. To provide the level of services and facilities that will need to be incorporated in the fit-out, 'interstitial floors' will be used in the laboratory building. The total cost is C\$138M before fit-out, rising to C\$240M on completion. It will be an important new addition for the University of Calgary Faculty of Medicine.

On a visit to the offices of Fluor we met two structural engineers, Jim McFarlane and Sean Halvorsen, who are working on the new development for extracting oil from the tar sands (oil sands) in northern Alberta at the Long Lake Upgrader Project near Fort McMurray. This is part of a massive new C\$70bn development to produce synthetic crude oil, the sands being 500m underground. Jim and Sean were working on the 'hydrocracker unit' and showed us some fascinating 3-D computer images of the complete project.

To obtain the oil, steam is injected into the tar sands to soften the bitumen and then recover it. From a structural engineering viewpoint, there is a great deal of complex plant, equipment and pipework that has to be housed and located in the large facility.

With 3m of permafrost, there are considerable heave forces, and we were shown details of the 900+ H-piles being installed on the site. Sitting on those will be the (largely) steel framework – 1200t of steel in total. All connections are bolted, and the steel is left totally bare, not protected in any way – a deliberate policy, and more than adequate for the 25-year design life of the structure.

At APEGGA (Association of Professional Engineers, Geologists & Geophysicists of Alberta) we met the President, Larry Staples, Executive Director & Registrar, Neil Windsor, and others to discuss the recognition of CEng by APEGGA when engineers wish to register using that UK-based qualification. The situation has moved forward a great deal in the 3 years since our last visit, and APEGGA is actively working with the registration organisations in 10 provinces and two territories through the Canadian Council of Professional Engineers (CCPE). Neil Windsor explained that:



**From left to right: Bill Meadowcroft, Andrew Boucher, Kenneth Johnson, John Charret and Mike Fordyce at the Foothills Medical Centre**

- Canadian graduates simply need 4 year's 'apprenticeship experience'.
- P.Eng registered engineers in other Canadian provinces have inter-provincial mobility; more than 99% are accepted automatically for registration in Alberta.
- For engineers coming to Alberta from other countries,

APEGGA needs to see academic credentials; they then pass the application to their Board of Examiners who may, or may not, ask for examinations to be taken.

In this last category, APEGGA is moving towards a 'looking to exempt' policy whereby exams may disappear altogether. This followed a survey of 9000 recently-registered P.Eng engineers which showed that the average time for processing applications had been 3-4 months for Canadian engineers and 6-7 months for those from other countries.

APEGGA stressed that everyone still needed at least 1 year of relevant North American experience but this did not have to be gained in Alberta.

Clearly this was welcomed by those present, and certainly both CPGCE and IStructE members present all felt that APEGGA had moved a long way in this recognition process. This was very good news.

Neil Windsor explained that IStructE members would almost certainly get registered as P.Eng, younger members under the (WA) accredited academic route, and older members because of their relevant experience. (Everyone has to take a professional ethics examination; see information about routes to registration in Alberta on APEGGA's website: [www.apegga.com](http://www.apegga.com)).

We agreed that APEGGA, CPGCE and IStructE would maintain contact in the future. APEGGA and the Canadian government see a considerable expansion and growth in the need for engineers in Alberta as massive new infrastructure projects take place or are being planned. This year they have handled some 4500 applications, one third each from Alberta, the rest of North America,

and the rest of the world.

The Government wants to see maintenance of high professional standards; recognition of the unprecedented economic growth in Alberta; addressing massive skills shortages; acceptance of provisional licensing in advance of formal registration; and to bring in the maximum number of people with the right skill sets in the Alberta economy. Engineers are also very busy in British Columbia, and Alberta is definitely losing some experienced engineers back to BC.

A dinner hosted by CPGCE Chairman, Bill Meadowcroft, in the Officer's Mess of the old Fort Calgary, was attended by 42 engineers and partners from the five engineering disciplines.

**Visit the CPGCE Website**

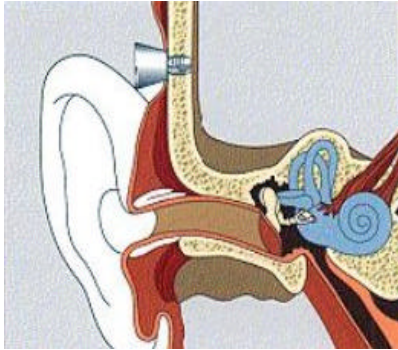
**For all the latest news and programs for future events.**

**[www.cpgce.org](http://www.cpgce.org)**

## Reconstructing your Face - Bioengineering in the Head and Neck

October 14<sup>th</sup> 2005

Ryan Swain, a doctoral candidate at the University of Alberta gave a stimulating presentation on the use of mechanical implants for prosthetics. Ryan, a graduate in mechanical engineering from the University of Manitoba, gave an insight into a grey area of medical research where the fields of medicine and engineering overlap. For some years now, prosthesis in the form of implanted teeth have been used very successfully to replace natural teeth and now this same technology is being successfully applied to other prosthesis including eyes, ears and noses as well as bone anchoring hearing aids (BAHA). For example, BAHA has been successfully developed for those persons who are completely deaf and allows patients to be fitted with an attachment that delivers sound waves via the implant in the bone structure of the skull, thus allowing that person greatly improved hearing capability. In addition, for those individuals who may have suffered facial disfigurement as a result of an accident, or through the treatment of some forms of cancer, these new techniques allow them to regain their self esteem and live and work a normal life.



These new techniques allow them to regain their self esteem and live and work a normal life.

The implant and abutment technology comprises three parts, the implant itself, the supporting material, normally bone, and the abutment, possibly an eye, an ear or even a nose. Implants are normally screwed into the supporting material which in some cases is bone a mere 4mm to 5mm thick. Some of the issues which have to be addressed in this process include compatibility of the insert material with human bone tissue, and how well the bonding between the implant and the natural bone is established, a process known as "osseointegration". Fortunately, the use of virtually 100% pure titanium for implants has proven to be an excellent selection since early experiments with rabbits indicated that the bone "grows" into the implant thus ensuring a solid anchor between the two.



Early tests to measure the effectiveness of this bonding were not that scientific and included "wiggling" the implant by hand, sound analyses, the amount of torque

required to remove the implant, radiography and magnetic resonance imaging (MRI) and dynamic velocity testing including impact testing and Resonant Frequency Analysis (RFA).

One of those procedures originally developed and tested, (OSTELL), gave rise to significant problems in that the process was hard to model, due the non uniform shape of the samples, and there was some difficulty in determining the RFA of the sample.



As a result a more realistic test, PERITEST, has now been developed in which a small rod, weighing 8 grams, to which an accelerometer is attached, is used to induce mechanical vibrations in the implant. Variables to be taken into account in such tests include the striking height, hand piece angulation and azimuthal direction. Raw data is recorded and from it resonant frequencies are calculated. Modelling the impact process included varying the inputs with between 2 to 4 Degrees of Freedom (DOF) and undertaking Finite Element Analysis (FEA) using ANSYS, a proprietary software program. In-vitro laboratory experiments were then undertaken to fully understand the processes involved and these were followed by lengthy analyses and numerical simulations to confirm the effectiveness of the procedure, its viability and repeatability. These included the measurement of both osseointegration loss and bone loss and simulation of loss of stiffness. The results of theoretical modelling correlated well with the results obtained from the experimental data.

Finally, in-vitro clinical tests were performed on a number of patients who had undergone the BAHA procedure and were conducted at the time of initial installation and then at intervals of one, three, six and twelve months after that time. The test results indicated that although there was an initial lowering of the resonant frequency of the implant after initial installation, the trend was reversed until, six months after installation, the resonant frequency had increased to levels in excess of those measured at installation. As a result, the current protocol in these procedures is to delay the attachment of any abutment until approximately six months after fitting of the implant.

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### 2005 Scholarship Award

The 2005 Scholarship award is in the admission phase where prospective candidates are submitting the applications to the selection committee.

This year to celebrate the 100th anniversary of Alberta as a province the CPGCE is awarding two engineering scholarships. It is expected that by the time the AGM is held on January 21, 2006 the committee will be in a position to announce the winners.

### Your 2005 CPGCE Executive Committee

<u>Name</u>	<u>Responsibility</u>	<u>Institution</u>	<u>Telephone</u>	<u>Email</u>
Bill Meadowcroft	Chairman	Mechanical	403-251-7158	wmeadow@telusplanet.net
Alan Rhodes	Secretary	Chemical	403-271-5309	landan@telus.net
Roger Frayne	Treasurer	Mechanical	403-287-3051	rogerfrayne@shaw.ca
Tom Williams	Membership	Electrical	403-271-8520	tom-williams@shaw.ca
Charles Dempsey	Scholarship Chair	Mechanical	403-287-2992	dempsey@calcna.ab.ca
Ken Smart	Edmonton	Electrical	780-459-3130	tramsk@telusplanet.net
Bob Enever	Editor	Electrical	403-271-1953	eneverr@shaw.ca
Alex Crabtree	Communications	Mechanical	403-531-7539	alex_crabtree@bjservices.ca
Ted Maciag	IStructE Visit	Structural	403-249-2995	beistr@shaw.ca
Ray Marsh	Scholarship	Electrical	403-281-1529	ray.lynnmarsh@shaw.ca
Leo Flaman	Scholarship	Mechanical	403-267-7234	leoflaman@shaw.ca
Tom Martin	Technical	Civil	403-246-1542	tmconsultants@shaw.ca
Anthony Lam	Assistant Treasurer	Electrical	403-503-0138	awlam@calgary.ca
Adrian Dumbrava	Technical	Chemical	403-537-8169	Adrian.Dumbrava@snclavalin.com

### Privacy

The CPGCE maintains computer records of its membership. The information that is held consists of the following:

Name,

Address

Telephone Numbers

Email Address

Institution Membership

This information is kept in strict confidence by the Executive Committee and is used solely to enable contact with the membership. The information is not used for any other purpose and is not made available to any third parties.

If you have any concerns about security of this information please contact a member of the Executive Committee.

Comments, Questions, or Concerns?

Please contact Bill Meadowcroft at: [wmeadow@telusplanet.net](mailto:wmeadow@telusplanet.net)