Canadian Prairies Group
NEWSLETTER
of Chartered Engineers
Spring 2007

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TOM MARTIN

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DAVE ELSON

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Chairman's Notes - Spring 2007

At the CPGCE Annual General Meeting held on February 3rd 2007 the Executive Committee was pleased to welcome two new members to its ranks – Arun Kumar and Bob Mote. Both Arun, who has been a regular attendee at many of our technical and social events over the years, and Bob, a somewhat more recent arrival to the province, have already shown that they are very enthusiastic in assisting your organisation in promoting its activities and image here in Western Canada. One of the first topics which they, in large part, raised was the effectiveness of our website at www.cpgce.org. The issue of branding of the chartered engineer was also raised along with other concerns and it was thus felt that this was an opportune moment to try and improve the "Chartered Engineer" image. After much discussion your Executive Committee has therefore decided, as a first step, to revisit the design and layout of the existing website and determine whether or not improvements can be made to make it more "user friendly" and current. If all goes well, members should, in the very near future, be able to avail themselves of the services of a "new and improved" website which, I hope, will prove both a useful and a used resource for all members.

Speaking of the website, members should also note that details of upcoming technical presentations are normally posted for up to three months in advance of the actual presentation date. While this does allow for members to plan their activities to attend those presentations that may be of particular interest to them, it has its drawbacks. One of the major ones is that by planning the program this far ahead, there are times when, for one reason or another, the dates of some have to be changed to meet the changing circumstances of the presenter. By regularly checking the website at www.cpgce.org members can be kept fully up to date with any changes to our schedule and I would heartily recommend that members do this.

Once again I would also encourage members who have knowledge of a specific presentation, paper or topic and a presenter that they feel would be of interest to the membership to contact either myself, or any other member of the Executive Committee. We can pursue the possibility of having this topic presented to our membership - after all this is your organisation. Your Executive Committee is here to serve you, our membership.

Roger Frayne

IN THIS NEWSLETTER

Everyone is welcome to attend the Calgary Technical Presentations.

We meet at the Danish Canadian Club, 727 11th Ave SW at 6:30 pm on the second Wednesday of every month.

Spouses and guests are always welcome.

More details on www.cpgce.org

"The University of Calgary Formula Student (SAE) Car Project"

February 14th, 2007 Report by Roger Frayne

An enthusiastic team of seven engineering students from the University of Calgary made a presentation on

the Formula Student Car competition, or Formula SAE as it is known in the USA. In the USA, the competition is sponsored in part by the Society of Automobile Engineers and in the United Kingdom, the IMechE and IET are two of the principal sponsors. The mission of the team is "furthering the development of the student members and providing them with a competitive advantage through a practical learning experience". Formula SAE originally began as a design competition in Detroit in 1981 and the University of Calgary first competed in Detroit in 2000, sponsored by the Faculty of Engineering, Department of Mechanical and Manufacturing Engineering. In the years following this initial competition the team has competed at Formula SAE East in Detroit in 2001, 2002 and 2003; Formula Student in Leicestershire, UK in 2005 and 2006 and Formula SAE West at Fontana, California in 2006. The 2007 team has over 60 student members and is supported and advised by Dr. S.T. Evans as well as faculty technicians and team alumni.

Competition rules

The competition rules require the design and manufacture of a single seat, open wheel style race car which is attractive, comfortable and safe. Among the criteria evaluated by the judges are handling, acceleration and braking as well as somewhat more esoteric criteria such as affordability (cost), reliability and ease of maintenance. Each entry is assessed on a number of static factors including overall design, cost and presentation as well as dynamic factors including acceleration, skid pan and endurance performance as well as endurance and fuel economy.

Current vehicle design

The current design is based upon steel based, space frame construction with semi stressed engine and drive train. Four wheel, independent, double wishbone, suspension is used incorporating pushrod/bell crank actuated two way damper spring units utilising double A arms, front and rear. Camber, castor, toe, ride height, shock absorber stiffness, anti-roll spring preload and spring rates can thus all be easily tuned and adjusted. The vehicle has a ground clearance of 25mm and the overall centre of gravity is 165mm and weighs 250kg (without the driver). The vehicle's wheelbase is 1956mm with a track of 1270mm

Power is delivered by a standard Honda CBR600F4i engine (common to all designs) with a built in six speed, sequential, manual transmission, custom tuned exhaust and intake coupled to a torsion limited slip differential. The engine has a displacement of 600cc and develops 58 kilowatts at the wheels and is of a four stroke, water cooled design. A semi stressed rear box section links the frame with the rear suspension. A final chain drive allows for a range of ratios which allows for quick change outs during the dynamic testing.

Wheel assemblies have a number of important design issues including strength, weight (unsprung mass), rotating mass, performance and cost. An upright design is used which has a number of benefits namely lightweight, strong and cheap. Hubs are designed with two pre greased, ball bearings. Brakes systems are comprised of 220mm diameter discs matched to AP racing, two piston, aluminum calipers and Ferodo brake pads. The brake rotors are cross slotted/cross cut for cooling which virtually eliminates brake fade.

Current performance characteristics have the vehicle accelerating from 0 to 96 km/hr in under 3.5 seconds with braking to a standstill from this speed in just over 21m and exerting a force of between 1.5G and 1.6G on the skid pan.

Design methodology

Extensive use is made of stock or pre-made parts where possible to keep the overall vehicle cost down. For all other components, these are modelled in CAD software from which drawings and solid models are used to manufacture the parts. Some critical parts require extensive testing from simple check calculations to Finite Element Analyses, destructive and non-destructive testing.

Material specifications

The space frame is fabricated from 1inch diameter,

1018 steel tube with wall thicknesses of 0.049", 0.065" and 0.095" and the final drive shafts are made of 4340, heat treated steel. The custom tripod housings are also made from heat treated, 4340 steel. Off the shelf tripod joints and half shafts are used along with a differential housing made from PVC pipe and a spring loaded, chain tensioner. Wheel hubs are also manufactured from CNC machined 4340 steel. The disc brakes are made from a cast gray iron, Durabar material and the brake calipers use graphite dusted brake pads.

Developments for the 2006 and 2007 car designs

Chassis and suspension

The 2006 design car was a radical re-design of previous efforts with virtually nothing re-used resulting in a vehicle that was vastly superior in strength and stiffness. For 2007 the wheel base has been reduced by 50mm for increased responsiveness and the driver provided with an additional 75mm of leg room. Both the front and rear roll-over hoops have also been modified to comply with rule changes and simplify construction. Design rules dictate a number of design constraints that must be followed. Many of these are related to safety and include side impact protection and a front crumple zone.

Engine air intake and cooling systems

Competition rules dictate that the air intake must be within the safety envelope of the vehicle and must incorporate a 20mm diameter restrictor between the throttle body and the engine. For both the 2006 and 2007 designs the plenum and restrictor are made of carbon fibre and the design is symmetrical – only one mould for both the top and bottom portions. The design was evaluated using CFD to ensure balanced air flow within the intake.

Data from previous designs was used to evaluate the vehicle cooling system. Aluminum was confirmed as the most effective material but a larger radiator was specified. The radiator was re-located to just ahead of the left rear tyre to accomplish a number of benefits including elimination of the blunt body effect, obtain direct airflow perpendicular to the radiator, create a low pressure behind the radiator and to protect it from damage.

Wheel assemblies

Possible improvements in future designs of wheel assemblies include CNC machined aluminum upright members; aluminum foam uprights; aluminum metal matrix brake rotors and hubs; new bearing and hub configurations and purchased wheel assemblies.

"Environmental and Permitting Processes for the Mackenzie Valley Pipeline"

by Brian Zytaruk, Manager, Mackenzie Project Environment Group, AMEC.

Wednesday, March 14th 2007
Report by Arun Kumar

Project Overview:

The drilling activities in the Mackenzie valley, located in the North West Territories (NWT), began in the early 70s. The natural gas, stranded in the Mackenzie valley for over 30 years, is still awaiting development. Imperial Oil Resources Venture Limited is the Client Organization, which is a consortium of companies consisting of Shell Canada, ConocoPhillips, Exxon Mobil and Aboriginal Pipeline Group (APG).

The gas processing and separation facilities have been proposed at three anchor fields (Niglintgak, Taglu and Parsons Lake) interlinked by pipelines of varying sizes from 8" to 30" diameters to gather and transport sweet gas. The proposed pipelines are all "above-ground" lines because of permafrost issues.

The proposed anchor fields typically have an air strip, helipad, barge landing, gravel pad, winter roads and borrow sites. The preliminary studies have looked at modularized units as well as stick built construction methods.

The challenge for construction and operation is the access, which is possible only during winter months. The usual logistical supports are difficult due to limited weather window. Full time helicopter traffic is envisaged for the entire duration of construction and operation.

The estimated cost of the project (Q4 of 2006) totalled 16.2 billion dollars, which is almost double the 2003 cost estimate. The cost of labour, logistics and material

are thought to be the main driving forces for the cost escalation.

AMEC started the environmental work in June 2001. The Joint Review Panel (JRP) looks at environmental, socio-economic and regional land uses. The first gas is expected by year 2014 subject to JRP agreement of the Project.

Environmental Impact Statement (EIS) Overview

AMEC started the environmental impact statement work in the year 2001 with limited guidance on regulation. EIS baseline development was conducted up to 2005, involving 32 communities in total.

The objective of EIS baseline development was to collect data from the 32 communities involved by public participation. Since 2001, two technical workshops were conducted and presently AMEC are in the process of conducting a round 3 EIS technical workshop.

Some of the major concerns of communities during construction activities are spills affecting quality of environment, huge fuel storages, quality of food and beluga harvesting. Air pollution and emission is also a challenge because of huge generator sets at the facilities. The pipeline project has an estimated 300 river/stream crossings, which are designed to satisfy local expectations.

All these concerns are addressed by community participation in environmental monitoring during construction as well as during operations.

The construction camp, which is a dry facility away from communities, is designed to house 1500 persons. A 7 day in and 7 day out working schedule is proposed. Camps and communities have to work together without affecting local customs and traditions of harvesting and trapping.

End notes:

The presentation ended with an interesting Q & A session. The questions were on cost estimation, concerns of logistics and labour, effect of global warming and water levels, and testing methods of pipelines. All the questions were satisfactorily answered by the presenter with a good sense of humour and professionalism.

Data Security Update

On 13th April 2005 Dr Mario Forcinito gave a very interesting presentation on "Data Security and Information Theory for the XXI Century". He recently contacted me regarding an update on his presentation and suggested that we visit:

http://cryptoblog.wordpress.com/

Two articles, amongst many others, caught my eye particularly and are reproduced below.

"Cryptography and Information Theory"

"Data Security and Information Theory are essential to modern life. I believe that far from being the exclusive domain of academics and geeks, the fundamentals and their application are easy to understand for most of people. This is a modest attempt to bring some of the issues to the public discourse."

"Encrypted Hard Drive"

Posted by Mario on March 13th, 2007

"The Washington Post reports the announcement of Seagate's new encrypted hard drive.
This product addresses the security problems created by stolen/lost laptops and the disposal of old computers with hard drives full of sensitive information.

> *SCOTTS VALLEY, Calif., March 12, 2007 /PRNewswire-FirstCall via COMTEX/ — Seagate Technology (STX) today announced that Momentus(R) 5400 FDE.2, the world's strongest encrypting 2.5-inch notebook PC hard drive with a comprehensive suite of powerful security capabilities, is shipping to ASI Computer Technologies for secure notebook systems that will feature Wave Systems Corp. (WAVX) security management software to simplify enterprise deployments.*
>
> *Seagate's Momentus 5400 FDE.2 (Full Disc Encryption) hard drive features perpendicular recording technology to deliver up to 160GB of capacity, a fast Serial ATA interface, and hardware-based AES encryption, a government-grade security protocol used to encrypt all hard drive information transparently and automatically, preventing*

unauthorized access to data on lost or stolen laptops. The encrypting hard drive also gives organizations an easy way to repurpose or retire laptops without compromising sensitive information and to comply with the growing number of data privacy laws calling for the protection of consumer information using government-grade encryption."

Editor, Bill Meadowcroft

Technical Program

Wednesday, April 11th

"Industrial Air Pollution Control Technology Review"

by Kurt Hansen, M.Sc., P.Eng, President, Green Inc. and Heather Jones, P.Eng., AMEC Earth and Environmental.

In today's world there are increasing pressures to either eliminate or significantly reduce emissions from industrial processes to very low levels. Emissions such as volatile organic compounds (VOCs) and oxides of nitrogen (NOx) are among those that are required to be controlled to extremely low levels and the presentation will discuss methods by which such reductions can be attained.

Wednesday, May 9th

"Glenmore/Elbow Drive/ 5th Street SW – Calgary's Largest Interchange Project"

by Jon Halford, P.Eng., Area Manager, Transportation Infrastructure, City of Calgary.

The construction of the Glenmore/Elbow Drive/5th Street SW interchange has been undertaken by the City of Calgary to improve traffic flow at one of the most severe bottlenecks on Calgary's road system. Budgeted to cost approximately $100 million, the improvements will allow for unrestricted movement on the Glenmore Trail from the existing junction at Ogden Road SE to the traffic lights at 37th Street SW together with additional traffic lanes between the new interchange and the Glenmore Causeway and 14th Street SW. The complete project is scheduled to take approximately three years to complete and will be welcomed by thousands of motorists who use this route to commute to and from work every day.

Wednesday, June 13th.

"Engineers in the Computer Age"

by Dr. Robert Mote. P. Eng., GMICE,

Lead Civil/Structural Engineer, Jacobs Engineering

This presentation looks at the impact of desktop computers on engineering calculations. It will illustrate how roles of engineers in the drawing office and engineering calculations have been transformed over the past number of years. To meet the demands of the future there is a need for change and this presentation seeks to change engineers' attitudes about Microsoft Office tools. It looks at three key areas; a comparison of conventional versus electronic calculations, defaults in engineering applications and the cost benefit analysis of change.

Possible future presentations

"Dynamic Analysis of Pipe Rack Structures" – Dr. Robert Mote

"Money Laundering" – Sgt. Steve Scott RCMP Integrated Proceeds of Crime (ICOP) unit

"Grow Ops" – Calgary Fire and/or Police Department or RCMP

Social Program

No formal Social Program has been proposed so far this year. As in the immediate past, any member who wishes to organize a function, visit or activity during the year may do so. We will gladly offer assistance.

It must be remembered that all functions are to be self funded.

The CPGCE, its Executive Committee and Members organizing any particular event cannot be held responsible for any injury, loss or other misfortune occurring immediately before, during or after such event. It must be clearly understood that members, their families and guests participate in the event at their own risk.

Your CPGCE Executive Committee

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Privacy

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

Name, Address, Telephone Numbers, Email Address and 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

From our European Correspondent

Canal du Midi - 17th Century Mega project

At my wife's request we are spending a year in southern France. We have rented an 1855 wine merchant's house in the village of Caunes-Minervois in the département of Aude. Our 15 mile trip into Carcassonne, the nearest large town, takes us past a section of the Canal du Midi. In November of last year while driving into Carcassonne past the Locks I noticed the water had been drained to facilitate repair of the locks. The locks are of an unusual oval shape constructed from blocks of stone. This particular lock was built on an aqueduct over a small river than flows beneath. Quite an achievement when I researched and found the system was completed in 1681.

A Monsieur Pierre-Paul Riquet of Beziers was what would be best described today as the entrepreneur who conceived the concept, developed the design and brought it to fruition. At the time movement of goods was extremely cumbersome and inefficient being almost exclusively by horse and cart. In Roman times a canal had been considered but never implemented. A canal was proposed several times in the intervening period but a suitable design was not put forward. France had major trade routes to Europe and was developing North American trade. To get to the Mediterranean coast at that time required sailing around Portugal and Spain. The latter was the major European power of the times. Sailing a ship

around the coast was not a trivial voyage, with potential losses from the weather and African pirates. There was also a tax for sailing past Gibraltar.

In the mid 17th century France, Riquet proposed a canal from Cette (now Sête) at the entrance to the Etang (saltwater lagoon) du Thau to Toulouse, some 240 kilometres. From here the boats could navigate down the Garonne River into the Gironde to Bordeaux. This was an incredible enterprise. Riquet had the agency to collect the Salt tax (a very lucrative state monopoly) for Louis XIV. To get the king's support he enrolled the Bishop of Toulouse and together they made the proposal to Colbert, Louis' Minister of Finance. Colbert immediately saw the strategic advantages of the project but there was much politicking. At the time Riquet was 58. There were many battles fought and mainly won by Riquet.

The major issue in the development of the Canal du Midi (or the canal between two seas), was the supply of water. Languedoc is dry region of France without any major rivers to feed the system. Riquet's solution was a very innovative hydraulic system. He developed a water collection network in the Black Mountains (Montagne Noir). He created an artificial lake in the middle of the mountains called the Bassin de Lampy. Water is collected here by small canals and then fed into the Barrage of St. Ferrèol. This was at the time the largest man made reservoir in the world; it holds 6 million m^3. The wall which holds the water is built along military lines (similar to a fortress) which is unsurprising as Vauban, France's great military engineer, was heavily involved in the project and military engineering was the source of all civil technology. The basic dam and the associated hydraulic system are still in place.

The water is then fed through another small canal to the Seuil de Naurouze, the high point of the Canal du Midi

some 200m above sea level. The canal passes through 16 locks into the Garonne River at Toulouse and 47 into the Etang du Thau. The construction of the canal system

included 126 bridges, aqueducts to feed water to the canal, 6 dams and 1 canal bridge. There were also enumerable quays, roads lock keepers' houses etc. to be constructed. This was a true mega project of its time. The project took from 1667 to 1681. Once in operation continuous improvements were implemented up until the mid 19th century when management of the canal was handed over to a railway company which unsurprisingly allowed this competitive transport system to decline.

The construction of the Canal du Midi had all the hallmarks of a mega project that long time participants in the Canadian engineering scene will recognize. It took longer than expected, bankrupted Riquet who died 1680 one year before its completion. It cost far more than expected, but once put into operation was a great success. It took a work force peaking at 12,000 fourteen years to move the seven million m^3 of earth all by hand. Riquet was by all accounts a model employer who provided many benefits to his workers.

It turned Sête from a small fishing village into a major port, reinforced Toulouse's position as the pre-eminent city of the region and drove the commercial growth of Bezier, Narbonne, Carcassonne and Castelnaudary.

What is amazing today is how much of Riquet's original infrastructure is still in place. The basic hydraulics of the system has changed little. In fact the canal now also acts as a reservoir for irrigation with supplementary storage and it is managed to meet both functions.

The refinements to the original design are in engineering. Where the canal crossed a river, Riquet's solution was to build a weir upstream allowing water to flow into the side of the canal and an overflow on the other side weir on the downstream weir. One assumes these were high maintenance. Most of these have disappeared and been replaced with canal bridges such as the large one at Bezier across the river Orb built in 1853.

Another reason for the canal bridge outside of Bezier was because at Fonsérannes Riquet had constructed a flight of nine locks to take the canal down to the River Orb. It took about an hour to work through these locks and as the traffic increased this became a bottleneck. The canal bridge reduced the number of locks in the flight.

The locks are oval in shape and designed to accommodate several oval boats. As canal boat design developed into a rectangular shape with semicircular

ends these became less efficient. However virtually all the original fitted stone locks are still in place albeit with modern steel gates.

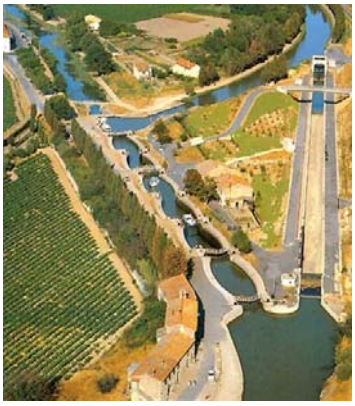
A landscaping function of 45,000 trees was planted along the canal. Today this would be considered an environmental improvement and incidentally makes the canal very picturesque. They were planted so the roots would strengthen the banks and the overhang trees

reduce evaporation from the canal.

Today almost 330 years since the canal was first completed the traffic is entirely non commercial. This does not detract from the original concept and the engineering, design and its implementation. A project of this size today would be considered a major project and the fact that it is still operational after a third of a millennium is evidence of the quality of the engineering at the time.

Addendum.

At the Locks at Fonsérannes the current operator of the Canal du Midi has installed some new technology. It takes 45 minutes to ascend through the six locks and 30 minutes to descend. Some 20 years ago a device called a 'Pente d'Eau' (literally a corner of water) was installed. It is basically a rectangular trench along which a movable gate is moved up or down carrying a triangular cross section of water plus the boat. The trough can be seen on the right of the photo. The motive power for the gate is supposedly two modified old diesel electric railway locomotives with rubber tires linked across the gate. As one can imagine, moving several hundred tons of water up or down an inclined slope with a sliding watertight gate has its challenges with a rubber tire powered motive power unit.



I'm told the design has not been a success. If I perchance see it in operation I will advise. Apparently there are two of these revolutionary devices in France. Meanwhile the Canal du Midi still operates reliably if somewhat slowly with its original six lock gates.

We would prefer to send your CPGCE Newsletter via e-mail, if possible. Please send your email address to Bill Meadowcroft at wmeadow@telusplanet.net