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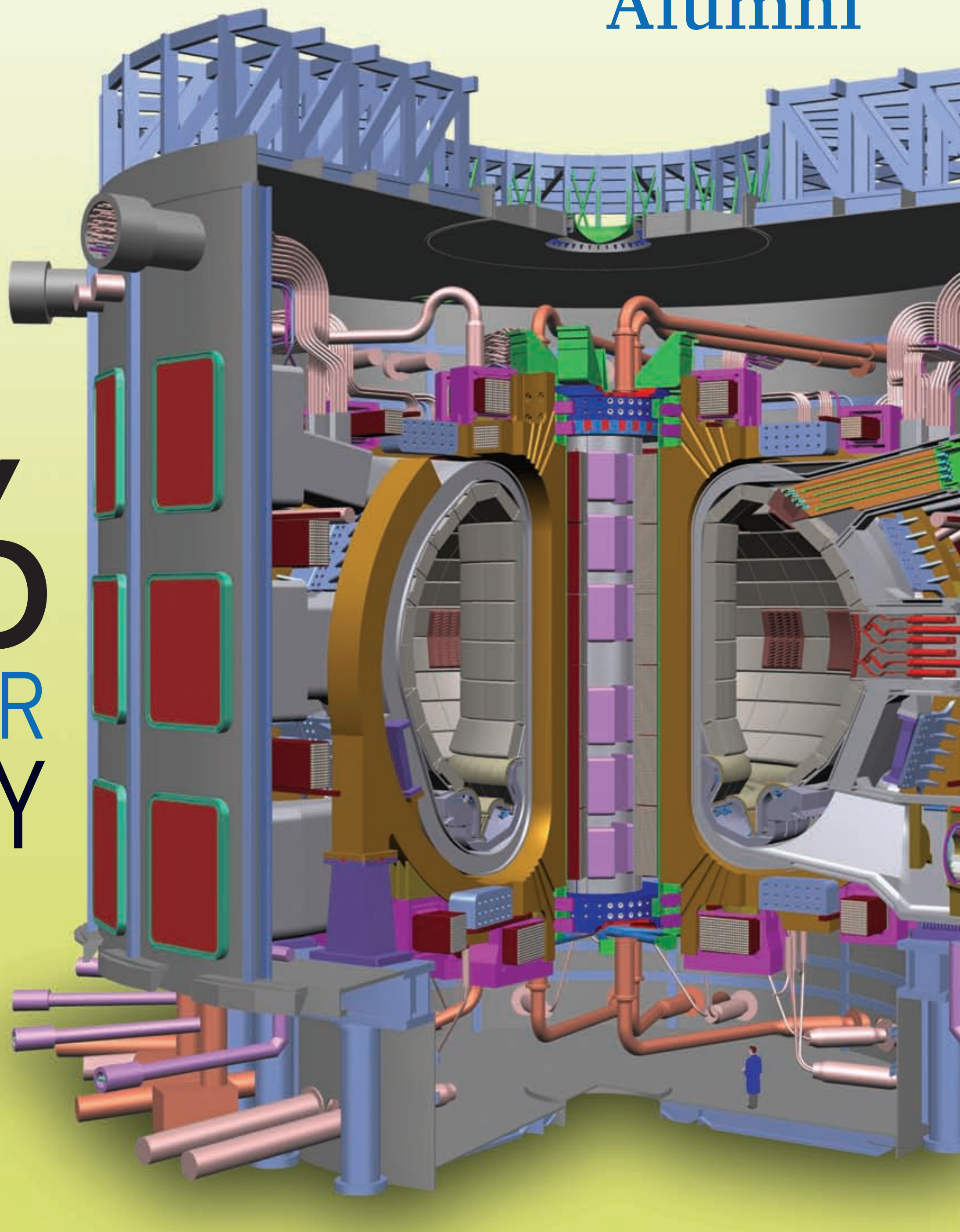
U of A Engineer

Keeping in Touch with Alumni



2016 A NUCLEAR ODYSSEY

The Master of Frac | Arms Around Petro-Canada | Earthshaking Collaboration

Message from the Assistant Dean

Fostering innovation. Transforming technology. Applying science. These are the roles and goals of the Faculty of Engineering.

We foster innovation through our work with Imperial Oil and Alberta Ingenuity with our Centre for Oil Sands Innovation.

We transform technology at the nano scale. We are applying molecular sieves to clean up oil sands production. We apply science to the basic resource industry. We are cleaning up coal production.

Fostering innovation, transforming technology, and applying science are challenging responsibilities. Those are the reasons we employ dozens of industry advisory committees, we recruit world-class researchers, and we nurture partnerships with corporations. We work to ensure that our curriculum is relevant to tomorrow's engineers. We have designed and built facilities equipped with the latest technology to support teaching and research.

Excellence is paramount to all we do. We take pride in the quality of our graduates. Our alumni have shaped the quality of life in Alberta, in Canada, and across the world for the past century and will continue for years to come. As we plan our centenary events in 2008, there will be much to celebrate.

Please plan to take part in activities of the Faculty. This year's Reunion Weekend will be a warm-up event to next year's centenary. Mark the dates September 27 to 30, 2007. Join us.

Yours truly,

David M. Petis
Assistant Dean
External Relations

Vision

To be one of the largest and most accomplished engineering teaching and research centres, a leader in north America.

Mission

To prepare top quality engineering professionals, to conduct world-leading research, and to celebrate the first-class reputation and outstanding accomplishments of alumni.

Values

Dedication, integrity, professionalism, and excellence in teaching, research, and service to the global economy and community.

NEW to www.engineering.ualberta.ca

In Memory of a Construction Giant

The late John Poole (Civil '37, LLD [Hon] '87) and his brother George (Civil '43) bought Edmonton-based Poole Construction from their father Ernest in 1948, building it into one of Canada's leading construction companies before selling it to a management team led by Bob Stollery (Civil '49, LLD [Hon] '85) in 1977. As PCL Construction, it now ranks as the largest Canadian company in its industry, active across the country as well as in the United States and the Bahamas.

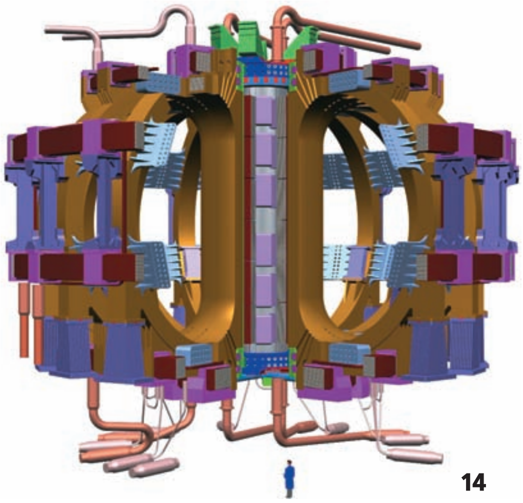
Poole was a big supporter to the Faculty of Engineering. Dr. David Lynch said, "John and Barbara Poole, and their family provided early and ongoing support for the construction of some of the new Engineering buildings that are on campus."

Those contributions led to one of the few structures to bear their names, the John and Barbara Poole Family Atrium at the U of A's Engineering Teaching and Learning Complex.

Read the complete memorial to John Poole at www.engineering.ualberta.ca.

Table of Contents

Summer 2007



COVER STORY

6 Arms Around Petro-Canada

As Petro-Canada's Calgary-based senior vice president for oil sands, Neil Camarta (Chemical '75) believes his job is to give engineers and their supervisors a clear map and to keep them moving along the road. He sees his role as barrier-breaking and providing "simple, clear messages that people can get their arms around."

FEATURES

12 Clean Water Champion

Every home and business is potentially vulnerable to both accidental and intentional water contamination. Process systems engineer Dr. Carl Laird (Chemical '00) has become a North American expert on determining water contamination sources in distribution systems. He has worked on research projects in tandem with both public health scientists and researchers at U.S. National Laboratories.

14 2016: A Nuclear Odyssey

In 2016, a $14.3-billion international engineering venture will explore the technology of nuclear fusion, creating enough energy to light a small city on less than a thimbleful of liquid hydrogen isotopes. High-energy plasma will ignite in what nuclear physicists describe as "the burn." This milestone in the development of human technology will be celebrated by Dr. Jerry Sovka (Chemical '58) who is managing the construction of the ITER project in France.

21 Tour of Duty: Mission to Afghanistan

As commander of an infantry platoon attached to Edmonton's 1st Service Battalion in 2004, it was Lieutenant Rob Gliddon's (Mechanical '07) job to orchestrate precious assigned resources—34 people, a collection of rough and ready vehicles, radio systems, and weapons—into an efficient, mobile force. The job: to protect convoys delivering essential supplies of food, water (essential in merciless 40 degree C temperatures), spare parts, and ammunition to 800 troops stationed throughout what Gliddon terms "a rough neighbourhood."

24 Earthshaking Collaboration

When you think of earthquake zones, Edmonton does not immediately come to mind. But earthshaking research taking place in Civil Engineering at the Faculty of Engineering applies to construction components in any area of the world that experiences tremors. In Canada, that includes the West Coast primarily, but also regions of northern and eastern Canada. Thanks to a collaboration between researchers and industry, a reaction frame reveals information about earthquake-sized forces.

28 An Imperial Career

His first paycheque from Imperial Oil came in the summer of 1945 when he worked as a student geologist and engineer at Pouce Coupe in northeastern British Columbia. Four decades later Don Lougheed (Mining '48) retired from the executive suite at the same company.

32 The Master of Frac

In 1984, Ron Bullen (Mechanical '61) concluded his first $6-million equipment sale to Russia and created the first joint venture between the Soviet state oil company and a Western company. The deal was struck not on the industry tradition of pay-per-service, but rather on a groundbreaking agreement that saw Fracmaster winning a share of the increased Soviet oil production. Five years later, the international business press hailed this as a "dream deal."

DEPARTMENTS

5 Engineer.alum@ualberta.ca

5 In memoriam

36 Cross Hairs on History – Pioneer of Ultrasound

The Dean of the Faculty of Applied Science (later renamed the Faculty of Engineering) from 1921 to 1929, Dr. Robert William Boyle is widely acknowledged as a pioneer of modern ultrasound. His research during this period included a detailed study of acoustic cavitation resulting from the passage of ultrasonic waves. He also investigated the transmission and reflection of waves, new methods to detect and visualize ultrasonic beams, and the diffraction and scattering of ultrasonic beams.

38 Kudos

39 Reunion

Message from the Editor

In this issue of *U of A Engineer* magazine we fast forward to 2016 and an upcoming milestone in the development of human technology: a nuclear "burn." The biggest and costliest science project ever built on Earth, ITER is a $14.3-billion international engineering venture based in France. This project will come to fruition (or should I say "fusion"?) with the help of Dr. Jerry Sovka (Chemical '58), who is managing the construction of the project.

Also in this issue we "fast backward" to the 1920s and the pioneering work on ultrasound conducted by Dr. Robert William Boyle, the Dean of the Faculty of Applied Science (later renamed the Faculty of Engineering).

U of A Engineers have been part of many scientific and technical breakthroughs in history, and the *U of A Engineer* magazine has chronicled these achievements: the invention of the crash position indicator (the forerunner of the "black box" flight locator) (winter 2005), the Alaska Highway (fall 2004), the Canadarm (summer 2004), Cold War technology (winter 2004), and a World War II top secret project (fall 2003).

Graduates of the Faculty of Engineering can take great pride in their contributions. And as editor of the *U of A Engineer* magazine, I take great pride is showcasing your achievements.

If you know of other significant milestones in engineering history, please contact me at 780.492.4514 or at sherrell.steele@ualberta.ca.

Yours truly,

Sherrell Steele

Communications and Public Relations Strategist

Faculty of Engineering

UofA Engineer

Summer 2007 Issue 23

U of A Engineer is the Faculty of Engineering alumni magazine. It is published three times a year by the Dean's Office and is distributed to Faculty of Engineering alumni, friends, and staff.

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errors and omissions

Dr. Alan Mather (Chemical '60, MSc Chemical '62), a professor emeritus, responded to the "Crosshairs on History" article in the winter 2007 issue of *U of A Engineer*. Mather believes the first PhD was not R. A. Ritter, but rather Ralph Ansley in Civil Engineering.

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Chemical and Materials Engineering

Williams, Dr. Michael (Professor emeritus)

Regarding "The Rules of Rheology" (about Dr. Arthur B. Metzner [Chemical '48]) in the *U of A Engineer*, winter 2007 edition, readers may be interested in one more fact about Metzner that was in the original draft of the obituary (authored by me) and omitted in the final article. I, too, am a rheologist and I knew Art well. Metzner was awarded the Bingham Medal by the Society of Rheology in 1977. This is the most prestigious prize available to North American rheologists and only the most talented and accomplished people have received it.

Another contributor to the Metzner article was the associate dean, Faculty of Engineering, U of A, Dr. Ken Porteous, who was a graduate student with Metzner in the Chemical Engineering Department at the University of Delaware.

Civil Engineering

Jaques, Susan (Civil '93)

In 1997, I moved from Calgary to Brisbane, Australia, where I continued contributing to the oil and gas pipeline industry for nine years, making many friends in Australia—including my Australian husband Jeff, whom I married in 2004. He works for the Canadian engineering company Hatch. In 2007, he transferred to South Africa for about two years. I have also joined Hatch and moved to South Africa. I will be working in project controls and estimating on large infrastructure projects upgrading rail, ports, and marine facilities to more efficiently export South Africa's iron ore. This will be a change from my 13 years in pipeline engineering, operations, and project management, but I look forward to the new challenges.

Parker, Gil (Civil '59)

I recently published a fifth book, *Looking Through "Glasnost,"* an examination of people in transition from the Soviet Union to Russia and adjacent new nations—stories gleaned from 15 years of travel and work in Russia.

My four prior books include:

Bridging the Pacific, Victoria's Sister Cities

Aware of the Mountain, Mountaineering as Yoga

Mom, Marian & Me, A Family's Poetry

Coast Mountain Men, Mountaineering Stories from the West Coast.

Electrical Engineering

Jain, Dr. R. C.
(MEng Electrical '85, PhD Electrical '88)

The story "Plug and Play the Oil Game" (in the fall 2006 issue of the *U of A Engineer*) was very interesting to me. In fact, I have used some of the equipment (temperature-controlled ovens) in the lab of Drs. Fred Vermullen and Steve Chute, located on the ground floor of the then Electrical Engineering department. Professor Chute was on my PhD committee, and I used to be afraid of his deep theoretical questions. They both were known as excellent teachers and won many awards for their outstanding instruction on electromagnetics.

It gives me immense pleasure to see that the work initiated by these two experts has come to the stage of yielding rich dividends. In fact, most students see electromagnetics as a dull and dry, over-mathematical area with little scope for practical applications.

Due to the low prices of the crude in the '80s and the cost of this technology, people had very low level of hope in this approach. I am sure high crude prices must have also tipped the balance in the favour of Dr. McGee and his technology. Taking this to the commercial level, McGee must be a very dedicated and competent engineer.

I wish all the best to Dr. McGee. Kindly convey my best wishes to him.

I hope that the research work initiated by the U of A professors will create many such success stories in future as well and bring more prestige to the University.

in memoriam

The Faculty of Engineering sincerely regrets the passing of the following alumni and friends.

Barnhouse, Frank
(Electrical '34)

Buckley, Lt. Colonel Robert R.
(Mining '45)

Hegler, Wyatt
(Mining '36)

Johnston, G. Calvin
(Civil '56)

King, Dr. Robert
Professor Emeritus
(Electrical '47)

Kuwahara. Kenneth
(Electrical '47)

Putters, Jean
(Electrical '60)

Manifold, Albert
(Mining '45)

McArthur, C. Patrick
(Electrical '60)

Neal, Jack
(Electrical '52)

The Faculty of Engineering was recently made aware of the following alumni who passed away more than a year ago.

Brooks, Gordon
(Chemical '52)

Carscadden, Thomas
(Electrical '47)

Petro-Canada's Edmonton refinery.

Arms Around Petro-Ca

by Bruce White

How many engineers does it take to build an oil sands plant? Thousands, says Neil Camarta (Chemical '75), who has already built one and is planning several more. To build a 100,000-barrel-a-day oil sands plant it takes:

- roughly 500 staff engineers to do the original design and manage construction,
- another 2,000 contract engineers to do detailed piping designs, electrical designs, and so on,
- plus another 10,000 tradespeople such as welders, electricians, and pipefitters
- and, finally, 1,000 operations people—including 100 engineers—to produce the oil once the project is built and to tweak production once the plant is up and running.

"We have a sucking noise here for engineers," says Camarta, who is Petro-Canada's Calgary-based senior vice president for oil sands.

"We're hiring them from all over the planet. We use engineers from every kind of nada

Neil Camarta
(Chemical '75)

discipline—mining, reservoir engineers, chemical, mechanical, and kinds of engineers you've never even heard of."

The oil sands business is a different ballgame from the old oil industry. Bitumen is a heavier hydrocarbon than conventional crude or heavy oil, containing more carbon and fewer hydrogen molecules. High-quality oil sand is about 11 percent bitumen.

Taking oil sands from the ground to your gas tank requires many processes. First, if the resource is near the surface, it is scooped from the ground with giant shovels. Deeper deposits are liquefied underground by an "in situ" process such as steam-assisted gravity drainage (SAGD) and pumped to the surface. Bitumen and sand are separated. The bitumen is diluted and piped to an upgrader. Coking units remove carbon. Hydrogen from natural gas is added to create synthetic crude. It's piped again to a modified oil refinery that turns it into gasoline, jet fuel, and other products.

Camarta compares the oil sands business to assembling cars, except that instead of working with car parts, he's working with molecules.

"Manufacturing engineers who have worked in car assembly plants are just as useful to me as oil and gas engineers, because once you build these things they have to run very reliably or you won't make any oil," he says.

As the point man for Petro-Canada's "10-billion-barrel" oil sands strategy, Camarta has a series of multi-billion-dollar projects on the go. The company is a partner in Syncrude, which has mined bitumen near Fort McMurray since the early 1970s and continues to expand.

Tweaking and expansion ("debottlenecking" in the industry jargon) are underway at Petro-Canada's MacKay River, which Camarta describes as "arguably the best SAGD project on the planet." Detailed engineering begins next year on Fort Hills, another colossal surface mine. To handle the Fort Hills output, an upgrader will be built simultaneously in Sturgeon County. Later on the agenda are two more in-situ projects, Lewis and Meadow Creek.

"These are the biggest projects on earth, they're right in our own back yard, and they

"We have a sucking noise here for engineers," says Camarta.

Four steam generators at MacKay River.

A Petro-Canada drilling rig near Cochrane, Alberta.

"That's what engineers are built for, that get-smart stuff."

are very engineering-intensive," says Camarta.

"After you build them, you continue to engineer them intensively because you want them to produce more oil. And that takes engineers to tweak them, to de-bottleneck them."

Fort Hills, like all the oil sands mines before it, will be built in chunks—manageable projects of 100,000 barrels per day capacity completed every two years or so until it reaches 400,000 bpd.

"You don't send everybody home and then five years later start again. You just keep going. You space them about every two years of continuous construction: bam, bam, bam. The advantage to that is that, hopefully, you can hang on to the same engineers, the same construction workers, and you all learn together—you get better every time."

Perhaps counterintuitively, the oil sands industry is a place where an engineer with a serious environmental bent can make a difference. Producing oil from in-situ oil sands releases twice as much carbon dioxide into the atmosphere as it takes to produce light petroleum. However, new technologies are constantly under development to reduce the amount of energy it takes to produce a barrel of oil.

The original oil sands processes—originated by U of A professor Dr. Karl Clark back in the 1920s and adopted by industry pioneers Suncor and Syncrude—involved moving ore from the mine by truck and conveyor belt, then mixing it with hot water in huge vats for separation.

"Then someone came up with the bright idea that we could just use a slurry pipeline: we could put the hot water in the pipeline, move it from A to B—and by the way, it will mix the oil sand and the hot water at the same time. It will do two things."

A key person in the development of this "hydrotransport" method was Dr. Jacob Masliyah, a Chemical Engineering professor and research chair who in 2006 was awarded an Order of Canada for his work.

"That technology alone has reduced the amount of hot water we need and the temperature of the hot water tremendously," Camarta enthuses.

"That's a wonderful engineering application. That's what engineers are built for, that get-smart stuff."

On the in-situ side, researchers are looking for ways to reduce the amount of natural gas used to make steam for SAGD. One promising avenue is vapour extraction (or Vapex), in which propane and butane

Engineering as Communications

After 32 years as an engineer in the oil industry, Camarta has evolved into a communicating engineer concerned more with big-picture issues than with individual calculations.

"I don't have to work out the size of a pipe, but I can get a pretty good gut sense of whether that pipe should be there at all, and whether we should invest in the pipe. That's where I come in," he explains.

His job is to give his engineers and their supervisors a clear map and to keep them moving along the road. He sees his role as barrier-breaking and providing "simple, clear messages that people can get their arms around."

"When you're working with 500 engineers, if there's confusion or indecisiveness then nothing is going to move forward. You've got to be able to step up and be the one who sets the purpose: this is what we're going to do today."

He credits this ability to his upbringing as an Alberta farm boy, the grandson of Italian immigrants lured to the Edson area by free land.

"When you're in farming, you have to be a pretty clear thinker. Everything's in the moment, and you have to make quick decisions. You also have to be pretty straight-shooting about communicating to anyone else you're dealing with."

In his teens, Camarta wanted to work in the oil sands, but not in the role he ended up with.

"By the end of high school I was the only boy left on my school bus, because all the other boys dropped out of school and went cat-skinning up in Fort McMurray, bringing home huge paycheques and buying big pickup trucks. And that's what I wanted to do," he recalls.

However, Camarta's mother insisted that he finish high school. With his good grades in math and sciences, Camarta followed a friend into Chemical Engineering at the U of A. His professors included Dr. Fred Otto (Chemical '57, MSc Chemical '59), who taught thermodynamics and later became Dean of Engineering. He also was inspired by Dr. Don Robinson, head of Chemical Engineering and co-author of the Peng-Robinson Equation of State used by petroleum engineers everywhere to model reservoir performance. ("He was a great professor," Camarta recalls.)

Camarta was one of 19 young men and one woman to graduate in Chemical Engineering in 1975. He left the U of A on a Friday and reported to work for Shell Canada on Monday morning. Through the height of the 1970s boom, he worked out of Calgary on oil and gas fields around Alberta. After a spell in Toronto, he moved to London to become head of corporate strategy in Shell International's coal and oil businesses.

Camarta's next posting gave him a front-row seat in history. He was in South Africa at the moment that apartheid ended and majority rule began. African National Congress leader Nelson Mandela was Camarta's neighbour in Johannesburg for a while before Mandela became president in 1994. Soon afterwards, Camarta returned to Alberta, where Shell Canada put him in charge of its new oil sands operation. He oversaw the building of the Muskeg River mine, which began producing bitumen in 2002.

Rather than accept another overseas posting, Camarta decided in 2005 to retire from Shell after 30 years with the company. However, his life of leisure and travel lasted less than two days before he was recruited by Ron Brenneman, Petro-Canada's president and CEO.

"If it's $60 oil and you're an oil sands guy, you don't want to be on the bench. You want to be on the ice," he says.

Within two months he moved into a modest office at Petro-Canada Centre. It doesn't have the requisite view of the mountains, but is nonetheless unforgettable because of a mounted bull bison's head on the wall, a gift from the Fort McKay Indian band. His desk is small and tidy, especially when you consider that his workload includes projects with a total stated value in excess of $10 billion.

Camarta isn't the only Alberta farm boy to make an impact as an engineer in the oil business. As a farmer, Camarta explains, you're a handyman—always fixing things and working with equipment—so, before you even arrive at university you have a good preparation for engineering.

"Guess what engineers do their whole career? They always fix stuff. That's what I do all day long. It's not always engineering things—it's some problem that I have to step into and help people fix."

vapour are injected into the well to stimulate the flow of bitumen. Mixtures of steam and vapour also are being tested. All options are on the table for Camarta's next big project after Fort Hills, the Lewis property, which contains three billion barrels of in-situ bitumen.

"Instead of 40,000 barrels per day SAGD projects, can we make it bigger, say 80,000 barrels per day? Can we get off gas? Instead of burning gas, can we burn something else to get steam?"

One alternative is burning asphaltine, a waste product, to replace natural gas for making steam. Nuclear power is another option. So is injecting oxygen into the ground and burning bitumen to stimulate flow.

"We're pretty open-minded about everything," Camarta says.

"But by the end of this year we will know exactly what we're going to do."

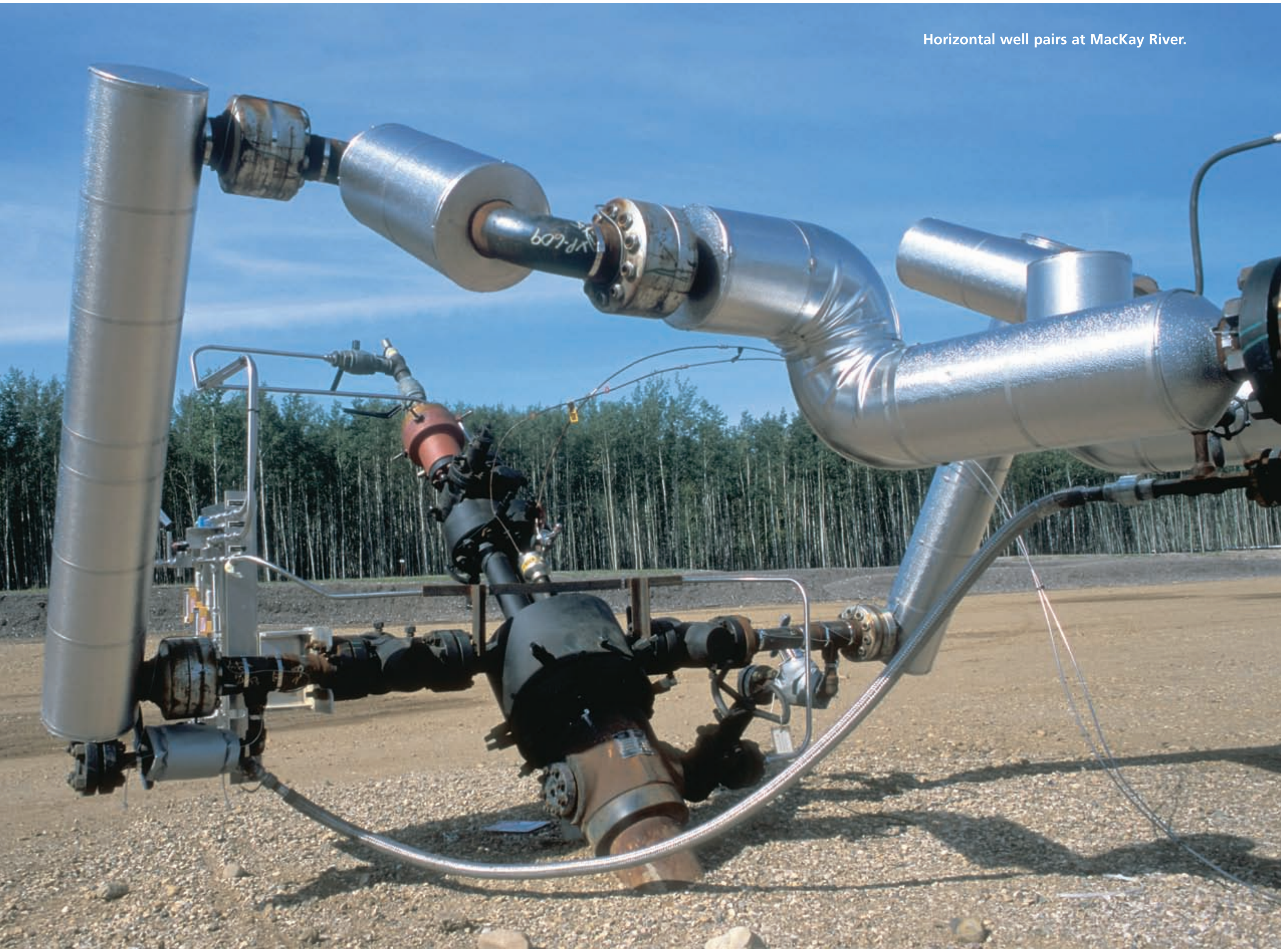
In the past 10 years, the amount of energy needed to produce a barrel of oil has decreased by 40 percent—and saved a lot of money as natural gas prices soared. The same is happening to water consumption and the emissions of carbon dioxide, a key culprit in global warming.

"The potential is there to take the CO_2 that comes out of the upgrader—it's almost pure CO_2—and capture it, compress it, and put it in the ground," Camarta says.

Alberta has numerous old oil and gas fields that are suited to this underground sequestration of CO_2. Pumping CO_2 into the ground also stimulates production from tired, old oil fields. Of course all this will require engineers to help build the infrastructure to remove, compress, and pipe away the carbon dioxide. Something else for Camarta to put his arms around.

One alternative is burning asphaltine, a waste product, to replace natural gas for making steam.

Bruce White is an Edmonton-based business writer and editor.



Horizontal well pairs at MacKay River.

Clean Water CHAMPI

Water is basic to human life. North Americans enjoy water supplies that are, for the most part, safe and pure. Yet we still hear stories about contamination—places like Walkerton, Ontario, and North Battleford, Saskatchewan, come to mind—and the spectre of terrorist warfare through water contamination lurks in the background.

Wild Alberta Gallery at the Royal Alberta Museum

A model of a drop of water enlarged 200 times showing a myriad of tiny organisms.

It is reassuring to know that technology is on top of it all. Water purification systems are continuously improving, and methods of detecting contamination are becoming increasingly sophisticated. Process systems engineering, a branch of chemical engineering, is the lead in this field, and one of its disciples is Dr. Carl Laird (Chemical '00).

Laird, who was raised in Bonnyville, Alberta, has become a North American expert on determining water contamination sources in distribution systems. He has worked on research projects in tandem with both public health scientists and researchers at U.S. National Laboratories.

The technology used, called large-scale optimization, relies heavily on computers and mathematics as well as engineering. Whether the contamination stems from accidental water-borne disease or deliberate terrorist activity, the process is similar: identify the contaminant, isolate the source, and then find solutions to remove the contaminant or render it ineffective.

"Every home and business is connected to a water distribution system, and that makes them vulnerable to both accidental and intentional contamination," says Laird.

"In addition, this also means that every home or business could be a potential source of contamination. Just think of the number of water taps in a city the size of Edmonton and imagine how difficult it would be to isolate the source of contamination using conventional methods. You can't rely on the first medical reports filtering in. That might take days or weeks, and, by that time, hundreds or thousands of people could be exposed. Computerized large-scale optimization can reduce the playing field for the people charged with finding the source and solving the problem."

Laird's interest in process systems engineering began in 1996 when he went to work for Hyprotech Ltd. (now Aspen Technologies Inc.) in Calgary as a co-op student.

"Like many Chemical Engineering students, my first thought was to work in the oil and gas industry," says Laird.

"When I went to Hyprotech and got involved with process simulation tools, I became hooked—not on oil, but on simulation technology."

The flexibility of Engineering's Co-op program enabled Laird to continue his full-time work at Hyprotech for two years, instead of the usual eight-month term, and

Dr. Carl Laird (Chemical '00) demonstrates the powerful advanced computing clusters that perform efficient parallel solution of large numerical problems like the water network source inversion problem.

then part time until graduation. Exceptional marks and five years' work experience as a simulation framework design engineer earned Laird a place as a graduate student at Carnegie Mellon University in Pittsburgh, a leader in chemical process systems engineering, where he studied under Professor Lorenz T. Biegler.

Laird had barely arrived in the U.S. when the 9/11 terrorist attacks occurred, raising fears of sabotage from other quarters such as germ warfare. By the time defense budgets for Homeland Security were revved up, Laird had completed his first year. He began collaborating with researchers at Sandia National Laboratories (SNL) in Albuquerque, New Mexico. In an effort to better protect the public, Laird and the SNL researchers developed advanced techniques for determining potential contamination sources in complex water networks with limited sensor information.

"Sensor technology that captures data, combined with numerical tools that analyze it, should be able to solve what at first appears to be an intractable problem," say Laird.

"We are not only examining model formulations, but also the fundamental numerical algorithms."

Two summer placements at the IBM T. J. Watson Research Center in New York, working with leading optimization experts like Andreas Wächter, enabled Laird to refine the technology and his expertise.

"Today we are using parallel computing and solving problems using water distribution models of real cities. We can get results even with limited sensor information. However, when a more sophisticated sensor system is installed, it enables us to be faster and more accurate."

Convincing cities to invest in sentry sensor systems has been a laborious process, but increased awareness is leading to action, according to Laird.

"We have developed a lot of technology to solve large numerical problems like this. Now we need to take what we've developed and apply it to other important areas—like human health concerns."

With his newly minted doctorate in hand, Laird has moved on to the University of Pittsburgh for a year to do just that. His post-doctoral work will focus on engineering applications in the field of epidemiology (disease control). The research team, led by Donald Burke and Derek Cummings, is using models to better understand the spread of diseases like dengue fever.

"Hopefully, we can increase our understanding of disease spread and, through the use of advanced computational tools, assist people who make health policy with their important decisions."

This summer, Laird will move to a new post in the chemical engineering faculty of Texas A & M University and continue his specialized research work.

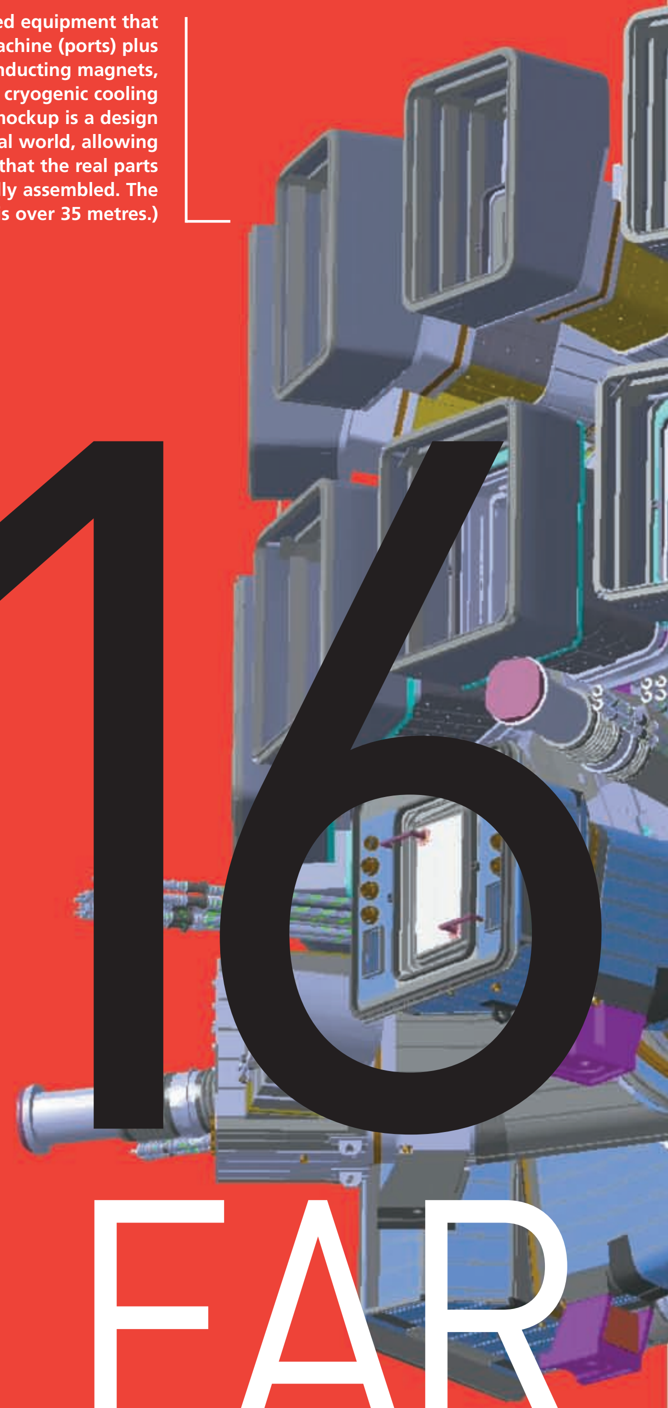
"I never thought when I enrolled at University of Alberta that chemical engineering could take me so many places," says Laird.

"Process systems engineering is pushing the frontiers in ways that will positively impact all aspects of our lives."

"Water is life's matter and matrix, mother and medium. There is no life without water."

—Albert Szent-Gyorgyi, Hungarian biochemist and Nobel Prize Winner for Medicine.

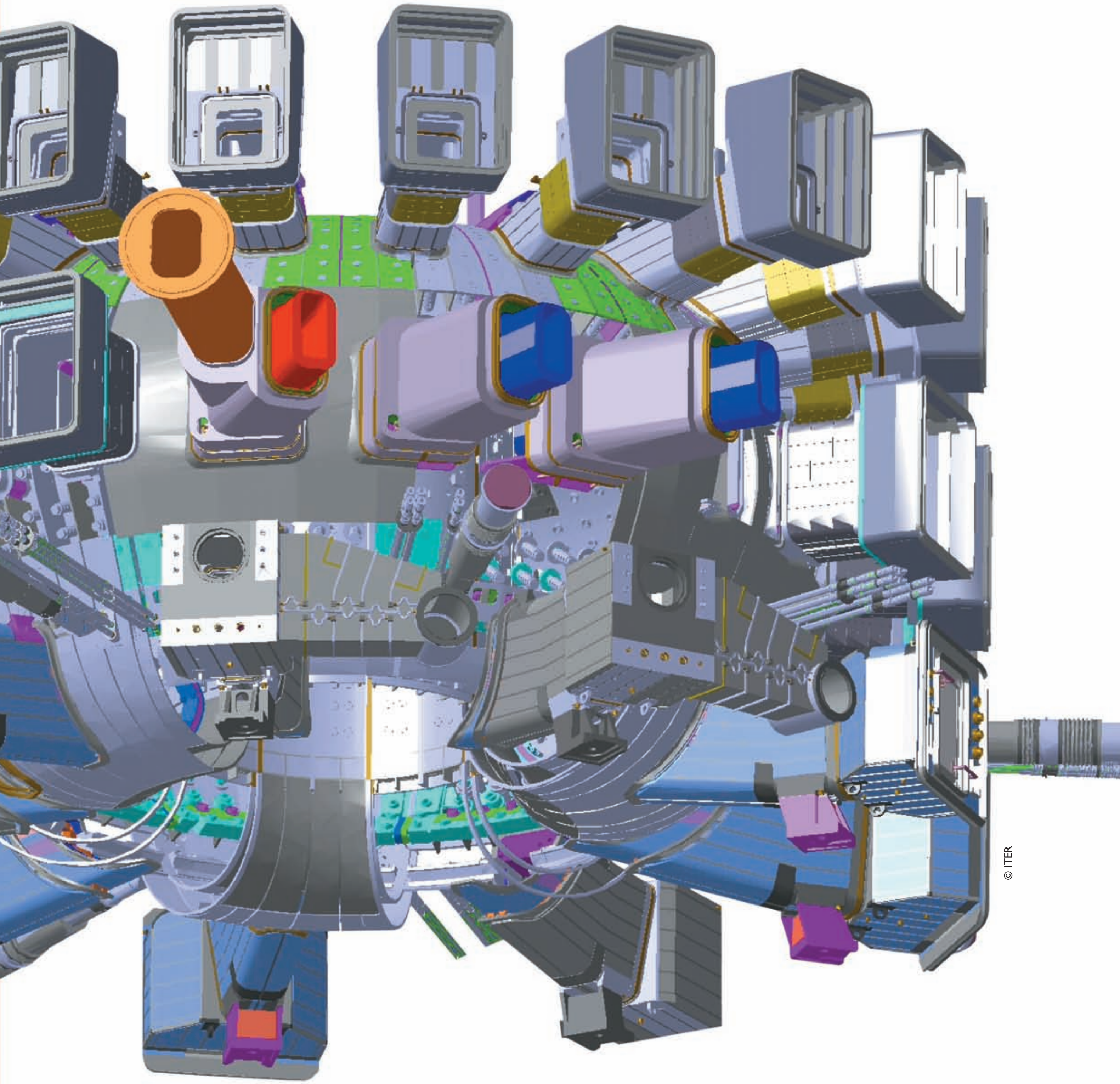
Andrea Collins is an Edmonton-based freelance writer and public relations consultant.



The ITER vacuum vessel and associated equipment that provides access into the tokamak machine (ports) plus vacuum pumping circuits, superconducting magnets, and their power busbars and cryogenic cooling systems. (This 3-D digital mockup is a design integration view of the virtual world, allowing engineers and physicists to ensure that the real parts fit together properly when finally assembled. The diameter of this assembly is over 35 metres.)

2016 A NUCLEAR ODYSSEY

by Bruce White



Nine years from now, if all goes according to schedule, the biggest and costliest science project ever built on earth will begin to operate in the south of France. Known as ITER (Latin for "the way"), this $14.3-billion international engineering venture will explore the technology of nuclear fusion—the reaction that powers our sun and every star in the universe.

And it will have been made possible in no small way through the help of Dr. Jerry Sovka (Chemical '58), a former farm boy from southern Alberta.

The main event will take place in 2016 inside a vacuum vessel the size of a 10-storey building, ringed with nine powerful electromagnets. The magnets will focus enough energy to light a small city onto less than a

Dr. Jerry Sovka
(Chemical '58)


Courtesy Dr. Jerry Sovka

thimbleful of liquid hydrogen isotopes: deuterium (with one electron, one proton, and one neutron) and tritium (deuterium plus a second neutron).

Powerful magnetic forces will strip away the hydrogen's electrons to create a high-energy plasma, which will ignite in what nuclear physicists describe as "the burn." A deuterium atom fuses with a tritium atom to create an atom of helium, a spare neutron, and an enormous release of energy. Temperatures inside the reaction will reach the order of 100 million degrees Celsius, providing energy to continue the reaction plus a healthy profit margin of at least 10 times the energy that was needed to ignite the fusion burn.

The initial tests at ITER will be brief, with the stated goal of working up to a burn that lasts for 500 seconds. The reactor will produce no electricity or other marketable commodity. Nevertheless, the first successful burn at ITER will be a milestone in the development of human technology. It will help take fusion technology from the realm of theoretical physics into the world of titanium nuts and bolts engineering.

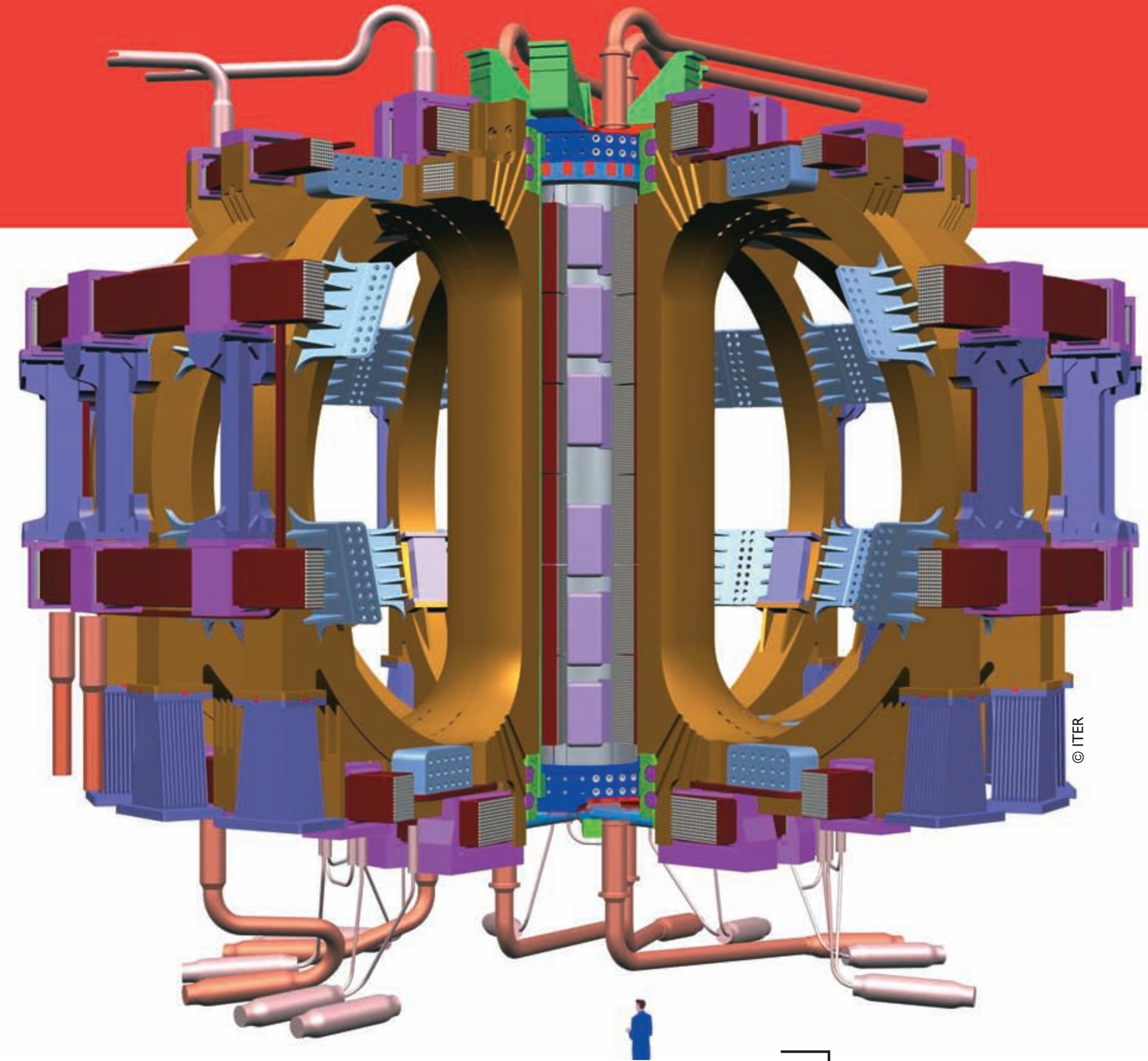
Sovka is managing the construction of the project, currently in the site-preparation stage, next to the large French atomic research centre.

Based in Honolulu but these days living in Aix-en-Provence, France, Sovka is a veteran nuclear engineer who has helped to build and commission Canadian fission reactors in Ontario, South Korea, and China. His international experience will be an important prerequisite for the tasks ahead, because ITER is the most complex international project ever attempted. The consortium has seven partners—China, Japan, the European Union, Russia, the United States, South Korea, and India.

Sovka is part of the U.S. team, assigned to the international organization at Cadarache, where the French hosts are providing the site and infrastructure with their European partners. Inspiration for the design came from Russian physicists. China is a leader in fusion, having successfully produced plasma in an experimental fusion reactor last year. Japan and the United States are designing the magnets for ITER. The cryogenics will come from India. The ITER project will require not only the highest level of nuclear engineering ever attempted, but also demands unprecedented diplomacy and cross-cultural collaboration.

Sovka seems to be the prototype of the


Aerial photo, looking northeast. In the foreground is CEA (Commissariat à l'énergie atomique) and the ITER Cadarache JWS, with the ITER construction site some two km eastwards.



A 3-D digital model of machine assembly process, showing superconducting magnets and vacuum vessel sectors, with cryogenic cooling piping and direct current magnet power.

engineer who can work successfully in such an environment. He is the polar opposite of the stressed-out nuclear power plant engineer played by Jack Lemmon in the 1979 movie *The China Syndrome*, a thriller set in a nuclear power plant on the brink of a catastrophic meltdown. Sovka is soft-spoken, calm, agreeable, and a careful listener. He displays a ready smile and a warm sense of humour. And he doesn't betray a hint of stress at work—a talent he says somewhat cryptically that he had to learn the hard way.

Sovka and his two brothers grew up in Cranford and Coaldale, Alberta, the sons of immigrants from what is now the Czech Republic.

Sovka's decision to seek a career in nuclear engineering was inspired in the U of A library, where he read the proceedings of the 1955 First International Conference on Peaceful Uses of Nuclear Energy. In those heady postwar days, nuclear engineers believed that harnessing fission would provide the world a clean, safe, and virtually unlimited source of electricity. Some in that era spoke of power so cheap that it wouldn't be worth metering.

In his final year at the U of A, Sovka turned down invitations for a career in Alberta's oil industry.

"This was too exciting," he says.

Graduating in 1958, Sovka was one of three Albertans to receive an Athlone scholarship to study in England. He received his Master's from the University of Birmingham and would later earn a Doctorate from MIT.

Sovka's career provides a neat timeline of Canada's nuclear industry. As a young engineer at Atomic Energy Canada Ltd. (AECL) in Toronto, he worked on the teams that designed Canada's early nuclear power plants. These Canada Deuterium Uranium or Candu reactors used pressurized heavy water as moderator and coolant, allowing them to be fueled with natural uranium oxide instead of the enriched uranium used in most other nuclear power plants.

Sovka worked for Ontario Hydro in the 1960s and 1970s on the engineering of reac-

© CEA

The ITER Design

At the core of ITER will be a spherical reactor vessel known as a tokamak, which is a Russian acronym for a "toroidal chamber in magnetic coils." It was designed between 1995 and 1999, but the United States rejected the initial design and pulled out of the consortium. The Americans returned in 2003, after a redesign resulted in a smaller and cheaper machine.

This generic design is now being adapted for the site in France. The first buildings will begin to rise while the superconducting magnets are still being tested and other components are being fabricated amongst the seven partners. The vacuum vessel itself will be 30 metres high and 20 metres in diameter, and will weigh 16,000 tonnes. It will be housed in a building nearly twice as tall to accommodate all the supporting systems, including cooling water, cryogenic fluids, and vacuum pumps.

tors at Pickering, Douglas Point, and Bruce. He lived for four years in South Korea as the head site engineer, overseeing construction of a Candu there. He worked with SNC in Montreal in the years after Three Mile Island, when rising populist fear of nuclear energy contributed to the cancellation of the project he was working on, a second Candu for Point Lepreau, New Brunswick.

The ultimately benign Three Mile Island incident in 1979—and the truly catastrophic accident seven years later at Chernobyl—turned western opinion against nuclear energy. Well-publicized design problems and cost overruns did the industry no favours, either. Safety standards grew considerably more stringent than before 1979. By the late 1980s the nuclear industry was in a deep downturn from which, two decades later, it is only beginning to recover.

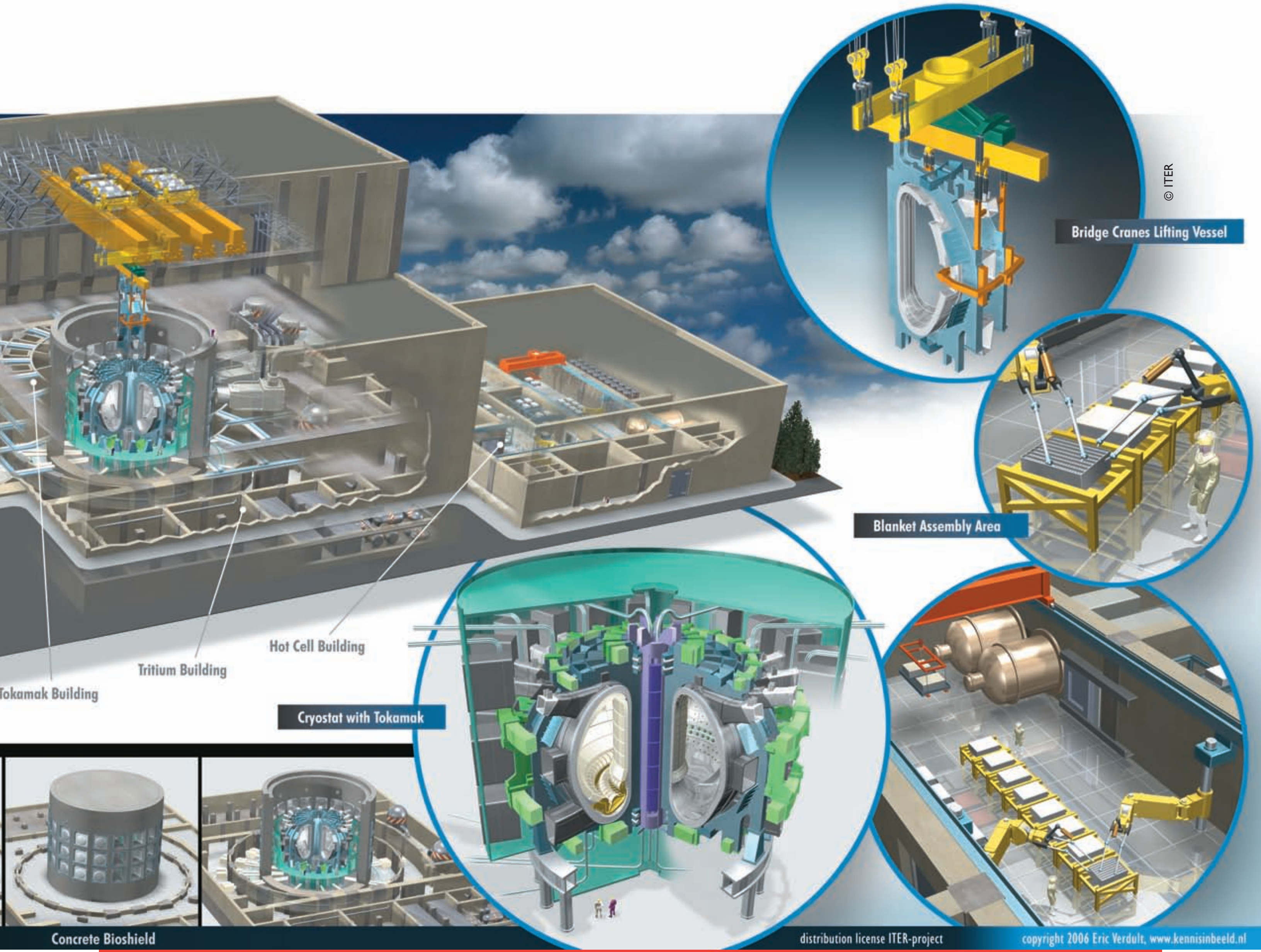
"We're still fighting fear and bias," says Sovka, unwavering in the belief of his youth in the potential for nuclear energy.

"I'm surprised it hasn't paid off for humanity as much as was imagined."

With the job market for nuclear engineers disappearing in the 1980s, Sovka saw a newspaper ad for a chief engineer for the Canada-France-Hawaii telescope (CFH). Designed by French astronomers and with a mirror shaped in Victoria, British Columbia, CFH had already been operating for five years. Sovka's experience with cryogenics and heavy equipment put him at the top of the list of more than 120 candidates who applied.

Sovka oversaw the operation of that high-resolution optical telescope, atop Mauna Kea on the Big Island, when charge-coupled device digital imaging systems replaced films and glass plates. He had a front-row seat for a total eclipse of the sun that passed directly over Hawaii in 1991.

Unlike many Albertans, though, he found Hawaii to be a difficult paradise—at least when you're working at 13,793 feet above the beach with 56 percent of the oxygen of sea level and permafrost in the ground. After a while, he wanted to return to nuclear engineering.



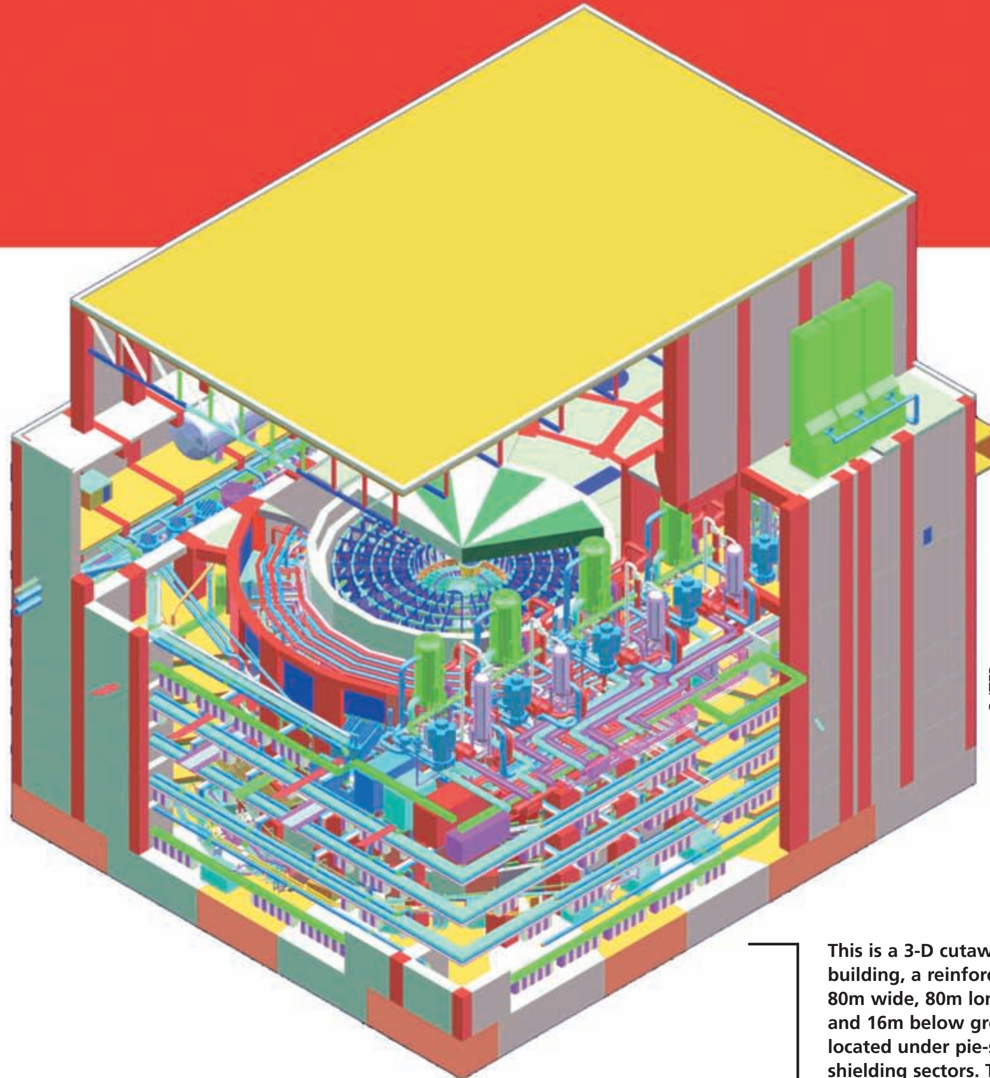
The Future of Fusion

As an investment, fusion has a time horizon that is measured in generations rather than years. ITER has been 21 years in development, but has yet to put a bulldozer on the site. One of the founding partners, the Soviet Union, no longer exists. The current timeline calls for construction to take 10 years and the experimental reactor to operate for 20 years. A demonstration fusion electric power plant could be up and running by 2050, and in the calculation of the U.S. Department of Energy, fusion reactors could supply half of the world's primary energy needs by 2200. This achievement would require capital investments that make our current oil sands projects seem trivial: trillions of dollars worldwide.

Fusion's backers often sound wildly optimistic, much like the early fission enthusiasts. The Chinese point out that the deuterium in one litre of seawater contains the recoverable energy to replace 300 litres of gasoline. The U.S. Department of Energy describes fusion's potential as "an ultimate solution" to energy supply. It describes fusion energy as inexhaustible, safe, and clean—it produces no greenhouse gases and no long-lasting nuclear waste. Fusion reactors can't melt down and are unlikely to contribute to the proliferation of nuclear weapons.

Optimism for fusion is widespread. In a recent online poll for the U.S. network MSNBC, 42 percent believed fusion power would be commercially viable in less than 20 years.

More likely, a commercial fusion power plant is at least 50 years away, by U.S. government estimate. For the next 100 to 200 years, most electricity will continue to be produced by a range of inputs, including new generations of fission reactors, gas, and coal plants.



This is a 3-D cutaway view of tokamak building, a reinforced concrete structure, 80m wide, 80m long, 54m above ground, and 16m below ground. The machine is located under pie-shaped green-white shielding sectors. The total height is equivalent to a 20-storeys-tall apartment building.

"Hawaii is not a big market for nuclear consulting engineers," Sovka says, smiling.

So, by 1993 he was back in Toronto working for AECL on two reactors for export to China.

His next assignment was as project manager on two Maple reactors at Chalk River, Ontario, which were designed to produce a variety of medical isotopes for MDS Nordion, a world leader in the field.

After the ITER group was formed in 1995, Canada offered to host the experimental fusion reactor in Ontario. Sovka was sent to Naka, Japan, in 2001, to help design the tokamak buildings and site layout. That never came to pass. In 2003, the government of Jean Chretien withdrew from funding the fusion community, focusing instead on fission technology and developing the Advanced Candu Reactor.

Sovka continued working with the Europeans at their worksite near Munich, furthering the design for their proposed site at Cadarache in the south of France. A three-month "temporary" contract has lasted for five years so far, with Sovka moving to Aix-en-Provence, France, last spring.

Meanwhile, Sovka continues to work on the biggest nuclear engineering project of his career.

Now 70 years old, Sovka does not expect to be working for ITER when the first burn takes place a decade from now. The first generation of Candus that he helped to build—originally designed to last for 35 years—are nearing the end of their useful lives, which turned out to be closer to 50 years. Many reactors are mothballed, or soon will be, and their generating capacity must be replaced before we can even think of how to handle the relentless growth in demand that will follow such innovations as hybrid and hydrogen-powered cars.

Sovka believes demand for nuclear engineers is about to accelerate, and worries that Canadian engineering schools aren't producing nearly enough graduates. Ironically, most of the world's young nuclear engineers come from former Candu customers—China, India, and Korea—or from Japan.

Sovka believes alternative energy sources also have a role to play, but they are not suitable for providing the basic generation needed to supply the grid. He doesn't see the alternative sector's windmills and solar cells ever managing to produce more than 10 percent of the world's needs—far less than the 16 percent that fission provides at present.

Asked, therefore, what he would tell an engineering student from Alberta, Sovka pauses only a second before responding.

"Find a way to help mankind in a way that will last a long time, rather than something that will be used up in a few years."

Bruce White is an Edmonton-based business writer and editor.

Lieutenant Robert Gliddon (Mechanical '07)

Tour of Duty

Mission to Afganistan

by Bev Betkowski

Two of Lt. Gliddon's platoon caught in a dust storm.

All photos courtesy Lt. Rob Gliddon

When Rob Gliddon (Mechanical '07) signed up for military duty back in 2000, the same year he enrolled at the University of Alberta as a fresh-faced kid from Edson, deprivation and misery weren't anywhere on his radar.

As it turned out, he got a sturdy helping of both while training as a reservist for the Canadian Forces. It was just the start of an adventure that would drop him into the hot, dusty grip of one of the world's touchiest hotspots.

The view from the convoy entering Kandahar.

"Joining up, it seemed like an exciting, adventurous, unusual thing to do," he says with a wry chuckle six years later, recalling those early days (and long nights) of training at CFB Wainwright.

"Well, I'd be freezing cold, soaking wet, hungry, and tired, wondering what I'd done."

But tough as it was, it honed him for what was to come. In fact, Gliddon has packed more into his 25-plus years than most people can imagine. And his education in the Faculty of Engineering helped prepare him for duty in Afghanistan.

When he found out in the winter of 2004 that he'd been accepted as a volunteer for the overseas mission, Lieutenant Gliddon knew he was up for it. As commander of an infantry platoon attached to Edmonton's 1st Service Battalion, he had to orchestrate precious assigned resources—34 people, a collection of rough and ready vehicles, radio systems, and weapons—into an efficient, mobile force. The job: to protect convoys delivering essential supplies of food, water (essential in merciless 40 degree Celsius temperatures), spare parts, and ammunition to 800 troops stationed throughout what Gliddon terms "a rough neighbourhood." That, and staying alive.

Gliddon was a long way from the polished hallways of the U of A Engineering Teaching and Learning Complex, but the same classroom fundamentals applied.

"My training in engineering gave me an analytical approach to problems. Some of the operations we conducted were complicated, involving a lot of choreography and integration of various groups and vehicles moving all over the place. If you're not able to gather all the information available to you and come up with a plan, you're not going to be successful.

"By using the same logical, sequential approach you would see in a design project or any big engineering endeavour, you can throw together a plan for an operation. A big part of engineering is management of time, resources, and people, and that was one of the biggest parts of my job."

Absolute accuracy was a vital element of the everyday balancing act—and almost impossible to achieve.

"It doesn't exist in a place like Afghanistan," Gliddon observes ruefully.

"You try to make a plan and stick to it as much as possible, keeping in mind if a vehicle breaks down, the plan is going to change."

The operations were all-day affairs. The convoys would venture out from their base at Kandahar airfield, bumping across raw countryside five or six days of the week, in an area that spanned from just shy of the Pakistan border—Osama Bin Laden country—through Kandahar city and on to a neighbouring province. Some days there were three vehicles to shepherd, other times, up to 25 loaded with precious cargo.

"The first time I left the safety of camp at Kandahar and went out onto open highway, I was anxious," Gliddon admits.

He considers himself lucky that his crew didn't often run into trouble, but vigilance was the order of the day.

"We got to know the areas and became familiar with how things looked, how the people and traffic behaved. You'd watch for erratic drivers behind you, or an empty market square that was usually busy, or you see a pile of rocks that wasn't there yesterday in the road."

When something didn't feel right, they'd turn the convoy and leave the area.

More than once, Gliddon and his comrades witnessed the aftermath of an ambush or an explosion that left human tragedy in its wake. He knows many of the troops who've fallen and been sent home to mourning families.

"The worst part of being there, of serving, is seeing friends hurt or killed."

To cope, Gliddon and his fellow soldiers threw themselves into their work.

"Mercifully, everybody was kept very busy, so being able to focus on your task helped. It allows you to focus on something other than grief. And we were close-knit, so you have a huge group of friends to provide support."

Gliddon's ironclad competence in assembling four-wheeled protection on a daily basis, and that of his team, earned the praise of their commander. Lt. Col. John Conrad told a *Globe and Mail* reporter that all of the serving U of A students were "gritty, determined, bright," and made him proud every day.

> "By using the same logical, sequential approach you would see in a design project or any big engineering endeavour, you can throw together a plan of (military) operation."

"They were quick studies," Conrad says now.

"They're inquisitive, bright, and they learn quickly," he adds. Gliddon especially, proved his mettle.

When the Nyalla, a new class of blast-proof vehicle rolled in to Kandahar, Conrad thought Gliddon and his young team were busy enough mastering the Mercedes G-wagon.

"You don't want to push reserve soldiers too hard, always giving them new weapons and new jobs to do."

Gliddon soon set his commanding officer straight.

"Gliddon was furious with me. He approached me and said 'Let's train one of my soldiers on the Nyalla, and if he passes, let us use this equipment.' Well, the guy did great and Gliddon's platoon was the main holder of these vehicles. This group was able to assimilate new roles. Anything I asked them to do, they grabbed it and cracked on.

"Gliddon's well-oiled team was invaluable to the unit," Conrad says.

"Anytime you go in a convoy, it's a leap of faith when you have the tactics of the Taliban. The infantry soldiers on average had well over 100 convoy escort tasks in the space of seven months.

"Gliddon's qualities as a leader were also evident," Conrad says.

"He is a good balanced person, and a soldier in harm's way can tell that. I don't know if it's the engineer in him, but he strove to do things exceptionally well. He has a passionate sincerity to do things well."

"That street runs both ways," Gliddon says.

"The tremendous support we received from Lieutenant Colonel Conrad and headquarters only drove the platoon to work harder."

Gliddon believes strongly in the Afghanistan mission, despite the growing list of dead and injured.

"I haven't had cause to question it. Most people there are trying to live their lives in peace. I wouldn't have volunteered if I didn't think it was important."

That said, he's gained a keen appreciation for the sanity of home.

"It's nice to walk in the street and not have to worry about dying. A lot of stuff that used to worry me doesn't seem so important anymore. Nothing's on fire, nobody's dying—it's all good."

Gliddon doesn't know if his long-term career will be with the military. But while doing his duty, the line-up at the Kandahar motor pool caught his eye, and though he didn't get the chance to pop hoods, he's intrigued by the possibilities.

"There will be a lot of advances in that field—alternative fuels and power sources—there's a lot of need for design work in that niche."

Somewhere along the way, he also intends to sign up for another tour of duty.

"We have the opportunity to do some very good work there, to take an active part in world affairs, rather than just being bystanders.

"Hopefully, we'll have a positive influence on a world which very much needs it."

Under Lieut. Rob Glidddon's Watch

34 personnel

Four G-wagons, a Mercedes-Benz army jeep complete with machine gun turrets, used to protect convoys by leading and bringing up the rear.

A half-dozen RG 31 armoured vehicles, made in South Africa. Newly arrived at the end of Gliddon's tour, the RGs boast more room and sturdier armour.

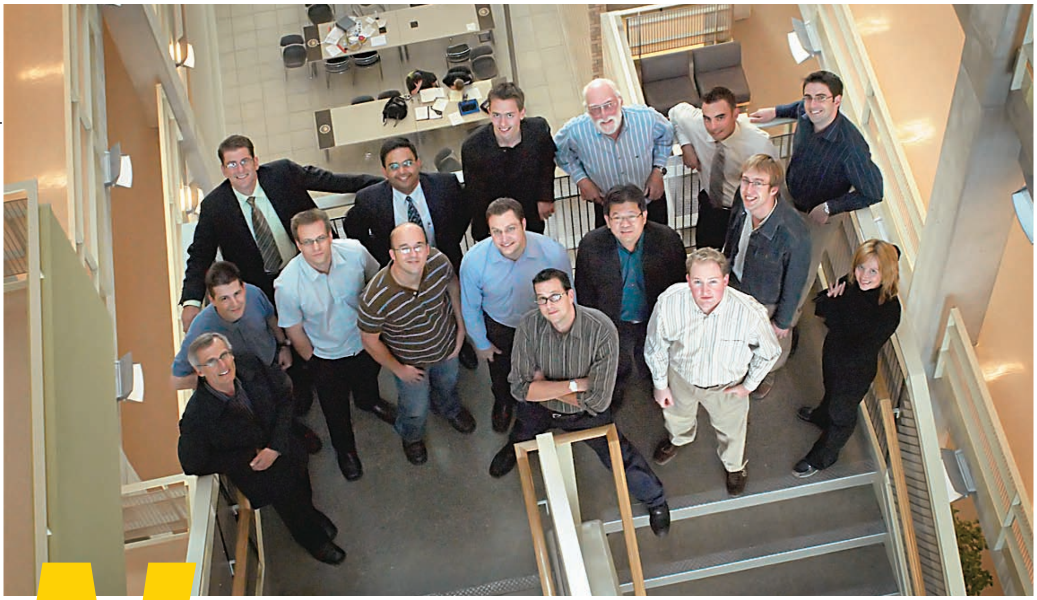
An assortment of satellite phones, handheld sets, and portable backpack sets.

Weapons systems including machine guns (everyone had one), night vision equipment, and body armour.

Bev Betkowski is an Edmonton-based freelance journalist.

The structural team at Cohos Evamy. The team includes fourteen Civil Engineering degree recipients from the U of A with three more degrees in process.

April Fuller, Affusion



Earthsha

by Bev Betkowski

When Dr. Robert Driver (Civil '83) called his friend Dr. Jeff DiBattista (MSc Civil '95, PhD Civil '00) a little more than a year ago, looking for support on a special project, DiBattista didn't hesitate.

"He told me about building a big reaction frame in their lab, and it was natural for us to want to help out," recalls DiBattista.

The "us" in this case is the powerhouse engineering firm of Cohos Evamy, which contributed its services to the Faculty of Engineering project for a token fee.

The reaction frame would provide the ability to apply large forces to a wide variety of building components for structural engineering research. Driver, a professor of Civil Engineering at the U of A, has long been involved in researching the behaviour of steel plate shear walls, which provide a means of bracing buildings against the forces of wind and earthquakes. It was decided early on that the reaction frame itself could also be a steel plate shear wall.

"It was his PhD topic and I helped him set up lab tests. I knew the history behind it," recalls DiBattista, who has been with Cohos Evamy since 2000.

The idea to design the structure out of steel instead of concrete, the usual material for reaction walls, was the brainchild of Driver and fellow professor Dr. Gilbert Grondin (PhD Civil '91). Known for their work with steel, the pair wanted to find out more about its potential.

"It's a new concept," said Driver.

"We wanted this project to be a symbol of new applications for steel and of the long history of steel plate shear wall research at the U of A."

Housed in the I. F. Morrison Structural Engineering Lab on campus and bolted to a concrete floor with 36 unshakeable high-strength steel rods, the structure represents much more than a tool for ongoing research. It was created from the bedrock of a relationship built on respect, energy, and multiple talents.

The Faculty and one of its most supportive private enterprise partners have designed a steel shear wall whose heavy-duty capabilities make it likely the world's first to take up residence in a research lab.

"The structures group at the U of A specializes in large-scale testing. This new equipment gives us a capability that few labs have in Canada," Driver said.

He marvels at how smoothly the whole thing came together.

"The Faculty of Engineering has a good

king

Collaboration

Dr. Robert Driver

The components of the reaction frame upon arrival at the Faculty of Engineering, prior to their assembly.

relationship with many industry partners and this is an example of that. All the companies that participated were extremely willing to help out, and made significant donations."

The shear wall project is just the latest in a succession of creative collaborations between the Faculty of Engineering and Cohos Evamy, one of its principal allies in private enterprise.

Many of the University of Alberta's showpiece buildings reflect the inspiration of Cohos Evamy talent. The firm can be credited for its design work on a sterling list of projects. Among them are the Engineering Teaching and Learning Complex, the Allan P. Markin/ CNRL Natural Resources Engineering Facility, the National Institute for Nanotechnology, and the Electrical and Computer Engineering Research Facility.

"Contributing to this in-house project was a way to give back to the Faculty," DiBattista said.

"We hire a lot of graduates from the U of A in Civil Engineering, and having a strong program is extremely important for our success. If the structural engineering program weren't there, we'd have a hard time."

To foster ongoing excellence, Cohos Evamy also supports the Faculty by sponsoring a design competition for fourth-year students, and provides a $5,000 graduate student scholarship in structural engineering.

The firm led the way on the shear wall project, drafting the design of the reaction frame, with input from Driver and Grondin. Dr. Laurie Kennedy, a professor emeritus in the Faculty, provided crucial seed money.

The partnership also received a generous boost from Waiward Steel Fabricators Ltd., an Edmonton firm. At DiBattista's request, the company gladly stepped up to the plate with $90,000 worth of materials, fabrication, and labour.

"They really came through, especially considering the substantial cost of their contribution," DiBattista said.

"The company was eager to be part of the cutting-edge venture," said Paul Zubick (Civil '83), manager of sales and contracts for the firm.

"Waiward views the U of A as a leader in structural steel teaching and research in North America. Support of research like this is vital to generating findings that are practical and applicable to current design and construction methods being used by industry. We get solutions to pertinent issues."

And contributing to a project like this not only helps companies like Waiward attract newly-minted, talented graduates, but "also keeps academics and students in touch with industry practice," he noted.

Painted trademark U of A gold, the reaction wall resembles nothing so much as a giant Meccano set, with its leggy skyscraper proportions and heavy steel plates honeycombed with bolt holes.

The design team had to be flexible in planning the wall, DiBattista noted.

"The challenge was trying to anticipate the needs of future research projects. It's not possible to predict exactly what shape and size future test specimens might be, so we used a 'kit of parts' strategy."

Holes for 25-millimetre diameter bolts are drilled on a 76 mm grid all over the frame, allowing the beams that hold the hydraulic jacks to be positioned in almost any configuration.

The wall, crafted from 33 tonnes of CSA 350W yield-strength steel, will be used to beef up the U of A's existing research of seismic systems for buildings. Already used by engineers around the world, the use of steel plate shear walls for buildings was a concept developed at the U of A in the 1980s when professors Dr. Geoff Kulak (Civil '58) and Dr. Jim Montgomery (Civil '73) were asked to help refine the relatively new method of using steel to frame new buildings. The approaches then in use in some countries—using thick infill panels or thin plates with many stiffeners—were uneconomical, Kulak said.

"We decided that neither of these directions was going to be attractive to the steel industry, so we turned to the aircraft industry for ideas developed in the 1930s," Kulak said.

"Thin plates, with no stiffeners, are a very effective way of carrying loads."

It's an approach still used in aircraft and for bridge girders that employ slender webs.

The ideas developed at the U of A remain basically unchanged today. Structures incorporating those ideas now include Seattle's federal courthouse and the Montreal head office of the Canam Group.

For Montgomery, the steel plate shear wall project brings him full circle. After developing such concepts with Kulak at the U of A, he went on to found the structural group at Cohos Evamy's Edmonton office, and 30 years later, helped the firm bring the reaction wall project to life back at the U of A.

"U of A has been on the leading edge of structural research since I was an undergraduate. It was a privilege for our firm to work closely with Waiward Steel and the team at the U of A to develop this project," Montgomery said.

"This will enable Driver and Grondin to maintain their North American leadership in the development of steel plate shear wall technology."

The U of A's new reaction wall is robust enough to apply earthquake-sized horizontal forces to crucial building components, simulating the notorious "whiplash" effect that takes hold as a tremor strikes and the ground begins to shake. Hydraulic jacks push against the reaction frame to simulate earthquake loads on test specimens of buildings. Clutched in the powerful grip of the reaction wall, a test structure reveals how much force a building's seismic system can take, its vulnerabilities, how much stress and how many load cycles the structure will endure before toppling.

The wall's capabilities allow Driver, Grondin, and their research teams to pinpoint just how much of a wallop buildings can take, by going a step beyond the theory.

"We do a lot of computer simulations these days, but it's really beneficial to be able to show what will happen in very large-scale experiments. It's much more convincing—we know we need to use experiments to validate any kind of computer simulations," Driver said.

The design of seismic systems is becoming more sophisticated all the time, but the need to verify the results is just as important.

The resulting data can be used by designers to continue engineering good, strong bones for their creations.

"We can push the boundaries of options available to designers," Driver said.

And while the need to achieve safety is a given, the ever-present challenge is to do it as economically as possible.

"Steel structures have an advantage in that they can be erected rapidly, which can reduce total construction costs significantly. The economy can be enhanced by developing steel systems that are not only structurally effective, but economical to fabricate."

"The design guidance provided through the research of the U of A structures group to firms like Cohos Evamy will be invaluable," said DiBattista.

"The work Driver and others at the U of A have done contributes significantly to improving the design tools we have at our disposal."

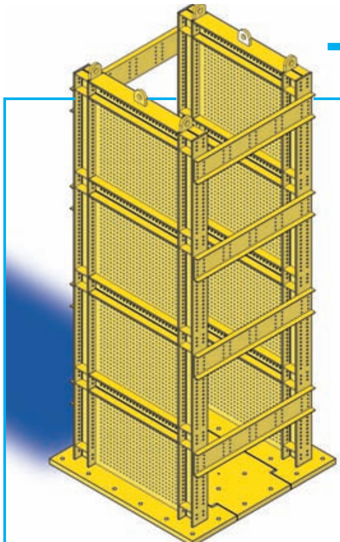
While the technology wouldn't apply to every project, "it shines in areas with high seismic risk," he added.

Besides symbolizing the stalwart alliance the Faculty of Engineering has fostered with its partners in private enterprise, the project also strengthens the U of A's ability to provide first-class structural engineering research, Driver noted. In this case, the findings can apply to any area of the world that experiences tremors—in Canada, that includes the West Coast primarily, but also regions of northern and eastern Canada.

The reaction wall went to work in December of 2006. The first test was part of a new research program on composite steel and concrete columns for multi-storey buildings that combine the advantages of both materials.

"We're excited about having such a unique laboratory installation, and it will only increase the level of exploration and the number of innovative projects by the structures group," Driver said.

Bev Betkowski is an Edmonton-based freelance journalist.



Tough Enough

The Reaction Frame

Weighs 32.9 tonnes, stands eight metres high, and consists of two parallel steel plate shear walls with a width of 2.8 metres positioned 2.4 metres apart.

Researchers can apply a maximum horizontal force of 5,000 kilonewtons (more than 1.1 million lb.).

Can take a maximum single force of 3,000 kN.

Capacity is greater than the current capacity of the 610-mm-thick reinforced concrete floor it is attached to. The next phase of the project is to reinforce the floor so that the capacity of the reaction wall can be fully utilized.

A series of 36 high-strength steel rods, each 57 mm in diameter, fasten the reaction frame to the floor. The rods are pre-tensioned with a force totalling 32,000 kN to prevent the frame from sliding as simulated earthquake loads are applied.

Don Lougheed
(Mining '48)

An Imperial Career

BY BRUCE WHITE

We live in an age of the contractors. Workers of nearly every occupation—welders, civil engineers, NHL 20-goal scorers—sign up to perform a job for a year or two and then leave when their term expires.

We do a job and we move on. Companies merge and we move on. New opportunities beckon and we move on again.

It is surprising, therefore, to recall how different things were a generation or two ago. It was possible for a young engineer to start with a summer job in the bush and retire from the executive suite of the same company four decades later. Such was the career of Don Lougheed (Mining '48) at Imperial Oil.

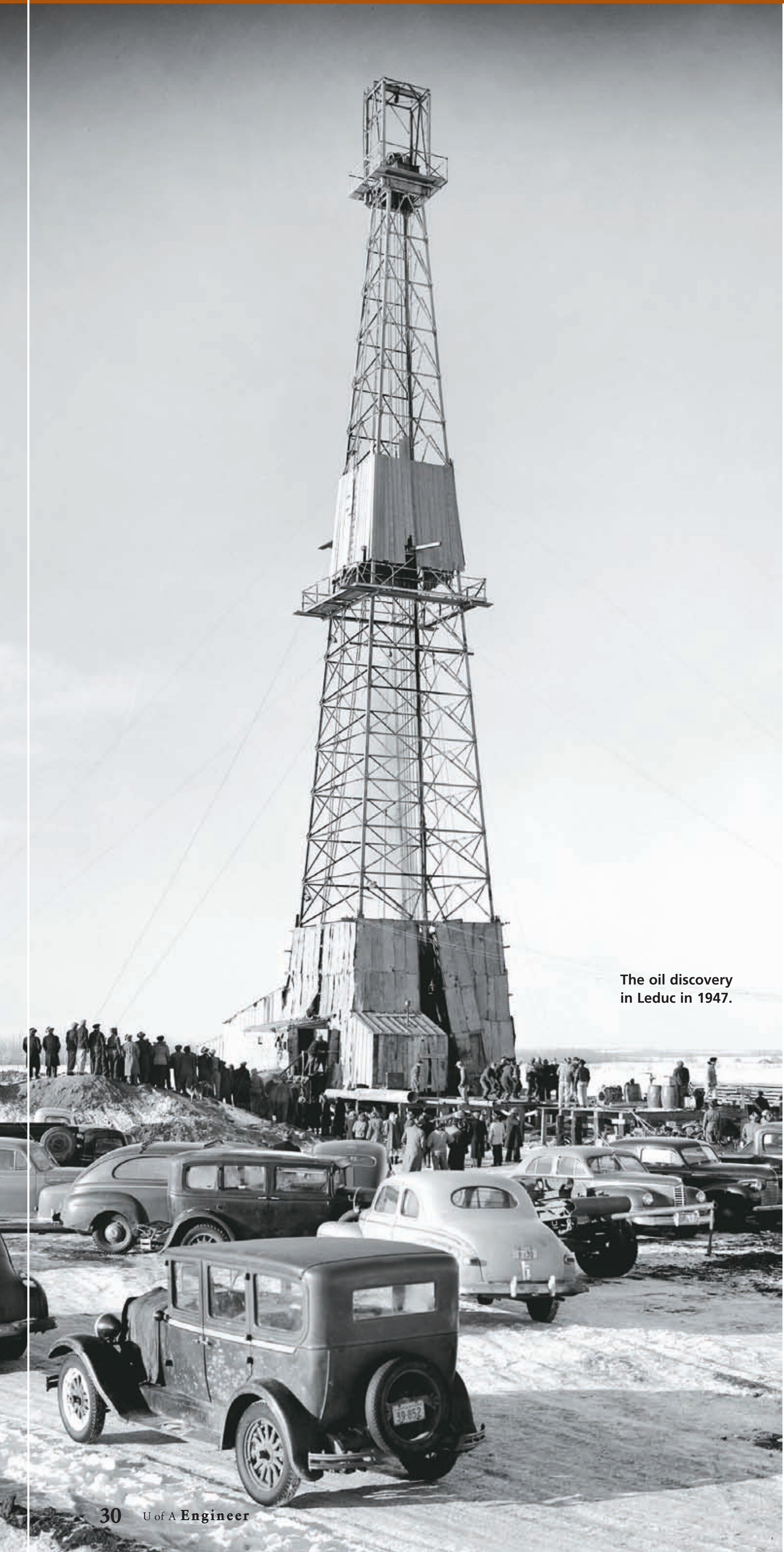
Lougheed's first paycheque from Imperial came in the summer of 1945 when he worked as a student geologist and engineer at Pouce Coupe in northeastern British Columbia. Geology was still just scratching the surface in 1945, but it made a deep impression on the young student. He returned to Imperial for the next two summers, working around Spirit River and High Prairie, Alberta.

"We just looked at the rocks on hillsides," Lougheed reminisces in his Calgary home.

"Most people when they look at rocks in the countryside have no understanding about what they mean. Once you get involved, and learn that these rocks mean something, it's very interesting."

Lougheed chose mining engineering because it included two geology courses. During the winter of his third year, an event

Roth and Ramberg Photography



The oil discovery in Leduc in 1947.

Provincial Archives of Alberta P.2733

occurred 25 kilometres southwest of the campus that reshaped Alberta and profoundly altered Lougheed's life: Imperial struck oil west of Leduc.

Oddly, the earth didn't move for the student engineer-geologist.

"Lookit. Back in those days it wasn't a big deal," Lougheed recalls.

"Nobody realized yet how significant it was. One little oil well down in Leduc? It's news now, but in 1947–48 it was a marginal affair."

That wouldn't take long to change. Leduc was the first important oil discovery made by a seismograph—bigger discoveries followed. Edmonton, it turned out, was almost encircled by petroleum. The first formation to be tapped, known as D3, is a large underground lake, containing 140 billion barrels of pressurized salt water. Oil, floating to the top of the lake, accumulated over the ages in 10 large pools that poke up relatively close to the surface in a big arc from Rimbey to Leduc to Big Lake. Imperial made an even bigger oil strike a year later at Redwater.

With Alberta's petroleum boom gathering momentum, Imperial Oil hired Lougheed, the top student in the U of A's 1948 mining engineering class. The company sent him on a whirlwind training course: three months in Leduc, three months in Turner Valley, three months in Redwater, and three months in Calgary. The whirlwind education would continue for 38 more years.

Next, Imperial sent Lougheed to Tulsa, Oklahoma, to work at Standard Oil of New Jersey's upstream research lab. There the 25 year old was near the cutting edge of another technological revolution: the Tulsa lab was pioneering the use of computers to model the performance of reservoirs under various production scenarios.

"I worked on one of the early IBM computers in 1950," Lougheed recalls.

"In those days they were huge things—all vacuum tubes. You had to wire them."

Lougheed became a reservoir engineer, although that designation hadn't been coined yet. He learned how production pressure relates to the various forces inside a reservoir, and how to predict an oil field's performance for the next 15 or 20 years.

"In other words, you might be able to predict that we might be able to inject gas at the top of the reservoir, or you should inject water below, or produce the field slower or faster—whichever way made more money. It was how you improved the value of the asset."

While his kid brother Peter was earning a law degree back in Edmonton, Don Lougheed lived the nomadic life of a young oil explorer in the early 1950s, raising two daughters with his wife, Doreen Bradley, a U of A Bachelor of Commerce graduate, class of 1949.

Doreen's father had worked as an engineer on highway projects all over Alberta, moving his family frequently around the province. He eventually became chief engineer of the provincial Highways Department. The transfers and moves would continue—the Lougheeds lived six times in Calgary, twice in Edmonton, and once each in Devon, Regina, Toronto, New York, and Tulsa, Oklahoma.

"The world is different today. Most people today don't understand that, back then, if you got promoted every couple of years and moved up, you'd stay with the company," Lougheed says.

"Each new stop brought new experiences and new friends to appreciate and treasure. We feel it broadens the outlook of children and adults to see more of our world."

Lougheed took his family to tiny Devon, Alberta, when it was virtually a company town with one main street. They also set up house in Manhasset, New York, where to get to the office Lougheed rode a train to Penn Station and then a subway to Rockefeller Center. In both places his job was "trying to figure out how to do a better job of recovering oil by lowering costs and improving recovery. It was applying knowledge to do a better job.

"When I went to New York in 1959–60, I was involved in the oil fields in Iran, Iraq, and Arabia. I was working in New York as an engineer with Standard Oil of New Jersey (Exxon), which had interests in all those fields and I was studying them."

In Calgary, he moved into the lower ranks of management. In Regina in the mid-1960s, he was Imperial's manager of exploration and production for Saskatchewan. He moved to Toronto in 1969 to become manager of the producing department—taking charge of production and exploration for the whole company in Canada. Soon he was a member of Imperial's executive team that looked at the big picture of the company's operations across Canada, marketing and refining as well as upstream production.

> "I had a feeling that education was important, so I worked hard and ended up at the top of the class in mining in 1948."

During the years his brother Peter was premier of Alberta, from 1971 to 1985, Don Lougheed wielded considerable power of his own. He became Imperial Oil's senior vice president and a member of the board from 1975–81. These were remarkable achievements for the two brothers, both grandsons of Sir James Alexander Lougheed (a businessperson and senator who is the only Albertan ever to be knighted, but whose family fell on hard times during the Great Depression).

"Peter had his career and I had mine," says Don.

"They were completely separate: I didn't tell him anything and he didn't tell me anything. Completely separate."

Still, Peter Lougheed's vision of a new Alberta received a considerable boost in 1978 when brother Don helped create Esso Resources, with its head office in Calgary, to oversee Imperial's exploration and production activity across Canada (the rest of Imperial's head office has since moved from Toronto to Calgary).

Two years later, in 1980, the National Energy Program (NEP) was introduced. While things didn't exactly come screeching to a halt at Esso Resources, activity did slow considerably in the tower on 4th Avenue S.W. The NEP came as a double-whammy to oil producers—it mandated a lower domestic price for crude and imposed a tax on production. The Trudeau government also sought to "Canadianize" the industry by creating a national oil company, Petro-Canada, and by paying huge incentives for Canadian companies such as Dome Petroleum to explore for oil on frontier lands.

Alberta was outraged—not the least by the loss of taxes now estimated at $100 billion—to the point that the premier publicly threatened to cut off oil and gas supplies to the rest of Canada.

To this day, Lougheed is inclined to see any government involvement in the industry as wrong-headed. He cites an example the fate of the Taglu gas field, discovered in the early 1970s in the Mackenzie Delta. Taglu, with nearly three trillion cubic feet of gas and byproducts worth more than $20 billion at today's prices, is one of three major gas discoveries in the delta that have not been developed for lack of a pipeline to southern markets. Lougheed hopes one will be built soon.

Lougheed left the board of Imperial Oil in 1981 and returned to Calgary as executive vice president and director of Esso Resources, from which he retired five years later.

He recalls two important lessons he learned in his student years that helped on his journey from iron ring to gold watch.

"I had a feeling that education was important," he says, "so I worked hard and ended up at the top of the class in mining in 1948."

He learned another lesson working those summers in the Peace Country: economic self-reliance. While hard work was important in shaping his career, he also recognizes that luck played a role in his career and those of many of his fellow students who went to head some of Canada's most important companies.

"All kinds of people did well," Lougheed says.

"We were very fortunate to be graduating in 1948 when everything was growing—things were expanding, and rapidly."

Bruce White is an Edmonton-based business writer and editor.

Ron Bullen (Mechanical '61)

Roth and Ramberg Photography

The MASTER of FRAC

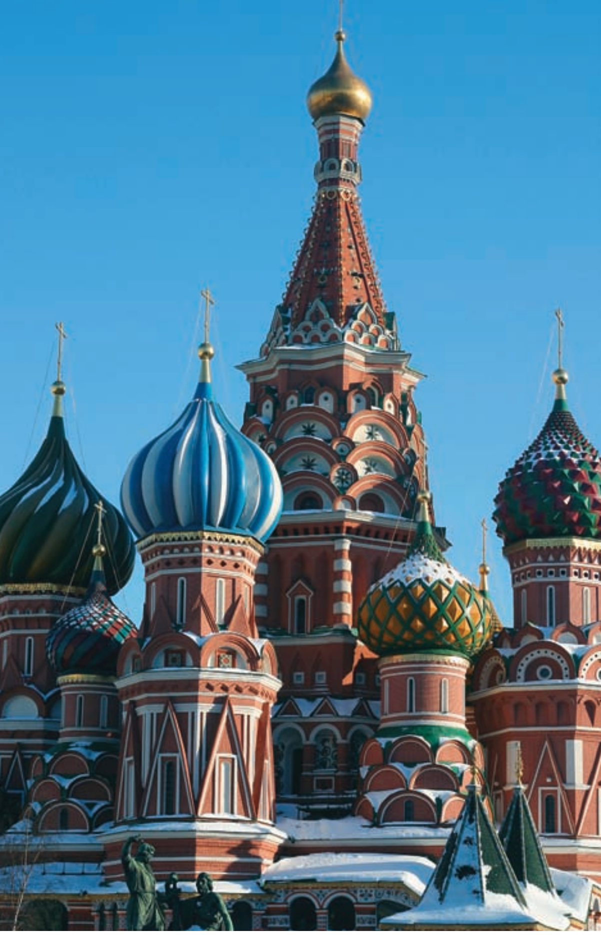
by Gail Gravelines

The meeting with officials of Machinoimport, the purchasing arm of the Soviet Ministry of Oil, had been scheduled for a Monday morning.

It was now Wednesday, and Ron Bullen (Mechanical '61) was in his third full day of waiting, in the hard-backed chair in the Ministry reception area, for his promised meeting to discuss oil field equipment sales. He had asked the receptionist late in the afternoon the previous Monday if the senior official, Mr. Michailoff, was available for his meeting. The receptionist flatly advised that Mr. Michailoff had left for the day.

"I didn't know it then, but the Soviet office had a back exit that allowed their officials to leave the office without ever having to walk through the reception area," Bullen laughs, recalling that fateful week back in 1984.

Western Siberia's legendarily rich oil fields, considered to be second in size only to the Middle East, had beckoned Bullen for years. Now, with words like *glasnost* (openness) and *perestroika* (restructuring) tripping off the lips of western business,



Left: St. Basil's Cathedral in Red Square.
Below: The Leningrad shipyards.

and praises being sung to new Soviet leader Michail Gorbachev and his program of *uskoreniye* (economic acceleration), Bullen was intent on establishing business relations with the Ministry of Oil.

"The Soviet Union was a plum waiting to be picked," says Bullen, president and founder of Calgary-based Canadian Fracmaster Ltd.

"Still, back in the early '80s, Russia was still a Communist state, the KGB were monitoring our every movements, and most people were afraid to go over—particularly the Americans."

Intent on striking a deal to sell oil field equipment to the Soviet Union, Bullen doggedly returned day after day to the reception office of Machinoimport.

"I got the same story on Tuesday, on Wednesday, on Thursday. Friday at noon, Mr. Michailoff walked out of his office and stood right in front of me. He looked at me and asked, 'Why are you still here? Everybody else leaves!'"

Not Bullen. Raised on a family farm in Alberta's Peace River Country, Bullen won the Governor General's award for the top marks for his Provincial Grade Nine Departmental exams, though he didn't see the inside of a classroom until grade eleven. He did his schooling by correspondence—his education happened on the farm alongside his father, fixing and building machinery. Bullen says he loves building, and build he has—hotels, houses, oil field equipment, fracturing methods, businesses, and relationships. He's been recognized for his achievements as the only winner of two Canada Awards of Excellence in one year, and the Frank Spragins Award from APEGGA.

That Friday, when Bullen concluded his first $6-million equipment sale into Russia, he began to build what, five years later, the international business press would hail as a "dream deal." He would create the first joint venture between the Soviet state oil company and a Western company. It was struck not on the industry tradition of pay-per-service, but on a groundbreaking agreement that saw Fracmaster winning a share of the increased Soviet oil production Bullen assured the Soviets his equipment, technology, and staff would deliver.

By the mid-80s, the long shadow of Canada's National Energy Program had stalled oil production back home. Bullen had already been to India, China, and North Africa selling his Fracmaster-developed oil well servicing equipment and hydraulic fracturing technologies.

(Fracturing, known in the industry as "fraccing" is a process in which special fluids are pumped at high pressures into the well, fracturing the formation rock to produce channels through which oil can flow back into the pipe to be pumped to the surface, thereby increasing oil production.)

"It wasn't as bad over there as everyone thought," says Bullen.

"It just wasn't North America.

"AMOCO was the first to use fracturing in Kansas back in 1948. They used a 300-horsepower pumper, river sand, and water. When I went to the Soviet Union, they were using 300-horsepower pumpers, river sand, and water to fracture their wells. I was very confident that we could do better with our 2,000-horsepower pumpers and our enhanced fluid technology," Bullen says.

Bullen could have settled for the sale of oil field equipment, but he was thinking of building something much bigger—a partnership with the Soviets and a share in the extra oil he said his technology would yield from their wells.

"I proposed a deal based on us seeing their geological data. They were very secretive in those days and there was no way they would share that information. They agreed that if we provided everything—the money, people, equipment, and technology—the Soviets would provide the land, the water, and the air.

"The deal was done on a handshake," says Bullen.

He and a translator sat on one side of an expansive boardroom table with the Minister of Oil, the Chief Engineer (equivalent to a company president), and a dozen or more Soviet bureaucrats lined up along the other side.

Bullen returned to Canada, loaded an entire trainload of his trademark yellow Fracmaster oil field equipment, shipped it by land to Montreal, by boat to Leningrad, by rail to Siberia, and then by barge up the Ob River to the western Siberian oil fields.

Bullen and his men arrived and moved into one of the stark prefabricated cement apartments that dotted the Siberian landscape.

"The standard of living there was about the poorest you could imagine," recalls Bullen.

"There were no hotels as we know them, little or no fresh fruit or vegetables. At one location, in the morning you had to go down to the front door, push away the snow, and go outside to turn on the electric heater to get hot water. If you were lucky, you would find a sheet of newspaper left for the toilet."

Soviet Oil Ministry officials greeted Bullen, directed the Canadian men and equipment to an oil well, and essentially said "Show us what you can do." Bullen's crew began the process of fraccing the well, anticipating the rush of crude to the surface to amaze the Soviets.

Nothing happened. The well was dead.

Undeterred, Bullen said they'd try again. When they fracced the second well on the next day, the oil surfaced, producing 350 barrels a day from what had been a 70-barrel a day well—more than a four-fold increase in production on one well alone.

"The Soviets were happy, but very conservative in showing it. That night we found out they had purposefully given us a dry well to start with," says Bullen.

All told, the company had gambled $3 million to show the Soviets how they could increase their oil production up to five times using Western equipment and technology.

After a year of hard-nosed negotiations, broken off three times, Canadian Fracmaster Ltd. and the Soviet oil agency signed a deal in the spring of 1989 creating Uganskfracmaster, a 51 percent Soviet and 49 percent Canadian-owned joint venture. The state-owned oil industry paid Uganskfracmaster for the increased oil produced using the fraccing process. Those proceeds were divided between the partners.

"I said to the Soviets that if we did well and made a profit, we would donate $1.25 million back to the community. I had a list of what I wanted the money to go for—dental care, school for the kids, housing, playgrounds, hospitals. When it came time to put the money into the community we exchanged lists. The Soviets didn't want what I offered. They wanted us to build a brewery."

Breweries had been destroyed as part of Gorbachev's unpopular efforts to fight the Soviet Union's high rate of alcoholism. Instead, vodka consumption rose even higher. Bullen tells of fishing trips with the Soviets, where eight men shared one flimsy rod with no line and several bottles of vodka.

"We agreed to put the $2 million they asked for into the brewery on the condition that our name wasn't part of it and that they didn't call us to help operate it or repair it," said Bullen.

His formal obligation to the Soviet officials met, Bullen invested an additional $5 million directly into the Siberian community, buying hospital equipment, building kindergartens, supplying police forces with Western-made security gear and medicines, and building a 140-suite apartment for oil field workers.

Two years after signing the deal, the Soviet government let the Canadian company pay itself a hard-currency dividend from oil exports. The move was touted as yet another coup, as Western companies were mostly forced to re-invest earnings from the Soviet Union within the country or try to trade for Soviet-made goods.

By then Fracmaster's operation employed more than 500 people—most of them Siberians—and provided an economic spinoff in Alberta, creating between 200 and 300 new jobs.

Bullen made dozens of trips to the Soviet Union. He specifically recalls the day he was on hand in Red Square to see the legendary May Day parade of Soviet Union military muscle.

"The equipment came rolling by, and most of it was just belching out blue-tinged smoke from these old diesel engines. It made me think you could call it Blue Square," Bullen chuckles.

"But their missiles were ominous and impressive."

After leaving Fracmaster in 1992, Bullen started over again in Russia, selling over $200 million worth of oil field equipment, and building hotels and housing in Siberia and the Black Sea region.

"The Russian people are a genuine pleasure to work with. They are wonderful people."

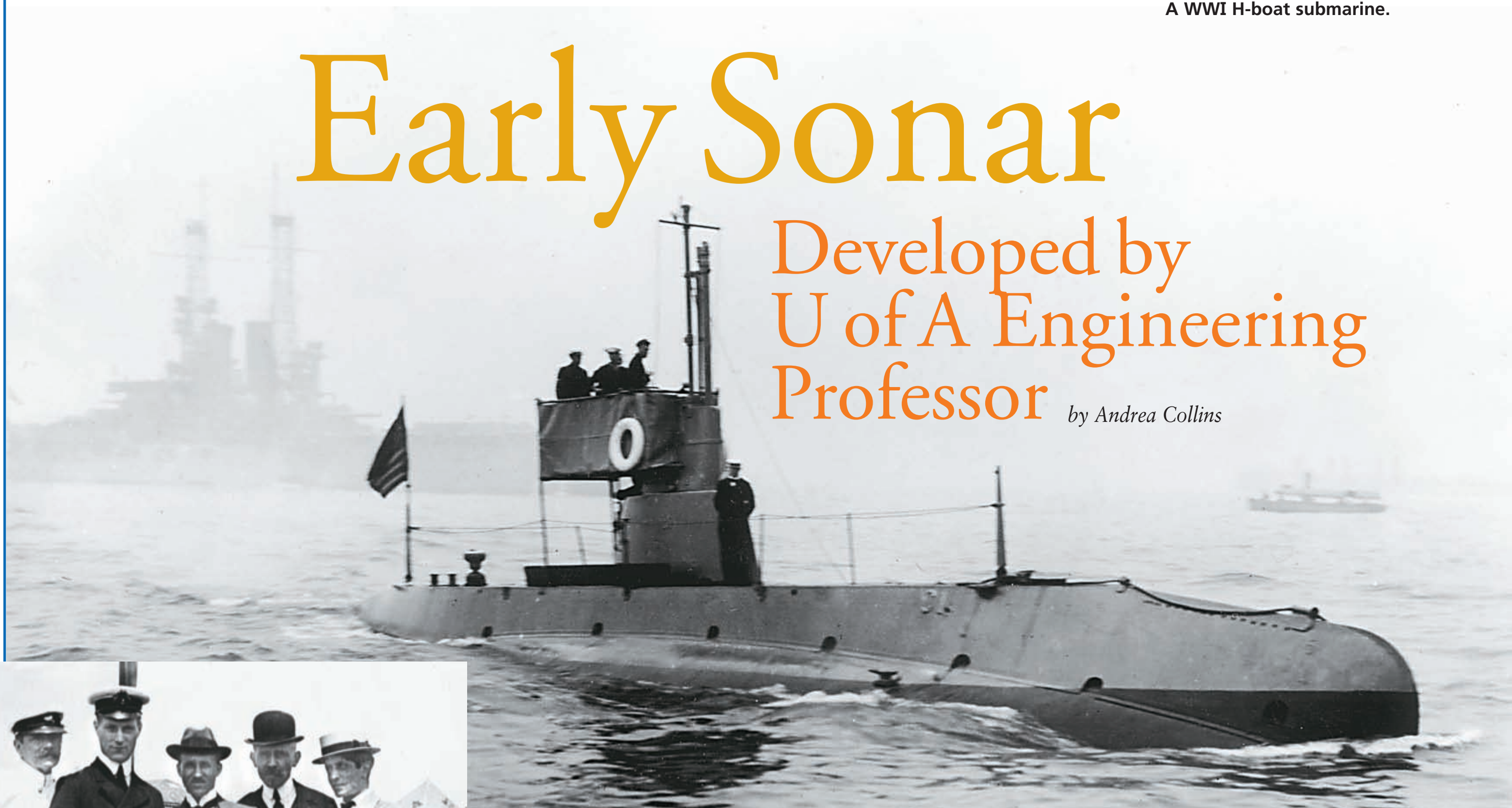
It's now been many years since Bullen has been to Russia, the result of a changing political and business landscape. Not that the man who loves to build has stopped building—there's the 35 large aircraft hangars he and his son-in-law are building at the Calgary Springbank Airport and the 400-unit gated resort community he is building in Poland.

> "I got the same story on Tuesday, on Wednesday, on Thursday. Friday at noon, Mr. Michailoff walked out of his office and stood right in front of me. He looked at me and asked, 'Why are you still here? Everybody else leaves!'"

He also builds as a hobby—the adult-sized wooden carousel rocking horse he carved and painted for his granddaughter, and the many pieces of fine furniture he's making in his home workshop. As if that weren't enough, he is also serving as the general contractor constructing a new house for a friend in Calgary.

"I guess I just like building," smiles Bullen.

Gail Gravelines is an Edmonton-based communications consultant.



A WWI H-boat submarine.

Early Sonar

Developed by U of A Engineering Professor

by Andrea Collins

Third from left: Dr. Robert William Boyle.

An important invention in anti-submarine warfare.

It was 1914, the start of World War I, and Britain expected to quell the aggressor quickly on the seas due to the superior might of its naval battleships. But Germany was relying on a different weapon to counter the Brits at sea—the submarine. Though the concept of submarines had evolved as early as the 16th century, the idea of using them as weapons of war was barely a dozen years old. Britain had brushed them off as an anomaly, an unethical form of warfare that did not "fit" the classic, balanced structure of a navy. (One senior admiral called submarine warfare "underhand, unfair, and damned un-English.")

Germany, however, saw submarines as an ideal weapon of stealth and used them to attack merchant ships, in effect laying siege to the island and reducing its ability to receive shipments of food, arms, and other materials. In 1915, Germany resorted to even more extreme measures, sinking the cruise liner *Lusitania*, with a loss of 1,200 lives.

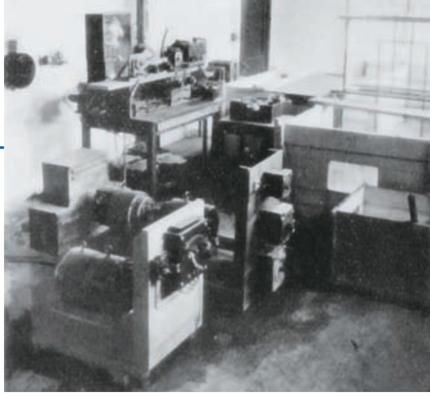
Lusitania was the final straw for University of Alberta head of physics, Dr. Robert William Boyle. A brilliant scientist and researcher whose focus was then on radioactivity, he had already volunteered his services to the Admiralty. He expressed his frustration with their inaction in a January 1915 letter to his mentor and former McGill professor, Ernest Rutherford, "Why is there no attempt to mobilize Empire scientific effort?"

A few months later, he had his answer. The Admiralty formed the Board of Inventions and Research (BIR) to look for "devices and methods that could shorten the war."

When Rutherford was appointed to the BIR panel that focused on submarines, mines, searchlights, telegraphy, electrical, optical, and acoustical subjects, Boyle wrote again. His persistence paid off and, with Rutherford's influence, "Billy" Boyle was on his way to England in April 1916 to join the scientific team.

Before Boyle arrived, Rutherford and his team had identified four potential means of submarine detection: utilizing the sound emitted, heat emitted, electromagnetic disturbance created, and visual characteristics. The team's initial work was devoted to passive detection through sound. While one research group worked on developing underwater acoustic microphones, Rutherford himself focused on the use of quartz, a piezoelectric material. When Boyle arrived, his first task was to develop a towed underwater electric acoustic signaler and later to work on a quartz transducer.

Meanwhile, the French, led by a scientist named Langevin, were working on active detection methods using an electrostatic method (the singing condenser). The two countries did not share their advances until after a June 1917 Allied Submarine Conference in Washington, where Britain,



Dr. Boyle's laboratory.

France, and the United States agreed to work cooperatively. Subsequently, scientists from France and England met and exchanged information, and Boyle was asked to replicate the French experiments in his lab. Results were initially disappointing, but that changed when Boyle was sent to France in 1917 for several months' work in Langevin's labs. There the knowledge and discoveries of both countries were merged: the British quartz transmitters and receivers were used with the newly invented French vacuum tube amplifiers. This development showed promise, and Boyle continued the consultations and experiments in both England and France over the ensuing months. After testing a few other theories, he focused on the echo method of picking up ultrasonic underwater radio signals. In March 1918, he was successful in identifying a submarine at a distance of 457 metres. He further simplified the system by adapting the echo method to both transmission and reception.

Combined with other British research, this became the basis for ASDIC (Anti-Submarine Division), the first type of sonar (Sound Navigation and Ranging, a name adopted by the United States). Following preliminary testing, 20 ASDIC sets were ordered and readied for installation in British ships; the trawler Ebro II was the first vessel outfitted with ASDIC and its crew began training in summer 1918. The ship was not fully operational until five days after Armistice was declared on November 11, 1918, so it was never deployed in this war.

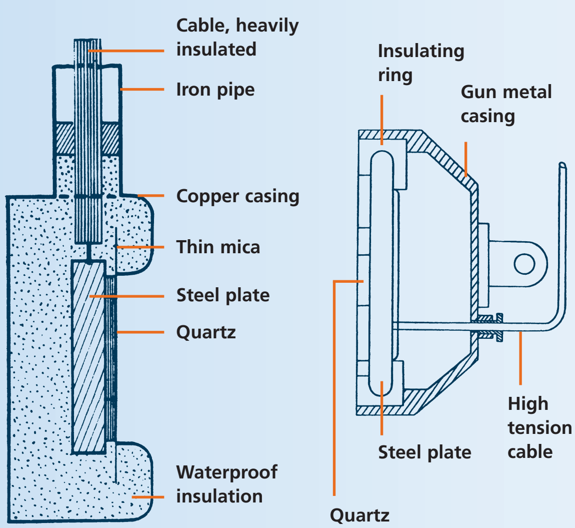
War's end found Boyle himself in France at an Allied conference on supersonic methods of detecting submarines, and he continued his ASDIC work for a few months post-war before he returned to University of Alberta, concluding in his final report to the Admiralty: "Considering their application in the future to all ships of the Navy and Mercantile Marines, these (ASDIC) results in my opinion warrant the continuation of this work in England on a much larger scale than the merely scientific experimental work we have accomplished so far."

His words were heeded, and work continued after the Great War's end. ASDIC provided Britain with a powerful weapon of warfare that gave it a head start in the early naval battles of World War II, a mere 21 years later.

Boyle received many awards and honours for his pioneering work in submarine detection and the development of ultrasound. But perhaps his most lasting legacy, familiar to Hollywood moviegoers for decades, is the recognizable submarine "ping, ping, ping" sound that means the enemy has been found.

Andrea Collins is an Edmonton-based freelance writer and public relations consultant.

SONAR (an acronym for Sound, Navigation and Ranging, but not used until World War II) is a system of underwater detection and location of objects by acoustical echo. The first sonars, invented during World War I by British, American, and French scientists, were used to locate submarines and icebergs and were called ASDICs (Anti-submarine Division) in Britain until 1948. They were passive devices. Active sonar became more common during the cold war, nuclear submarine years.



Dr. Robert William Boyle

Robert William Boyle was born in Carbonear, Newfoundland, in 1883. His scholastic achievements led to a scholarship to McGill University where he enrolled in engineering and became a protégé of Ernest Rutherford, who was researching the field of radioactivity. On graduation Boyle taught physics at McGill and continued his research under Rutherford, work that led to his receiving McGill's first PhD in 1909 and a scholarship to continue his work on radon and thoron in England for the next two years.

Boyle returned to McGill in 1911, but his tenure was short-lived. Dr. H. M. Tory, the first president of the University of Alberta, invited him to become the first head of the Department of Physics, and Boyle assumed this position in 1912. Though there were many challenges in establishing a new department at a new university, Boyle found time to persevere with his research on radioactivity, publishing many papers. He remained at U of A until 1916 when he joined the British Navy's BIR scientific research team during World War I. Work there led to the discovery of sonar for use in anti-submarine warfare.

On his return to the University of Alberta in 1919, Boyle established a research program focused on ultrasonics. Two years later, he was named Dean of the recently established Faculty of Applied Science, a position he retained until 1929.

He is also credited with creating a hub of research in western Canada during this decade. His own research included a detailed study of acoustic cavitation resulting from the passage of ultrasonic waves. He also investigated the transmission and reflection of waves, new methods to detect and visualize ultrasonic beams, and the diffraction and scattering of ultrasonic beams.

One other question that Boyle and his team at U of A explored was whether the speed of sound depended on the frequency of the ultrasound waves. Boyle wrote an extensive review of the new field of ultrasound that summarized much of his work; it was published in 1928.

In 1929, Tory offered Boyle a post with the newly formed National Research Council of Canada, where he headed the Division of Physics and Electrical Engineering until his retirement in 1948. He travelled extensively for the next seven years, and died at age 72 in London, England. He is widely acknowledged as a pioneer of modern ultrasound.

CHILDS, DAVID

(Chemical '00)

was named one of Alberta's most enterprising employees of 2006 by *Alberta Venture* magazine. Childs won the Customer Service E-Award. Childs is a process engineer for CoSyn Technology. He was congratulated for solving engineering problems at Syncrude's Fort McMurray operations. Childs suggested an inexpensive control system that alleviated the need for additional equipment and saved his client $15 million. He also anticipated a need for an electronic filing system that has been adopted by all business units at Syncrude.

CONSTABLE, KEN

(Electrical '72) PEng

was named president and chief executive officer of RedEnvelope Inc., in February 2006. Prior to joining RedEnvelope, he served as senior vice president and general manager of Provide Commerce Inc. From 1999 to 2003, Constable was with Dell Inc. where he served as vice president and general manager of several international divisions in Asia and Canada. From 1994 to 1999, he held a variety of senior positions at Nabisco Inc., including president and chief executive officer of Nabisco Canada Ltd. Prior to that, he was at PepsiCo from 1978 to 1994, where his senior management roles included regional vice president for Kentucky Fried Chicken Latin America, president of Frito-Lay Puerto Rico, vice president and chief marketing officer of Frito-Lay International, regional general manager of PepsiCo in South Latin America, and director of Marketing of PepsiCo Japan. Constable started his career as a brand manager with Procter & Gamble in Canada.

GUPTA, RAMESH DR.

(Electrical '76, PhD Electrical '80)

has been honoured as a Fellow of the Institute of Electrical and Electronics Engineers (IEEE). Following graduation, Gupta worked at COMSAT Laboratories in Clarksburg, Maryland, for more than 20 years. He served in various technical and management positions including as the managing director of the RF and satellite technologies group. In 2001, Gupta joined AMCOM Communications as a vice president of advanced business and technology. He served as a consultant to Japan Satellite Corp (JSAT) at Lockheed Martin Commercial Space Systems, Newtown, Pennsylvania, on JSAT-9 and JSAT-10 satellites, successfully launched for operation in 2006.

Gupta has contributed extensively to the development of gallium arsenide (GaAs) monolithic microwave integrated circuits and their applications to various satellite and wireless subsystems. He contributed to the development of beam-forming networks for reconfigurable active-phased arrays for advanced satellite systems.

Gupta has published more than 75 papers on satellite and wireless RF technology and systems for the American Institute of Aeronautics and Astronautics, at IEEE conferences, and in technical journals. He holds four U.S. patents. He was recipient of the Best Paper award at the 9th International Digital Satellite Communications Conference in Copenhagen, Denmark in 1992 and the COMSAT Laboratories Research Award in 1994.

As part of the technical and management team at Mobile Satellite Ventures (MSV), Gupta is presently involved with the development and deployment of a next generation hybrid Space Based Network.

OSPINA, CARLOS DR.

(MSc Structural '96, PhD Structural '01)

was recently honoured for best paper in the new construction category at the Composites in Civil Engineering (CICE) 2006 Conference, organized every two years by the International Institute for Fiber-Reinforced Polymers in Construction. Ospina is co-author of the paper titled "Indirect Crack Control Procedure for Fiber-Reinforced Polymer (FRP)-Reinforced Concrete Beams and One-Way Slabs." The paper provides an alternative model for flexural crack control of FRP-reinforced members in which, consistent with current American Concrete Institute (ACI) 318 recommendations for steel-reinforced members, cracks are controlled indirectly through a maximum bar spacing requirement instead of being calculated directly. The procedure results from the impracticalities associated with direct crack width measurement in concrete structures due to the high variability of both concrete cracking and crack width measurements. The proposed model accounts for the dominant effects that bar cover, FRP reinforcement stress, stiffness, and bond properties have on cracking of FRP-reinforced concrete beams and one-way slabs. The process is part of an effort towards unifying the crack control design provisions in ACI 440.1R-06, the design guideline that regulates the design of concrete structures reinforced with FRP bars, to follow the format adopted by the ACI 318 code.

LIM, SOO PING

(Mechanical '74)

has been appointed auditor general for Singapore. After obtaining his engineering degree and performing his national (military) service, Lim joined the public works department in 1975 as a mechanical engineer. Singapore, then a very young Republic, was stepping up its infrastructure development, e.g. public housing, schools, utilities, expressways, airports, and industrial estates. In 1988, Lim was admitted into the administrative service to work at policy level in government. His first appointment was director of planning in the Ministry of Home Affairs. Subsequently he was appointed to various positions in a number of government ministries, and handled policy issues in such areas as security, emergency planning, immigration, rehabilitation, primary production, building and construction, community development, information and communication, and arts and culture. He rose to the level of deputy secretary in the administrative service.

Lim has served on the boards of several government-linked organizations, including a construction company, a rehabilitative enterprise, two hospitals, a polytechnic, a performing arts centre, an arts school, and a music conservatory. He is a past president of the Canadian Alumni Singapore, and is currently a member of its advisory board.

STEIGER, DENNIS

(Electrical '86, MEng Electrical '89) PEng

has been appointed vice president, engineering for Shaw Communications Incorporated. Steiger is accountable for leading the development and implementation of the network infrastructure for cable, Internet, digital phone, and satellite. Steiger joined Shaw in 1994 as senior engineer. He has extensive knowledge and 20 years of experience in the cable and telecommunications industries.

Mark your calendar for

REUNION 2007

September 27 to 30

Reunion Activities Hosted by the Faculty of Engineering

Friday, September 28, 2007

Dean's Reception
4:30 – 7:00 p.m.
Engineering Teaching & Learning Complex (ETLC) – Solarium (2nd Floor)
Contact: Peggy Hansen at peggy.hansen@ualberta.ca or 780.492.7050

Kick off your Reunion Weekend by reconnecting with Engineering classmates, professors, and colleagues. Dean David Lynch and Mrs. Lynch invite all Engineering alumni and their guests to join them for complimentary hors d'oeuvres and refreshments in the ETLC Solarium.

Saturday, September 29, 2007

Dean's Brunch
9:00 – 11:00 a.m.
Engineering Teaching & Learning Complex (ETLC) – Solarium (2nd Floor)
Contact: Peggy Hansen at peggy.hansen@ualberta.ca or 780.492.7050

All Engineering alumni who graduated in 1962 or earlier and their guests are invited to a complimentary hot brunch, hosted by Dean David Lynch and Mrs. Lynch. Dr. Lynch will celebrate the accomplishments of alumni and will speak on the past, present, and future of the Faculty of Engineering at the University of Alberta.

Open House, Tours, and Lectures
9:00 a.m. – 4:00 p.m.
Engineering Teaching & Learning Complex (ETLC)
Contact: Peggy Hansen at peggy.hansen@ualberta.ca or 780.492.7050

The Faculty of Engineering is pleased to welcome alumni, prospective students, and guests to Engineering Open House 2007. Take in displays from the four Engineering departments and numerous student groups and attend free lectures on a variety of engineering-related topics. Tours of the Engineering buildings will be available. The alumni hospitality lounge will be open to provide a quiet place to enjoy a coffee and catch up with former classmates.

Confirmed Class Organizers

For class organizer contact information, or to volunteer to organize a class that is not listed, contact Leanne Nickel at leanne.nickel@ualberta.ca or (780) 492-4159.

'42 Civil, Louis Grimble
'47 Civil, Bill McLaggan
'47 Electrical and Eng Physics, Bob Shortreed
'52 Chemical, Bill Laureshen
'52 Electrical and Eng Physics, Bob Choate
'52 Petroleum, Dr. Pete Dranchuk
'57 Chemical, Dr. Fred Otto
'57 Civil, Doug Ferrier
'57 Electrical, Anders Anderson
'57 Mining, Andy Barnes, Dr. Vern Plitt
'62 Electrical and Eng Physics, James Spalding
'62 Mechanical, Walter Germaniuk
'67 Chemical, David McNeil
'67 Civil, Ron Neuman, John McDougall, Peter Rivers
'67 Electrical, Peter Van Der Zee
'67 Mechanical, Rob Armstrong
'72 Chemical, Jim Smith
'72 Electrical, Lloyd Checknita
'77 Chemical, John Prusakowski
'77 Civil, Al Stowkowy, Ken Hart
'77 Electrical, Bob Nichol
'77 Mechanical, Paul Humphreys, Claus Littman, Ed Howes
'82 Chemical, Ian Verhappen
'82 Civil, Peter Mittal, Gary Evans, Don Law, Oscar Rutar
'82 Electrical, David Woodhouse
'87 Mechanical, Sheila Buckle
'92 Computer, Electrical and Eng Physics, Kurous Behzad
'92 Mechanical, Joel Regenstreif
'97 Chemical, Debra Tetteh-Wayoe, Anna Ho
'97 Mechanical, Andrew Searle
'02 Computer, Sunny Bhasin
'02 Electrical, Scott Hohn
'02 Eng Physics, Anastasia Elias

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University of Alberta ENGINEERING

Engineering Generations

Last year, the Faculty of Engineering launched the "Engineering Generations" program to celebrate the rich tradition of U of A Engineers and to recognize families who have multiple members who have graduated from the Faculty.

Engineering families are honoured on the brick wall immediately outside the solarium in the Engineering Teaching and Learning Complex. Names have been mounted on plaques. There are 170 families representing over 540 alumni—a testament to the fact that U of A Engineers frequently act as mentors to young people considering careers in engineering, and that this mentoring often takes place within families.

If you have family members who are also U of A Engineers and your names do not yet appear on our wall, please speak to David Petis to ensure that your family is recognized.

For further information contact:

David M. Petis, Assistant Dean
External Relations, Faculty of Engineering, University of Alberta
E6-050 Engineering Teaching and Learning Complex
Edmonton, AB T6G 2V4
Tel: 780.492.5080 Fax: 780.492.0500
E-mail: david.petis@ualberta.ca

Marta Dmytruk (Civil '97) and **Chrys. Dmytruk** (Chemical '60).

I wish to make a gift of:

☐ $100 ☐ $500 ☐ $1,000 ☐ $2,500 ☐ Other $________

☐ Cheque (made payable to the University of Alberta) ☐ VISA ☐ MasterCard

__________/__________/__________/__________/ expiry date: __________

Name (please print): ______________________________________

Signature: ______________________________________

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☐ a corporate matching gift form from my (or my spouse's) employer

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Your tax credit for your gift:	$42.00	$209.00	$418.00	$1,045.00

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$ __________ Mechanical Engineering Learning Laboratory Fund*

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☐ I would like information on how to make a gift of publicly traded securities to support the Faculty of Engineering at the U of A.

☐ I would like information on how to include the Faculty of Engineering at the U of A as part of a will, life insurance, or other planned gift instrument.

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