

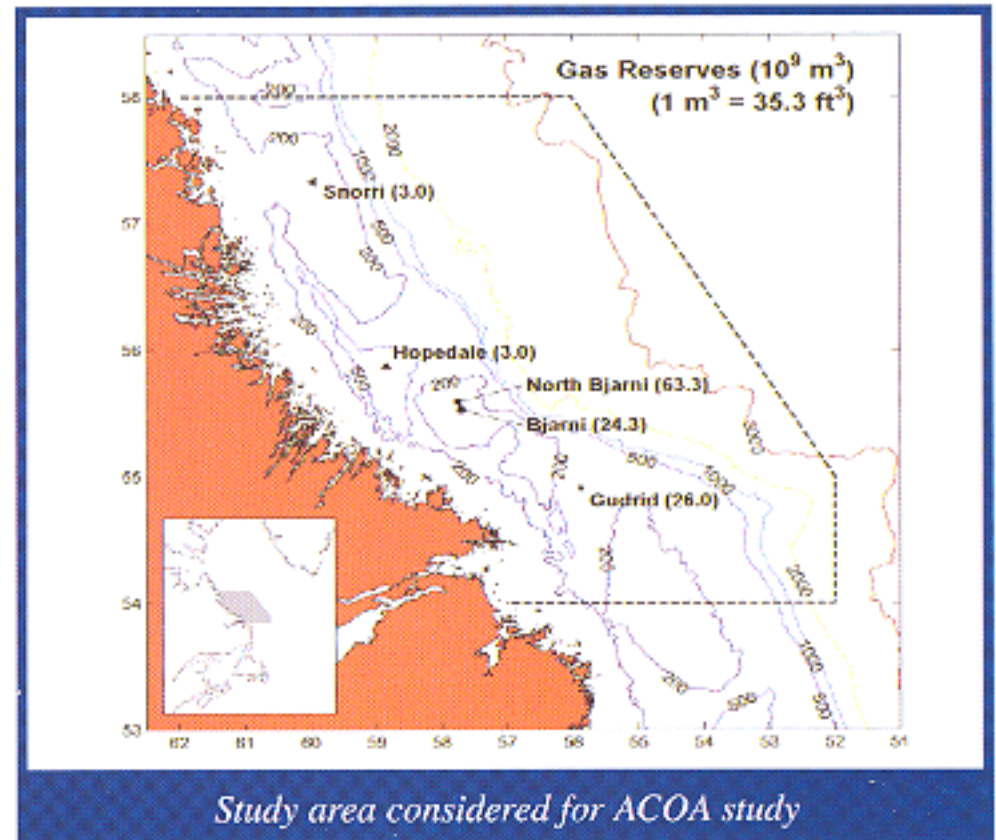


Labrador Environmental Characterization Study

In May of 2007 C-CORE submitted the report "Location, Environmental and Other Factors Influencing Exploration and Development of Labrador Gas" to the Atlantic Canada Opportunities Agency (ACOA). Prepared by C-CORE, Jacques Whitford, Minaskuat and Sikumiut Environmental Management, the objective of the report was to describe the metocean, sea ice, iceberg and iceberg scour regime in the study region (see Figure), as well as the geotechnical conditions and any other development considerations (i.e. regulatory, aboriginal issues, environmental). The report provides insight into the technical requirements for exploration as well as protection, installation and operation of alternative gas production concepts.

Canadian Ice Service (CIS) charts were used to compile ice frequency and type. Various parameters (thickness, floe size, drift speed) were assessed using the available literature, additionally thickness and drift was characterized using data collected using upward looking sonar. Metocean conditions were evaluated using the MSC50 wind and wave hindcast and other data available primarily through Environment Canada and the Department of Fisheries and Oceans (DFO). Iceberg frequency was estimated using CIS iceberg charts and other survey data. Iceberg drift was calculated using wellsite observations collected during drilling operations and supplemented with data from the CIS iceberg drift model. Iceberg size was evaluated from wellsite observations and various aerial surveys. The summary of the iceberg scour regime was based primarily on data collected during the 2003 Makkovik Bank seabed survey. Geotechnical conditions were identified using data summarized in the Bjarni Development Study (Petro-Canada, 1983) and various data compiled by the Geological Survey of Canada (Atlantic). Information regarding regulatory, aboriginal and environmental issues was drawn from a wide variety of sources.

With a number of data gaps noted, data collection programs were



recommended to better distinguish specific parameters. These include iceberg scour frequency and geometry, iceberg size, frequency and movement, pack ice characteristics, bathymetry and geotechnical data. Repetitively mapping the 2003 scour survey area with multibeam would yield very useful and reliable data regarding iceberg scour rates, given that the comparison would be between two large multibeam data sets. Detailed iceberg surveys should be conducted on an ongoing basis to better distinguish iceberg frequency, size distributions and movement. Of particular interest is the presence of ice islands, which can also influence activities downstream on the Grand Banks or in the Orphan Basin. Additional information on pack ice draft distributions would allow better characterization of potential pack ice loads, particularly multiyear floes (frequency and thickness) which are poorly documented at present, with the exception of a few reports produced in the 1970's. Additional bathymetric information along the inner shelf is required to identify potential landfall routes for pipelines. As well, geotechnical and geological information is required to support future developments.

Inside this Issue	
Arctic Research at C-CORE	2
Geotechnical Engineering Mentor Program	3
Long-Term Research Project	4
New Employees at C-CORE	6
New Board Members	7



**From Everyone at
C-CORE**

Arctic Research at C-CORE

Recent years have seen renewed interest in offshore oil and gas exploration in the Arctic regions. With this increased attention has re-emerged the need to find acceptable and efficient development options. One key element of the development puzzle is the method of transporting oil or gas product from offshore production locations to existing infrastructure (for example by pipeline).

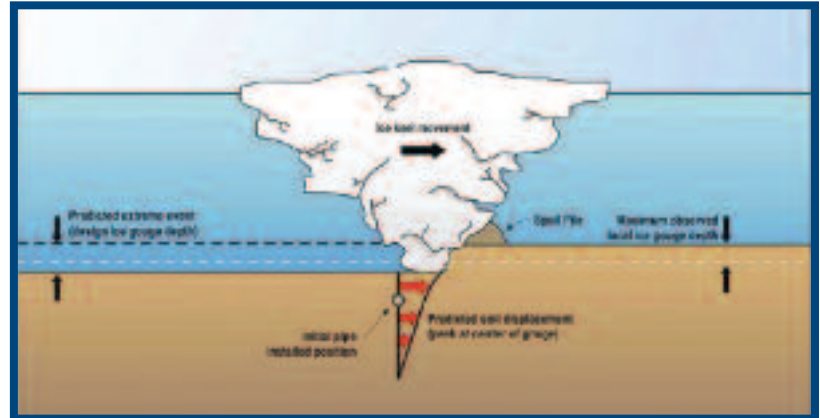
C-CORE has been contracted by the US Government Minerals Management Service (MMS), Department of the Interior to study the design options for offshore pipelines in the US Beaufort and Chukchi Seas off the north and west coast of Alaska.

The design of arctic pipelines and protection requirements in the Arctic offshore are driven by hazards such as ice gouging, strudel scour and upheaval buckling. The pipeline wall thickness, linepipe grade and ductility, trench depth and backfill requirements are important factors for consideration in pipeline engineering design. The particular focus of the project is to address data requirements, analysis and design methods for arctic pipelines subjected to the following hazards:

Ice Gouging - In northern waters, ice features may have sufficient draft to contact the seabed and a process known as ice gouging can occur. The ice keel can penetrate into the seabed and create gouges or furrows that can be meters deep, tens of meters wide and hundreds of meters long. Ice gouging in the vicinity of a pipeline can lead to loading damage or failure, even if the pipe is buried below the depth of the gouging keel.

Strudel Scour - Strudels are powerful vortices that can form when spring river floods flow over sea ice. The river water breaks through at weak points, and pours downwards through holes, resulting in a strong downward-pointing jet which can scour the seabed and expose a buried pipeline. Strudel scour may be a threat when pipelines are constructed across the mouths of rivers or off river deltas. The pipeline loses support, and can be at risk from vortex shedding, hydrodynamic loads, buckling and ice keel contact.

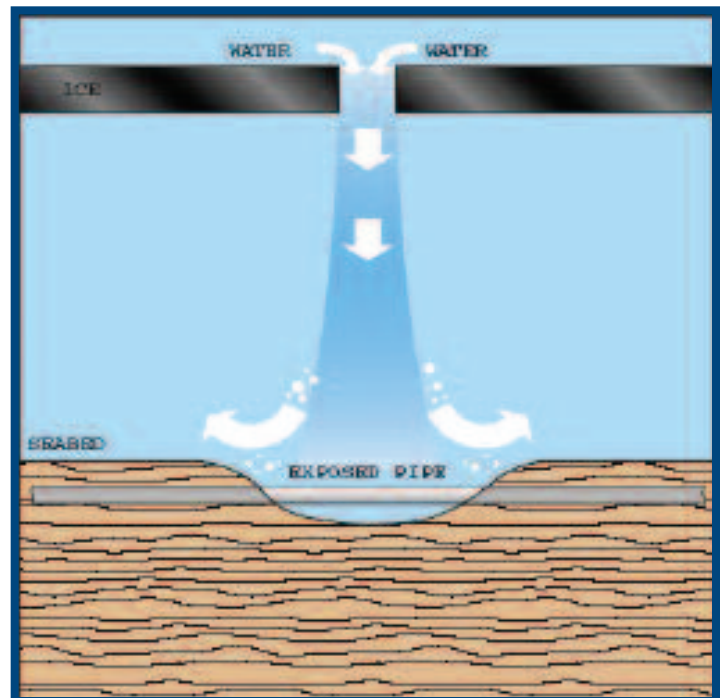
Upheaval and Lateral Buckling - An operating pipeline carries a large axial compressive force due to pressure and temperature effects, and it can cause the pipeline to buckle. (If the pipeline is buried or in a trench, it usually buckles upward if there is insufficient soil cover to resist this buckling force. If the pipeline



Ice Gouging

is not buried, it buckles sideways.) Pipeline buckling may be accentuated by combined action with ice gouging or strudel scour.

The results of this study will allow operators and regulatory authorities to properly consider the potential impact of these Arctic hazards to offshore pipelines. This provides a basis for ensuring safe and efficient designs are developed for future offshore Arctic developments. The work will be completed at the end of 2007.



Strudel Scour

Geotechnical Engineering Mentor Program at C-CORE

In response to the demand for geotechnical engineering expertise, C-CORE has initiated a program specifically for “growing” bright young engineers into highly qualified geotechnical specialists.

C-CORE provides world class technical expertise in four areas: geotechnical engineering, ice engineering, intelligent systems and remote sensing. While these have traditionally been somewhat independent pursuits, increasingly they are “bundled” to provide clients with a more comprehensive service. For example, using satellite reconnaissance, the Remote Sensing Team is able to measure ground deformations on the order of 0.5 cm or larger. The Geotechnical Team can use these measurements to provide analysis of the resulting stress on infrastructure. Similarly, the Ice Engineering Team is expert in ice gouge phenomena whereby an iceberg or ice keel gouges or scours the seabed. Combining this with our geotechnical expertise enables C-CORE engineers to analyse the continuum from ice properties to ice-seabed interaction, seabed response, and resulting structural response of, for example, a buried pipeline.

C-CORE will invest \$390,000 over three years to train and develop a base of young, highly-qualified geotechnical engineers. This will advance the local knowledge pool and develop innovative technologies and solutions to benefit resource and civil developments both locally and abroad.

The program will be delivered in three main components:

- i) Internships in Innovative Technology – aimed at providing 2 years of work experience to graduates seeking full-time employment;
- ii) Co-operative Work-Term Placements – aimed at providing



Students and Mentors of C-CORE’s Geotechnical Engineering Mentor Program
(L-R) Dave Mercer (Work Term Student), Vince Morgan (Director, Geotechnical Engineering C-CORE), Tim Park (Engineering Graduate), David Tucker (Part Time Grad Student), Dr. Ryan Phillips (Principal Consultant, Geotechnical Engineering – C-CORE), Kenton Pike (Full Time Grad Student)

practical experience for 4 month work placements to engineering students enrolled in co-operative educational programs; and
 iii) Graduate Student Stipends – aimed at encouraging students to complete advanced graduate degrees focused on industry relevant issues, particularly in support of the Province’s resource developments.

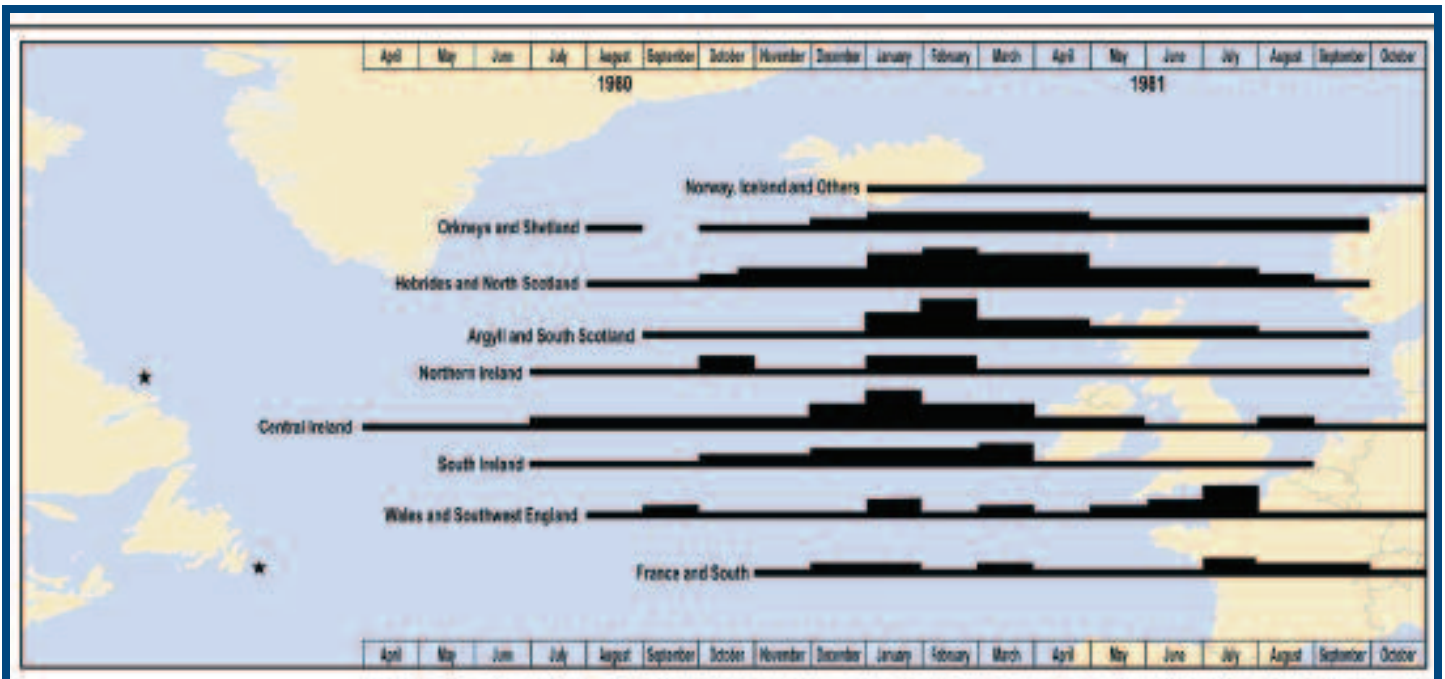
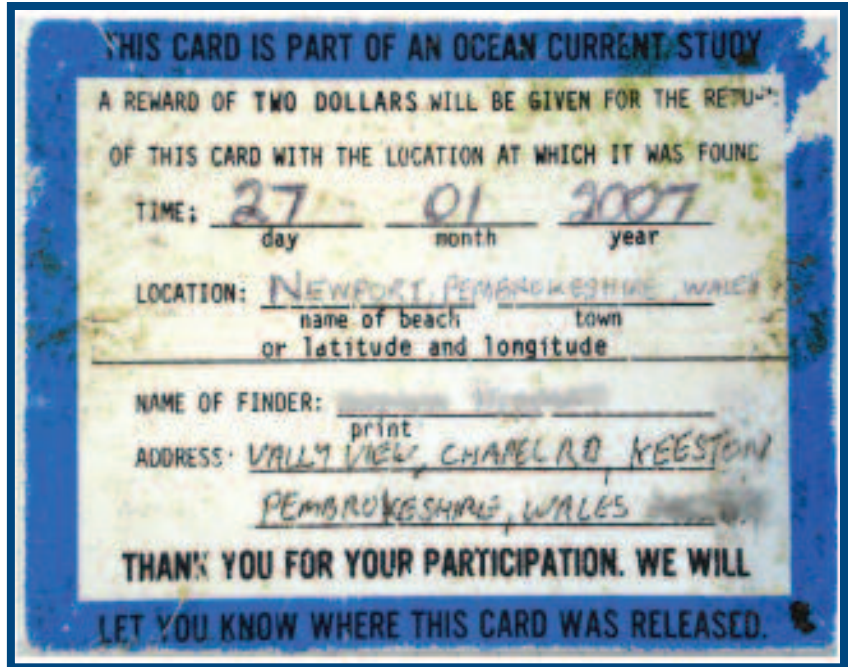
Through its industrial projects and partners, C-CORE will lever support from industry and government, and provide its own investment to train people to meet the innovative geotechnical engineering needs of our clients and partners. Those companies interested in being involved in the program through joint work placements of the interns or those who are interested in co-sponsoring a graduate student to work on a geotechnical issue of relevance to your firm are asked to contact Dr. Ryan Phillips (Ryan.Phillips@c-core.ca).

Long-Term Research Project?

Would oil spilled off Newfoundland and Labrador result in a pollution threat to the Province? If asked that question today, C-CORE would integrate surface current and wind data with oil slick fate prediction models, run a few thousand Monte Carlo simulations and, after several minutes, tell you where and with what probability an oil slick could wash ashore. When asked that question in 1979, deriving an answer took a little longer – 28 years and counting!

In 1979/80 C-CORE released nearly 10,000 plastic cards that were designed to float on the sea surface, drifting with the current and wind in imitation of an oil slick. Nine thousand drifter cards were released from key areas offshore Newfoundland and Labrador and, as a supplement to the program, 800 were released in the Beaufort Sea. Two years later upwards of 20% of the cards were returned from locations indicated in the figure on page 4.

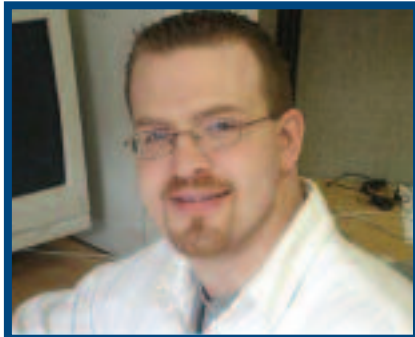
(Continued on page 5)



*Return rates from Europe by latitude of drift cards released in 1979 off Newfoundland and Labrador (drop zones indicated by *). Each line width (-----) represents a rate of 1-5 cards per month*

C-CORE Fellowships

One key to C-CORE's success in providing advanced engineering solutions to complex challenges is our commitment to supporting research for future commercial utilization. C-CORE maintains its position at the leading edge of technology development by proactively facilitating lifelong learning of its staff and through our support of business and engineering undergraduate and graduate students. C-CORE will soon reach the very significant milestone of having supported 1000 students.



Rocky Taylor

This year we have reintroduced the C-CORE Fellowship. This fellowship existed in the early days of C-CORE but has not been awarded in over a decade. The fellowship is for up to \$20,000 annually for two years and is available to staff who wish to take a leave of absence to complete a graduate degree, or others

undertaking graduate research relevant to our clients.

C-CORE is very pleased to announce that the first "new" C-CORE Fellow is Rocky Taylor. Rocky is on an educational leave from C-CORE to pursue a Ph.D. in Ice Engineering at Memorial University. Rocky's thesis is focused on the role of fracture in the compressive ice failure process and will examine the spatial and temporal variation of ice pressure at several scales. The ultimate objective is to integrate this knowledge into a probabilistic framework connecting local ice pressures, probabilistic averaging methodology and global load models used in the determination of design loads for structures in ice.

C-CORE is an innovative engineering solutions provider based in St. John's, NL, Canada.

We publish *C-CORE News* twice a year for our partners, clients, and associates.

President & CEO

Dr. Charles Randell

Vice-President, Operations

Susan Kennedy

Directors

Des Power
Vince Morgan
Freeman Ralph
Paul Adlakha
Tanya Ivany

Deputy Director

Chris Fowler

Business Manager

David Gullage

Principal Consultant - Ice Engineering

Dr. Ian Jordaan

Principal Consultant - Geotechnical Engineering

Dr. Ryan Phillips

www.c-core.ca

709-737-8354

info@c-core.ca

Long-Term Research con't

(Continued from page 4)

Gradually the return rate slowed then stopped, conclusions were drawn, reports written and the project closed. Fast forward 25 years to January 2007 and you can imagine the surprise at C-CORE when the card pictured arrived in the mail. It was released off Newfoundland and Labrador in 1979 and retrieved 28 years later on the coast of Wales. (Incidentally, two dollars no longer covers the postage.)

Today if C-CORE was to predict the fate of an oil spill we could do so in hours, but we doubt we would still be writing about it nearly 30 years later.



New Employees

C-CORE's growth in activity – we now deliver on over 100 contracts annually – has resulted in the need for a senior position dedicated to assessing and addressing future clients' needs. Filling this position is Paul Adlakha who joins C-CORE as Director of Marketing and managing C-CORE's new office in Nova Scotia.



Paul has a degree in Electrical Engineering and has spent most of his career in marketing and business development of technology oriented companies - both in the manufacturing and the services sectors. Prior to coming to C-CORE he was Vice President Marketing and Sales at SEIMAC Ltd.

Originally from India, Paul now lives in Fall River, just outside Halifax, with his fiancé. He has 4 daughters also living in Nova Scotia.

2007 and is employed in the capacity of Project Engineer. Brad is a recent Memorial graduate, having completed the Bachelor of Engineering program in May 2007 where he majored in mechanical engineering. Prior to coming to C-CORE, Brad gained valuable work-term experience with organizations including Hibernia, Chevron, Hydro and IOT. When he's not busy with his engineering duties, Brad enjoys scuba diving, kayaking, ball hockey, hiking and playing guitar.



Muthu Gandhi joined our GeoSIS team as a Software Developer in May 2007. Muthu graduated from Memorial University's Bachelor of Engineering program in May 2007 with a major in computer engineering. His time in the co-operative program allowed him to gain relevant experience with companies such as Research in Motion,

Stratos and the YOA Foreign Exchange. In addition to his passion for computers, Muthu enjoys a game of soccer.



Fazan Kasmani joined our Ice Engineering team in August 2007. Like his colleagues, Fazan graduated from MUN's Bachelor of Engineering program in May of this year, majoring in ocean and naval architectural engineering. His work term experience included working with BMT Fleet, the Vancouver Shipyard, and Peter Kiewit and Sons, to

name a few. Undoubtedly his interest in ship design and construction is well suited to his chosen profession. Other noted interests include sailing, windsurfing, snowboarding and soccer.

Brad Elliott joined our Geotechnical Engineering team in July

C-CORE Welcomes New Board Members



Ruud B. Zoon
Vice President
East Coast Operations
Husky Energy

Mr. Zoon joined Husky Energy in September of 2004 as General Manager East Coast Development, and was appointed Vice President East Coast Operations in August 2005. Based in St. John's, Newfoundland and Labrador, he is responsible for all aspects of Husky's East Coast operations,

including the \$2.35 billion White Rose development.

Mr. Zoon started his career with Mobil Oil Corporation in 1984, working in engineering and leadership roles in the Netherlands and the United States. From 1996 to 1998 Mr. Zoon was Asset Manager of the Beryl Area; Mobil's largest oil and gas producing asset in the North Sea.

From 1998 to 2004, Mr. Zoon was Vice President of Floating Production for Bluewater Energy Services, with responsibility for capital projects and operations related to its fleet of floating, production, storage and offloading (FPSO) vessels in the North Sea, South Africa and China. He was instrumental in facilitating the successful growth of the company. During his tenure with Bluewater the number of FPSOs under his control increased from two to five.

Prior to joining Husky, Mr. Zoon was President and Managing Director of Sonoil B.V., a consultancy firm advising oil companies on capital project execution and supporting oil industry acquisition and divestment activities.



Stephanie Wilson
Director, Project and Risk
Management Systems
TransCanada

Ms. Wilson is currently the director of TransCanada's Project and Risk Management Systems team that supports TransCanada's growing pipeline and power project portfolio. Prior to this role, she was a manager in TransCanada Power Projects Implementation team responsible for the construction and

operation of 749 MW of wind power projects in Quebec's Gaspé Peninsula. Before joining TransCanada in 2001 as a project manager, responsible for small to medium size projects in TransCanada's pipeline integrity group, Ms Wilson was a mechanical engineer with Gazoduc TransQuebec and Maritimes

(TQM) responsible for various engineering and operational duties. She began her career with NB Power as a Mechanical Engineer based out of Saint John, New Brunswick, in its thermal generation group.

Ms. Wilson was a member of the Board for the Foundation of nature museums of Montreal (Planetarium, Biodome, Botanical gardens, and Insectarium) She was born and raised in Montreal and moved to New Brunswick to study at the University of New Brunswick where she received her B.Sc. in Mechanical Engineering.



Cathy Duke
Deputy Minister
Department of Innovation,
Trade and Rural Development,
Government of Newfoundland
and Labrador.

Cathy Duke was appointed Deputy Minister, Department of Innovation, Trade and Rural Development, Government of Newfoundland and Labrador in November 2006. The department is the province's economic development agency

responsible for the promotion and support of small and medium enterprise development, regional economic development, innovation, trade and investment.

Prior to this, Ms. Duke served as Executive Director of the Ireland Business Partnerships where she led the province's efforts to encourage trade and partnership opportunities with Ireland in the areas of business, culture and education. Ms. Duke came to this position from the private sector where she served as President of Sports Villas Resort Inc., the operator of the Terra Nova Golf Resort.

Her previous involvement in the business community included executive positions as Executive Director of Hospitality Newfoundland and Labrador, Executive Director of the Economic Recovery Commission, Vice President of Coastal Associates and Consultants Limited and Business Development Officer with the Atlantic Canada Opportunities Agency. Among her former board appointments are board positions with the St. John's International Airport Authority, the Newfoundland and Labrador Tourism Marketing Council, the St. John's Board of Trade and the Governor General's Canadian Leadership Conference. Over the years, Ms. Duke has been an active volunteer in the women's community. She holds a Bachelor of Social Work (B.S.W.) and Masters of Business Administration (M.B.A) from Memorial University of Newfoundland and Labrador.

Ms. Duke resides in St. John's, NL where she lives with her

Logbook: Return to Newfoundland and Labrador

My first employment was in the early 80's with Petro-Canada's offshore research group in Calgary. The main focus at the time was analyses of ice and wave loads for the Hibernia and Terra-Nova facilities. I moved to St. John's in 1988 to work at C-CORE, later deciding to enroll in a Master's program in Ocean Engineering at MUN. I completed a doctorate entitled 'Decision-making for Offshore Resource Development' in 1997 while doing consulting work with Ian Jordaan and Associates.

While in St. John's, I made some great friends and enjoyed hiking, back-country skiing, canoeing and playing music. I met my wife Glenda in 1991 and we have two daughters. As a result of this marriage I have also inherited a very large, wonderful Newfoundland family.

We moved to Edmonton in 1998 where I worked in the pipeline group at C-FER and Glenda worked at the University Hospital. Activities there included coaching soccer and volunteering with the Rabbit Hill Ski Club, where our younger daughter participated in competitive downhill skiing. Our family also enjoyed two great trips overseas, one to Europe and the other to South Africa to visit family and see Kruger National Park.

We returned to St. John's this year after I was offered a position in the Ice Group at C-CORE. The offshore and arctic related work at C-CORE is very exciting and C-CORE has a very



Mark and his family in South Africa

positive management approach. St. John's provides great outdoor life and has an amazing variety of cultural activities for a relatively small city. We are pleased to be back and look forward to visits next summer from a number of friends we made out west who have expressed a keen interest to see Newfoundland. We also plan to get back into cross-country skiing and take up kayaking.

Dr. Mark Fuglem is a Senior Project Engineer with C-CORE's Ice Engineering Team

If undelivered, return to:



Captain Robert A. Bartlett Building
Morrissey Road
St. John's, NL
Canada A1B 3X5

