

ANNUAL REPORT
April 2006 – March 2007



Table of Contents

Introduction	
Summary of Industry-----	3
Background-----	3
Mission and Mandate	
Mission-----	4
Mandate-----	4
Governance	
The Board of Directors-----	5
Highlights of 2006 - 2007	
International Marine CNG Forum-----	6
The Link-----	6
Oil & Gas Week 2007-----	6
Local and Global Presence-----	7
Alliances-----	7
Major Milestones-----	8
Our Community-----	8
Research	
Research Advisory Committee-----	8
Research Projects-----	9
Research Reports-----	11
The Centre Team-----	12
Membership	
Who our membership includes-----	16
Our Facilities	
Natural Gas Research Lab-----	17
Indoor Natural Gas Test Facility-----	17
Project Space-----	18
Future Directions-----	18
Thank You-----	19

Introduction

Summary of Industry



The Centre for Marine CNG located in the Port of St. John's
Photo Courtesy of City of St. John's.

One of the newest frontiers in the upstream energy sector is marine compressed natural gas (CNG), and the economic challenge of how to safely transport and market marine CNG on a regional or international basis. Stakeholders are working to meet these challenges head-on and are creating solutions for all aspects of development, transportation and delivery of a reliable CNG product to varied customers.

Marine transport of Compressed Natural Gas (CNG) is critical to the monetization of stranded gas reserves, and to meet the energy needs of developing economies worldwide. The Centre for Marine CNG Inc. is the focal point for testing and development by technology proponents and potential users of CNG systems. Regulations and safety standards have been drafted by several Class Societies to support marine transportation of CNG.

Traditional concerns surrounding technical feasibility have given way to economic considerations on a project by project basis, with increased focus on the niche capabilities that marine CNG fulfills. Proponents have succeeded in overcoming the technical challenges and have attained regulatory approvals for their designs. The race is on to be the first successful commercial application of this technology.

The Centre for Marine CNG Inc. has been tracking the progress of all the proponents, while advocating for the technology as a whole. While research continues on the technical aspects of CNG, the gas owner/operators have recognized that the first project is imminent and are following the technology appropriately.

Background

The Centre for Marine CNG Inc. is the world's first research and development corporation for large-scale marine transportation of compressed natural gas. The Centre is located in St. John's, Newfoundland and Labrador, Canada, and brings together oil and gas companies, shipping companies, class societies, regulators, technology proponents, scientists and governments, all focused on innovation in the field of compressed natural gas.

The east coast of Canada (Newfoundland & Labrador and Nova Scotia) hosts a significant supply of natural gas resources located within a close shipping distance to robust markets in the northeastern United States. Industry and government alike have been actively seeking the means to develop these gas reserves, however, traditional solutions (e.g. pipeline) have

technical and cost issues surrounding them and have not proven to be economic in this environment. It is for these reasons that the Centre is located in Canada's largest offshore supply and service Port.

Mission and Mandate

The original vision of the Centre has adjusted to accommodate the dynamics of the industry. Between January 2006 and early 2007, the Members, the Board and the Centre team developed a new Mission and Mandate to reflect the purpose and strategic direction of the Centre.



Michael Hanrahan, Bill Sember, John O'Dea

Mission

We will be at the forefront of technology development associated with marine compressed natural gas and, as appropriate, other natural gas marine monetization applications; providing value to our Members and working in partnership with industry, governments, research institutes and other stakeholders.

Mandate

We will be the *Centre of Excellence* in promoting and performing research and development activities supporting innovative natural gas development and transportation systems. We will earn this status by diligently conducting the following core activities:

- Leading and executing research programs;
- Providing focused consultancy services and technical advice;
- Offering laboratory and testing services;
- Advocating for emerging technologies; and
- Collaborating with leading institutions and universities.

These guiding statements afford the Centre the opportunity to pursue research opportunities and business in areas that complement the body of knowledge and expertise being developed in the primary pursuit of developing marine CNG technology.

Governance

The Board of Directors

The Board of Directors of the Centre for Marine CNG Inc. meets on a quarterly basis and has responsibility for governance of the Centre including fiscal oversight, adherence to operating plans, and performance of the executive team.



Standing (L-R): Michael Hanrahan, Dr. Bill Pike, Brian Condon, Dr. James Wright, Mark Richards, Dr. Raymond Gosine
 Sitting (L-R): John O’Dea, Bill Sember, Dr. Chris Loomis, Gunther Baumgartner
 Missing: Ruud Zoon, Andrew Noseworthy

Name	Office	Affiliation	Address
Dr. Christopher Loomis ^(E,A)	Chairman	Memorial University	St. John’s, NL
Mr. William Sember ^(E)	Vice Chairman	ABS	London, UK
Mr. Gunther Baumgartner ^(E,A)	Treasurer	North Atlantic Refining	Come by Chance, NL
Mr. John O’Dea ^(E)	Secretary	McInnes Cooper	St. John’s, NL
Dr. Raymond Gosine	Director	Memorial University	St. John’s, NL
Dr. William Pike	Director	Hart E&P Publications	Houston, TX
Dr. James Wright	Director	Memorial University	St. John’s, NL
Mr. Brian Condon	Director	Dept. Natural Resources	St. John’s, NL
Mr. Mark E. Richards	Director	Versa Power Systems	Ohio, USA
Mr. Ruud Zoon ^(A,N)	Director	Husky Energy	St. John’s, NL
Mr. Andrew Noseworthy ^(N)	Director	ACOA	St. John’s, NL
Mr. Michael Hanrahan ^(E,A,N)	Managing Director	Centre for Marine CNG	St. John’s, NL

E=Executive Committee A=Audit Committee N=Nominating Committee

Highlights of 2006-2007

International Marine CNG Forum



The 3rd annual International Marine CNG Standards Forum was held on November 7th-9th, at the Delta Hotel in St. John's, Newfoundland and Labrador. The event was a success attracting over 100 delegates from 13 countries. There were 30 speakers, each respected leaders in their fields, who addressed many relevant topics including:

- Power generation with CNG was the fuel solution;
- Creating safe models for CNG carriers based on LNG;
- Insurance for the marine CNG industry;
- The Mtwara-Mombasa CNG export project; and
- 12 months of progress (the Marine CNG technology developers' panel).

The 2006 event featured three keynote speakers: Mr. Robert Kennedy, Jr., who referenced the environmental benefits of marine CNG; Ambassador Kenneth D. Taylor, who spoke about the geopolitical threats to energy supply that are affecting price but also stimulating innovation; and Dr. William Pike, who spoke about many new technologies for natural gas monetization including hydrates.

The event received excellent press attention and was covered by local and international media including The Telegram, VOXM News, Rogers Cable, TradeWinds, Upstream and Hart Publications.

Planning for the 2007 International Marine CNG Forum is well underway. This year's event will be at the Fairmont Hotel Newfoundland, in St. John's, on October 30th and 31st.

The Link

The Link is the Centre's newsletter published on a quarterly basis. It is distributed to a list of over 800 subscribers throughout the world and is featured on our website (www.cmcng.com). The Link provides a concise overview of news and events in the marine CNG industry, as well as affording the Centre an opportunity to showcase its research initiatives and human resources.

Oil & Gas Week 2007

In February, the Newfoundland and Labrador-based oil and gas industry participants sponsored a week of activities to promote the



important role the industry plays in our community. The theme of this year's event was "World of Opportunity". As the province's only research & development corporation dedicated exclusively to the oil & gas industry we felt it critical to be a sponsor of Oil & Gas Week and to host an Open House and Reception at our Centre.

Oil and Gas Week 2007 provided information to the public on the provincial oil and gas sector with a focus on research and development. The guests, including college and university students, provincial government and industry representatives, as well as the media, learned about current research initiatives, the potential of marine CNG, and the bright future for offshore eastern Canada.

Local and Global Presence

Fulfilling our mandate to promote this new technology, representatives of the Centre for Marine CNG attended strategic events around the world. Speaking engagements occurred at the following:



Photo Courtesy of Canada-Newfoundland & Labrador Offshore Petroleum Board

- Petroleum Research – Atlantic Canada's (PRAC) Small Field Development Workshop in Halifax, Nova Scotia, Canada
- NOIA Conference in St. John's, Newfoundland and Labrador, Canada
- LNG Global Outlook Conference in New Orleans, United States
- Society of International Gas Tanker and Terminal Operators (SIGTTO) conference in Vancouver, British Columbia, Canada
- Oil & Gas Symposium in Halifax, Nova Scotia, Canada

- International Oil & Gas CFD Conference in London, England

The Centre was also represented at the following events:

- Energy Commercialization Conference Saint John, New Brunswick, Canada
- Global Petroleum Show Calgary, Alberta, Canada
- Gastech, Abu Dhabi, United Arab Emirates.

The Centre submitted an abstract and was approved to present at the 2007 Offshore Technology Conference (OTC) in Houston.

Alliances

In 2006 – 2007, the Centre formed several strategic alliances that enable it to retain minimal overhead while offering competitive services. Our current alliance partners include:

- Poseidon Marine Consultants – full service naval architecture and marine engineering consulting firm, St. John's, Newfoundland & Labrador, Canada.

- nsb Offshore – engineering consultants and offshore professional and staffing company, St. John’s, Newfoundland & Labrador, Canada;
- M.A. Abdi Process Consulting & Services Inc. – process engineering consulting, St. John’s, Newfoundland & Labrador, Canada;
- Dr. Brian Veitch, P.Eng. – marine systems advisor, St. John’s, Newfoundland and Labrador, Canada; and
- Memorial University of Newfoundland, Faculty of Engineering and Applied Sciences Industrial Outreach Group – graduate students, post-doctoral fellows and research associates, St. John’s, Newfoundland & Labrador, Canada.

Major Milestones

As part of the Atlantic Innovation Funding Program sponsored by the Atlantic Canada Opportunities Agency (ACOA) the Centre has undertaken research, development and commercialization objectives. These activities feature dominantly on our agendas and in our budget. Major milestones achieved last year include:

- Completed and published a report on PVT analyses of the absorption of condensates in glycol medium used as displacement fluid in CNG storage system (page 9).
- Completed a draft report on gas transfer system (terminal) options including an assessment of design and suitability.
- Completed draft “Guidance Notes for Concept Stage Risk Assessments for the Transportation of Marine CNG.” (page 11)
- Completed evaluation of CNG storage systems and vessel (barge) concept design.

Our Community

For the second year, the Centre Team contributed to the Janeway Children’s Hospital and the Port of St. John’s Harbour Lights Christmas Fundraising Campaign in support of the school lunch association. Like our research & development, our corporate giving focuses on the future – our children.

Research

Research Advisory Committee

As outlined in Article 8.3 of the Centre’s By Laws, research projects and activities to be undertaken by the Centre shall be assessed, approved and monitored by the Research Advisory Committee. The Research Advisory Committee comprises: Dr. Majid Abdi (Chair) – Centre for Marine CNG Inc.; Dr. Jacob Verhoef – Geological Survey of Canada; Dr. Brian Veitch – Memorial University of Newfoundland;



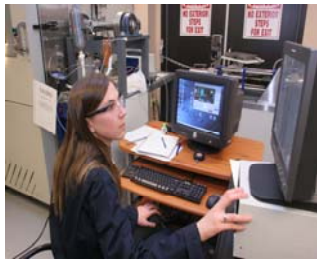
Craig Ivany of the Centre performing routine GC operations

Mr. Glen Lochte – Husky Energy; Mr. Howard Meyer, Gas Technology Institute; and Mr. Craig Young, P.Eng. – Centre for Marine CNG Inc. The responsibilities of the Research Advisory Committee are:

1. Identify criteria and process for review of research proposals and conducting review of these proposals;
2. Monitor the progress of Centre research by identifying criteria and process for reviewing progress reports and conducting review of those reports;
3. Make recommendations to the Board of Directors, through the Managing Director, for adjustments to the Centre’s research including adding projects, terminating projects, allocating and adjusting funds and budgets; and
4. Establishing the criteria for Research Projects including protocols, standards, confidentiality, access and the like.

Research Projects

1. **Abedinzadegan Abdi M.**, Hussain A., Hawboldt K., and Beronich E., “Experimental Study of Solubility of Natural Gas Components in Aqueous Solutions of Ethylene Glycol at Low Temperature and High Pressure Conditions”, under review, *Journal of Chemical and Engineering Data*, 2007



Erika Beronich from the Centre reviewing analysis results

Abstract. A new experimental setup has been validated to measure gas solubility at low-temperature and high-pressure conditions. Solubility of natural gas components, for example, methane, nitrogen, and carbon dioxide, was measured in aqueous solutions of 40 and 60 mass % of ethylene glycol at 15.00 and 20.00 MPa and at temperatures of -10.0, 0.0, and 10.0 °C.

2. Jassim E., **Abedinzadegan Abdi M.**, and Muzychka Y., “Computational Fluid Dynamics Study for Flow of Natural Gas through High Pressure Supersonic Nozzles: Part 1 - Real Gas Effects and Shockwave”, in press, *Journal of Petroleum Science and Technology*, PET/06/097, 2006

Abstract. The computational fluid dynamics technique was used to study the behaviour of high pressure natural gas in supersonic nozzles. Although many applications of gas flow produce insignificant errors when the gas is assumed ideal, our results indicate significant variation of gas properties. This paper illustrates natural gas behaviour when it is considered to be real and how erroneous the properties may become when the gas is assumed to be ideal. The paper also presents the influences of properties related to the flow of natural gas through supersonic nozzles. Using a quite accurate equation of state model, real gas effects are studied and compared with the perfect gas case. The results show a significant variation in gas properties estimation. Location of shockwave is also analyzed. The comparison

of results for two gases (methane and nitrogen) indicated that shockwave position can significantly change when the gases considered as real rather than ideal.

3. Jassim E., **Abedinzadegan Abdi M.**, and Muzychka Y., “Computational Fluid Dynamics Study for Flow of Natural Gas through High Pressure Supersonic Nozzles: Part 2 - Nozzle Geometry and Vorticity”, in press, *Journal of Petroleum Science and Technology*, PET/06/098, 2006

Abstract. The computational fluid dynamics technique is used to study the behaviour of high pressure natural gas when it flows through nozzles with supersonic velocities. Effect of nozzle geometry is discussed by inserting a constant area channel between the convergent and divergent parts of the system. Various conduit lengths are analyzed to show how the minimum temperature could be influenced by the geometry of the nozzle. The results also show that changing channel length can affect the position of shockwave. The results for the effect of vorticity on the performance of the nozzles show that although losses in pressure increase due to inlet swirl flow, vorticity increases very sharply in the vicinity of the shock. It could be concluded that the region just before the shock spot is the main region where fine particles can be separated because of the large vorticity strength. Shock with reasonable strength may be favored in practical applications where fine particles separation is desired.



Erika Beronich of the Centre working with the PVT system

4. Jassim, E., **Abedinzadegan Abdi M.**, and Muzychka Y., “Simulation of Natural Gas Flow through Complex Geometries Using Computational Fluid Dynamics”, Proceedings of the *International Oil and Gas CFD Conference (IOCC)*, London, UK, 30 November – 1 December, 2006

Abstract. The multi-phase flow of a real multi-component natural gas mixture through various channel shapes was modeled to analyze the flow behaviour and predict the phase change regions and nuclei formation using CFD models. While most researchers constrain their analysis to perfect gases, only a few have considered real gas effects. Due to the scarcity of theoretical, as well as experimental information on cold jet behaviour, we embarked on work analyzing the behaviour of real gas (non-ideal) compressible flow through crack and conduits with complex geometries which is being financially supported by Centre for Marine CNG Inc. This information is needed to analyze fracture mechanics of compressed natural gas tanks. During the study, the fluid flow and heat transfer phenomena related to the behaviour of a cold jet created from crack on a typical high pressure CNG vessel was simulated. The cold jet phenomenon from the crack was assessed in three areas: the leak flow through the crack, the jet influence on the areas surrounding the crack, and the wall temperature distributions on the adjacent tanks, connecting lines, valves and fittings. The flow field developed through a small orifice with known geometry was simulated. A nozzle shape was selected for the preliminary studies since the inner geometry of a crack can be irregular. For the preliminary study, the working fluid

used in the simulation was pure methane. The simulation will be linked to suitable property estimation software using parameter-tuned equations of state to predict real multi-component natural gas flow conditions.

Research Reports

1. **Marine CNG Risk and Safety Assurance (Young, C. and Seitz, J., 2007)**

The purpose of this study is to give insight to potential hazards and consequences for marine transportation of CNG. This report provides a solid starting point in value chain selection processes, identification of areas for directed research and aid in the creation of industry standards for this new technology.

The unique properties of CNG are identified and discussed to allow for evaluation of potential risk. Key components and key operations are identified as well as interaction between the two. Within the study, different hazard identification methods are proposed for concept stages as well as consideration to assess consequence and overall risk to a project.

Specifically, this report discusses risk assessment criteria, primary hazard identification, key components and key operations in normal and emergency scenarios as well as interaction and event tree analysis. Overall, the study identifies the key components in the CNG transportation chain with a defined structure for evaluating their potential for risk under different event scenarios.



2. **Marine CNG Loading and Unloading Systems (Melville, J. and Young, C., 2007)**

The overall objective of the study is to evaluate gas transfer systems, both onshore and offshore, that allow the safe and efficient transfer of high pressure CNG from a supply source to a delivery location. Supply sources could include, but are not be limited to, offshore oil and gas production facilities, onshore marine terminals and

inshore sub sea pipelines. Delivery locations include offshore unloading buoys and onshore marine terminals; either connected to market by pipeline.

This report addresses the facilities/systems available for loading and unloading CNG carriers.

Different potential systems are evaluated with a focus on any advantages and/or limitations for application in the CNG domain as well their impact on CNG vessel design.

Project scenarios for CNG are also developed with respect to the loading/unloading systems and each scenario has been evaluated to determine the optimum transfer system. Assessment is focused in areas of technical consideration as well as risk identification and evaluation. Considerations of economics are not examined at this time.

The Centre Team

Michael Hanrahan

Managing Director

Immediately prior to his 2004 appointment, Michael was with Irving Oil where he held senior positions at the Irving Refinery, Corporate headquarters, and the Liquefied Natural Gas (LNG) Project in Saint John.

From 1997 to 2000, Michael was part of the project team for the \$1billion Irving Oil Refinery expansion, the first major refinery expansion project in North America since 1980. Between 2001 and 2004, he led the Project Team for the first LNG receiving terminal in Canadian history to receive full regulatory approval to proceed. Concurrent with these activities, while at Irving Oil, Michael had responsibility in Canada and the United States for Government Relations, Health, Environment, Safety and Loss Management.

Michael has worked in private and public sector positions throughout Canada and gained invaluable experience in his home province of Newfoundland and Labrador working on the Hibernia Project and the Goose Bay Low Level Flight Training Project.

Craig Young , P. Eng

Operations Manager

Craig joined the Centre for Marine CNG in 2006 as Operations Manager with overall responsibilities for Projects and Facilities Management. Craig began his career with Schlumberger in Western Canada, followed by 3 years in their West Africa offshore operations. Upon returning to Newfoundland, he was involved with Subsea consulting before joining NewTech Instruments in 2000. He was appointed Engineering Manager of the Manufacturing Division after NewTech was purchased by Rutter Technologies in 2003. Craig graduated from Memorial University where he is currently working on his MBA.

Craig Ivany**Laboratory Supervisor**

Craig joined the Center's Team in January 2007 as Laboratory Supervisor with responsibilities of overseeing the day to day operations of the laboratory.

He began his career with Intertek Caleb Brett as a petroleum inspector and lab technician at Newfoundland Transshipment Limited. He transferred to Nova Scotia where he performed inspection and testing duties out of several petroleum facilities and then moved to New Brunswick to work in the Irving Oil refinery laboratory. Craig is a graduate of the Bachelor of Technology program at Memorial University of Newfoundland and the Marine Environmental Technology program at the Marine Institute. Craig is a Certified Engineering Technologist.

Heidi Skinner**Business Coordinator**

Heidi joined the Centre for Marine CNG Inc. in June 2007 as Business Coordinator. She is responsible for accounts payable/accounts receivable, webpage development and public relations. Heidi is also involved with the overall coordination of the annual International Marine CNG Forum.

In 2007, Heidi received the Business Management/Human Resource Management diploma from Keyin College in St. John's, Newfoundland & Labrador.

Heather Tucker**Office Coordinator**

Heather is the Office Coordinator for the Centre for Marine CNG Inc. She joined the staff in February 2007 and along with administrative responsibilities, Heather's duties include organizing the annual International Marine CNG Forum. In 2006 Heather received the Tourism and Hospitality Management Diploma from the College of the North Atlantic, St. John's, Newfoundland & Labrador.

Dr. Majid A. Abdi**Process Engineering Consultant**

Dr. Abdi's expertise, acquired in industry and academia, lies in mid- and downstream oil and gas production and processing. He is a senior process engineering consultant with the Centre for Marine CNG Inc. and chairs the research advisory committee.

He holds a Ph.D. in Chemical Engineering from UBC, Vancouver, Canada, B.Sc. and M.Sc. degrees both in Chemical Engineering from Tehran Polytechnic, Iran.

His current professional activities include: natural gas production, processing and large-scale transportation, process intensification and compact process equipment design, process engineering and simulation. Dr. Abdi is an Assistant Professor with the Faculty of Engineering and Applied Science at Memorial University of Newfoundland.

Erika Beronich**Chemical Engineering & Research**

Erika Beronich, Ph.D. student and natural gas researcher has been linked to the Centre for Marine CNG since 2006. Erika received the degree of Chemical Engineer from the National Technological University in Cordoba, Argentina, in 2003, where she worked as a research assistant for the Physical-chemistry Group of New Materials, part of the Centre for Research and Development of the same University.

As a Master's Student in the Faculty of Engineering & Applied Science, Memorial University of Newfoundland, Erika was awarded the Postgraduate Scholarship in Environmental Science (Geological Association of Canada), and is a Fellow of the School of Graduate Studies for academic excellence. In 2006, she completed her Master's thesis in Natural Gas Liquids recovery on offshore platforms and started a Ph.D. program in oil and gas at Memorial University.

Esam Jassim**Mechanical Engineering & Research**

Esam joined the research Team of the Centre for Marine CNG in Fall 2005 as mechanical and Research Engineer. His responsibilities include researching hydrate formation and deposition, numerical simulation using Computational Fluid Dynamic technique, cold jet phenomena, and real gas flow.

After completing his B.Sc. in Mechanical Engineering, University of Mosul, Iraq, Esam began his career as a design Engineer in Steel and Iron Establishment in Iraq. Esam has a M.Sc. in mechanical engineering/air-conditioning and refrigeration system design, also from University of Mosul, Iraq. Currently, he is a PhD student in Faculty of Engineering and Applied Science, Memorial University.

Stephen Duffett**Business Consultant**

Stephen joined the Centre in the fall of 2005 having been involved in the Newfoundland & Labrador business community for more than ten years. His experience extends from the management of companies supplying business-to-business products and services to the development and management of commercial real estate. He is a graduate from Memorial University Faculty of Business Administration and Group ESC Rennes Business School in France.

Arshad Hussain**Term Researcher**

Dr. Arshad Hussain currently works with the Department of Chemical Engineering at the National University of Science and Technology in Pakistan.

As a research fellow at Centre for Marine CNG, he worked on a research project to study the natural gas compositional, thermo-physical and fluid phase analysis under varied pressure

and temperature conditions during loading and unloading operations using custom designed PVT systems. GOR (Gas Oil Ratio), Gas Chromatography (GC) were used as major analytical techniques for this work.

He has authored 12 technical papers/presentations and holds a Ph.D. in Chemical Engineering from Otto-Von-Guericke University, Magdeburg, Germany and M.Sc. degrees in Chemical Engineering from Friedrich-Alexander University Erlangen-Nuremberg, Germany. He is a member of European Membrane Society.

Work Term Students

Over the past year the Centre hosted two work term students who contributed significantly to our progress. Mr. Ryan Pretty is studying Engineering at Memorial University and worked on installation and commissioning of our PVT analytical laboratory. Mr Troy Stuckless is completing his Business Administration degree at Memorial and focused his efforts on Forum planning and institutionalizing an execution plan for the annual event.



Offshore base in Port of St. John's
Photo Courtesy of the City of St. John's.

Membership

The Centre for Marine CNG is a not for profit independent research and development corporation incorporated under Part II of the *Canada Corporations Act*. We are a member-based organization for which annual membership dues, ranging from (US) \$4,500 to (US) \$22,500, are paid in exchange for a schedule of benefits including priority access to research facilities and results and complimentary attendance at our annual Forum. We are pleased to have earned the commitment of an international membership list, representing some of the leading entities in their respective fields.

Membership within the Centre includes:

Member	Country	Since
EnerSea	USA	2004
Advanced Production & Loading (APL)	Norway/USA	2004
BMT Fleet Technology	United Kingdom/Canada	2004
Geostorage Associates (A.G.R.E.N.)	Canada	2004
Emera	Canada	2004
Gas Technology Institute (GTI)	USA	2004
Mistras	USA	2004
Duke - Maritimes & Northeast Pipeline	Canada	2004
Det Norske Veritas (DNV)	Norway	2004
Fluor	Canada	2004
Memorial University of Newfoundland	Canada	2004
Government of Newfoundland & Labrador	Canada	2004
Bluewater	The Netherlands	2004
American Bureau of Shipping (ABS)	USA	2004
Norsk Hydro	Canada	2004
Husky Energy	Canada	2005
ExxonMobil	Canada	2005
TransCanada	Canada	2005
Atlantic Canada Opportunities Agency	Canada	2005
Natural Resources Canada (NRCan)	Canada	2005
Tyco	USA	2006
CE Tech	Norway	2006
Petrobras	Brazil	2006
ABB	Canada/USA	2006
Varun Shipping	India	2006
SIGTTO	Bermuda/UK	2006
IPT	Brazil	2006
Sea NG	Canada	2007

Our Facilities



Erika Beronich of the Centre carrying out routine maintenance on PVT apparatus



Natural Gas Analyzer



Craig Ivany of the Centre conducting a GOR analysis

Natural Gas Research Lab

After commissioning a full service reservoir fluid analysis set, the Centre has been fulfilling industry focused research in the areas of gas process engineering for CNG applications. The PVT system is capable of detailed sample analysis at temperatures ranging from -35°C to 200°C and pressures from atmospheric to 1000 bar (15,000 psi). Recent research has included gas absorption studies and refinement of Computational Fluid Dynamic models for CNG applications.

Indoor Natural Gas Test Facility

The Centre houses North America's only facility capable of performing large scale, live natural gas research and testing indoors. With approximately 280m^3 (3000 square feet) of space that has been qualified as Class I, Zone 2 compliant, the Centre can perform industry focused research and testing in various flow and phase regimes.

A large scale natural gas loop, capable of pressures ranging up to 275 bar (4000 psi) and production scaled flow rates of multi phase flow is being designed for applications including dynamic gas analysis, flow assurance, condensate analysis, as well as equipment testing and verification.

Equipped with a dedicated ventilation and safety system, independent control and monitoring as well as its immediacy to existing oil and gas infrastructure, the test

loop will provide relevant applied research for local and international clients.



Erika Beronich & Dr. Majid Abdi of the Centre completing a Constant Composition Expansion experiment

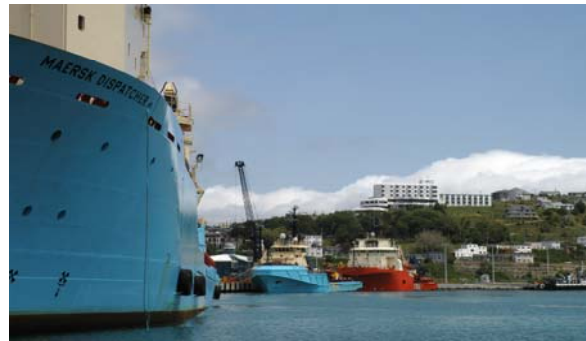
Project Space

The Centre has 450m² (5000 square feet) of dedicated project space that can be utilized by membership and clients for short and medium – term projects. Equipped with dedicated telecommunications, data infrastructure, administration and logistics to support the project space we can accommodate our clients with little advance notice.

Future Directions

As the Centre approaches the fourth anniversary of incorporation, and the final year of financial support from the Atlantic Canada Opportunities Agency, Government of Canada, it is well positioned to be self-sustaining. Focus areas in the next three years include the following:

1. Marine CNG technology research and development
2. Frontier natural gas development technologies
3. Reservoir fluid analytical laboratory commercialization
4. Turnkey R&D project management
5. Professional services (consulting)
6. Government R&D grants.

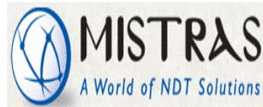
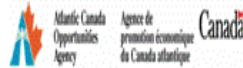


Port of St. John's
Photo Courtesy of City of St. John's

Our objective is to be the Centre of Excellence that supports innovative natural gas development and transportation systems.

Thank you

The Centre would like to thank our government partners and members for their continued support throughout 2006 - 2007.





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