



NORTHERN OIL AND GAS RESEARCH FORUM PROCEEDINGS

CONFERENCE PARTNERS

The United States and Canada Northern Oil and Gas Research Forum 2008, Current Status and Future Directions for the Beaufort Sea, North Slope and Mackenzie Delta, held in Anchorage, Alaska 28 – 30 October 2008, was an accomplishment that demonstrated vision, commitment and cooperation of numerous individuals who represented a variety of organizations. Members of the conference executive committee, organizing committee and the organizations that supported their participation are listed below.

U.S. – CANADA NORTHERN OIL AND GAS RESEARCH FORUM

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For the United States

Drue Pearce	Federal Coordinator, Office of the Federal Coordinator for Alaska Natural Gas Transportation Projects; Washington, D.C.
Mead Treadwell	Chairman, United States Arctic Research Commission; Anchorage, Alaska
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Julia Gourley	Senior Arctic Official for the United States, Bureau of Oceans, Environment, and Science, U.S. Department of State; Washington, D.C.
Hans Neidig	Special Assistant to the Secretary of the Interior for Alaska, U.S. Department of the Interior; Anchorage, Alaska
Captain Michael Inman	Chief of Response, United States Coast Guard 17 th District, Department of Homeland Security; Juneau, Alaska

For Canada

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Tom Hutchinson	Chairperson, Canadian Polar Commission; Ottawa, Ontario
Natalie Shea	Science and Technology Advisor, Energy Science and Technology Programs, Natural Resources Canada; Ottawa, Ontario
Ray Case	Director, Environment Division, Environment and Natural Resources, Government of the Northwest Territories; Yellowknife, Northwest Territories
Norm Snow	Executive Director, Inuvialuit Joint Secretariat; Inuvik, Northwest Territories
Hugh Bain	Senior Advisor, Habitat Science, Environment and Biodiversity Science Branch, Fisheries and Oceans Canada; Ottawa, Ontario



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ORGANIZING COMMITTEE

For the United States

Dennis Thurston	Minerals Management Service, U.S. Department of the Interior
John Payne	North Slope Science Initiative and U.S. Bureau of Land Management
Michael Baffrey	U.S. Department of the Interior
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Ruthie Way	Minerals Management Service, U.S. Department of the Interior

For Canada

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Terry Baker	Northern Oil and Gas Branch, Indian and Northern Affairs, Canada
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Don Cobb	Northern Research Energy Development, Fisheries and Oceans Canada
Rob Dilabio	Geological Survey of Canada, Natural Resources Canada
Norm Snow	Inuvialuit Joint Secretariat, Canada
Paul Barnes	Canadian Association of Petroleum Producers

Forum Facilitation, Abstracts and Proceedings

Dave Kerr	Golder Associates, Calgary, Alberta
Bette Beswick	Golder Associates, Calgary, Alberta



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SPONSORING ORGANIZATIONS



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Canada



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1 INTRODUCTION

On October 28 to 30, 2008, the United States and Canada Northern Oil and Gas Research Forum, Current Status and Future Directions for the Beaufort Sea, North Slope and Mackenzie Delta was held in Anchorage, Alaska. The forum was attended by 306 participants.

The purpose of the research forum was to provide an opportunity for U.S. and Canadian scientists, industry, and regulators to share information about research programs and to discuss future directions for northern oil and gas development. The forum provided an important communication venue for regulators, industry and communities to become better informed about existing research, data gaps, and how information is used in decision-making. Future directions for research were identified as well as areas of common interest between the US and Canada.

The objectives of the forum were:

- to showcase current research programs, demonstrating how they have contributed to decision-making through environmental assessments and the regulatory process and highlighting the involvement of indigenous people in research programs;
- to identify how to move research findings into decision-making fora;
- to discuss future oil and gas research needs, including synergies and partnerships, for the Beaufort Sea, Mackenzie Delta and North Slope; and
- to identify research and development priorities and next steps to advance our understanding of the interaction between the oil and gas industry and the Arctic environment.

2 FORUM ORGANIZATION

2.1 OVERVIEW

The morning of the first day focused on setting the stage for the research forum. Participants to the forum were welcomed by Ms. Drue Pearce, Federal Coordinator of Alaska Natural Gas Transportation Projects, and Mr. Patrick Borbey, Assistant Deputy Minister of Indian and Northern Affairs. Their opening remarks were followed by Ms. Mead Treadwell, Chairman of the US Arctic Research Commission and Ms. Ruth McKechnie, Senior Advisor, Northern Oil and Gas Branch, Indian and Northern Affairs Canada who provided overviews of northern oil and gas activities in the US and Canada, respectively.

A joint US/Canada panel set the stage by providing a variety of perspectives on northern management research needs and priorities. Some insight into the ArticNet research program's activities supported by the Canadian Research Icebreaker, the CCGS Amundsen was provided by luncheon speaker Dr. Martin Fortier, Executive Director of ArcticNet.

On the morning of the second day, industry representatives outlined research priorities from the perspective of industry in both the U.S. and Canada. This included an overview of current and future development scenarios, research issues and priority areas for future research.

Over the three days of the research forum, 39 presentations covered technical-engineering topics (including oil spill response), socio-cultural/socio-economic issues, biological resources, and physical sciences. An additional 25 posters were displayed covering a variety of research areas in the arctic region.

A wrap-up presentation summarized the forum highlights that had been identified by the forum facilitators including future research priorities. Conference participants were then invited to contribute their additional observations which were added to the wrap-up presentation and are summarized in the Research Priorities and Issues Section (section 3.11).



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2.2 FORUM AGENDA

United States and Canada Northern Oil and Gas Research Forum: Current Status and Future Directions in the Beaufort Sea, North Slope and Mackenzie Delta

October 28 to 30, 2008
Marriott Hotel
820 W 7th Ave.
Anchorage, Alaska

Day 1 October 28, 2008

8:30 - 8:40

Welcome

8:40 - 9:05

Opening Remarks

USA – Drue Pearce
Federal Coordinator, Office of the Federal Coordinator
Alaska Natural Gas Transportation Projects; Washington, D.C.

Canada – Patrick Borbey,
Assistant Deputy Minister,
Northern Affairs Organization
Indian and Northern Affairs Canada; Ottawa, Ontario

9:05 - 9:15

Purpose of the Forum (Facilitator)

Setting the stage for the Forum
Objectives, agenda and results
Key questions for consideration throughout the workshop
Expectations for wrap up session

9:15 - 9:40

Overview of USA Northern Oil and Gas Activities and Research Programs

Mead Treadwell, Chairman of the U.S. Arctic Research
Commission; Anchorage, Alaska

9:40 - 10:05

Overview of Canadian Northern Oil and Gas Activities and Research Programs

Ruth McKechnie, Senior Advisor, Northern Oil and Gas Branch,
Indian and Northern Affairs Canada; Ottawa, Ontario
Natalie Shea, Science and Technology Advisor, Energy Science
and Technology Programs, Natural Resources Canada; Ottawa,
Ontario



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10:05 – 10:20

Health Break

10:20 – 11:20

Panel: Management Research Needs and Priorities

United States

John Payne, Executive Director of the North Slope Science Initiative

John Goll, Regional Director of Minerals Management Service

Canada

Robert Steedman, National Energy Board; Calgary, Alberta

Norm Snow, Executive Director, Inuvialuit Joint Secretariat

Technical-Engineering

11:20 - 11:40

Alaskan Beaufort and North Slope Solid Waste Disposal Under the UIC Program - Thor Cutler, United States Environmental Protection Agency; Seattle, Washington

11:40 - 12:00

Ice Engineering Issues for Beaufort Sea Development - Garry Timco, National Research Council of Canada; Ottawa, Ontario

12:00 - 12:20

Ice Road Construction and Recovery on Tundra Ecosystems, National Petroleum Reserve, Alaska (NPR-A) - Scott Guyer, Bureau of Land Management, Alaska State Office; Anchorage, Alaska

12:20-12:30

Questions on theme 1

12:30 - 13:30

Lunch Hosted by the Government of Canada

Speaker “ArcticNet” Dr. Martin Fortier, Executive Director

13:30 - 13:50

Speculation on the Origin and Persistence of Thick Multi-Year Ice in the Arctic- Humfrey Melling, Fisheries and Oceans Canada; Sidney, British Columbia

13:50- 14:10

Creation of Leads and Ridges: What is the Ice Behavior?

Max Coon, NorthWest Research Associates, Inc.; Seattle, Washington

14:10- 14:30

Materials R&D for Northern Pipelines – Integrity, Safety, and Environmental Protection in the North- Winston Revie, CANMET Materials Technology Laboratory, Natural Resources Canada; Ottawa, Ontario



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- 14:30 - 14:50 **Questions on theme 1**
- 14:50 - 15:10 **The Status of Current Technology for Oil Spill Cleanup in Ice** - Ian Buist, S.L. Ross Environmental Research Limited; Ottawa, Canada
- 15:10 - 15:30 Health Break
- 15:30 - 15:50 **Detection of Oil on and Under Ice: Phase III Evaluation of Airborne Radar System Capabilities in Selected Arctic Spill Scenarios** –John Bradford, Boise State University; Boise, Idaho
- 15:50 - 16:10 **The Oil Spill Recovery Institute: Present and Future Work in the Arctic** - W. Scott Pegau, Oil Spill Recovery Institute; Cordova, Alaska
- 16:10 – 16:30 **ERMA: A New High Resolution Environmental Data Display and Management System for Oil Spill Planning and Response** - Amy Merten, Co-Director, NOAA Coastal Response Research Center; Silver Spring, Maryland
- 16:30 - 16:50 **Oil Spill Preparedness, Response and Countermeasures Planning in the Arctic** - Steve Potter, S.L. Ross Environmental Research Limited; Ottawa, Ontario
- 16:50- 17:10 **Empirical Weathering Properties of Oil in Ice and Snow** - Ian Buist, S.L. Ross Environmental Research Limited; Ottawa, Ontario
- 17:10- 17:20 **Questions on theme 1**

Day 2 October 29, 2008

Industry Panel

- 8:00- 8:45 **USA Industry Research Priorities:**
- Highlights of current and future development scenarios, research issues and priority areas for future research
- Pete Slaiby, General Manager, Alaska, Shell Exploration & Production Company
- Geoffrey Haddad, Manager Alaska Exploration, ConocoPhillips Alaska, Inc.
- Marilyn Crockett, Director Alaska Oil and Gas Association



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8:45 – 9:30

Canada Industry Research Priorities:

Highlights of current and future development scenarios, research issues and priority areas for future research

Gary Bunio, VP Operations and COO, MGM Energy, Calgary

Bob Bleaney, Manager Commercial & Regulatory Affairs,
ConocoPhillips Canada

Paul Barnes, Manager - Atlantic Canada, Canadian Association
of Petroleum Producers

9:30-9:50

Questions

Socio-cultural/ Socio-economic

9:50 - 10:10

Variability in Cross Island (Arctic Alaska) Subsistence Whaling: An Examination of Natural and Anthropogenic Factors - Michael Galganitis, Applied Sociocultural Research; Anchorage, Alaska

10:10 - 10:30

Inuvialuit Community Perspective: Mackenzie Gas Project - Impacts, Planning and Mitigation – Amanda Cliff, Inuvialuit Regional Corporation: Inuvik, Northwest Territories.

10:30 - 10:50

Health Break

10:50 - 11:10

The Study of Ecosystem Services and Sharing Networks to Assess the Vulnerabilities of Communities to Oil and Gas Development and Climate Change in Arctic Alaska - Gary Kofinas, Director, Resilience and Adaptation Program, School of Natural Resources and Agricultural Sciences, University of Alaska, Fairbanks; Fairbanks, Alaska

11:10 - 11:30

The Environmental Stewardship Framework in the NWT - David Livingstone, Director, Renewable Resources and Environment, Indian and Northern Affairs Canada; Yellowknife, Northwest Territories

11:30 - 11:50

Caribou Harvest Monitoring in the National Petroleum Reserve-Alaska: Developing Effective Future Mitigation - Stacie McIntosh, Bureau of Land Management, Arctic Field Office; Fairbanks, Alaska

11:50- 12:10

Social and Economic Effects in Canada's Mackenzie Delta Region from the Return of Oil and Gas Activity 2000-2004 - Thom Stubbs, Integrated Environments Limited; Calgary, Alberta



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12:10- 12:30

Questions on theme 2

12:30 - 13:30

Lunch Hosted by the University of Alaska Fairbanks

Geographic Information Network of Alaska

Speaker “Arctic observation systems, current and planned”

Aimee Devaris, U.S. National Weather Service, Alaska Region,
Deputy Director; Anchorage, Alaska

Biological Sciences

13:30 – 13:50

**Assessing the Potential Effects of Near Shore Hydrocarbon
Exploration on Ringed Seals in the Beaufort Sea Region
2003-2006** - Lois Harwood, Fisheries and Oceans Canada;
Yellowknife, Northwest Territories

13:50 - 14:10

**Populations and Sources of Recruitment in Polar Bears:
Movement Ecology in the Beaufort Sea** -Andrew Derocher,
Department of Biological Sciences, University of Alberta;
Edmonton, Alberta

14:10 - 14:30

**Satellite Tracking of the Western Arctic Stock of Bowhead
Whales** - Lori Quakenbush, Wildlife Biologist, Alaska
Department of Fish and Game; Fairbanks, Alaska

14:30 - 14:50

**Bowhead Whale Feeding Variability in the Western Beaufort
Sea - Feeding Observations and Oceanographic
Measurements and Analyses** - Carin Ashjian, Woods Hole
Oceanographic Institution; Woods Hole, Massachusetts

14:50 - 15:10

Seasonal Distribution of Canadian Beaufort Beluga Whales -
Pierre Richard, Research Scientist, Marine Mammal Stock
Assessment, Arctic Research Division, Fisheries and Oceans
Canada; Winnipeg, Manitoba

15:10 - 15:30

Questions on theme 3

15:30 - 15:50

Health Break

15:50 - 16:10

**Bowheads and belugas in the Alaska Beaufort and Chukchi
Seas: implications of oil and gas development and climate
change** - Robert Suydam, Wildlife Biologist, North Slope
Borough; Barrow, Alaska

16:10 - 16:30

**Fish Research in the Western Canadian Arctic in support of
Hydrocarbon Development.** - Jim Reist, Arctic Fish
Ecology/Assessment, Fisheries and Oceans Canada; Winnipeg,
Manitoba



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16.30 - 16:50 **Northern Marine Coastal and Ecosystem Studies, CCGS Nahidik Fishing Program** - Patricia Ramlal, Arctic Research Division, Fisheries and Oceans Canada; Winnipeg, Manitoba

16:50 – 17:10 **Questions on theme 3**

Day 3 October 30, 2008

Biological Sciences

8:00-8:20 **Timing and location of King Eiders staging in the Beaufort and Chukchi Seas.** - Abby Powell, Research Ecologist, U.S. Geological Survey; Fairbanks, Alaska

8:20-8:40 **Science-Based Decision Making: the Mackenzie Gas Project and Environmental Impacts on Birds** - Craig Machtans, Forest Bird Biologist, Western Arctic Unit, Environment Canada; Yellowknife, Northwest Territories

8:40-9:00 **Effects of Oil Field Infrastructure on Calf Growth and Survival in the Central Arctic Caribou Herd** - Steve Arthur, Wildlife Biologist, Alaska Department of Fish and Game; Fairbanks, Alaska

9:00 - 9:20 **Subsistence Mapping of Nuiqsut, Kaktovik and Barrow** Stephen R. Braund & Associates; Anchorage, Alaska

9:20-9:40 **Questions on theme 3**

Physical Sciences

9:40 - 10:00 **Seabed Geo-environmental Constraints to Offshore Hydrocarbon Development in Beaufort Sea** - Steve Blasco, Marine Environment Geoscience, Natural Resources Canada; Dartmouth, Nova Scotia

10:00 - 10:20 **Waves and Sediment Mobility in the Southeastern Beaufort Sea** - Steve Solomon, Marine Environment Geoscience, Natural Resources Canada; Dartmouth, Nova Scotia

10:20 - 10:40 **Automated Lagrangian Water Quality Assessment System (ALWAS)** - Robert Shuchman, Co-Director, Michigan Tech Research Institute, Michigan Technological University; Ann Arbor, Michigan

10:40 - 11:00 **Questions on theme 4**

11:00 - 11:20 Health Break



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PROCEEDINGS**

- 11:20 - 11:40 **Subsidence, Flooding, and Erosion Hazards in the Mackenzie-Beaufort Region** - Don Forbes, Marine Environmental Geoscience, Natural Resources Canada; Dartmouth, Nova Scotia
- 11:40 - 12:00 **Modern Erosion Rates and Loss of Coastal Features and Sites, Beaufort Sea Coast, Alaska** – Benjamin Zones, United States Geological Survey.
- 12:00 - 12:20 **Enhancement of Permafrost Monitoring in the Mackenzie Valley** - Sharon Smith, Permafrost Research Scientist, Natural Resources Canada; Ottawa, Ontario
- 12:20 – 12:40 **Questions on theme 4**
- 12:40 - 13:40 Lunch
- 13:40 - 14:00 **Characterization and Water Use of Alaskan North Slope Lakes** - Daniel White, Institute of Northern Engineering, University of Alaska Fairbanks and Michael Lilly, GW Scientific; Fairbanks, Alaska
- 14:00-14:20 **Hydrology of the Mackenzie Delta Region** - Philip Marsh, Land Use Impacts on Hydrology and Aquatic Ecosystems, Environment Canada; Saskatoon, Saskatchewan
- 14:20 - 14:40 **Wind and Wave Hindcasts for the Beaufort Sea** - Val Swail, Climate Data and Analysis, Environment Canada; Downsview, Ontario
- 14:40 - 15:00 **Regional Hydro-Climatology and Its Relationship to Northern Oil and Gas Development** - Barrie Bonsal, Climate Impacts on Hydrology and Aquatic Ecosystems, Environment Canada; Downsview, Ontario
- 15:00 - 15:20 **Questions on theme 4**
- 15:20- 17:00 Wrap Up Everyone (Facilitated)
- 17:00 – 17:15 Next Steps and Closing Remarks



3 CONFERENCE HIGHLIGHTS

3.1 OPENING REMARKS: DRUE PEARCE (U.S.A)

Drue Pearce, Federal Coordinator
Office of the Federal Coordinator for Alaska Natural Gas Transportation Projects
Opening Remarks: U.S. and Canada Northern Oil and Gas Research Forum
October 28, 2008
Anchorage, AK

It is my pleasure to welcome you all to the first United States and Canada Northern Oil and Gas Research Forum.

I'm Drue Pearce and I'm here to tell you why you are here.

Policy decisions are made every day that will affect the Beaufort Sea, the North Slope and the Mackenzie Delta for decades, even centuries.

We're here to learn about the research that's being done to inform the decision makers.

Many, if not most, policy makers are also politicians. And politicians learn – during long and often dull committee meetings – to ask questions. Unfortunately, sometimes they are just trying to appear smarter than the guy sitting next to them.

But most have a sincere intellectual curiosity that leads them to want as much information as they can possibly gather before they make a decision. The best of them don't, on the other hand, want to study every issue to death.

So your job in this modern world is to provide that information in a cogent fashion that informs the decisions of the day.

Key to the process or processes is framing the question. What do the decision makers need to know?

A few key quotes come to mind, such as

"You got to be careful if you don't know where you're going, because you might not get there."
By Yogi Berra, and

"Research is the process of going up alleys to see if they are blind." --- By Marston Bates.

Now, I'm well aware that some of you probably don't hold policy makers in high esteem, assessing them as Yogi Berra did when he said, *"There are some people who, if they don't already know, you can't tell 'em."*



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I'm here to tell you, though, that wise decision makers want to make informed decisions.

And your research results – if presented to the appropriate decision makers in a useful format - which synthesizes recommendations, conclusions and key issues in an unbiased manner - are some of the most useful tools that inform policy makers. Research results aren't the only tool that should be used in the decision making process but they are one of the most important components of information a policy maker should have.

Research can be sophisticated. But it doesn't have to be – some of the best knowledge comes from simply looking. I'm in a Yogi Berra mood since it's World Series time, and he also said, *"You can observe a lot by just watching."*

But sometimes we over think problems, here's an example:

Sherlock Holmes and Dr Watson were going camping. They pitched their tent under the stars and went to sleep. Sometime in the middle of the night Holmes woke Watson up and said: "Watson, look up at the stars, and tell me what you see."

Watson replied: "I see millions and millions of stars."

Holmes said: "and what do you deduce from that?"

Watson replied: "Well, if there are millions of stars, and if even a few of those have planets, it's quite likely there are some planets like earth out there. And if there are a few planets like earth out there, there might also be life."

And Holmes said: "Watson, you idiot, it means that somebody stole our tent."

Simple observation has resulted in major design changes on the North Slope. We learned in Prudhoe Bay that caribou don't want to cross ring roads. So, Kuparuk has a road system that looks from the air like the veins in a leaf – which allows the caribou to munch away to their hearts content without ever having to cross a road.

From simple observation to complicated scientific modeling, we are all engaged in answering the questions of our time.

I would like to extend my appreciation to all the people who worked so hard to pull together this Forum, in particular Dennis Thurston with the United States Department of the Interior's Minerals Management Service, Michael Baffrey with the United States Department of the Interior and Ruth McKechnie with Indian and Northern Affairs Canada.

The idea for a conference came, in time honored fashion, from a discussion over beer and wine after a long day of Arctic Council meetings in Narvik, Norway. Ruth was talking about ice scouring research that was being done in the Canadian Beaufort. That led to a discussion about the various research efforts on both sides of the border and the question of whether we were communicating effectively cross border.

Not a year later, here we are at the first of what I hope will be many forums.



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As President Bush said, “We will act, learn and act again, adjusting our approaches as science advances and technology evolves.” The United States is committed to ensuring that our policies are informed by the best information science can provide.

This forum provides a great opportunity for the United States and Canada, countries that share not only a border but also a commitment to the responsible development of our resources, to bring together scientists, resource managers and industry to discuss what research is being conducted and how it can be used. But it’s not enough to simply catalog what you are doing; we want to build a cooperative effort in which the research that is being done is the research that policy makers need to make the decisions of the day.

The forum topics range across a number of important issues. We will focus on the heart of the North Slope indigenous culture: the Bowhead whales that migrate across our border, wherever it is, in the Beaufort Sea. We will look at work being done on ice behavior. We’ll hear about ice engineering issues and about infrastructure effects on caribou. As well as that ice scouring work I mentioned.

The information presented this week will be the cutting edge results that will inform decision makers and resource managers for the next few years.

Are we doing enough? Are we studying the right topics?

I can tell you that in my new position, Federal Coordinator for Alaska Natural Gas Transportation Projects, I’ve developed a to-do list that includes a number of new topics and old topics that need to be updated.

When I joined DOI under Gale Norton’s leadership, our mantra for decision making was Consultation, Communication, and Cooperation, all in the service of Conservation. While that mantra may no longer be in vogue, this forum brings all those C components together in an attempt to bring together the right people to begin a dialogue about what research is underway and how we can collectively and collaboratively engage in more.

Government funded or directed research must be tied to identified research needs, especially in these tough economic times. That’s why DOI led the charge to create the North Slope Science Initiative (NSSI). Dr. Bill Seitz, USGS, had the idea. He worked with Dr Rowan Gould, FWS and Henri Bisson, BLM, to refine the concept and it was a hit with the Secretary. The NSSI is comprised of the State and federal resource managers with Industry and local residents at the table. Together they decide what science is needed to make sound resource management decisions.

The Arctic is changing. The Northwest Passage is poised to become a major shipping thoroughfare and there are distinct changes ashore. Change presents both new opportunities and challenges for the Arctic. It’s imperative that we manage our response to those opportunities and challenges wisely.

The change has no borders and it’s important that the two nations – divided by a common language though we may be – attack the challenges collaboratively.



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For the past year and a half, the U.S. Executive Branch has been reviewing its policies related to the Arctic region in a comprehensive manner. The last review was completed in 1994. The Department of State and the National Security Council are leading the process, which involves every federal agency with Arctic responsibilities. We are in the final stages of this review; a final product should be released soon. Because it's not final, I am not in a position to discuss its content and conclusions.

However, I can share some of the key issues that have been discussed.

Since 1994, much has changed in the Arctic, most notably the significant melting of Arctic sea ice. As a result, we anticipate increased human activity in shipping and energy development. We want to ensure that these activities are conducted in a way that minimizes any negative impacts on the Arctic environment.

The discussions focused on a number of topics, three of which are being discussed at this forum: international scientific cooperation, economic issues, and environmental protection and conservation.

In every meeting, without fail, people would ask what the relevant research results are and whether more research is being done.

From the Inupiat Elder who observes Bowhead whale or polar bear behavior to the decision makers in DC and Ottawa who ask "why", the common thread is curiosity and a need to understand our world. You men and women provide a critical link in the path to wise conservation and adaptive management.

It's not always pretty, as Albert Einstein observed in a Yogi moment of his own, saying, "*if we knew what it was we were doing, it would not be called research, would it?*"

But if you make your research relevant, package it into a useful format, which synthesizes recommendations, conclusions and key issues in an unbiased manner, I can assure you that your results attract attention and be used.

Thank you for being a part of this experiment in collaboration, which I hope leads to many future consultative, cooperative efforts between us. And if you run out of ideas, have I got a project or two for you!

Thank you and enjoy the forum.



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3.2 OPENING REMARKS: PATRICK BORBEY (CANADA)

Patrick Borbey, Assistant Deputy Minister
Northern Affairs Organization
Indian Affairs and Northern Development Canada
Northern Oil & Gas Research Forum '08
Anchorage, Alaska
October 28, 2008

Let me start by thanking you, Drue, for your warm welcome and for making members of the Canadian delegation feel so at home in Alaska. I am sure I speak for everyone here when I say how much we are enjoying the tremendous hospitality of the City and people of Anchorage.

We are especially grateful to our American hosts for recognizing the importance of science to resource development, and for sponsoring this inaugural research forum. Whether we are policy makers, regulators, industry leaders or local residents, we all have a vested interest in capitalizing on each other's knowledge and expertise as we determine future directions for northern oil and gas development. Today's meeting comes at a pivotal time in this region's history. The Arctic is undergoing sweeping changes with consequences for Canada, the U.S., other circumpolar countries and the world as a whole.

On the one hand, the Arctic's enormous economic potential is being unleashed as the North's oil and gas reserves are unlocked. At a time when emerging economies require new energy sources and traditional energy producers' supplies are depleting, the Arctic's wealth of oil and gas has the potential to fuel decades of future global growth.

In Canada, we believe it is essential that Northerners – particularly Aboriginal people – benefit from these opportunities. Measures such as land claim settlements, consultations and direct involvement in resource development, such as the Aboriginal Pipeline Group, are enabling Northern communities to participate in development opportunities, decision-making processes and benefit from increased activity.

At the same time there is tremendous opportunity, there is also dramatic environmental change. Melting tundra and glaciers and shrinking ocean ice mean a shortened season for ice roads and the potential for new marine shipping channels opening across the circumpolar region.

The winds of change are also compromising the centuries-old way of life of Aboriginal people and affecting the Arctic's wildlife and fragile ecosystems. These impacts underscore the need for environmental management and adaptation strategies that help Northern residents adjust to a fast-changing world and ensure sensitive Arctic ecosystems are safeguarded for future generations.

Equally challenging, regulations designed in a bygone era can no longer keep pace with these rapid changes. It would be an understatement to say that oil and gas development in the North is expensive. Understandably, industry is hesitant to invest in these costly ventures without the certainty that the rules will be clear and fair to all parties involved. The business community



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wants to know what to expect from a regulatory perspective and be assured that timelines will be met. Otherwise, the investment becomes cost prohibitive.

Reconciling these diverse interests and demands is at the heart of sustainable development – and the reason why we need sound science. To respond effectively to the profound changes taking place in the Arctic, we must strengthen our ability to predict and prepare for them through groundbreaking research, the incorporation of traditional knowledge and the participation of Northerners and Aboriginal people in our research programs.

We also need to learn from each other's experiences and lessons learned wherever we can. And that is what this forum is all about. It's a chance to share research results and create synergies to ensure that science informs the decision-making processes for environmental assessments and regulatory processes. Ensuring effective mitigation measures are in place enables oil and gas activity to proceed in an environmentally responsible manner while simultaneously assuring local communities that the public interest is protected.

Given our shared geography and common economic and social goals, it is important that we take advantage of each other's experience and expertise. Certainly, Canada has much to learn from the U.S. experience as oil and gas exploration activity ramps up in the Canadian Beaufort. While there was a lot of activity in the area in the 1970's through to early 90's, only recently, since 2002, have we seen a renewed interest in offshore exploration. There have been record bids for exploration licenses in the Beaufort Sea in the last two years in the deeper oil rich zones, resulting in work commitments in excess of \$1.2 billion.

Another area of interest in Canada's North is the proposed Mackenzie Gas Project, - a major pipeline infrastructure project to bring 6 trillion cubic feet of natural gas from the Mackenzie Delta to southern markets.

As potential infrastructure projects become a reality and exploration activity expands so, too, does the need to ensure that the baseline information is available, technical and engineering design issues based on sound science are being adequately addressed, and that the appropriate monitoring programs are in place and informed by traditional knowledge.

That's why science has played such a crucial role in oil and gas initiatives. Early on, a biophysical gaps analysis was conducted to identify the necessary research to be undertaken for both Mackenzie Gas development and induced oil and gas activity to respond to the environmental assessment and regulatory review. Since 2002, some \$70 million has been spent on Northern oil and gas research to help decision makers make well-informed policy, regulatory and investment choices.

Over the last three years, under the leadership of the United States and Norway, Canada has been very involved in the Arctic Council's Arctic Monitoring and Assessment Programme. The programme recently completed an exhaustive scientific study of oil and gas activities in the Arctic. A summary of the scientific results can be found in the Overview report – Arctic Oil and Gas (2007).

This Arctic Council initiative offers an assessment of the environmental, social, economic and human health impacts of current oil and gas activities in the Arctic and their probable impacts in



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the future. These assessments help us to focus on what research and monitoring should be undertaken for oil and gas activity. In fact, it was through this very process of collaboration that today's forum was initiated. Cooperation such as this is essential and must be the underpinning for future science efforts in the North.

Canada is eager to share its research and knowledge on these issues with industry and regulators both here in Canada and the U.S. Indeed, our goal is to ensure that our country becomes a global leader in Arctic science.

To advance this goal, we are planning to establish an Arctic Research Station. In planning the station, we have borrowed best practices from our international partners. We have visited facilities from pole to pole – from the Barrow Arctic Research Station and Toolik Station here in Alaska to the Rothera Station in the Antarctic.

The year-round, large-scale polar research facility will put Canada on the cutting edge of environmental science and resource development, such as oil and gas. Our goal is to establish a staging and research facility that will attract the best researchers from around the globe who can collaborate on joint projects and build on the legacy of the International Polar Year research efforts.

Canada's commitment to science is further reflected in its accelerated research investments under the International Polar Year. At \$150 million, Canada's contribution to this global initiative is the largest of any of the 60 participating nations. Almost all of the funds – \$100 million – are being spent on 43 science and research projects employing 1200 Canadian and 130 foreign scientists from 20 countries.

Much of the research will be of benefit to regulators and industry involved in oil and gas development, such as those studying sea ice and oceans, hydrology and the carbon cycle. Also of interest are projects examining the effects of climate change and potential adaptation strategies. For example, there is a project looking at the impacts of climate change on permafrost across northern Canada. Permafrost is of vital interest to industry since its presence dramatically affects infrastructure such as buildings, roads and local services.

Research also has a major contribution to make in informing sound regulatory decisions. Canada is taking action to encourage future exploration and development by improving Northern regulatory systems. Our Northern Regulatory Reform Initiative has a two-fold approach, focussing on both operational-level improvements to areas of federal responsibility and on fundamental changes in legislation to ensure that the systems meet the highest standards of effectiveness, predictability and timelines. This will increase certainty for industry while ensuring that our environmental goals are met through sustainable development.

So, clearly, there are multiple benefits from sharing research at a forum such as this one. Recognizing this, both our countries hope to foster greater connections and understanding among everyone with a stake in Arctic oil and gas.

I am optimistic that this week's meeting will be just the beginning of a longer-term research relationship. Canada would be very interested in hosting a future follow-up forum, so we can



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continue to identify emerging research priorities that we should pursue together and build on this collaborative first effort.

In light of the challenges and opportunities I've outlined, there has perhaps never been a time when this work was more needed. Nor, as this forum underscores, has there been a better chance to make the right decisions today – based on sound science – that will benefit northern communities, our economies and countries for years to come. I encourage everyone here to fully seize the tremendous potential this forum offers and look forward to learning the results of your deliberations.

Thank you.

3.3 RESEARCH PROGRAM OVERVIEW

To set the stage for the research forum, representatives of the government agencies which coordinated funding and research for northern environments provided overviews of their agencies' programs.

Mr. Mead Treadwell, Chair of the U.S. Arctic Research Commission, described oil and gas resources in northern Alaska within the context of the circumpolar environment. The Arctic U.S. Research Program of approximately \$400 million per year is spread across at least 15 federal agencies in cooperation with over a dozen nations, using infrastructure worth billions of dollars. Highlight issues include maritime boundary discussions, global climate change, and changes in moving product to market, especially tanker traffic enabled by longer Arctic shipping seasons.

Ms. Ruth McKechnie, Senior Advisor to the Northern Oil and Gas Branch, Indian and Northern Affairs Canada (INAC) outlined the hydrocarbon potential of northern Canada and the Beaufort Sea. The Federal Northern Oil and Gas Science Research Initiative funds research projects in a number of federal government departments, is leveraged with a number of other programs, and provides linkages with academia. The research is in support of the environmental assessment and regulatory requirements for the Mackenzie Gas Project and induced oil and gas activity. Initiatives that promote international cooperation include the Arctic Council, International Polar Year, High Arctic Research Station, and ArcticNet. The Environmental Studies Research Fund (ESRF) finances environmental and social studies related to exploration, development, and production activities on frontier lands and is funded by levies on frontier oil and gas licences.

Ms. Natalie Shea, Science and Technology Advisor for Energy Science and Technology Programs for Natural Resources Canada outlined the Program of Energy Research and Development (PERD), which has an annual budget of approximately \$56 million and supports energy research and development programs across 13 federal science-based departments and agencies. PERD's northern-related programs include research and development to support northern regulatory processes pipelines, marine transportation and safety, offshore environmental factors, remediation, and gas hydrates.



3.4 PANEL ON MANAGEMENT RESEARCH NEEDS AND PRIORITIES

A joint United States and Canada panel provided insight into current management research needs and priorities.

Dr. John Payne, Executive Director North Slope Science Initiative, presented an overview of previous and current research in Alaska's arctic. Both broad categories of research, such as sea ice conditions and socio-economic change, were identified along with examples of more specific research needs such as permafrost measurement techniques and caribou demographic data analysis. The need for greater communication and dissemination of information was highlighted, together with a need for greater collaboration among researchers and managers.

Dr. John Goll, the Alaska Regional Director U.S. Minerals Management Service (MMS) described the work of the MMS, which manages the U.S. outer continental shelf. The MMS supports research programs, including the Technical Assessment and Research Program, which encompasses engineering and oil spill response studies, and the Environmental Studies Program. The Environmental Studies Program is guided by three broad research themes: monitoring marine environments, fate and effects research, and social and economic impacts.

Dr. Robert Steedman, from Canada's National Energy Board, provided a regulators perspective on Beaufort Sea research priorities. These included spill cleanup readiness, facility evacuation in mixed ice conditions, same- season relief well capability, offshore waste treatment guidelines and drilling on the shelf slope. This was complemented by an overview of the Biophysical Research Requirements (Data Gaps) for Beaufort Sea Hydrocarbon Development report (2008) commissioned by Environmental Studies Research Funds (ESRF) Management Board.

Mr. Norm Snow, Joint Secretariat, Inuvialuit Settlement Region, Northwest Territories, Canada described Western Arctic Management research needs and priorities. These encompass species-specific research on priority harvested species such as marine mammals and fish as well as research needs towards management of oil and gas activities, including oil spill response and waste management. The need to include climate change considerations in research was also highlighted, along with an integrated data management system.

3.5 PANEL ON OIL AND GAS INDUSTRY RESEARCH PRIORITIES

A joint United States and Canada industry panel presented information on current industry activity, challenges and research in the Arctic.

Mr. Pete Slaiby, General Manager, Shell Exploration and Projection, Alaska presented an overview of Shell's Arctic experience, current and future activities and research and technical challenges. He identified critical research needs and opportunities for synergies between industry partners, regulators and the scientific community. Among the challenges presented for responsible and successful development, safety, reliability and cost effectiveness were



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highlighted, along with continued efforts to reduce the operational footprint while maximizing benefits and minimizing impacts.

Mr. Geoffrey Haddad, Vice- President, Exploration and Land, ConocoPhillips, Alaska discussed current exploration and development in the NPR-A and Chukchi Sea and associated research focus areas in both the onshore and offshore. Key Alaska research areas for the onshore focused on minimizing environmental impacts for example, through extended reach drilling and small footprint developments. Offshore research areas included site- specific drilling solutions, acquisition of baseline information, ice- hardened structures and seabed interactions with development infrastructure.

Ms. Marilyn Crockett, Executive Director Alaska Oil and Gas Association, discussed industry activities and research needs in the arctic. This included a “Tool Box” for Oil and Gas Development in sensitive areas to address research needs such as baseline studies, technological advances in seismic, drilling and access to remote sites. Population data on ESA listed species and underwater sound impacts were examples of research needs presented. Research challenges were identified in the areas of coordination/collaboration, prioritization, government funding and publication, peer review of study results.

Mr. Gary Bunio, Vice- President Operations, MGM Energy Corporation provided an overview of MGM’s drilling programs in 2008-09, along with ongoing research programs in Canada’s arctic. He explored the theme of research in the context of a research model that should address our “understanding”, “invention”, “innovation” and “implementation of findings” as applied to the arctic oil and gas industry. Key items identified for Northern Energy Development in the context of research needs included timelines, infrastructure, labour and the regulatory framework.

Mr. Bob Blainey, Manager- Commercial and Regulatory Affairs, ConocoPhillips, Canada provided an overview of oil and gas resource potential in the Canadian arctic. Key onshore challenges were identified as tundra/permafrost preservation, narrow weather windows, logistics and transportation, infrastructure and sensitive environments. Key offshore challenges include ice structure/seabed interaction, sensitive marine environments and safety. Regional research priorities were identified in the areas of navigation/transportation, ice environment, cost reduction, and support for the Canadian Beaufort Regional Environmental Assessment Initiative.

Mr. Paul Barnes, with the Canadian Association of Petroleum Producers (CAPP) presented an overview of CAPP’s role in the Canadian Oil and Gas industry. This was followed by a review of northern Canada’s petroleum industry activity, challenges of operating in northern Canada and the use of research and development to address these challenges. Research drivers were identified in the areas of resource recovery, regulatory streamlining, project level assessment, physical and biological baseline data and stakeholders expectations regarding environmental and social performance. CAPP acknowledges the collaboration that is taking place between industry and government research and development funders in the north and see continued opportunities to advance sustainable northern communities, support individual and community economic self sufficiency, and to develop associated infrastructure.



3.6 TECHNICAL-ENGINEERING

Most presentations in the technical-engineering session focused on the predominant engineering challenge of the oil and gas industry in Arctic environments – ice, both on sea and on land.

Sea ice was the topic of three of the presentations. Dr. Garry Timco provided an overview of the research conducted by the Natural Research Council's Canadian Hydraulics Centre which addresses ice engineering challenges faced in the Beaufort Sea. Dr. Humphrey Melling (Fisheries and Oceans Canada) spoke about the PERD-supported long-term pack-ice monitoring program, and resulting observations about multi-year ice floes. Dr. Max Coon outlined progress in developing a model to predict sea ice behaviour in the creation and evolution of leads and ridges.

On land, Mr. Scott Guyer presented the results of the Bureau of Land Management's investigations into the effects and recovery of tundra ecosystems following ice road construction, and Dr. Winston Revie of Natural Resources Canada's CANMET Materials Technology Laboratory spoke about research and development focused on reliability issues faced by northern pipelines operators.

The status of the Underground Injection Control program used to manage solid waste in the Alaskan oilfields was described by Mr. Thor Cutler of the U.S. Environmental Protection Agency (EPA), who also spoke about the future for carbon dioxide geosequestration under the EPA's proposed new Class VI rule.

3.7 OIL SPILLS

Comments and questions from forum participants on the issue of oil spills indicated that it is a topic of particular concern for northern residents and environmental organizations. Industry representatives commented that understanding the behaviour of oil spills and knowing how to deal with them was important, but that implementing practices that prevented them in the first place was the priority.

The presentations dealt with a variety of issues related to oil spills. Dr. John Bradford discussed the results of an MMS-sponsored research program on how airborne radar systems can be used to detect oil under ice. Mr. Ian Buist discussed the results of laboratory testing on weathering properties of oil in ice and snow. Technologies and preparedness to deal with spills after they occurred were addressed in presentations by Dr. Scott Pegau (Oil Spill Recovery Institute), Mr. Steve Potter and Mr. Ian Buist (SL Ross Environmental Research Ltd.), and Dr. Amy Merten (Coastal Response Research Center, National Oceanic Atmospheric Administration).

3.8 SOCIO-CULTURAL, SOCIO-ECONOMIC

Topics related to issues affecting human communities were the focus of the session on socio-cultural and socio-economic research. Four presentations presented results of research of socio-cultural and socio-economic conditions in areas affected by oil and gas development in northern environments. Two of them – Mr. Michael Galginaitis' (Applied Sociocultural Research) presentation on subsistence whaling, and Ms. Stacie McIntosh's (Bureau of Land



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Management) presentation on caribou harvest monitoring – discussed community resource use. Dr. Gary Kofinas (University of Alaska Fairbanks) described two in-progress research projects examining the resilience and vulnerabilities of communities in northern Alaska to oil and gas development and climate change. Mr. Thomas Stubbs (Integrated Environments) described the social and economic effects of the renewal of oil and gas activity to Canada's Mackenzie Delta Region in 2000 – 2004.

Two presentations described processes that provide context for socio-cultural and socio-economic programs. Ms. Amanda Cliff (Inuvialuit Regional Corporation) described planning processes related to obtaining funds from the \$500 million Mackenzie Gas Project (Social) Impact Fund, and Mr. David Livingstone (Department of Indian Affairs and Northern Development) described the environmental stewardship framework, which establishes the context for responsible economic development in the Northwest Territories.

3.9 BIOLOGICAL SCIENCES

Biological sciences were the primary focus of twelve presentations. Mr. Stephen Braund's (Stephen R. Braund & Associates) presentation on subsistence mapping of Nuiqsut, Kaktovik, and Barrow linked the topics of subsistence use of wildlife with biological research topics. This was illustrated through the results of interviews with community members and maps produced by data collected in a GIS.

Research on marine mammals was a strong focus of the biological sciences sessions. Ms. Lois Harwood (Department of Fisheries and Oceans) presented results of an investigation into the effects of near-shore hydrocarbon exploration on ringed seals. Dr. Andrew Derocher (University of Alberta) described the preliminary findings of a 5-year research program, initiated in 2007, to examine polar bear movement in the southern Beaufort Sea population. Bowhead whales were the topic of two presentations: Dr. Carin Ashjian (Woods Hole Oceanographic Institution) spoke about bowhead whale feeding behaviour, and Ms. Lori Quakenbush (Alaska Department of Fish and Game) spoke about bowhead whale movement. Mr. Pierre Richard (Fisheries and Oceans Canada) presented the results of satellite tracking of beluga whales in the Beaufort Sea. Mr. Robert Suydam (North Slope Borough) described observations of bowhead and beluga whale responses to oil and gas development in the Alaskan Beaufort and Chukchi seas, compounded by the influences of subsistence hunting and climate change.

Dr. James Reist (Fisheries and Oceans Canada) provided an overview of fish research in the western Canadian Arctic, and Dr. Patricia Ramlal described the multidisciplinary research program based from the Canadian Coast Guard Ship *Nahidik*.

Dr. Stephen Arthur (Alaska Department of Fish and Game) presented the surprising findings that when intensive industrial development caused a shift in the location used by calving of the Central Arctic caribou herd to an area of reduced habitat quality, the population of the herd increased.

Dr. Abby Powell's (University of Alaska) presentation on king eiders showed the movement patterns of king eider ducks revealed through satellite tracking. Mr. Craig Machtans' (Canadian Wildlife Service, Environment Canada) presentation was also about birds, with a focus on the



special demands placed on research when it is to be used to support regulatory processes and decisions.

3.10 PHYSICAL SCIENCES

The last topic to be addressed at the research forum was physical sciences. Two presentations of research from the Geological Survey of Canada highlighted the dynamic nature of the Beaufort Sea. Steve Blasco's presentation on seabed geoenvironmental issues, including ice scour and seabed permafrost, highlighted a number of constraints to hydrocarbon development. Mr. Steve Solomon's presentation described research into hydrodynamics and sediment movement in the nearshore environment of the Mackenzie Delta region of the Beaufort Sea.

Dr. Donald Forbes (Natural Resources Canada) spoke about the on-shore Mackenzie Delta, and how subsidence of the delta affects flooding and erosion. He also presented the results of research on the hydrology of the Mackenzie Delta Region (Marsh et.al). Results from the Geological Survey of Canada's permafrost monitoring network were described by Dr. Sharon Smith.

Two papers described research in freshwater environments. Mr. Robert Shuchman (Michigan Tech Research Institute) described how water quality data can be collected using the Automated Lagrangian Water Quality Assessment System (ALWAS). Mr. Michael Lilly presented results of investigations into effects of water withdrawal for oil and gas development from lakes on the Alaska North Slope.

The final two presentations of the conference addressed an issue underlying much of the discussion of the preceding presentations – climate. Ms. Val Swail's (Environment Canada) presentation described the use of historical data of wind and wave conditions in the Beaufort Sea to create models that can be used to predict extreme events. Dr. Barrie Bonsal's presentation discussed climate change, and how projected changes to hydro-climatology raise a number of research issues with respect to future oil and gas exploration and development in the Mackenzie Basin/Beaufort Sea.

3.11 RESEARCH PRIORITIES AND ISSUES

Research needs and priorities was the subject of three panel discussions, representing the "consumers" of research: oil and gas resource managers, U.S. industry, and Canadian industry. Each forum participant identified different research priorities and issues because each holds different perspectives, has different issues that require resolution, and must respond to different core missions or directions. Nevertheless, some common themes were identified, along with common research priorities. Highlights of these are presented below.

3.11.1 Infrastructure

Many forum participants identified the need for more robust infrastructure and logistical support for research programs and industrial activity. Providing safe, reliable and cost-effective support facilities is a challenge. The value of support facilities was demonstrated by the varied research programs supported by the CCGS *Nahidik* and the ArcticNet initiatives supported by the CCGS



Amundsen. Access to ice-strengthened vessels for marine research was identified as a priority in both the US and Canada.

3.11.2 Sea Ice

The physical properties of sea ice, how it affects design and engineering of facilities, changes in ice cover related to climate change and its influence on the marine environment were identified as continuing priorities for research. While predictive modeling of ice behaviour is improving, there remains the need for more research using remote sensing and on the physical properties of sea ice. Effects of ice scour, movement and behaviour of multi-year ice, characteristics and probability of extreme ice features, were some of the items identified as requiring further research attention.

3.11.3 Long-term Studies

Natural systems are dynamic; observations made at a single point in time have limited usefulness compared to long- term observations. Knowing long-term trends and natural variability in populations like polar bear and caribou provides clues to how oil and gas development may contribute to other factors that drive population changes. Similarly, being able to analyze physical data such as meteorological data provides a better understanding of extreme events and trends, as well as provides clues to long- term climate change.

Long-term studies were also felt to be important in our understanding of cumulative effects in the Arctic, providing data sets and information that can be used as benchmarks to help us understand changes in biophysical conditions over time.

3.11.4 Information Use Across Boundaries

The range of presentations and discussions from a variety of perspectives illustrated how the usefulness of information can be enhanced by making a transition across boundaries of time, scale, jurisdiction, and application.

Time

The technology used to collect data and interpret information that formed the basis of many of the forum presentations would have been considered fantastical during the Arctic oil and gas development initiatives in the early 1980's. Being able to monitor the daily (hourly!) circumpolar movements of an Eider duck or beluga whale, by using satellite imagery and to detect the depth of scour of ice movements on the floor of the Beaufort Sea by using multibeam technology are examples of technological transitions that have significantly changed the ability to understand the natural environment.

It was acknowledged that advances in technology should continue to be supported as new information is provide which in turn strengthens knowledge based decision making. Nevertheless, on a number of occasions through the course of the forum, reference was made to the importance of capturing the knowledge and experience of people who were involved in earlier northern industrial initiatives. Bringing together the knowledge gained from different time



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periods, including intergenerational knowledge provided by Traditional Knowledge, allows for a baseline to be established, enabling monitoring of long-term trends and an increased understanding of the interaction of oil and gas development in northern environments.

Forum participants also frequently observed that oil and gas industrial practices have evolved significantly. Most notable from an environmental impact perspective is the reduction in the size of the footprint of industrial sites, which reduces the area of impact as well as the level of activity required to construct and operate the facility.

Scale

A number of forum presentations exposed the challenge of applying research results collected at one scale to resolving problems at a different scale. For example, understanding the physical properties of oil weathering in laboratory tests is only the beginning of understanding how it will behave in the field conditions experienced in the Beaufort Sea. Similarly, computer models of the behaviour of ice movement require significant testing against real conditions before they can provide reliable predictions of the real world environment.

Jurisdiction and Collaboration

Much of the research presented at the forum demonstrated interagency cooperation and collaboration among multiple government agencies, industry, academia and non-government organizations. A number of studies demonstrated that researchers' focus is on developing an understanding of the natural environment regardless of the jurisdiction in which it occurs. Pointed examples of how the natural environment boundaries have little relationship to political boundaries was demonstrated in satellite tracking of wildlife – from krill to bowhead whale, and from ducks to polar bear. Research collaboration across jurisdictions is beneficial for all stakeholders and should be encouraged.

Application

Proponents of oil and gas development and the managers of the resource emphasized the importance of the transition from data collection to the application of that data in ways that solve problems. Decisions are rarely made in a “science bubble”, and decisions must often be made even though information is not complete or perfect. Decision makers emphasized the importance of receiving information in a form that is relevant and useful to them.

3.11.5 Collaboration and Communication

Many of the presentations highlighted the collaborative nature of the research programs, with funding and cooperation shared among a number of agencies, and including participation of academia, industry, and government organizations. Many also demonstrated widespread availability of their work, through mechanisms such as websites that provided access to data as it was collected. Nevertheless, a number of participants identified the need for better collaboration and communication, particularly with respect to the compatibility of data and methods of data acquisition.

The complexity of factors that affect social systems requires additional collaboration to bring together information to better understand factors such as climate change, economic effects of



development, and external social influences on communities. Furthermore, clarity is required about appropriate and meaningful indicators of social conditions. In addition, it was identified that better sharing of information among communities would enhance their ability to be resilient in the face of these changes.

3.11.6 When Things Go Wrong

The Beaufort Sea, North Slope and Mackenzie Delta are harsh and isolated. This presents special challenges for working in these areas, particularly when things go wrong.

Oil Spill Cleanup

The focus of dealing with oil spills in Arctic marine environments is on prevention for example through engineering design, use of innovative technologies and reduced industrial footprint. Nevertheless, the consequences of an oil spill and the ability to clean it up, particularly in remote areas or in ice-infested water, were issues of particular concern to many forum participants. The assessment of risk and acceptable levels of risk is also an area that needs more attention.

Although the increasing ability to detect oil on and under ice was demonstrated (see Bradford's presentation), the current technology to detect oil spills in mixed ice environments, illustrated by images of people in small boats tipping over ice pans with poles to see if oil was present, suggests that some aspects of detection remain rudimentary.

The current best-practice method of cleaning up oil on ice by burning (see Buist's abstract), is still viewed as a valid practice. After a winter oil spill, burning is used for spill cleanup during spring breakup. Cleanup in mixed ice environments was identified as particularly problematic. Issues related to spill cleanup readiness, such as available materials and resources, ability to deal with spills in mixed ice environments, and disposal of recovered oily wastes are also research priorities.

Emergency Response

Inclement weather conditions and long distances from well-equipped and adequately-staffed emergency response centres are a few of the factors that present challenges to conducting research or working in these remote northern locations. Facility evacuation in mixed ice conditions from platforms and ships was identified as an area requiring further attention.

Same-Season Relief Well Capability

Research into the benefits, alternatives and risks associated with same-season relief wells, and implementation of regulatory policies on same-season relief wells were identified as priority issues.

Communication and Information Sharing

The need to share information and research results with regulators and industry was a common theme when discussing oil spill prevention, response and further research priorities. In particular, the sharing of best practices/best available technology and lessons learned was seen as a way to advance our understanding of the issues and to improve access to available data.



3.11.7 Emerging Issues and Challenges

The forum provided an opportunity to identify a number of emerging issues, trends and challenges that the oil and gas industry will face in the future. The theme of “Change” emerged as a key driver for research in the arctic, either as a result of climate change and the need to look at adaptive research across, physical, biological and socio-economic fields, or change in the context of technological advances in both industry tools and practices and in the ability to access increasingly more remote resources and to bring them to market.

Climate change, ocean shipping, technological advances in oil spill prevention, response and monitoring, cumulative effects and gas hydrates were identified as issues that are likely to gain increased importance for future research programs in the Arctic.

Climate Change

The need to address climate change as an underlying consideration in research programs was mentioned by many forum participants. Forecasting models were felt to be important, particularly with respect to broad scale studies on Arctic shelf conditions. Questions about potential climate change effects on the natural environment including permafrost integrity, sea ice conditions, implications for traditional cultural practices (e.g., subsistence harvesting), and increased shipping traffic were raised frequently. Similarly, the need to look at adaptive management research was felt to have increasing relevancy with respect to exploration and production.

Ocean Shipping

An extended ice-free season will allow for increased shipping. The direct effects of increased shipping including shipping noise and waste management, as well as its potential to contribute to cumulative effects, are issues that require consideration. This was felt to be particularly important in regards to a potentially ice-free northwest passage.

Oil Spill Prevention, Response and Monitoring

Although oil spills have been a concern since exploration and production first took place in the arctic region, research and development continues to make advancements in the areas of spill prevention, response and monitoring. Data Management systems, linked to real-time environmental conditions (wave, wind and sea-ice) are expected to advance in the future, improving our ability to predict hazardous conditions for exploration, production and shipping activities. In addition, technological advances in drilling production and shipping are expected to increase, further reducing the potential for spills. Similarly, our ability to track and monitor spills, both on and under the ice, in all four seasons is expected to advance through a variety of remote sensing and site-specific technologies.

Cumulative Effects

As industrial development, shipping traffic and other uses of the arctic region increases, the cumulative effects and management of these activities is expected to become an issue both within and across U.S. and Canada’s jurisdictions. This has implications for various regional land use management initiatives and the development of effective means to monitor and manage a range of



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activities in remote environments. Issues of arctic sovereignty, security, environmental protection and provision of socio-economic opportunities for aboriginal peoples of the North are likely to overlap as oil and gas activity expands in the region.

Gas Hydrates

Gas hydrates in the arctic were identified as a possible future source of energy, albeit with a longer time frame for development than oil and gas resources. Information about geo-environmental properties of gas hydrates, regulation and information about safety of gas hydrate development and production was identified as an emerging issue in the Arctic requiring additional research.

4 CONCLUSION

Participants at the Northern Oil and Gas Research Forum concluded that such events provide important opportunities to share the results of research across the US and Canada's arctic regions. Collaborative research programs that extend across U.S. and Canada borders have been undertaken in the past and are continuing to provide insight into a range of key issues facing the oil and gas industry in the arctic.

Technological advances in exploration and development activities continue to reduce the footprint that the industry has on the environment; however there remain many issues to address with regards to environmental and socio-economic effects management, including oil spill prevention, response and monitoring. Applied research must continue to answer questions on key issues to improve decision making and our knowledge of the interaction between the industry and the arctic environment.