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Feedback on the ASPPR Hybrid System for Type B Vessels

G.W. Timco and I. Kubat

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Ungava Bay should be included in
 Hybrid system expands the season
                                                                                                                                                                                                                                                                                                                                                 these regulations
                                                                                                                               Is there analysis how many ships would be affected by this? would be affected by this? Not that these Zo YIMO? What happen vessels still be
 Is there some expectation that these
                                                                                                                                                                                                                                                                                           Nares Strait should be Zone 1
 rules would be adopted by IMO?
                                                                                                                                                                                                                                        What happens outside of the Hybrid System? Will
       Basis for assignment
                                                                                                                                                                                                                                             vessels still be allowed to operate?
      of ice multipliers
                                                                                      ade porods en The presence of an Ice Navigator is required for AIRSS.

Resident Dates look okay - there is nothing that appears too restrictive No problem to implement with proper training no problem to implement with proper training appears too restrictive No problem to implement with proper training appears too restrictive No problem to implement with proper training appears too restrictive No problem to implement with proper training appears too restrictive No problem to implement with proper training appears too restrictive No problem to implement with proper training appears too restrictive No problem to implement with proper training appears too restrictive No problem to implement with proper training appears too restrictive No problem to implement with proper training appears too restrictive No problem to implement with proper training appears too restrictive No problem to implement with proper training appears too restrictive No problem to implement with proper training appears too restrictive No problem to implement with proper training appears too restrictive No problem to implement with proper training appears too restrictive No problem to implement with proper training appears too restrictive No problem to implement with proper training appears to the problem to implement with the proper training appears to the problem to implement with the proper training appears to the problem to implement with the proper training appears to the problem to implement with the proper training appears to the problem 
clear.

We would be interested to see how the ice severity charts come out using only ice boundaries also appear justified.

Number 1 tra
      needs to be made
                                                                                                                                                                                                                                                                                    Ice Regime calculations should override the normal Zone/Date requirements
                                                                                                                                                                                                                                                                                                                                     Problem Pelly Bay – choke point entrance is 
between rocks
                                                                                                                                                                                                                                                                                                                         Number 1 training is to
                                              I also reviewed the ice severity charts in Appendix B with particular emphasis on the areas (Zones) that I have operated
                                                vessels. For Type B vessels the charts seem well represented
Ship horse power and tonnage are important.
                                                                                                                                                                                                              We have some problems with Zone 6, and its current geographic some problems with as access dates
            Regulations should be promote use of technology by promote use of technology promote use of tech
                                          Regulations should encourage people to
                                                                                                                                                                                                                                                                          should they be incorporated into the system?
                                                                                                                                                                                                                                                                                                                How is it proposed to actually enforce I ce Navigator
  Should the reports be sent to NORDREG? If needed probably yes, however, if anything could reduce bureaucracy that would be appreciated
                                                                                                                                                                                                                                                                                         Feedback system from the operators is key
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Technical Report CHC-TR-071

March 2010







Feedback on the ASPPR Hybrid System for Type B Vessels

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Prepared for

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> Technical Report CHC-TR-071

> > March 2010



ABSTRACT

Research and recent international initiatives have shown that Transport Canada's Arctic Shipping Pollution Prevention Regulations (ASPPR) need to be modified and updated. The Canadian Hydraulics Centre of the National Research Council of Canada has been conducting research on methods to improve and update the two navigation control systems contained in the ASPPR. NRC-CHC undertook research leading to a revised approach (Hybrid System) to navigation control and applied this approach to a Type B vessel to illustrate the Hybrid System. This system would redefine some of the existing Zone boundaries and allow mostly expanded windows for shipping using a combination of Ice Regime System Mandatory dates and Open Zone dates. This report summarizes the stakeholders' comments and discussion on the proposed Hybrid System.

RÉSUMÉ

Plusieurs études et de récentes initiatives internationales ont démontré que le Règlement sur la prévention de la pollution des eaux arctiques par les navires (RPPEAN) requiert une mise à jour. Le Centre d'hydraulique canadien (CHC) du Conseil national de recherches Canada (NRC) a proposé une méthodologie visant à améliorer les deux systèmes de gestion de la navigation contenus dans le RPPEAN. Sur la base des analyses effectuées par le NRC-CHC, on présente une nouvelle approche – le « Système hybride », lequel est appliqué à des navires de type B à des fins de démonstration. Ce système prévoit la modification de l'étendue des zones existantes et l'élargissement de la période d'accès pour la navigation, en faisant intervenir des dates obligatoires pour le système des régimes des glaces et pour les aires ouvertes. Ce rapport résume les commentaires des intervenants et les discussions qui ont été abordées sur ce Système hybride.





TABLE OF CONTENTS

ABSTRACT	1
RÉSUMÉ	
TABLE OF CONTENTS	3
LIST OF FIGURES	4
LIST OF TABLES	
1.0 INTRODUCTION	5
2.0 The PROPOSED Hybrid System	6
2.1 Zone Boundaries	6
2.2 Zone Dates	6
2.3 Modified Ice Regime System	
3.0 STAKEHOLDERS FEEDBACK	
3.1 Distribution of the Report	
3.2 Formal Presentations	
3.3 Individual Consultations	10
3.4 Consultation Meeting	
4.0 STAKEHOLDERS COMMENTS ON THE HYBRID SYSTEM	13
4.1 General Impression	
4.2 Problems?	
4.3 Is anything missing?	
4.4 Comments on Proposed Dates for Type B Vessels	
4.5 Proposed Change to Zone 5	
4.6 Proposed Change to Zone 4	
4.7 Proposed Changes along Ellesmere Island	
4.8 Other Potential Regions for Change?	
4.9 Dealing with Highly Variable Regions	
4.10 Other Factors?	23
4.11 Qualifications of an Ice Navigator	
4.12 Reporting during the MIRSM Dates	
4.13 Training of the Hybrid System	
4.14 Future Research?	
5.0 SUMMARY	
6.0 ACKNOWLEDGMENTS	
7.0 REFERENCES	28
Appendix A	
The Zone- Date System	
Appendix B	
The Ice Regime System	
Appendix C	
Presentations from the Montreal Consultation Meeting	39



LIST OF FIGURES

Figure 1: Comparison of the existing zone boundaries in the Zone-Date System was	ith
those in the proposed Hybrid System.	7
Figure 2: Operating dates for a Type B vessel in the proposed Hybrid System	7
Figure 3: Proposed change in the boundary for Zone 5	19
Figure 4: Proposed change in the boundary for Zone 4	20
Figure 5: Potential changes along Ellesmere Island	21
Figure 6: Map of northern Canada showing the Zones in the existing Zone-Date S Zone #1 has the most severe ice conditions and Zone #16 has the lightest	
conditions.	33
LIST OF TABLES	
Table 1: Proposed Ice Multipliers for the Hybrid System for Type B Vessels	
Table 2: Zone-Date Table	
Table 3: Ice Multipliers in the Ice Regime System	38

Feedback on the ASPPR Hybrid System for Type B Vessels

1.0 INTRODUCTION

Transport Canada controls navigation in Canada's Arctic waters through the Arctic Shipping Pollution Prevention Regulations (ASPPR). The purpose of these Regulations is to minimize the likelihood that a ship will enter ice conditions that are beyond the ship's designed safe operating parameters. The Regulations are based on two completely different approaches for dealing with a vessel in different ice conditions at different times of the year. These systems are the Zone-Date System (ZDS) and the Ice Regime System (IRS). The Canadian Hydraulics Centre of the National Research Council of Canada (NRC-CHC) has been investigating the scientific basis for these regulations.

Timco et al. (2009a) presented a hybrid control system which was based on a scientific analysis of the historical ice information in Canada's Arctic waters. This "Hybrid System" combines the ZDS and the IRS into an updated integrated system. The NRC-CHC spent considerable effort to disseminate the information on the Hybrid System to all stakeholders. They did this through presentations at scientific conferences and committee meetings, individual meetings with stakeholders, and through a formal consultation meeting which was held in Montreal in March 2010.

This report presents a brief overview of the Hybrid System and summarizes the comments by stakeholders of the system. For a full understanding of the comments, it is important that the reader is familiar with the system proposed by Timco et al. (2009a).



2.0 THE PROPOSED HYBRID SYSTEM

The proposed Hybrid System combined the two existing navigation control systems into a single integrated system. Details of the Zone-Date System and the Ice Regime System are presented in Appendix A and B respectively.

In developing a new control system the following attributes were considered to be important:

- Have a strong scientific basis (i.e. not be based on *ad hoc* approach).
- Allow the operators sufficient opportunity to operate safely in the Arctic.
- Facilitate a means for operators to manage risk in a systematic way.
- Develop a quantifiable system that will allow improvements and innovation in rule making.
- Include the new IACS Polar Class vessels (Kendrick 1999, 2005; IMO 2002; Santos Pedro 2003: IACS 2007).

The NRC-CHC conducted a very thorough analysis of the ice conditions in Canada's Arctic and used this analysis to develop the Hybrid System. The NRC-CHC approach tried to ensure that the system was relatively simple to understand and apply yet based on strong science. As a starting point, they developed the system and applied it to a Type B vessel. This type of vessel was chosen since most present day Arctic operators use Type B vessels and so they are familiar with them and their operating range.

2.1 Zone Boundaries

The analysis showed that the existing zone boundaries were actually quite representative of the ice conditions in the Arctic. However there were a few proposed changes. Two of these changes were major (Zone 4 and Zone 5) and some were minor (mainly changes to Zone 1, 3 and 6). Figure 1 shows the proposed zone boundaries for the Hybrid System. The existing zone boundaries for the ZDS are also shown for comparison.

2.2 Zone Dates

The dates for allowable operation in the Hybrid System are based on two different types of operation:

Open Zone (OZ) – Historically, when ice conditions were shown to be very light in a zone, vessels could operate without any formal reporting or record keeping of the ice conditions. Operation was controlled by due care and diligence of the Master.

<u>Modified Ice Regime System Mandatory (MIRSM)</u> – When ice conditions were historically shown to be more severe, the modified ice regime system must be used to determine the allowable regions of navigation for the vessel. Of course due care and diligence of the Master was still required.

The operating dates for both the Open Zone and the MIRSM are shown in Figure 2 for all 16 zones for a Type B vessel (note these are based on the revised zone boundaries shown in Figure 1);



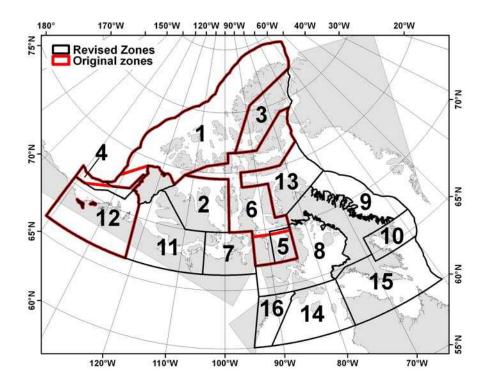


Figure 1: Comparison of the existing zone boundaries in the Zone-Date System with those in the proposed Hybrid System.

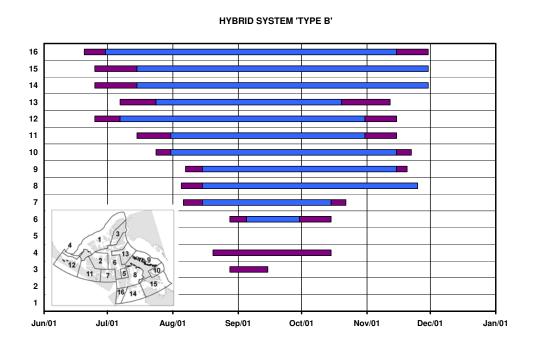


Figure 2: Operating dates for a Type B vessel in the proposed Hybrid System

Page 8



2.3 Modified Ice Regime System

The Modified Ice Regime System would have the same basic format as the existing System. That is, each vessel class would be assigned unique Ice Multipliers and the Ice Numeral would be calculated according to Equation 1. The IN=0 go/no-go would still be used to determine whether a vessel can enter a specific ice regime. However, there would be some significant changes compared to the existing Ice Regime System. These changes are summarized as follows:

<u>Ice Categories</u> – There are only be two ice categories used in the Modified System. These are first-year sea ice and Old Ice. In the existing system, Old ice is subdivided into second-year ice and multi-year ice. However research by the NRC-CHC (Johnston and Timco, 2008) has clearly illustrated that even experienced ice specialists have uncertainty on differentiating between these two ice types. Therefore they would not be subdivided in the modified system and ice older than one season would be treated as Old Ice.

<u>Ice Thickness</u> - The existing Ice Regime System is based on the ice thickness as defined by the World Meteorological Organization (WMO) and detailed in MANICE (2005). These definitions are related to **growing** sea ice and they do not apply to sea ice that is decaying. Therefore it is proposed that the Ice Numeral would be calculated based on the actual ice thickness and not by the WMO definitions. However, the same thickness boundaries as used by the WMO would be used for defining the Ice Multipliers.

<u>Summer Bonus</u> - The NRC-CHC (Timco and Johnston 2003; Timco et al 2004) has shown that the existing Ice Regime System can be modified to accommodate summer ice conditions with better correlation to empirical data. The NRC-CHC has suggested that this Summer Bonus should be granted to vessels if they meet all of the following criteria:

- 1. Summer ice conditions are in effect These conditions would commence if the ice has decayed to the rotten stage (thaw holes throughout the full-thickness of ice). The summer decay bonus should be removed as soon as there is Thin First-year ice (or thicker ice) in the ice regime in the autumn during ice growth (Timco and Johnston 2003).
- 2. *Ice Navigation Equipment* Vessels with high quality equipment for identifying ice features to aid in safe navigation have the ability to anticipate and avoid unsafe ice conditions. The criteria for sufficient Ice Navigation Equipment must be decided by Transport Canada with input from key Stakeholders.
- 3. *Experienced Masters* Vessels with experience Masters and personnel often have a better appreciation for unsafe ice conditions and safe speeds in different ice conditions. The criteria for sufficient Experience must be decided by Transport Canada with input from key Stakeholders.

The Ice Multipliers for all first-year ice types (including Open Water) should be increased by +1 for vessels that qualify for the Summer Bonus.

No Decay Bonus for Old Ice - Significant research (Johnston et al, 2002, 2003; Johnston 2004; Johnston and Timco 2008; Timco and Johnston 2002) has shown that multi-year ice does not decay in the same manner as first-year sea ice. The research has shown that

first-year ice strength decreases quite rapidly such that it is approximately 15% of its mid-winter strength in early July. Multi-year ice does not decay to this extent. Therefore, there is little justification for applying a decay bonus for Old Ice. The Ice Multipliers for Old Ice will be the same throughout the year.

<u>Ice Navigator</u> - An experienced Ice Navigator is required to implement the Modified Ice Regime System. The criteria for sufficient qualifications for an Ice Navigator must be decided by Transport Canada with input from key Stakeholders.

Reporting to NORDERG - Reporting requirements need to be sufficient to allow a Pollution Prevention Officer (PPO) to monitor, as needed, the assessment of whether the vessel is in potentially unsafe conditions and is being operated safely (position and speed). The current Ice Regime System also requires vessels to report their experience to NORDREG. It is suggested that this detailed reporting (i.e. after-action reports) would not be a requirement with the Modified Ice Regime System. However, the vessel must keep sufficient records to justify navigation during the date periods when the Modified Ice Regime System is mandatory.

<u>Ice Multipliers</u> –Table 1 provides the Ice Multipliers for Type B vessels in the Modified Ice Regime System.

Table 1: Proposed Ice Multipliers for the Hybrid System for Type B Vessels

	Thickness Range	Ice Multiplier	Summer Bonus Ice Multiplier
		100 manaphor	100 111011
Old Ice	all	- 4	- 4
First-Year Ice			
(TFY)	> 120 cm	- 2	- 1
(MFY)	70 - 120 cm	- 1	0
(FY)	50 - 70 cm	1	2
(FY)	30 - 50 cm	1	2
(GW)	15 - 30 cm	1	2
(G)	10 - 15 cm	2	3
(N)	< 10 cm	2	3
Open Water		2	3

3.0 STAKEHOLDERS FEEDBACK

Transport Canada and the Canadian Hydraulics Centre were interested in receiving feedback from stakeholders of the Arctic regulations. This was actively pursued using four different approaches discussed below.

3.1 Distribution of the Report

The NRC-CHC printed and distributed 130 copies of the report describing the Hybrid System (Timco et al 2009a). Also, about 100 copies of the electronic report were distributed through email. The report was also available on the NRC-CHC website (www.chc.nrc.ca) in the section on CRT papers and reports.

3.2 Formal Presentations

Presentations were made at the CMAC-Northern meetings in both Quebec City and Yellowknife. Scientific papers were presented at four international cold regions conferences (Kubat and Timco, 2008; Kubat et al. 2008; Timco et al. 2009b; Timco et al. 2009c).

3.3 Individual Consultations

A series of individual meetings were held between the NRC-CHC and a number of stakeholders. Also, feedback was supplied directly to the NRC-CHC through several written comments submitted to them. The following people and organizations were involved with this feedback:

- Fednav/Enfotec Tim Keane, Bob Gorman, Tom Paterson
- PetroNav Chris King, Catherine Huneault, Mario Bonenfat
- Desgagnes Transarctic Waguih Rayes
- NEAS Georges Tousignant
- Chevron Capt. Keith Jones, Capt. Don Connely, Alexander Brovkin, Robin Browne
- Lloyd's Register Robert Hindley, Rob Bridges
- CCG Capt. John Vanthiel, Capt. Perry Stares, Capt. Mark Taylor, Capt. David Fowler, Denise Veber, Fiona Robertson, Barb O'Connell
- CIS Doug Bancroft, Darlene Langlois, François Choquet, Leah Braithwaite, Roger DeAbreau
- Stena Rederi AB Goran Liljestrom
- Mariport Group Christopher Wright
- L&W Environmental Consulting Wayne Lumsden
- Inuvialuit Joint Secretariat Norm Snow
- Maersk Line Limited Stephen Carmel
- NEB Bharat Dixit
- Imperial Oil Jim Hawkins
- Woodward Group of Companies Fred Constantine, Capt. Ed Anthony



3.4 Consultation Meeting

A consultation meeting was held in Montreal on March 10, 2010 to discuss direct feedback on the Hybrid System. The meeting was held at the Delta Hotel on University Ave. The meeting was chaired by Victor Santos-Pedro of Transport Canada. The meeting was structured to allow ample time for participants input. There were seven formal presentations made at the meeting. They were:

- Update on the changes to the Canadian and international Arctic shipping regulations (V. Santos-Pedro)
- Update on the Arctic Marine Shipping Assessment (R. MacDonald)
- Overview of the proposed Hybrid System (G. Timco)
- Overview of the CHC individual meetings on the Hybrid System and overview of questions posed to the Stakeholders (I. Kubat)
- Overview of comments received from Stakeholders (G. Timco)
- Arctic Community Access & Climate Change: Hybrid System Review (M. McCullough, C. Wright, W. Lumsden)
- Ice Numerals for Polar Class vessels (A. Kendrick)

These presentations are reproduced in Appendix C.

The following people were involved with this meeting:

- Rod Allan, Transocean
- George Argyros, BP
- Aneesh Bakshi, DNV
- Darryl Balasko, Churchill Gateway Development
- Andy Bush, ExxonMobil
- Carole Campeau, Ocean Group Inc.
- Clarence Carroll, DNV
- Jim Collins, Husky Energy
- Don Connelly, Chevron
- John Cowan, Fednav
- Bharat Dixit, National Energy Board
- Bill Drew, Port of Churchill
- Jacques Fortin, Transport Canada
- Roy Friis, Northern Transportation Company Limited
- Ron Grady, Canadian Coast Guard
- Marc Hudon, QRAC President
- Alex Iyerusalimskiy, ConocoPhillips
- Andrew Kendrick, BMT Fleet Technology
- Jim King, CFN Consultants (Atlantic) Inc
- Ivana Kubat, Canadian Hydraulics Centre
- Burt Lahn, US Coast Guard
- Marcel LaRoche, Lloyd's Register
- Goran Liljestrom, Stena Rederi AB



- Wayne Lumsden, L&W Environmental Consulting
- Ross MacDonald, Transport Canada
- Bill Maddock, ExxonMobil
- John Mattson, Northern Transportation Company Limited
- Tim McAllister, US Coast Guard
- Mark McCulloch, Government of Nunavut
- Andrew McNeill, Canadian Coast Guard
- Colin Nelson, Transocean
- Dale Nicholson, DFO Canadian Hydrographic Service
- Jean Ouellet, Canadian Coast Guard
- Viorel Pana, DNV
- John Paton, Government of Nunavut
- Anthony Potts, Canadian Coast Guard
- David Pugh, Shell Oil
- Fiona Robertson, Canadian Coast Guard
- Victor Santos-Pedro, Transport Canada
- Jaideep Sirkar, US Coast Guard
- David Sitland, Canadian Coast Guard
- David Soule, National Defence
- Wade Spurrell, Canadian Coast Guard
- John Stubbs, Fednav
- Garry Timco, Canadian Hydraulics Centre
- Georges Tousignant, Nunavut Eastern Arctic Shipping
- Heather Villaudy, Government of Nunavut
- Dugald Wells, Cruise North Expeditions Inc.
- Christopher Wright, The Mariport Group Ltd.
- Han Yu, ABS
- Tom Zagon, Canadian Ice Service

The NRC-CHC has collected all comments and these are summarized in the next section.



4.0 STAKEHOLDERS COMMENTS ON THE HYBRID SYSTEM

The NRC-CHC developed a series of questions which directed the responses received form the stakeholders. There were three general questions and a number of questions related to more specific issues. The questions and the responses are given below. It should be noted that the NRC-CHC slightly edited some of the responses but tried to maintain the spirit of the response.

4.1 General Impression

The first question asked of the stakeholders was "What is your general impression of the Hybrid System?". Overall the response was very good and most people felt that this system was an improvement over the existing systems(s). The detailed comments are given below:

- Generally the proposed system is taking the right direction.
- The approach needs to be expanded beyond Type B ships before it can be evaluated fully.
- The analysis relies on whether the Ice Numeral assigned is correct.
- Whilst there is confidence and experience with the Ice Numerals for Type B ships there is less confidence in higher ice classed ships.
- Analysis of the Zones and average ice conditions/numerals for the various classes of ships makes sense, and to me is logical. It would provide a more realistic Zone/Date system.
- Not sure why we don't just use the MIRS all the time for every region of the Arctic.
- If the diligent Ice Navigator does his calculations, then his routing should be safe, the ultimate goal.
- Concept appears to be workable from both an operations and regulatory perspective
- Good it gives flexibility to an otherwise largely in-flexible system.
- A real benefit is that it recognizes the variability in ice conditions.
- I am impressed with the excellent principals stated in this report having a strong scientific basis.
- Allows operators sufficient opportunity to operate safely in the Arctic.
- Facilitates a systematic way to manage risk.
- provides a quantifiable system to allow improvements and innovations in rule making
- If a higher level of regulatory oversight is desired then the proposed Hybrid System leaves too much to individual interpretation.
- I question the safety and risk that will result if the proposed Hybrid System places too much onus on the Master of a vessel to decide whether or not a vessel should proceed into a particular area.
- It appears the system addresses risk from the perspective of the ship risk that ice could damage a vessel. I would have thought a system that addresses risk from the perspective of the environment would be more appropriate.
- The system as proposed does not differentiate between types or size of ship for example a large oil tanker presents a larger hazard than a small survey ship for example.



- Boundaries of the existing Zones surprisingly show a good "agreement" between what ice conditions were then and what they are now, given the type of technology in 70's.
- As it looks the suggested system is simple. The Z-D system was seen as very simple; IRS little bit complicated (at the beginning), but not now.
- The authors are to be congratulated on their work to date.
- The authors have carried out a logical analysis of historical ice data in order to investigate the Hybrid System.
- I agree that the existing systems are inadequate and need upgrading to meet changes in the Arctic ice regimes and potential demands for working in the Arctic.
- It is not only "significant research" that has shown that the ASPPR and AIRSS need to be modified but also the continual feedback from commercial and CCG vessel operators to TC, NORDREG, CHC, etc.
- This is how the "hands-on, practical experience" of ship operators (ship owners, masters and ice navigators) gets taken into account in the process of change.
- It is the conditions as seen by the Master, together with careful judgment and voyage planning, that then best determines the success and safety of an intended (or aborted) ice transit.
- There is no question that in depth analysis of Canadian Ice Service (CIS) ice charts (as presented in the report) is the best choice to revise and improve on the current zone date system.
- We agree with the proposal and look forward to continued involvement with TC/CHC and Stakeholders as the process progresses.
- We have to ensure that any changes can also be practically and reasonably accommodated within offshore exploration and production activity as this has features and requirements different from regular shipping activity.
- In recent years ships could stay longer; this year (2009) though could start earlier (mid June) but had to leave earlier than last few years.
- This system can be applied, understood, and it accounts for actual factors.
- If the system (new) is implemented today, it will only affect us in a good way.
- For new inexperienced companies the Hybrid System will at least mitigate damage, problems etc.
- Yes the system is workable.
- How will the system deal with different vessel classes if 2 different vessel classes (e.g. Type B versus Type A) will have different boundaries for individual zones?
- Aim of the ZDS is to take the worst conditions into account; it has to be addressed on the fly. AIRSS system based on what can be seen outside the window - visibility, snow, weather conditions should be included.
- How do you look at situation when there is a cargo vessel that is not compliant with classes but is strongly supported?
- Go by experience of those who operate there, not those who sit in the office; office people can help with administrating implementation.
- Many areas still have variability between years and routes are pretty specific so choke
 points should be looked at, not only the whole areas. The solution would be more
 Zones but this would make it very complicated.



- Open ended boundary: prudent mariners apply IRS but not "cowboys" and the Regulations must be for cowboys.
- Cad Regulations cannot favourite Cad vessels but has to be designed for International vessels.
- Ice charts much better after 1995 when RADARSAT1 was launched. Do analysis from 1996 onward.
- This is basically how we operate, it is a good system.
- IRS should be taken as a tool (which it is) rather than regulation. It is helping younger Masters and will especially to new ones coming.
- Hybrid system expands the season.
- More operators are undertaking a risk based assessment prior to voyages in ice. How will this system fit with this approach?

4.2 Problems?

Stakeholders were asked if they foresaw any potential problems with this system. There were a wide variety of comments made on this. However overall there were no major problems identified. The detailed comments are given below:

- There should be a feedback system for capturing any problems from vessels using the system so that the dates and zones can be refined on a more regular basis, especially accounting for the use of higher ice class ships where there is less operational experience.
- Review periods should also be set after implementation.
- No, but new players will have to educate themselves about this system.
- Master of a commercial vessel is commercially driven to deliver the cargo and make a profit for the owner so caution must be used to give them more latitude to operate.
- A change in the regulations that places this final decision-making on the Master of the vessel will result in less safety, not more.
- Sometimes ice information from the CIS Ice Charts is of poor quality (due to moving ice) and routing decisions based on these could cause problems.
- Ice conditions quickly change in the Arctic which means any system based on data going back 25 years would strike me as going to be wrong.
- What about anniversary date for First-year ice to become multi-year ice (i.e. October 1 when the CIS changes any remaining first-year ice to a classification of second-year ice). How will this be taken into account?
- For past 3 years, ships were sitting at ice edge waiting for CCG for at least 3 days. What is needed is 1) more infrastructure, 2) more navigation, 3) support from CCG.
- When there are growlers, or a foot of snow on ice, the mariner doesn't know what is under that so identification is difficult.
- Problem is human resource for sea staffing is a problem world wide; operating in ice is unique to Canada; Recruiting = problems in two areas in engineering (chief engineer), and on the deck. Getting qualified Ice Navigators might be a problem also.
- If North gets busy scheduling will be more difficult for everyone because of capacity.
- Problem with extending season is support to vessels by CCG; would have to be to vessels that will not be requesting CCG support.



- Where the islands are that's where it is tougher (no ability to avoid heavy ice).
- What if climatology changes totally in next 14 years, when is this going to be updated?
- No problem to implement with proper training.
- Would like to see the distinction between second-year ice and multi-year ice kept in the system. This is important for the Beaufort Sea region.
- How will the Polar Class vessels be integrated into a new system? Will they have more freedom to operate in multi-year ice conditions? If so, we should be looking at ways to use modern technology to characterize risk levels better and integrate these into the new system.
- How will managed ice be treated in the new system? Managed ice may be of high
 concentration with very variable floe sizes, but will rarely generate complete brash
 ice coverage. However, reduced load levels should be considered.

4.3 Is anything missing?

Stakeholders were asked to identify if they saw any shortcomings and missing elements with this system. A number of items were identified. Some were quite valid whereas others were a reflection of the system not fully developed yet for all vessel classes. A few items were important to note – many mentioned that risk-based systems are common and questioned how this system could be used in a risk-base analysis (both for planning and insurance). Questions were raised about the type of reporting that would have to be made during the IRSM dates. Also, many mentioned the need to continually monitor this and update it if necessary. A listing of the general comments is given below:

- Basis for assignment of ice multipliers needs to be made clear.
- System for feedback by users of the system should be mandated and integrated into the AIRSS reporting system.
- Is it possible to have varying dates each year depending upon the Ice Chart information? This would be useful for planning.
- The Inuvialuit Game Council is concerned about the freezing-in of barges that are loaded with fuel and allowing them to over-winter in this state.
- Are smaller vessels and seismic vessels including in these regulations?
- The general approach seems fine; specifics may need some fine tuning.
- What happens outside of the Hybrid System? Will vessels still be allowed to operate?
- Should this be based on the latest 20 years? Perhaps not since we are seeing more variability from year-to-year.
- Need to build-in an update look every 5 years.
- Is there some expectation that these rules would be adopted by IMO?
- How would this system be applied in the Northwest Passage with the sovereignty issue still undecided?
- If you were going to address allowable fuel or the carriage of hazardous material this would have been a good place to do it.

¹ BMT Fleet Technology has recently issued a draft report that provides information to establish the Ice Multipliers applicable to PC vessels (BMT Fleet Technology, 2010) – see also Appendix C of this report.



- In general enforcement is not addressed.
- Decay is not taken into account.
- How will the system take into account experience of Masters and navigation equipment all year round, not only in summer? For certain zones it should be mandatory.
- For the offshore industry in the North American Arctic, I hope that we do not forget that we do not have the experience we once had and until we replace that experience we need to ensure that any updated regulations address this.
- We would be interested to see how the ice severity charts come out using only ice conditions for the last ten years and the last six years.
- We think a "bonus" should be developed for use of the ice experienced master/ice navigator for ships that are "highly manoeuvrable".
- Don't know, we'll see once we practice it.
- Changes to Ungava Bay and Hudson Bay.
- What happens outside of the Hybrid System? Will vessels still be allowed to operate?
- Look at risk based philosophy, particularly giving credit to a vessel that can operate in "wounded" stage, i.e. vessel able to operate in a state of some damage. Could it be incorporated in rules?
- Ship horsepower and tonnage are important should they be incorporated into the system?
- Tug boats are not part of this system.
- What about putting instrumentation on a vessel to monitor the loads? Would this change the system?
- Also include pressure conditions in calculation of IN.
- I am concerned that we are not addressing safe speed issue.
- The reporting issue is not clear to me.
- Validation is important especially for negative ice numeral regions.
- There may be regions that experience significant ice drift or movement of ice which make navigation particularly difficult. Is this included in the system?
- Perhaps a model of the ice drift could be used and combined with the WMO charts to give regions of difficult navigation.
- Ice condition may be experienced in a region, which would limit the ice class; however no ships may be operating in that region. This could affect the ice class allowed into the zone.
- I wonder what the merits of using a zone system is opposed to adopting the contours provided by the maps? If the purpose is to provide a more scientific basis and accurate determination of the boundaries then those identified in the maps could be used in lieu of the straight line zones.
- I would also raise the attention of the developments at the IMO in forming a Mandatory code for Polar Waters. One item that has been highlighted during discussions was the governance of ice class and the need for a harmonized approach to restrictions in light of the common ice class rules (Polar rules) which now provides a level basis for the Administrations to base the restrictions on. In this respect it is worth noting that the system should be developed to ensure flexibility and consistency in future requirements that may be applied to all Administrations, which



is the reason for noting the approaches used by other Administrations in finding a common approach.

4.4 Comments on Proposed Dates for Type B Vessels

The Timco et al. (2009a) report presented some proposed dates for a Type B vessel for entry into all of the zones in the Zone-Date System (reproduced in Figure 2). Most stakeholders felt that the dates were reasonable but there were some comments related to specific regions. The Nunavut government presented some information on an independent analysis of the impact of the Hybrid System on Nunavut communities (Mariport Group, 2009). The specific comments related to the proposed dates for a Type B vessel are given below:

- Dates look okay there is nothing that appears too restrictive
- The proposed modifications to some Zone boundaries also appear justified.
- We note the suggested changes in dates with the Hybrid System and we are particularly pleased to see that the approach with regard to use of a modified AIRSS is considered "mandatory".
- Usually the vessels don't have problems to access North of 60°N on the first day allowed by ZDS (from East Coast).
- Proposed changes to dates depends on quality of escort we can expect.
- We note that the charts, in Appendix B, show Jones Sound as "reasonable" by August 7 versus the existing ZDS of August 25 and I can certainly agree with this for the more highly manoeuvrable (smaller) vessels.
- I also reviewed the ice severity charts in Appendix B with particular emphasis on the areas (Zones) that I have operated vessels. For Type B vessels the charts seem well represented.
- What happens outside of these dates? Can the Ice Regime System still be used and if so, what is the reporting procedure for it?

4.5 Proposed Change to Zone 5

Analysis of the ice information in Zone 5 indicated that part of the existing Zone 5 appeared to be navigable for a Type B vessel at least for part of the summer. Timco et al (2009a) suggested that the zone boundary be changed as shown in Figure 3. This proposed change was controversial. Some Masters noted that the passage through this region was affected by a series of small islands and this makes the route very limited. It appeared that the ice conditions in this region also varied considerably from year-to-year. The specific comments are given below:

- I do not agree with this proposal because of the navigational dangers in this area.
- Conditions vary throughout the season depending on the wind and tidal currents.
- If a vessel became beset, it could easily be carried aground.
- The need to redraw the zone date boundaries is fully agreed with.
- Pelly Bay is a good change (that will allow to ship to communities there), however, Committee Bay never clears out; in 2009 shipping started 5 weeks



- earlier than used to be, but in Pelly Bay more ice than usually at the entrance (they go there for past 7 years) than they've seen.
- Zone 5 (Pelly Bay) should be changed; there is no way that the long LNG or cargo vessel could proceed through it.
- Problem Pelly Bay choke point entrance is between rocks.
- Zone 6 is too large. if Zone 5 (Pelly Bay) opens there would be more commercial traffic and escort (end of August) will become a problem.
- Positive: ZD for planning purposes; Zone 5 will open for commercial operation; Negative: escort especially in zone 6 with increased traffic (though for CCG positive given the age of fleet + lack of flexibility).
- Not feasible, yes will be more traffic but for planning transit do I take a chance to be stuck in ice for 3 weeks? Not a chance!!

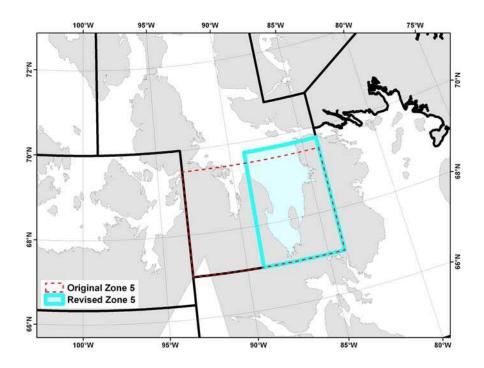


Figure 3: Proposed change in the boundary for Zone 5

4.6 Proposed Change to Zone 4

The analysis of the ice conditions in the western Arctic indicated that the boundaries in the Beaufort Sea were not in agreement with the ice conditions. Timco et al (2009a) suggested a change in the zone boundary as shown in Figure 4. This change largely affects Zone 4 and also Zone 1 and Zone 12. There was general agreement for this although most of the current shop operators do not operate in this region. The comments are given below:

- We don't ship there so this is not a concern for us
- The need to redraw the zone date boundaries is fully agreed with.
- The examples given in the report (Zone 4 and 5) have not surprised us



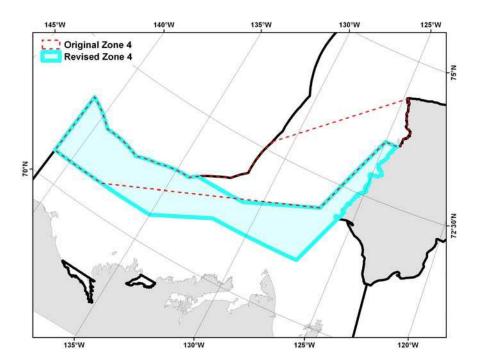


Figure 4: Proposed change in the boundary for Zone 4

4.7 Proposed Changes along Ellesmere Island

Analysis of the ice conditions along the east coast of Ellesmere Island indicated that the existing zone boundaries were not correct. Most of this region is part of Zone 6 but the analysis indicated that this region had ice conditions which were too severe for a Type B vessel (see Figure 5). Therefore it was suggested that this region (which includes Kennedy Channel, Kane Basin and Smith Sound) should be part of either Zone 1 or Zone 3. Overall there were comments on this since few vessels have historically gone into these regions. The comments are given below:

- No comment about this our company doesn't ship there.
- We have some problems with Zone 6, and its current geographic spread needs careful review, as well as access dates.
- Zone 3 is political zone put together because of Eureka supply (i.e. to get there through the Norwegian Bay).
- Des Groseilliers sea lift to Eureka always goes there with icebreaking support; it has to be guarantied that the sea lift will get in → if IRS is mandatory in this region there might be a problem = objection from CCG because of planning.
- Boundary between Zone 6 Zone 3 almost as if Zone 1 should be mapped there, but who goes there, only CCG.
- Zone 3 most likely put there to go to Eureka.
- Nares Strait should be Zone 1.



- We don't have the kind of vessels to go there.
- Zone 6 was included in this region because of an ice bridge forming regularly every year in Nares Strait giving open water; not any more since the bridge doesn't form. What if in next decade there is no ice because the ice bridge starts forming again?
- Many MY floes, high water currents in this region.

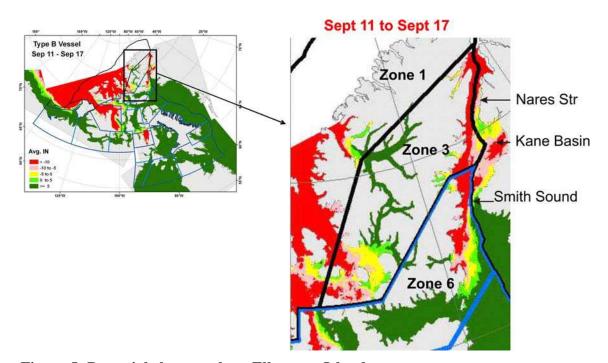


Figure 5: Potential changes along Ellesmere Island

4.8 Other Potential Regions for Change?

Operators were asked if they could suggest other geographic regions where they felt the proposed Hybrid System did not cover. There were several suggestions for this and these will be investigated by the NRC-CHC in revising this system. The detailed comments are given below:

- Please clarify if it is intended to finalize one update to the zone map, or have zones and maps dependent on ice class?
- Yes, see particularly Government of Nunavut analysis relative to Frobisher Bay (Zone 15) and Roes Welcome Sound (Zone 8) (Mariport Group, 2009).
- Ungava Bay should be included in these regulations.
- Zone 6 is getting ice from Zone 2 (Larsen Sound South western corner of the Zone 6). Fednav (Enfotec) did an analysis on type of vessel needed for shipping in this zone based on years 1974-2008 and recommended PC5.
- Disagreement also in Western part of Zone 6 going to the Melville Island.



- Late 60's Northeast side of Baffin Island always had to follow west coast off Greenland (around Thule), but last few years (7 years) on August 1st we could follow east coast off Baffin Island and this could not be done before.
- Iqaluit the first port and usually access to it is hard, this year (2009) thought was very good (good combination of winds and ice conditions) for that they would appreciate having CCG there to help them through patches.
- Repulse Bay a problem towards the end of shipping season. Last 2 years in summer Furry & Hecla Strait with no problem, which saves about 5 days to go through there (15–16 hrs versus 5 days to go around) that was last week in September, but Regulations might not allow it. However, this is only applicable if there is no ice; if there is ice you do not try to go there.
- Ice conditions off Resolute harsh in fall.
- Lancaster Sound looks like wide open area but there is only narrow navigable route to go; always take into account 1)narrow water ways 2)bathymetry 3)pressure 4)wind and 5) currents.
- Zone 6 should be 6a, 6b, 6c etc where 6a would be also mandatory while rest of 6 would go based on proposed system.
- Zone 10 and 9 seem to fit quite well for Type B vessel.
- Zone 7 in general needs better charting because sometimes for routing the new route is where sounding is and that is not good.
- Zone 8 OK to use IRS.
- Zone 9, 14, 15, 16 easy to navigate and find favourable ice numeral.
- Zone 11 by the time they get there from East is open, but it is a short window.
- Zone 10 OK this is the zone where IRS has to be used most often because of their requirements need to go there before July (3rd week of July).
- Any delays in Zones 14 & 15 will become a problem. This is potential for difficulties for anyone.
- Zone 15 is critical; Zone 14 less so but still. In both Zones 14 and 15 is important to look at them from end; In addition Ungava Bay does not seem to fall into any Zone. Should you extend Zone 14 to Ungava Bay?
- Zone 6 needs to be completely re-evaluated.
- The ZDS should probably never have included Roes Welcome Sound in Zone 8.
- Zone 6 regarding access to Grise Fjord, NWP and Kugaaruk.
- Zone 8 regarding access to Repulse Bay via Roes Welcome Sound.
- Zone 15 regarding access to Iqaluit.

4.9 Dealing with Highly Variable Regions

Some regions of the Arctic have highly variable ice conditions from year-to-year. The NRC-CHC asked for feedback on how these regions should be treated in the Hybrid System. Some comments are given below:

- IRSM at all times with further consideration for future updates as data is reviewed and operational experience gathered.
- Limit the open zone to the highest probability of safe access and use MIRS outside of these dates to earliest opening, latest closing.



- Our company uses the MIRS always.
- Ice Regime calculations should override the normal Zone/Date requirements.
- For our part we have always used AIRSS (since its introduction) irrespective of whether the ship was entering a zone well within the zone date parameters.
- In regions like Zone 6 make IRS mandatory all the times, this is what they do even in the ZDS (looking for open water); also use ice pilot.
- Cad vessels due diligence but what about international flag vessels do 6 as 6a/6b
 this is where a lot of transit will be.
- What used to be 5 make 6a and 6b.
- The use of the MIRS would seem to offer a valid mechanism to accommodate variability on season opening and closing around a core open zone period.

4.10 Other Factors?

The NRC-CHC asked many experienced Masters and operators if they felt that factors other than the ice should be considered along with the ice conditions in some regions of the Arctic. Their comments are given below:

- High Currents.
- Limited Manoeuvrability (hydrographic considerations).
- High probability of fog.
- Regions of grounded ice.
- Increasing the additional factors may be a valuable data collection exercise for operators, but its inclusion in the hybrid system may reduce the simplicity of the system.
- Wind and storm conditions can have a major impact. Frobisher Bay early season access, and the early season lead off the Kivalliq shore are examples.
- Ice conditions that may be acceptable in the open sea could pose a severe hazard in a narrow channel.
- If adverse wind conditions are encountered when close to shore, severe ice pressure can develop rapidly causing highly dangerous situations.
- Some areas may be deemed a high risk only if multiyear ice is present while some areas may be risky in any ice.
- In areas of high current, tide, ice pressure and proximity to navigational dangers, the vessel operator may have to push their vessel to the maximum to avoid being set onto navigational dangers.
- More snow & blowing snow hampering visibility late in the year.
- Shorter daylight hours later in the year.
- Can vessel navigate around the floes or other ice hindrances?
- We agree with the approach of only two ice categories, i.e. first year ice and old ice (for second or multi year ice).
- Is based on experience; these listed are called additional risks that exist everywhere, but how do you translate them by restricting dates, by lowering IN, or how.
- Winds are awful in Kuujjuarapik (Hudson Bay) late in fall mid November is very late not for ice reason but for great winds and waves.



- Visibility: shorter days.
- More snow (even during the daylight).
- Fog (dense fog).
- Narrow waterways, bathymetry, pressure, wind, currents.
- As in previous IRS if there is ridging subtract 1 to reflect the hazard, darkness, fog, etc (tidal currents as well).

4.11 Qualifications of an Ice Navigator

During the consultation meetings, the need and qualifications of an Ice Navigator were discussed. The comments provided to the NRC-CHC are given below:

- It is understood that Transport Canada has already prepared guidelines on qualifications for an ice navigator. It is suggested that clarifications on the content of this form part of a separate consultation exercise.
- The cost/benefit analysis for the Polar Code showed that Bridge Team experience and/or deployment of an ice navigator were the best approach to safe navigation in ice infested waters.
- The report seems to be written with the idea that Ice Navigators will be Canadian, but this might not be the case with increased shipping in the Arctic.
- How is it proposed to actually enforce Ice Navigator qualifications?
- Does the Canadian government contemplate requiring pilots licensed by the Canadian government that will act as the qualified ice navigator?
- If so there is a large logistical challenge in recruiting, training, qualifying, and deploying pilots.
- If you do not use a qualified ice navigator, this system is really unenforceable which renders the whole thing not really of much use.
- In my opinion, the existing "Ice Navigator" qualifications in the regulations are inadequate to address safe navigation on ships.
- The presence of an Ice Navigator is required for AIRSS.
- I can't imagine that any company would send a ship north without this expertise
- Transport Canada should define the requirements.
- In the role of an (independent) ice navigator, AIRSS and the resultant ice numeral causes "no argument" between ice navigator and ice-inexperienced Masters or shore management.
- We trust that TC will continue to consult with Stakeholders regarding the experience and qualifications/certification of ice navigators.
- We feel that the present "qualification" in ASPPR is inadequate and particularly when the ice navigator is providing such service to a ship where the master and OOW have little or no polar ice experience.
- Use ice advisors on-board; as for experience how do you obtain it, it takes years; good job training on-board is necessary.
- The Ice Service Specialists (ISS) do not know hydrography. They should not be issuing alternate routes. It should be CCG and TC to provide info on navigating; Canadian Ice Service (CIS) would and has to only provide info on ice.



- Ice navigators must be in ice for a long time perhaps in the Gulf, but if not, at least 30 days in Arctic is necessary to be a navigator.
- Multiple issues cargo operations + ice issues which are usually one person. What about training in ice? What is a bigger threat, ice or cargo operation?
- Need to include skill sets & interpretation of RADARSAT imagery, satellite & radar technology.

4.12 Reporting during the MIRSM Dates

The NRC-CHC discussed the need and type of reporting that stakeholders felt should be made during the dates where the Modified Ice Regime System was mandatory. The comments are given below:

- Operators should comment, but collection and reporting of ice information should be considered.
- Further discussion is necessary amongst key stakeholders.
- The decision to operate outside the limits of the Zone/Date would not be made by the Master of the vessel, but by a regulatory oversight body.
- There should be one report per day sent to NORDREG in case of using the IRS.
- This access during MIRS dates would be at the responsibility of the master, and would not have to be cleared beforehand with NORDREG.
- Should the reports be sent to NORDREG? If needed probably yes, however, if anything could reduce bureaucracy that would be appreciated.
- Pollution prevention office at NORDREG does not have any operational experience who is responsible? The ice info might not be available for that specific area especially if there is not icebreaker nearby.
- Is there analysis how many ships would be affected by this?
- NORDREG should be 2-way, but it really is one way communication; what is expected is feedback on IN calculations (if wrong) etc.
- Changing system in middle of vessel's life could be detrimental.
- Sending report to NORDREG before the route is very important and have to be documented => better decision and judgment when the description is in writing; sees it as a good way to repeat since once you are putting something on paper you think about what you will do.
- After Action report not sure, most likely not.
- Once people are trained they will be more confident to report (to send report to NORDREG (as people are not confident to send it to NORDREG if they are not sure if they calculated IN correctly).
- Insurance they look at regular logs in vessel so decisions made only on vessel should not be a problem.
- It is up to TC to decide what to do about information.

4.13 Training of the Hybrid System

Stakeholders were asked if they felt that some type of training would be required for them to understand and feel comfortable with the proposed Hybrid System. Overall it was felt that no substantial training would be required. The comments are given below:

- None at this stage. As a classification society it would be beneficial to continue to participate in workshops to understand ship operator challenges and how the ice class rules are being integrated into a shipping control system.
- There is probably need for a follow on workshop for working through some of the scenarios for higher ice class ships using the ice chart data once it is developed.
- Updating the CHC AIRSS Ice Pictorial Guide (Timco and Johnston 2003b) would be very good.
- Not necessary for government to be responsible for training.
- Have available tools and classroom for 1-2 days, simulations, on-line tools, readily available tools, practical training also based on analyzing NORDREG reports (i.e. based on how they reported and analyzed so far).
- What is experience? It is hard to define, cannot make comparison.
- Number 1 training is to recognize type of ice.
- Number 2 is the time to be there, but how long is hard to say as now (50 hrs) seems very low; should be very basic task to do before going to Arctic.
- 1-2 day classroom, ideally onboard the vessel. Companies more open to training, costs money but repairing ship costs more.
- Reluctant to wrap it up to too many regulations, good as is now, not too many courses on top of what is now. Not spending too much time in courses, but they also have to work.
- DVDs, manuals on how to accurately implement the system, what you are looking at, something as pictorial guide, something "for dummies".
- 1/2 to 1 day course.
- In general if we keep in mind this is for safety of ship and training of Masters, transposed to make better decision for ships then this is a right way to go.
- Training available through ice navigation institute.

4.14 Future Research?

The NRC-CHC asked stakeholders what scientific research should be done to help to continually improve the Hybrid System and if they were willing to supply data to the NRC-CHC for this. The comments are given below:

- Feedback system from the operators is key, with an agreed review date fixed now.
- Review of any ship incidents / damage events for zones and zone boundaries before final agreement.
- So far the focus has been on Type B vessels. Concept needs to be extended to encompass both higher and lower ice classes.
- A definite commitment should be made to continually refine.
- Our company would supply information to the CHC for this.

- Both successes and failures of the system should be reported.
- To get feedback from Masters; to analyze NORDREG reports; also to help to future training, if Masters are reporting well what they see. Analyze what NORDREG has received so far to measure quality and flaws made by Masters. But how to analyze it and make decision on it?
- How would you treat the other class, it would translate to different dates. Would it translate to the other type of vessel?
- Good to do but research should not be part of requirement.
- Data collected using GPS data on what ship do during voyage how much they turn, how fast they go use for simulation purposes.
- Regulations should encourage people to promote use of technology.



5.0 SUMMARY

The large amount and thoughtful comments received by the NRC-CHC indicate the high level of interest in updating the navigation control systems in the Arctic Waters Pollution Prevention Regulations. The authors realize that regulations are not developed by a consensus process. Nevertheless, the feedback provided to the authors has helped to highlight a number of new important points and reinforce the analysis presented in the Timco et al. (2009a) report on the Hybrid System. This report and the feedback from stakeholders provide much information to take into consideration by the Regulators in the update of the ASPPR.

6.0 ACKNOWLEDGMENTS

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Appendix A

The Zone- Date System





THE ZONE-DATE SYSTEM

In 1972, the Canadian Government drafted the Arctic Shipping Pollution Prevention Regulations (ASPPR) to regulate navigation in Canadian waters north of 60°N latitude. These regulations include the Shipping Safety Control Zones (Figure 6), and the Date Table (Table 2), made under the Arctic Waters Pollution Prevention Act (see e.g. ASPPR 1989). Both of these are combined to form the "Zone/Date System" (ZDS) matrix that gives entry and exit dates for various ship types and classes. In this system, the ship types and classes, in descending order of ice capability are: Arctic Class: 10, 8, 7, 6, 4, 3, 2, 1A, 1 and Type Ships²: A, B, C, D, E.

The Arctic Class was normally but not accurately described as the thickness in feet of level ice that the vessel would have the power and strength to break. The Type ships represent the Classifications Societies' designation of ice-capable ships that are in turn equivalent to the Baltic Rules. The "Zone-Date System" is based on the premise that nature consistently follows a regular pattern year after year. It is a rigid system with little room for exceptions.

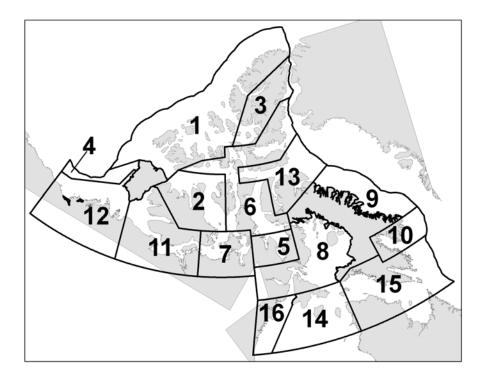


Figure 6: Map of northern Canada showing the Zones in the existing Zone-Date System. Zone #1 has the most severe ice conditions and Zone #16 has the lightest ice conditions.

² The 1972 tables reflect versions of the Baltic Rules that have been superseded. The current version of Type B is more structurally capable than the version assumed in the Canadian regulations (A. Kendrick, personal communication).

Kubat et al. (2005, 2006, 2007) has been investigating the veracity of the Zone-Date System for Transport Canada. They found that there are very large variations in the ice conditions from year-to-year. An examination of several years of data has shown that the Zone-Date System allows vessels into ice regimes which have a high potential to damage the vessel and it often restricts vessels from entering regions where the ice conditions are favourable for a safe passage. The large annual variations are not taken into account by this system - it has fixed (rigid) entry dates that often do not reflect the severity of the ice.

Table 2 : Zone-Date Table

Itom	Category	Zone 1	Zone 2	Zava T	Zana Z	Zone 5	Tone	Zone 7	7	Zone 9	Zona 10				W	STARLE TO SERVE	
A	No. 10 Dec 10 De	12000	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	* 12 Gay 19 c	50, 15, 24, 25, 5, 5, 2	S. 1 11 19 19 19 19 19 19 19 19 19 19 19 1	1960 - 100 - 10			11,111, 111,311 111	St. 55. US: 501 611U. 1	2005000000000					1.000
1.	Arctic Class 10	All Year	All Year	Alt Year	All . Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	Ali Year	All	All	Ali
2.	Arctic	July 1	Ali	Ali	All	All	All	Ali	All	All	All	All	All		Year	Year	Year
۷.	Class 8	to to	Year	Year	Year	Year	Year	Year	Year	Year	All Year	All Year	Ati Year	All Year	All	All	All
3.	Arctic	Aug. 1	Aug. 1	July 1	July 1	July 1	All	Ali	All	Ali	All	All	All	Ali	Year All	Year	Oct. 15
. J.	Class 7	to	to	to	ta t	to	Year	Year	Year	Year	Year	Year	Year	All Year	Year	All Year	Ail Year
	Class /	Sept. 30	Nav. 30	Dec. 31	Dec. 15	Dec. 15	rear	rear	184	rear	rear	rear	rear	rear	rear	rear	Year .
4.	Arctic	Aug. 15	Aug. 1	July 15	July 15	Aug. 1	July 15	July 1	July 1	All	All	July 1	All	All	All	Ail	All
	Class 8	to	to	to	to	to	to	to	to	Year	Year	to	Year	Year	Year	Year	Year
		Sept. 15	Oct. 31	Nov. 30	Nov. 3D	Oct. 15	Feb. 28	Mar. 31	Mar. 31			Mar. 31					
5.	Arctic	Aug. 15	Aug. 15	July 15	July 15	Aug. 15	July 20	July 15	July 15	July 10	July 10	July 5	June 1	June 1	June 15	June 15	June 1
	Class 4	to	to	to	to	to	to	10	to	to	to	to	to	to	to	to	to
		Sept. 15	Oct. 15	Oct. 31	Nov. 15	Sept. 30	Dec. 31	Jan. 15	Jan. 15	Mar. 31	Feb. 28	Jan. 15	Jan. 31	Feb. 15	Feb. 15	Mar. 15	Feb. 15
6.	Arctic	Aug. 20	Aug. 20	July 25	July 20	Aug. 20	Aug. 1	July 20	July 20	July 20	July 15	July 5	June 10	June 10	June 20	June 20	June 5
ŀ	Class 3	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to
		Sept. 15	Sept. 30	Oct. 15	Nov. 5	Sept. 25	Nov. 30	Dec. 15	Dec. 31	Jan. 20	Jan. 25	Dec. 15	Dec. 31	Dec. 31	Jan. 10	Jan. 31	Jan. 10
7.	Arctic	No	No	Aug. 15	Aug. 1	No	Aug. 15	Aug. 1	Aug. 1	Aug. 1	July 25	July 10	June 15	June 25	June 25	June 25	June 10
1	Class 2	Entry	Entry	to	to	Entry	to	to	to	to	to	to	to	to	to	to	to
				Sept. 30	Oct. 31		Nov. 20	Nov. 20	Nov. 30	Dec. 20	Dec. 20	Nov. 20	Dec. 5	Nov. 22	Dec. 10	Dec. 20	Dec. 10
8.	Arctic	No	No	Aug. 20	Aug. 20	No	Aug. 25	Aug. 10	Aug. 10	Aug. 10	Aug. 1	July 15	July 1	July 15	July 1	July 1	June 20
	Class 1A	Entry	Entry	to	to	Entry	to	to	to	to	to	to	to	to	to ·	to	to
					Sept. 30		Oct, 31	Nav. 5	Nov. 20	Dec. 10	Dec. 10	Nov. 10	Nov. 10	Oct, 31	Nov. 30	Dec. 10	Nov. 30
9.	Arctic	No .	No	No	No	No.	Aug. 25	Aug. 10	Aug. 10	Aug. 10	Aug. 1	July 15	July 1	July 15	July 1	July 1	June 20
	Class 1	Entry	Entry	Entry	Entry	Entry	to .	to	to	to	to	to	to	to	to	to	to
							Sept. 30	Oct. 15	Oct. 31	Oct. 31	Oct. 31	Oct. 20	Oct. 31	Oct. 15	Nov. 30	Nov. 30	Nov. 15
10.		No	No	Aug. 20	Aug. 20	No	Aug. 15	Aug. 1	Aug. 1	Aug. 1	July 25	July 10	June 15	June 25	June 25	June 25	June 20
	Type A	Entry	Entry	to	to	Entry	to	to Oct 25	to	to	to	to .	to	to	to	to	to
11.				Sept. 10	Sept, 20		Oct. 15		Nov. 10	Nov. 20	Nov. 20	Oct 31	Nov. 10	Oct. 22	Nov. 30	Dec. 5	Nov. 20
11.	T B	No	No	Aug. 20	Aug. 20	No	Aug. 25	Aug. 10	Aug. 10	Aug. 10	Aug. 1	July 15	July 1	July 15	July 1	July 1	June 20
	Туре В	Entry	Entry	to Sept. 5	to Sept. 15	Entry	to Sept. 30	to Oct. 15	to Oct. 31	to Oct. 31	to Oct. 31	to Oct. 20	to Oct. 25	to	to	to	to
12.		No	No	No.	No No	No .	Aug. 25	Aug. 10	Aug. 10					Oct. 15	Nov. 30	Nov. 30	Nov. 10
12.	Type C	Entry	Entry	Entry	Entry	Entry	Aug.∠⊃ to	to	to	Aug. 10 to	Aug. 1 to	July 15 to	July 1 to	July 15 to	July 1	July 1	June 20
	Type C	Entry	Entry	Entry	Entry	Entry	Sept. 25	Oct. 10	Oct. 25	to Oct. 25	Oct. 25	ю Oct, 15	Oct. 25	0 Oct. 10	to Nov. 25	to Nov. 25	to
13.		No	No	No	No	No	No No	Aug. 10	Aug. 15	Aug, 15	Aug. 5	July 15	July 1	July 30	July 10	July 5	Nov. 10 July 1
13.	Туре D	Entry	Entry	Entry	Entry	Entry	Entry	to	to	to	Aug. 3 to	to		July 30 to	to	July 5	to .
	· she n	Liny	⇔ гкі у	in a	Liuy	Li ili y	Cita y	Oct. 5	Oct. 20	Oct. 20	Oct. 20	Oct. 10		Sept. 30	Nov. 10	Nov. 10	Oct. 31
14.		No	No	No	No	No	Na		Aug. 20	Aug. 20	Aug. 10	July 15			July 20	July 20	July 1
	Type E	Entry	Entry		Entry		Entry	to	to	to	to	to to			to	to	to to
	. Abar	Linky	Liney	will y	LIMI	Ella y	Liniy		Oct. 20	Oct. 15	Oct. 20				Oct. 31		Oct. 31
					,			Sept. 30	UGL ZU	OQL 10	QQ, 20	Jehr M	COL ZU	OCpt. 20	OGC 31	T.YUY	UU. 31



Appendix B

The Ice Regime System





THE ARCTIC ICE REGIME SHIPPING SYSTEM

Transport Canada, in consultation with stakeholders, made extensive revisions to the Arctic Regulations through the introduction of the Ice Regime System (ASPPR 1989; Canadian Gazette 1996; Equivalent Standards 1995; AIRSS 1996). The changes were designed to reduce the risk of structural damage in ships which could lead to the release of pollution into the environment, yet provide the necessary flexibility to ship-owners by making use of actual ice conditions, as seen by the Master to determine transit.

The Arctic Ice Regime Shipping System (AIRSS) is based on a simple arithmetic calculation which produces an "Ice Numeral" that combines the ice regime and the vessel's ability to navigate safely through that ice regime. The "Ice Regime" is a region of generally consistent ice conditions. The Ice Numeral (IN) is based on the quantity of hazardous ice with respect to the ASPPR classification of the vessel. The Ice Numeral is calculated from

$$IN = [C_a x IM_a] + [C_b x IM_b] + \dots$$
 [1]

where IN is the Ice Numeral, C_a is the concentration in tenths of ice type "a", and IM_a is the Ice Multiplier for ice type "a" and Ship Category (ASPPR 1989). The term on the right hand side of the equation (a, b, c, etc.) is repeated for as many ice types as may be present, including open water. The ice types are based on the World Meteorological Organization classifications. The values of the Ice Multipliers (see Table 3) reflect the capability of the vessel class to operate in different ice conditions without damage. The multipliers are adjusted to take into account the decay or ridging of the ice. The Ice Numeral is therefore unique to the particular ice regime and ship operating within its boundaries.

The vessel class is defined in terms of vessels designed to operate in severe ice conditions for both transit and icebreaking (Canadian Arctic Class - CAC) as well as vessels designed to operate in more moderate first-year ice conditions (Type ships). In this system, the vessel classes, in descending order of ice capability are Canadian Arctic Class: CAC1, CAC2, CAC3, CAC4 and Type Ships: A, B, C, D, E.

The Ice Regime System determines whether or not a given vessel should proceed through that particular ice regime. If the Ice Numeral is negative, the ship is not allowed to proceed. However, if the Ice Numeral is zero or positive, the ship is allowed to proceed into the ice regime. Responsibility to plan the route, identify the ice, and carry out this numeric calculation rests with a qualified Ice Navigator (ASPPR, 1989) who could be the Master or Officer of the Watch. Due care and attention of the mariner, including avoidance of hazards, is vital to the successful application of the Ice Regime System. Authority by the Regulator (Pollution Prevention Officer) to direct ships in danger, or during an emergency, remains unchanged.

Table 3: Ice Multipliers in the Ice Regime System

					Ice	Multipl	iers		
			Typ	CAC					
	Ice Types	Ice Types			С	В	Α	4	3
MY	Old / Multi-Year Ice		- 4	- 4	- 4	- 4	- 4	- 3	- 1
SY	Second Year Ice		- 4	- 4	- 4	- 4	- 3	- 2	1
TFY	Thick First Year Ice	> 120 cm	- 3	- 3	- 3	- 2	- 1	1	2
MFY	Medium First Year Ice	70-120 cm	- 2	- 2	- 2	- 1	1	2	2
FY	Thin First Year Ice:								
	stage 2	50-70 cm	- 1	- 1	- 1	1	2	2	2
	stage 1	30-50 cm	- 1	- 1	1	1	2	2	2
GW	Grey-White Ice	15-30 cm	- 1	1	1	1	2	2	2
G	Grey Ice	10-15 cm	1	2	2	2	2	2	2
NI	Nilas, Ice Rind	< 10 cm	2	2	2	2	2	2	2
N	New Ice	< 10 cm	""	""	"	""	""	"	**
	Brash (ice fragments < 2 i	m across)	"	"	"	"	**	"	**
	Bergy Water		"	"	"	"	**	"	**
Open Water		**	**	"	**	**	"	**	

<u>Ice Decay</u>: If MY, SY, TFY or MFY ice has Thaw Holes or is Rotten, add 1 to the IM for that ice type.

<u>Ice Roughness</u>: If the total ice concentration is 6/10s or greater and more than one-third of an ice type is deformed, subtract 1 from the IM for the deformed ice type.

Transport Canada sponsored the NRC-CHC to perform a considerable amount of research to investigate the scientific veracity of the Ice Regime System using a seven Task approach (Timco et al. 1997). Based on the research results and discussions with Stakeholders, a Discussion Paper was produced (Timco and Kubat 2002). This led to a Workshop of Stakeholders in Montreal in 2003 with the final outcome of a suggested modified Ice Regime System that better fit the empirical data (Timco et al. 2004).

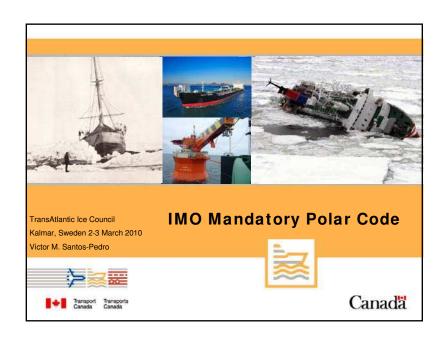


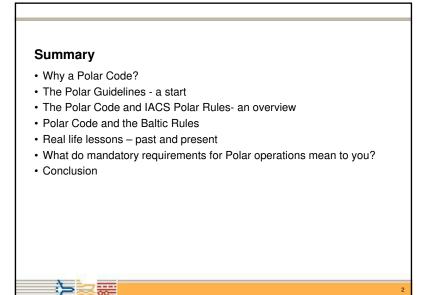
Appendix C

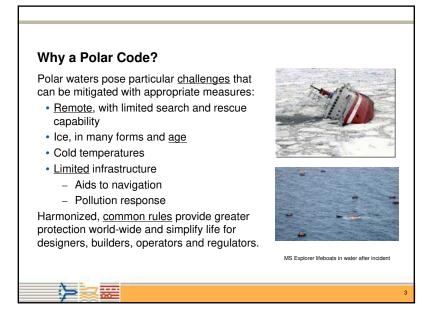
Presentations from the Montreal Consultation Meeting

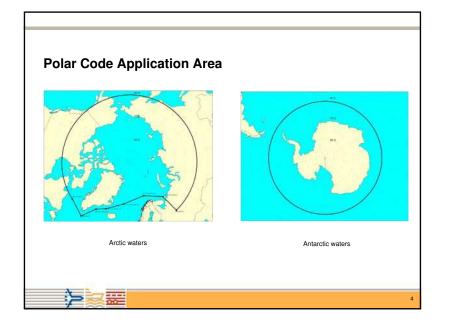
- Update on the changes to the Canadian and international Arctic shipping regulations (V. Santos-Pedro)
- Update on the Arctic Marine Shipping Assessment (R. MacDonald)
- Overview of the proposed Hybrid System (G. Timco)
- Overview of the CHC individual meetings on the Hybrid System and overview of questions posed to the Stakeholders (I. Kubat)
- Overview of comments received from Stakeholders (G. Timco)
- Arctic Community Access & Climate Change: Hybrid System Review (M. McCullough, C. Wright, W. Lumsden)
- Ice Numerals for Polar Class vessels (A. Kendrick)











Guidelines for ships operating in Polar waters - the history

1993 IMO Outside Working Group formed after Helsinki meeting Proposed requirements for vessel operation in Polar waters Original Guidelines 2002 Guidelines for ships operating in Arctic ice-covered waters published · Include provisions for construction, equipment, operations and environmental protection and damage control · Construction aspects refer to draft IACS Unified Requirements for Polar Class Ships 2006 IACS Council adopts Unified Requirements 2007 World-wide distribution of images of "MS Explorer" accident and sinking 2009 Guidelines updated and expanded to cover all polar waters (A.1024 (26)) Development of mandatory Polar Code added to IMO work plan 2010 Proposals for ice navigator competencies considered Discussion on mandatory requirements begins



Guidelines for ships operating in Polar waters

- Scope

PREAMBLE

GUIDE

·Chapter 1 - General

PART A - CONSTRUCTION PROVISIONS

- •Chapter 2 Structures
- · Chapter 3 Subdivision and stability
- Chapter 4 Accommodation and escape measures
- · Chapter 5 Directional control systems
- ·Chapter 6 Anchoring and towing arrangements
- ·Chapter 7 Main machinery
- Chapter 8 Auxiliary machinery systems
- · Chapter 9 Electrical installations

PART B - EQUIPMENT

- ·Chapter 10 Fire safety
- · Chapter 11 Life-saving appliances and survival arrangements
- •Chapter 12 Navigational equipment

PART C - OPERATIONAL

- Chapter 13 Operational arrangements
- ·Chapter 14 Crewing
- •Chapter 15 Emergency equipment

PART D - ENVIRONMENTAL PROTECTION AND DAMAGE CONTROL

 Chapter 16 - Environmental protection and damage control



Guidelines for ships operating in Polar waters

- Recent developments
- Updated in 2009 to include Antarctic waters
- In place by Assembly Resolution A.1024 (26)
 - · Further recognizes the remoteness of Polar waters and limited infrastructure
 - Takes into account risk-based approach to marine safety and pollution prevention
 - · Retains all essential features:
 - qualified crew
 - preparedness
 - lifesaving equipment
 - damage stability by ice
 - voyage planning



Ice Class - Links IMO and IACS requirements

Polar Class	Ice Description (based on WMO sea ice nomenclature)
PC 1	Year round operation in all Arctic ice-covered waters
PC 2	Year round operation in moderate multi-year ice conditions
PC 3	Year round operation in second-year ice which may include multi-year ice conclusions
PC 4	Year round operation in thick first-year ice which may include old ice inclusions
PC 5	Year round operation in medium first-year ice which may include old ice inclusions
PC 6	Summer / autumn operation in medium first-year ice which may include old ice inclusions
PC 7	Summer / autumn operation in thin first-year ice which may include old ice inclusions



Developments towards mandatory Polar Code

- IMO Guidelines in place by 2002
- Antarctic Treaty members decision to request southern Polar waters be included in scope of IMO Guidelines
- Instant images to the world of "MS Explorer" accident and subsequent sinking
- Updated Guidelines by Assembly Resolution A.1024 (26) in 2009
- Agreement at Maritime Safety Committee to develop a mandatory Polar Code in 2009
- · Lead by IMO Design & Equipment Sub-committee



IACS Unified Requirements for Polar Class Ships

- Common set of construction requirements
 - · Joint effort from class, academia, industry and researchers
 - Hull design requirements are state-of-the-art scenario and mechanics based
 - Design based on plastic structural behaviour
 - Steel distributed differently
 - Machinery requirements have similar approach to new Baltic Rules
 - No power requirements



Proposed Principles for a Mandatory Polar Code

- Take holistic and integrated approach addressing platform, personnel and operations taking realities of remote, hostile environment and limited infrastructure/SAR into account
- · Consider use of Goal-Based Standards where appropriate
- Use existing Guidelines, with additions from original draft Polar Code and add control of shipping, as starting point
- Apply Polar Code to Convention vessels
 - Expansion to fishing vessels, barges, and pleasure craft also being proposed
- Implement through amendment to SOLAS, and, as appropriate, other IMO instruments
- Enforce compliance via Port-State Control / Flag-State monitoring



IACS Unified Requirements

UR I.1 - Polar Class Descriptions and Application

UR I.2 - Structural Requirements

UR I.3 - Machinery Requirements

- Adopted by IACS Council in 2006; part of all member society Rules since 2008
- Under continuing development to extend scope and address issues of interpretation and application



12

Ice Class Implications

- · Structural weight increases rapidly with
- Strength buys the potential for extending safe operations
- Operators, designers need a full understanding of operational requirements before selecting base ice class, and any supplementary features
- · Builders, Class and regulators have a set of common rules

		Nominal
PC 1		
PC 2		
PC 3		
PC 4		
PC 5		
PC 6	\rightarrow	1A Super
PC 7	\rightarrow	1A



Common Features - Operation

- Crewing
- Training
- Ice Information
- •Manuals & Procedures
- •Independent navigation / Escort







Baltic Rules / Polar Code

- Baltic Rules
 - Ice-classes reflect first-year ice conditions (Baltic / St. Lawrence)
 - Power and ice-class are inter-related (systems approach)
 - · Elastic principles for structure
 - Infrastructure, including SAR, is sufficient and close by
- Polar Code
 - Ice-classes selected for expected operation, ranging from (possibly) no ice, to year-round management of multi-year ice
 - No prescribed power requirement assumes owner will establish power requirement sufficient for safe operation
 - Plastic principles for structure
 - · Limited infrastructure in place
 - Remote operations



Crewing and Training

- · Operating in ice requires specialized expertise, built on experience and
- Ice navigation training simulators are a work in progress
- · Significant onboard and local or regional experience required
- Availability of trained ice navigation personnel will be an increasing problem
- Standardized certification must be a priority for IMO and national administrations





Establishing Crewing Requirements for Polar waters

- Inter-relationship between STW Code and Polar Code
- STW establishes competences and training requirements
- Polar Code sets out requirements
 - how many, when, where, previous experience





17

Polar Operating Limitations

- Ice Passports and Ice Regimes
 - Russian practice is a good model, though assumptions and theory are mostly unknown
 - Canadian Ice Regime system is popular with its users
 - Polar class design methods lend themselves to estimation of safe speeds for prevailing conditions
- Some suppliers (e.g. podded propulsor manufacturers) specify limits for the operation of their equipment
- Safety and other equipment specified by temperature limits
- Enforcement by knowledgeable operators supplemented by Flag State / Port State Control



19

Recent Developments Regarding Crew Training

• Amendments to STW Code proposed at IMO in January 2010 include:

	Deck	Engine
Sufficient and appropriate experience in operating ships in Polar waters	√	
Ice characteristics	√	
Vessel performance in ice and cold climate	√	√
Voyage and passage planning in ice (based on IMO Guidelines for voyage planning for passenger ships operating in remote areas)	V	
Operating and handling a ship in ice - navigation and safe speed, communications with icebreakers, finding shelter - propulsion systems and rudders, heeling and trim systems, engine loads, cooling	√ √	V
Knowledge of local requirements	√	
Equipment limitations - compass error, radar and ice clutter, communications	√	
Safety precautions and emergency procedures - dealing with SAR limitations, recognizing effects of cold, towing procedures establishing safe working practices, common hull and equipment damage, firefighting	√ √	V
Environmental considerations - restrictions, e.g. PSSAs, oil-spill equipment limitations	√	√

Other Common Operational Features

Examples can include:

- Operation of cooling water systems to prevent ice ingestion
- Operation of ballasting systems/tanks to reduce risk of freeze-up
- Operation of machinery space HVAC to maintain reasonable temperatures and prevent damage to engine systems
- · Procedures for berthing, mooring and anchoring

Winterization guidelines need to be incorporated in operator guidance as well as design development.



20

Advantages of the Polar Code approach

- Joint on-going development effort
- Future rule development based on common framework for research and analysis of in-service results
- · Construction standards closely linked to Classification Rules
- · Transparent, shared standards
 - Benefits will increase as designers, builders, operators become more familiar with the concepts
- Preparedness for remote operation



21

Importance of holistic approach • Design considerations can be tailor-made or negated by how you operate • All aspects must be considered Design - Fram Operation - MS Explorer Operation - MS Explorer

Rescue Services for Polar waters

If ship abandonment is needed:

- LSA nominal capacities do not account for bulky cold weather clothing or survival suits
- Liferafts have very low survivability in pack ice conditions, and other severe limitations
- Standard lifeboats have limited ice capability and little inherent winterization
- Offshore industry has been proactive in seeking better solutions; shipping (largely) has not

Rescue is likely to take a long time.



Impact of mandatory requirements for Baltic owners

- No direct impact if operations are only in Baltic or similar conditions
- If operating outside Baltic, more consistent application of equivalencies between IACS and Baltic ice classes
- · Choice of ice class for specific operations
- Direct impact from construction requirements
 - Plastic-based structural design balances steel requirements
 - Designers and builders will become more proficient due to common rules



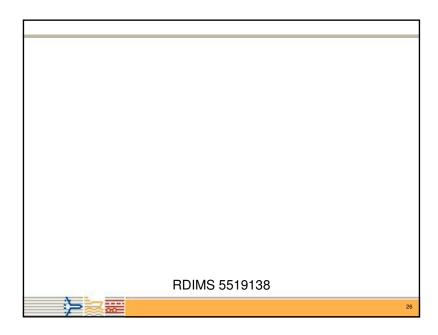
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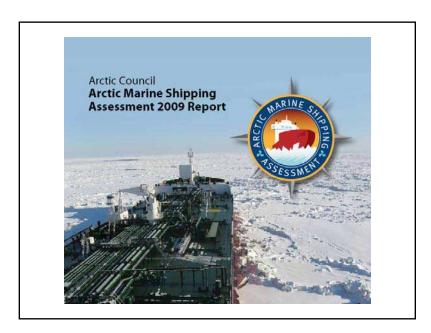
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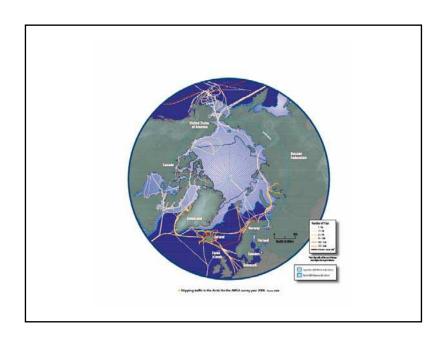
- Introduction of a comprehensive mandatory Polar Code will enhance safety and environmental protection for remote operations in routine and extreme conditions
- Polar Code provides flexibility for owner in selection of ice-class and power
- Common construction requirements can be improved, but with one set of rules, all benefit
- Mandatory requirements will have no direct impact on <u>exclusive</u> Baltic and similar operations

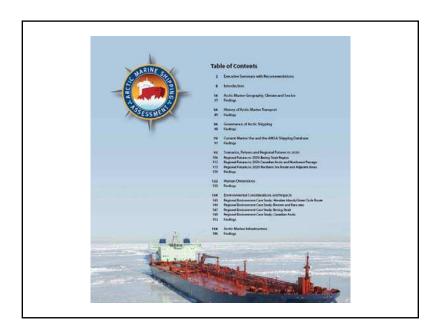












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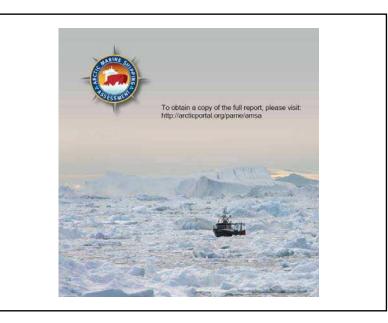
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Scientific Analysis of the Hybrid System for Type B Vessels

Garry Timco, Ivana Kubat and Anne Collins

Canadian Hydraulics Centre National Research Council of Canada Ottawa, Ontario, Canada

Hybrid System Consultation Meeting Delta Hotel, Montreal, March 10, 2010



1---Zone - Date System (ZDS)

- In 1972, the Canadian Government drafted the Arctic Shipping Pollution Prevention Regulations (ASPPR)
- North of 60° latitude
- These regulations include the 16 Shipping Safety Control Zones, and the Date Table (Zone-Date System ZDS)
- The ZDS is based on the premise that nature consistently follows a regular pattern year after year. It is a rigid system with little room for exceptions.

Transport Canada Regulatory Shipping Systems

- Zone-Date System (ZDS)
- Arctic Ice Regime Shipping System (AIRSS)

NRC-CHC Research

The NRC Canadian Hydraulics Centre has examined the Zone-Date System

They found that although it is a reasonable representation, there are many year-to-year variations that this system does not take into account

Some years these variations penalize Operators and in other years, the Regulator is allowing shipping in unsafe ice conditions

2---Ice Regime System (AIRSS)

- In 1996, Transport Canada introduced the Arctic Ice Regime Shipping System AIRSS
- An "Ice Regime" is a region of generally consistent ice conditions
- AIRSS represents the actual ice conditions in vicinity of a vessel
- It is a regulatory Standard that can be used, with certain conditions, outside the ZDS

NRC-CHC Research

The NRC Canadian Hydraulics Centre has examined the Ice Regime System

They found that it could be a very useful approach for evaluating potential damage to vessels in the Arctic.

They proposed a number of important modifications to improve the existing system (the Modified Ice Regime System)

AIRSS

- AIRSS is based on calculation that produces "Ice Numeral" (IN) that combines the Ice Regime and vessel's ability to navigate safely in that region
- IN is calculated for each Ice Regime from:

$$IN = [C_a \times IM_a] + [C_b \times IM_b] + \dots$$

IN = Ice Numeral

C_n = Concentration in tenths of ice type "a"

IM_a = Ice Multiplier for ice type "a"

IN >= 0vessel allowed to proceed

IN < 0.....vessel NOT allowed to proceed

International Initiatives

- New IMO Guidelines for polar class ships have been developed
- The IACS Unified Requirements for polar class ships have been developed, and came into effect in March 2008. They will be the preferred standard for new vessel construction.
- They are not part of the existing Transport Canada regulations

 \Rightarrow time for revisions

Four Potential Approaches suggested by the NRC-CHC for Regulations

- 1. Modified Ice Regime System
- 2. Regimes Ice Chart System
- 3. Hybrid System
- 4. Arctic Certificate System

The Hybrid System was chosen as the best way forward at a Stakeholders Consultation Meeting in Montreal in 2008.

Hybrid System

- Integrates both ZDS and IRS into a single system;
- ZDS Existing **Dates** evaluated and **updated**;

Zones re-evaluated:

- IRS uses the CHC Modified Approach
- Based on the IACS Polar Classes (PC) vessels and Type A and Type B vessels only.

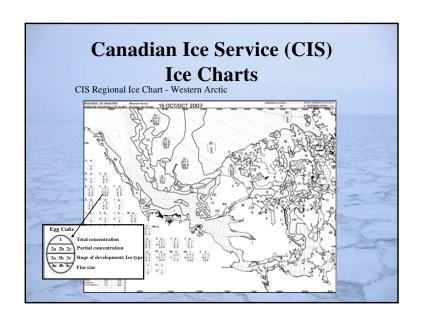
The NRC-CHC developed a <u>proposed</u> Hybrid System and applied it to a Type B vessel

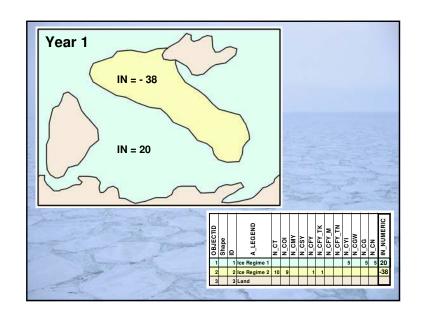
The next several slides will illustrate how this is being done

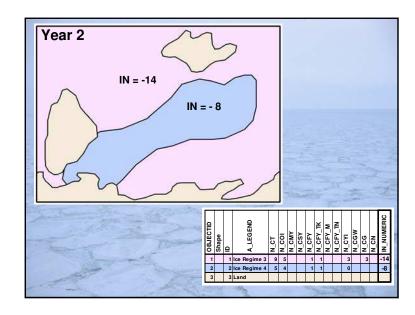
CHC Marching Orders

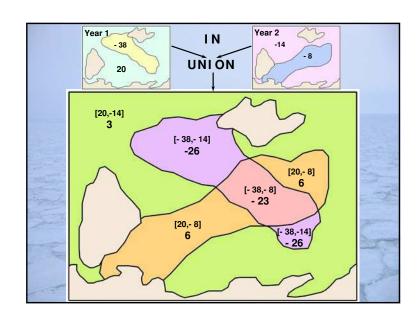
In developing the Hybrid System, the CHC was asked to keep the following in mind:

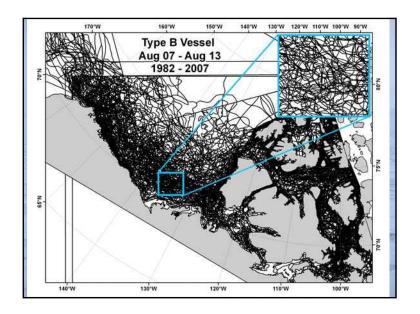
- Operators like the predictability and scheduling features given by a zone-date type system
- Prudent and experienced operators use the ice regime system all of the time
- Can't develop a system that would give an unfair advantage to Canadian operators
- Keep it simple (even if it sacrifices some accuracy)

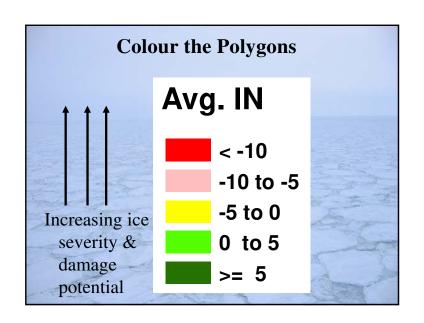


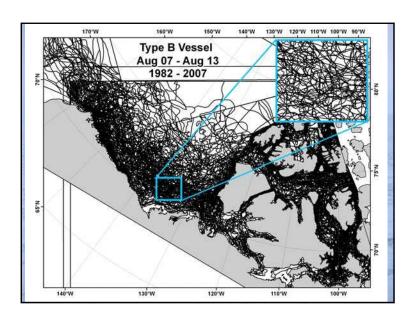


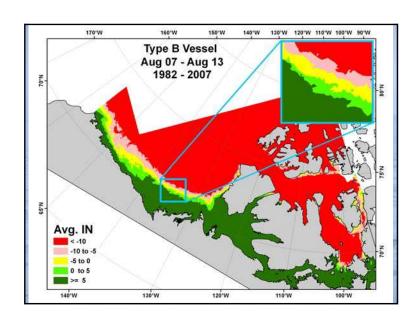








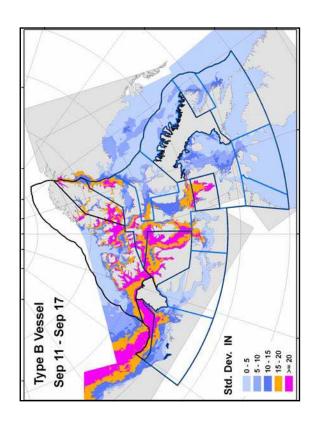


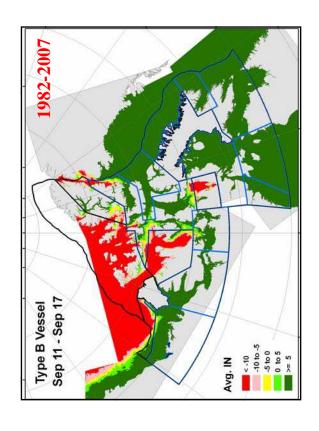


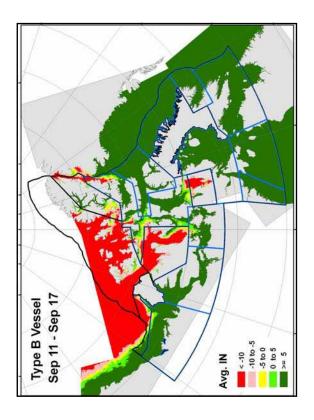
Analysis: The Hybrid System

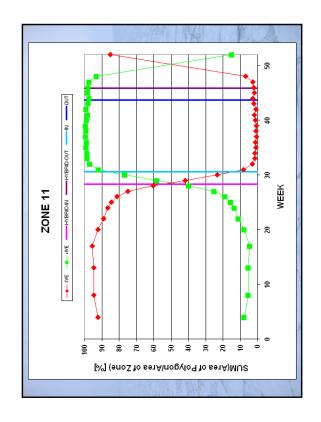
- The NRC-CHC has evaluated the ice conditions using this approach for all regions of the Arctic for the last 25 years
- They have compiled this information to look at damage potential (IN Numbers) and variability from year-to-year
- They have used this information to develop the basis for the Hybrid System

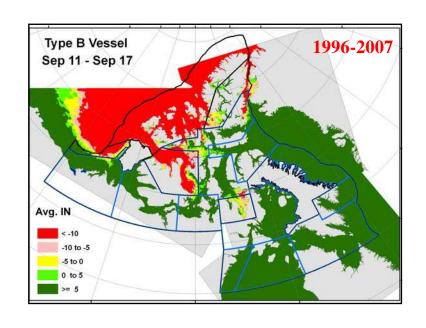
The next few slides illustrate the input data:









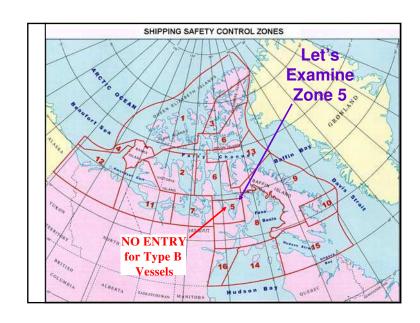


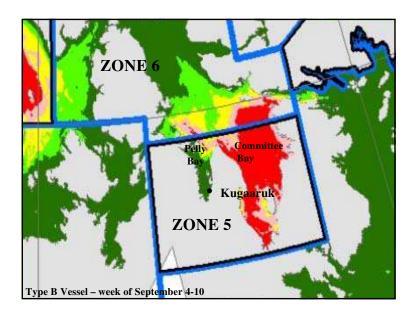
Illustrative Examples

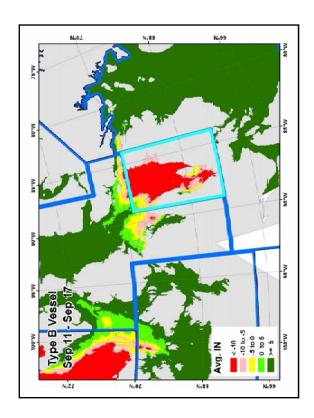
The following few slides will illustrate the rational behind some proposed changes to the existing regulatory system:

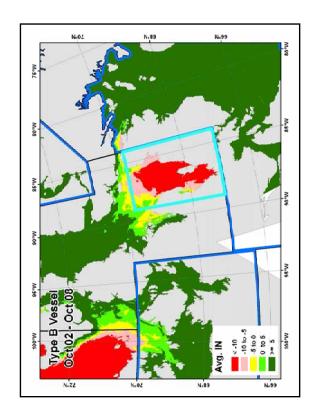
- 1. Changes in Zone boundaries
- 2. Changes to Entry/Exit dates

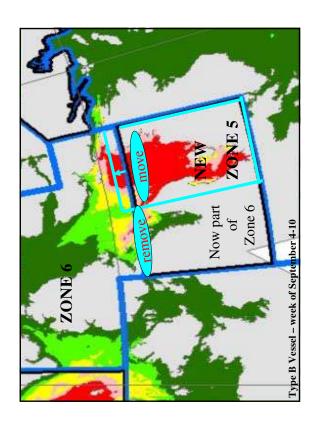
These examples illustrate the Hybrid approach

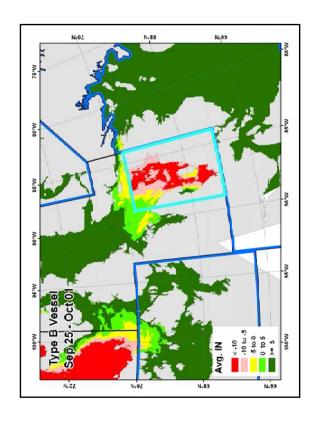


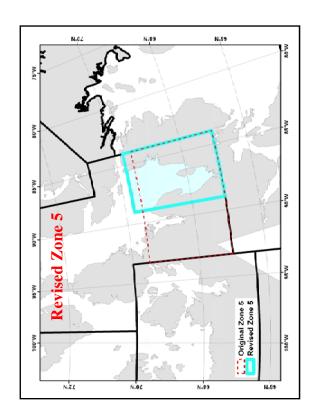


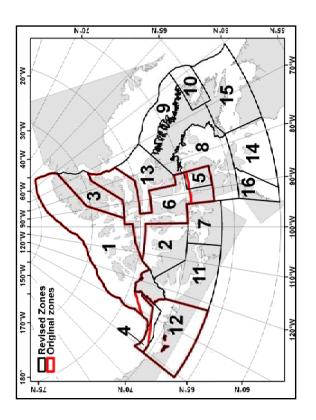


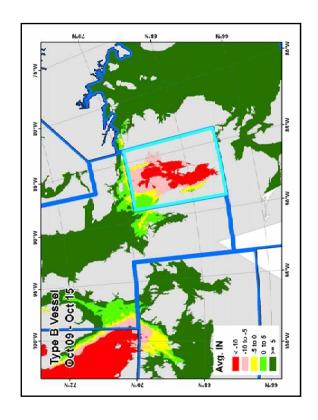


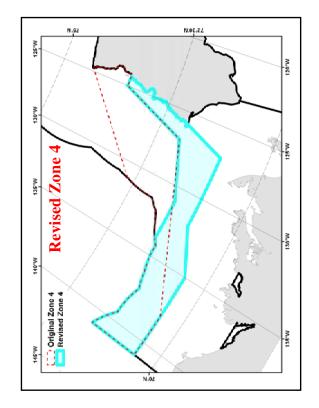




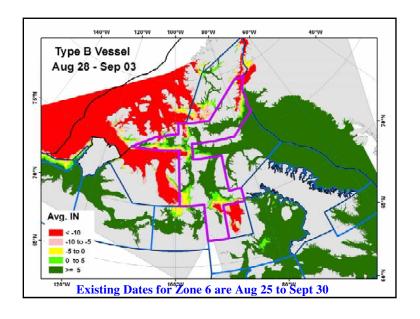


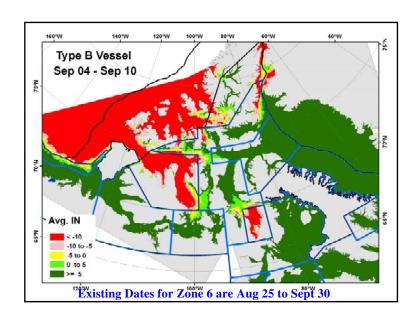


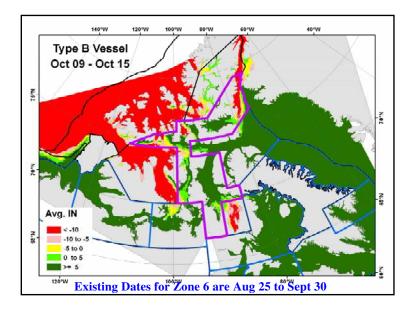


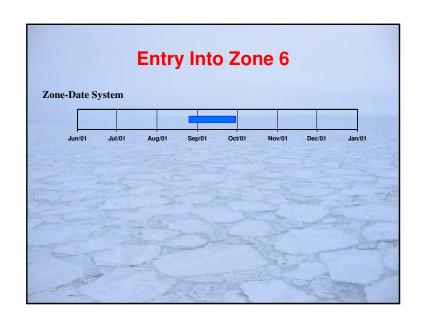


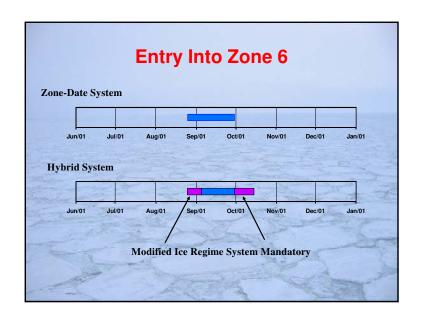
Changes to Entry/Exit Dates The Hybrid System will have a similar format to the existing Zone-Date System There will be Entry/Exit dates for each Zone. However, the Dates will be categorized as: >Modified Ice Regime System Mandatory, or >Open Zone. Let's look at the (revised) Zone 6

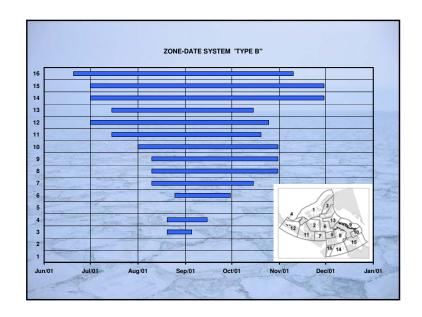


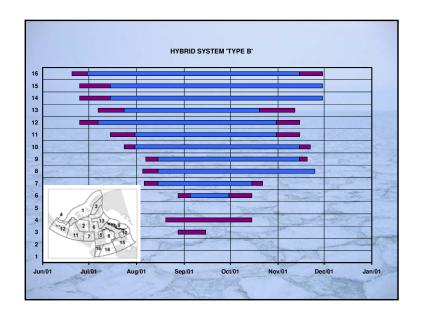












Modified Ice Regime System

- The Modified Ice Regime System is the similar in structure to the existing System except:
 - Only two ice types first-year ice and Old ice
 - First-year ice is based on the ice thickness, not the WMO definitions
 - Summer bonus for vessels that meet the requirements (experience, ice information systems, and summer ice conditions)
 - No decay bonus for Old Ice
 - Requirements for Ice Navigator to be determined
 - Reporting of Ice Numerals to NORDREG would <u>not</u> be mandatory (but records must be maintained)

Current Status

- The NRC-CHC has developed a draft "strawman" Hybrid System for Type B vessels
- CHC-TR-063 Technical Report
- They consulted with many of the Stakeholders throughout the year for input/feedback/criticisms/suggestions, etc.
- Consultation meeting March 10, 2010 in Montreal

Ivana will give an overview of the issues discussed with the Stakeholders



Hybrid System - Questions

I. Kubat NRC - Canadian Hydraulics Centre Ottawa, Canada

March 10, 2010

Hybrid System Consultation Meeting

Montreal

Companies/people consulted

- Fednav/Enfotec Tim Keane, Bob Gorman, Tom Paterson
- PetroNav Chris King, Catherine Huneault, Mario Bonenfat
- Desgagnes Transarctic Waguih Rayes
- NEAS Georges Tousignant
- Chevron Capt. Keith Jones, Capt. Don Connely, Alexander Brovkin, Robin Browne
- Lloyd's Register Robert Hindley
- CCG Capt. John Vanthiel, Capt. Perry Stares, Capt. Mark Taylor, Capt. David Fowler, Denise Veber, Fiona Robertson, Barb 'Connell
- CIS Doug Bancroft, Darlene Langlois, Francois Choquet, Leah Braithwaite, Roger DeAbreau

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Approach

- · Over 130 reports distributed
- · Questions on Hybrid System sent
- Meetings with stakeholders scheduled (in person, over the phone, correspondence by mail)

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Companies/people consulted

- Stena Rederi AB Goran Liljestrom
- · Mariport Christopher Wright
- · Inuvialuit Joint Secretariat Norm Snow
- · Maersk Line Limited Stephen Carmel
- · NEB Bharat Dixit
- ImperialOil Jim Hawkins
- Woodward Group of Companies Fred Constantine, Capt. Ed Anthony

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Questions

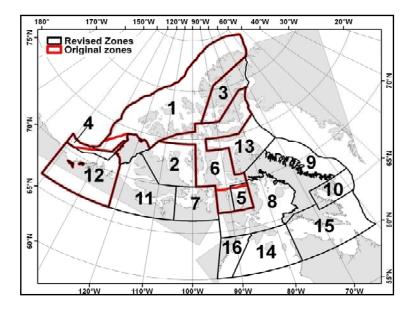
General

- 1. What is your general impression of the Hybrid System?
- 2. Do you see any problems with its implementation?
- 3. Is anything missing?

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Questions

Specific

- 1. Based on your experience, what are your thoughts on the CHC proposed dates for a Type B vessel for each of the 16 zones?
- 2. What are your thoughts on the proposed changes to Zone 5?
- 3. What are you thoughts on the proposed changes to Zone 4?

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Questions

Specific

- 4. Do you think that Zone 1 should extend down into Kennedy Channel and Kane Basin?
- 5. Do you think that part of the now Zone 6 (Smith Sound) should be included in Zone 3 (or Zone 1 if it extends down)?
- 6. Are there other areas that should be changed which are not outlined in the CHC report?

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Questions

Specific

- 7. How do you think that the Hybrid System should deal with a specific geographic region of a Zone that has highly variable ice conditions from year-to-year? (e.g. Peel Sound and Franklin Strait in Zone 6) when the rest of the Zone is an Open Zone?
 - Keep as Open Zone but emphasize due care and diligence of the Captain
 - Ice Regime System Mandatory (IRSM) at all times?
 - Each year, Transport Canada specifies if the IRMS is required based on an evaluation of the Canadian Ice Service information.

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Questions

Specific

- 9. What are your thoughts on the need and qualifications of an Ice Navigator?
- 10. What level of reporting to Transport Canada and the Canadian Coast Guard do you feel should be required during the Modified Ice Regime System Mandatory dates?
- 11. What are your thoughts on Type B being the lowest vessel class in the system?

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Questions

Specific

- 8. The present system has been developed solely by looking at the ice conditions. However other factors may be important in specific geographic regions. What are specific examples of regions where the ice conditions are not the sole factor that should be considered in this system?
 - High currents
 - Limited maneuverability due to pingos, islands, etc.
 - High probability of fog (include dates)
 - Limited hydrographic information (i.e. shipping is confined to a specific route)
 - Regions of grounded ice
 - Other?

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Questions

Specific

- 12. What scientific research should be done to help to continually improve it?
- 13. Are you willing to supply data to the CHC for this?
- 14. What training or education is required for your organization to better understand the Hybrid System and implement it?
- 15. Final Comments?

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Transports Canada



Comments to Questions on the Hybrid System

G.W. Timco NRC - Canadian Hydraulics Centre Ottawa, Canada

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General Impression

- provides a quantifiable system to allow improvements and innovations in rule making
- If a higher level of regulatory oversight is desired then the proposed Hybrid System leaves too much to individual interpretation.
- I question the safety and risk that will result if the proposed Hybrid System places too much onus on the Master of a vessel to decide whether or not a vessel should proceed into a particular area.
- It appears the system addresses risk from the perspective of the ship – risk that ice could damage a vessel. I would have thought a system that addresses risk from the perspective of the environment would be more appropriate
- The system as proposed does not differentiate between types or size of ship for example – a large oil tanker presents a larger hazard than a small survey ship for example.

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General Impression

- Generally the proposed system is taking the right direction
- The approach needs to be expanded beyond type B ships before it can be evaluated fully
- Analysis of the Zones and average ice conditions/numerals for the various classes of ships makes sense, and to me is logical. It would provide a more realistic Zone/Date system.
- No sure why we don't just use the MIRS all the time for every region
 of the Arctic
- If the diligent Ice Navigator does his calcs, then his routing should be safe, the ultimate goal
- Concept appears to be workable from both an operations and regulatory perspective
- · Good it gives flexibility to an otherwise largely in flexible system
- A real benefit is that it recognizes the variability in ice conditions

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General Impression

- As it looks the suggested system is simple. The Z-D system was seen as very simple; IRS little bit complicated (at the beginning), but not now
- It is not only "significant research" that has shown that the ASPPR and AIRSS need to be modified but also the continual feedback from commercial and CCG vessel operators to TC, Nordreg, CHC, etc.
- It is the conditions as seen by the Master, together with careful judgment and voyage planning, that then best determines the success and safety of an intended (or aborted) ice transit.
- We agree with the proposal and look forward to continued involvement with TC/CHC and Stakeholders as the process progresses.
- we have to ensure that any changes can also be practically and reasonably accommodated within offshore exploration and production activity as this has features and requirements different from regular shipping activity.

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General Impression

- · System they can apply, understand, account for actual factors
- This is how the "hands-on, practical experience" of ship operators (ship owners, masters and ice navigators) gets taken into account in the process of change.
- IRS should be taken as a tool (which it is) rather than regulation. It is helping younger captains and will especially to new ones coming
- This is basically how we operate, it is a good system

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END

Problems?

- What about anniversary date for First-year ice to become multi-year ice (i.e. October 1 = FY → SY)
- For past 3 years ships were sitting at ice edge waiting for CCG for at least 3 days. What is needed is 1) more infrastructure 2) more navigation 3) support from CCG
- Problem is human resource for sea staffing is a problem world wide; operating in ice is unique to Canada; Recruiting = problems in two areas 1) in engineering (chief engineer – got them from Russia)
 2) on the deck
- if North gets busy scheduling will be more difficult for everyone because of capacity
- problem with extending season is support to vessels by CCG; would have to be to vessels that will not be requesting CCG support
- what if climatology changes totally in next 14 years, when is this
 going to be updated
- Not with a proper training

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END

Problems?

- There should be a feedback system for capturing any problems from vessels using the system so that the dates and zones can be refined on a more regular basis, especially accounting for the use of higher ice class ships where there is less operational experience.
- No, but new players will have to educate themselves about this system
- Master of a commercial vessel is commercially driven to deliver the cargo and make a profit for the owner so caution must be used to give them more latitude to operate
- A change in the regulations that places this final decision-making on the Master of the vessel will result in less safety, not more
- Sometimes ice information from the CIS Ice Charts are of poor quality (due to moving ice) and routing decisions based on these could cause problems
- Ice conditions quickly change in the Arctic which means any system based on data going back 25 years would strike me as going to be wrong

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Is anything missing?

- · Basis for assignment of ice multipliers needs to be made clear.
- System for feedback by users of the system should be mandated and integrated into the AIRSS reporting system.
- Is it possible to have varying dates each year depending upon the Ice Chart information? This would be useful for planning.
- The Inuvialuit Game Council is concerned about the freezing-in of barges that are loaded with fuel and allowing them to over-winter in this state.
- Are smaller vessels and seismic vessels including in these regulations?
- What happens outside of the Hybrid System? Will vessels still be allowed to operate?

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Is anything missing?

- Should this be based on the latest 20 years? Perhaps not since we are seeing more variability from year-to-year
- · Need to build-in an update look every 5 years
- Is there some expectation that these rules would be adopted by IMO?
- how would this system be applied in the Northwest Passage with the sovereignty issue still undecided?
- · In general enforcement is not addressed
- If you were going to address allowable fuel or the carriage of hazardous material this would have been a good place to do it.
- · Decay is not taken into account
- How will the system take into account experience of Captains and navigation equipment all year round, not only in summer => for certain zones it should be mandatory

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Proposed Dates?

- · Dates look okay there is nothing that appears too restrictive
- The proposed modifications to some Zone boundaries also appear justified.
- we note the suggested changes in dates with the Hybrid System and we are particularly pleased to see that the approach with regard to use of a modified AIRSS is considered "mandatory".
- Usually the vessels don't have problems to access North of 60°N on the first day allowed by ZDS (from East Coast)
- Proposed changes to dates depends on quality of escort we can expect
- We note that the charts, in Appendix B, show Jones Sound as "reasonable" by August 7 versus the existing ZDS of August 25 and I can certainly agree with this for the more highly manoeuvrable (smaller) vessels.
- I also reviewed the ice severity charts in Appendix B with particular emphasis on the areas (Zones) that I have operated vessels. For Type B vessels the charts seem well represented

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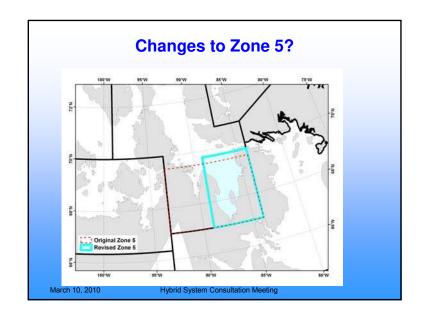
Is anything missing?

- for the offshore industry in the North American Arctic, I hope that we
 do not forget that we do not have the experience we once had and
 until we replace that experience we need to ensure that any updated
 regulations address this
- we would be interested to see how the ice severity charts come out using only ice conditions for the last ten years and the last six years.
- we think a "bonus" should be developed for use of the ice experienced master/ice navigator for ships that are "highly manoeuvrable".
- Changes to Ungava Bay and Hudson Bay should they be included?

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END



Changes to Zone 5?

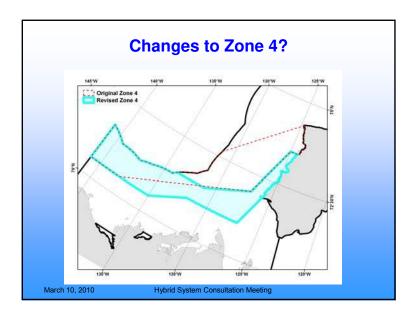
- I do not agree with this proposal because of the navigational dangers in this area.
- Conditions vary throughout the season depending on the wind and tidal currents.
- · If a vessel became beset, it could easily be carried aground.
- The need to redraw the zone date boundaries is fully agreed with.
- Pelly Bay is a good change (that will allow to ship to communities there), however, Committee Bay never clears out;
- Zone 5 (Pelly Bay) should be changed; there is no way that the long LNG or cargo vessel could proceed through it
- Problem Pelly Bay -> choke point entrance is between rocks
- Zone 6 is too large if Zone 5 (Pelly Bay) opens => more commercial traffic => escort (end of August) will become a problem
- Positive: ZD for planning purposes; Zone 5 will open for commercial operation; Negative: escort especially in zone 6 with increased traffic
- Not feasible, yes will be more traffic but for planning transit Do I take a chance to be stuck in ice for 3 weeks? Not a chance!!

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END

END



Changes to Zone 4?

- · We don't ship there so this is not a concern for us
- The need to redraw the zone date boundaries is fully agreed with.
- The examples given in the report (Zone 4 and 5) have not surprised us

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Extending Zones 1 or 3?

Sept 11 to Sept 17

Alert

Sept 11 to Sept 17

Alert

Nares Str

Zone 3

Smith Sound

Aug 25 to Sept 30

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Extending Zones 1 or 3?

- · No comment about this our company doesn't ship there
- We have some problems with Zone 6, and its current geographic spread needs careful review, as well as access dates
- Zone 3 is political zone put together because of Eureka supply (i.e. to get there through the Norwegian Bay)
- Des Groseilliers sea lift to Eureka always goes there with icebreaking support; it has to be guarantied that the sea lift will get in → if IRS is mandatory in this region there might be a problem = objection from CCG because of planning
- Boundary between Zone 6 Zone 3 => almost as if Zone 1 should be mapped there, but who goes there, only CCG
- Zone 3 most likely put there to go to Eureka
- · Nares Strait should be Zone 1
- We don't have the kind of vessels to go there

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END

Other Regions?

- Zone 7 in general needs better charting because sometimes for routing the new route is where sounding is and that is not good
- Zone 9, 14, 15, 16 easy to navigate and find favourable ice numeral
- Zone 11 by the time they get there from East is open, but it is a short window
- Zone 10 OK this is zone where IRS has to be used most often because of their requirements need to go there before July (3rd week of July)
- Any delays in Zones 14 & 15 will become a problem -> this is potential for difficulties for anyone
- Zone 15 is critical; zone 14 less but still in both Zones 14 and 15 is important to look at them from end; In addition Ungava Bay does not seem to fall into any Zone = Extend Zone 14 to Ungava Bay

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END

Other Regions?

- Yes, see particularly GN analyses relative to Frobisher Bay (Zone 15) and Roes Welcome Sound (Zone 8)
- Ungava Bay should be included in these regulations
- Disagreement also in Western part of Zone 6 going to the Melville
 Island
- Repulse Bay a problem towards the end of shipping season. Last 2 years in summer Furry & Hecla Strait with no problem, which saves about 5 days to go through there – that was last week in September, but Regulations might not allow it. However, this is only applicable if there is no ice, if there is ice you do not try to go there.
- · Ice conditions off Resolute harsh in fall
- Lancaster Sound looks like wide open area but there is only narrow navigable route to go; always take into account 1)narrow water ways 2)bathymetry 3)pressure 4)wind and 5) currents

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Yearly Variable Regions?

- IRSM at all times with further consideration for future updates as data is reviewed and operational experience gathered.
- Limit the open zone to the highest probability of safe access and use MIRS outside of these dates to earliest opening, latest closing
- · Our company uses the MIRS always
- Ice Regime calculations should override the normal Zone/Date requirements
- For our part we have always used AIRSS (since its introduction) irrespective of whether the ship was entering a zone well within the zone date parameters.
- In regions like Zone 6 make IRS mandatory all the times, this is what they do even in the ZDS (looking for open water); also use ice pilot
- Cad vessels due diligence but what about international flag vessels
 do 6 as 6a/6b this is where a lot of transit will be

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END

Other Factors?

- · High Currents
- · Limited Manoeuvrability (hydrographic considerations)
- · high probability of fog
- · regions of grounded ice
- Increasing the additional factors may be a valuable data collection exercise for operators, but its inclusion in the hybrid system may reduce the simplicity of the system.
- Wind and storm conditions can have a major impact. Frobisher Bay early season access, and the early season lead off the Kivalliq shore are examples
- Ice conditions that may be acceptable in the open sea could pose a severe hazard in a narrow channel
- If adverse wind conditions are encountered when close to shore, severe ice pressure can develop rapidly causing highly dangerous situations
- Some areas may be deemed a high risk only if multiyear ice is present while some areas may be risky in any ice

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Ice Navigator

- It is understood that Transport Canada has already prepared guidelines on qualifications for an ice navigator. It is suggested that clarifications on the content of this form part of a separate consultation exercise
- The cost/benefit analysis for the Polar Code showed that Bridge Team experience and/or deployment of an ice navigator were the best approach to safe navigation in ice infested waters
- The report seems to be written with the idea that Ice Navigators will be Canadian, but this might not be the case with increased shipping in the Arctic
- How is it proposed to actually enforce Ice Navigator qualifications?
- Does the Canadian government contemplate requiring pilots licensed by the Canadian government that will act as the qualified ice navigator?
- If so there is a large logistical challenge in recruiting, training, qualifying, and deploying pilots.
- If not the qualified ice navigator this system relies on is really unenforceable which renders the whole thing not really of much use

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Other Factors?

- in areas of high current, tide, ice pressure and proximity to navigational dangers, the vessel operator may have to push their vessel to the maximum to avoid being set onto navigational dangers.
- More snow & blowing show hampering visibility late in the year
- · Shorter daylight hours later in the year
- Can vessel navigate around the floes or other ice hindrances
- We agree with the approach of only two ice categories, i.e. first year ice and old ice (for second or multi year ice).
- Is based on experience; these listed are called additional risks that exist everywhere, but how do you translate them – by restricting dates, by lowering IN, or how?
- Winds are awful in Kuujjurapik (Hudson Bay) late in fall mid November is very late not for ice reason but for great winds and waves

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END

Ice Navigator

- in my opinion, the existing "Ice Navigator" qualifications in the regulations are inadequate to address safe navigation on ships.
- The presence of an Ice Navigator is required for AIRSS.
- I can't imagine that any company would send a ship north without this expertise
- Transport Canada should define the requirements
- In the role of an (independent) ice navigator, AIRSS and the resultant ice numeral causes "no argument" between ice navigator and ice inexperienced masters/OOW or shore management.
- We trust that TC will continue to consult with Stakeholders regarding the experience and qualifications/certification of ice navigators.
- We feel that the present "qualification" in ASPPR is inadequate and particularly when the ice navigator is providing such service to a ship where the master and OOW have little or no polar ice experience.

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Ice Navigator

- Use ice advisors on-board; as for experience- how do you obtain it, it takes years; good job training on-board is necessary
- ISS does not know hydrography => they should not be issuing alternate routes, it should be CCG and TC to provide info on navigating; CIS would and has to only provide info on ice
- In ice for a long time in Gulf, but if not, at least 30 days in Arctic cannot be navigator
- Multiple issues cargo operations + ice issues => all in one person => What about training in ice? What is bigger threat, ice or cargo operations?

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Required Research

- Feedback system from the operators is key, with an agreed review date fixed now.
- Review of any ship incidents / damage events for zones and zone boundaries before final agreement.
- · Our company is willing to cooperate and support this effort.
- So far the focus has been on Type B vessels. Concept needs to be extended to encompass both higher and lower ice classes.
- · A definite commitment should be made to continually refine
- · Our company would supply information to the CHC for this
- · Both successes and failures of the system should be reported
- To get feedback from Captains; to analyze Nordreg reports; also to help to future training
- How would you treat the other class? Would it translate to different dates? Would it translate to the other type of vessel?

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Type B Lowest Class

- There also needs to be consideration for ships below Type B. As the ice in the Arctic becomes more seasonable there is increased likelihood that operators may take advantage of the summer season for open water transit
- Non ice classed vessels should still be able to access the Arctic within agreed dates, particularly in Zones 14,15 and 16. Limiting access to only Type B would shut Churchill out of the grain trade, and could materially impact summer season cruise ship access.
- · Churchill doesn't need a Type B vessel
- If only Type B and higher vessels will be included it might cause problems for shipping to Churchill. Not all supply ships are Type B or higher;
- What are the chances that for transit voyages Type B vessel be used? (transit rather no destination)
- Type C and lower: what about insurance for those, any restrictions

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Training Requirements

- None at this stage. As a classification society it would be beneficial
 to continue to participate in workshops to understand ship operator
 challenges and how the ice class rules are being integrated into a
 shipping control system.
- There is probably need for a follow on workshop for working through some of the scenarios for higher ice class ships using the ice chart data once it is developed.
- Updating the CHC AIRSS Ice Pictorial Guide would be very good
- Not necessary for government to be responsible for training
- Have available tools and classroom for 1-2 days, simulations, online tools, readily available tools, practical training -> also based on analyzing Nordreg reports (i.e. based on how they reported and analyzed so far)
- What is experience? It is hard to define, cannot make comparison

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Training Requirements

- Number 1 training is to recognize type of ice
- Number 2 training is the time to be there, but how long is hard to say

 as now (50 hrs seems very low; should be very basic task to do
 before going to Arctic)
- 1-2 day classroom, ideally onboard the vessel, companies more open to training, costs money but repairing ship costs more
- Reluctant to wrap it up to too many regulations, good as is now, not too many courses on top of what is now = not spending too much time in courses, but also have to work
- DVDs, manuals on how to accurately implement the system, what you are looking at, something as pictorial guide, something "for dummies"
- 1/2 to 1 day course
- In general if we keep in mind this is for safety of ship and training of captains, transposed to make better decision for ships then this is a right way to go

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IRSM Reporting

- · Is there analysis how many ships would be affected by this?
- NORDREG should be 2-way, but it really is one way communication; what is expected is feedback on IN calculations (if wrong) etc.
- Will have to work on Open zone for Type C & D. At this point no dates presented for Type C and lower.
- · Changing system in middle of vessel's life could be detrimental
- Sending report to NORDREG before the route is very important and have to be documented => better decision and judgement when the description is in writing; sees it as a good way to repeat since once you are putting something on paper you think about what you will do
- · After Action report not sure, most likely not
- Once people are trained they will be more confident to report (to send report to NORDREG (as people are not confident to send it to NORDREG if they are not sure if they calculated IN correctly)
- Insurance they look at regular logs in vessel so decisions made only on vessel should not be a problem

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IRSM Reporting

- Operators should comment, but collection and reporting of ice information should be considered
- · Further discussion is necessary amongst key stakeholders
- The decision to operate outside the limits of the Zone/Date would not be made by the Master of the vessel, but by a regulatory oversight body.
- there should be 1 report per day sent to NORDREG in case of using the IRS
- This access during MIRS dates would be at the responsibility of the master, and would not have to be cleared beforehand with NORDREG.
- Should the reports be sent to NORDREG? If needed probably yes, however, if anything could reduce bureaucracy that would be appreciated
- PPO office @ NORDREG does not have any operational experience

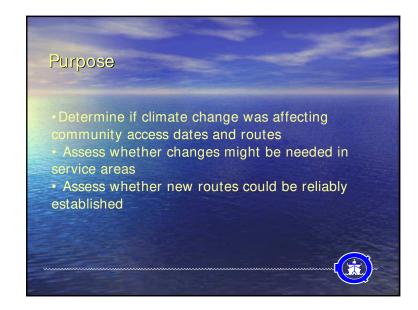
 who is responsible ? The ice info might not be available for that
 specific area especially if there is not icebreaker

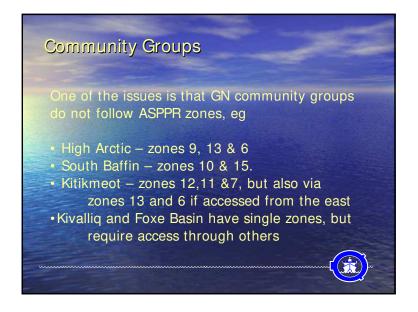
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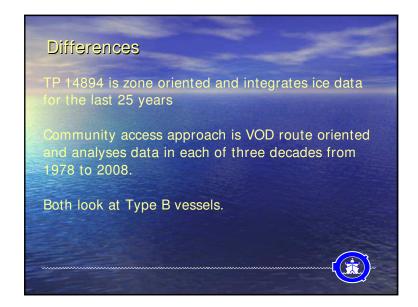






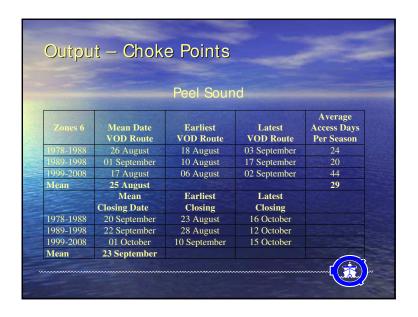


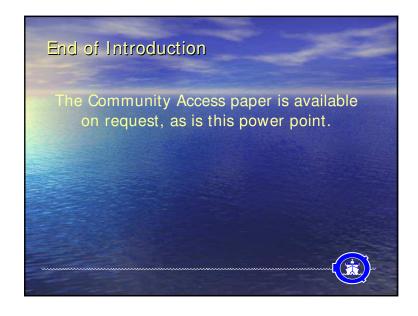








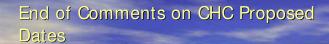










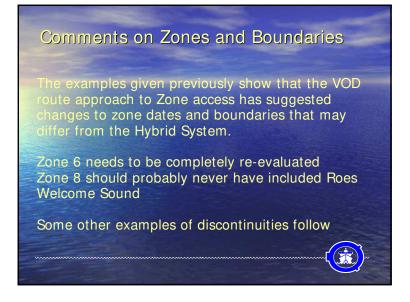


There are several more communities and zones where the VOD route and the proposed Zone dates differ.

The VOD approach does not always indicate a more relaxed approach to community access. In several cases we would argue that access dates should be tightened up.

Kugaaruk – Zone 5 Community Access Open Zone 46 days Baffin Entrance 16Jne-04JLy-21Oct-01Nov Lancaster Sound 12Jne-07Jly-06Oct-20Oct Prince Regent 31Jly-14Aug-29Sep-28Oct Kugaaruk 21Jly-21Aug-07Oct-28Oct Hybrid System. Open Zone 24 days Zone 13 07Jly-24Jly-20Oct-12Nov Zone 6 28Aug-06Sep-30Sep-15Oct



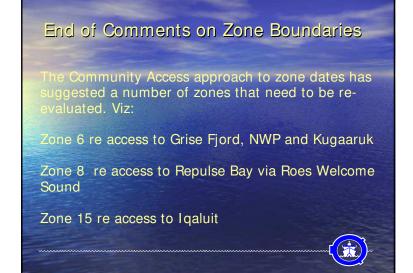






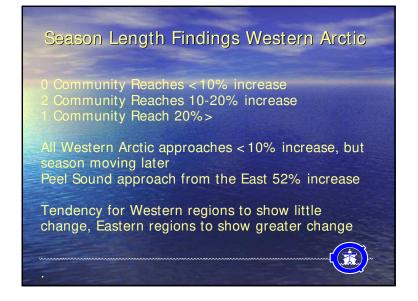


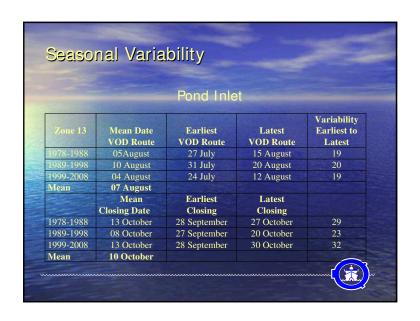




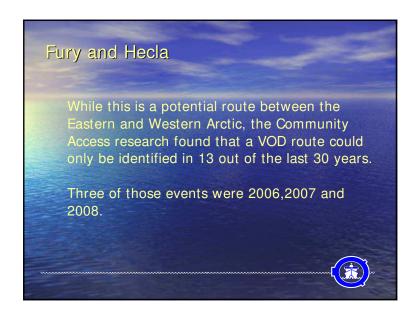


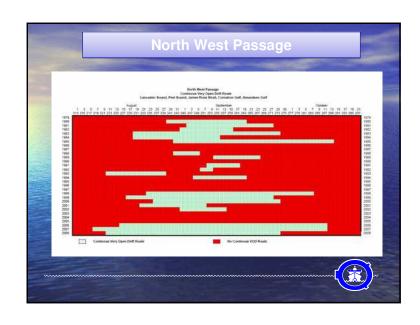


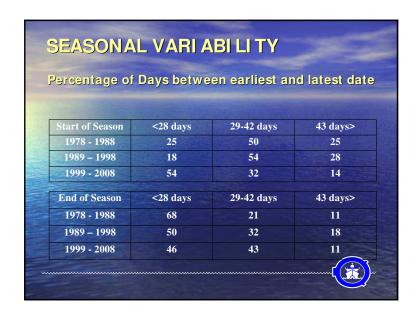






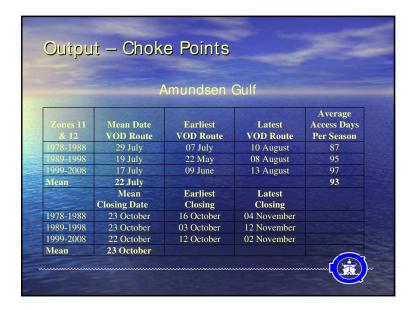






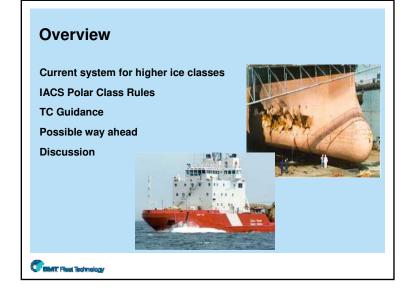












Current System

- AIRSS incorporates the Canadian Arctic Categories under the 1995 "Equivalent Standards" (CAC 1- CAC 4)
- AIRSS does not incorporate the Canadian Arctic Classes (AC1 ΔC10)
- Ships designed under other approaches to ice class are assessed on a case-by-case basis; responsibility for providing suitable data, calculations and justification rests with the Owner (e.g. USCGC Healy, MV Umiak)



AIRSS Multipliers

 Note that while CAC 1 and 2 are permitted 'unlimited operations', CAC 3 and 4 are not strictly permitted to operate in 10/10th multi-year ice

AES/WMO			Ice Multipliers for each Ship Category						
Ice Codes	Ice Types	Thickness	Type E	Type D	Type C	Тура В	Type A	CAC 4	CAC 3
7+ or 9+	Old / Multi-Year Ice		-44	-4	4	-	-4	-8:	-1
Đ-	Second-Year Ice		4	-4	-4	-4	-5	-2	1
6 or 4•	Thick First-Year Ice	> 120 cm	-3	-3	-3	-2	-1	1	2
	Medium First-Year Ice	70-120 cm	-2	-2	-2	-1	-1	2	2
7	Thin First-Year Ice	30-70 cm	-1	-1	-1	1	2	2	2
9	Thin First-Year Ice - 2nd Stage	50-70 cm					0.00		
8	Thin First-Year Ice - 1st Stage	30-50 cm	-4	-1	1.	-1	2	2	2
3 or 5	Grey-White Ice	15-30 cm	-1	1	1	1	2	2	2
4	Grey Ice 10-15:		- 3	2	2.	-2	2	2	2:
2 1 ∞∆	Nilas, Ice Rind New Ice Brash (on tragments < 2 m across) Bergy Water Open Water	< 10 cm < 10 cm	2	2	2	2	2	2	2

COMMIT Float Technology

IACS Polar Classes

Polar Cla	ss Ice Description (based on WMO Sea Ice Nomenclature)
PC 1	Year-round operation in all Polar waters
PC 2	Year-round operation in moderate multi-year ice conditions
PC 3	Year-round operation in second-year ice which may include multi-year ice inclusions.
PC 4	Year-round operation in thick first-year ice which may include old ice inclusions
PC 5	Year-round operation in medium first-year ice which may include old ice inclusions
PC 6	Sum m er/autumn operation in m edium first-yearice which m ay include old ice inclusions
PC 7	Summer/autumn operation in thin first-year ice which may include old ice inclusions



TC Guidance

Ship Safety Bulletin 04/2009:

- As an interim measure PC 6 and 7 vessels will be allowed to operate as Type A and B vessels under the ASPPR Zone/Date system and also under the Arctic Ice Regime Shipping System (AIRSS) (TP12259).
- The PC vessels are intended to be more suited to polar operations than are their Baltic equivalents, so this approach is conservative, and it may be revised for full implementation, giving access advantage to PC vessels



Class Factors for PC Designs

PC	Vs	Po	h_ice	sig_f	Cfdis
Class	m/s	Mpa	m	Mpa	kT
1	5.70	6.00	7.00	1.40	250.00
2	4.00	4.20	6.00	1.30	210.00
3	3.00	3.00	4.25	1.20	180.00
4	2.50	2.45	3.50	1.10	130.00
5	2.00	2.00	3.00	1.00	70.00
6	1.75	1.50	2.80	0.70	40.00
7	1.50	1.30	2.50	0.65	22.00

$$F_n = fa \cdot Po^{0.36} \cdot V_{ship}^{1.28} \cdot M_{ship}^{0.64}$$

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TC Guidance (cont)

- For other Polar Class vessels, the two highest classes (PC 1 and PC 2) will be permitted to operate throughout the Arctic at any time of year, provided they comply with other provisions of the Standard TP 12259 and with the damaged stability, subdivision, and pollutant segregation requirements ...
- Vessels constructed as PC 3, 4, and 5 will also be permitted to operate under the AIRSS (TP 12259) subject to compliance with damaged stability, subdivision, and pollutant segregation. In the interim, it will be necessary to assign ice multipliers on a case-by-case basis, subject to the general principle that a PC 3's multipliers and resulting ice numerals will be no more onerous than those for CAC 3, and those for PC 4 will be no more onerous than those for CAC 4. PC 5 vessels will be expected to have multipliers between those for CAC 4 and Type A.



Possible Way Ahead

- 1. The resulting system should resemble the existing system as closely as possible, to maintain familiarity to the users;
- The system should remain as simple as possible to interpret and to apply;
- 3. The system should reflect the scientific background to the Polar Rules; and
- The system should provide some advantage to the PC 6/7 classes over Type A/B (1AS/1A), as the polar classes have been developed explicitly for polar waters.



Additional Principles

Vessels with a Polar Class designation will be permitted:

- To access any area of the Arctic in which the Ice Regime numeral is positive, using speeds appropriate to the ice conditions (due caution of mariners);
- To transit locally negative ice regimes using speeds that do not exceed the following <u>limits</u>:

Polar Class	Permissible Speed
PC3	3.0 m/s (6 kts)
PC4	2.5 m/s (5 kts)
PC5	2.0 m/s (4 kts)
PC6	1.75 m/s (3.5 kts)
PC7	1.5 m/s (3 kts)



Suggested Revised Basic Ice Numerals

1	Ш	III	IV	٧	VI	VII	VIII	IX	х	ΧI
SHIP CATEGORY	ICE TYPE	OPEN WATER	GREY ICE	GREY WHITE ICE	THIN FIRST YEAR 1st STAGE	THIN FIRST YEAR 2nd STAGE	MEDIUM FIRST YEAR	THICK FIRST YEAR	SECOND YEAR	MULTI YEAR
	ICE TYPE SYMBOL	ow	G	GW	FY	FY	MFY	TFY	SY	MY
CAC 3/PC3		2	2	2	2	2	2	2	1	-1
PC 4		2	2	2	2	2	2	2	-4	-2
CAC 4		2	2	2	2	2	2	1	-2	3
PC 5		2	2	2	2	2	2	1	-2	-4
PC 6		2	2	2	2	2	1	0	-2	-4
Type A		2	2	2	2	2	1	-1	-3	-4
PC 7		2	2	2	2	2	0	-4	-3	-4
Type B		2	2	1	1	1	-1	-2	-4	-4
Type C		2	2	1	1	7	-2	-3	-4	-4
Type D		2	2	1	-1	-1	-2	-3	-4	-4
Type E		2	1	-1	-1	-1	-2	-3	-4	-4

SMIT Fleet Technology

Additional Principles (cont)

Vessels will also be required:

- To spend no more than 24 consecutive hours in negative ice regimes;
- To ensure that a qualified ice navigator is on watch at all times while navigating actively in a negative ice regime;
- To report status regularly



