WINMOS Activity 5 – Human element and training

Sub activity 5:1 – Desktop study on defining relevant skills and competences for ship officers

Ahti Hyppönen & Magnus Winberg

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Abstract

This report is for WINMOS Activity 5: Human element and training. This sub activity report 5:1 “Desktop study on defining relevant skills and competences for ship officers"is prepared by Aboa Mare.

The desktop study is in two parts. The first part studies the existing international regulations and conventions in order to ascertain the requirements for winter navigation. In addition, other relevant documents are studied and also some existing training programs. The second part consists of interviews with experienced merchant marine shipmasters and icebreaker officers, in order to complement and clarify the training needs for Baltic winter navigation.

By combining the requirements with the information from the interviews it was then possible to get a fairly clear picture of the main points to be addressed in a Baltic training program.

The results of the study were clear. Existing training programs were found to include the majority of the required information. In appendix 3 and 4 are the basic training courses and evaluating criteria for ship officers and ice breaker officers presented.

Table of Contents

Terminology, abbreviations and acronyms

Term/abbreviation	Explanation
Aboa Mare	Aboa Mare Academy and Training Center, see www.aboamare.fi
BRM	Bridge Resource Management: command bridge resource allocation according to requirements of STCW 2010. See also MRM.
COLREGS	COLlision REGUlationS
DNV	Det Norske Veritas
HELCOM	Helsinki Commission
IACS	International Association of Classification Societies
IMO	International Maritime Organization, 4 Albert Enbankment, London SE1 7SR, UK.
MARPOL	International Convention for the Prevention of Pollution from Ships (MARPOL)
ME	Main Engine
MRM	Maritime Resource Management: command bridge resource allocation according to requirements of STCW 2010. See also BRB.
MLC	Maritime Labour Convention
SOLAS	International Convention for the Safety of Life at Sea (SOLAS), 1974
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers.
UNCLOS	United Nations Convention on the Law OF the SEa
WINMOS	Winter Navigation Motorways Of the Sea

1 Introduction

In 2009, The European Council adopted the Strategy for the Baltic Sea Region. The EU Baltic Sea Strategy is a master plan for developing the Baltic Sea region. Maritime transport plays an important role in the Baltic Sea Strategy when considering environmental and accessibility aspects, as well as questions about safety and security. Winter navigation is a "hotspot" in the Strategy. WINMOS is considered as a flagship project within the priority area Maritime Safety and Security.[1]

The objectives of the WINMOS project is to improve efficiency, sustainability, safety and environmental performance of winter navigation in the Baltic Sea. [2]

WINMOS consists of 7 Activities. Aboa Mare is involved in *Activity 5, Human element and training facilities.*

1.1 Background and motivation

This study is based on the assignment to Aboa Mare of WINMOS for Activity 5: Human element and training, Sub activity 5:1.

1.2 Objectives and scope

The objectives of the study are to research relevant international conventions and other pertinent information in order to gather information needed to specify the contents applicable to training for Baltic ice and winter conditions. The study is divided into discussing international regulations, recommendations and guidelines and also existing ice navigation/winter navigation training courses. From this information we seek to gather the relevant information and put forth a suggestion for the contents of an ice/winter navigation course. It is assumed that merchant ship officers and icebreaker officers will need training with, at least partly, different contents.

The desktop study is complemented by interviewing merchant marine officers and icebreaker officers with extensive experience of winter navigation in the Baltic Sea

The proposed training is relevant for all onboard personnel but main objective is on deck and engineering officers.

2 International conventions

This part of the study looks into current international conventions and regulations and the objective is to specify whether the conventions contain relevant requirements, what these requirements are, and if they can and/or should be included in a training program.

[1] HELCOM MARITIME 11/2012
[2] HELCOM MARITIME 11/2012

2.1 SOLAS- Safety Of Life At Sea

SOLAS 1974 contains the following references to ice/winter navigation relevant for the Baltic Sea[3]

Chapter V navigational requirements:

Regulation 5 (Meteorological services and warnings):

" requests SOLAS Contracting Governments to encourage the collection of meteorological data by ships at sea and to arrange for their examination, dissemination and exchange in the manner most suitable for the purpose of aiding navigation, including, inter-alia, to issue at least twice daily weather information suitable for shipping containing data, analyses, warnings and forecasts of weather, waves and ice."

In a training context, this implies that the officers should be able to collect, analyze and transmit meteorological data and furthermore receive, interpret and make use of meteorological information, including ice information

Regulation 31 obliges the master as follows:

"every ship which meets with dangerous ice, a dangerous derelict, or any other direct danger to navigation, or a tropical storm, or encounters sub-freezing air temperatures associated with gale force winds causing severe ice accretion on superstructures, or winds of force 10 or above on the Beaufort scale for which no storm warning has been received, to communicate the information by all means at his disposal to ships in the vicinity, and also to the competent authorities. SOLAS Contracting Governments are requested to ensure that, when intelligence of any of the dangers specified above is received, all concerned are informed accordingly"

In this regulation, some points related to ice and cold conditions are addressed, but in practice they are not very relevant in the Baltic Sea.

Regulation 32 specifies

"the information required in danger messages, such as kind, position, time and date of dangers observed; barometric pressure and tendency; wind force and direction; sea state; swell, including direction from which it comes, period or length; and true course and speed of the ship. Sub-freezing air temperatures associated with gale force winds causing severe ice accretion on superstructures are specifically mentioned and require information on time and date, air and sea temperature, and wind force and direction"

Again, same comment as on regulation 31.

2.2 STCW – Standards on Training, Certification and Watchkeeping- 1978 as amended[4]

STCW does not address "ice" directly in part A (mandatory) of the Code but part B (guidance) includes anew Section B-V/g of the STCW Code on 'Guidance regarding training of Masters and Officers for ships operating in Polar waters' (exp. entry into force 1 Jan 2012).

[3] IMO; SOLAS 1974
[4] IMO; STCW 1978 as amended

2.2.1 STCW part A

From part A we can extract the following as having relevance to training:

- Table A – II/ 2 (management level)

  - Plan a voyage and conduct navigation:

  "Voyage planning and navigation for all conditions by acceptable methods of plotting ocean tracks taking into account, e.g.: .3 **ice"**

- Manoeuvre and handle a ship in all conditions:

  "While underway, a full assessment is made of possible effects of shallow and restricted waters, **ice,** banks, tidal conditions, passing ships and own ship's bow and stern wave so that the ship can be safely manoeuvred under various conditions of loading and weather"

and

  "practical measures to be taken when navigating in or near **ice** or in conditions of ice accumulation on board"

It is thus clear that some knowledge, understanding and proficiency in handling ice conditions are required from the ship´s master and chief officer but NOT from the operational level officers.

Further study of the STCW Code reveals some more information.

- A VIII/2 Watchkeeping arrangements and principles to be observed , part 2 Voyage planning:

-sub-paragraph 3:

  "The intended voyage shall be planned in advance taking into consideration **all pertinent information** and any course laid down shall be checked before the voyage commences."

and

-sub-paragraph 5 :

  "Prior to each voyage the master of every ship shall ensure that the intended route from the port of departure to the first port of call is planned using adequate and appropriate charts and other nautical publications necessary for the intended voyage, containing accurate, complete and up-to-date information regarding those **navigational limitations and hazards which are of a permanent or predictable nature, and which are relevant to the safe navigation of the ship"**.

and

-sub-paragraph 7:

  "If a decision is made, during a voyage, to change the next port of call of the planned route, or if it is necessary for the ship to **deviate substantially from the planned route for other reasons**, then an amended route shall be planned prior to deviating substantially from the route originally planned"

Sub-paragraph 3, 5 and 7 are thus relevant for ice training. The special needs of ice navigation has to be addressed when discussing voyage planning in ice conditions.

• A VIII/2 part 4-1 Principles to be observed in keeping a navigational watch:

-sub-paragraph 18:

> " When deciding the composition of the watch on the bridge, which may include appropriately qualified ratings, the following factors, inter alia, shall be taken into account:
>
> .2 **weather conditions**, visibility and whether there is daylight or darkness;
>
> .3 proximity of **navigational hazards** which may make it necessary for the officer in charge of the watch to carry out additional navigational duties;
>
> .4 use and **operational condition** of navigational aids such as **radar** or electronic position-indicating devices and any other equipment affecting the safe navigation of the ship;
>
> .6 whether there are **radio duties** to be performed;
>
> .8 any **unusual demands** on the navigational watch that may arise as a result of **special operational circumstances."**

These are to be taken into consideration during training.

Sub-paragraph 40.9 is the first direct mention of" ice" :

> -" The officer in charge of the navigational watch shall notify the master immediately: if the ship meets any hazard to navigation, such as ice or a derelict"

This is directly coupled to the SOLAS requirement mentioned earlier and as such has no direct relevance on training for the Baltic.

The abovementioned can be found in part 4-1 concerning the navigational watch, but part 4-2 concerning the engineering watch also has to be addressed.

Part 4-2 Principles to be observed in keeping an engineering watch, sub paragraph 55:

> "When deciding the composition of the engineering watch, which may include appropriately qualified ratings, the following criteria, inter alia, shall be taken into account:
>
> .3 any special modes of operation dictated by conditions such as weather, **ice**, contaminated water, shallow water, emergency conditions, damage containment or pollution abatement"

Again, this has to be considered relevant in training.

2.2.2 STCW part B

Abovementioned are the requirements in the mandatory (A) part of the STCW code. The guidance given in part B of the Code addresses ice navigation specifically in Section B-V/g. This section is entitled "**Guidance regarding training of masters and officers for ships operating in polar**

waters" and is thus not directly applicable to Baltic conditions. Nevertheless, when scrutinizing the guidance it is clear that a great deal can, and should, be applied to Baltic ice navigation too.

The following list has been modified for Baltic conditions by applying strikethroughs on deletable words and phrases and additions are made in *italic.*

1 It is important that masters, officers in charge of a navigational watch and officers in charge of an engineering watch on board ships operating in *Baltic* ~~polar~~ waters should have relevant experience and training, as follows:

.1 Prior to being assigned duties on board such ships:

.1.1 For masters and officers in charge of a navigational watch, the training should provide basic knowledge on at least the subjects given in paragraphs 2 to 11 hereunder; and

.1.2 For officers in charge of an engineering watch, the training should provide basic knowledge on at least the subjects given in paragraphs 3, 6, 10 and 11 hereunder.

.2 Masters and Chief Engineer Officers should have sufficient and appropriate experience in operating ships in *Baltic ice infested* ~~polar~~ waters.

Ice characteristics – ice areas

2 Interpretation of different ice-charts and awareness of limitations in meteorology and oceanography data, ice physics, formation, growth, ageing and stage of melt; ice types and concentrations; ice pressure; friction from snow-covered ice; implications of spray-icing and icing up; precautions against icing up and mitigation of consequences; ice regimes in different regions and different seasons~~, including the differences between the Arctic and the Antarctic~~; recognition of consequences of rapid change in ice and weather conditions; movement of ~~icebergs and~~ pack ice.

Ship's performance in ice and cold climate

3 Vessel characteristics; vessel types, hull designs; ice-strengthening requirements; ice class in different classification societies – *Finnish-Swedish* ~~polar~~ class and local regulations; limitations of ice classes;winterization and preparedness of vessel; low-temperature system performance.

Voyage and passage planning for a ship in ice***

4 Development of safe routeing and passage planning to avoid ice where possible, including interpreting various forms of ice imagery and data to assist in the preparation of a strategic passage planning; entering ice from open water to avoid ~~icebergs and~~ dangerous ice conditions; navigation, determining when it is safe or not safe to enter areas containing ice ~~or icebergs~~ due to darkness, swell, fog or pressure ice.

Operating and handling a ship in ice

5 Preparations and risk assessment before approaching ice-infested waters; unassisted operation of vessels with different ice-class in different ice-types; safe speed in the presence of ice ~~and icebergs~~; communications with an icebreaker and other vessels; navigation in various ice concentrations and coverage; awareness of the increase in energy of movement; ~~use of icebergs for shelter~~ and access through packed ice.

6 Use of different type of propulsion system and rudder, including awareness of system strength and capacity limitations; use of heeling and trim systems, engine loads and cooling problems.

Regulations and recommendations

7 Local requirements for entering different regions, ~~including the Antarctic Treaty~~; international regulations and recommendations.

Equipment limitations

8 Use of and hazards associated with terrestrial navigational aids in *ice covered* ~~polar~~ waters; ~~high latitudecompass errors~~; discrimination of radar targets and ice-features in ice-clutter; ~~limitations of electronic positioning systems at high latitude; limitations in nautical charts and pilot descriptions; limitations in communication systems.~~

Safety precautions and emergency procedures

9 ~~Availability of hydrographic data sufficient for safe navigation; precautions when navigating in poorly charted waters; limitations of search and rescue readiness and responsibility, including GMDSS area A4 and its SAR communication facility limitation; awareness of contingency planning;~~ knowledge of towing procedures; value of contact with other ships and local SAR organization; recognizing dangers when crews are exposed to low temperatures; procedures and techniques for abandoning the ship and survival on the ice; crew fatigue problems due to noise and vibrations; carriage of additional resources such as bunkers, food and extra clothing; awareness of the additional severity of consequences of incidents in *icecovered* ~~polar~~ waters.

10 Establishing safe working procedures; awareness of the most common hull and equipment damage and how to avoid them; fire-fighting systems limitations.

Environmental considerations

11 Sensitive sea areas regarding discharge; areas where shipping is prohibited or should be avoided; special areas in MARPOL; oil-spill equipment limitations; plan for coping with increased volumes of garbage, bilge water, sludge, sewage, etc.; consequences of pollution in a cold climate.

It is thus evident that almost the entire Section B-V/g is relevant for training for Baltic conditions.

2.3 MARPOL [5]

Marpol 73/78 Convention requirements concerning Baltic Sea are as follows:

In Marpol 73/78 **Annex I Prevention of pollution by oil**, **Annex II Control of pollution by noxious liquid substances, Annex IV Prevention of pollution by sewage from ships and Annex V Prevention of pollution by garbage from ships,** MARPOL:

> " defines certain sea areas as "special areas" in which, for technical reasons relating to their oceanographical and ecological condition and to their sea traffic, the adoption of special mandatory methods for the prevention of sea pollution is required. Under the Convention, these special areas are provided with a higher level of protection than other areas of the sea."

Under this definition, the Baltic Sea is designed as a special area under Annexes I, IV, V and VI.

Thus, these special requirements also have to be addressed in training for winter conditions, emphasizing the added or different measures to be taken in ice and cold conditions.

[5] IMO; MARPOL73/78

2.4 IMO Polar Code [6]

The work to improve circumstances for shipping in Polar waters has progressed from the first **Guidelines for ships operating in Arctic ice-covered waters** in 2002 which were amended to become the **Guidelines for ships operating in polar waters** (thus including also Antarctic waters) in 2009.

Since then, work has progressed towards developing a mandatory Polar Code, which is scheduled to be finalized in 2014. This draft Polar Code is, as such, not directly applicable to Baltic conditions, but can be considered, in the same way as STCW Section B-V/g, to be applicable in a modified form to Baltic training requirements.

As the Polar Code is too extensive to be presented in this report, we present only the chapter headings here:

DRAFT INTERNATIONAL CODE FOR SHIPS OPERATING IN POLAR WATERS:

CHAPTER 1 – GENERAL
CHAPTER 2 – POLAR WATER OPERATIONAL MANUAL
CHAPTER 3 –SHIP STRUCTURE
CHAPTER 4 – STABILITY AND SUBDIVISION
CHAPTER 5 – WATERTIGHT AND WEATHERTIGHT INTEGRITY
CHAPTER 6 – MACHINERY INSTALLATIONS
CHAPTER 7 – OPERATIONAL SAFETY
CHAPTER 8 - FIRE SAFETY/PROTECTION
CHAPTER 9 – LIFE-SAVING APPLIANCES AND ARRANGEMENTS
CHAPTER 10 – SAFETY OF NAVIGATION
CHAPTER 11 – COMMUNICATION
CHAPTER 12 –VOYAGE PLANNING
CHAPTER 13 – MANNING AND TRAINING

POLLUTION PREVENTION MEASURES (ENVIRONMENTAL PROTECTION MEASURES)

CHAPTER 1b – PREVENTION OF OIL POLLUTION
CHAPTER 2b – PREVENTION OF POLLUTION FROM NOXIOUS LIQUID SUBSTANCES
CHAPTER 3b – PREVENTION OF POLLUTION BY HARMFUL SUBSTANCES IN PACKAGED FORM
CHAPTER 4b – PREVENTION OF POLLUTION BY SEWAGE FROM SHIPS
CHAPTER 5b – PREVENTION OF POLLUTION BY GARBAGE

We can argue that chapters 2 and 2b are not applicable to Baltic conditions. All other chapters can, and should, be addressed in training for Baltic conditions.

[6] IMO Working Group report SDC1-WP 4

2.5 MLC-Maritime Labour Convention[7]

The MLC Labour Convention , 2006, includes some requirements (title 3 and 4) that can be applied to winter conditions in the Baltic Sea. These concern health, safety protection and accident protection, and, to some extent accommodation, food and medical care onboard. All these are to be addressed when training for winter conditions in the Baltic.

> **Title 3. Accommodation, recreational facilities, food and catering**
>
> Regulation 3.1 – Accommodation and recreational facilities
> Regulation 3.2 – Food and catering
>
> **Title 4. Health protection, medical care, welfare and social security protection**
>
> Regulation 4.1 – Medical care on board ship and ashore
> Regulation 4.2 – Shipowners' liability
> Regulation 4.3 – Health and safety protection and accident prevention
> Regulation 4.4 – Access to shore-based welfare facilities
> Regulation 4.5 – Social security

2.6 International Code on Intact Stability, 2008 (IS code) [8]

In our context, the IS Code 2008 addresses the icing problem extensively. Icing is addressed in chapters 1.1, 2.1.4, 2.1.5, 2.4.3.2, 3.4.2.7, 3.4.2.8, 3.3.2.3 and 3.7.1. Chapter 6 - Icing considerations- addresses the pertinent details concerning icing considerations and is the main document to be used**.** The text is too extensive to be disseminated in this study, but it is perfectly clear that IS 2008 has to be included in training for Baltic conditions.

2.7 COLREGS 1972[9]

The Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs) does not in general address ice or winter conditions. Only in Rule 6 –Safe speed- **ice** is addressed:

> "In determining a safe speed the following factors shall be among those taken into account:
> b) Additionally, by vessels with operational radar:
> iv) the possibility that small vessels, **ice** and other floating objects may not be detected by radar at an adequate range"

Thus, this is similar to SOLAS and STCW requirements and is applicable only to open sea conditions, meaning in practice the detection and avoidance of icebergs and growlers and not applicable to ice-covered waters in the Baltic. This is not to say that at least a short discussion on COLREGS application to ice conditions should not be made.

[7] ILO
[8] IMO 2008
[9] IMO 1972

2.8 UNCLOS - United Nations Convention on the Law of the Sea[10]

The UNCLOS does not discuss ice-covered waters at any length, but some details are mentioned.

SECTION 8. ICE-COVERED AREAS, Article 234

> "Coastal States have the right to adopt and enforce non-discriminatory laws and regulations for the prevention, reduction and control of marine pollution from vessels in **ice-covered areas** within the limits of the exclusive economic zone, where particularly severe climatic conditions and the presence of ice covering such areas for most of the year create obstructions or exceptional hazards to navigation, and pollution of the marine environment could cause major harm to or irreversible disturbance of the ecological balance. Such laws and regulations shall have due regard to navigation and the protection and preservation of the marine environment based on the best available scientific evidence."

It is clear that this is related to MARPOL regulations, and, as such, should be included in a training course but not to any great extent.

3 Other relevant documentation

This part of the study looks into different recommendations and guidelines which are not mandatory, but nevertheless have a big impact on deciding the contents for training in Baltic conditions. The objective is to specify which kind of information is available, what these information implies, and if they can and/or should be included in a training program.

3.1 IACS –International Association of Classification Societies[11]

IACS has published Unified Requirements for Polar Class Ships. In the Baltic context, these requirements are not applicable, instead we should use the well-established Finnish –Swedish Ice class system (and its applications in classification societies' ice class notation systems) in training. It is nevertheless important to discuss at some length the different classification systems and how to determine their equivalence.

3.2 HELCOM recommendations[12]

The Helsinki Commission (HELCOM) has promulgated recommendations for winter navigation in the Baltic Sea, the most prominent of which are HELCOM Recommendation 25/7, 2004 and HELCOM Recommendation 28E/11, 2007. The relevant points in these recommendations are:

Recommendation 25/ 7:

1. Ice surveillance systems
2. Equivalence of ice classification rules
3. Safety requirements
3.1 Traffic restrictions based on safety aspects
3.2 Exemptions on traffic restrictions
3.2.1 Exemptions on traffic restrictions due to favourable weather conditions
3.2.2 Exemptions on traffic restrictions based on detailed analysis of the strength of the vessel
3.3 Winterisation of ships
4. Operational matters related to winter navigation
4.1 Vessel Traffic Management and Information System in winter

[10] UNCLOS
[11] IACS
[12] HELCOM 2004, 2007

4.2 Operational instructions for ships

Recommendation 28E/11:

RECOMMENDS FURTHERMORE the Governments of the Contracting States to advance educational offers for seafarers of high quality training programmes in navigation in ice conditions according to the 1978 International Convention on Standards in Training, Certification and Watchkeeping for Seafarers. Such training programmes should provide knowledge, understanding and proficiency required for operating a ship in ice-covered waters, including:

- ice conditions, ice types and ice chart;
- ice classes, ship's construction and traffic restrictions;
- icing and winterisation;
- voyage planning and operation in ice;
- icebreakers and assistance,

RECOMMENDS ALSO the Contracting Parties to promote the use of the Electronic Chart Display and Information System (ECDIS) and the use of qualified Baltic Sea Pilots during their voyage in the Baltic Sea in ice conditions until the Master or Senior Watchkeeping Officer of the vessel has achieved sufficient experience in winter navigation,

These recommendations state clearly and in detail the different contents to be included in training programmes and, furthermore, urges governments to advance the possibilities for seafarers to participate in training programmes for Baltic winter conditions. The HELCOM recommendations should be taken into consideration when designing training programmes.

3.3 DNV standard for certification No.3.312[13]

In 2008, the classification society DNV published a Standard for certification no.3.312- Competence of officers for navigation ice. This standard is described by DNV as:

"This new standard specifies the competence requirements for ship's officers who are expected to navigate a vessel through ice infested waters."

The standard is very comprehensive and it is not possible to discuss the details in the body text of this report. The standard, with some modifications, is presented in attachment 1.

However, the standard is global and thus it includes some parts that can be omitted for Baltic conditions. For reasons of clarity of this report, the table part of the DNV standard with the points that can be omitted marked by strikethrough is presented as attachment 1 to this report.

3.4 National regulations

In the Baltic countries, local regulations and guidelines are promulgated. All officers should be made aware of the information in these sources and be able to interpret and use them. The information in these sources should be included in the training program.

As an example, we include the contents of the Finnish instructions[14] ;

" Finland´s Winter Navigation,Winter 2013–2014, Instructions for winter navigation operators"

Please observe that these instructions include supplements for "Icebreaker assistance in the Russian

[13] DNV 2008
[14] Finnish Transport Agency 2013

Ports of the eastern part of Gulf of Finland (Russia)" and "The Estonian icebreaking service (Estonia)" The Swedish Maritime Administration publishes a similar document.

4. Ice Navigation courses and literature

In addition to the resources in the previous chapters, a review was made on the contents of a small sample of current and former courses in Ice Navigation. The courses were ICETRAIN, the last course was conducted in February 2014, at Aboa Mare Simulation Center in Espoo and Maritime Safety Training Centre in Lohja; Ship Operation in Ice from March 11-14, 2002, arranged in Rauma by the Centre for Maritime Studies of University of Turku; and Basic Ice Navigation course of Aboa Mare.

Available materials of ICETRAIN included course programs of past courses and materials used in the lectures such as lecturers' power point presentations. ICETRAIN is a three-day course and has developed from a course emphasizing theory lessons to a course with somewhat less theory and more practical training in the ship-handling simulator and the Safety Training Centre facilities. The quality control of the course is exercised by DNV-GL ensuring that the contents fulfill their criteria.

Ship Operation in Ice course handouts were used to analyze the contents of the course. It covers a wide variety of topics in winter navigation, including e.g. ice breaking history, management of icebreaker operations, descriptions of ice conditions and ice strength, and working ability and health risks in cold environment.

Additionally web pages of known course providers were examined but this did not bring significant new information.

The two books reviewed were

- Buysse, J. Handling Ships in Ice (2007). London: The Nautical Institute.
- Haapio, A. Navigation in Ice Infested Waters and Icebreaker Assistance (1999). Espoo: Meriturva Ship Simulation Unit.

The first concentrates on actual navigation in ice whereas the latter covers other aspects of the topic as well, for example the attention required by the cargo, safety collaboration with the company and the ships, structural items, machinery systems and power plants etc.

Baltice.org web pages were also reviewed for possible training topics. Foremost possible additional item identified was BIM and BIM Annual Reports which belong under the topic of management and administrative issues.

5. Interviews

Based on the collected data, a form was compiled for a semi-structured interview (appendix 2). The form is a list of common subjects in ice navigation training, with some but not nearly all sub-topics under each topic listed. The goal of this setting for the interview was to facilitate the spontaneous input by the interviewees, topics that they considered important in ice navigation training, and on the other hand as completely as possible to cover the field of topics in the current ice navigation training.

5.1 Results of the interviews

The results are presented in a condensed form and arranged according to the ship type of the interviewees, i.e merchant ship and icebreaker.

5.2 The view of merchant ship masters

The interview was conducted in March 2014. Three experienced shipmasters were interviewed. All masters had a minimum of ten years´ experience of winter navigation in merchant vessels in the Baltic Sea.

The first point was to give a freely formulated opinion on the three most important items of training regarding merchant ship officers and icebreaker officers. The following items were brought forth:

- The importance of correct information and following/using this information
  - this goes both ways between merchant ship and icebreaker
- The importance of full situational awareness – what is happening- and also the existence of backup plans in case the situation changes. (The words used were "escape plans")
- The importance of knowledge about (and ability to execute) the correct ways to maneuvre in heavy ice conditions, in order to avoid damages to the ship.

When moving on to the more specified tasks in the interview list, the masters had no special comments on items 1 and 2, Basics of Ice Operation and Ship design for Ice Operations. They felt them to be correct and had nothing to add or subtract.

Item 3, Safety & emergency equipment, survival, was on the other hand seen as not too important and should be addressed only briefly. The masters said that it is not very important because the equipment does not function at all (or poorly anyway) in winter conditions.

On the other hand, item 4, Engine department and technical items, was seen as highly important and should be addressed at some length. Especially the ME cooling systems and the correct use of these was mentioned.

Item 5, Cargo handling & equipment, was seen as relevant. The correct use of ballast tanks (freezing problems etc.) were mentioned specifically.

Continuing the list to item 6, Management issues, the discussion became somewhat muddled and no clear opinion on the importance of this item was brought forth. The geist of it seemed to be that the shipmasters were uncomfortable with the item, mostly because the regulations are as they are and the seafarers cannot influence them in any way. The end result was thus unclear, but the item was nevertheless not considered unnecessary. No suggestions for added items were put forth either.

The item 7, Voyage planning and preparations, was seen relevant. Nothing should be subtracted but the interviewees put forth the suggestion of just using "ordinary seamanship". At the very end an important notation was made: the masters felt again the importance of correct and sufficient reporting and information flow, not only between icebreakers and VTS etc., but also the very important ship-to-ship information flow, which was seen as seriously degraded over the past decade or so.

The last item 8, Watch-keeping during passage, ship handling in ice, was on the whole seen as relevant. No suggestions for addition were put forth and nothing was seen as not necessary.

5.3 The view of icebreaker officers

The interview took place on a multi-purpose icebreaker on March 9th, 2014. The Captain, Chief Officer and 1st Officer took part in the interview which was the same semi-structured interview

described in chapter 5.2., in form of a group discussion. The interviewees have icebreaker experience 12, 8 and 12 years respectively, and other ice navigation experience on e.g. merchant vessels 5, 2 and 10 years.

Due to the free conversation the items did not always come up under the 'correct' topics; therefore they are presented here in free order, and only direct comments regarding the topics are connected to the interview list. Substance knowledge is included in this chapter since it illustrates the topics that were thought of as important.

Practical preparations for the journey were emphasized: sufficient amounts of fuel, water, provisions etc. taking into account that the journey could take a much longer time than in summer conditions.

'Icing and stability' was considered an important topic. Also stability of vessels with timber cargo was mentioned. The required minimum GM is not sufficient for winter navigation and assistance situations, especially towing by icebreakers.

Action by a vessel nearly getting stuck was mentioned the advice often being to stop with the bow into wind and wait for assistance instead of possibly getting stuck in the ice with side wind.

'Ice strengthening' was mentioned as important and especially the correct trim and draught as per the ice belt. Otherwise 'ship design for ice operations' was not kept very important since it cannot be influenced anymore by the onboard personnel. Ballasting should be commenced in time before icebreaker assistance and the ballast kept onboard until in port. Vessels have better performance in ice properly ballasted when not laden.

Proper work clothing in sub-zero temperatures was mentioned and also practical advice such as not keeping the crew stand-by outside unnecessarily in mooring and towing operations for example.

'Engine department and technical items' was seen as good to handle, including basic items when to slow down, having engines in maneuvering mode, cooling water arrangements etc.

Under 'management issues' was mentioned the understanding that schedules change and the ship cannot decide on icebreaker assistance and that there is a reason for the traffic restrictions, weaker vessels simply do not perform sufficiently in the ice and have much higher risk for ice damages.

In 'voyage planning and preparations' an important item is where to get information, such as baltice.org web pages. 'Pilot books and navigation guides' was not seen as especially relevant. Ice waypoints, weather forecasts and ice charts are sources of information, and especially by listening to the VHF one can get much information. Considering ice charts the use of the "egg" in the chart was mentioned as relevant due to the wide use of it in e.g. Canada, hence the importance of it in specifically Baltic Sea ice navigation is unclear but since it contains important information it can be seen as a relevant item as suggested by the interviewees.

More efficient and concentrated watch-keeping was emphasized: going around ice floes instead of just going straight, adjusting the radar (3 cm) and using the searchlights. There are new ice radars and ice modes for marine radars. Grounds and shallow areas can give echoes sometimes. Ship's draught can be less than icebreaker's and assistance is not possible in shallow water that is sufficient for the ship. Avoiding damages is an important topic: bow into the pressure / wind if stopping, rudder midships when taking astern and propeller always rotating when being towed. In traffic and assistance situations it is safe as long as there is ice between the vessels but one has to be very careful with open water areas. A big CPA to other vessels is not always advisable and meeting other vessels should be

arranged according to ice conditions with green to green more frequent than in open water and agreed by VHF when necessary.

Pilot boarding brought up some items. When pilot is boarding from ice slow speed should be kept and not stop unless told to do so. The ice at the pilot boarding area is kept unbroken as much as possible. Pilot boarding places vary with the changing ice conditions.

Berthing and unmooring of merchant vessels was not considered relevant from icebreaker point of view.

Under icebreaker assistance one should keep a steady course when the breaker is maneuvering around own ship, follow the instructions and keep continuous VHF-watch on the working channel. One important point when being towed is hand steering so that one tries to keep the masts in line with the icebreaker, and lowering the search lights also when following an icebreaker. Placing of anchors before assistance so that the vessel can be towed and ballasting before assistance begins, the propeller as down as possible, are important. Having mooring winches ready and canvases removed when in ice were mentioned.

6. Conclusion

The desktop study amended with input from experienced merchant vessel and icebreaker officers yielded a clear picture of the items to be included in a proposed training program for ship officers. Existing programs are fairly comprehensive but some adjustments and review would increase their effectiveness. The training materials should be revised and updated as necessary.

General finding is that operating vessels in ice requires special skills. Actual navigation, making and online adjustment of route plan and ability for precise and even aggressive maneuvering differ from normal open water shipping. Training and assessment of these skills sets special accuracy requirements to simulators and ship models used for this type of training, including visualization of ice optically and in radar, collision and breaking forces of different ice, ice specific towage modes etc.

The study concentrated on deck officers and the need for training of engineering officers was not included at any length. This was partly due to the officers interviewed being exclusively deck officers and also because we received information that another desktop study will be done, concentrating on the engineering officers. This objective of the study changed on this point.

We suggest that the study is complemented with a similar study concerning the engineering officers and using the results of this study to compile a list of contents for a training program. The goal should be to plan, test and evaluate a new training program for Baltic ice /winter conditions and, ultimately, to launch the training program on the market.

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DNV standard for certification No.3.312 , modified for Baltic requirements :Appendix 1

1. Underpinning Knowledge and Understanding

1.1 Regulations

1.1.1 Identify relevant local regulations and requirements for the voyage, based on the area(s) to be transited (~~Northern Sea Route,~~ Baltic, ~~Alaska, Canadian Arctic, Greenland, Svalbard, Sea of Okhotsk, Antarctica)~~

1.1.2 Act in accordance with local regulations
1.1.3 Act in accordance with flag state stability requirements
1.1.4 Explain when and where an Ice Pilot/Navigator is required and how their services should be obtained
1.1.5 ~~State the extent of the Antarctic Treaty Area~~

1.2 Reporting requirement

1.2.1 Find details about the ship reporting system for the area you will operate in (boundaries, services)
1.2.2 Find details on how to receive ice services and ice charts in an area
1.2.3 ~~Make an initial clearance request to enter an area (e.g. Marine Ops HQ, ECAREG, NORDREG (voluntary), AUSREP, etc.)~~

1.2.4 Comply with the reporting routines / requirements in the area of operation
1.2.5 Report unexpected delays in ETA due to ice-conditions
1.2.6 ~~Communicate sightings of ice and icebergs to authorities~~

~~*Canada*~~

1.2.7 ~~Prepare a Routing message and After Action Report (Arctic Ice Regime Shipping System)~~

1.3 Environmental factors

1.3.1 Identify particular sensitive sea areas regarding discharges
1.3.2 Describe the consequences of pollution in a cold climate
1.3.3 Develop a plan to cope with increased volumes of garbage, bilge water, sewage etc. on long stays
1.3.4 ~~Verify discharge limitations according to applicable regulations in polar regions (e.g. ASPPR)~~
1.3.5 ~~Operate with due regard for the safety of polar wildlife (seals, penguins, polar bears, whales) in the vicinity~~

1.4 Weather forecast & conditions

1.4.1 Describe the characteristics of polar low pressure systems
1.4.2 Recognise possible limitations in weather-forecast
1.4.3 Recognise possible rapid changes in weather conditions
1.4.4 Adjust the voyage plan due to weather conditions
1.4.5 Anticipate effects of weather, winds and current on drifting ice and ice pressure
1.4.6 Explain the risks of sudden onshore winds
1.4.7 ~~Explain the risks of katabatic (outflow/fall) winds, especially in Antarctica and Greenland~~
1.4.8 Explain when to expect local fog conditions and low visibility due to sea fog, sea smoke and snow

1.5 Glaciology and ice recognition

1.5.1 Identify different sea-ice types (drift/pack ice, fast ice, floe, ~~ice island, ice shelf, iceberg, nilas~~)
1.5.2 ~~Identify icebergs, bergy bits and growlers~~
1.5.3 ~~Describe differences in types of icebergs with reference to their stability~~
1.5.4 ~~Explain the risk of calving of icebergs, glaciers and ice shelves and the need to keep sufficient distance~~
1.5.5 Describe hazardous ice conditions such as ridging and hummocks; shear zone ice ~~and floe bergs~~; grounded ice; pressure and compression; ~~glacial and multi-year ice~~

1.5.6 ~~Recognise the difference in behaviour between current-driven glacial ice and wind-driven pack ice~~
1.5.7 Recognise signs of ice in the vicinity
1.5.8 Describe ‘ice blink’, ‘ice fog’ and ‘water sky’
1.5.9 ~~Observe seawater temperature when approaching ice infested waters~~
1.5.10 Explain ice terminology terms
1.5.11 Interpret ice reports
1.5.12 Interpret sea ice symbols

~~*Great Lakes & St. Lawrence*~~

~~1.5.13 Interpret lake ice symbols~~
~~1.5.14 Identify different lake ice types~~
~~1.5.15 Recognise that ice may be submerged by weight of snow cover U~~
~~1.5.16 Recognise and avoid batture ice floes (St. Lawrence River)~~
~~1.5.17 Anticipate the behaviour of frazil ice on the St. Lawrence river, reaching great depths, possibly resulting in blockage of seawater inlets~~

1.6 Ship construction & class notations

1.6.1 Compare own ship’s class to polar class/ice classes
1.6.2 Describe ice class characteristics for own vessel
1.6.3 Explain the terms ‘ice belt’ and ‘ice draft’
1.6.4 Determine the location of ice strengthening for own vessel
1.6.5 Determine the trimming requirements of own vessel regarding ice class

1.6.6 Determine power and performance requirements for own ice classed vessel
1.6.7 Determine the types of steel used in the vessel's construction (shell expansion plan), indicating impact risks
1.6.8 Discuss the effects of the brittleness of ship components due to sub-zero temperatures
1.6.9 Explain the influence of ice class of own vessel on operational performance / limitations
1.6.10 Describe the voyage limitations for different ice classed vessels
1.7 Ship propulsion
1.7.1 Discuss benefits and hazards of open propeller versus Kort Nozzles in ice transit
1.7.2 Discuss the advantages and disadvantages / limitations of fixed and controllable pitch propellers
1.7.3 Discuss the use and effectiveness of tunnel thrusters in ice
1.7.4 Discuss the use of azimuting propeller units in ice navigation
1.7.5 Demonstrate awareness of engine cooling intake problems

2. Vessel Preparation

2.1 Winterisation
2.1.1 Determine the feasibility of winterising the vessel
2.1.2 Prepare a winterisation plan to operate a vessel in sub-zero temperature conditions
2.1.3 Ensure oils are replaced with winter grade type oil or special arctic mix fuel
2.1.4 Explain why steam-heating should be opened to all wing ballast tanks
2.1.5 Explain the importance of draining piping, heating system, protective covers and sounding tanks and void spaces
2.1.6 Explain why no freshwater ballast, but only seawater ballast should be retained
2.1.7 Explain why ballast tanks should be slackened in a sub-zero environment
2.1.8 Discuss actions to be taken for engine-room, sanitary systems, hydraulic pump room, steering gear flat compartment, under deck passage and duct keel, bow thruster room, emergency generator room, emergency fire pump room, CO_2 room and other fire fighting rooms
2.1.9 Describe the preventive measures used to maintain deck equipment in operational readiness in sub-zero conditions
2.1.10 Check winterisation has been carried out
2.1.11 Verify bridge window heating is available and operational
2.2 Resources
2.2.1 Ensure availability of large quantities of salt on board, medicines and medical supplies, sufficient bunkers, food and water for a voyage, possibly extended by ice conditions
2.2.2 Identify if adequate and sufficient equipment (clothing, ice mallets for ice-removal) is on board
2.2.3 Verify if the area of operation requires additional equipment
2.3 Searchlights
2.3.1 Ensure searchlights are properly positioned, minimising glare
2.3.2 Ensure searchlights are ready for use at all times
2.3.3 Use searchlights during operations in dark conditions

3. Crew preparation

3.1 Working conditions
3.1.1 Describe working conditions for the voyage
3.1.2 Establish safe working procedures in cold conditions

Table 3-1 Competence Requirements

3.1.3 Emphasize importance of limiting exposure time for outside work
3.1.4 Explain the chill effect of wind/temperature/humidity
3.1.5 Identify early signs of frostbite and hypothermia
3.1.6 Explain actions in case of frostbite and hypothermia
3.1.7 Brief crew on expected conditions, duties, safe working procedures and how to avoid, recognise and treat cold weather injuries
3.1.8 Inform crew when entering ice
3.1.9 Explain the likelihood of prolonged outside mooring operations
3.1.10 Explain the difficulty of handling mooring gear in cold conditions
3.2 Crew safety
3.2.1 Provide adequate clothing and eye protection against snow blindness
3.2.2 Emphasize the necessity and use of the provided clothing and equipment
3.2.3 ~~Implement safety precautions to protect crew members who need to work out on the ice (e.g. anchoring to ice) from polar bears (Arctic)~~

3.3 Living conditions
3.3.1 Inform the crew of the possible effects of ice noise and vibration on sleeping patterns
3.3.2 Inform the crew of the possible effects of varying daylight hours

4. Voyage Planning

4.1 Commercial considerations

4.1.1 Check charter party requirements against intended voyage
4.1.2 Verify feasibility of the voyage
4.1.3 Verify lay time conditions for possible ice induced delays
4.1.4 Determine if cargo is deliverable as per contract
4.1.5 Check marine insurance limitations
4.1.6 Check coverage for potential towing
4.1.7 Recognise higher fuel consumption in ice, even though distance may be shorter
4.1.8 Recognise limited refuelling opportunities in remote operating areas

4.2 Collecting data

4.2.1 Use the available documents and guidelines developed for your area of ~~operation (e.g. 'Guidelines for Ships Operating in Arctic ice-covered waters', 'Ice Navigation in Canadian Waters'; 'Guide to navigation through Northern Sea Route', etc.)~~
4.2.2 Identify local information sources for the planned voyage
4.2.3 Discuss conditions with local agent
4.2.4 Identify availability of ice breakers
4.2.5 Identify sources for ice forecasts
4.2.6 Obtain ice charts
~~4.2.7 Recognise limitations of navigational information in polar regions~~
~~4.2.8 Recognise that information may only be available in a local language~~

4.3 Planning routes in ice

4.3.1 Plan a route through an ice environment, using available ice information, ice-charts, ice atlas, seasonal outlooks and relevant publications
4.3.2 Verify advised routes are safe routes for the vessel
4.3.3 Monitor updated routing instructions from authorities
4.3.4 Judge ice movement and navigate the vessel accordingly
4.3.5 Interpret the Baltic Code for Sea Ice
4.3.6 Assess ice concentration in an area (in /10ths)
4.3.7 Use the "ice egg" method (Egg Code)

~~*Canadian waters*~~

~~4.3.8 Describe the conditions under which the Arctic Ice Regime Shipping System Standards (IARSS) may be applied U~~
~~4.3.9 Explain the differences between the Date/Time Zone system and the Ice Regime System U~~
~~4.3.10 Apply the Zone/Date system to vessel operation in Canadian waters, using the relevant tables A~~
~~4.3.11 Describe how to apply the Arctic Ice Regime Shipping System U~~
~~4.3.12 Perform Ice Numeral calculations I~~
~~4.3.13 Describe options when encountering a negative ice regime U~~

5. Navigating in High Latitudes

5.1 Charts and chart information

~~5.1.1 Recognise the chart projection for charts used in the polar regions (e.g. Polar Stereographic) and the date of survey~~
~~5.1.2 Explain the differences in calculating distances and bearings between chart projections used for the polar regions, as compared to Mercator projections~~
~~5.1.3 Recognise the lack of correct and complete topographical data on charts of polar regions, and its consequence on determining the height and detection range of land masses~~
5.1.4 Mark relevant information on charts such as anticipated ice edges, areas of close pack ice, environmentally sensitive areas and known problem areas
5.1.5 Recognise that navigation marks in coastal areas may be removed or replaced by unlit winter spar buoys and that listed light-characteristics cannot be relied upon

5.2 Positioning systems

5.2.1 Check vessel has adequate positioning systems for the voyage
5.2.2 Explain the need for cross-checking the ship's position with other navigation systems
~~5.2.3 Recognise limitations of positioning systems in high latitudes~~
~~5.2.4 Describe the errors to be expected when plotting positions obtained by GPS on arctic charts~~
5.2.5 Assess the effects and implications of loss/degradation of heading/gyro, position and speed inputs to navigation and operating systems
5.2.6 Recognize effects of operating in ice on fathometers and pit log

5.3 Compasses

~~5.3.1 Describe limitations of the magnetic compass in high latitudes~~
~~5.3.2 Recognise high latitude errors in gyro~~
~~5.3.3 Interpret manual of gyro for use in high latitudes~~

5.4 Ice remote sensing and radar

5.4.1 Describe the types, availability and limitations of sea ice remote sensing products

5.4.2 Use sea ice remote sensing products
5.4.3 Interpret remote sensing images of ice
5.4.4 Use radar for ice interpretation
5.4.5 Properly tune a 3 cm radar for ice conditions
5.4.6 Show presence of ice and ridging using 10 cm radar
5.4.7 Differentiate between ice and other targets by adjusting gain, anti-clutter sea and/or anti-clutter rain of the radar receiver
~~5.4.8 Locate an iceberg on radar by the clutter-free 'shadow' it may produce~~
~~5.4.9 Interpret the differences in radar return from glacier ice/icebergs in comparison to similar sized vessels.~~
5.4.10 Make daytime comparisons of radar picture with visual to increase radar interpretation skills at night
5.4.11 Communicate radar-settings when handing over the watch
5.4.12 Fix position using two or more radar-ranges
5.5 Communication equipment
~~5.5.1 Verify if the vessel has the required (operational) communication equipment on board for operating in polar regions~~
5.5.2 Recognize the effects of icing, brittle fracture and increased vibration from ice operations on ship's antennae
~~5.5.3 Describe limitations in communication equipment in high latitudes & low temperature~~

6. Ship-handling in Ice

6.1 General
6.1.1 Explain the hazards in connection with ballast and trim in relation to ice
6.1.2 Set optimal trim / draft where the propeller and rudder are well below the level of any ice to be encountered
~~6.1.3 Prepare fenders to be ready for use when negotiating sharp turns in leads~~
6.1.4 Retract the pit sword (and other retractable underwater appendages) before entering ice
6.1.5 Determine a safe operating speed given ice conditions and vessel characteristics
6.1.6 Describe the hazards of stern movement and turning for vessels with reference to rudders and propellers
6.1.7 Demonstrate correct rudder-position when moving the vessel astern
6.1.8 Determine the best rudder angle to use in certain conditions
6.1.9 Explain the influence of the thickness of the ice on the diameter of the ship's turning circle
6.1.10 Compare the dangers of turning manoeuvres (long turn vs. short turn star-manoeuvre)
6.1.11 Carry out a turning manoeuvre in ice, avoiding collision-impact of stern and sides
6.1.12 Move sideways and turn using azipods, without sustaining damage to hull/propulsion system

6.2 Bridge Watch keeping
6.2.1 Explain the role of the ice pilots and ice navigators and responsibilities on the bridge
6.2.2 Explain why the vessel should be in manual steering mode when operating in ice
6.2.3 Demonstrate preparedness to change course and speed at any given moment
6.2.4 Write a standing order for operating in ice
6.2.5 Explain the importance of plotting the vessel's position at short intervals
6.2.6 Maintain extra look-out for drifting ice both visually and on radar
6.2.7 Post stern lookout with radio when backing in ice, if view from bridge is insufficient
6.3 Icing / Ice accretion
6.3.1 Identify conditions for icing
6.3.2 Estimate the rate of ice accretion, using data in the Mariner's Handbook
6.3.3 Determine a strategy to reduce the accumulation rate of ice on the vessel
6.3.4 Explain the benefit of slightly lowering anchors in the hawse pipe in freezing spray conditions
6.3.5 Monitor ice build up (special attention in darkness, blind areas, e.g. forward containers on deck)
6.3.6 Monitor stability of the vessel
6.3.7 Discuss de-icing methods used on ship's structure, tanks and machinery
6.4 Entering ice
6.4.1 Assess ice conditions
6.4.2 Log position where confronted with ice, including ice details
6.4.3 Find an area of lower ice concentration to enter the ice
6.4.4 Demonstrate the correct approach angle when entering ice
6.4.5 Demonstrate the correct way of adjusting speed and power-output, prior to ice contact as well as upon contact with ice
6.4.6 Estimate ice thickness by observing the edges of pieces as they turn against the ship's side
6.5 Routing in ice
6.5.1 Monitor ice presence continuously
6.5.2 Use leads, openings and fragments in ice
6.5.3 Explain why open water leads in ice must be monitored very closely
6.5.4 Monitor ice drift and resulting pressure from tides and wind
6.5.5 Check the position of ice channels
6.5.6 Avoid colliding with ridges, ~~growlers & multi-year ice in polar regions~~
6.5.7 Assess the need for deviations from the intended track
6.5.8 Plan for deviations from the intended track
6.5.9 Explain why a major deviation from an advised course is not recommended
~~6.5.10 Describe the precautions for navigating near ice shelves, ice islands and tabular icebergs~~
6.6 Communications
6.6.1 Find frequencies and services of the Marine Communications and Traffic Services in the area of operation

6.6.2 Maintain proper communications with authorities, ice pilots, icebreakers and other vessels
6.6.3 Prepare a radio message for reporting dangerous ice
6.6.4 Prepare a radio-message reporting conditions leading to severe ice accretion on ship's superstructures
6.6.5 Use internationally accepted ice terminology /~~iceberg~~ nomenclature
6.6.6 Ensure that working channels are kept open continuously
6.6.7 Maintain radio watch on 2128 kHz and 156,8 mHz once icebreaker assistance is requested
6.6.8 Decide on signalling codes and meaning with ship ahead and astern of you
6.6.9 Conform to the light and sound signals requirements of the region
6.7 Icebreaker assistance
Request
6.7.1 Describe factors which influence the effectiveness of ice-breaker escort operations
6.7.2 Explain how to obtain icebreaker assistance
6.7.3 Provide the icebreaker with requested data regarding own vessel, such as Type of vessel, Ice Class, HP, Backing power, Crash stop distance, Breadth, Deadweight, Draught, Loaded or in ballast
6.7.4 Inform icebreaker of any change in the state of your vessel while waiting for assistance
6.7.5 Conform to the standard operating procedures for working with an icebreaker in an area
When following an icebreaker
6.7.6 Follow instructions from the ice-breaker at all times when under escort
6.7.7 Explain the factors which determine the minimum escort distance and the maximum escort distance
6.7.8 Monitor progress (position/speed) continuously, when following an icebreaker or other vessel
6.7.9 Maintain minimum escort distance as indicated by icebreaker
6.7.10 Report to icebreaker if escort distance cannot be maintained
6.7.11 Interpret the operational signals between icebreaker and escorted vessel
6.7.12 Take appropriate actions when the light and sound-signals given by an icebreaker indicate that it has come to a halt
When in convoy
6.7.13 Understand the build-up of the convoy, when in convoy
6.7.14 Know the location of own vessel and other vessels' names or IDs, when in convoy
6.7.15 Monitor ship-to-ship distances continuously, when in convoy
6.7.16 Communicate changes in own speed immediately to other vessels
~~*St. Lawrence River*~~
~~6.7.17 Explain the main priority of icebreakers; ensuring channels remain open~~
7. Specific Operations
7.1 Passing other vessels in ice
7.1.1 Establish communication with other vessel
7.1.2 Determine if both ships are in the same channel
7.1.3 Agree with other ship(s) on how to pass each other
7.1.4 Identify prevailing wind-direction and force prior to passing
7.1.5 Overtake another vessel correctly, taking into account strength of both vessels, possible need to leave a channel and speed adjustments by both vessels
7.1.6 Pass another vessel correctly, when meeting, taking into account strength of both vessels, possible need to leave a channel and sufficient ice separation
7.2 Anchoring operations
7.2.1 Describe preparatory actions related to anchors, prior to entering ice
7.2.2 Recognise limited possibilities for anchoring in ice-covered waters
7.2.3 Explain why it is not advisable to anchor in ice-covered waters
7.2.4 Determine the forces of drifting ice when anchored
7.2.5 Monitor position while anchored
7.2.6 Heave anchor at short notice when anchored in icy waters
~~7.2.7 Explain the technique of using anchors and ice-anchors ("deadmen") for mooring to ice~~
7.2.8 Recognise the icing effect of washing of chains when heaving anchor
7.3 Towing
7.3.1 Describe the safety precautions to be taken on the forecastle while being towed
7.3.2 Prepare vessel for towing (e.g. hoist anchors away from towline if necessary)
Baltic
7.3.3 Describe the notch (close coupled) towing operation as used in the Baltic
7.3.4 Describe the need for mast alignment in notch (or close coupled) towing
~~*Russian Arctic*~~
~~7.3.5 Describe the method of using the anchor-chain for towing~~
~~7.3.6 Prepare vessel and anchor-chain for anchor-chain towing~~
7.4 Pilot transfer
7.4.1 Carry out pilot transfer from ice-breaker / other boat
7.4.2 Carry out pilot transfer from ice edge
7.4.3 Carry out pilot transfer in broken ice
7.4.4 Carry out pilot transfer by gangway and ladder
7.4.5 Instruct when the pilot ladder is to be lowered in case of ice-accretion conditions

7.5 Berthing, Unberthing and Mooring
7.5.1 Discuss the recommended procedures and considerations when berthing and unberthing in ice

7.5.2 Judge ice in the harbour and possible need for tugs to clear the berth
7.5.3 Adjust power ahead and astern to prevailing conditions, such as low under keel clearance and high concentrations of ice
7.5.4 Demonstrate different techniques when approaching berths
7.5.5 Berth and unberth the vessel with tug-assistance
7.5.6 Berth and unberth the vessel without tug-assistance
7.5.7 Use the propeller wash to clear the ice
7.5.8 Use the bow to plough away the ice
7.5.9 Recognise the efficient clearing/washing of ice between ship and berth using azipods
7.5.10 Take measures to prevent ballast tanks from freezing, when berthed (slack to below water level)
7.5.11 Maintain maximum safe draught while discharging by taking in ballast simultaneously
7.5.12 Recognise the forces of drifting ice when moored or docked
~~7.5.13 Take appropriate actions when moored or docked at river berths or in strong tidal areas, where ice is in motion~~
7.5.14 Recognise that mooring operations can be prolonged in cold climates
~~7.5.15 Moor to the ice edge~~
~~7.5.16 Prepare for and take appropriate action in the event of sudden ice break-up caused by wind/sea action~~
7.6 Getting beset
7.6.1 Apply correct procedures to try and avoid getting beset
7.6.2 Explain the importance of maintaining low revs on engine and movement of rudder in ice
7.6.3 Determine, once halted in ice, if ramming is advisable (e.g. better ice conditions ahead, chance of success, sufficient ice strengthening, bow-shape)
7.6.4 Execute ramming
7.6.5 Apply correct procedures once getting beset cannot be avoided
7.6.6 Report position and situation to icebreaker/approaching vessels etc. once beset
7.6.7 Explain the possibilities for trying to free your vessel once beset
~~7.6.8 Explain why it is advisable to wait for natural environmental changes~~
7.6.9 Explain the icebreaker operations to be expected for freeing a beset vessel and the dangers of these operations

8. Performance Monitoring

8.1 Deck equipment
8.1.1 Recognise potential problems with deck equipment due to sub-zero temperatures and describe measures to prevent them
8.1.2 Clear snow and ice from equipment and working areas regularly
8.1.3 Check operation of equipment regularly
8.1.4 Arrange windlass to be ready for operation at all times
8.2 Soundings
8.2.1 Explain why soundings may appear incorrect in a cold environment
8.2.2 Carry out regular soundings to detect damages (also empty tanks/void spaces)
8.3 Fire fighting systems
8.3.1 Explain the limitations of using CO_2 in sub-zero conditions
8.4 Fuel
8.4.1 Adjust the fuel oil heating system when moving from temperate areas to cold areas and vice versa to avoid extensive cooling or overheating
8.4.2 Recognise the expansion of fuel oil when moving from a cold to a warmer climate and take necessary measures to prevent spills
8.5 Damages
8.5.1 Describe the most common hull damages in ice operations, their cause and ways to avoid them
8.5.2 Describe the most common damages to machinery during ice operations, their cause and ways to avoid them
8.5.3 Describe the most common damages to engines during ice operations, their cause and ways to avoid them
8.5.4 Inspect vessel for mechanical and equipment damages, following de-icing operations
8.5.5 Inspect ship systems for vibration damage during ice operations
8.5.6 Describe the potential for damage to cathodic protection

List of items for interview **appendix 2**

WINMOS 5.1. ABOA MARE 2014-03

POSSIBLE ITEMS OF BALTIC ICE-NAVIGATION TRAINING

SEMI-STRUCTURED INTERVIEW

1. PLEASE LIST 3 MOST IMPORTANT THINGS THAT NEED TO BE TRAINED WITH
    a. OFFICERS OF MERCHANT VESSELS
    b. OFFICERS OF ICE BREAKERS
2. FOLLOWING IS A LIST OF TOPICS THAT COULD BE PART OF THE FUTURE TRAINING AND LEARNING MATERIALS FOR NAVIGATING IN ICE. PLEASE DISCUSS EACH ITEM

    - IS IT IMPORTANT IN TRAINING OF OFFICERS OF MERCHANT VESSELS / ICEBREAKERS?
    - WHAT ARE THE MOST IMPORTANT SUB-TOPICS UNDER EACH TOPIC? ONLY PART OR NONE OF THE SUB-TOPICS ARE LISTED BELOW.
    - WHAT ITEMS ARE MISSING AND NEED TO BE INCLUDED?
    - THE LIST IS BASED ON ICE TRAINING LITTERATURE, IMO AND OTHER RECOMMENDATIONS, CURRENT CONTENTS OF ICE NAVIGATION COURSES ETC.

1 Basics of Ice Operation

Ship-ice interaction, ship performance in ice
Ice conditions, ice qualities
Ice damages
Icing and ship stability

2 Ship design for Ice Operations

Typical hull forms
Propulsion concepts
Ice classification and ice strengthening

3 Safety & emergency equipment, survival

4 Engine department and technical items

5 Cargo handling & equipment

Tanker cargo systems & sub-zero temperatures

6 Management issues

Rules and regulations
Safety and Baltic Sea environmental aspects
Collaboration between fleet management
Maritime authorities and ships
Ice breakers, traffic restrictions

7 Voyage planning and preparations

Pilot books and navigations guides
Weather information systems
Ice information systems, ice codes and ice charts
Planning to approach to forthcoming ice fields
Real time information and route plan updates
Mandatory and voluntary reporting and information support

8 Watch-keeping during passage, ship handling in ice

Routines during navigation in open and ice infested sea areas
Use of radar
Drift ice / fast ice / Independent operation in different ice conditions
Avoiding damages to hull, rudder and propeller
Procedures when meeting and overtaking
Procedures during icebreaker assistance and towage
Operations under pilotage
Berthing and unmooring

APPENDIX 3

Course description of Basic Ice Training Course for Ship Officers

1 Basics of Ice Operation

Ship-ice interaction, ship performance in ice
Ice conditions, ice qualities
Ice damages
Icing and ship stability
Working in low temperature

2 Ship design for Ice Operations

Typical hull forms
Propulsion concepts
Ice classification and ice strengthening

3 Safety & emergency equipment, survival

Fire Fighting Equipment
Lifeboat, Life drafts
Survival suites

4 Engine department and technical items

Main Engine
Auxiliary Engine
Electrical Power Systems
Deck Machinery

5 Cargo handling & equipment

Cargo systems & sub-zero temperatures
Ballast water treatment

6 Management issues

Rules and regulations
Safety and Baltic Sea environmental aspects
Collaboration between fleet management
Maritime authorities and ships
Ice breakers, traffic restrictions

7 Voyage planning and preparations

Pilot books and navigations guides
Weather information systems
Ice information systems, ice codes and ice charts
Planning to approach to forthcoming ice fields
Real time information and route plan updates
Mandatory and voluntary reporting and information support
Bunker and other supplies
Draft, Trim, Ballasting

8 Watch-keeping during passage, ship handling in ice

Routines during navigation in open and ice infested sea areas
Use of radar
Drift ice / fast ice / Independent operation in different ice conditions
Avoiding damages to hull, rudder and propeller
Procedures when meeting and overtaking
Procedures during icebreaker assistance, convoying and towage
Operations under pilotage
Berthing and unmooring

9 Navigating in Arctic Areas (Optional)

Ship-ice interaction, ship performance in ice
Ice conditions, ice qualities
Ice damages
Icing and ship stability

Rules and regulations
Collaboration between fleet management
Maritime authorities, Ice breakers and ships

Ice Pilotage

10 Simulator training

Navigation in open and ice infested sea areas
Independent operation in different ice conditions
Avoiding damages to hull, rudder and propeller
Procedures when meeting and overtaking
Procedures and Communication during icebreaker assistance, convoying and towage
Berthing and unmooring

Basic Ice Training Course for Ship Officers fulfills requirements according to the Polar Code if section 9 is involved to Course content.

APPENDIX 4

Course description of Basic Training Course for Icebreaker officers

This course is a complement to Sea Captains and certifies to an endorsement as an Ice Navigator on Icebreakers.
The course is divided into two parts a theoretical, including simulator training, and a practical part onboard icebreakers.

1.1 Theoretical part

Weather and ice conditions
Sea ice
Ice conditions
Weather and wind

Navigating in ice
Radar navigation in ice
Nav. In the Archipelago
Nav. In coastal areas
Nav. In Sea ice

Assisting vessels
Basic maneuvers of icebreakers
Different maneuvers in ice during assistance of vessels
Convoying

Coordination and cooperation
Principal rules for supervising and assisting
Cooperation

Icebreakers
Icebreakers in the world and in the Baltic

Information's systems
IBNet

Reporting and supervising

Legislation
Legislation in different countries

Communication

1.2 Simulator training
Cutting loose vessels stuck in (both from front and rear)
Close assisting without towing
Towing, in notch and on long wire
Assisting in convoys
Overtaking and shifting convoys
Towing in Flaw

Communication

1.3 Self-study coastal geographic in the Baltic

2. Practical training (during 1-2 icebreaking seasons)

3. Evaluation and Assessment

Theoretical part, written test
Simulator training, briefing and debriefing.
Self-study, two written test of different areas
Practical training, seminar mark

All parts have to be fulfilled with approved knowledge before endorsement will be issued.