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# OPERATION OF SEAGOING CRUISE SHIPS IN POLAR WATERS OF THE ANTARCTICA

**Summary**. As maritime tourism has been developing dynamically in recent years, including cruises into polar areas, the author attempts to identify factors essential for the safety of navigation in those sea areas, with a specific focus on the waters of the Antarctica. The presented methods of navigation take account of hazards that are typical in polar waters. All the considerations are based on the guidelines of the Polar Code.

**Keywords:** safety of navigation; maritime tourism; Polar Code; Antarctica

## 1. LEGAL STATUS OF POLAR WATERS

Polar areas, including the Arctic and the Antarctic areas, are commonly perceived and treated as being similar. That said, there are a lot more differences than similarities. From the international law perspective, those areas have a separate status, with political, geographic and economic conditions excluding the possibility of one area adopting any of the normative solutions already in place in the other.

The legal system for the areas around the South Pole is based on the provisions of the Antarctic Treaty (Washington Treaty) of 1 December 1959 [1]. The subject of the treaty comprises an area located south of 60th parallel of south latitude, including all ice shelves. Recognizing that, in the interest of all mankind, the Antarctica should not become an arena or subject of international disputes, the parties to the Antarctic Treaty agreed that the Antarctic

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would be used exclusively for peaceful purposes. Over three decades later, on 4 October 1991, the Protocol on Environmental Protection to the Antarctic Treaty was signed in Madrid, under which the relevant parties committed to ensuring the comprehensive protection of the Antarctic environment, and its dependent and associated ecosystems, and rendering the Antarctic as a natural reserve, to be exclusively used for peaceful and scientific purposes.

International law gives no territorial claims to Antarctic territory, but, by introducing the above instruments, the claims on mainland Antarctica were 'suspended' for the duration of the treaty [4].

## 2. TYPES OF DIFFICULTIES POSING FAILURE RISKS TO VESSELS OPERATING IN ICE

Specific environmental conditions prevailing in the areas of ship operation enhance risk factors (icing of ship, low temperatures etc.), thus increasing the likelihood of a failure. Fig. 1 illustrates graphically the specifics of vessel operation in terms of environmentally increased risks affecting a ship's technical systems, cargo and people [2].

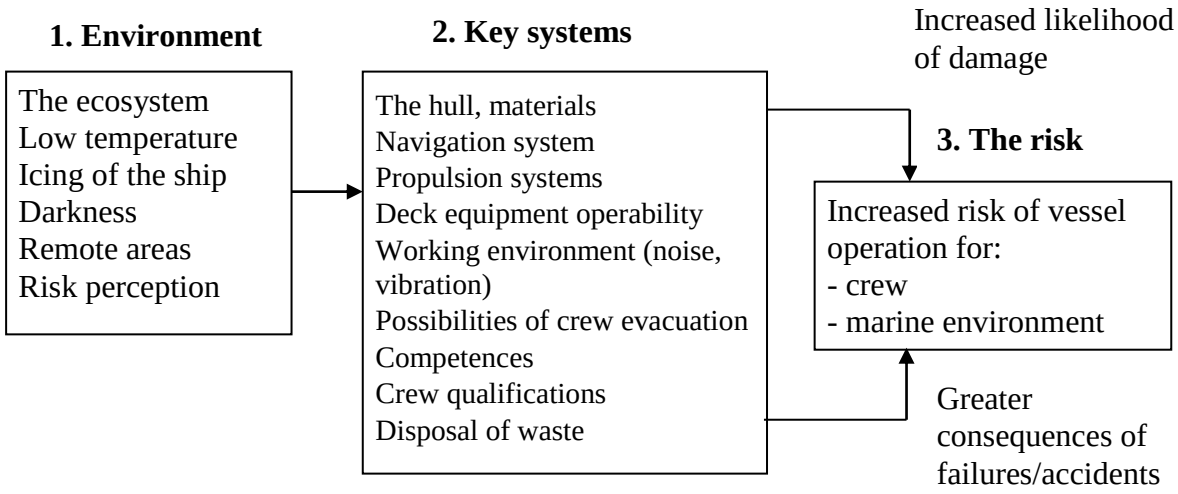


Fig. 1. Simplified model of failure risk during navigation in ice [2]

## 3. BASIC CONDITIONS OF SAFE SHIP OPERATION IN POLAR WATERS

Safe navigation in polar waters requires structural changes in the ship and specific crew behaviour. These include the following:

- Designed strengthening of the hull, rudder, shaft and propellers (according to ice class)
- Increased efficiency of the main engine (according to conditions of navigation in ice)
- Operational capability of marine systems in temperatures down to -40° and below
- Safe work of marine systems with ship's icing and after grounding
- Work of the crew on a continuous 24 h basis and in complete darkness (polar night)
- Work of the crew exposed to noise, impacts and vibration of the ship
- Maximized use of information in ice field forecasts, making use of experts' experience and assistance through cooperation with guidance centres for masters

- Development of operating procedures in various navigational emergency (higher risk) situations and ship failure in ice

In conclusion, a general relationship describing the total risk for a ship navigating in ice can be observed. The relationship comprises a sum of three risk groups: risk of damage of marine systems, failure to detect ice on a ship's route and the loss of human life.

The total risk of navigation in ice can therefore be written by this formula:

$$R_C = \sum R_E + \sum R_I + \sum R_H \tag{1}$$

where:
$\Sigma R_E$ – sum of risks associated with damage to technical systems on board
$\Sigma R_I$ – sum of risks of failure to detect ice on a ship's route
$\Sigma R_H$ – sum of risks associated with the threat of human life loss [2]

## 4. INTERNATIONAL LEGAL SOURCES GOVERNING ICE NAVIGATION AT SEA

The International Maritime Organization (IMO) has provided a number of conventions, codes and guides, which make up the legal basis governing marine navigation in ice and polar regions. The most important are:

- International Convention for the Prevention of Pollution from Ships (MARPOL 73/78 Marpol PROT 1997)
- International Convention for the Safety of Life at Sea – SOLAS 1974, with the protocols SOLAS PROT 1978, SOLAS PROT (HSC) 1988
- International Convention for the Safety of Fishing Vessels of 1977 with Annex to the Torremolinos Protocol of 1993

The International Code for Ships Operating in Polar Waters (Polar Code) [3] was developed to enhance navigation safety conditions in polar waters, i.e., in areas where navigation encounters specific difficulties, and to mitigate the effects of this type of navigation in the areas concerned. The Polar Code, another a regulatory instrument introduced by the IMO, entered into force on 1 January 2017 in the form of Chapter XIV of the 1974 SOLAS Convention (i.e., the International Convention for the Safety of Life at Sea).

The Polar Code distinguishes three ice classes of ships, namely:

1. Category A ships – designed for operation in polar waters in at least medium first-year ice, which may include old ice inclusions
2. Category B ships – capable of operating at least in thin first-year ice, which may include old ice inclusions
3. Category C ships – capable of operating in open water or in ice conditions less severe than those included in categories A and B

The Polar Code contents include the following parts: Introduction, including general provisions applicable to other parts of the code; Part I-A concerns the compulsory requirements of safety measures; Part I-B provides guidance for safety issues; Part II-A addresses pollution prevention measures relating to polar waters; and Part II-B deals with additional guidance relating to pollution prevention addressed in Part II-A.

The Polar Code is based on the analysis of factors causing increased navigational hazards in polar regions. These include thickness of ice, sub-zero temperatures, prolonged periods of day or night, far distance of vessels from stationary transmitting equipment, difficult rescue operations and extreme weather conditions.

The priority of the code is to ensure the safest possible operation in polar waters, which, due to the specific environment, are characterized by dynamic weather changes, difficulties in ship-shore communications, and uncertain navigational information.

## 5. MARITIME ANTARCTIC TOURISM

The International Association of Antarctic Tour Operators (IAATO) is an international organization founded in 1991. The main objective of its activities is the promotion of safe and environmentally friendly tourism to Antarctica. Initially established by seven operators offering trips to Antarctica, the IAATO currently comprises over 100 members from all over the world. The organized tours are in compliance with the Antarctic Treaty and a number of international safety- and protection-related conventions. The IAATO coordinates annual plans concerning the number of cruise ships headed to the Antarctic region, and the timing and number of ships calling at particular ports, harbours and bays/gulfs. One of the aims here is to control the number of tourists putting foot on the Antarctic shore in the same place at the same time (it should be no more than 100).

Tab. 1

The number of tourists who arrived in Antarctica during the 1990/91 to 2015/16 seasons

| Season | Number of tourists | Number of ships | Tourists from Poland |
|---|---|---|---|
| 2015/16 | 38,476 | 53 | 103 |
| 2014/15 | 36,702 | | 76 |
| 2013/14 | 37,405 | | 120 |
| 2012/13 | 34,354 | | 93 |
| 2011/12 | 26,509 | | 53 |
| 2010/11 | 33,824 | 42 | 37 |
| 2009/10 | 36,875 | | 79 |
| 2008/09 | 37,858 | | . |
| 2007/08 | 46,069 | | . |
| 2006/07 | 37,552 | | . |
| 2000/01 | 12248 | 18 | . |
| 1990/91 | 1,055 | | . |

Source: based on IAATO 2017

The IAATO publishes annual reports revealing the number of tourists arriving by sea or air. The base ports for ships are Ushuaia, Puerto Madryn, Port Hobart and Auckland. Although the analysis covers the 2000-2001 to 2015-2016 seasons (Table 1), the first marine tourists (194 in total) showed up in that region in the 1957/58 season during the Antarctic summer. In the past 10 years (2006/07 to 2015/16 seasons), however, the Antarctic continent has been annually visited by as many as 38,478 tourists. In the last season, 53 ships conducted commercial activities. Shipping in polar waters requires that ships, and their crews and systems, satisfy special requirements of the Polar Code.

## 6. CONCLUSIONS

Every year, the number of cruise ships and tourists in polar waters rises. Vessels in Arctic and Antarctic waters are particularly vulnerable to equipment failures and accidents, due to the presence of ice and icebergs. The IMO, after several years of discussions among experts, introduced the Polar Code, which that entered into force on 1 January 2017. The Polar Code includes regulations concerning the principles of construction, equipment and performance standards. Enhanced technical requirements and special training for crews will help to reduce risks to people and the polar marine environment.

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