INTERNATIONAL MARITIME ORGANIZATION

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SUB-COMMITTEE ON SHIP DESIGN AND EQUIPMENT
54th session
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DEVELOPMENT OF A MANDATORY CODE FOR SHIPS OPERATING IN POLAR WATERS

Comments on document DE 54/13/4

Submitted by the Russian Federation

SUMMARY

Executive summary:	This document contains proposals on the basic IMO requirements for ships operating in ice-covered polar waters to be included in Part A: Mandatory requirements and in Part B: Recommendations of the draft Polar Code
Strategic direction:	5.2
High-level action:	5.2.1
Planned output:	5.2.1.19
Action to be taken:	Paragraph 3
Related documents:	DE 52/26 (section 18); DE 53/18/1; DE 53/18/2; DE 53/18/3; DE 53/18/5; DE 53/18/6; DE 53/18/7; DE 53/18/8; DE 53/18/9 and DE 54/13/4

1 This document provides comments on the report of the Correspondence Group contained in the document DE 54/13/4 and is submitted in accordance with the provisions in paragraph 4.10.5 of the revised Guidelines on the organization and method of work of the MSC and the MEPC and their subsidiary bodies (MSC-MEPC.1/Circ.2).

2 On the basis of the longstanding experience of exploring the Arctic and Antarctic as well as ensuring safety of the navigation of ships in these regions, the Russian Federation proposes to include the following requirements and recommendations in the Polar Code:

Part A – Mandatory requirements

2 Definitions

"2 Under the icebreaking capability we understand a maximum thickness of level compact ice through which ship is capable to continuously move using full power at a minimum steady speed of about 2 knots (1 m/s). It is assumed that ice bending strength is not less than 500 kPa and ice has natural snow cover about 20-25 cm deep."

4 Classification and equivalency

4.1 Classification. All ships operating in polar waters covered with ice are assigned ice classes whose description is shown in table 4.1. On the basis of the navigational conditions presented in this table the requirements to ice strength and ice propulsion are imposed, which determine the difference between classes as far as the ship's structure and operational capabilities are concerned.

Table 4.1 – Description of polar classes

Polar class	General description of navigational conditions	Minimum level of icebreaking capability, m
PC 1	Year-round operation in all Polar ice-covered waters	[3.0]
PC 2	Year-round operation in moderate multi-year ice conditions	[2.4]
PC 3	Year-round operation in second-year ice which may include multi-year ice inclusions	[1.8]
PC 4	Year-round operation in thick first-year ice which may include old ice inclusions	[1.3]
PC 5	Year-round operation in medium first-year ice which may include old ice inclusions	[1.0]
PC 6	Operation during the summer-autumn period in open floating residual and young ice	[0.7]
PC 7	Operation during summer period in open floating residual ice cake	[0.5]

4.2 Equivalency. For the possibility to assess compliance with polar classes of the existing ships built under the supervision of different classification societies and the application for these ships of the requirements of the present Polar Code, data on the identification of ice classes based on the comparison of bow shell plating thickness shown in table 4.2 may be used.

Table 4.2 – Approximate correspondence between polar classes of IMO and ice classes of other classification societies

Classification Society	Ice Class				
IMO Polar Code	**PC2**	**PC3**	**PC4 / PC5**	**PC6**	**PC7**
Russian Maritime Register of Shipping (Rules 2007)	Arc9/Arc8	Arc7	Arc6	Arc5	Arc4
CASPPR, 1995	CAC2	CAC3	CAC4	A	B
American Bureau of Shipping	A4	A3	A2	A1	A0
Det Norske Veritas	POLAR-20	POLAR-15	POLAR-10 ICE-15	ICE-10 ICE-1A*	ICE-05 ICE-1A
Lloyd's Register	AC2	AC1.5	AC1	1AS	1A

Germanischer Lloyd	Arc3	Arc 2	Arc1	E4	E3
Finnish-Swedish Ice Rules	-	-	-	1A Super	1A
Bureau Veritas	-	-	-	1A Super	1A
Nippon Kaiji Kyokai	-	-	-	1A Super	1A
Korean Register of Shipping	-	-	-	ISS	IS1
China Classification Society	-	-	-	B1*	B1
Registro Italiano Navale	-	-	-	1AS	1A

5.3 Machinery

5.3.1 The installed power of the propulsion unit should be sufficient to provide ship of each polar class for a minimum admissible level of the icebreaking capability indicated in table 4.1 required for the safe navigation of ship with no risk of the environmental pollution under design ice and weather operational conditions.

5.9 Icebreaker escorting

5.9.1 To improve safety of the year-round operation of the fleet in polar waters with ice cover in the remote areas of the Arctic and Antarctic as well as when the icebreaking capability is insufficient, ships of all polar classes (except the highest PC 1 class as applied to the Antarctic) are in need of the icebreaker support. Required demand for the icebreaker support may be assessed by the ship icebreaker escorting schedules stated in Part B of the present Code.

PART B – Recommendations

4.1 Classification

For the estimation of icebreaking capability of polar ships with conventional icebreaking bow shape the following calculation (regression) formula may be used the latter being based on the analysis of the experience of construction and experimental investigators:

$$h_{л} = \frac{0{,}07 \cos^{\frac{3}{2}} \varphi \sqrt{\sin\left(\frac{\alpha_0 + \beta_0 + \beta_2}{3}\right)}}{\sqrt[6]{f_d}\sqrt[5]{L/B}\sin^{\frac{3}{2}}(90° - \beta_{10})} \sqrt{\frac{P_e}{B}}\sqrt[6]{D}\ , \text{m}$$

where

φ – stem angle, deg
α_0 – entrance angle of design water line, deg
β_0 – flare angle of frame line No.0, deg
β_2 – flare angle of frame line No.2, deg
β_{10} – flare angle amidships, deg
L – vessel's length at DWL, m
B – vessel's breadth at DWL, m
P_e – total propeller thrust, t
D – vessel's design displacement, t
f_d – coefficient of the dynamic ice/ship's hull friction.

Recommended values of $\mathbf{f_d}$ parameter:

- for stainless steel – 0.065,
- for *Inerta-160* coating – 0.072,
- for typical shipbuilding steel – 0.080.

Note: Frame lines are numbered from bow to stern

5.1 Design/structure/ice strength calculation

5.1.1 For the more precise definition of the safe navigation in ice it is recommended, similar to the Russian practice, to provide polar ships with the "Recommendations on ice safety" (Ice Certificate). This document is issued by the recognized competent organization on the basis of the examination of ice performance of ships depending on the structure, hull lines, dimensions and power. Safe speeds of ships under various ice conditions are determined by calculation taking into consideration specific character of the icebreaker escorting or independent sailing of ship.

5.9 Icebreaker escorting

5.9.1 To assess demand for the icebreaker support of ships of different polar classes it is recommended to use diagrams shown below in figure 9.1 for the Russian path of Arctic and figure 9.2 for the Antarctic representing the statistical dependency of admissible duration of the independent sailing of ship upon her icebreaking capability (polar class), area and season of operation.

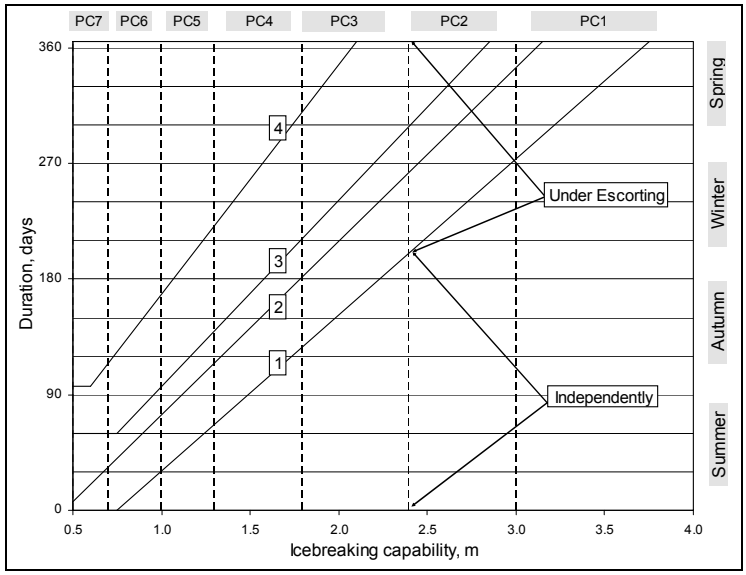

Figure 9.1 – Duration of the independent navigation of cargo ships in the Arctic versus their icebreaking capability:

.1 in transit navigation along the NSR and in the East Arctic region;

.2 in the West Arctic region;

.3 in the western part of the Kara Sea; and

.4 in the south-eastern part of the Barents Sea (Pechora Sea).

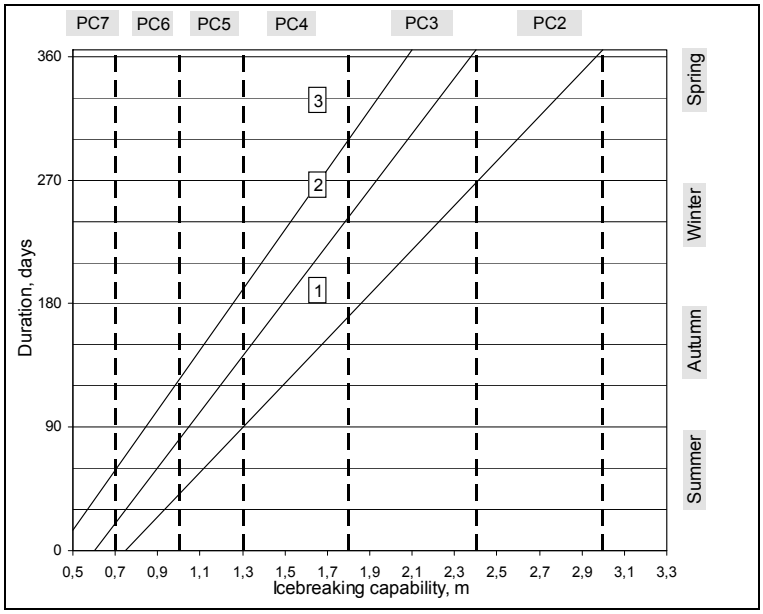

Figure 9.2 – Dependence between icebreaking capability and duration of independent navigation of icebreaking cargo ships in Antarctic:

.1 in regions 1 (Weddell Sea), 8 (Somov Sea), 10, 11 (Amundsen Sea and Bellingshausen Sea);

.2 in regions 2, 5 (Cooperation Sea), 9 (Ross Sea); and

.3 in regions 3 (Lazarev Sea and Riser-Larsen Sea), 4 (Kosmonavtov Sea), 6 (Davis Sea), 7 (Mawson Sea and Dumont d'Urville Sea).

Action requested of the Sub-Committee

3 The Sub-Committee is invited to consider the present proposal from the Russian Federation and take action as appropriate.