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"POLAR LOAD LINES" FOR MARITIME SAFETY: A NEGLECTED ISSUE IN THE INTERNATIONAL REGULATION OF NAVIGATION AND SHIPPING IN ARCTIC WATERS?

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1. Introduction

This paper discusses load lines for safe loading arrangements of vessels for international shipping in polar waters within the framework of a global system designed for safe carriage of goods and passengers. The International Convention on Load Lines (LLC), 1966 as amended, establishes a regulatory framework for the limits of loading of ships on international voyages.[1] The LLC is an important technical instrument that safeguards life and property at sea, but it is silent on load lines for international shipping in polar regions.

In recent years the International Maritime Organization (IMO) has had a flurry of regulatory activities resulting from concern over safety and environmental implications of increased international shipping in polar regions, especially in the Arctic. These include: an update to the International Convention for the Safety of Life at Sea, 1974 (SOLAS)[2] to include ice data in meteorological services and warnings, Ice Patrol Service and danger messages including for ice conditions;[3] the Intact Stability Code, 2008 recommendations regarding icing allowances in loading to ensure stability;[4] new navigation areas (NAVAREAS) and meteorological areas (METAREAS) and expansion of the World-Wide Navigational Warning System (WWNWS) into Arctic waters;[5] amendment of the Guidelines for Ships Operating in Arctic Waters, 2002 in 2009 to include Antarctic waters, now known as the Polar Guidelines;[6] amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW) regarding training for Arctic seafarers;[7] adoption of the Guidelines on Voyage Planning for Passenger Ships in Remote Areas[8] and Guide to Cold Water Survival;[9] a mandatory ship reporting system for vessels of 5000 and more tons for the

[1] International Convention on Load Lines, 5 April 1966, 640 UNTS 133 (in force 21 July 1968) [hereafter LLC].
[2] International Convention for the Safety of Life at Sea, 1 November 1974, 1184 UNTS 2 (in force 25 May 1980) [hereafter SOLAS].
[3] SOLAS, ibid., Chap. V, Arts. 5, 6, 31, 32.
[4] Intact Stability Code, IMO Doc. MSC 85/26/Add.1/Annex 2, 4 December 2008 (in force 1 July 2010), Chap. 6.
[5] Global Maritime Distress and Safety System (GMDSS), report on the Arctic MSI Services, IMO Doc. COMSAR 15/3/9, 23 December 2010.
[6] Guidelines for Ships Operating in Polar Waters, Resolution A.1024(26), 2 December 2009, IMO Doc. A 26/Res.1024 18 January 2010 [hereafter Polar Guidelines].
[7] International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, London, 7 July 1978, 1361 UNTS 2, as amended by the Manila Amendments, Final Act of the Conference of the Parties, IMO Doc. STCW/CONF.2/33, 1 July 2010), Resolution 11 and Section B-V/g.
[8] Guidelines on Voyage Planning for Passenger Ships Operating in Remote Areas, IMO Doc. A25/Res.999, 3 January 2008.
[9] Guide to Cold Water Survival, IMO Doc. MSC.1/Circ.1185, 31 May 2006.

Barents Area;[10] and consideration of a proposal to include the Iridium mobile satellite system, with its cover of polar regions, in the Global Maritime Distress and Safety System (GMDSS).[11] Recent amendment of the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) provides a procedure for carriage of cargo at low temperature.[12] Currently, the IMO is developing a mandatory Polar Code[13] to apply in association with a new Chapter XIV of SOLAS and amendments to Annexes 1, 2, 4 and 5 of the International Convention for the Prevention of Pollution from Ships, 1973/78 (MARPOL).[14] This paper raises the question whether the regulation of navigation in the Arctic should also address load lines requirements.

The paper starts by setting out the historical context of load lines, presents a rationale for discussion of the LLC in a polar context, revisits the functions and framework of the LLC with an Arctic perspective, and considers intact stability provisions in the emerging mandatory Polar Code, SOLAS requirements and the Intact Stability Code. The presentation concludes with reflections on the nascent standard of polarworthiness. Given the fundamental physical change occurring in Arctic waters and growing international polar shipping, an important question is whether we can or should assume that the LLC at this time is sufficient to address the loading safety needs of Arctic shipping, and if not, whether it should be revisited to consider dedicated load lines and practises for loading operations in Arctic waters.

2. Historical context

Load lines are possibly one of the oldest maritime safety issues to be addressed by regulation. Concern with the safe loading of ships can be traced as far back as the Rhodian Sea Law and Roman times, but the earliest precursors of load lines as regulated markings on the hull of a vessel likely date back to the practices of maritime city states in the 13th and 14th century Mediterranean, in particular Venice and Genoa.[15] As a subject of international regulation, at least at a bilateral or subregional if not global level, the pre-modern era of load lines regulation started with the United Kingdom, in particular with the legislation of the "Plimsoll Act" in the last quarter of the 19th century.[16] The national regulation of load lines thereafter spread to other maritime trading nations in the late 19th and early 20th centuries with the effect that national load

[10] Adoption of a New Mandatory Ship Reporting System in the Barents Area (Barents SRS), Resolution MSC.348(91), 28 November 2012, IMO Doc. MSC 91/22/Add.2, Annex 27.

[11] Radiocommunications and Search and Rescue, Recognition of the Iridium Mobile-satellite system, IMO Doc. MSC92/9/2, 9 April 2013.

[12] International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk, Art. 18.5, in Amendments to the 1974 SOLAS Convention and associated instruments, IMO Doc. , MSC 93/3, 6 December 2013, Annex 6.

[13] Ship Design and Construction: Development of a Mandatory Code for Ships Operating in Polar Waters, Report of the Working Group (part 2), IMO Doc. MSC 93/WP.7/Add.1, 21 May 2014. The report consists of a narrative [hereafter SDC Report] and an annex containing the code [hereafter Draft Polar Code].

[14] International Convention for the Prevention of Pollution from Ships, 2 November 1973, 1340 UNTS 184 as amended by Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships of 1973, 17 February 1978, 1340 UNTS 61 (in force 2 October 1983, Annexes I & II) [hereafter MARPOL].

[15] P. Boisson, *Safety At Sea. Policies, Regulations and International Law* (Paris: Edition Bureau Veritas, 1999).

[16] Nicolette Jones, *The Plimsoll Sensation. The Great Campaign to Save Lives at Sea*, (London: Little, Brown, 2006).

lines regulations were applied to international shipping calling in those ports. Much as load lines were considered important for maritime safety, there was lack of uniformity among national standards as a result of competitive loading practices often undertaken at the expense of safety.[17]

The modern era of load lines regulation started with the advent of intergovernmental organizations dedicated to navigation and shipping.[18] These organizations elevated load lines regulation from a national, bilateral and sub-regional level to a global level. The first international convention on load lines was adopted in 1930,[19] with five States as parties, but including the United Kingdom which at the time accounted for the largest fleet in the world. It was not until the advent of the IMO that a truly global international instrument would be adopted. The LLC was adopted on 5 April 1966 and came into force on 21 July 1968. Its subscription consists of a large number of States representing more than 99% of global tonnage.[20] It was substantially amended in 1988,[21] 2003[22] and more recently with regard to the code for recognized organizations and the Code for the Implementation of IMO Mandatory Instruments, 2011.[23] The purpose of the Convention is described as a desire "to establish uniform principles and rules with respect to the limits to which ships on international voyages may be loaded having regard to the need for safeguarding life and property at sea."[24] In reality, the LLC contains more than load lines regulations and addresses broader safety matters through technical requirements for structure, openings, guard rails and means for safe passage for crew protection, stowage, etc.[25] A particular feature of the LLC is the designation of load lines for particular zones (covering the various maritime trading regions) and seasonal (summer and winter) loading limits with start and end dates.[26]

3. Rationale for discussing load lines in a polar context

In comparison to established trade routes, the Arctic is a new maritime trading region where navigation conditions are different. There are at least three reasons why a discussion of load lines for Arctic waters is appropriate and timely. First, Annex II of the LLC does not contain dedicated Arctic zones and seasons as is the case for other maritime trading regions.[27] This was not a gap at the time the Convention was negotiated and adopted because in the 1960s international

[17] Boisson, supra note 15; C. Earnest Fayle, *A Short History of the World's Shipping Industry* (New York: Routledge, 2010).
[18] Boisson, supra note 15.
[19] International Convention respecting Load Lines, 5 July 1930, TS 858 vol. 2, 1076.
[20] IMO, online: <http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-on-Load-Lines.aspx>.
[21] Protocol of 1988 relating to the International Convention on Load Lines, 1966, 11 November 1988, 2 UST 102 (in force 3 February 2000; further amendments adopted in 2003 came into force on 1 January 2005). The 1988 Protocol streamlined surveying and certification requirements with those of SOLAS and MARPOL and simplified the amendment procedure to provide for tacit acceptance.
[22] Consisting of comprehensive revision of technical regulations. Adopted through the tacit approval procedure in June 2003 and entered into force on 1 January 2005.
[23] IMO Doc. A 27/Res.1054(27), 20 December 2011.
[24] LLC, supra note 1, Preamble.
[25] LLC, ibid., Annex I.
[26] LLC, ibid., Annex II.
[27] LLC, supra note 1, Annex II.

navigation and maritime trade in the Arctic were very limited and national. Polar-specific load lines for international shipping were unnecessary. Since then commercial activities in the Arctic have increased to the extent that there is discrete but visible growth in international maritime trade in and through the region.[28] Vessels transiting the Northern Sea Route (NSR) generally commence their voyages in North Atlantic Waters, North Sea or Baltic Sea and terminate in the Sea of Japan or China Sea, and vice versa. The voyage entails different zones and seasons. Given the absence of dedicated international "polar load lines" the current practice is to utilize the North Atlantic Winter Zone 1 (NAW 1) and North Atlantic Winter 2 (NAW 2) load lines for international shipping in the Arctic. Ice navigation may affect the freeboard of a vessel.

Second, recent and current initiatives to develop international polar standards for navigation safety do not address load lines. The Polar Code has no provisions and makes no mention of load lines in the Arctic and Southern Ocean. The development of the Code has considered a broad range of other safety and environmental instruments, including intact stability. Discussions in the IMO did not consider whether polar-specific, let alone Arctic load lines, should be developed or existing practices validated or confirmed. This appears to be also the case in the International Association of Classification Societies (IACS). In operation since 2008, the IACS Unified Requirements for Polar Class, while referring to ice loads for polar class ships and providing for upper and lower ice waterlines, do not address load lines, for example to elaborate on upper and lower water ice waterlines.[29]

Third, the load line requirements distinguish between requirements for sea water and fresh water.[30] Fresh water is less dense than saline sea water, affecting draught and loading capacity. Thus Canada has load lines for vessels navigating the Great Lakes that differ from those for seagoing vessels.[31] The justification lies in the nature of the water regime. Although the presence of fresh water in the Arctic Ocean has been known for some time, recent scientific literature suggests that there may be more fresh water on the surface than previously thought. Rabe et al. note that "liquid freshwater determines upper ocean stratification and plays a major role in Arctic Ocean dynamics, and the formation of water masses and sea ice."[32] They note that as much as 10% of worldwide river runoff goes into the Arctic Ocean. Their work focused on liquid freshwater content above the 34 isohaline. For the 1992-2012 the change amounted to an increase of 30% of liquid freshwater reservoir, larger than the average annual export of liquid and solid freshwater. In another study, De Steur et al. concluded that "[H]ydrographic data from the Arctic Ocean show that fresh water content in the Lincoln Sea, north of Greenland, increased significantly from 2007 to 2010, slightly lagging changes in the eastern and central Arctic."[33]

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[28] For example, see transit statistics for the Northern Sea Route, online: http://www.arctic-lio.com/nsr_transits.

[29] International Association of Classification Societies, Requirements Concerning Polar Class, IACS Req. 2011, online: http://www.iacs.org.uk/document/public/Publications/Unified_requirements/PDF/UR_I_pdf410.pdf.

[30] LLC, supra note 1, Art. 12 (submersion rule).

[31] Load Line Regulations (SOR/2007-99), s 8.

[32] B. Rabe et al., "Liquid export of Arctic freshwater components through the Fram Strait 1998 – 2011," *Ocean Science* 9, 91-109 (2013); see also B. Rabe et al., "An assessment of Arctic Ocean freshwater content changes from the 1990s to the 2006-2008 period," *Deep-Sea Research* I, 58185, 173 (2011) .

[33] L. de Steur et al., "Hydrographic changes in the Lincoln Sea in the Arctic Ocean with focus on an upper ocean freshwater anomaly between 2007 and 2010," *Journal of Geophysical Research: Oceans*, 118, 4699–4715 (2013); see also L. de Steur et al., "Freshwater Fluxes in the East Greenland Current: A decade of observations," *Geophysical Research Letters*, 36, L23611 (2009).

They noticed an anomaly produced by a decrease in the upper ocean salinity. The total volume of anomalous fresh water in the Lincoln Sea was approximately 13% of the total estimated fresh water in the region in 2008 before it was exported. This science does not appear to have yet proposed a connection between increased fresh water amounts and sufficient change in the water regime as to affect navigation safety. Considered from a maritime perspective, is the increase of fresh water on the surface of the Arctic Ocean to such an extent as to make a difference for navigation safety? Are the changes in the water regime (i.e., surface navigable waters) temporary or prolonged? Is the water regime still fundamentally seawater or is it analogous to the mixed waters of an estuary or perhaps closer to the Great Lakes, i.e., fresh water? Are there seasonal salinity changes to be concerned about? Is it conceivable that the reserve buoyancy and freeboard requirements should be different than those for the North Atlantic Winter? More scientific work and consideration by marine architects are needed.

4. Regulatory framework for load lines and ship stability

A closer look at some of the key provisions of the LLC with an Arctic perspective provides more insights. The Convention applies to vessels on international voyages,[34] but does not include every category of vessel[35] navigating in all waters.[36] Thus in principle, if the LLC were to apply to all Arctic waters, the Convention would cover transit shipping (e.g., from Shanghai to Rotterdam) and international destination traffic (e.g., export of iron ore from Kirkenes, Northern Norway, to Qingdao, China) in the Arctic. The rules apply to designated marine regions as defined in Annex II,[37] although as will be seen below, they expressly apply to Arctic waters only in part.

A key requirement of the LLC is the issuance of the required International Load Line Certificate, where appropriate, an International Load Line Exemption Certificate.[38] No ship is permitted to leave port without this certificate.[39] There is a system of reciprocal recognition of such certificates by State Parties.[40] While baseline standards are set out in the Convention,

[34] "International voyage" means a sea voyage from a country to which the present Convention applies to a port outside such country, or conversely. LLC, supra note 1, Art. 2(4).

[35] Fishing vessels are exempted; LLC, supra note 1, Art. 5. Art. 6 provides for other exemptions. There are specific rules for fishing vessels in the Intact Stability Code, supra note 4, and Cape Town Agreement of 2012 on the Implementation of the Provisions of the 1993 Protocol relating to the Torremolinos International Convention for the Safety of Fishing Vessels, 11 October 2012 (not yet in force).

[36] Vessels navigating solely in specified waters within national jurisdiction and which are essentially fresh water regimes (e.g., Great Lakes and St Lawrence Seaway, Caspian Sea and Rio de la Plata estuary and inland waters) are not subject to the Convention. LLC, supra note 1, Art. 5. In Canada and Russian waters on the landward side of straight baselines from which the outer limits of the territorial sea are determined raise an interesting question of application.

[37] LLC, ibid., Art. 11.

[38] LLC, ibid., Art. 3(1).

[39] LLC, ibid., Art. 3(1).

[40] LLC, ibid., Art. 20. An interesting question is whether certificates issued by Arctic States stipulating load line requirements different from those in the LLC would also be recognized by other States. Art. 22(2) of the United Nations Convention on the Law of the Sea provides that in regulating innocent passage coastal State "laws and regulations shall not apply to the design, construction, manning or equipment of foreign ships unless they are giving effect to generally accepted international rules or standards." United Nations Convention on the Law of the Sea, 10 December 1982, 1833 UNTS 3.

national maritime administrations may assign a greater freeboard than the minimum freeboard determined in accordance with Annex I.[41] States will not do this lightly as in practice it entails a self-imposed loading restriction that might be unattractive to shipowners seeking to register their vessels under conditions that maximise their loading and consequently trading potential. The Convention also foresees situations where a maritime administration requests another to survey a particular ship and issue the international load line certificate.[42] This provision could be useful for those flags which lack capacity or may not have the surveying capacity in the port where the vessel concerned is located. For example Arctic coastal States can perform this function on behalf of non-Arctic requesting flag States. International certificates are accepted by other State Parties.

The Convention has a rule regarding submersion, which essentially maintains a distinction between sea water and fresh water for load line purposes.[43] This could be useful if it turns out that the change in water regime in the Arctic should lead to different load lines for different areas. An interesting question to consider is whether the Arctic Ocean might need a dedicated system of zones and seasons, reflecting the navigable periods and water and ice regimes. The LLC permits special rules that may be drawn up by all or some States by agreement, but in accordance with the Convention.[44] This could be of interest to Arctic States, should they decide that polar load lines are needed. There are good reasons why Arctic States should cooperate together, as well as through the IMO, not least of which because of a recommendation concerning the harmonization of standards for shipping regulation in the region made in the Arctic Council's *Arctic Marine Shipping Assessment* 2009 report.[45] Should they agree on regional special rules, the LLC requires them to communicate these to the IMO for circulation to other State Parties.[46] However, this provision permits Arctic States to develop regional rules applicable only to ships flying their flags. The LLC does not confer any additional jurisdiction to coastal States and for port state inspection purposes the applicable rules are those in the Convention itself.

The technical regulations for determining load lines are set out in Annex I. They are based on the assumption that cargo is properly stowed, ballast is proper and stability requirements under other regulations are properly met (e.g., Intact Stability Code).[47] The Intact Stability Code is a mandatory SOLAS code and vessel stability standards and rules have also been made mandatory for the LLC by the 1988 Protocol.[48] In Chapter 6 the Code stipulates an icing allowance requirement for loading conditions for ships operating in areas where ice accretion which could affect ship stability.[49] This requirement is accompanied by advice to maritime administrations "to take icing into account and are permitted to apply national

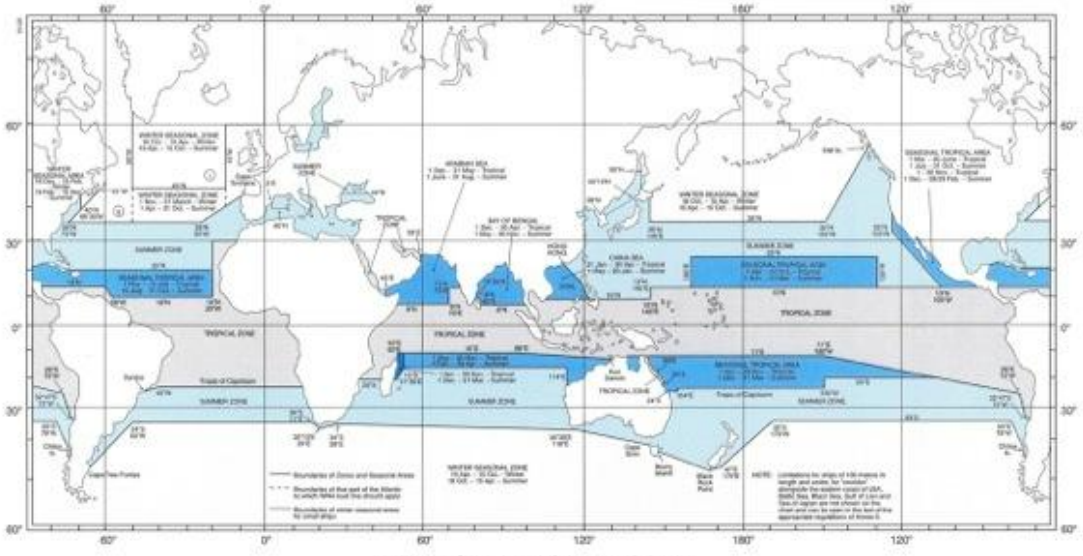
[41] LLC, supra note 1, Art. 3(2).
[42] LLC, ibid., Art. 17.
[43] LLC, ibid., Art. 12.
[44] LLC, ibid., Art. 25.
[45] *Arctic Marine Shipping Assessment 2009 Report* , recommendation I/B at p. 10, online: <http://www.pame.is/amsa-2009-report>.
[46] LLC, supra note 1, Art 25.
[47] LLC, ibid., Annex I, Chap. 1.
[48] LLC Prot, supra note 21, Arts. 10 (information supplied to the master), 27 (freeboards/conditions of equilibrium), and 44 (stowage).
[49] Intact Stability Code, supra note 4, Art. 6.1.1.

standards where environmental conditions are considered to warrant a higher standard than those recommended in the following sections." This provision supports Arctic coastal State requirements to apply higher safety standards.

Ships are required to comply with intact stability standards and the maritime administration is responsible for satisfying itself that the ship's general structural strength is adequate for the draught corresponding to the assigned freeboard. Compliance with class requirements in accord with national standards may satisfy this requirement.[50] Shipmasters are to be provided with information for the loading and ballasting of their ships to minimize structural stresses.[51] The LLC does not appear to factor additional risks encountered in navigating polar environments, such as the extreme cold temperatures, navigating through ice fields and including icebreaking for higher polar class vessels. These factors are likely to pose further stresses on the hull, in addition to the nature, stowage, and lashing of cargo and ballast segregation. It would be appropriate to contextualize loads with reference to the voyage and type of the vessel.

The LLC's Annex II prescribes the zones and seasonal areas and periods for load lines (see Map 1). The northernmost LLC zones in Arctic waters are covered by the definition of North Atlantic Winter Seasonal Zone I. This zone "lies within the meridian of longitude 50°W from the coast of Greenland to latitude 45°N, thence the parallel of latitude 45°N to longitude 15°W, thence the meridian of longitude 15°W to latitude 60°N, thence the parallel of latitude 60°N to the Greenwich Meridian, thence this meridian northwards."[52]

MAP 1: Load Lines Convention



[50] LLC, supra note 1, Annex I, Reg. 1.
[51] LLC, ibid., Annex I, Art. 10(1).
[52] LLC, ibid., Annex II, Art. 46(1).

Even if this definition is interpreted to continue indefinitely northwards into the Central Arctic Ocean, only a relatively small area of the region is covered and the current major maritime routes through the Northwest Passage and Northern Sea Route are not included. A strict interpretation suggests that the North Atlantic Winter Seasonal Zone 1 applies only to Eastern Greenland's waters. The definition of the North Atlantic Winter Seasonal Zone II is not of assistance either.[53] Thus the general load line for the Winter North Atlantic was not expressly intended to apply for much of the Arctic.[54] Its application to other Arctic waters appears to have been a matter of convenience. As international shipping in the region increases, the scope of application of the LLC to Arctic waters is likely to be unsatisfactory and could require the inclusion of new Arctic zone(s) in Annex II or an extension of the Winter North Atlantic Zone 1 to Arctic waters.

Work on the mandatory Polar Code is vital for promoting maritime safety in international Arctic (and Antarctic) shipping. The current version of the draft Code addresses requirements for maritime safety (design, construction, equipment, operational, training), search and rescue and pollution from ships.[55] The definition of Arctic waters originally drawn from the 2009 Polar Guidelines is relegated to the new Chapter XIV of SOLAS.[56] "Arctic waters" as understood in the IMO for regulatory purposes to date do not coincide with the geographical scope of any of the LLC zones (see Figure 2).

The Polar Code provisions of closest relevance to the LLC concern intact stability, but they largely address topside icing and a vessel's stability after it suffers damage, e.g., if it

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[53] "The North Atlantic Winter Seasonal Zone II lies within the meridian of longitude 68°30'W from the coast of the United States to latitude 40°N, thence the rhumb line to the point latitude 36°N, longitude 73°W, thence the parallel of latitude 36°N to longitude 25°W and thence the rhumb line to Cape Toriñana." "Excluded from this zone are the North Atlantic Winter Seasonal Zone I, the North Atlantic Winter Seasonal Area and the Baltic Sea bounded by the parallel of latitude of the Skaw in the Skagerrak. The Shetland Islands are to be considered as being on the boundary of the North Atlantic Winter Seasonal Zones I and II." LLC, Annex II, Reg. 46(1). Similarly unhelpful is the North Atlantic Seasonal Area, defined as "is the meridian of longitude 68°30'W from the coast of the United States to latitude 40°N, thence the rhumb line to the southernmost intersection of the meridian of longitude 61°W with the coast of Canada and thence the east coasts of Canada and the United States." LLC, ibid., Art. 46(2).

[54] "The part of the North Atlantic referred to in Regulation 40 (6) (Annex I) comprises:

(a) that part of the North Atlantic Winter Seasonal Zone II which lies between the meridians of 15°W and 50°W;

(b)the whole of the North Atlantic Winter Seasonal Zone I, the Shetland Islands to be considered as being on the boundary."

LLC, ibid., Annex II, Art., 52. Art. 40(6) provides the Winter North Atlantic freeboard as follows: **"**The minimum freeboard for ships of not more than 100 m in length which enter any part of the North Atlantic defined in regulation 52 (Annex II) during the winter seasonal period shall be the winter freeboard plus 50 mm. For other ships, the winter North Atlantic freeboard shall be the winter freeboard."

[55] Draft Polar Code, supra note 13.

[56] SDC Report, supra note 13, para. 5. Arctic waters are defined as "[… those waters which are located north of a line from the latitude 58º00´0 N and longitude 042º00´0 W to latitude 64°37´0 N, longitude 035°27´0 W and thence by a rhumb line to latitude 67º03´9 N, longitude 026º33´4 W and thence by a rhumb line to Sørkapp, Jan Mayen and by the southern shore of Jan Mayen to the Island of Bjørnøya, and thence by a great circle line from the Island of Bjørnøya to Cap Kanin Nos and hence by the northern shore of the Asian Continent eastward to the Bering Strait and thence from the Bering Strait westward to latitude 60ºN as far as Il'pyrskiy and following the 60th North parallel eastward as far as and including Etolin Strait and thence by the northern shore of the North American continent as far south as latitude 60ºN and thence eastward along parallel of latitude 60ºN, to longitude 56º37´1 W and thence to the latitude 58º00´0 N, longitude 042º00´0 W (see figure 2).]" Polar Guidelines, supra note 6, Art. G-3.3.

sustains water ingress as a result of hull penetration after striking ice.[57] The Code provides for the issuance of a Polar Ship Certificate,[58] required to be kept on board just like the international load lines certificate.[59] The issuance of the certificate does not appear to need to consider load line issues, although it is expected to take into consideration the anticipated range of operating conditions.[60] The Code also introduces the concept of "Polar Service Temperature" requiring that ship systems and equipment are fully functional at the expected low temperatures.[61] The explanation provided by the SDC Working Group is that

> 18. For ships intended to operate in low air temperatures, the Polar Service Temperature will be shown on the Polar Ship Certificate. This indication of capability will be used in voyage planning and operations to reduce the risk of experiencing conditions that may reduce the functionality of essential safety equipment.
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> 19. Using this approach to the implementation of temperature-related requirements is intended to clarify the threshold below which ships may be required to adopt additional design and operational measures and which can be readily adapted into the testing and certification systems used in the few areas in which SOLAS currently addresses temperature. It was noted by IACS that the approach could be aligned with existing standards developed by IACS.[62]

Concern has been raised that the concept of Polar Service Temperature may have been developed "in haste, without a sufficient understanding of the technical justification and likely impact on the design and equipping of both new and existing ships."[63] It is also to be noted that load line issues do not appear to have been addressed in formulating the concept of Polar Service Temperature.

Against this backdrop, the question to consider is whether the Polar Code will also need to cross-refer to the LLC as a key instrument in maritime safety. The Code anticipates review and possible amendment within a few years of entry into force in response to technological and other developments.[64]

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[57] Draft Polar Code, ibid., Part I - A, Chap. 4, Stability and Subdivision.
[58] Defined as "… a certificate issued by the Administration or by an organization recognized by the Administration [indicating] [defining] the environmental conditions and operational capability for which the ship has been designed for operation in polar waters." Draft Polar Code, ibid., Part I – A, Art. 2.15.
[59] Draft Polar Code, ibid., Part I – A, Chap. 1, Art. 1.4. As in the case of the load lines certificate, the Polar Ship Certificate shall be issued or endorsed either by the Maritime Administration or by any person or organization (e.g., a classification society) recognized by it in accordance with SOLAS regulation XI-1/1. Ibid., Art. 1.4.2. Endorsement and renewal dates are expected to be harmonized with other SOLAS certificates.
[60] Draft Polar Code, ibid., Art. 4.1.
[61] Defined as "…a temperature at least [100C] [2 □] below MDLT for the intended operation in polar areas." Draft Polar Code, ibid., Art. 2.14 and 1.5.
[62] Development of a Mandatory Code for Ships Operating in Polar Waters: report of the Working Group, IMO Doc. SDC 1/WP.4, 24 January 2014, paras. 18-19.
[63] A concern expressed by the International Chamber of Shipping and Cruise Lines International Association. Ibid., para. 20.
[64] Draft Polar Code, supra note 13, Art. 1.6.1

5. Conclusion: towards polarworthiness?

Regulatory activity in the IMO, in particular on the Polar Code, amendments to SOLAS and MARPOL, ice provisions in the Intact Stability Code and polar seafarer training in STCW collectively may be characterized as steps towards the development of a new standard of seaworthiness appropriate for polar regions, i.e., polarworthiness. These are initial steps in an iterative and adaptive process of regulation. Polar standards should be expected to evolve considerably as understanding of ocean change increases, commercial interest continues to grow, impacts of shipping on the environment are better defined, connections between various IMO instruments are enhanced, polar technology develops further and training of polar seafarers expands.

Ultimately, the rationale for revisiting the LLC is to underscore the need for a better understanding of the standard and elements of seaworthiness in a changing polar environment. The difficult navigation conditions in the Arctic require a high standard of seaworthiness in all its aspects. It should be remembered that seaworthiness as a key concept in domestic and international public and private maritime law and is of significance not only for maritime safety purposes, but also as a principle that guides risk distribution in maritime contracts. Seaworthiness plays an important role in charterparties, bills of lading, passenger carriage, marine insurance and towage, among other standard forms. Historically, it can be demonstrated that advances in maritime safety standards have tended to enhance international shipping. In the Arctic, high standards speak to viability in the first place.