Polar Code on Roger Revelle
The what, why, where, and how
What is the Polar Code?

The polar code is Chapter XIV - Safety measures for ships operating in polar waters in the International Convention for the Safety of Life at Sea (SOLAS).

The U.S.A ratified the code on Oct 7 1977 and the code entered into force on May 25 1980. All SOLAS vessels are to comply with the code.
Why was the Polar Code developed?

The Polar Code has been developed to supplement existing IMO instruments in order to increase the safety of ships' operation and mitigate the impact on the people and environment in the remote, vulnerable and potentially harsh polar waters.
Where is it applicable in Arctic waters?
Where is it applicable in Antarctic waters?
How is the Polar Code structured?
(MEPC 68/21/Add.1 Annex 10)
How does one comply with the polar code?

The Polar Water Operations Manual with as output the Polar Ship Certificate serves two purposes:
1. It is a risk mitigation tool. It identifies the equipment on board and its capabilities as it relates to the polar environment and location.
2. It is a document for future reference for the crew that have certain strategies to cope with low temperatures and ice.
The Sequence of work

Environmental Assessment • 16 hours

Operational assessment • 92 hours

Development of PWOM • 108 hours

ABS Regulatory Review & issuance of Polar Certificate • 20 hours

An ABS-POLARIS (Polar Operational Limit Assessment Risk Index System) analysis for ice operational limitations based on the vessels’ approximate correspondence ice class (Ice Class IC);
• a temperature analysis for temperature limitations and determine applicability of low temperature and ice accretion requirements.
• Ice Accretion analysis
• Sea Water Temperature analysis
Precipitation analysis
• Hours of daylight/darkness analysis
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ABS facilitated a workshop with the ship owner’s personnel and Glosten personnel. In general, the specific scope of the workshop is highly dependent upon the extent of the operation (risk of encountering ice and/or low air temperature and level of ice class) and has 2 day duration. (Brainstorming on operational risks)
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  - 16 hours

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  - 20 hours

To write the PWOM. An ABS Polar Code Subject Matter Expert (SME) will be available to offer guidance as needed to ensure the operational assessment report and PWOM are easily reviewed while also being useful for the ship’s crew for operations to polar waters. The SME will be available for phone calls, online meetings, emails, etc. More than half of all the effort is for the creation of this manual. In practice this was a lot of joint editing with Glosten and SIO.
The Sequence of work

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If a physical survey is required, the Engineering Review will identify items to be verified by the attending surveyor.

If the survey is not required, the engineering documentation review may lead to issuance of the Polar Ship Certificate (PSC).

(In Revelle’s case there was one final verification attendance)
How did the Roger Revelle satisfy the requirements?

The limitations depend on the complexity of risk mitigation: We tailored the polar ship certificate to our needs to avoid excessive work and cost:

- Limited to open waters only (= ice concentrations of less than 1/10th)
- Limitation to the lesser of 80° (Purposely no North or South hemisphere defined)
- Air temperature limitation
What are our operational limitations based on?

<table>
<thead>
<tr>
<th>Issue</th>
<th>Limitation</th>
<th>Reason</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Ice conditions</td>
<td>Limited to open waters [≤10% Ice] and no ice</td>
<td>Training requirements: we have not trained our crew as per the polar code requirements</td>
<td>The vessel was not close enough to warrant the expense.</td>
</tr>
<tr>
<td></td>
<td>accretion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.2 Air temperature</td>
<td>Limited to -10°C</td>
<td>The Revelle has a design service temperature of 0°F (-17.8°C) and carries no winterization notations.</td>
<td>This temperature limitation, as well as the limitations of Ice Class C, were considered during the assessment of environmental hazards (ABS 2022b).</td>
</tr>
<tr>
<td>5.3 80 latitude limitation</td>
<td>80 degrees.</td>
<td>No GNSS compass on board</td>
<td>For our purposes this was a perfect concession as 80 degrees south is 90% land, and far away from our stations.</td>
</tr>
</tbody>
</table>
### Training Requirements

<table>
<thead>
<tr>
<th></th>
<th>TANKERS</th>
<th>PASSENGER SHIPS</th>
<th>OTHER SHIPS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In ice-free waters</strong></td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td><strong>In open waters</strong></td>
<td><img src="https://www.dnv.com/maritime/polar/index.html" alt="Certificate in Basic Training" /></td>
<td><img src="https://www.dnv.com/maritime/polar/index.html" alt="Certificate in Basic Training" /></td>
<td>None</td>
</tr>
<tr>
<td>(ice concentration less than 1/10)</td>
<td><img src="https://www.dnv.com/maritime/polar/index.html" alt="Certificate in Basic Training" /></td>
<td><img src="https://www.dnv.com/maritime/polar/index.html" alt="Certificate in Basic Training" /></td>
<td><img src="https://www.dnv.com/maritime/polar/index.html" alt="Certificate in Advanced Training" /></td>
</tr>
<tr>
<td><strong>In other ice-covered waters</strong></td>
<td><img src="https://www.dnv.com/maritime/polar/index.html" alt="Certificate in Basic Training" /></td>
<td><img src="https://www.dnv.com/maritime/polar/index.html" alt="Certificate in Basic Training" /></td>
<td><img src="https://www.dnv.com/maritime/polar/index.html" alt="Certificate in Advanced Training" /></td>
</tr>
<tr>
<td>(ice concentration more than 1/10)</td>
<td><img src="https://www.dnv.com/maritime/polar/index.html" alt="Certificate in Basic Training" /></td>
<td><img src="https://www.dnv.com/maritime/polar/index.html" alt="Certificate in Basic Training" /></td>
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</tr>
</tbody>
</table>

**Source:** https://www.dnv.com/maritime/polar/index.html
Risk Mitigation

- Identifying Hazards (Coming up during EA, OA, or any time)
- Determining applicability
- Determining impact and probability
- Device Risk Mitigation Strategy
- Put Physical, Procedural or training Requirement in place
- Record in PWOM and other applicable documentation
Hazards taken into consideration.....

Just a small selection
While taking inventory of all ship’s equipment through the lens of seeking out compatibility with extreme temperatures and remoteness of the vessel, we found a couple of risks, such as our AFFF for example, and the quantity of calories and water available for abandoning ship situations.

<table>
<thead>
<tr>
<th>System</th>
<th>Rated Temperature [°C]</th>
<th>Information Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life Saving appliances (lifeboats, launching appliances, etc.)</td>
<td>Viking liferafts model 25DK+ “Can be deployed at temperatures as low as -30°C”</td>
<td>myviking.viking-life.com</td>
</tr>
<tr>
<td>Lifer raft inflation system</td>
<td>-30°C (same as raft)</td>
<td>myviking.viking-life.com</td>
</tr>
<tr>
<td>Liferaft hydrostatic release</td>
<td>Rated to -30°C</td>
<td>cmhammer.com</td>
</tr>
<tr>
<td>Firemain</td>
<td>SIO please provide</td>
<td>SIO please provide</td>
</tr>
<tr>
<td>Ship Service Generators</td>
<td>SIO please provide</td>
<td>SIO please provide</td>
</tr>
<tr>
<td>AFFF Foam extinguishers</td>
<td>Lowest usable temp +2°C</td>
<td>Ansul product sheet</td>
</tr>
<tr>
<td>CO₂ fire extinguishers</td>
<td>Rated to -30°C</td>
<td>Placard on extinguisher</td>
</tr>
<tr>
<td>GMDSS radio VHF8900s</td>
<td>Rated to -15°C</td>
<td>Operators Manual</td>
</tr>
<tr>
<td>Radars antenna unit</td>
<td>Rated to -25°C</td>
<td>Operators Manual</td>
</tr>
<tr>
<td>EPIRB</td>
<td>Rated to -20°C</td>
<td>Operators Manual</td>
</tr>
<tr>
<td>EPIRB hydrostatic release</td>
<td>Rated to -30°C</td>
<td>cmhammer.com</td>
</tr>
<tr>
<td>VHF liferaft aircraft radio</td>
<td>Rated to -10°C</td>
<td>Operators Manual</td>
</tr>
<tr>
<td>Vessel’s Hull structures</td>
<td>Rated to -17°C (0°F)</td>
<td>NAVSEA 1986</td>
</tr>
</tbody>
</table>
Physical corrections to be made

- AFFF had to be replaced with a kind suitable for low temperature environments.
- Water and food rations had to be sufficient for one week, due to being in a remote location. We ended up buying a pallet of water and boxes of high energy bars.
- Tools had to be bought for removal of built-up ice.
- Abandon ship bags and additional cold weather gear was bought. (however not required)
- Radio for aircraft frequencies.
- Penray Winter Blend (bulk) Diesel Fuel Treatment 55 gal drum Prevents fuel gelling, prevents wax crystal formation. (800) 748-7788. A 55 gal drum treats 165,000 gallons.
Procedural changes

- Ice accretion rounds
- Portable radio management
- Keeping sludge tank empty
- Avoiding critical operations

In short: Good Sea(wo)manship!
On Roger Revelle’s first port of call after the GEOTRACES cruise in Antarctic waters, port state control boarded the vessel in Punta Arenas, Chile.
We were issued one deficiency for not having the master chief and other Officers in charge to be certified in accordance with STCW chapter V and the polar code.

It was a mistake by the port state control officer; he assumed we were navigating in ice concentrations exceeding 10%. We called our ABS representative, and a local surveyor discussed the matter with port state control. The finding was then cleared.
How was UCSG involved?

Minimal. The whole process was between ABS and us. (We did seek input)
Costs

Material costs: 20%
Manhours in Design: 80%

$90,297.83 - ~$100,000
To facilitate a smoother transfer of information and utilizing the additional bandwidth through Glosten, a significant part of these Glosten costs are subcontracting costs with ABS.
Key Stakeholders

Glost en
Thank you for your attention, and a thank you to our funding agencies!

Credits:
- Pictures taken by ResTech Nicholas Benz
  nbenz@ucsd.edu
- Slide 15 and 22 contain screenshots derived from DNV
  https://www.dnv.com/maritime/polar/index.html