Shipboard Polar Research

32 YEARS POLARSTERN

and the requirement for POLARSTERN II

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Presented by U. Pahl / T. Boebel
# DPFVS POLARSTERN DBLK

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build</td>
<td>09.12.1982</td>
</tr>
<tr>
<td>Power Main Engine</td>
<td>14116 kW</td>
</tr>
<tr>
<td>Midlife Conversion</td>
<td>1998-2002</td>
</tr>
<tr>
<td>Displacement</td>
<td>12 614 BRZ</td>
</tr>
<tr>
<td>Beam</td>
<td>25 m</td>
</tr>
<tr>
<td>Draft</td>
<td>11,21 m</td>
</tr>
<tr>
<td>Length of all</td>
<td>118 m</td>
</tr>
<tr>
<td>Crew and scientist on board</td>
<td>44 Crew and &lt;79 scientist on board</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification</th>
<th>Hull</th>
<th>Machinery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hull</td>
<td>GL + 100A5 ARC 3</td>
<td></td>
</tr>
<tr>
<td>Machinery</td>
<td>GL + MC ARC 3 Aut</td>
<td></td>
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</table>
POLARSTERN

1982 – 2012: 30 Years operation for science and logistic
Sailing millage until 31. Dec 2012: 1 487 123 SM

9456 users
27 Arctic expeditions  29 Antarctic expeditions
310 Days / Year on sea  45 Cruises
Since commissioning every year successful supply of NEUMAYER station

<table>
<thead>
<tr>
<th>Station</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Georg von Neumayer Station</td>
<td>1981-1992</td>
</tr>
<tr>
<td>Neumayer Station</td>
<td>1992-2009</td>
</tr>
<tr>
<td>Neumayer III</td>
<td>2009-20??</td>
</tr>
</tbody>
</table>

• Overwintering Station
• all the year science observation
• Logistic base for Antarctic field work
• Supply Base for Kohnen Station
• DROMLAN hub
POLARSTERN –

Icebreaker and supply vessel
Offloading of Pistennbucky, Tanks, crans, goods and container on Atka shelf ice
Fuel dump at the shelf ice edge of 20 m with fuel pump and hose
POLARSTERN –

The ship for rough weather in the southern ocean
POLARSTERN –

But shelter inside
POLARSTERN – recreation area
POLARSTERN –
medical help at all time all weather
POLARSTERN –

The research icebreaker
POLARSTERN –

Scientific colloquium and planning facilities

Bilateral cooperation has been much improved by AWI scientists for many years since 1990.
Polarstern-

Arctic icebreaking and deployed Seismic Streamer and Airguns

Streamer

Airguns
Polarstern-fishery research – trawling
Polarstern- Hydroacoustic systems
Polarstern-
Laboratory reconfiguration with mobil containers
Helicopter-based operation for science, logistic, observations, and ice recognizances

Elektromagnetik – Bird auf Helikopterdeck

Limitierung:
- Reichweite Helikopter
- Lagermöglichkeit wissenschaftlicher Geräte auf Helideck

Meereisminimum 2007 (ARK XXII-2)
22 Messflüge: > 4000 km Daten

Rückgang der Meereisdicke (Messungen von Polarstern)
Status of PSII Project

2012 Design study based on the scientific and technical requirements
2013 Decision for a favorite design study which was further developed
2013 – 2015 Adaption of the scientific requirements and „wish list“

- General Shipbuilding design with general arrangement and investigation for ice breaking capabilities, propulsion power, sea going capabilities at the HSVA
- For this design engineers of
  - the Federal Waterways Engineering and Research Institute,
  - a ship design consultant company
  - the shipping company of Polarstern
  - lawyer and business advisor
  - and over more than 40 representatives of the different scientific groups and marine institutes where involved
- This first ship design was the basis for the description which was handed to the shipyards in at 15 January 2016
- Up to now the shipyard tendering process is ongoing and no further information except direct information to the involved shipyards can be given
- Except of a few major requirements which are mandatory, the shipyards are forth to develop there own design, therefore the final negotiation design can be totally different to the preliminary design which is shown here
General requirements

Classification of the ship to Polar Code and relevant requirements for the Antarctic treaty and environmental protocol

- In principal expected operation temperature (−50°C to +45°C, DAT -30°C limited scientific work up to −40 °C)
- Possibility for emergency overwintering in the Antarctic Weddel Sea Gyro
- Lifecycle of about 30 years
- Concept of „Safe return to Port“, except when stuck in ice
- Cruising speed in open water 12 kn, maximum speed is due to the necessary installed power for icebreaking about 17-18 kn
- Ice breaking capability 1,5 m with 20 % coverage of snow @ 3 to 5 kn continuous cruising speed
- Capability of cruise trips length up to 90 days (except in Emergency Overwintering scenario)
- Scientific payload 1000 t (incl. supply goods for Neumayer III Station and antarctic summer campaigns)
Requirements for the ship design

- Maximum 130 persons on board,
- same amount of crew (44 persons) living in single and double rooms
- Normal cruises up to 60 scientist
- Safety equipment (life boats) on each side 100%
- 80 places for 20” Containers (laboratories and storage)
- Seakeeping stabilizer suitable for the transit cruises and station operation
- Helicopter Deck and Hangar for 2-3 Helicopter

For science and on and off loading at Neumayer station III:
- multiple systems like sliding beams
- A-Frame
- cranes
- Hangars with moonpool, and laboratories
- Winches
- the “german” traditional open working deck in L-Form at starboard

- Reliability of all systems
- Improved maneuvering capability and dynamic positioning capabilities
- Rooms for international reception and political delegations
Requirements for the ship design

- POLAR CLASS similar to hull of FS Polarstern: this equivalent to the PC 2
- Optimization of the hull shape for ice breaking capabilities
- Optimization of the hull shape for efficiencies transit cruises (cruising speed, sea keeping capabilities, energy efficiencies etc.)
- Optimization of the hull shape for noise emission and vibration (aim to reach fulfill ICES 209 in open water conditions)
- Optimization of the hull shape for bubble sweep down and hydroacoustic capabilities
- Optimization of the shape wind flow for atmosphere and air chemistry sciences

This list is not ended here .....
Requirements for Engine

• Diesel-electric propulsion concept

• Noise emission in compliance to ICES 209 with some modifications

• Claim to an overall "quiet ship".

• Compliance with the exhaust emission limits according to IMO Tier III and beyond (NOx- limits -30% and use of particle filters (reduction of 90 %). The use of LNG was examined, but rejected on the basis of technical conceptual and logistical evaluation

• Demanding energy efficiency and environmental standards, including the “Blauen Engel”

• High demands on the redundancy levels of the systems
Approximate dimension:

Length of about 145 m
Beam about 27.30 m
Draft (construction) about 11 m
Displacement incl. payload about 26,000 t
Thank you for your attention