ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

PS II
Projekt
POLARSTERN II

Requirements for the new German Research Icebreaker Polarstern II

Heinrich Miller, Alfred-Wegener-Institut
05.03.2025

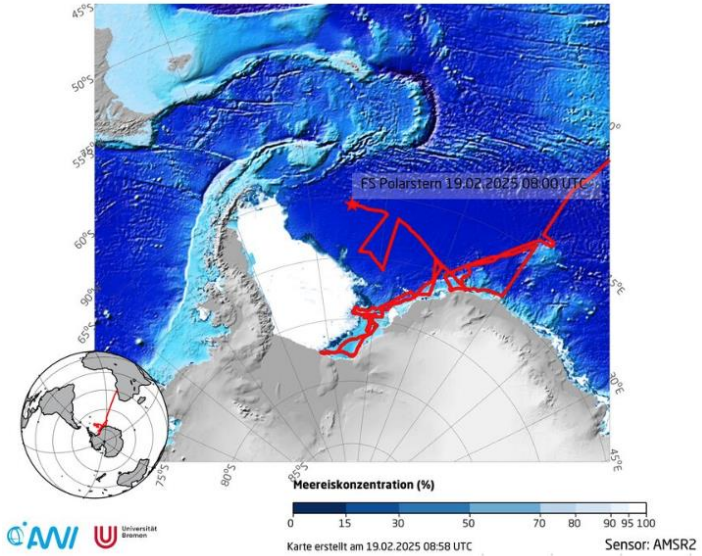
HELMHOLTZ

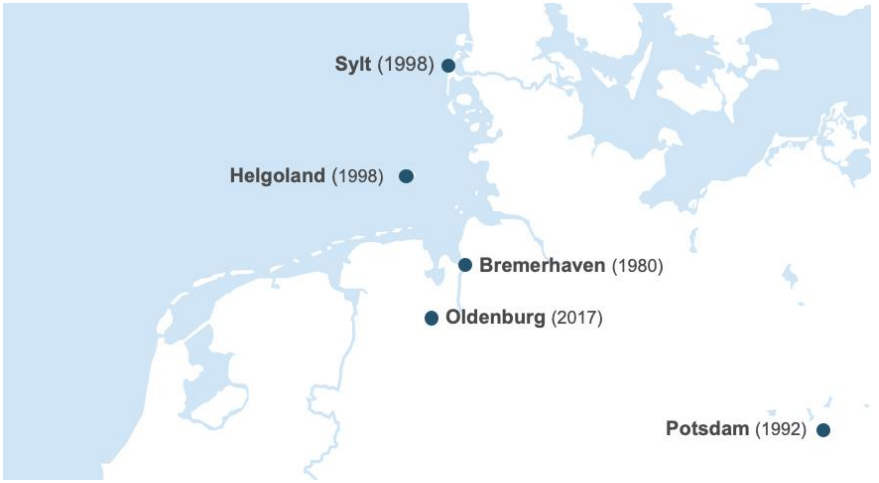
Scope of this presentation

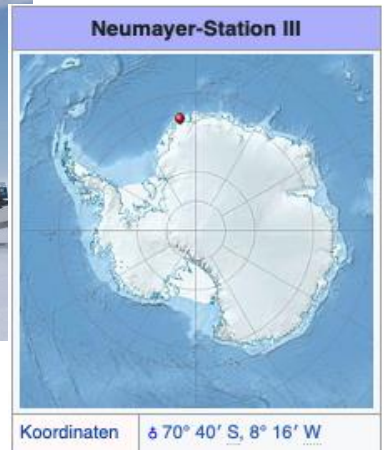
- Alfred Wegener Institute in brief
- Capabilities of Polarstern
- Requirements for the new vessel

Alfred-Wegener-Institute ...

- Is one of the leading institutions in polar, coastal and marine research







Foundation

1980 Establishment of the Institute in Bremerhaven as a foundation under public law.

Employees

1,150 employees (31.12.2023)

Funding (2023)

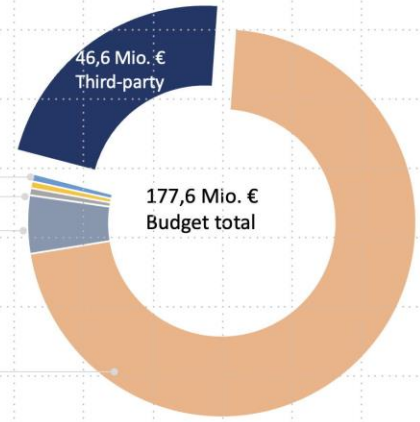
0,85% State of Schleswig-Holstein

0,85% Lower Saxony

0,85% State of Brandenburg

7,45% State of Bremen

90% Federal Ministry of Education and Research (BMBF)



Research Infrastructure

V

tions

and Sylt

Alfred Wegener Institute

Uthörn

RV Heincke

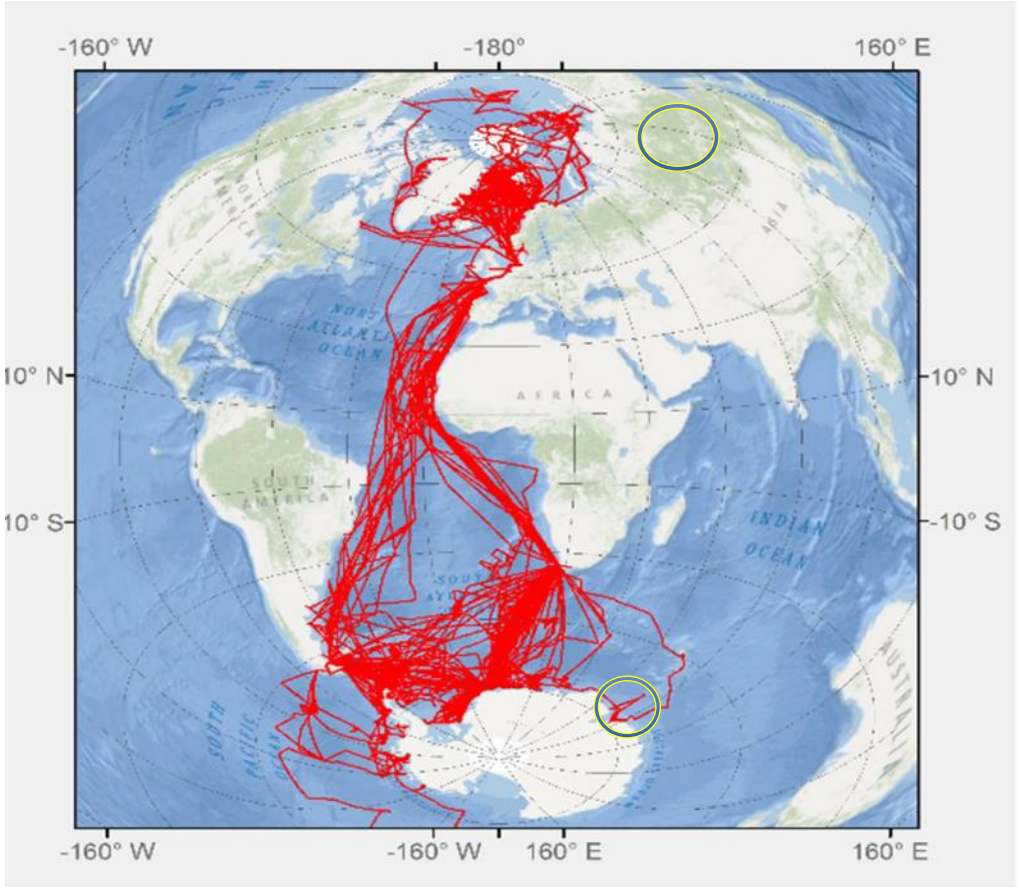
PS II
Projekt
POLARSTERN II

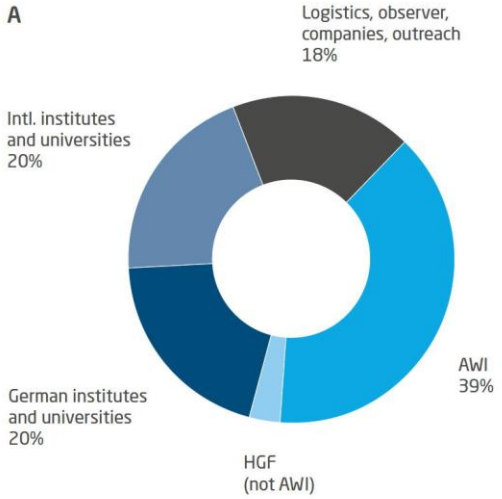
RSV POLARSTERN DBLK

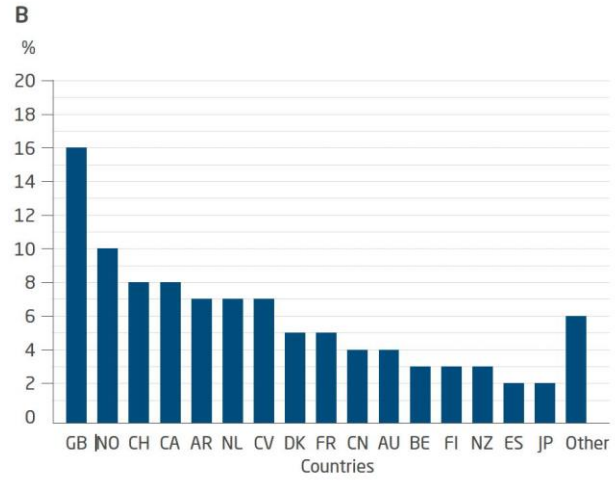
POLARSTERN

1982 – 2025: 42 years service for science and support
Total distance sailed til now: almost 2.000.000 NM

310-320 days at sea per year
~ 14000 users







PS II
Projekt
POLARSTERN II


icebreaker
supplyvessel
researchvessel
planeterde
POLARSTERN


POLARSTERN

PS II
Projekt
POLARSTERN II

PS II
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POLARSTERN II

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POLARSTERN II


POLARSTERN

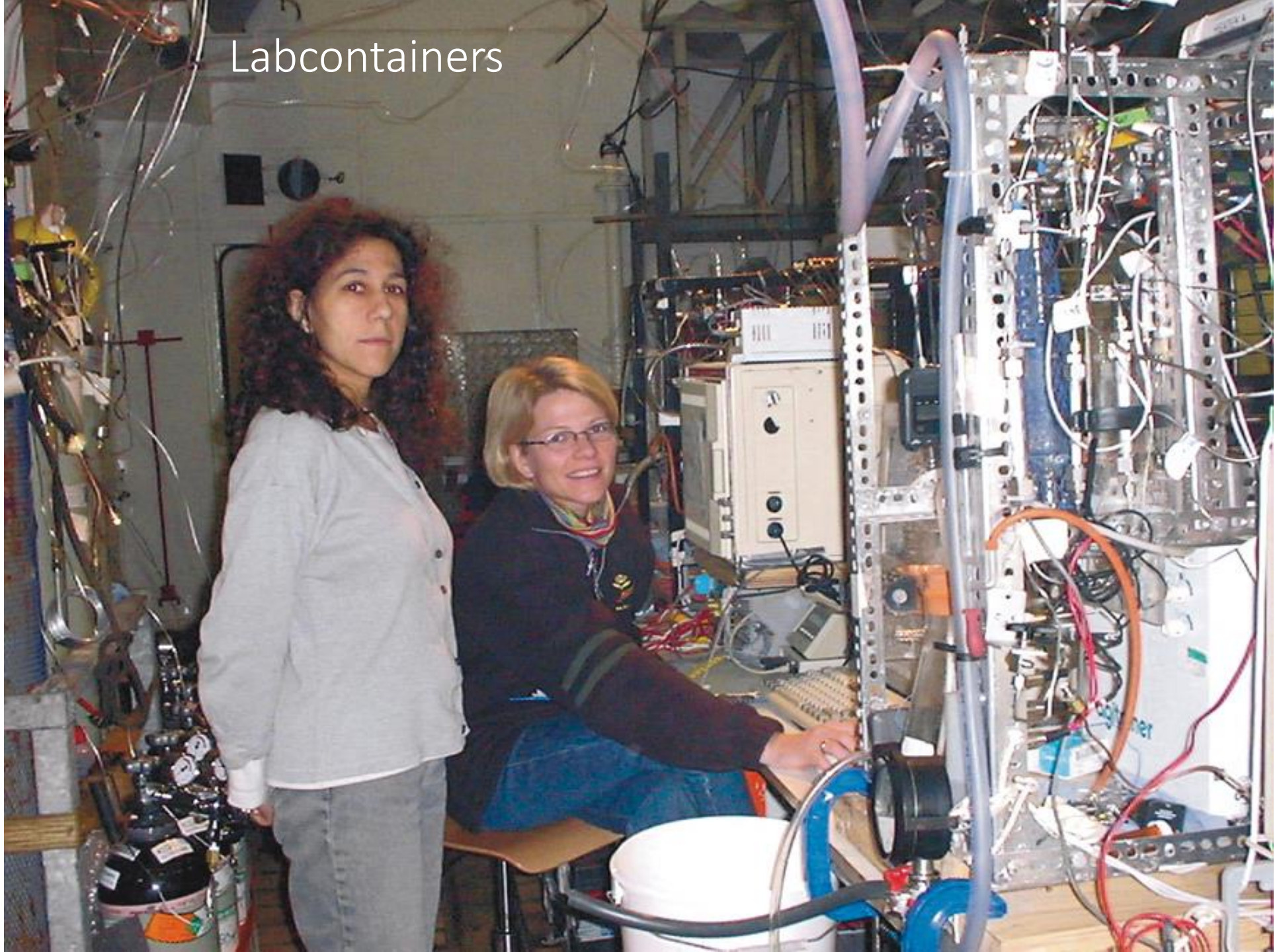
POLARSTERN –

In stormy seas of southern ocean

PS II
Projekt
POLARSTERN II


Geo/wetlab

Labcontainers



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POLARSTERN II

Derived specific requirements - ship

- Classification as „POLAR CLASS 2“ (PC2) vessel which fulfils the Polar Code and all relevant rules
- Complies with the Antarctic treaty environmental safety protocols
- designed for extreme temperatures: polar service temperature (PST)-48°C and air temperature +45°C
- Designed for 30 years of service
- Capabilities to conduct science during the winter season in Arctic/Antarctica
- Endurance of 90 days – enough supplies for 6 month and 110 people
- Ice breaking capability of 1,8 m with 20 % snow cover at 3 kts (Last ice regions)
- Crossing of ice ridges forward by ramming and backwards by milling
- High manoeuvrability in ice conditions
- Optimized transit speed of 12 kts in open water
- Good seaworthiness on station and travelling in open water
- Dynamic positioning system for station work in open water (Bft 8 with a 1.5 kts current and wind from 20° ahead)

Facts and figures (1)

MAIN DATA

Length	159.80 m
Width	27.30 m
Draft (max.)	11.10 m
Depth	14.20 m
Icebreaking speed	3 kn
- with an ice thickness of 1.8 m and a snow cover of 20 %	
Autonomous journey duration	90 days

CLASSIFICATION

IACS Iceclass PC2
(year-round operation in multi-year ice)
Ecolable DE-UZ141 „Blauer Engel"

Flag	Federal service flag
Home port	Bremerhaven
Owner	Alfred Wegener Institute (AWI)

Helicopters	2x Type EC145
Lifeboats	4x 70 People
Container storage spaces	80x 20 feet
Cranes / lifting gear	9x / 33 t max.
- i.e. Jib crane	2x 33 t / 30 m
- i.e. Deck crane	2x 10 t / 15 m

PROPULSION

diesel-electric

Generators (total power)	34,000 kW max.
- 2x MGO	
- 2x Dual Fuel MGO / Methanol	
Azimuth propulsion*	2x 8,500 kW
Centre propeller	1x 10,500 kW
Bow thrusters	2x 2,000 kW

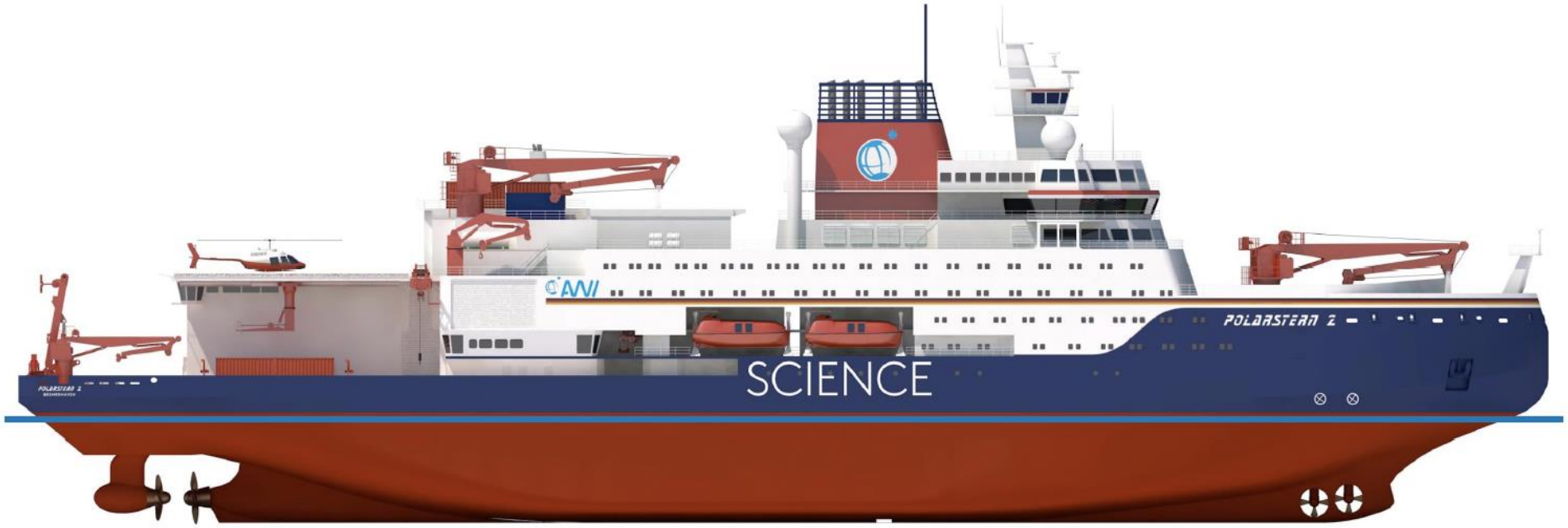
An approx. 17,800 kWh battery system enables emission-free measurements without fuel consumption for 2-3 hours.

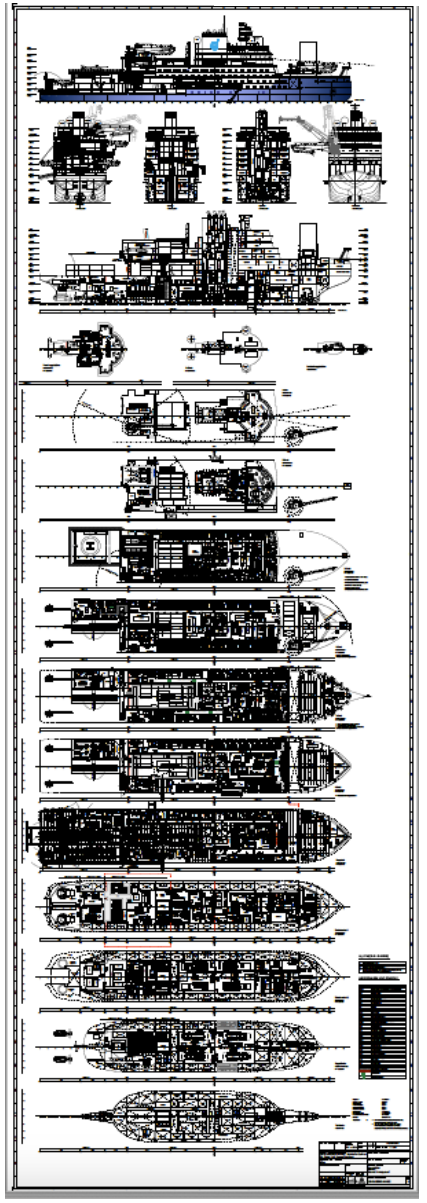
** These are 360° rotating propeller units. They give the ship unique manoeuvrability in ice and on station.*

PEOPLE ON BOARD

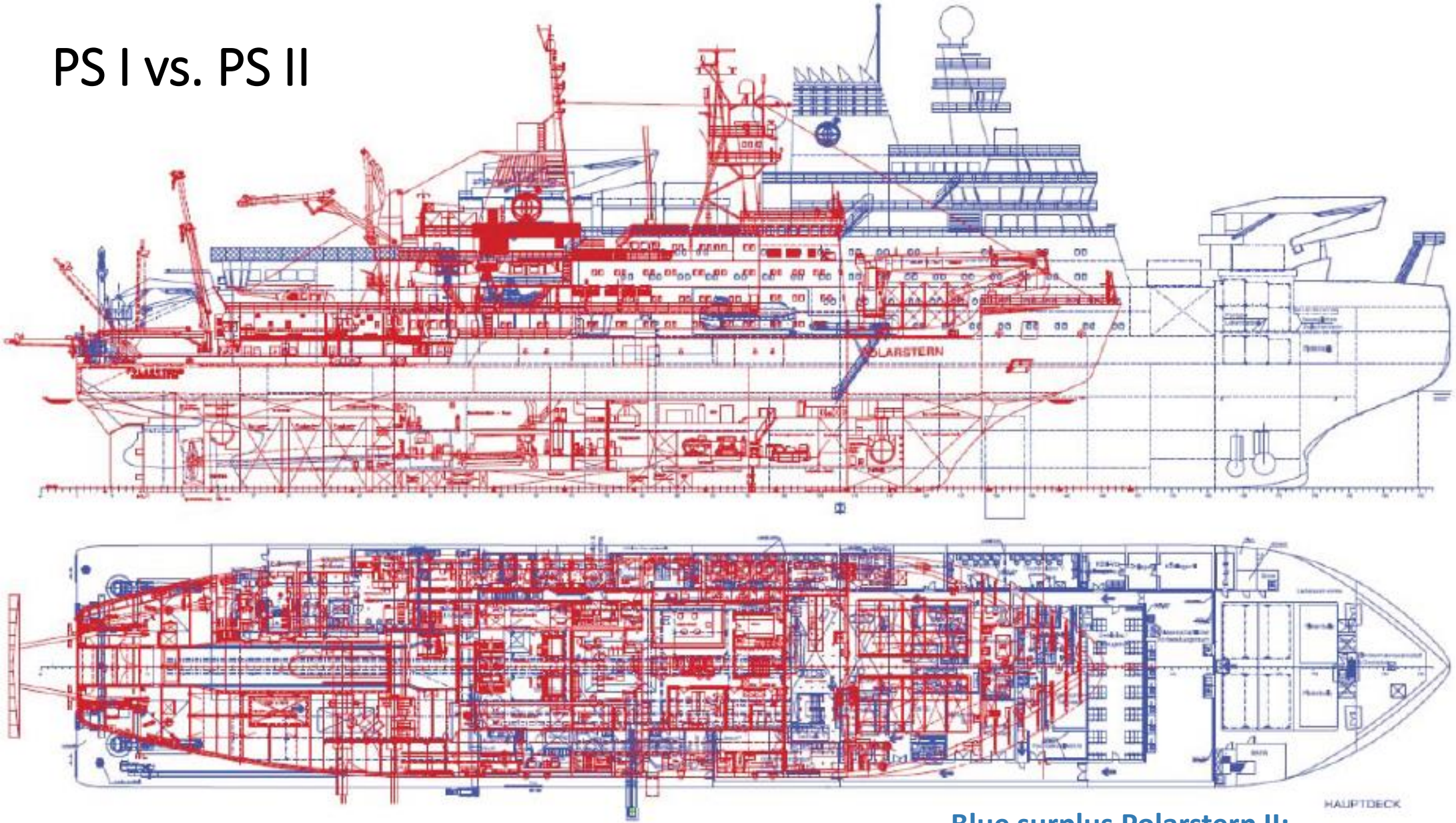
Crew	50 People
Scientific staff	60 People (regular operation)
	90 People (transit)

Polarstern II





PS I vs. PS II



Red: Polarstern (Volume: 42.500 m³)

Blue: Polarstern II (Volume: 84.200 m³)

Blue surplus Polarstern II:

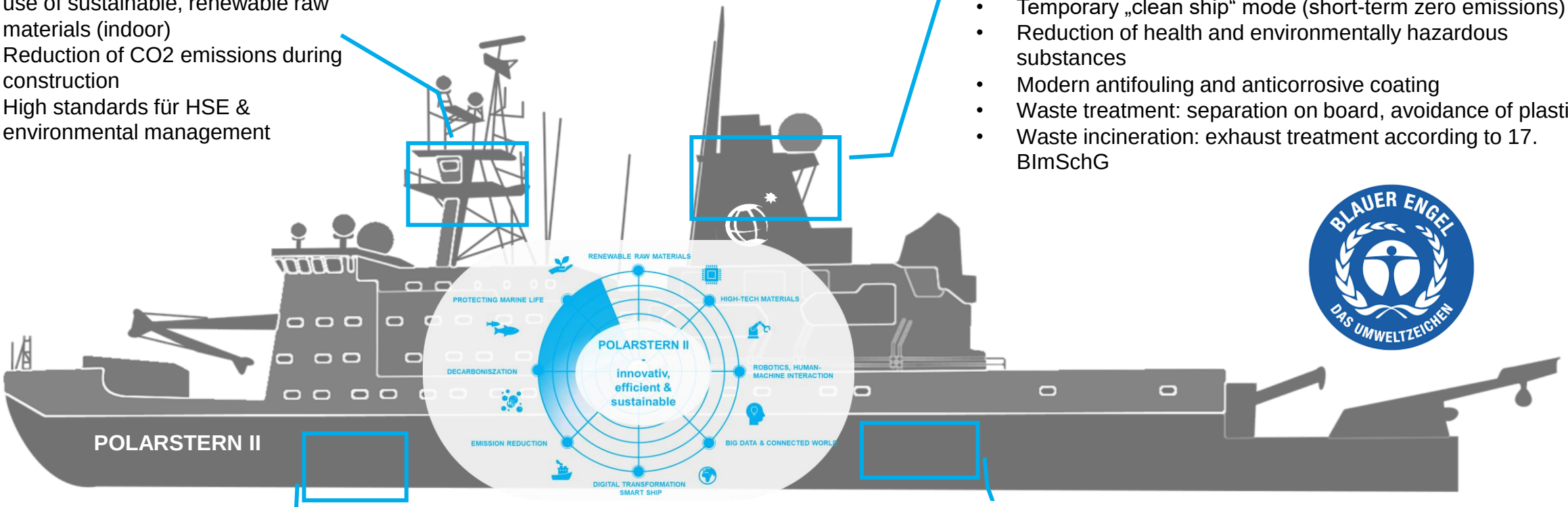
abt. 40% of area for laboratories

abt. 70% scientific area (working deck, scientific hangar)

Innovative, efficient & sustainable

Sustainable construction:
- use of sustainable, renewable raw materials (indoor)
- Reduction of CO2 emissions during construction
- High standards für HSE & environmental management

Emission reduction:
- Reduced NOx emission (Tier III minus 30%)
- Particle filters (low PM emissions)
- Temporary „clean ship“ mode (short-term zero emissions)
- Reduction of health and environmentally hazardous substances
- Modern antifouling and anticorrosive coating
- Waste treatment: separation on board, avoidance of plastic
- Waste incineration: exhaust treatment according to 17. BImSchG



Design:
- Very low noise and vibration levels
- Optimized hull design
- Accessibility for people with partial physical limitations
- Acoustic comfort on board

Propulsion & energy supply:
- Low-emission hybrid propulsion concept (diesel electric / battery pack)
- Low-sulphur fuels plus additional use of alternative fuels (methanol)
- High energy efficiency
- Heat recovery
- Modern, environmental-friendly heating, ventilation and air conditioning
- Continous monitoring & optimization of fuel consumption using digital tools

Derived specific requirements – Ship operation and science

- ★ scientific and Neumayer payload in holds and on deck of up to 1000 t
  - a range of cranes for loading and research operations
  - ~80 x 20 ft container place for storage, reefer, laboratories
- ★ a suite of modern hydroacoustic sensors
- ★ includes all past scientific operational modes of Polarstern
- ★ modern hangars, moonpool, labs, winches and a big working deck
- ★ new robotic systems such as ROVs, AUVs, UAVs operated by an AWI group
  - data acquisition, digital infrastructure and communication capabilities
  - a high level, integrated bridge system
- ★ helicopter landing deck and infrastructure incl. hangar for 2 helicopters H145

Facts and figures (2)

FACILITIES

Meeting rooms, lecture rooms, infirmary, mess rooms, library, gym, etc.

SCIENTIFIC FACILITIES

Laboratories (for various purposes)	13
- dry labs	5
- chemistry labs	3
- wet labs	2
- fish lab	1
- isotope lab	1
- seismic lab	1

Moonpool – a large moonpool allows work below the water surface even when the ship is enclosed by ice.

DEVICES

ROV (Remotely Operated Vehicle) – is a cable-guided remote-controlled underwater vehicle that can operate at depths of up to 6,000 metres. Among other things, ROVs allow sampling of the seabed.

AUV (Autonomous Underwater Vehicles) – are autonomous underwater robots that carry out pre-defined tasks independently. AUVs are used, for example, to collect oceanographic and bathymetric data.

LARS (Launch And Recovery System) – can safely launch and recover a variety of surface, remote-controlled and autonomous underwater vehicles, even in heavy seas.

UAS (Unmanned Aerial Systems) – there will be a range of autonomous, highly specialised drones that are optimised for different scientific questions, ranges and payloads.

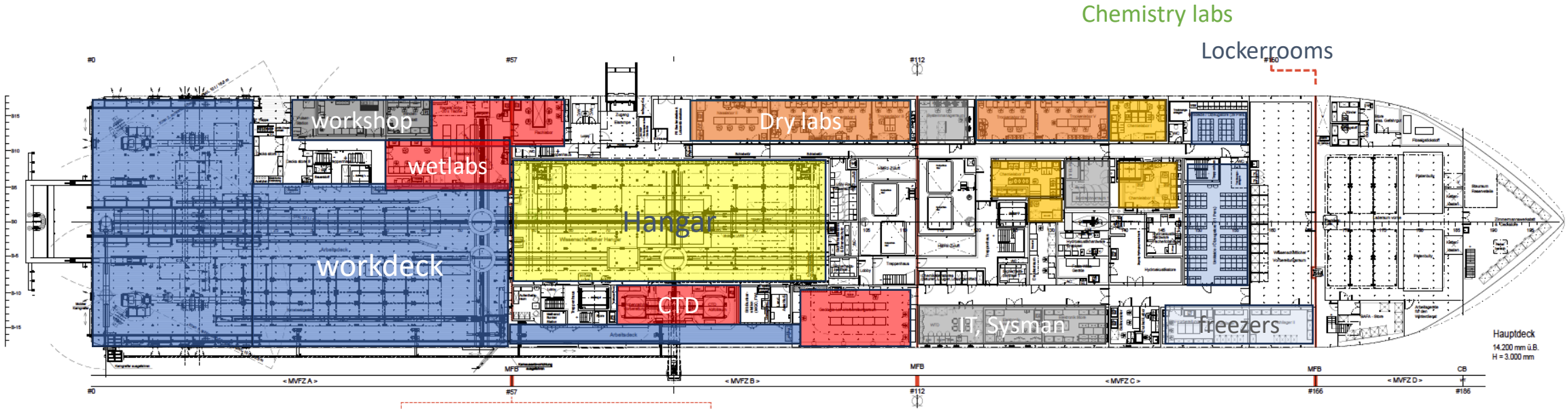
GPC (Giant Piston Corer) – a drilling device capable of extracting sediment cores up to 60 metres long, which will greatly enhance sedimentary climate information.

Piston, box and gravity corers, 2D and 3D seismics, MUC (Multi Corer), various fishing devices.

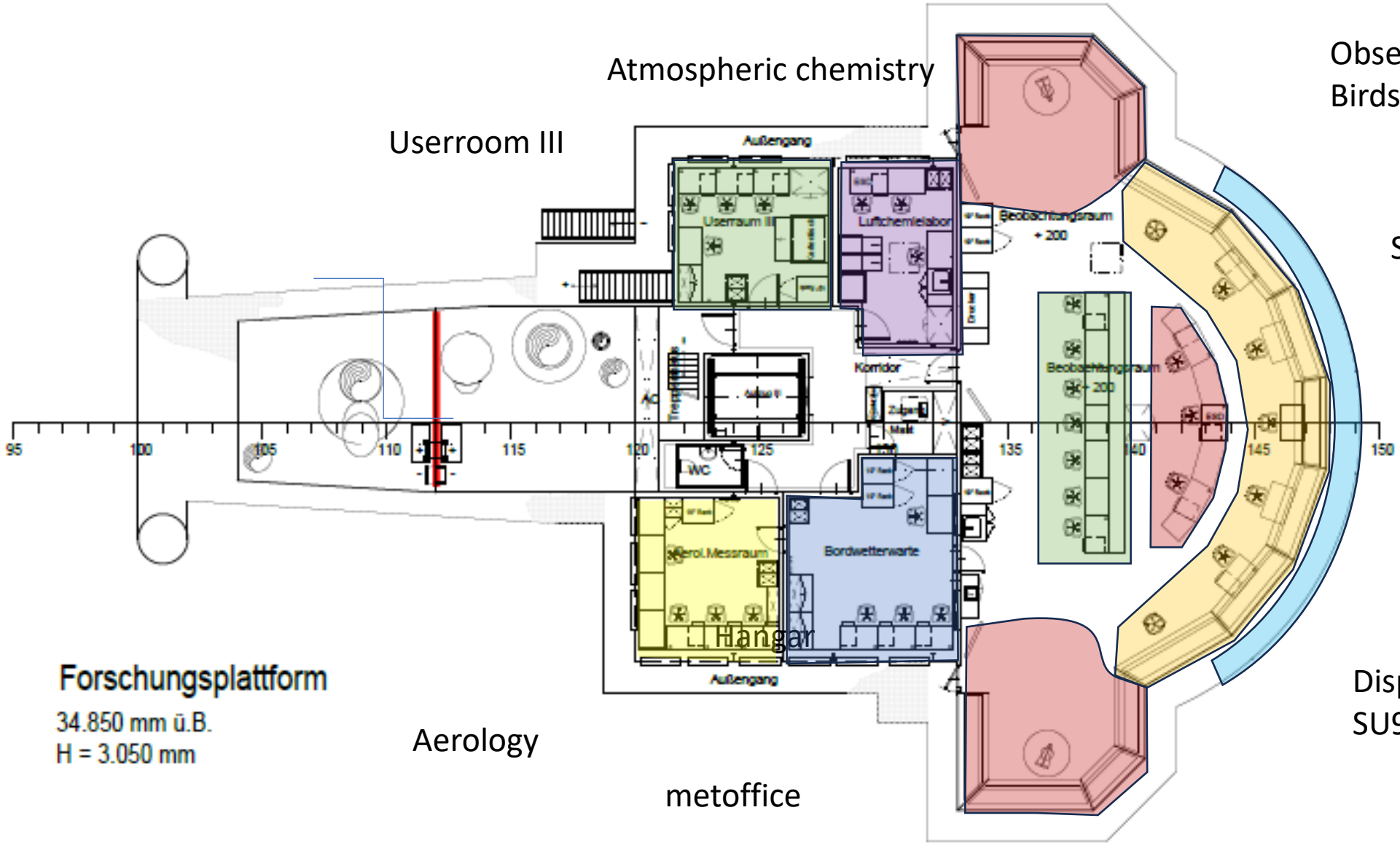
ADDITIONAL TECHNOLOGY

Hydrographic trunks, magnetometer, balloon filling hall, cold rooms, underwater positioning systems, modern communication systems with real-time transmission, etc.

Main Deck


Chemistry labs
Lockerrooms
workshop
wetlabs
Dry labs
Hangar
workdeck
CTD
IT, Sysman
freezers
Hauptdeck
14.200 mm ü.B.
H = 3.000 mm
< MVFZ A >
< MVFZ B >
< MVFZ C >
< MVFZ D >
MFB
CB
#0
#57
#112
#166
#186

Science platform 34,85 m ü.B. H=3,05 m



ROV and Moonpool

https://www.awi.de/en/about-us/service/press/single-view/polarstern-neubau-auftrag-fuer-deutschen-forschungseisbrecher-vergeben.html