Royal Netherlands Institute for Sea Research

New toys for girls and boys: The new Royal NIOZ oceanic research vessel

Henk de Haas

Content

New research fleet for The Netherlands

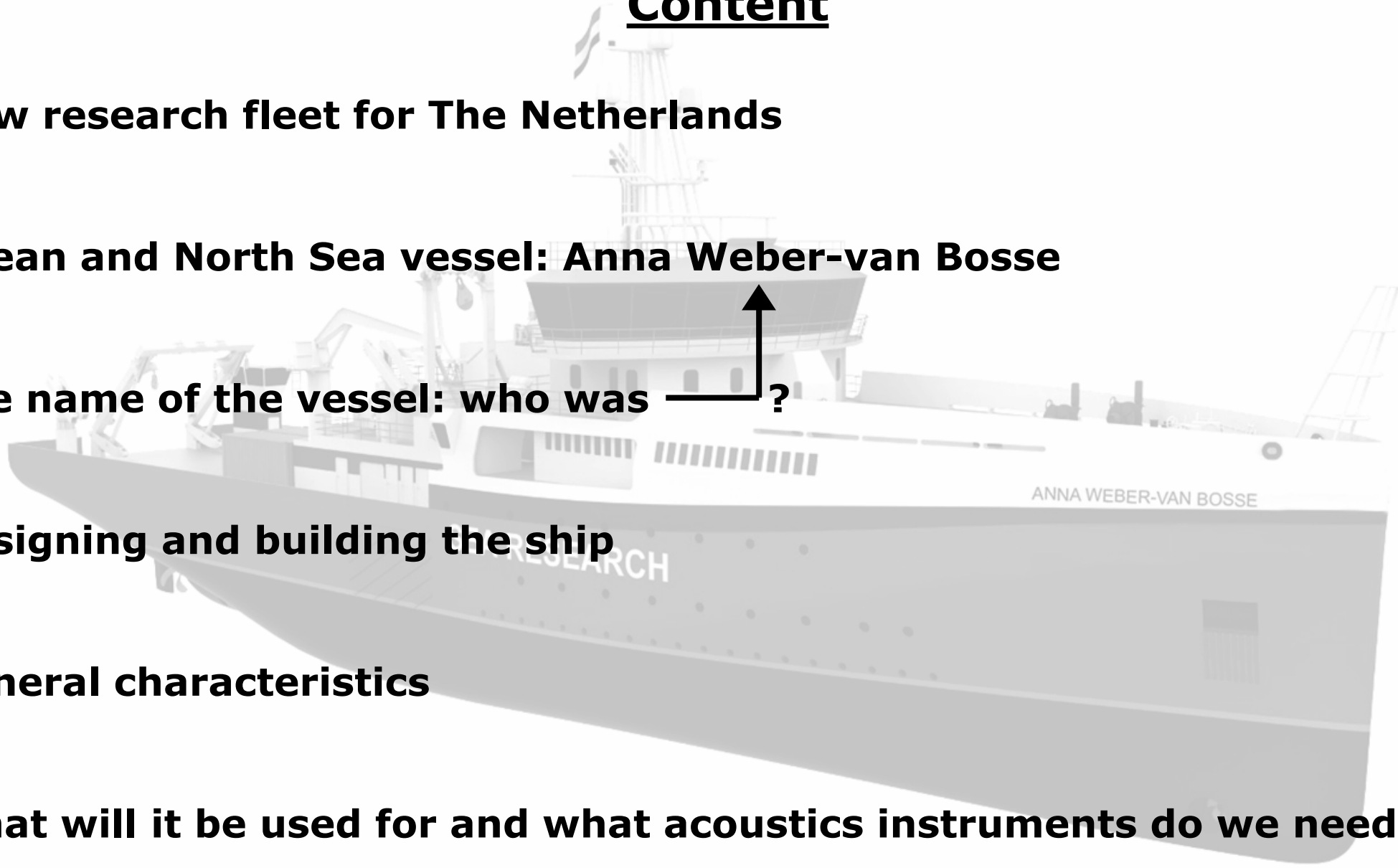
Ocean and North Sea vessel: Anna Weber-van Bosse

The name of the vessel: who was ?

Designing and building the ship

General characteristics

What will it be used for and what acoustics instruments do we need?



Old NIOZ research fleet

- **Stern:** 15 m, local work
- **Navicula:** 23 m, Waddensea and Dutch SW delta
- **Pelagia:** 66 m, North Sea and ocean

New NIOZ research fleet

Local vessel: Adriaen Coenen, delivered July 2022

Waddensea and SW delta:
Wim Wolff, expected Q4 2023

North Sea and oceans:
Anna Weber-van Bosse
expected Q3 2025

This presentation

Anna Weber-van Bosse

The ship

The lady

Anna Weber-van Bosse

Born 27 March 1852: Anne Antoinette van Bosse

Married at age 19, widow at age 26

Studied botany and met zoologist Max Weber

Age 31: Anna and Max married → Anna Weber-van Bosse

Anna and Max Weber organised and joined various (marine) scientific expeditions (a.o. South Africa, Indonesian archipelago)

→ Her most important publications (algae)

Anna Weber-van Bosse

Siboga Expedition (Indonesia, 1899-1900):

1910: Anna Weber was an internationally highly esteemed scientist and the first woman in The Netherlands receiving an honorary doctorate

Anna Weber christens the NIOZ vessel Max Weber (1933)

1935: Appointed Knight in the Order of Oranje-Nassau

29 October 1942: Anna Weber-van Bosse dies at age 90

Designing and building the ship

Main design goals:

- Best possible platform for science
  (physical & chemical oceanography, geology, biology, archeology, ……)

- 24 hours science

- More people than on Pelagia

- Larger working deck than Pelagia

- Test platform for maritime industry

- Reduced environmental impact

Designing and building the ship

First ideas

Available money
(Never enough)

Advise and design

C-JOB

Wishes scientists

Legal regulations

Calculations and model testing

MARIN

Wishes crew

Laws of nature

Final design and building

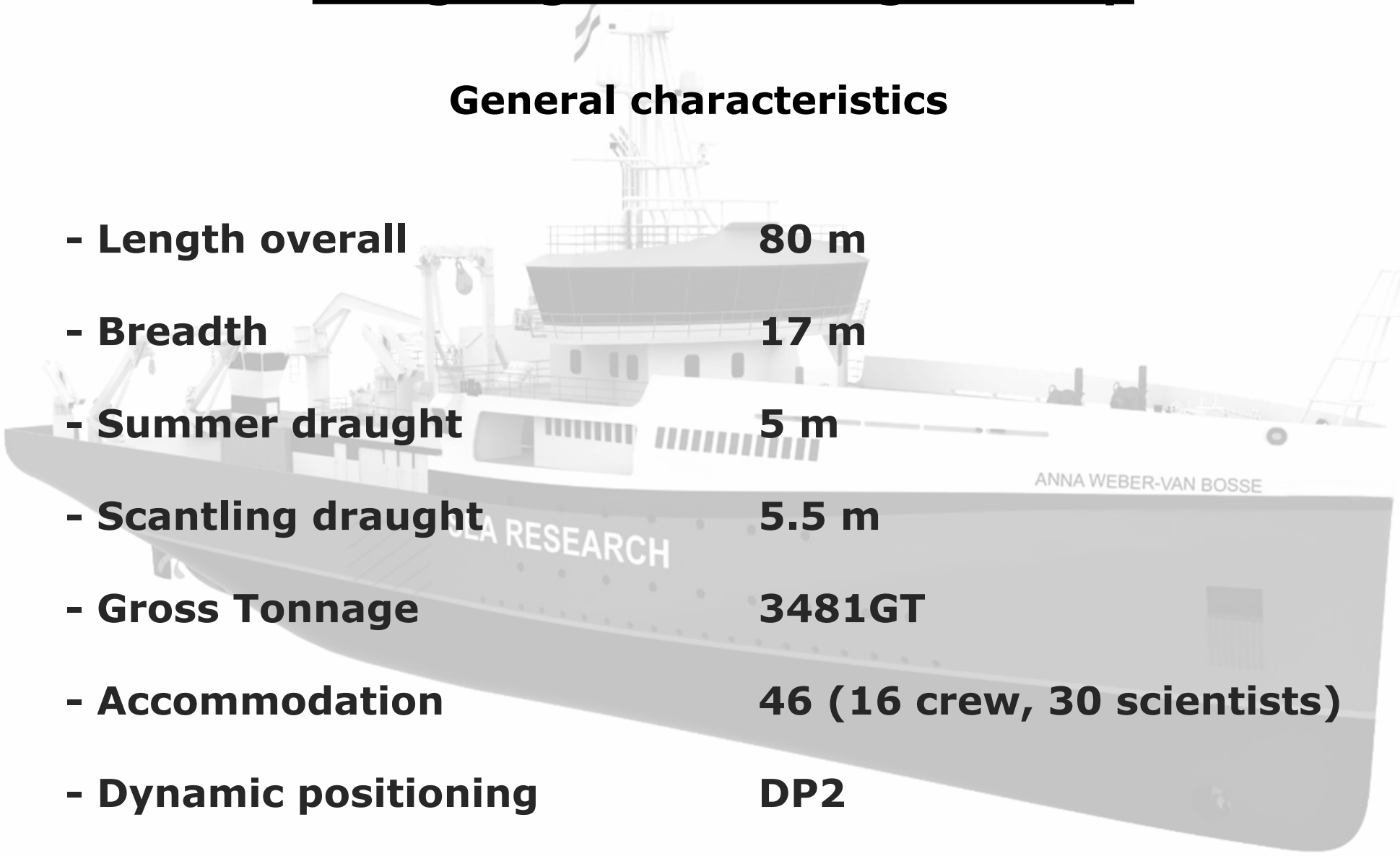
ARMON

New ship

10 years

Designing and building the ship

General characteristics



- Length overall	80 m
- Breadth	17 m
- Summer draught	5 m
- Scantling draught	5.5 m
- Gross Tonnage	3481GT
- Accommodation	46 (16 crew, 30 scientists)
- Dynamic positioning	DP2
- Ice class	1c (edge of ice fields)

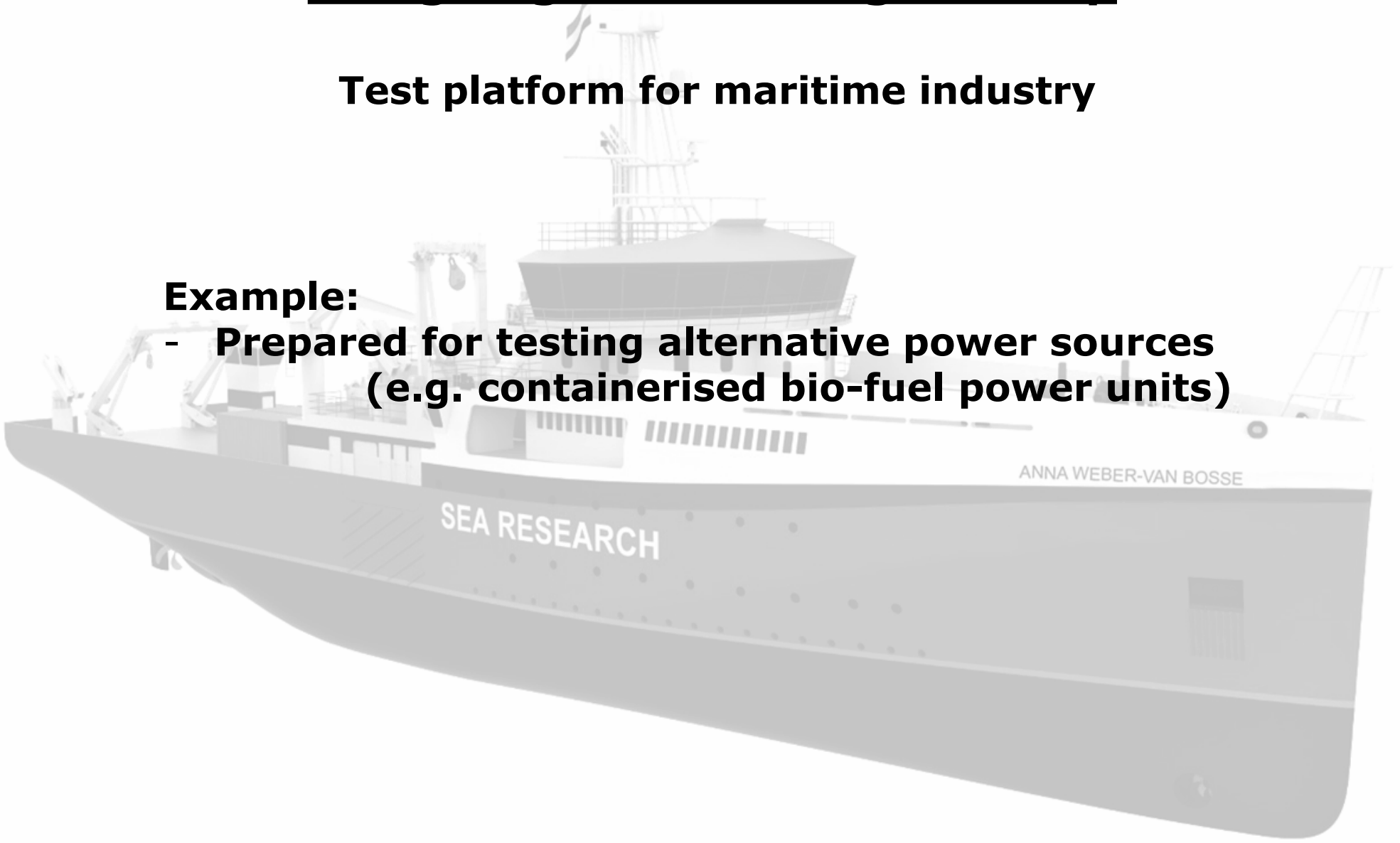
Designing and building the ship

Science platform

- Limited number of fixed labs/working areas:
    - Main lab (chemistry, sediments, preparation of equipment)
    - Wet lab (water samples, plankton nets, etc.)
    - Dry lab (science centre, microscopy, acoustics, video wall, etc.)
    - Geolab/ROV, AUV, glider hangar
    - CTD hangar (separated from other activities)
- Large working deck (starboard side and aft deck)
- Laboratory containers (17) in hold and on deck: multipurpose ship
- Drop keel and gondola for large set of acoustic equipment

Designing and building the ship

Test platform for maritime industry

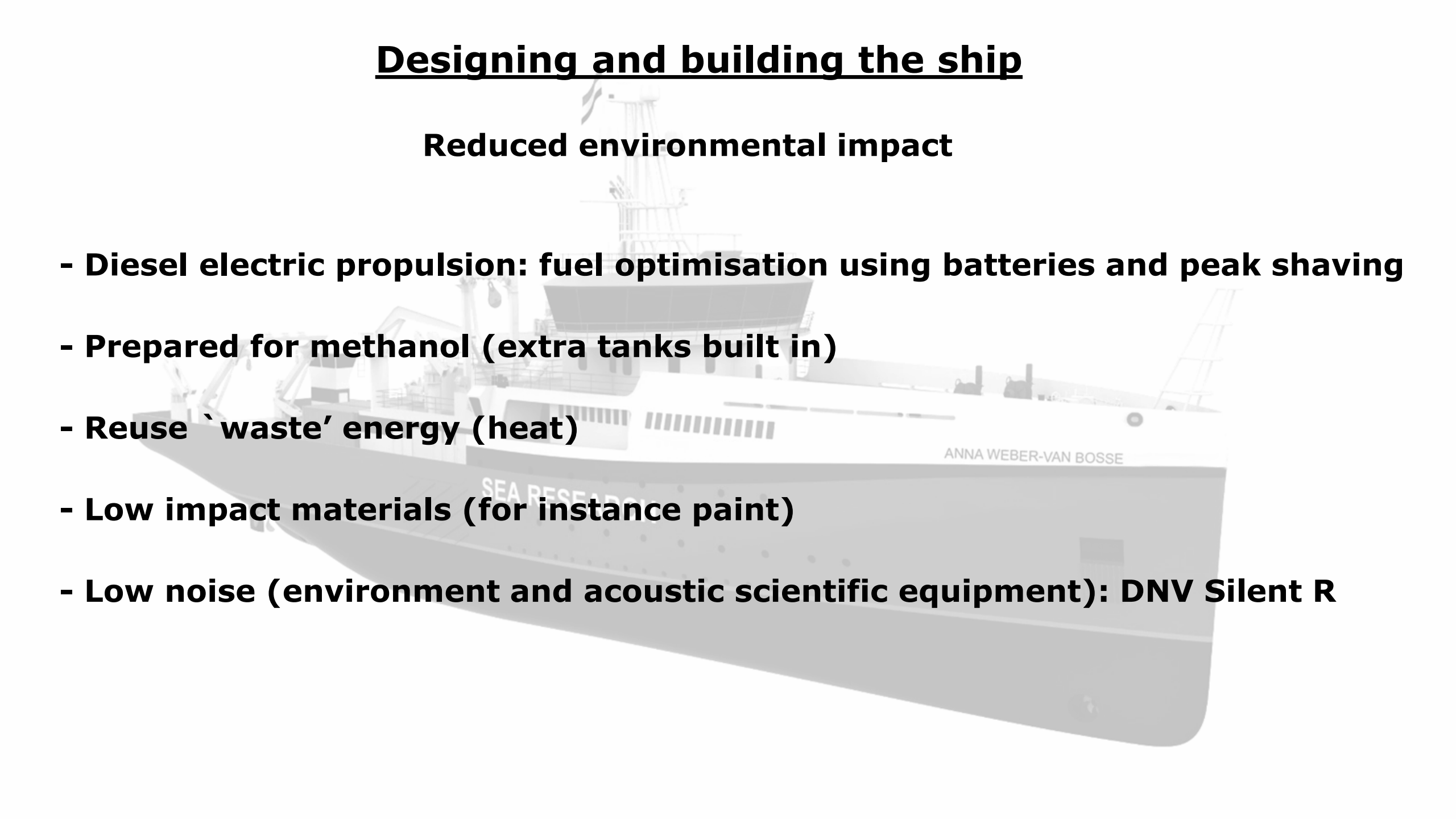


Example:

- **Prepared for testing alternative power sources (e.g. containerised bio-fuel power units)**

Designing and building the ship

Reduced environmental impact



- Diesel electric propulsion: fuel optimisation using batteries and peak shaving

- Prepared for methanol (extra tanks built in)

- Reuse `waste' energy (heat)

- Low impact materials (for instance paint)

- Low noise (environment and acoustic scientific equipment): DNV Silent R

Scientific acoustic equipment

Examples of science using acoustics

Biology: bathymetry, habitat mapping, water column observations (fish, plankton)

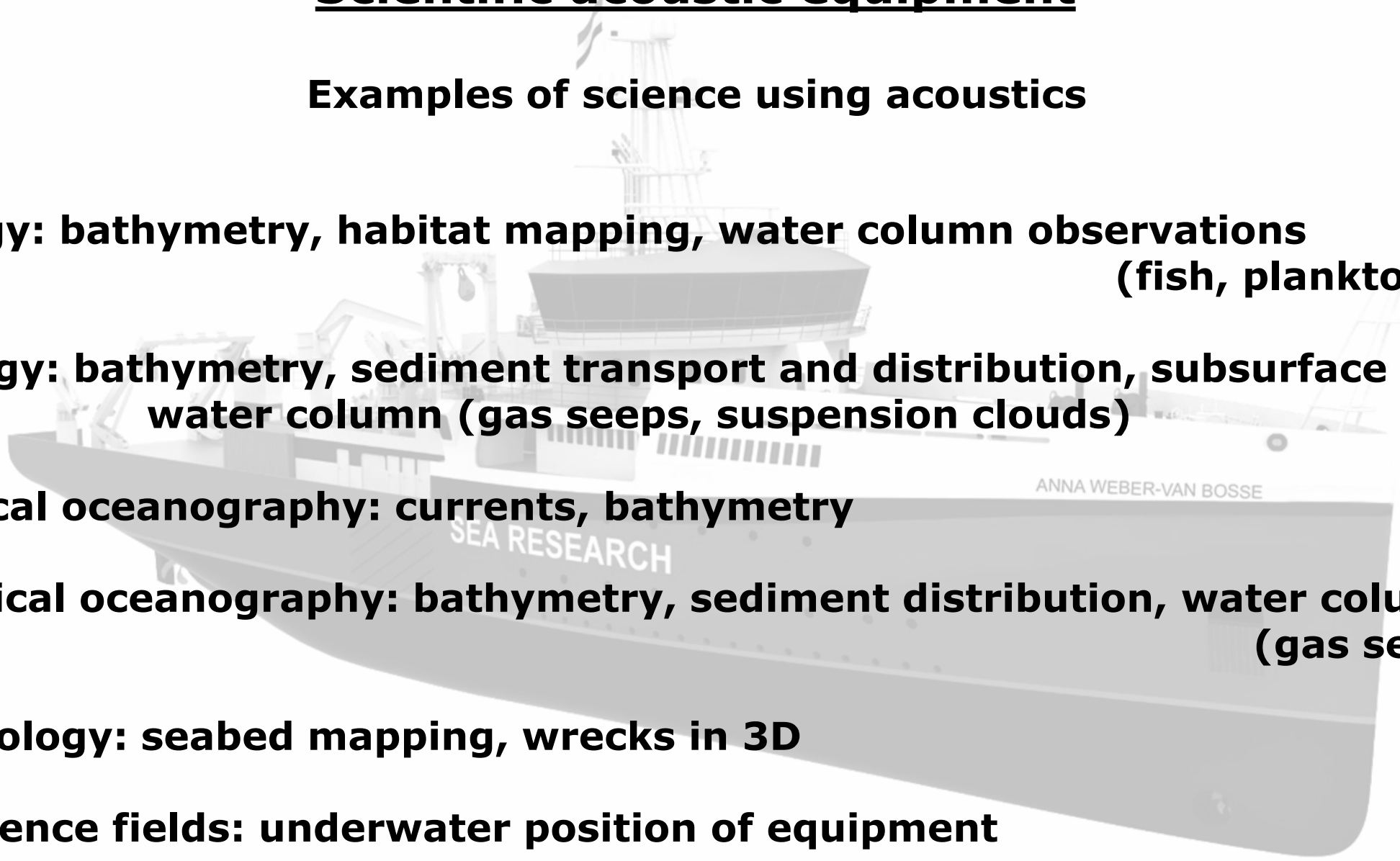
Geology: bathymetry, sediment transport and distribution, subsurface structures, water column (gas seeps, suspension clouds)

Physical oceanography: currents, bathymetry

Chemical oceanography: bathymetry, sediment distribution, water column (gas seeps)

Archeology: seabed mapping, wrecks in 3D

All science fields: underwater position of equipment



Scientific acoustic equipment

Detailed bathymetry
Seabed backscatter
Water column reflections

} **Multibeams**

Improvements relative to Pelagia (EM302, 1°x2°): **Higher resolution, better data in deep water, better data in shallow water, visualise objects in water column, more details in backscatter**

Deep water: **EM304 MKII, 0.5°x1.0° (incl. extra detections)**

Shallow water: **EM2040 MKII, 0.4°x0.7° (200-700 kHz, extra detections)**

SIS Remote

Scientific acoustic equipment

Depth at station and on transit:
- **Simple and reliable**
- **Shallow and deep water** → **Single beam echosounder**
- **Bridge and science**
- **Data logging possible**

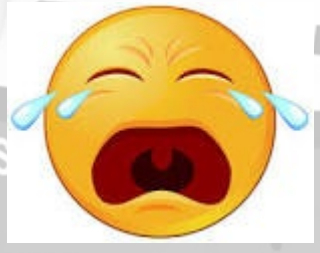
Pelagia: EA600 **Functions well**

Successor of EA600: **EA640**

Scientific acoustic equipment

Sediment profiling:
- **Shallow and deep water**
- **High resolution and deep penetration**
- **No/weak side reflections (so narrow beam)**
- **Various pulse types**
- **Basic (real-time) processing**

Pelagia: Oretech 3010



(Bad penetration in firm sediments
Quick loss of penetration on slopes)

Parametric echosounder: TOPAS PS18

Scientific acoustic equipment

Water column observations
Many different `targets':
- **fish, plankton**
- **gas bubbles**
- **sediment plumes**
- **density layers**

Need to quantify

} **Multiple frequencies**

Good processing options

Widely used in science world to compare data

Pelagia: EK500 (18, 38, 120 kHz)

→ **More frequencies and processing needed**

→ **EK80: 18, 38, 70, 120, 200, 333 kHz transducers**
EchoView software

Scientific acoustic equipment

Underwater positioning:

- **Samplers (box, pistoncorers)**
- **Towed equipment (video, dredge)**
- **ROV/AUV**
- **Shallow and deep water**

2 USBL systems

Pelagia: HiPAP 100  **, but not in shallow water and towing further behind the ship**

Shelf seas and ocean range<5000m: HiPAP502

Deep ocean: HiPAP102

Scientific acoustic equipment

Information on currents essential
for physical oceanography,
but also biology, geology, chemistry
Surface down to 1 km or more

} **Multiple ADCPs**

Pelagia: 1 vessel mounted 38 kHz ADCP: no details in upper layers

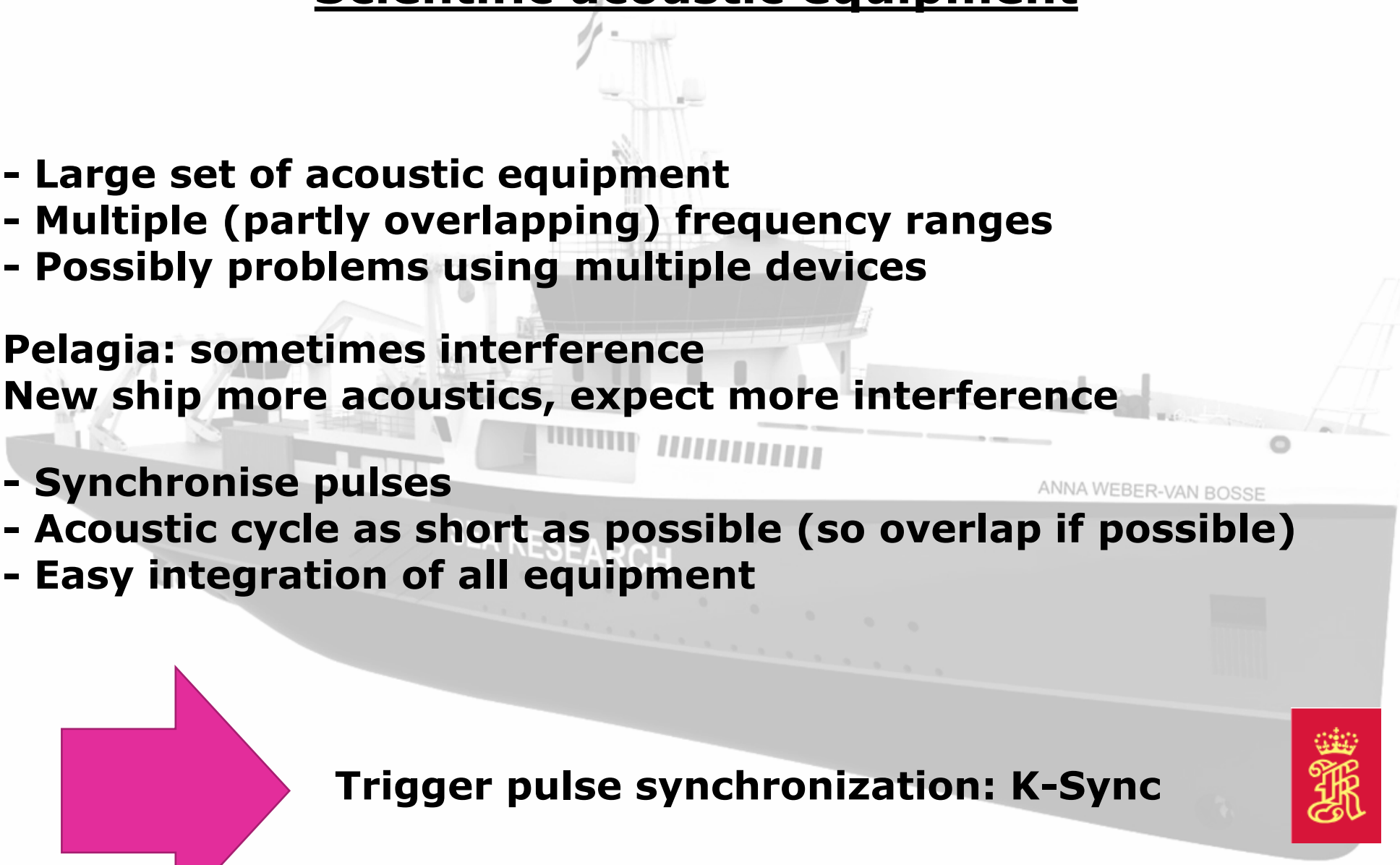
NIOZ has high frequency ADCPs to be deployed on rope:
does not work during transit

Easy operation: ADCPs should all use same software

55, 100, 250, 500 kHz ADCP from single manufacturer

NORTEK

Scientific acoustic equipment



- Large set of acoustic equipment
- Multiple (partly overlapping) frequency ranges
- Possibly problems using multiple devices

Pelagia: sometimes interference
New ship more acoustics, expect more interference

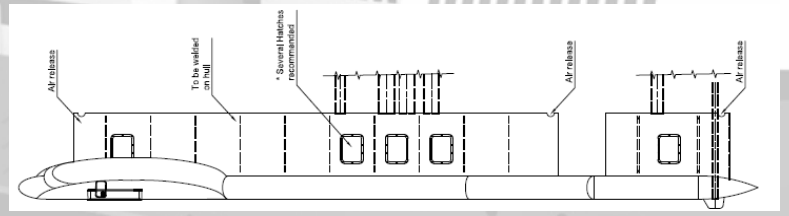
- Synchronise pulses
- Acoustic cycle as short as possible (so overlap if possible)
- Easy integration of all equipment

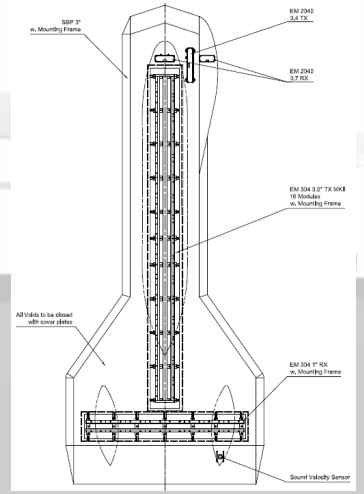
Trigger pulse synchronization: K-Sync

Scientific acoustic equipment

Acoustics and air bubbles  →
- **Gondola**
- **Pole**
- **Drop keel**
- **Blister**

Various options discussed and designs made





- **Large gondolas and blisters cause drag**
- **Asymmetrical location → asymmetric drag**
  compensate with rudder → additional drag

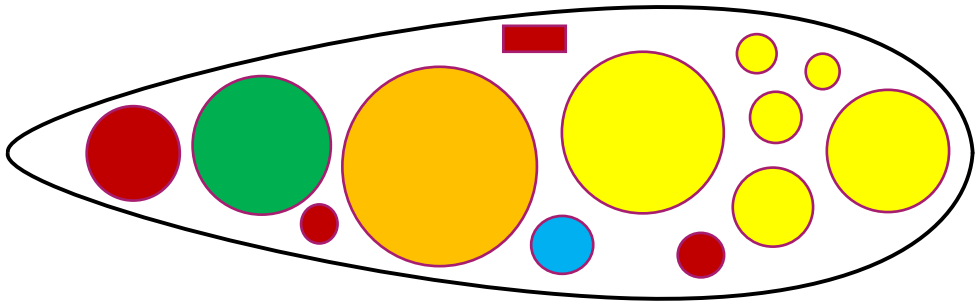
} **Extra fuel consumption (Extra CO_2 and money)**

Location of scientific transducers

Final solution, important: shallow NIOZ harbour → Nothing below keel

- **HiPAP502: deployment pole (sphere protected when not in use)**

- **EK80, 1 ADCP & HiPAP102: drop keel (3.3x0.8 m, 3 m down)**



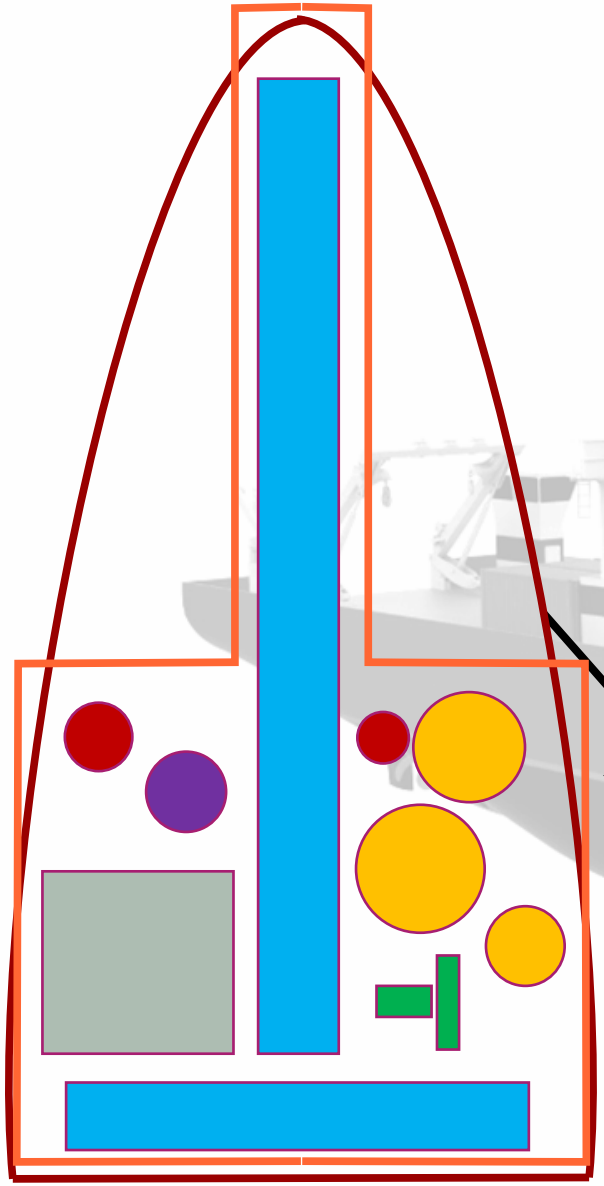
EK80
100 kHz ADCP
HiPAP102
Hydrophone
Spare

- **All other acoustics:**
  hull-integrated gondola (±4x8m):
  symmetrical & lower drag → save fuel (5%)

This sheet has been adjusted for public release

Location of scientific transducers

Hull-integrated gondola

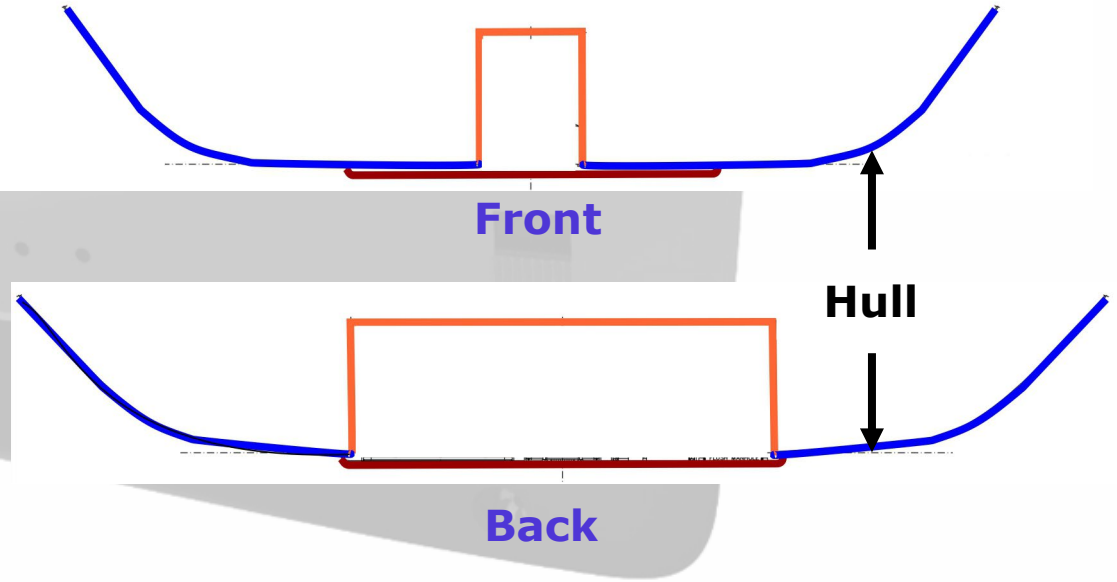


- ADCP (acoustic window)
- EA640
- EM2040 MKII
- EM304 MKII
- TOPAS PS18
- Spare

Underwater shape

Internal walls

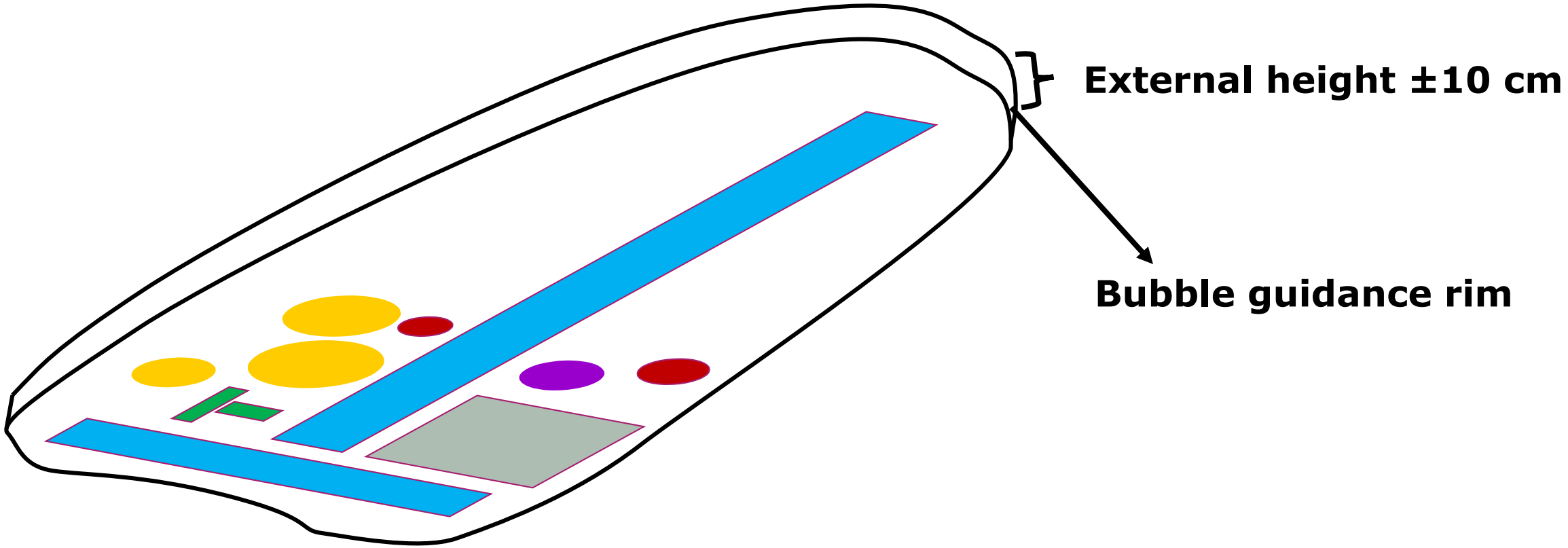
Cross sections



This sheet has been adjusted for public release

Location of scientific transducers

Hull-integrated gondola



This sheet has been adjusted for public release

Location of scientific transducers

Hull-integrated gondola, will it work?

Pelagia EM302 gondola:

Plenty of room for air bubbles

Freely mounted

Location of scientific transducers

Hull-integrated gondola, will it work?

Asked shipyard for ships with similar integrated gondola

All respondents 

…… but be aware that the success also depends on:
- **General hull shape**
- **Bow shape**
- **Weather**
- **Thruster tunnels**
- **Welding seams**
- **Etc.**

Demand for low environmental impact ship
Positive experiences earlier vessels

→ **Hull-integrated gondola**

The End