

Modernization of RV Aranda

IRSO 2015,
Scripps Institution of Oceanography,
San Diego, 21 October 2015



Jukka Pajala

Senior officer, M.Sc. (Tech) Naval architect, MRINA

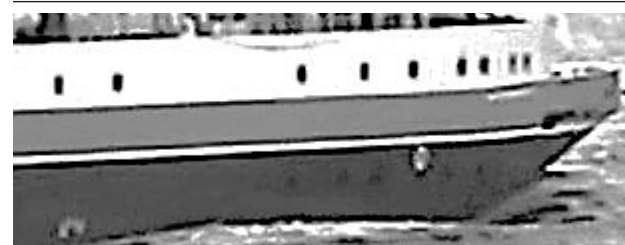
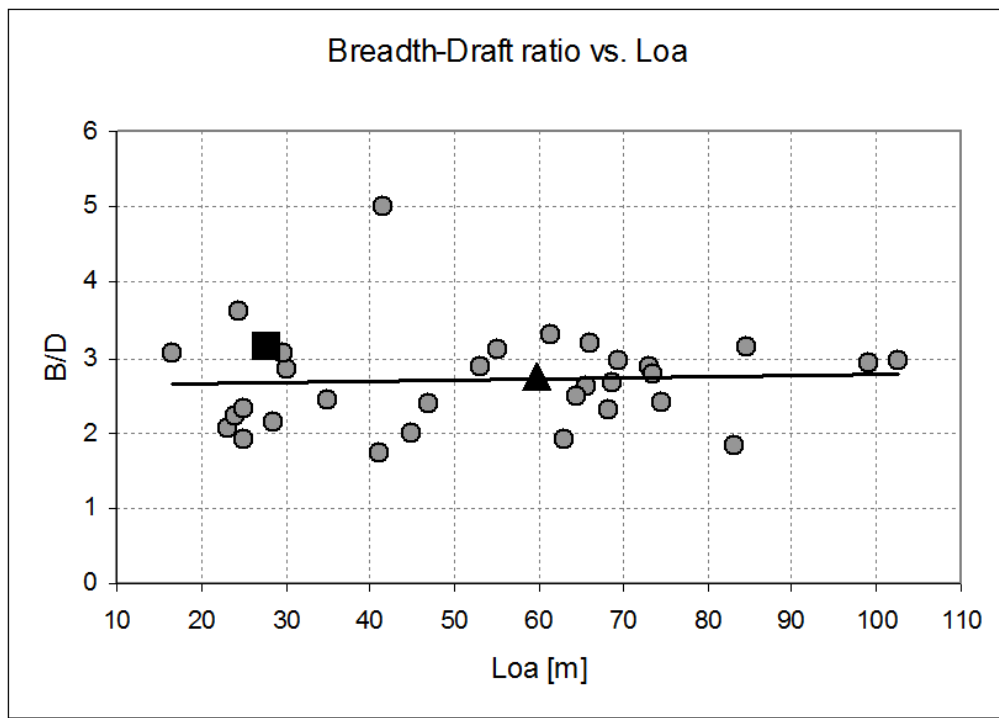
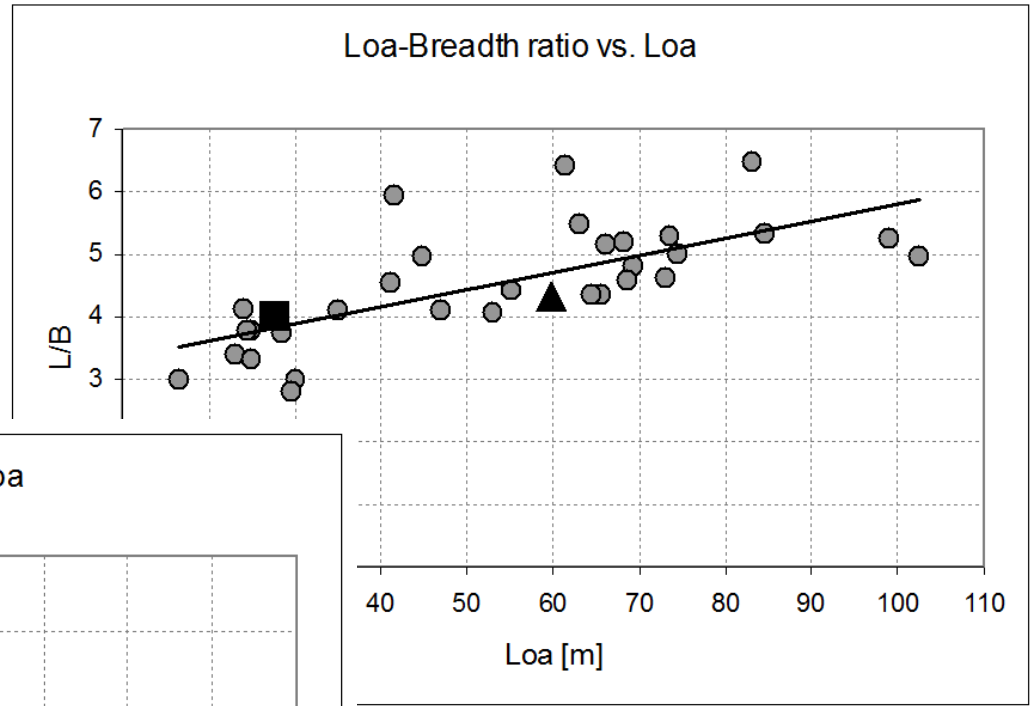
Finnish Environment Institute

Marine Research Centre



Main dimensions

| | |
|-------------------------|--------------|
| Length _{WL} | 52.5 m |
| Breadth _{MAX} | 13.6 m |
| Draft _{DESIGN} | 4.6 m |
| Grosstonnage | 1599 RT |
| Lighthouse | 1 325 m tons |
| Deadweight | 500 m tons |



ARANDA2020

Main dimensions



Aranda's Design criteria

HVAC

Outside air temp – 35 - +35 C

Sea temp -2 ... + 25 C

DECK GEAR OPERATION

Air temp – 35 - +35 C

HULL MATERIAL

Above waterline - 10 C

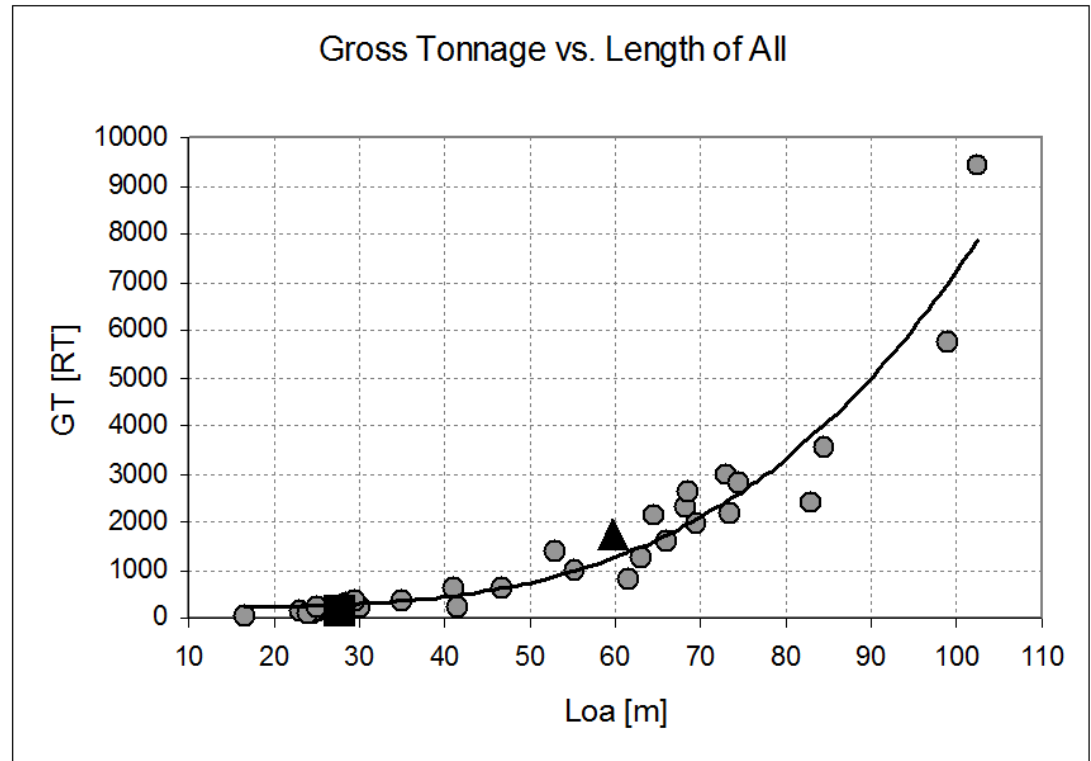
Under waterline 0 C

Sea state 6

Acc to DNV Class 1A1 E0

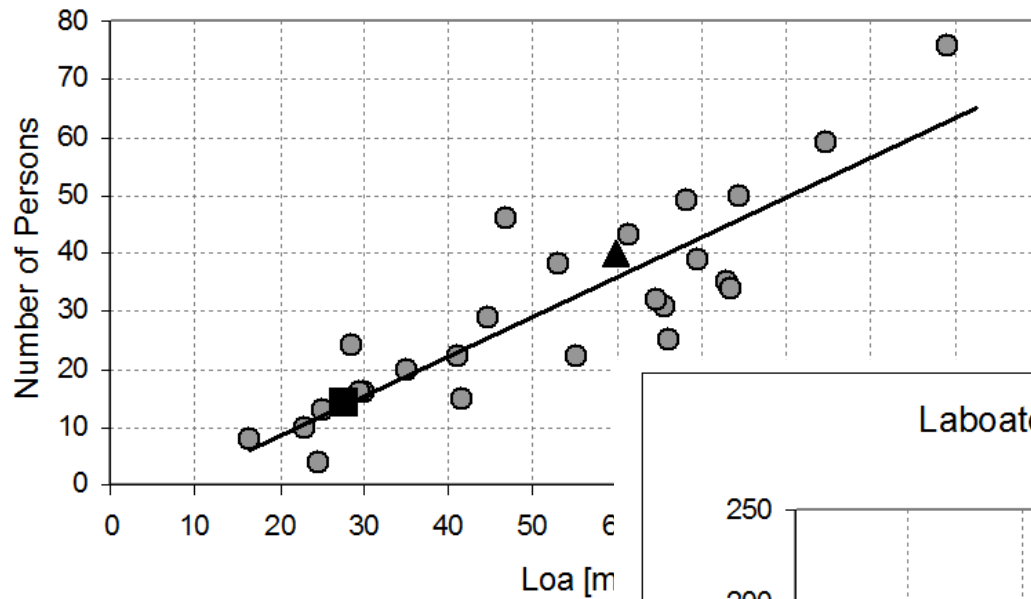
Special purpose ship **Ice 1 A**

Super

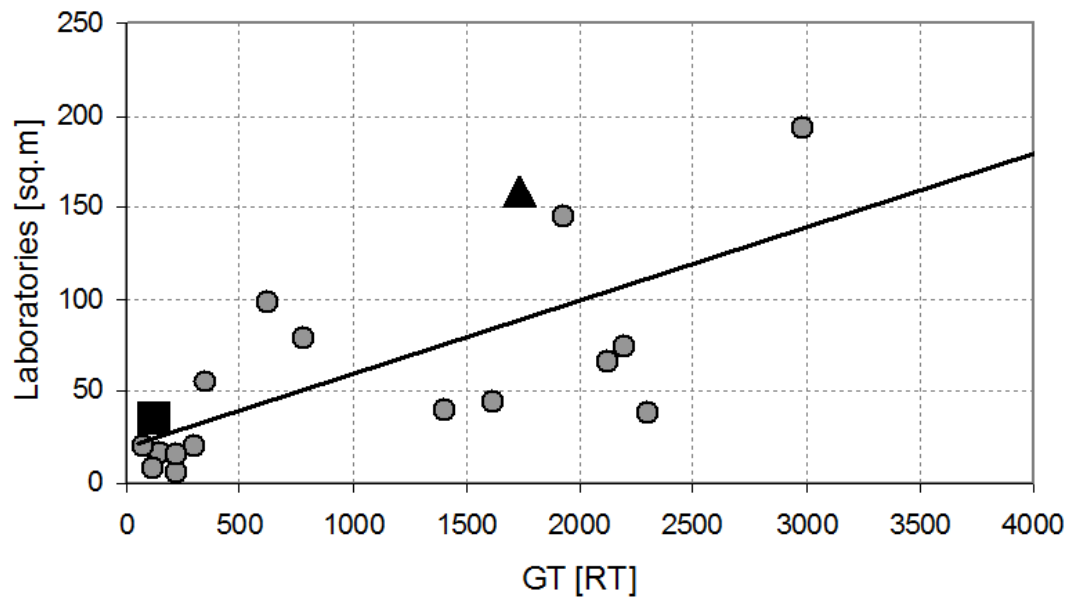


ARANDA2020

Number of Persons onboard vs. Ship Length



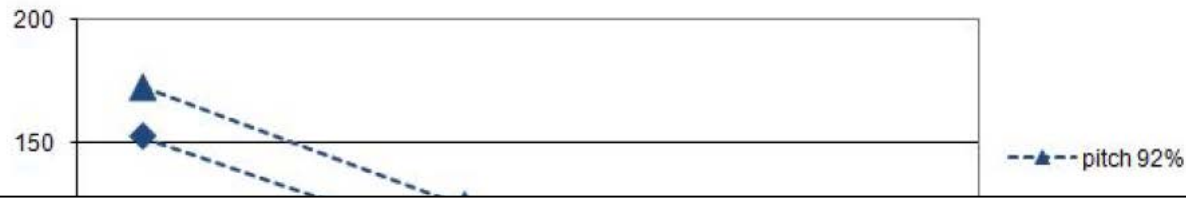
Laboatory spaces vs. Gross tonnagel



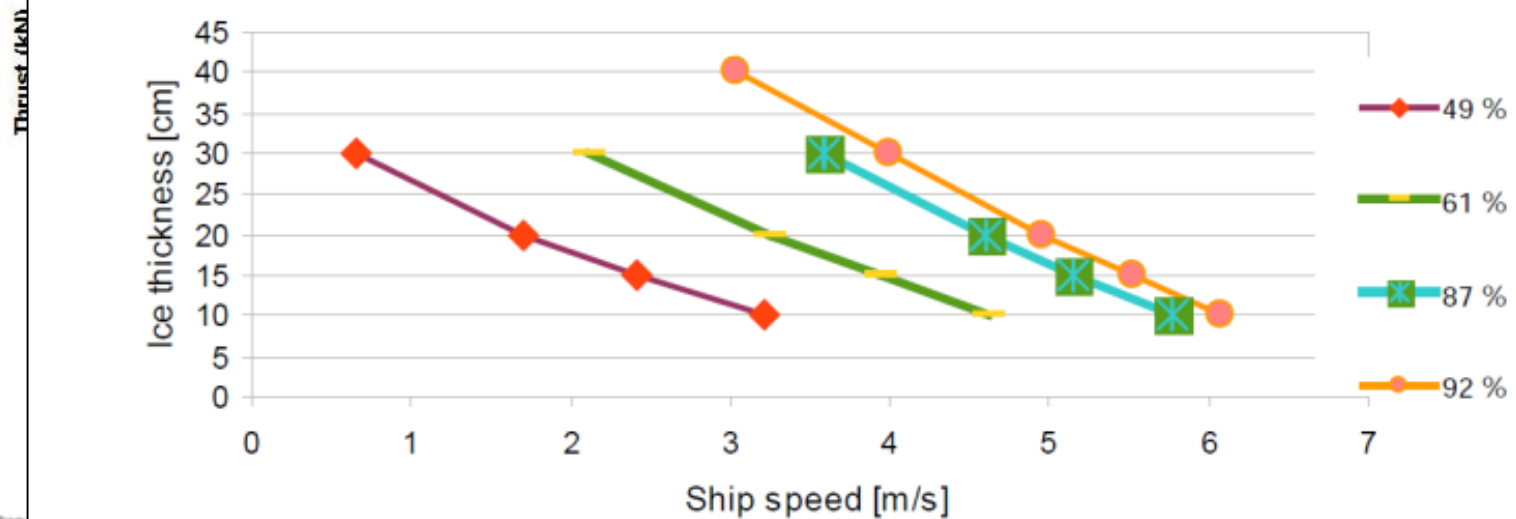
ARANDA2020

Ship performances, level ice

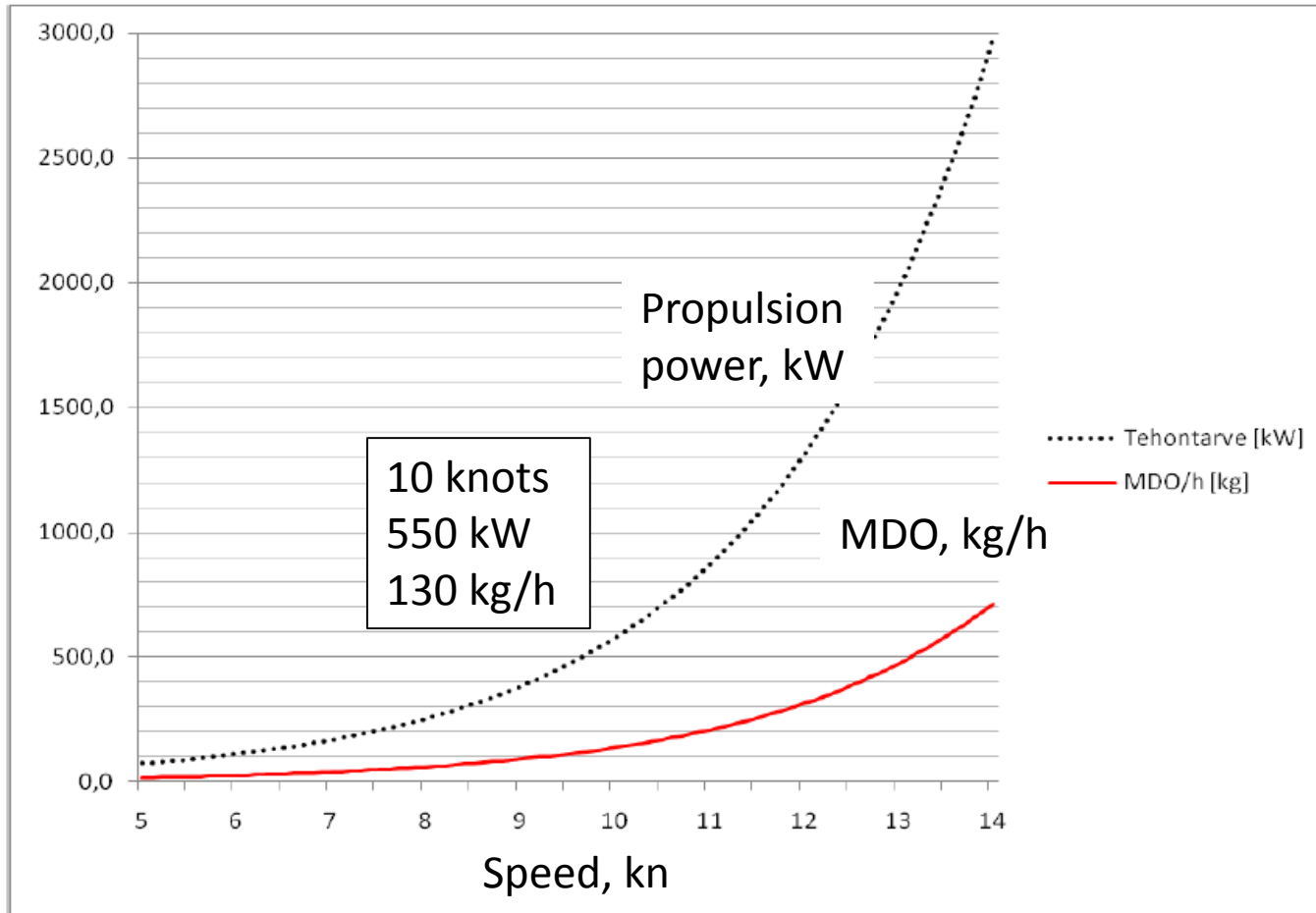
Theoretical net thrust curve



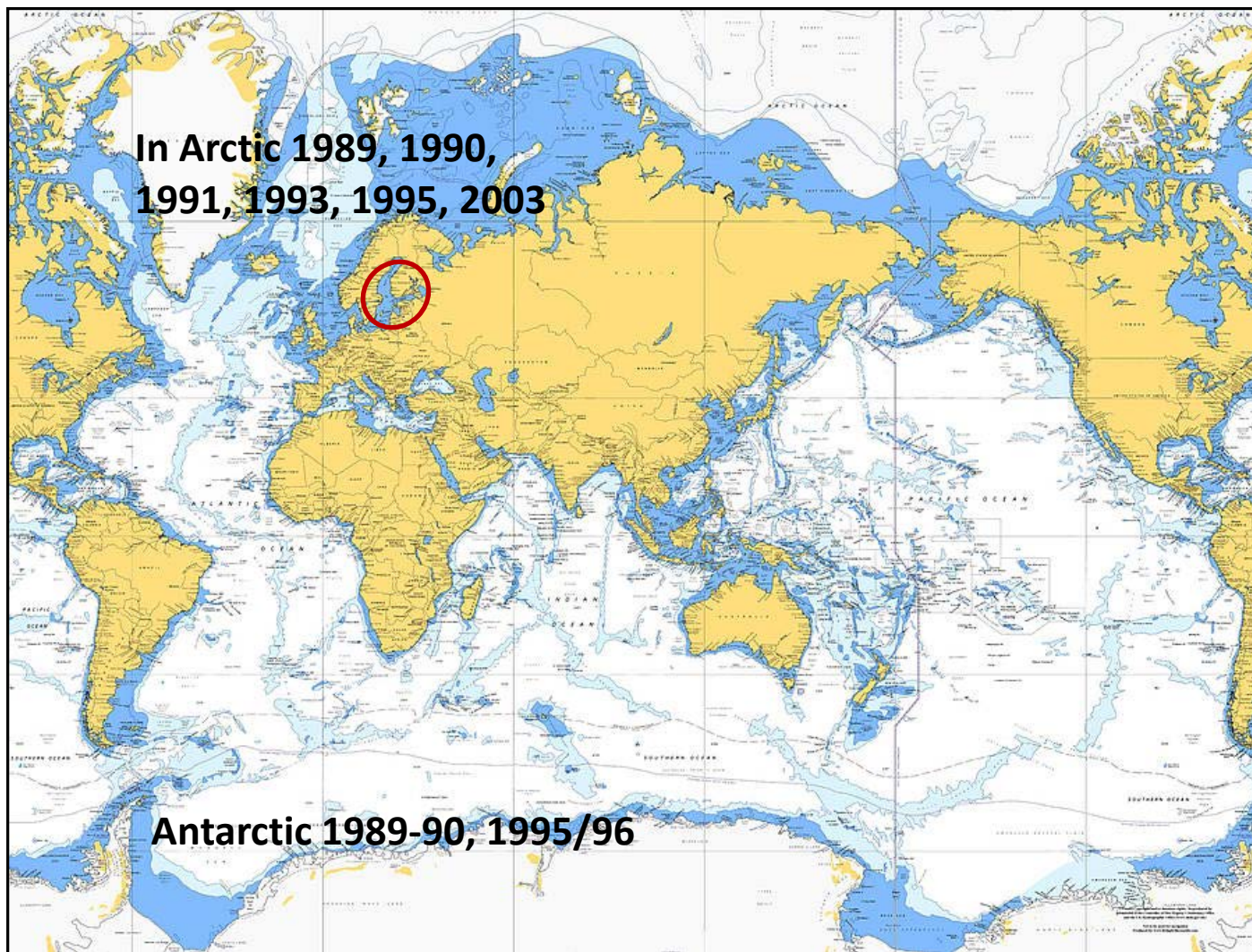
Aranda h-v curve



Ship performances, fuel consumption

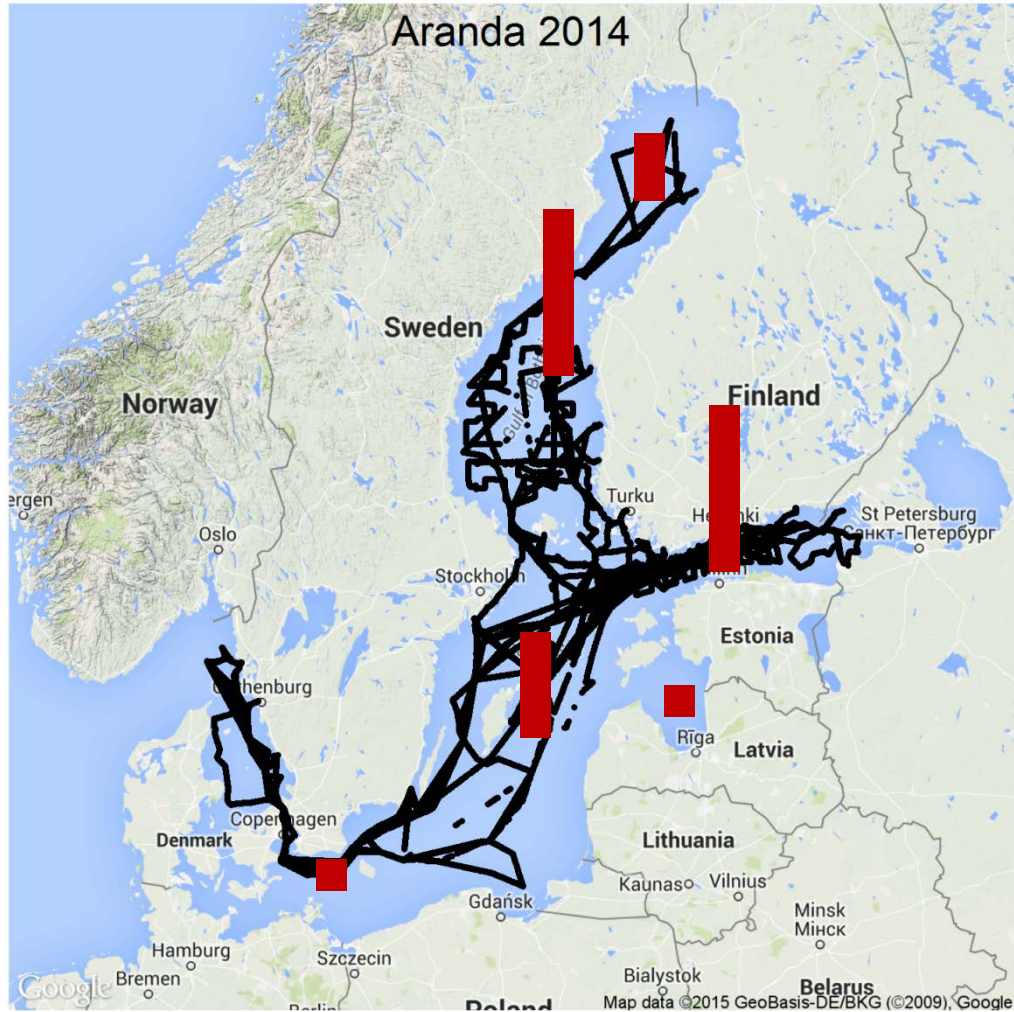


RV Aranda's navigation area 1



ARANDA2020

RV Aranda's navigation area 2



ARANDA2020

Modernization, why?

A large white research vessel named ARANDA is shown sailing on the sea. The ship has a complex superstructure with various antennas and equipment. The name 'ARANDA' is visible on the side of the hull. The background shows a hazy sky and a distant coastline.

Ship is basically good but 25 years old
Old systems - high maintenance costs
New scientific requirements
10 M€ is less than 60 M€

Aranda to be the Finnish maritime industry's flagship of competence in the design and construction of special-purpose ships.

ARANDA2020

Four main objectives

Communication facilities, internal and external

Ship's minimum emissions, as an example of real time controlling.

Unmanned research systems, robotics in water and in air

Silent ship for active and passive acoustics

Technology studies in process

Hull extension to increase the aft working deck 50 m², impacts of alternatives to the ship's hydrostatic and dynamic performance

Future communication systems for marine research vessel, inside the ship and data transfer to the shore

Waste heat potential for exploitation

Update of laboratory arrangement (sampling, analysis, storage).

Possibilities for the use of solar and wind energy on board

Available fuel options, economy and emissions, as well as a fuel cell based electricity production

Efficient and safe work boat, alternatives and benefits

A study of laboratories

Study of accommodation alternative arrangements and an example of the cabin interior

Study of operation of unmanned airborne vehicles, requirement for ship outfitting

Operation of unmanned waterborne vehicles, requirement for

Replacement of the Schilling rudder with smaller one and/or a azimuthing thrust

Diesel electric machinery, options and their impact on the energy economy, emissions and performance of the vessel

Unmanned continuously measuring systems of uncontaminated water and air samples

Advanced DP system for marine research vessels

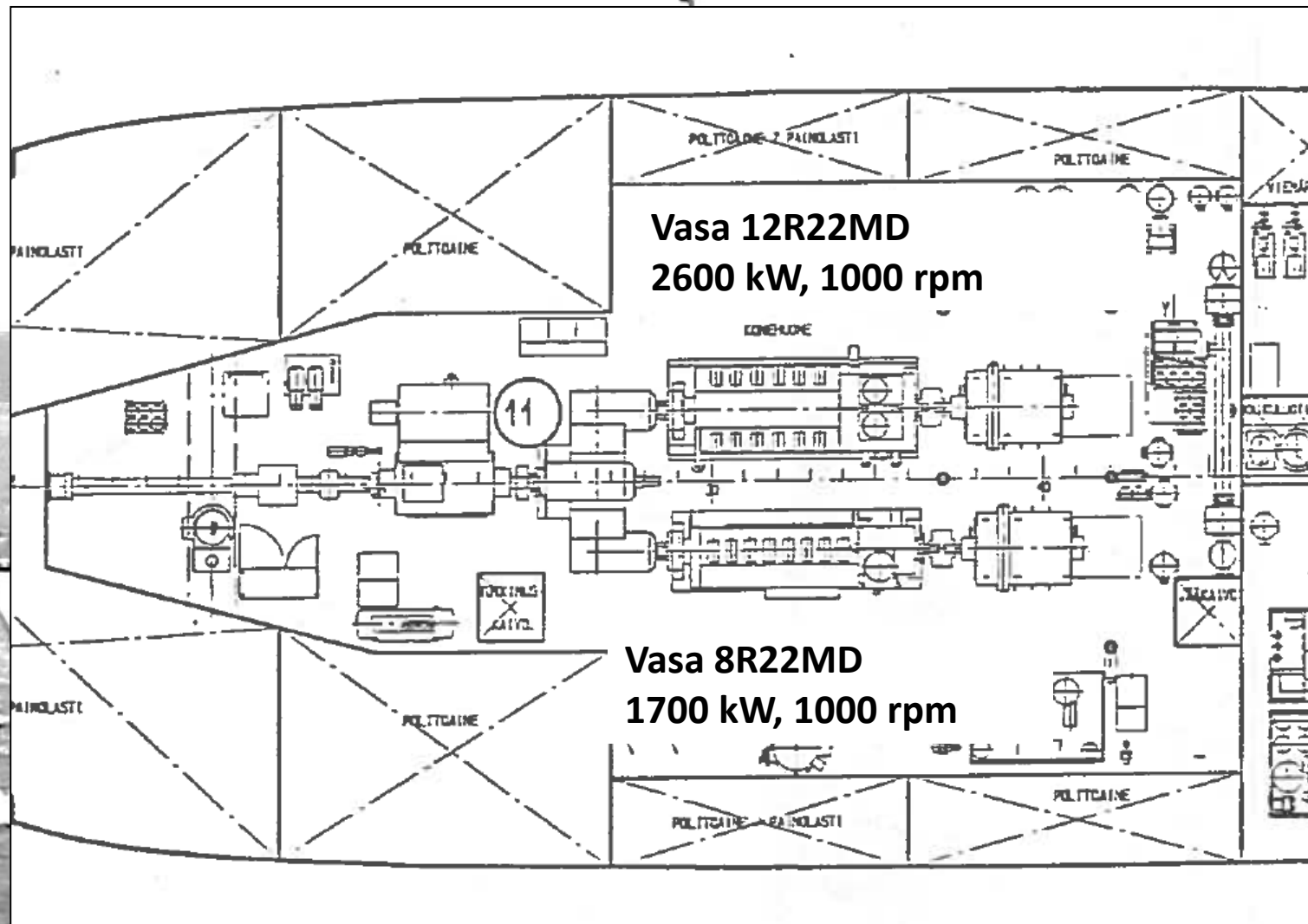
Safe passage to the boat and onto the ice regarding possible new side door, lifting and landing gear

Review of existing international and national rules and regulations, the impact of the sailing area (Baltic Sea vs. Arctic Ocean)

Advanced acoustic measurement system including seabed mapping and marine life monitoring

Experts from eleven Finnish companies are working for these now.

Reducing underwater noise

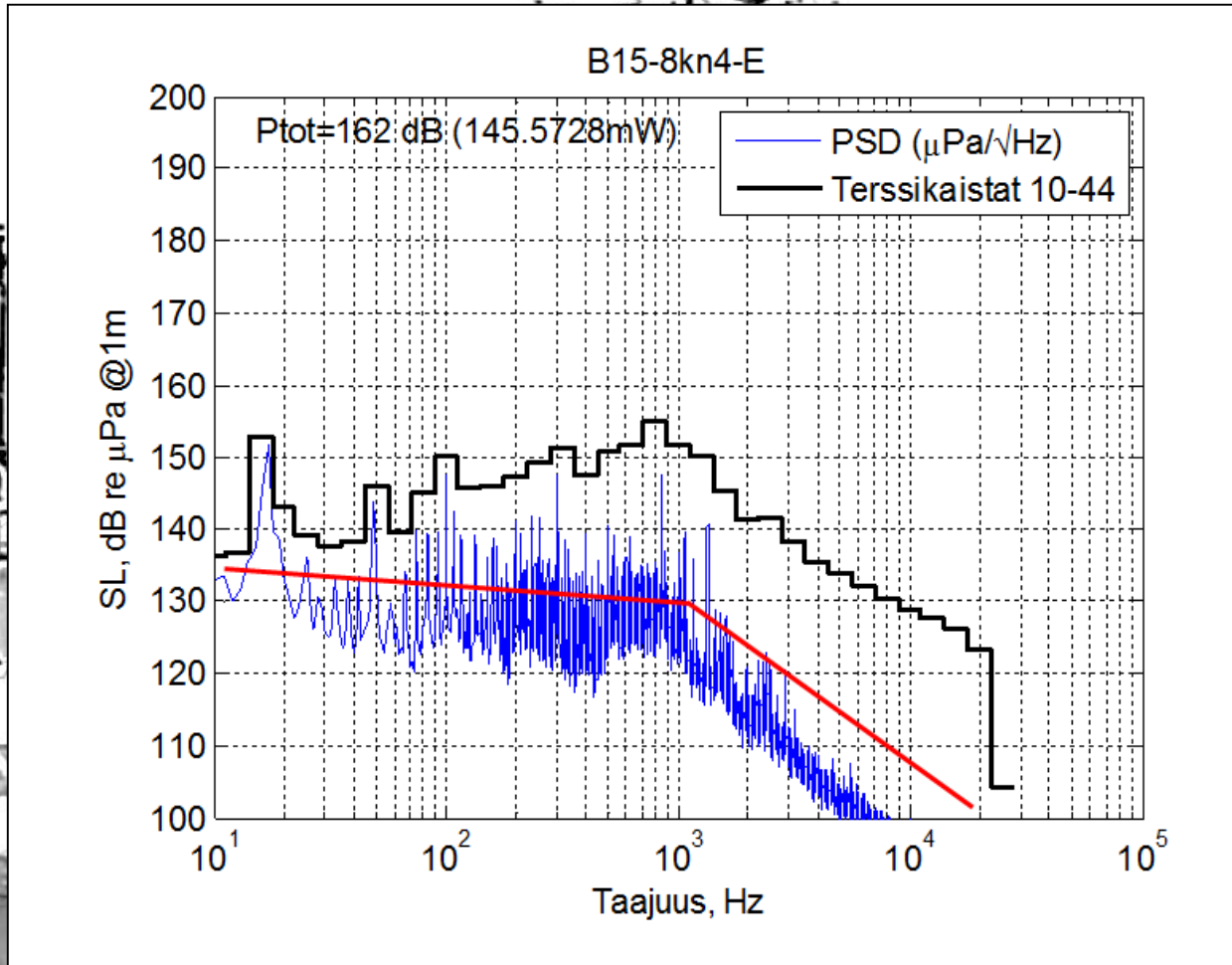


Reducing underwater noise



ARANDA2020

Reducing underwater noise

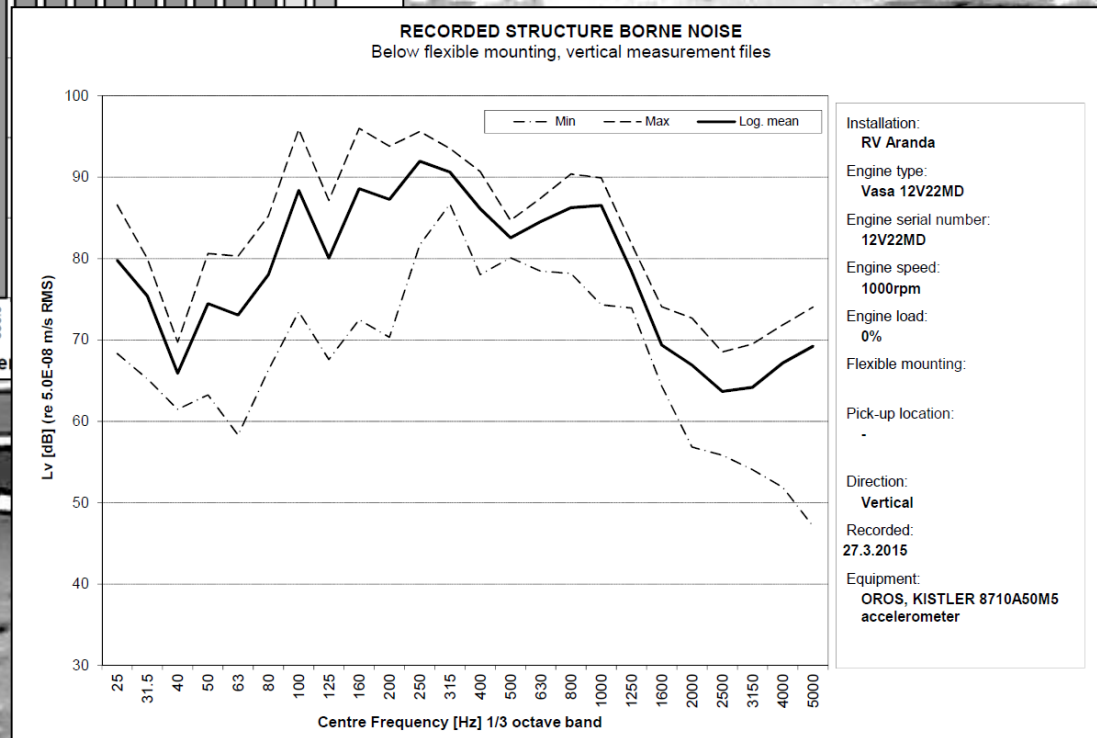
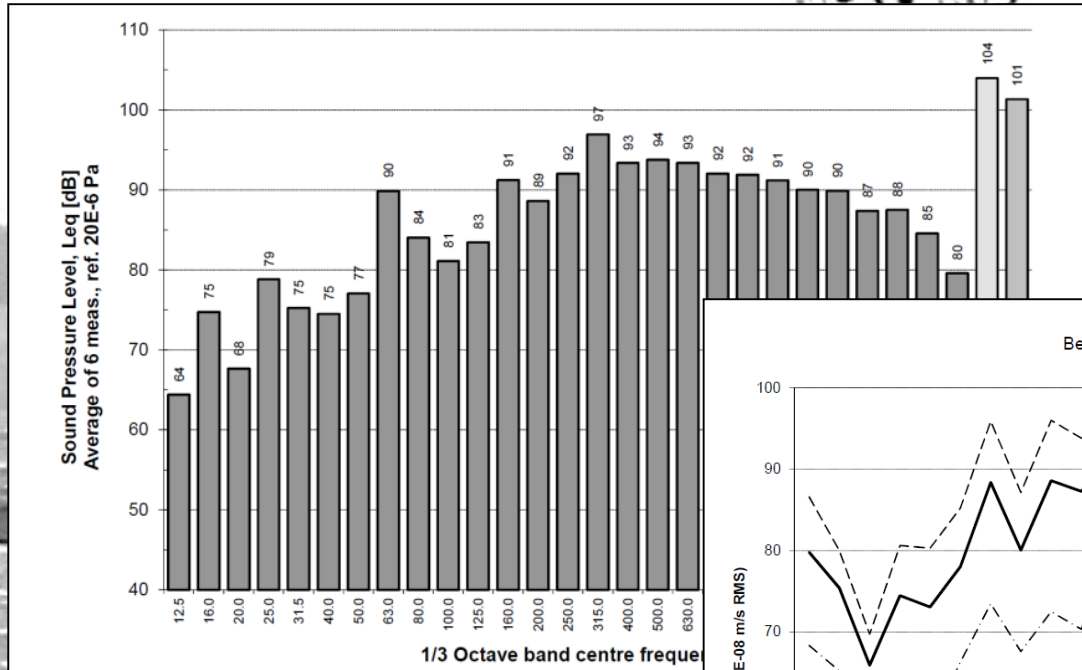
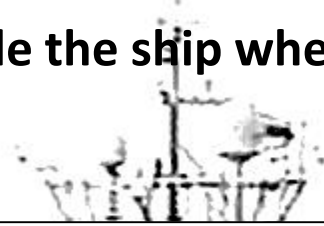


Engines as noise sources,

Measurements inside the ship when engines running

Vasa 8R22MD

1700 kW, 1000 rpm



Separated sources, air sound and vibrator

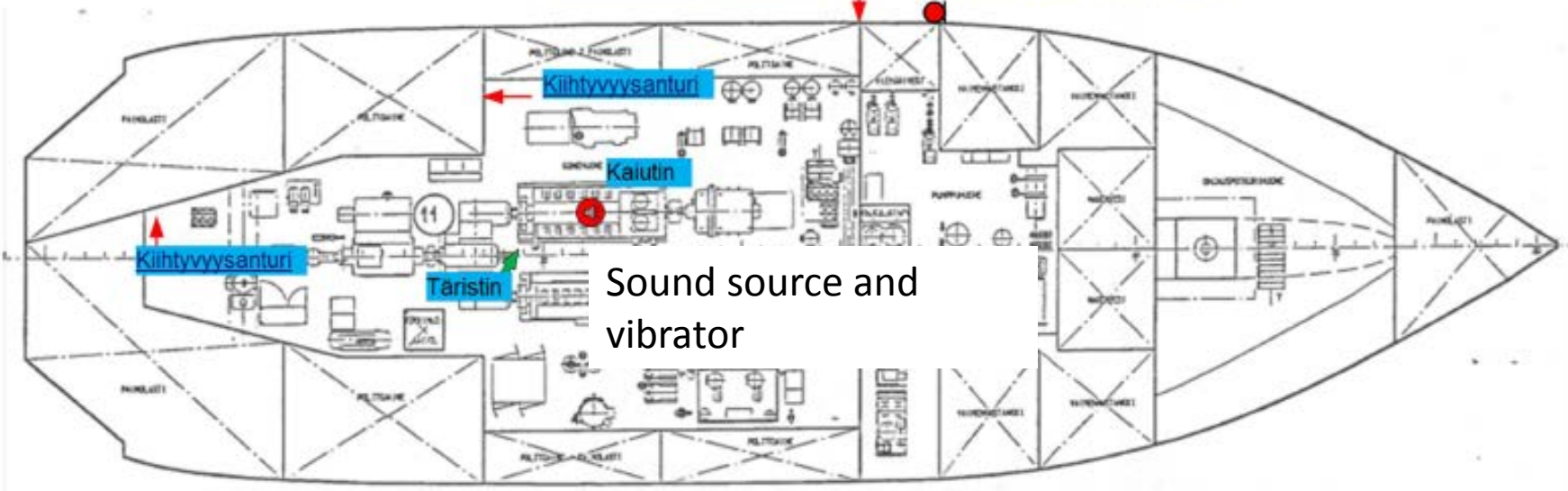
Measurements inside and outside the ship, engines off

Accelerometers inside

Kiihtyvyyssanturi 0.5 m syvyydessä
ja 1.5 m pinnan yläpuolella

Accelerometers and
hydropohne outside

Hydrofi

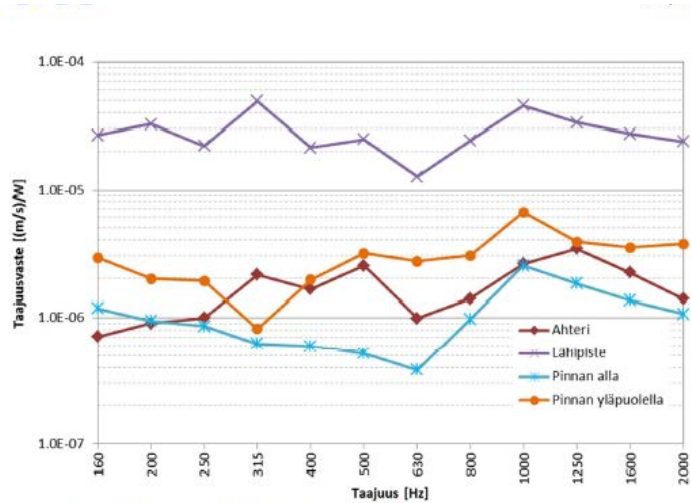


Separated sources, air sound and vibrator

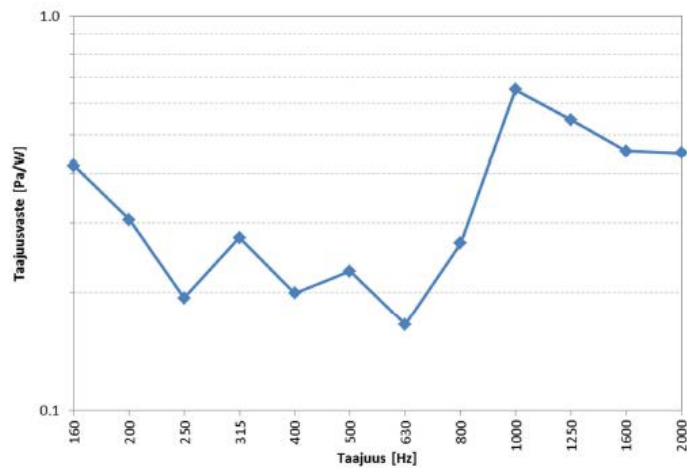


Separated sources, results

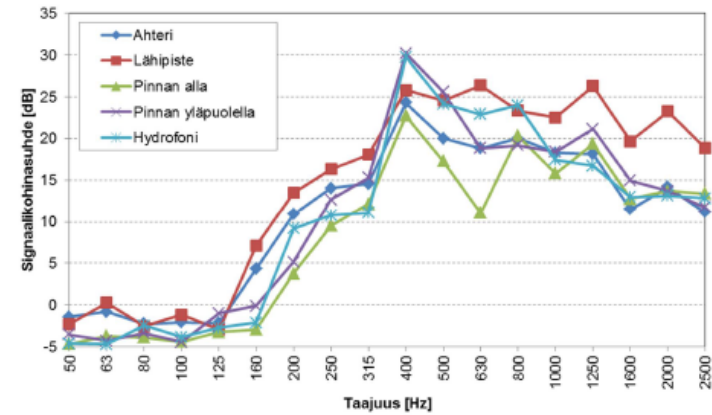
CR-04279-15
10 (16)



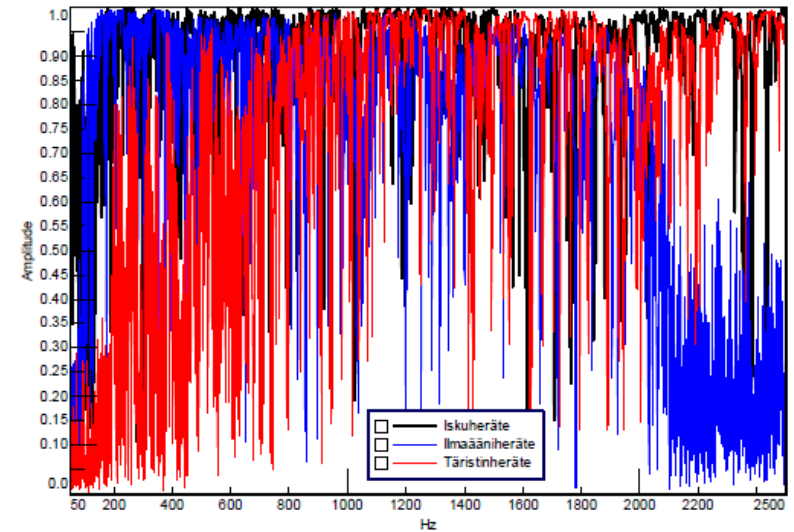
Kuva 19. Värähtelytaajuusvasteet ilmaäänierätteellä.



Kuva 20. Hydrofonin taajuusvaste ilmaäänierätteellä.

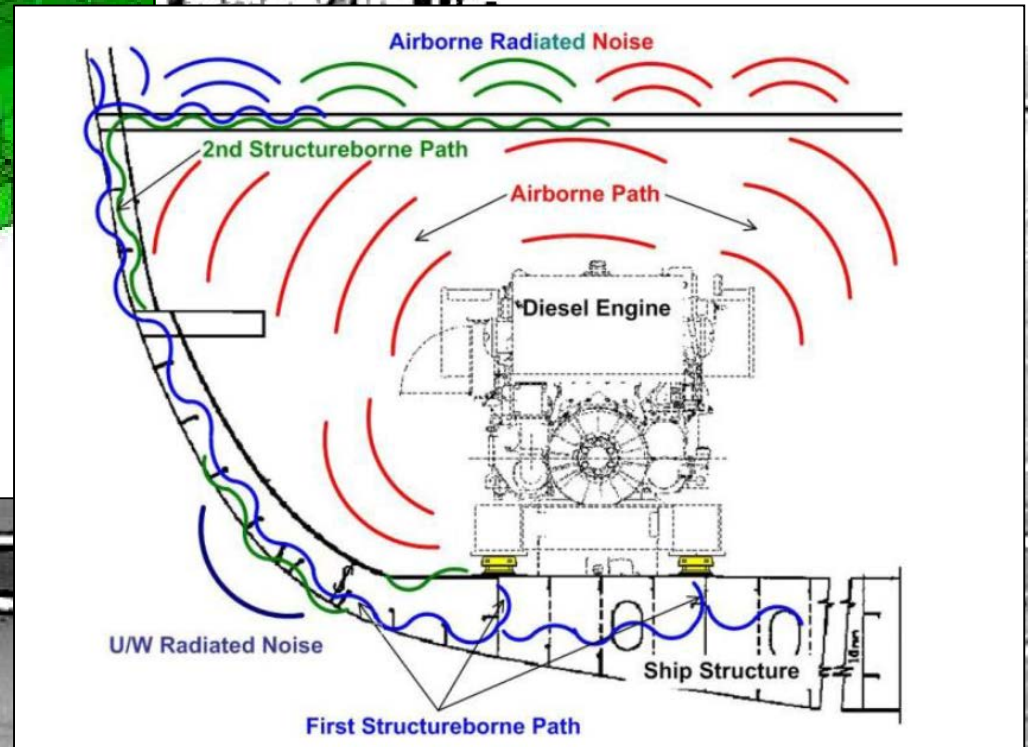
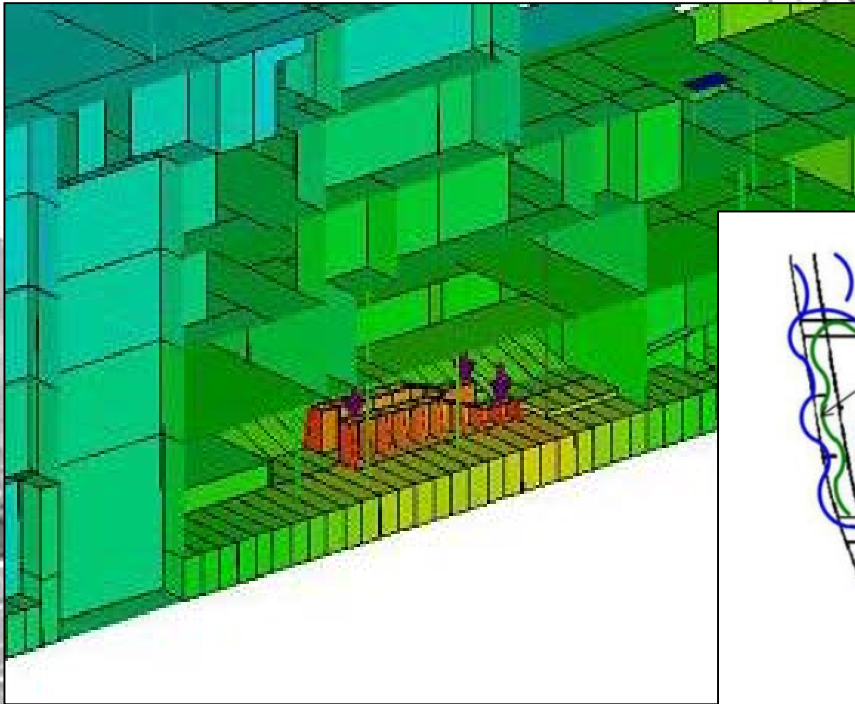


Kuva 10. Vastespektrien signaalkohinasuhteet iskuherätteellä.



Kuva 11. Koherenssi eri herätteillä lähipisteessä.

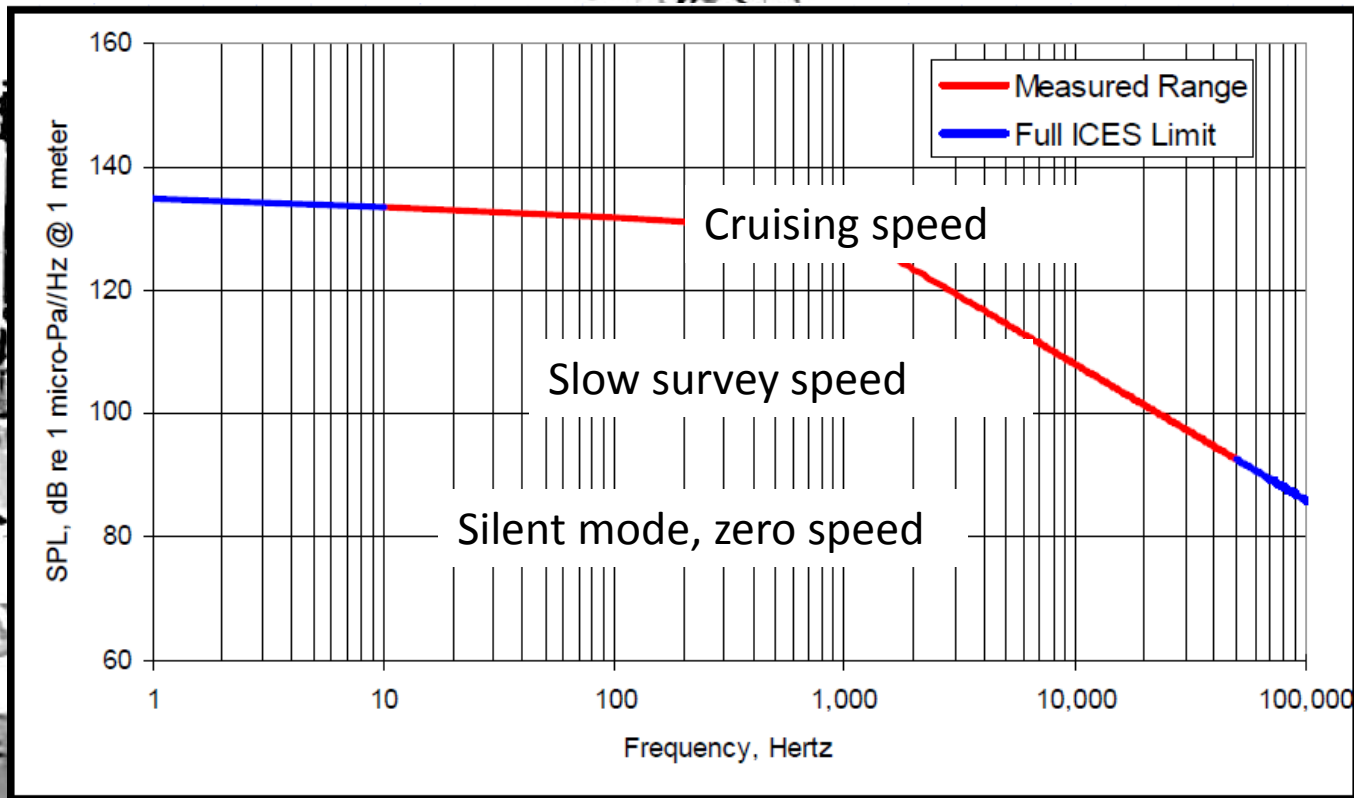
Next step: modelling the vibration transfer from ship to the sea



Reducing underwater noise

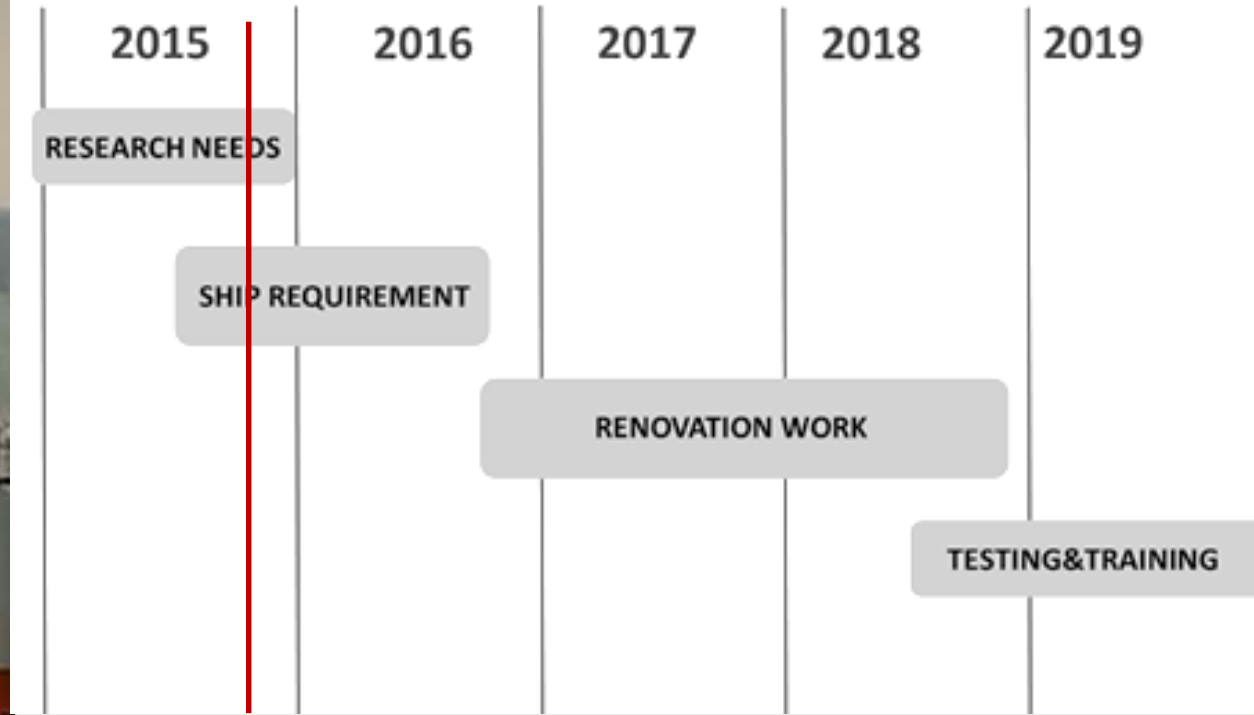
Targeting low

ICES Silent-R



ARANDA2020

Modernization schedule



ARANDA2020



Thank you for your attention.



Jukka.Pajala@ymparisto.fi