

Modernization of RV Aranda

IRSO 2016,
Capri, 9-13 October 2016

REMOVING UNWANTED SOUND SOURCES

Jukka Pajala

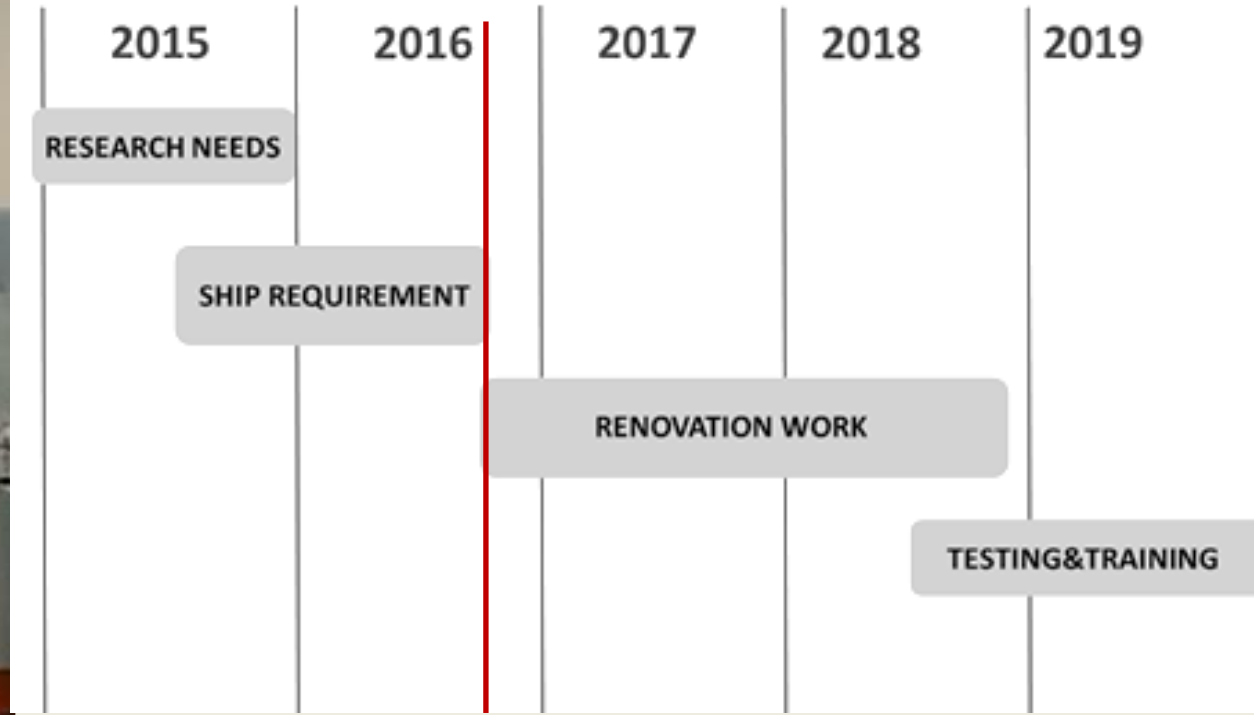
Senior officer, M.Sc. (Tech) Naval architect, MRINA

Finnish Environment Institute

Marine Research Centre



Modernization schedule



Request for quotation, October 2016
Ship yard contract, December 2016

RV Aranda at present

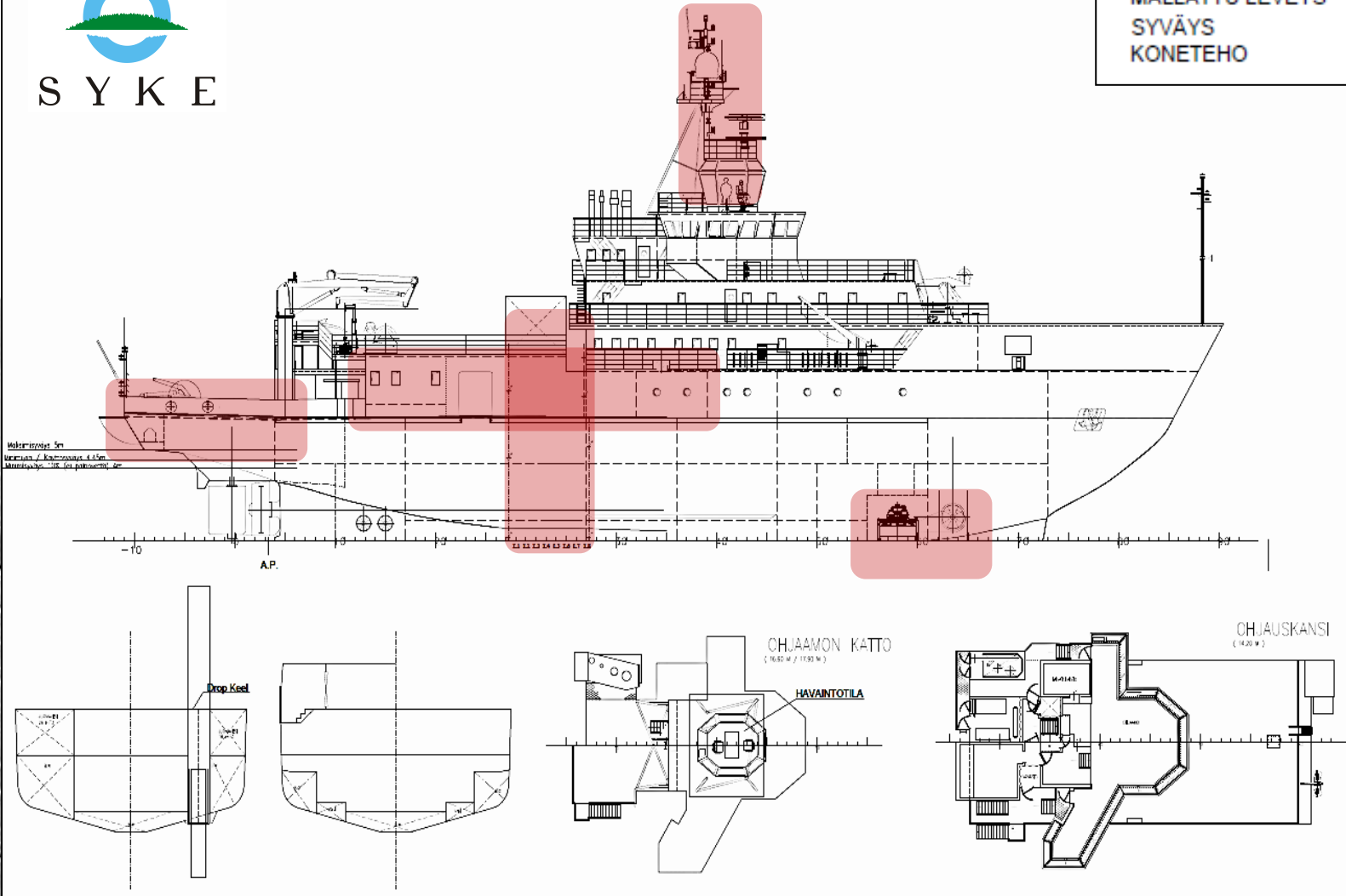


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RV Aranda in the future



SUURIN PITUUS	65,67	m
PERPENDIKKELIPITUUS	55,59	m
MALLATTU LEVEYS	13,80	m
SYVÄYS	5,00	m
KONETEHO	3000	kW



Prioritizing the researchers' needs

Top 10/26

- 1 Safety on working deck and in labs
- 2 Scientific winch and gear maintenance/update
- 3 Aft working deck update (bigger size)
- 4 Low energy consumption and emissions
- 5 Heating, ventilation and AC update in laboratories
- 6 **Low ship self- noise**
- 7 Laboratory lay out update
- 8 Cabin furniture refit
- 9 Safe transfer to/from working boat and ice
- 10 Heating, ventilation and AC update in cabins

6. LOWER SHIP SELF-NOISE

UNDERWATER RADIATED NOISE AND AIR NOISE INSIDE THE SHIP

WHY IT IS IMPORTANT TO REDUCE NOISE?

IT IS POLLUTION (IMO GUIDELINES)

UNDERWATER RADIATED NOISE HAS AN ADVERSE IMPACT ON ECOSYSTEM (EU MSFD D11)

NOISE INSIDE THE SHIP IS UNCOMFORTABLE

HIGH SELF-NOISE LOWERS THE SCIENTIFIC PERFORMANCE

6. LOWER SHIP SELF-NOISE

BASICS OF UNDERWATER NOISE

Sonar equation $SPL = SL - PL$

Sound pressure level (SPL), Source level (SL), Propagation loss (PL)

Sound pressure level (SPL):

Level of mean square sound pressure (p_{RMS}^2):

$$SPL \equiv 10 \log_{10} \frac{p_{RMS}^2}{p_0^2}$$

p_{RMS} = RMS sound pressure

$p_0 = 1 \mu\text{Pa}$ (reference sound pressure)

Units: dB re 1 μPa

IS RV ARANDA A NOISY SHIP?

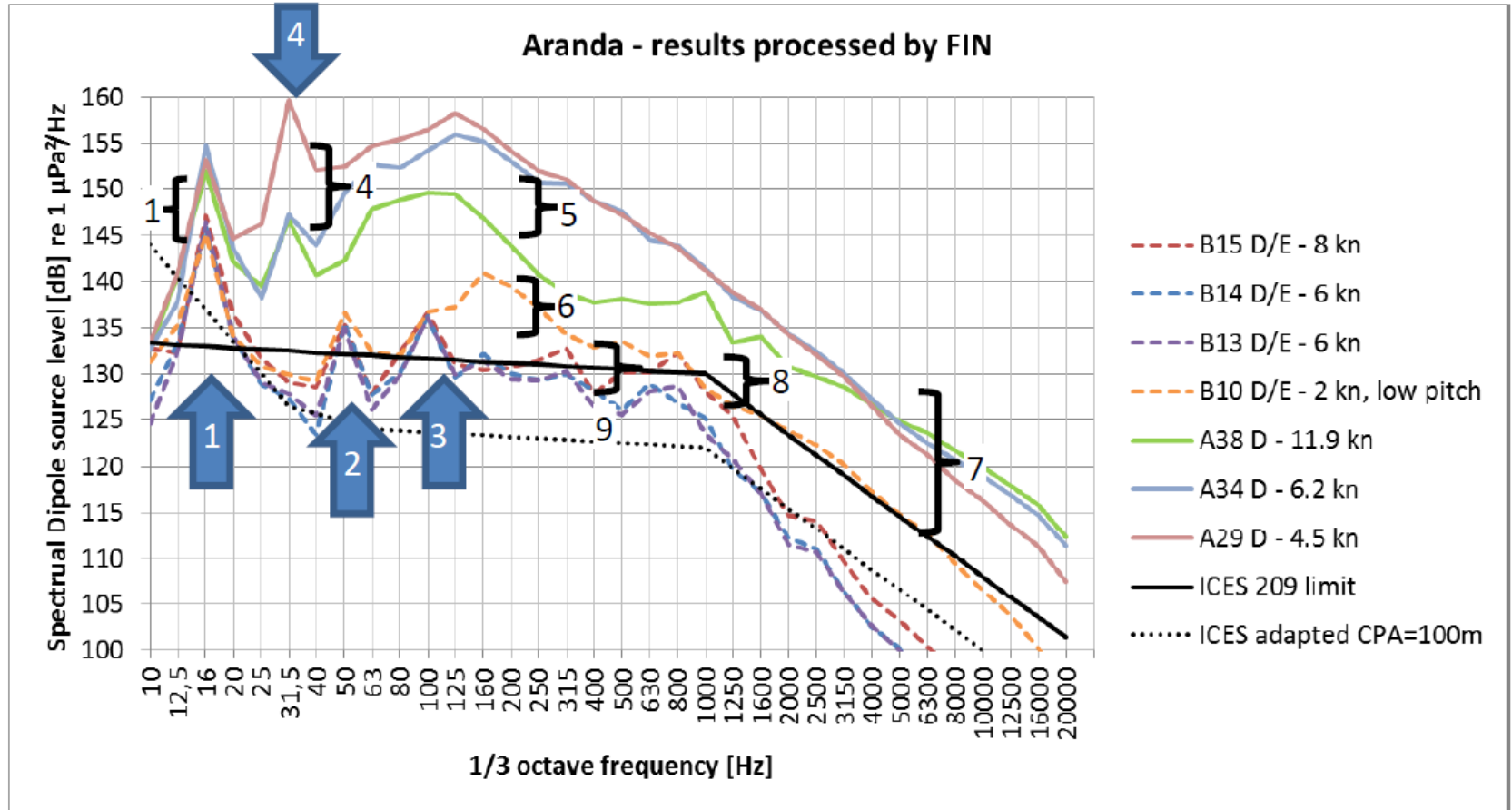
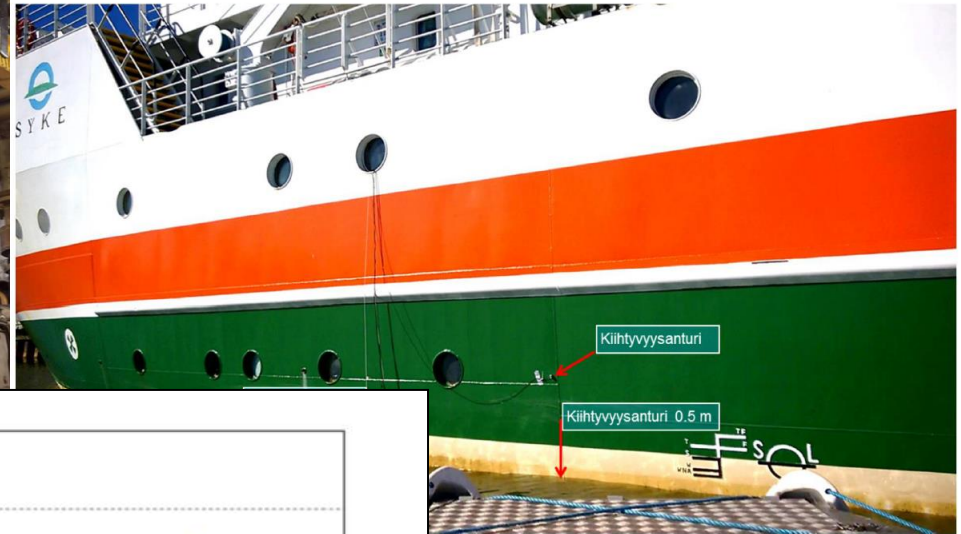


FIGURE 9: RESULTS FROM PROCESSED UNDERWATER NOISEMEASUREMENTS FOR DIFFERENT OPERATION MODES

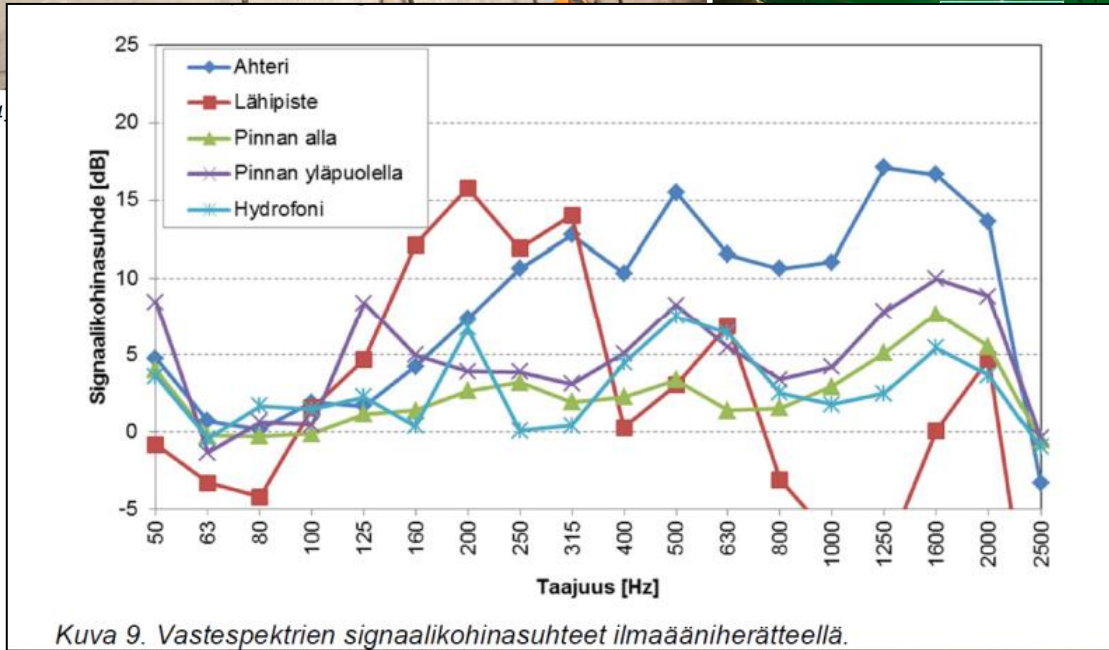
MITIGATION MEASURES ONBOARD RV ARANDA

INSIDE ACOUSTICS



Kuva 4

iden sijoitus.

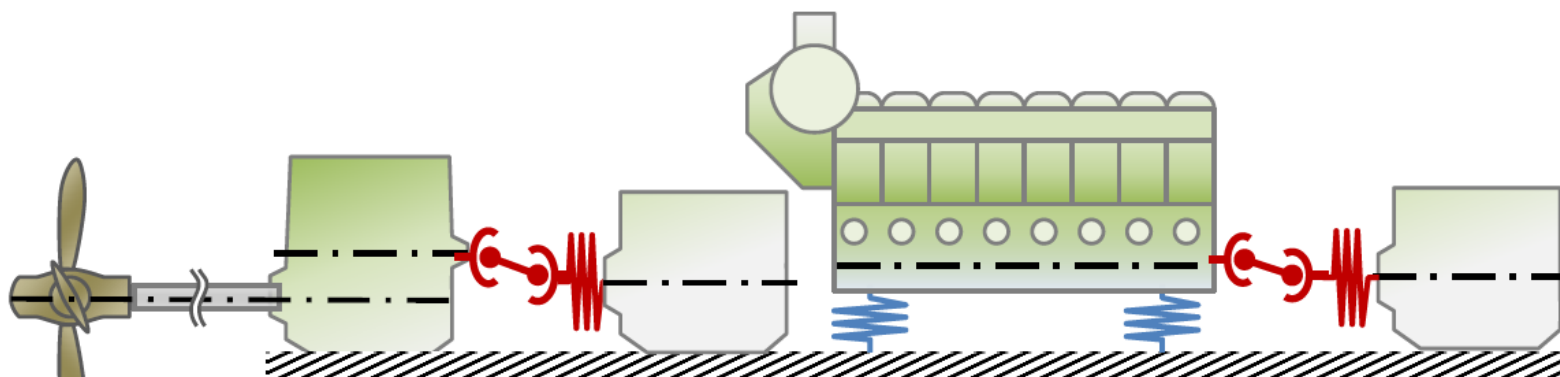
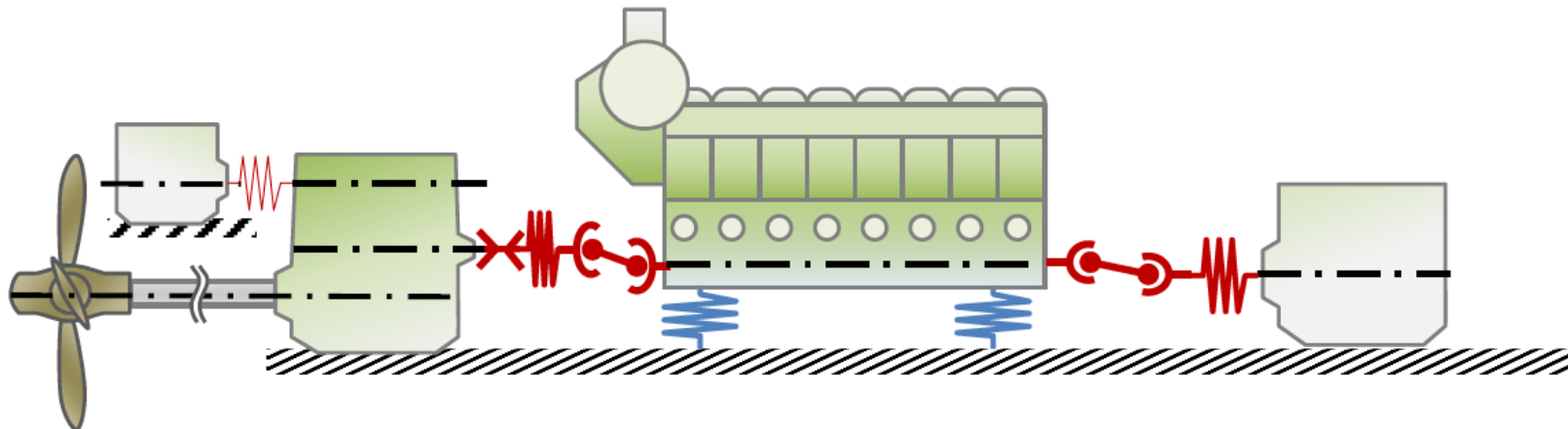


Kuva 9. Vastespektrien signaalikohinasuhteet ilmaäänierätteellä.

MITIGATION MEASURES ONBOARD RV ARANDA

MAIN PROPULSION SYSTEM

4



MITIGATION MEASURES ONBOARD RV ARANDA

...

7

MAIN ENGINE RESILIENT MOUNTING (LOW RESONANCE)

HARD ELASTIC MOUNTING OF GENERATORS

NEW PROPELLER BLADES (HIGHER EFFICIENCY)

OPERATING AT CONSTANT PITCH (AVOIDING CAVITATION)

ENERGY EFFICIENCY (LESS POWER LESS NOISE)

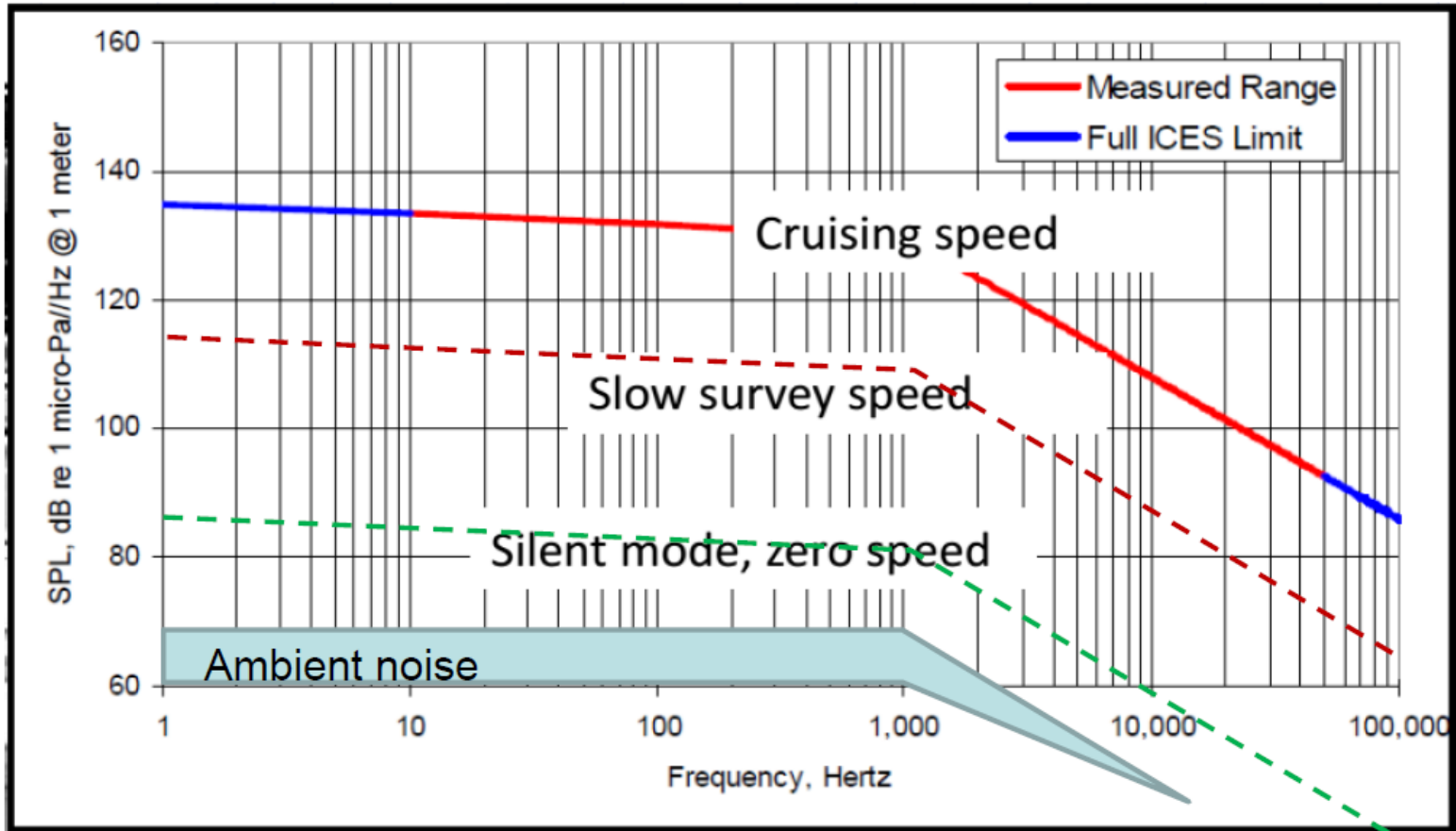
OPERATION WITH A BATTERY SYSTEM (ENGINES STOPPED)

ONLINE MONITORING OF SELF-NOISE

HARBOUR GENERATOR IN BOX

MITIGATION MEASURES ONBOARD RV ARANDA

TARGETS FOR UNDERWATER NOISE



**Grazie per
l'attenzione!**

