Standards for project JOMOPANS: ocean noise monitoring for the North Sea

JOINT MONITORING PROGRAMME FOR AMBIENT NOISE IN THE NORTH SEA

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JOMOPANS End Event. 10th June 2021.

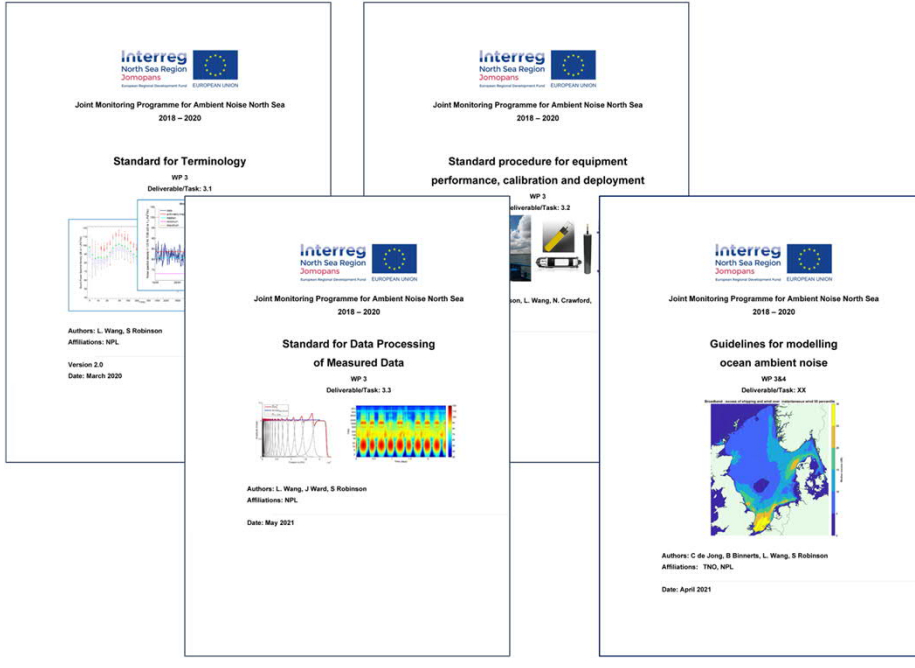
Getting the standards wrong…

The Vasa warship

Laufenburg Bridge

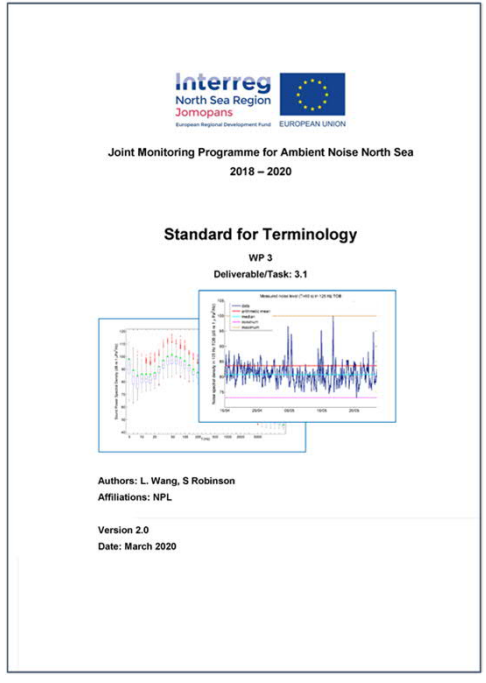
JOMOPANS standards (WP3)

- Previously, no existing international standards for monitoring ocean ambient sound
  - Needed to build on earlier projects (EU BIAS, NPL GPG 133, …)
- Procedures (project “standards”) developed for:
  - Terminology
  - Equipment performance specification, calibration and deployment
  - Data processing and analysis
  - Modelling
- Outputs to feed into future ISO standards



Terminology

- Terminology
- Defines key terms and metrics for ocean sound monitoring
- Building on existing standards
  - ISO 80000-8 standard (2020)
  - ISO 18405 standard (2017)
  - ISO 18406 standard (2017)
- Coherence with other monitoring projects
  - Strong coherence with US ADEON project
  - ADEON terminology procedure used as basis for a number of definitions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Joint Monitoring Programme for Ambient Noise North Sea
2018 – 2020

Standard for Terminology

WP 3

Deliverable/Task: 3.1

Authors: L. Wang, S Robinson

Affiliations: NPL

Version 2.0

Date: March 2020

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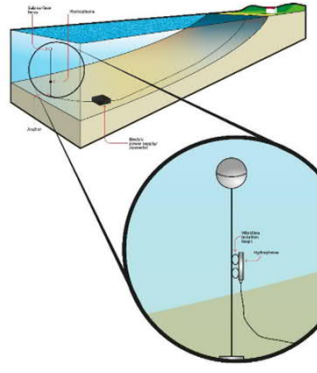
Equipment and deployments

- Mixture of equipment types used
- Minimum performance specification defined
- Fixed cabled hydrophones
  - Cabled back to shore
- Shorter-term autonomous recorder deployments
  - Sound traps
  - Wildlife Acoustics SM2M and SM3Ms
- Minimum duty cycle: 30% (10min on, 20 min off)
- Guidance provided on deployment methods

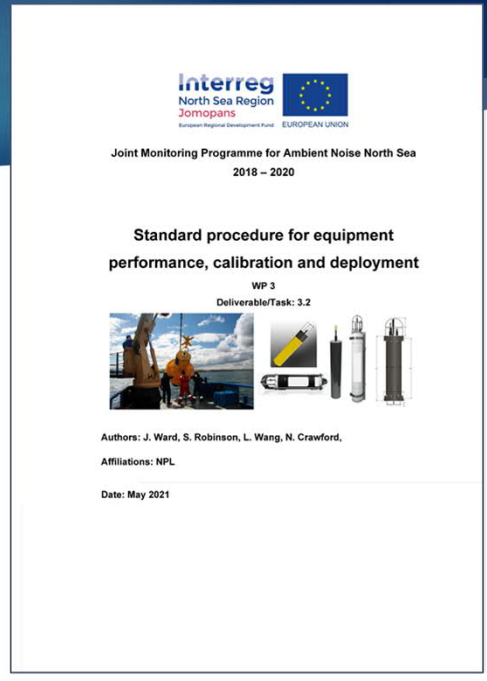
Metric	Specification
Frequency range:	10 Hz – 20 kHz (Note: focus frequencies are the 63 Hz and 125 Hz TOB)
Dynamic range:	Minimum 16 bit (nominal dynamic range 96 dB), Preferably 24 bit (nominal dynamic range 144 dB) Note: actual dynamic range is from noise floor defined by system self-noise to the maximum measureable undistorted sound pressure
Sensitivity:	In the range: -165 to -185 dB re. 1 V/µPa
Directionality:	Omnidirectional to within +/- 1 dB up to 20 kHz azimuthal, and to within +/- 2 dB in vertical elevation (see description of recorder performance when hydrophone is attached to body)
Sampling rate:	44 or 48 kHz (20 kHz frequency range)
Filtering:	Any filter characteristics should be known Especially, low and high pass filtering caused by frequency roll-off of instrumentation
System self-noise:	Better than 64 dB re 1 µPa^2/Hz at 63 Hz; Better than 59 dB re 1 µPa^2/Hz at 125 Hz. 6 dB below the lowest sound level.



Equipment calibration

- traceability to international standards required
  - methods based on IEC 60565:2020
- building upon EU EMPIR project UNAC-LOW
- calibrations requested before and after the deployments
- absolute calibrations for hydrophone and recording system
- in-situ field calibrations requested prior to deployment and post recovery
  - typically using an air “pistonphone” calibrator

- Calibration workshop hosted at NPL (January 2020)
- comparison of calibrations undertaken
- estimated worse case agreement: 1.5 dB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Standard procedure for equipment performance, calibration and deployment

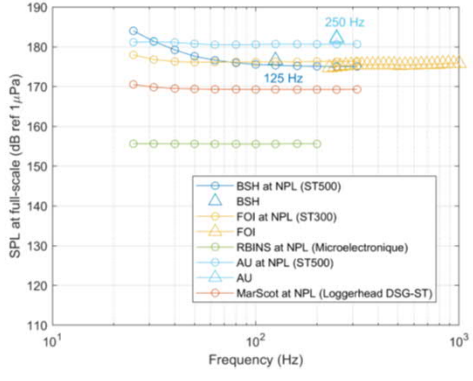
WP 3

Deliverable/Task: 3.2

Authors: J. Ward, S. Robinson, L. Wang, N. Crawford,

Affiliations: NPL

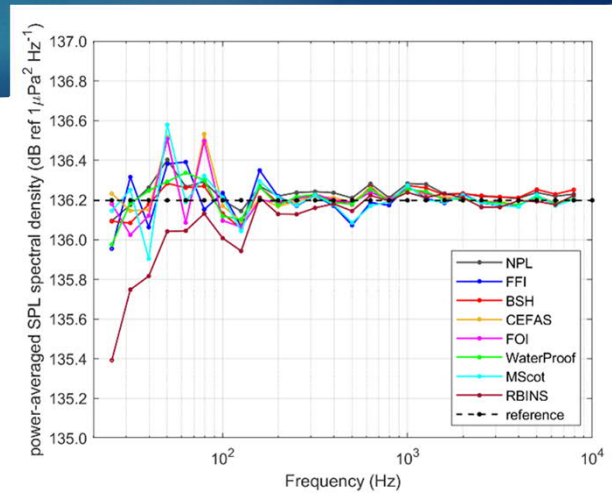
Date: May 2021

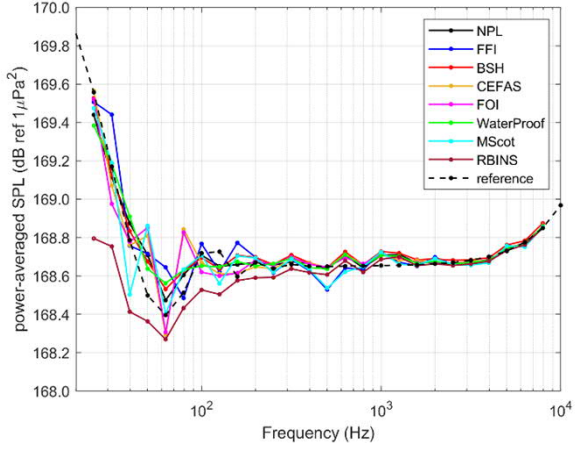


Data analysis procedures

- Specification for methods of calculating the key metrics from measurement data
- Detailed descriptions provided of analysis

- Benchmarking:
  - As a check on performance of software algorithms used by partners, benchmarked data sets were created for validation of analysis algorithms
  - benchmarked data sets circulated to all partners (“Ring test”)
  - Benchmarked data: two sets of synthesised data of known statistics and expectation value: “white” noise and “pink” noise



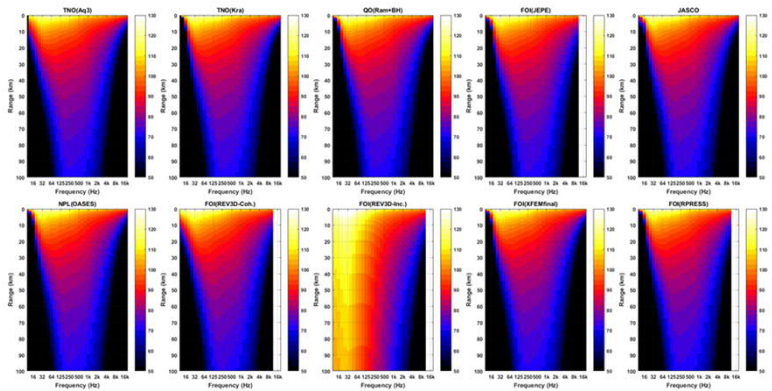


Modelling

- Choice of propagation models
- Environmental parameters
  - Bathymetry, seabed, sound speed…
- Source models (ships, wind)
- AIS data
- Resolution (spatial, temporal, frequency)
- Benchmarking:
  - Model performance tested against benchmarked scenarios
  - Model results compared

Shallow water - low frequency	Shallow water - high frequency	Deep water - low frequency	Deep water - high frequency
Ray theory	*Ray theory*	*Ray theory*	*Ray theory*
Normal mode	*Normal mode*	*Normal mode*	*Normal mode*
Wave number integration	*Wave number integration*	*Wave number integration*	*Wave number integration*
Parabolic equation	*Parabolic equation*	*Parabolic equation*	*Parabolic equation*
Energy flux	*Energy flux*	*Energy flux*	*Energy flux*

Green – suitable; Amber – suitable with limitations; Red – not suitable or



Legacy: the future of standards

- Procedures (project standards) developed in JOMOPANS:
  - Terminology
  - Equipment performance specification
  - Equipment calibration and deployment
  - Data processing and analysis
- JOMOPANS outputs to feed into future ISO standards
- New WG started in ISO TC43 SC3
  - WG5: monitoring ocean ambient sound
- New Work Item Proposal circulated – to be discussed at October meeting
- JOMOPANS partners will be active members of WG5
  - including leading work items

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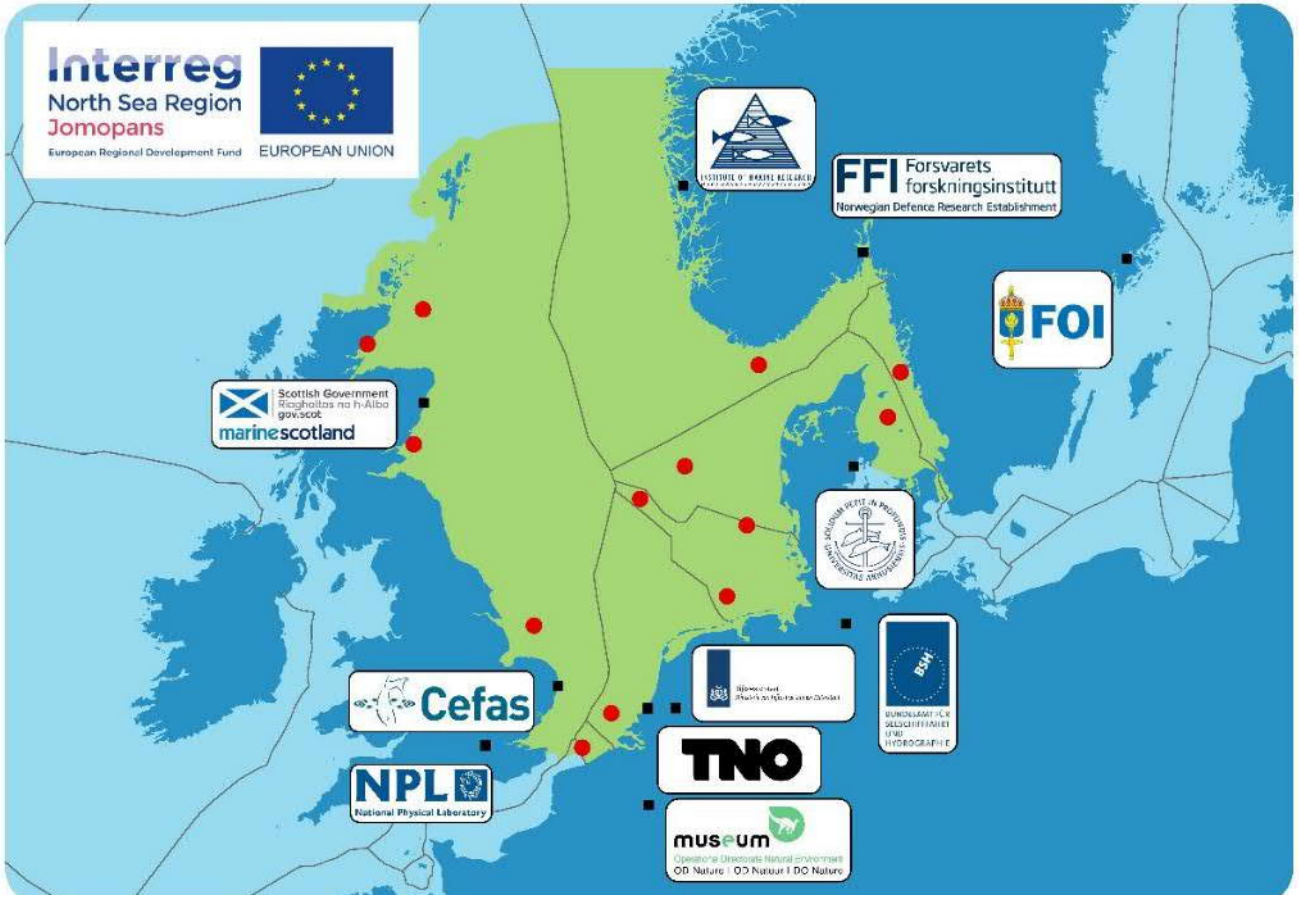
JOMOPANS: any questions?



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