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NOISE CONTROL FOR A BETTER ENVIRONMENT

NEPTUNES, Best Practices for sea-going vessels at berth

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ABSTRACT

Noise emitted by sea-going vessels at berth, at anchor or maneuvering results in annoyance among residents living near ports. Within the NEPTUNES project, which stands for Noise Exploration Program To Understand Noise Emitted by Seagoing vessels, research is going on how to mitigate and reduce noise from these vessels. After the preparatory work, an inventory phase was started; complaints were gathered and also was examined whether legislation or policies were in place to counter ship-generated noise. Also was asked to what extent noise measurements, awareness building and expectation management are available in the ports joining the NEPTUNES project. The results of this inventory phase will be presented in this paper. After the inventory phase, a design phase was started to develop a method for measuring ship-generated noise, a noise labeling method and Best Practices. These Best Practices encompass technical, logistical and “soft” interventions such as expectation management and awareness building among sailors and staff of the port terminals. Besides the results of the these phases of the NEPTUNES project, the paper will also give a sketch of the project and project organization.

Keywords: Noise, Annoyance, Ports, Vessels
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1. INTRODUCTION

The NEPTUNES project was initiated by the Port of Rotterdam and aimed to get more insight into the ship-generated noise problems in ports collaborating in this NEPTUNES project. The project performs research what type of ships and sources are the cause of annoyance perceived by residents living close to the port. Advancing the science of measuring and quantifying the ship-generated noise is part of the project as well to identify the problems with legislation, regulations or policies if legislation, etc. if these are available. The project also aims to find ways to mitigate annoyance. The acronym NEPTUNES stands for Noise Exploration Program To Understand Noise Emitted by Seagoing ships. Within the NEPTUNES project, nineteen ports collaborate, eleven ports actively as project member and eight ports as a member of the so-called resonance group. The ports are mainly situated in Europe. Two ports are situated in Oceania and one port in North-America. Besides the project plan the project should deliver the next deliverables:

1. Questionnaire
2. Measurement protocol [1]
3. A method for noise labelling [1]
4. Best Practice Guide

This paper focusses on the Best Practice Guide. During EURONOISE 2018 a paper was presented about the yield of the questionnaire. In [4] the other deliverables are described. With ship-generated noise is meant noise caused by the auxiliaries and equipment of the ship at berth or anchor and also noise from maneuvering ships.

2. NEPTUNES ORGANIZATION

The NEPTUNES project is divided up into five phases, which are:

0: Preparatory phase

1: Inventory phase

2: Design phase

3: Implementation phase

4: Final phase

The organization structure is depicted below.

On top of the structure is the Project Board (PB) which consists of all project members (12). For the day to day steering, risk and conflict management the Delegated Project Board (DPB) is responsible, and the Central Project Team (CPT) coordinates and is mainly doing the work. In case additional noise measurements are needed, see elsewhere in this paper, then the Local Project Teams (LPT) are active. These additional noise measurements are not part of the NEPTUNES project. The resonance group consists of members not active in the NEPTUNES project.

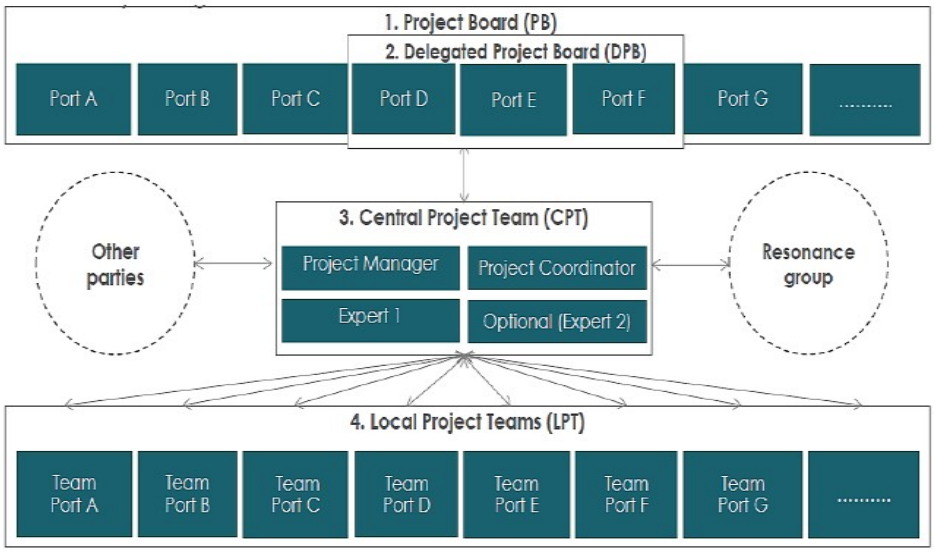

Figure 1: Project organization NEPTUNES

3 BEST PRACTICE GUIDE

When it comes to Best Practices, one can distinguish the next type of measures:

1. Measures at source
2. Measure in the propagation path
3. Measures at the receiver
4. Measures that affect the perception

Measures of the first category are product or process integrated measures. For instance use of low noise fans or quiet procedures (quiet way of working). However, it is also possible to install this kind of measures afterward when a ship is already in operation. This is more expansive than installing measures during construction. By adding measures during retrofit of a ship, costs can be saved.

Measures in the propagation path can exist from enclosures or barriers. Enclosures can also be fitted during the construction or afterward. The same principle of the costs is here applicable. Barriers are also possible, but it has its limitation due to the height of the sources of the ship. Barriers are only effective when erected near the source or the receiver. A very rare applied measure is changing logistics. By choosing for a procedure

that the nosiest ships are moored at the farthest quay away from the residential district or changing the orientation of the ship by turning the helm (from lar board to starboard or vice-versa). In those cases that measures taken on the sources of the ship and in the propagation path are not applicable, effective or too costly measures at the source are needed. This can be done in varies ways. Insulation of the façades and roofs are most common. However, changing the layout of the dwelling or a smart design of the residential district can help to mitigate the noise emitted by the ship at berth. In the Best Practice Guide, leaflets are included that provide information about noise mitigation.

Besides the more technical measures mentioned afore, the Best Practice Guide of the NEPTUNES project comprises also “soft measures” such as gaining awareness among terminal staff and sailors and performing expectation management [3]. Training the terminal staff and make them aware that they have to take into consideration the noise and annoyance in residential districts. They can also send this message to the sailors. Working with expectation management and Mutual Gain Approach can help to soften the perception and attitudes of residential. These instruments can be used when expansion or intensification of port areas is planned, or new housing district is planned which in potential could lead to conflict and more complaints. Most of the ports are aware of it. In some states, legislation is in place that rules the processes of expansion plans on both sides. In other states, this is missing, and one relies on voluntary collaboration, etc.

The last type of measure that can be mentioned here is about the use of non-acoustic factors. By applying materials and colors, keeping the port, the premises of the terminals and companies settled in the port well kept, will to a certain extent affect the attitude and perception of the residents. Less nuisance will be experienced.

The leaflets included in the Best Practices Guide are:

a. Machinery (e,g. auxiliaries, fans, pumps}
b. Silencers (in exhaust, funnel, ducts)
c. External Power Supply (use of electricity, LNG powered energy platforms outside the ship)
d. Public Address systems (optimization speakers, ..)
e. Propagation path (see text afore)
f. Insulation (walls, roofs,..)
g. Expectation management
h. Mutual Gains Approach
i. Urban planning
j. Awareness
k. Complaint management
l. Organizational and planning
m. Non-acoustic measures
n. Cargo handling
o. Maneuvering

Per leaflet is a number of measures is given in terms of expected reduction, cost indication, limitations and lessons learned. In total more than 50 measures are given in the Best Practice Guide. An excerpt is given in table 1 below.

Table 1: measures per leaflet(excerpt)

Leaflet title	Measures/ interventions	Expected reduction	Phase of implementation	Audience	Leaflet no.
Mitigation at the source					
Machinery	Measures at the auxiliary engine(s) (e.g. silencer in the exhaust duct(s) and resilient mounting, etc.)	1-30 dB (depending on the measure)	D, C_1, R	Shipowners, shipbuilders, shipping companies, ship engineers (designers/architects) and maintenance staff	1
	Measures at the fan(s) (e.g. acoustically optimised fan design, silencer(s) and optimised air flow)	1-20 dB (depending on the measure)			
	Measures at the pump(s) (e.g. installation inside the ship's hull, avoidance of cavitation and low noise design)	1-20 dB (depending on the measure)			
Silencers	Implementation of a silencer inside the exhaust air duct of the auxiliary engine(s), Silencer types: reactive silencer, absorption silencer and combination of both	1-30 dB (depending on the implementation)	D, C_1, R	Shipowners, shipbuilders, shipping companies, ship engineers (designers/architects), silencer manufacturer and maintenance staff	2
External Power Supply	Using an external power supply instead of internal power from the ship's auxiliary engine(s), such as LNG power pac, LNG power barge and shore power)	1-10 dB	D, C_1, R	Shipowners, shipbuilders, shipping companies, ship engineers (designers/architects), terminal owners, port authorities, ship's crew (captain) and maintenance	3

				staff	

4. CONCLUSIONS

By using the Best Practice Guide ports, shipping companies and shipbuilders can prevent or mitigate the noise emitted by seagoing ships. As mentioned afore, the best way to avoid noise and nuisance is by applying low noise equipment when designing and building a ship. Making an existing ship quieter is more challenging. Besides using quiet equipment it is also possible to lessen the nuisance by means of good communication using the “soft measures” such as complaint management, expectation management and mutual gains approach. The latter can only be used when new developments are planned. A number of measures can also be applied in inland vessels. Ports can give incentives when ships are less noisy. For instance by levying less access fees.

5. ACKNOWLEDGMENTS

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