Objective:
1. To announce BURNSi
2. To present the scope and Methodology
3. Show related measurement results
Content

• Introduction
• Objective
• Underwater Radiated Noise
• Methodology
• Orca
• Workshop
Introduction

Technology:
- Requirements
- Design
- Construction
- Exploitation

International cooperation:
- CSSM Workshops
- RIMPASSE (SET-panels)
- COSIMAR
- MEASURE (MCDV)
- TESSMEX
- BURNSi

Tools:
- Standards
- Mathematical models
- Reduction measures
- Measurement facilities
- Database (Historical data)
- Signature Management System
Introduction

Average spreading
In keel-aspect @ 20m:
- Deep water (2 dB)
- Shallow water (5-7 dB)
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Objective

The long-term goal of the BURNSi workshops is the validation and improvement of national prediction models for the analysis and realistic calculation of **underwater radiated noise** levels of naval platforms and the effect of noise control measures.

In analogy with the Benchmark Target Strength Simulation (BETSSi) workshops, organized by WTD71(FWG) in cooperation with DRDC and TNO.
Underwater Radiated Noise

Noise sources:

- Propulsion System (engine)
- Auxiliaries
- Propeller
- Flow

\[ \sum \text{Total level} \]

\[ v < \text{CIS} \quad v > \text{CIS} \]

Graph showing the relationship between noise level and speed, with different noise sources plotted: Propeller, Propulsion system, Flow, Auxiliaries, and Total noise.
Underwater Radiated Noise

Machinery sources:

Propulsion system
- Motor
- Gearbox

Auxiliaries
- DG-sets
- Pumps

BURNSi
- Structure-borne
- Air-borne
- Fluid-borne

\[ L_p = L_a + T + S \]
Underwater Radiated Noise

Hydrodynamic sources:

**Propeller**
- Cavitation noise ($v > \text{CIS}$)
  - Tip vortex cavitation
  - Sheet cavitation
  - Bubble cavitation
- Propeller noise ($v < \text{CIS}$)
  - Inflow turbulence
  - Trailing edge noise
  - Tip noise
  - Noise banding

**Flow**
- Flow induced noise
- TBL excitation
- Structural re-radiation
- Flow noise
- Turbulence direct rad.
- Bubbles
Underwater Radiated Noise

RIMPASSE:

Planet

- Swath (3850 ton)
- PM propulsion
- DG set double mounted and enclosed located above waterline

Quest

- Monohull (2200 ton)
- DC propulsion
- Damping tiles
- DG sets on common enclosed raft
Underwater Radiated Noise

Propeller noise:

QinetiQ
Methodology

Data & Info
- Ship information
- On-board acoustic measurement data

Radiated noise measurement data

Simulations
- Prediction model

Radiated noise predicted results
- CDF

Benchmark & validation
Orca class

Main Characteristics:

- Displacement: 210 Tonnes
- Length: 33 m
- Breath: 8.3 m
- Keel depth: 2 m
- Hull material: Steel
- Propulsion: 2 x 1864 KW
- Maximum Speed: 18 kts
# Orca class

## Machinery:

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Propellers (5 bladed fix pitch)</td>
<td>2x</td>
</tr>
<tr>
<td>2</td>
<td>Propulsion Diesel engines (CAT3516)</td>
<td>2x</td>
</tr>
<tr>
<td>3</td>
<td>Diesel Generator sets (CAT3054T)</td>
<td>3x</td>
</tr>
<tr>
<td>4</td>
<td>Diesel Fire Bilge Pump</td>
<td>1x</td>
</tr>
<tr>
<td>5</td>
<td>Air Compressor unit</td>
<td>1x</td>
</tr>
<tr>
<td>6</td>
<td>Steering Hydraulic Power Pack</td>
<td>2x</td>
</tr>
<tr>
<td>7</td>
<td>Bilge pump</td>
<td>1x</td>
</tr>
</tbody>
</table>
Workshop

Tasks:

1. Global assessment of overall radiated underwater noise levels of ORCA taking in account all machinery and hydrodynamic noise sources for different specified operational conditions.

2. Detailed prediction of the radiated underwater noise levels of Diesel Generator sets.

3. Detailed prediction of the radiated underwater noise levels of propulsion diesel engines for different speeds.
Workshop

Provided information & data:

1. Structure borne noise levels mounting and flanking path
2. Airborne noise levels
3. Dynamic stiffness of flexible elements
4. Drawings
   - Machinery room layout
   - Ship hull and machinery foundations
5. Mechanical impedance ship foundations

Diesel engine (CAT3516)  
DG-sets (CAT3054T)
1. Each participating organization shall provide results for all specified test cases and all parameter settings as far as their modelling capabilities allow.

2. Results shall be delivered to the workshop organizers prior to the workshop according to a specified format.

3. All gathered results shall be distributed/shared among all participants of the workshop for use within their organization.
Workshop

Schedule:

Announcement: December 2019
Possible participants: Defense Material Organizations, Ship Yards, R&D institutes, ……
Specification: February 2020
Workshop: September 2020
Location: The Netherlands
Questions?