

THE EXAMINATION OF POSITION OF SHIP'S NOISES SOURCES BASED ON HYDROACOUSTICS METHOD

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The paper presents the experimental research associated with the transmission of acoustic energy generated by moving ship into the water. The paper present the methodology of evaluations acoustics energy from the mechanisms of ship into the water environment. For that purpose the research of noise distribution over ship's hull were conducted along with the hydroacoustic field. The hull is source of waves of complex surface shape inducing waves of different amplitudes and phases depending on the position of ship's machinery. As a result of the hull vibrations generated wave distribution depending on the primary sources, as the main propulsion units, generators or other mechanisms. This research allowed to determine position of the main noises' sources of acoustics energy of machinery and propulsion system depending on class of ships.

INTRODUCTION

The Department of Radiolocation and Hydrolocation of the Polish Naval Academy more than thirty years leads investigation related with experimental research the transmission of the acoustic energy generated by moving objects into the sea water. The research are provided for the following aims:

- Scientific research/investigations,
- Passive ship defense,
- Monitoring self underwater noise,
- Protecting of water environment (sea mammals),

- Classification and identification objects,
- Reconnaissance of sea object,
- Description of the technical state of ship,
- Improve acoustics research method and skills,
- Development of passive hydroacoustics systems.

These results are very important for save people and warships during duty at the sea. This paper presents chosen and results of investigations lead in the Polish Navy and used to determine the position of ships noises' sources.

The main aim of investigations were:

1. The determine of locations of underwater noise's sources,
2. To expand the methods of hydroacoustics investigation about longitudinal changes of hydroacoustic noise chosen ships.

1. METHOD OF INVESTIAGTIONS

The main method of investigations is dynamic method of measurement underwater noises. The sensors there are directly on the permanent special construction situated on the bottom of sea. The directional buoys lead ship straight above underwater section of hydrophones. This method allows calculate longitudinal and transverse (spatial) distribute of underwater sound generated by hull of moving ship. The measurement transverse and spatial distribute of underwater noises required more than one sensor, but investigation longitudinal distribute acoustic energy emitted by hull of ship don't require more than one sensor. The appearance of range where were made investigations is presented in Fig.1.

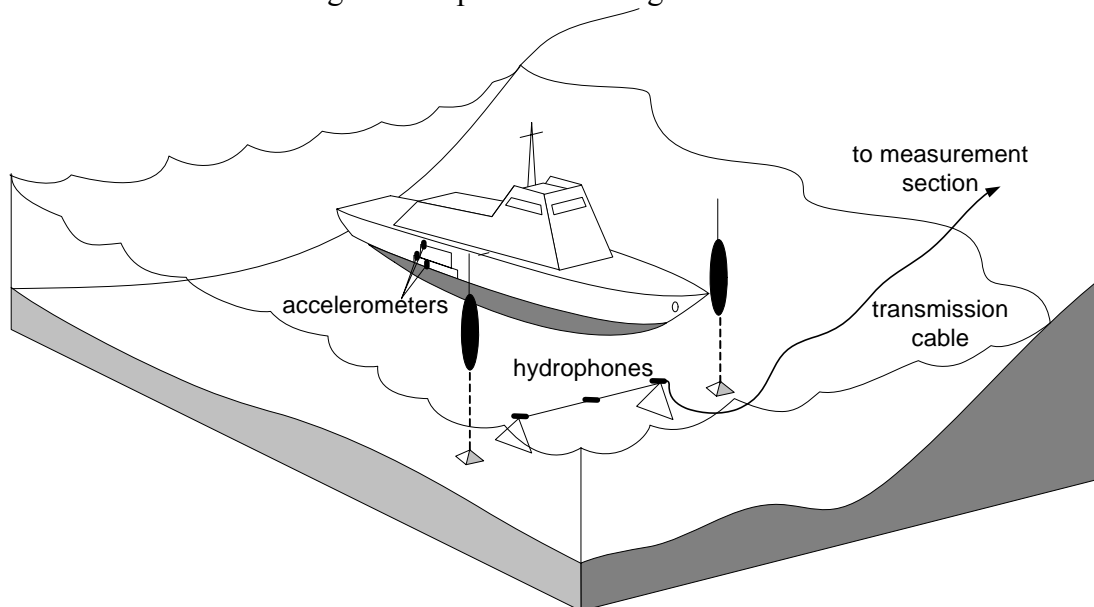


Fig.1 The dynamic measurement of ship's noise – one of the method of the investigations sources and spatial distribution of underwater noise

In dynamic method of hydroacoustic measurements two groups of researchers take part in investigations. First group on the acoustics range measure underwater noises and second group

on the board of investigated ship measure vibration the main sources of sound. This method allows to check correctness measured records of vibration and underwater noise [1].

2. RESULTS OF RESEARCH

The experiences obtained during previous investigations show that knowledge is very important about position of harmonics of generating set in spectrum of ship's underwater noise [2,3]. Harmonic, which a generating set is a source almost always appears in the spectrum of underwater sounds, because a movement of the ship is impossible without supplying the current to power electrical system [4].

In this examinations the harmonics related with the generating sets were a base of localization another ship's mechanisms. Idea of location the main sources of underwater noise is presented in Fig. 2.

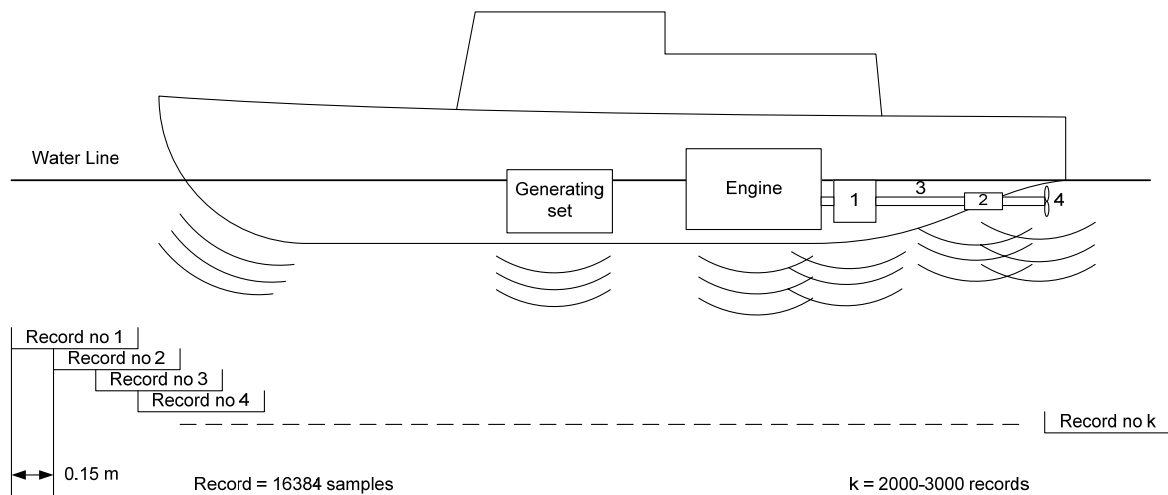


Fig.2 The dynamic measurement of ship's noise – the method of measurement, analyze of longitudinal distribution of sources of underwater noise. 1-gear, 2-bearings, 3-shafts

The method based on characteristics harmonics tracking in k records, where k depend on length of measurement data and length of ship.

The dozen ships were being analyzed, every at different parameters of the operating of ship's mechanisms. It was noticed that every ship have an individual image, which distinguish its from other ships. Some results for four chosen ships is presented in Fig. 3 to Fig. 6. In this article four ships of different types and sizes moving with the comparable speed from 9 to 11 knots were committed comparing, it is shown on Table 1. We can see that the distances between main sources underwater noises aren't comparable. It is allowed in the further investigations to test all sources witch appear in the tested files and to describe its shape. The calculated distances are similar to really length of investigation ships.

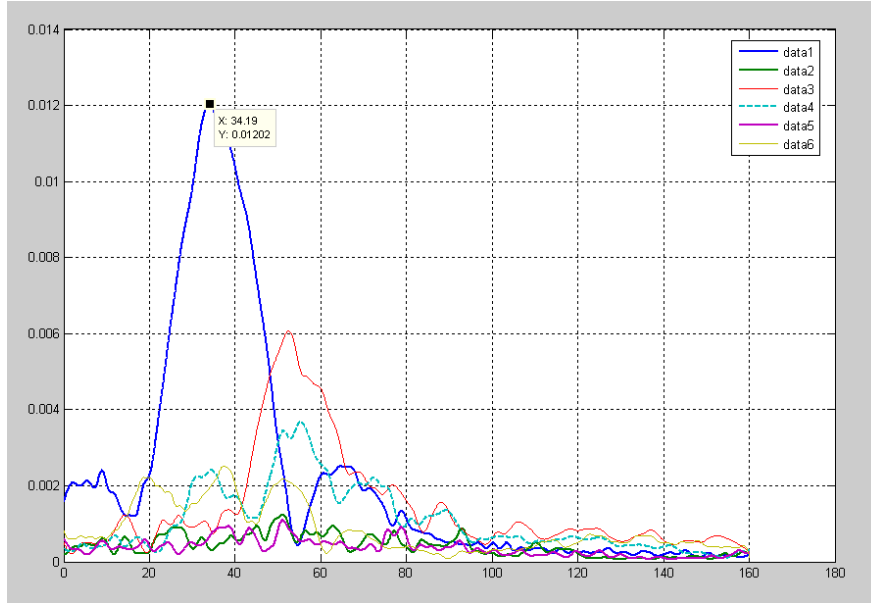


Fig.3 Ship 1 – the analyze of longitudinal distribution of sources of underwater noise: Speed 10 kts, Generating set marks dotted line, the higher line - engines

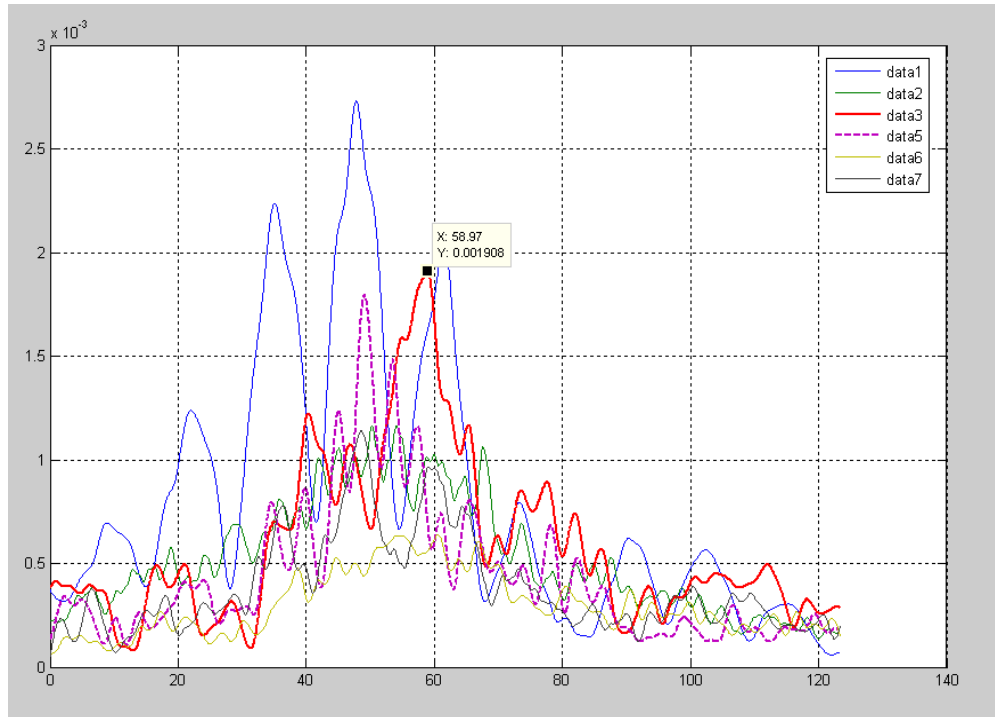


Fig.4 Ship 2 – the analyze of longitudinal distribution of sources of underwater noise: Speed 9,6 kts, Generating set marks dotted line, the accentuation line - engines

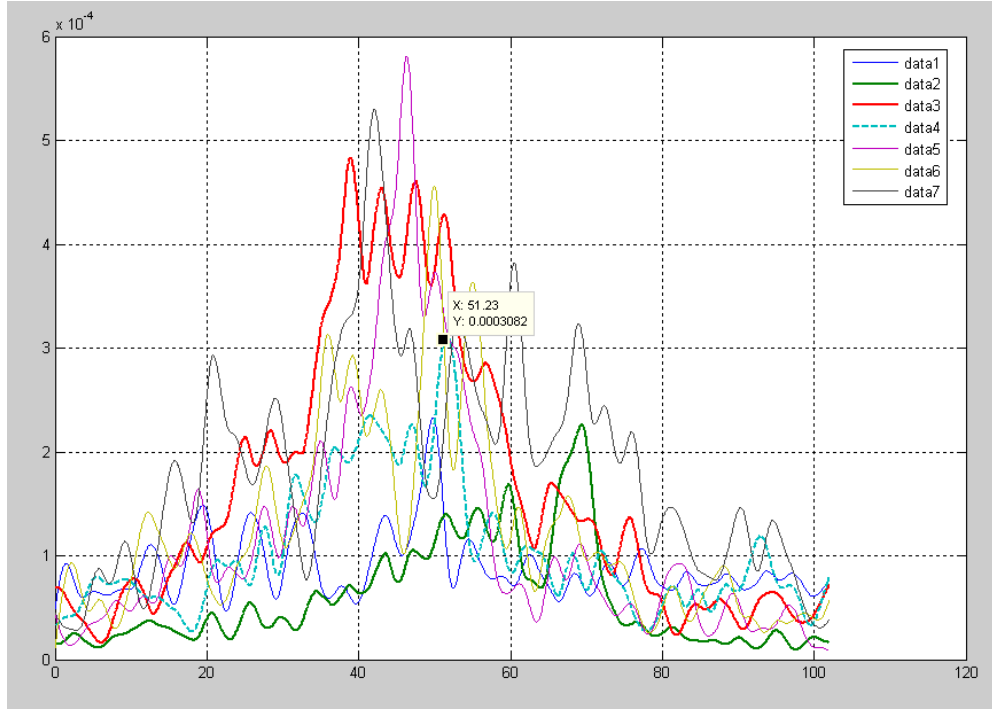


Fig.5 Ship 3 – the analyze of longitudinal distribution of sources of underwater noise: Speed 11 kts, Generating set marks dotted line, the higher lines - engines

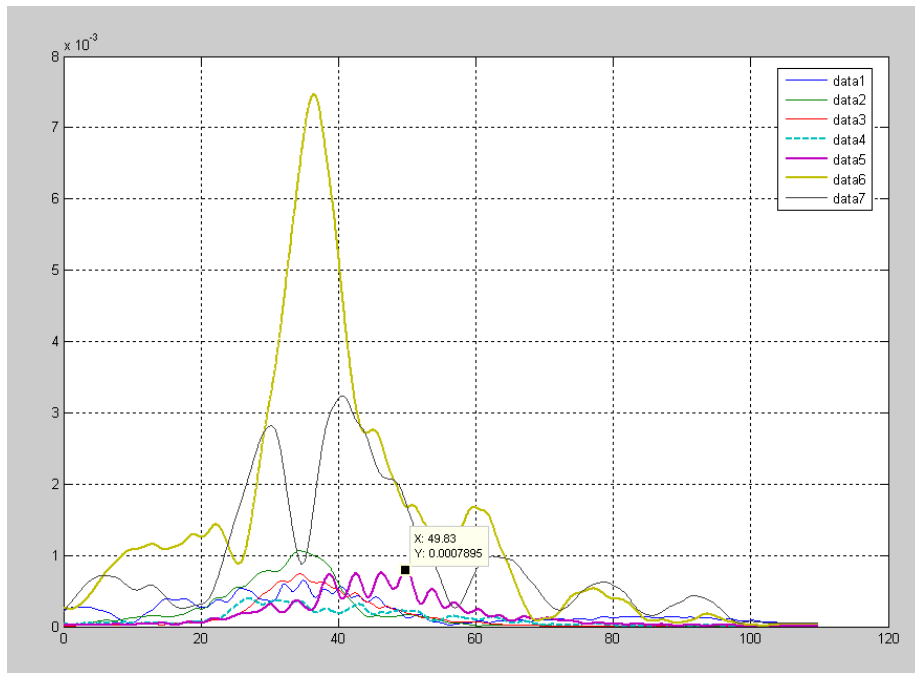


Fig.6 Ship 4 – the analyze of longitudinal distribution of sources of underwater noise: Speed 9 kts, Generating set - accentuation line, the higher lines – engines

Tab.1 The position of ship's various machinery in relation to position of sources generating sets

	Gensets [m]	Engines [m]	Propellers [m]	Difference G-E [m]	Difference E-P [m]	Difference G-P [m]
Ship1 10 kts	52,47	34,19	-	18,28	-	-
Ship 2 9,6 kts	49,05	58,97	-	-9,92	-	-
Ship 3 11 kts	51,8	38,88	69,36	12,92	-30,48	-17,56
Ship 4 9 kts	26,79	36,46	49,83	-9,67	-13,37	-23,04

3. SUMMARY

The preliminary research of position of ship's sources of hydroacoustic noise allows to conclude:

1. Based on the measured underwater noise generated by ship it is possible to get conclusion about distances between main sources of underwater noises generated through hull of investigation ship.
2. The experience gathered during research and analyzing measurements handle to study the detailed methodology of measurements and analyze of position ship's main sources of underwater noises.
3. The results of research will be considered during configuration of measurements equipment with taking into account the parameters of working main mechanisms (included heavy current engineering system).
4. The results show that it is necessary to have detailed base of location parts of hull and ships' mechanisms, which will let probably precise classification being based on a location along of objects.

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