

**ОСОБЕННОСТИ ИЗМЕРЕНИЙ ПОДВОДНОГО ШУМА С БОРТА
ВСПОМОГАТЕЛЬНОГО СУДНА**
MEASUREMENT FEATURES OF UNDERWATER NOISE USING A SUPPORT SHIP

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Рассмотрены особенности измерений подводного шума, проводимые с борта вспомогательного судна, учитывающие необходимость устранения влияния качки корабля и обтекания подводной измерительной системы, вызванного подводными течениями или дрейфом вспомогательного судна. Приведены примеры удачных конструктивных решений, обеспечивающих снижение помехи измерениям на низких частотах.

Features of underwater noise measurements conducted from the side of an auxiliary vessel are considered, taking into account the need to eliminate the impact of ship's rocking and flow around an underwater measuring system caused by undercurrents or the drift of an auxiliary vessel. Examples of successful design solutions that reduce noise interference at low frequencies are given.

Ключевые слова: вибрации; гидрофон; дрейфующее судно; измерения подводного шума; подводные течения; трос-кабель.

Key words: vibrations; hydrophone; drifting ship; underwater noise measurements; underwater current; conductor-and-support cable

Литература:

1. **А.М. Еняков, О.А. Панин, С.В. Сильвестров.**

О необходимости оценки неопределенности результатов измерений подводного шума кораблей // Вестник метролога, 2015, № 3, с. 20 – 32.

2. **А.М. Еняков, О.А. Панин, С.В. Сильвестров.** Проблемы и перспективы стандартизации измерений подводного шума, излучаемого коммерческими судами // Альманах современной метрологии, 2015, № 5, с. 117 – 156.

3. **Marine Strategy Framework Directive (MSFD).** European Parliament, Directive 2008/56/EC.

4. **EC Decision 2010/477/EU** “Criteria and methodological standards on Good Environmental Status of marine waters”.

5. **Monitoring Guidance for Underwater Noise in European Seas.** Science and Policy Report by the Joint Research Centre of the European Commission – JRC-88733-2014. Электронный ресурс: <http://publications.jrc.ec.europa.eu/repository/bitstream/JRC88733/lb-na-26557-en-n.pdf>

6. **ANSI S12.64-2009 Quantities and Procedures for Description and Measurement of Underwater Sound from Ships - Part 1: General Requirements.** American National Standards Institute, USA

7. **ISO 17208-1 (2016) Underwater acoustics — Quantities and procedures for description and measurement of underwater sound from ships — Part 1: Requirements for precision measurements in deep water used for comparison purposes**

8. **A. Barbagelata.** Pile driving noise assessment. Report No 60804. Электронный ресурс: http://www.colmarsrl.com/files/misure-drumore/pile_50712.pdf

9. **М.А. Calderon and G.M. Wenz.** A portable, general-purpose underwater sound measuring system/Электронный ресурс: <https://archive.org/stream/portablegeneralp00cald#page/n1/mode/2up>

10. **C.O. Walton and M.M. Marriam** Vibration and towing characteristics of surface-suspended hydrophone systems// Report 1558 of the Department of the Navy David Taylor Model Basin, Aug. 1961

11. **Christopher R. Levesque.** Vibration Suppression in Finite Length Marine Cable Systems// Massachusetts institute of technology, September 1997. Электронный ресурс: <https://dspace.mit.edu/bitstream/h>

12. **Jason I. Gobat.** Reducing Mechanical and Flow-Induced Noise in the Surface Suspended Acoustic Receiver// Massachusetts institute of technology, May 1997. Электронный ресурс: <https://dspace.mit.edu/bitstream/>

13. **Brian Corzilius.** Hydrophone Usage and Deployment. Collected Methods and Sources// Cornell Bioacoustics Research Program, November 27, 1996. Электронный ресурс: http://www.sie-solutions.com/BRP/Hydrophone_UseDeploy.pdf

14. **S.P. Robinson, P.A. Lepper, and R.A. Hazelwood,** NPL Good Practice Guide for Underwater Noise Measurement, No. 133, ISSN: 1368-6550, 2014.

15. **В.А. Гордиенко, В.Н. Некрасов, Н.В. Краснописцев.** Особенности воздействия подводных течений на низкочастотные

гидроакустические стационарные вертикально распределенные приемные системы// ВМУ. Серия 3. ФИЗИКА. АСТРОНОМИЯ. 2014. № 4

16. **Ch. Audoly, C. Rousset, E. Baudin and T. Folegot.** AQUO project - research on solutions for the mitigation of shipping noise and its impact on marine fauna – synthesis of guidelines // Proc. Of the 23rd International Congress on Sound and Vibration, Athens, July 2016.

17. **T. Gaggero at al.** Uncertainties in measurements of ship underwater noise emissions// Proc. of 11th European Conference on Underwater Acoustics ECUA 2012, 2-6 July 2012, Edinburg, UK, vol. 2, pp. 1152 – 1161.

18. **Электронный ресурс:** www.colmarsrl.com/underwater-acoustics/company-profile.html

19. **А.М. Еняков.** Серийные гидрофоны ВНИИФТРИ и история их создания// Альманах современной метрологии, ФГУП «ВНИИФТРИ», 2016, № 7, с. 139 – 185.

REFERENCES:

1. **A.M. Enyakov, O.A. Panin, S.V. Silvestrov.** On the necessity of uncertainty estimation of measurements of ships underwater noise // Bulletin of the metrologist, 2015, No. 3, p. 20 – 32. (In Russian)

2. **A.M. Enyakov, O.A. Panin, S.V. Silvestrov.** Problems and prospects of standardization of the measurement of underwater noise radiated from commercial vessels // Almanac of modern Metrology, VNIIFTRI, 2015, No. 5, p. 117 – 156. (In Russian)

3. **Marine Strategy Framework Directive (MSFD).** European Parliament, Directive 2008/56/EC.

4. **EC Decision 2010/477/EU** “Criteria and methodological standards on Good Environmental Status of marine waters”.

5. **Monitoring Guidance for Underwater Noise in European Seas.** Science and Policy Report by the Joint Research Centre of the European Commission – JRC-88733-2014. <http://publications.jrc.ec.europa.eu/repository/bitstream/JRC88733/lb-na-26557-en-n.pdf>

6. **ANSI S12.64- 2009 Quantities and Procedures for Description and Measurement of Underwater Sound from Ships - Part I: General Requirements.** American National Standards Institute, USA

7. **ISO 17208-1 (2016) Underwater acoustics — Quantities and procedures for description and measurement of underwater sound from ships — Part I: Requirements for precision measurements in deep water used for comparison purposes**

8. **A. Barbagelata.** Pile driving noise assessment. Report No 60804. http://www.colmarsrl.com/files/misure-di-rumore/pile_50712.pdf

9. **M.A. Calderon and G.M. Wenz.** A portable, general-purpose underwater sound measuring system/<https://archive.org/stream/portablegeneralp00cald#page/n1/mode/2up>

10. **C.O. Walton and M.M. Marriam** Vibration and towing characteristics of surface-suspended hydrophone systems// Report 1558 of the Department of the Navy David Taylor Model Basin, Aug. 1961

11. **Christopher R. Levesque.** Vibration Suppression in Finite Length Marine Cable Systems// Massachusetts institute of technology, September 1997. <https://dspace.mit.edu/bitstream/>

12. **Jason I. Gobat.** Reducing

Mechanical and Flow-Induced Noise in the Surface Suspended Acoustic Receiver// Massachusetts institute of technology, May 1997. <https://dspace.mit.edu/bitstream/>

13. **Brian Corzilius.** Hydrophone Usage and Deployment. Collected Methods and Sources// Cornell Bioacoustics Research Program, November 27, 1996. http://www.sie-solutions.com/BRP/Hydrophone_UseDeploy.pdf

14. **S.P. Robinson, P.A. Lepper, and R.A. Hazelwood,** NPL Good Practice Guide for Underwater Noise Measurement, No. 133, ISSN: 1368-6550, 2014

15. **V. A. Gordienko , V. N. Nekrasov , N.V. Krasnopistcev.** The peculiarities of the effects of underwater currents on low-frequency hydroacoustic stationary vertically distributed receiving systems // Moscow University Physics Bulletin 4(2014).

16. **Ch. Audoly, C. Rousset, E. Baudin and T. Folegot.** AQUO project - research on solutions for the mitigation of shipping noise and its impact on marine fauna – synthesis of guidelines // Proc. Of the 23rd International Congress on Sound and Vibration, Athens, July 2016.

17. **T. Gaggero at al.** Uncertainties in measurements of ship underwater noise emissions// Proc. of 11th European Conference on Underwater Acoustics ECUA 2012, 2-6 July 2012, Edinburg, UK, vol. 2, pp. 1152 – 1161.

18. www.colmarsrl.com/underwater-acoustics/company-profile.html

19. **A.M. Enyakov.** VNIIFTRI serial hydrophones and the history of their creation // Almanac of modern Metrology, VNIIFTRI, 2016, No. 7, p. 139 – 185. (In Russian)