IMPROVING THE METHODS OF CHARACTERIZATION OF NOISE ANNOYANCE ON PASSENGER VESSELS MODIFYING THE STANDARD NOISE TESTS

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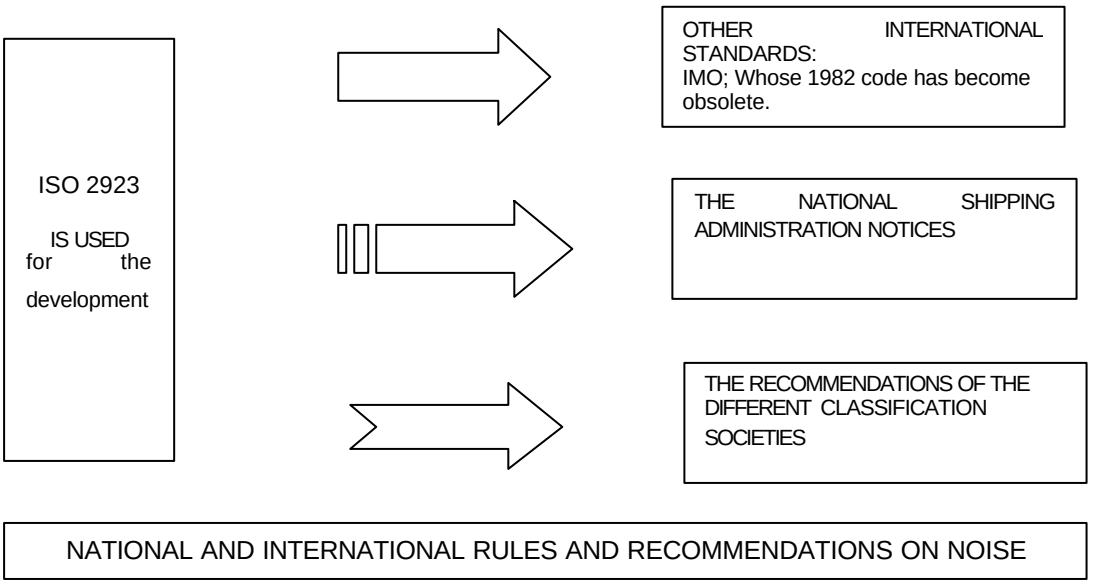
ABSTRACT

The Acoustic and Vibration Laboratory of the University of Cadiz has been working during the past years in the evaluation of the acoustic environment on board passenger ships [1]. At the same time, the laboratory has been operating a quality system for it testing activities that complies with the requirements of ISO 17025 [2]. The information compiled during these tests could be interesting for future updates of the test procedure. This is the reason why we are working in the new guidelines to address noise conditions on passenger ships. The guidelines are being developed under the consideration of the need to improve the testing of the annoyance of the noise for the crew and the passenger onboard passenger ships. This paper deals with two basic data analyses we think must be considered by international standards, in order to improve the description of environmental noise on board ships, and unify the survey criteria.

THE INTERNATIONAL STANDARD ISO 2923

The International Standard that specifies the techniques for the measurement of noise on board vessels is the ISO 2923 [3]. We would like to emphasize three of the main objectives of the standard:

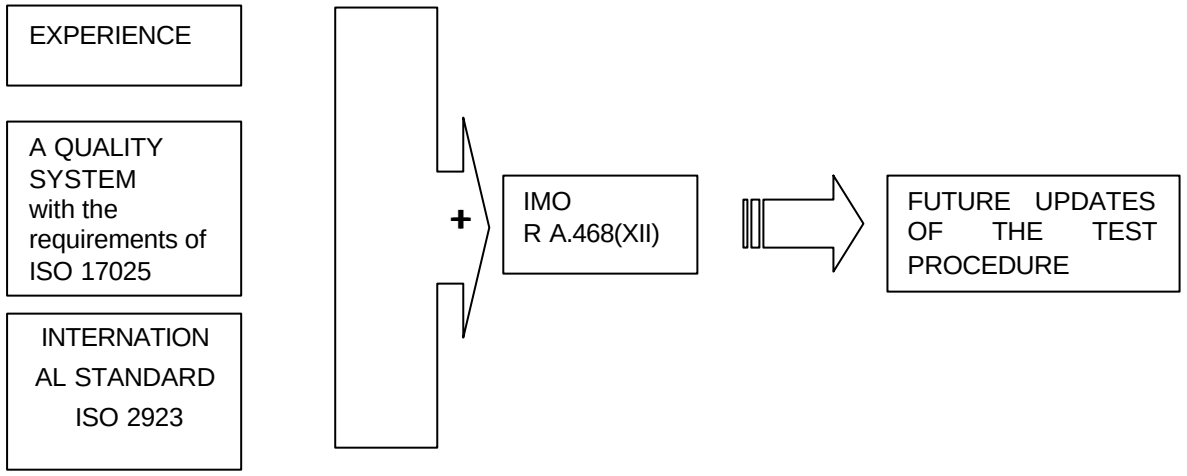
- Assure the results of the test can be used to assess noise annoyance over crew and passengers
- Assure the results of the test can be used to assess audibility of acoustical alarms
- Assure reproducible and comparable measurements



The question is how good is the ISO 2923 in order to let the technicians achieve these three objectives We bear in mind that ISO 2923 is used as the basis for the development of national and international rules and recommendations on noise evaluation on board vessels

- Other international standards like the International Maritime Organization [4], whose 1982 code has become obsolete.
- The national shipping administration notices [5].
- The recommendations of the different Classification Societies [6] [7].

Nowadays, all the physical measurements should be carried out in accordance with these rules and recommendations. All of them are designed to standardize the measurements and give the requirements for noise related to comfort, hearing damage and working environment for safe navigation onboard ships. We have the hope that these efforts let us improve the evaluation and characterization of the background noise onboard.



EVALUATION OF NOISE ON BOARD VESSELS

In our opinion, the determination of the environmental acoustic comfort on board must always be carried out by means of an objective test. In this way, the classic test of the acoustic environmental and its repercussion over the population is the A-weighted equivalent continuous sound pressure level (Leq), taken by the instrument during a time interval of T seconds. The instrumentation system needed to do this is an integrating-averaging sound level meter that meets the requirements for a type 1 instrument specified in IEC 804 [8], preferable digital and with data storage facilities. The estimation of a Leq visually or the determination of other quality of the noise subjectively (as ISO 2923 says) will lead to errors, and will not assure reproducible and comparable measurements.

In the other hand, we strongly recommend describing a noise situation by the use of two quantities not gathered in the ISO 2923. We think future revisions of this standard should check up the following subjects in order to guarantee a better approximation to the actual degree of annoyance over the people on board passenger vessels, and assure the safety of life at sea.

1. The description of the spectra of the noise is essential for the analysis of the noise. We think the analysis of sound measuring the continuous pressure levels have to be in thirds octave bands or better resolution not in octave bands, as ISO 2923 requires. The reason is two folded:

- The presence of the tonal sound must be determined observing the presence of a peak. If this peak stands out the adjacent components at least in 5 dBA, the acoustic problem caused by a tone sound has been confirmed. To assess the noise and its repercussion to the community, it is necessary to penalty the tonal sound and the impulsive noise [10] [11].
- In the other hand, the usual test to determine the audibility of the acoustic alarm signals must be done detecting the prime component of the spectrum of the alarm in third octaves. In the same way, if the peak stands out of the nearly bands in at least 5 dBs, the audibility of the alarms is assured [5].

2. It may desirable to describe the distribution of the A-weighted sound pressure levels because it can be a powerful tool to describe the behavior of the existing noise. For this purpose, percentile levels such L95 and L5 may be determined. Viewing these percentile levels provides an indication of the degree of variability of the noise. These graphics show a handy check to verify the validity of the Leq analysis and to better describe the noise environment [12]:

- When the noise has steady character, then there is no significant fluctuation of the noise. That means the distribution of the pressure levels have a sharp peak shape. In this case, the difference between the L5 and the L95 does not exceed 5 dBs and the Leq should be an appropriate value to describe the environmental noise.
- But, when the fluctuation of the noise makes the distribution graphic broad, it is necessary to study the behavior of the noise more deeply. In these cases the Leq value has nothing to do with the description of the noise presented at this area. We can check different shapes of the distribution graph: broadband distribution, distribution with several peaks, asymmetric distribution, etc. These distribution graphs can provide much practical information about the nature of the noise. For instance, it could indicate the presence of multiple intermittent sources, a noise varying cyclically with time, an irregular source of noise or noise with impulsive character, etc. For example, if our interest is centered in the background noise level, it is easy to isolate from intermittent noise.

Nowadays the instrumentation systems capable of yielding in real time the spectra in third octaves and the statistical distribution of the sound pressure level are simple to use, and they cover a great range of prices and models.

CONCLUSION

The correct election of the acoustic data to be calculated by the sound level meter, would represent a significant improvement in the information obtained from the acoustic environment on board vessels. After managing these sensible data the engineers will be able to focus on the proper answers of the acoustic problems and assure the comparison of results between vessels. It must be emphasized that the estimation of noise made by objective methods is the guarantee to obtain reproducible and comparable measurements.

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