

DEVELOPMENT OF BONA-FIDE OCCUPATIONAL REQUIREMENTS FOR HEARING IN CANADIAN COAST GUARD OPERATIONS

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1. INTRODUCTION

The Canadian Coast Guard (CCG), a division of the Department of Fisheries and Oceans (DFO), provides continuous support for a number of essential services in Canadian waters, including: ice-breaking and ice escort; maintenance of navigational aids; conservation and protection; environmental response; fisheries research; hydrography; and search and rescue. These services are often performed under hostile meteorological conditions, in remote locations and for extended periods of time. It is essential that Ships' Officers and Ships' Crew meet appropriate minimum medical requirements to ensure safety and performance in a range of operating conditions.

To address fitness-for-work requirements, CCG has a mandate to review its medical standards to better define relevant components of medical fitness essential to safe and effective seagoing operations. The Canadian Human Rights Commission (CHRC) requires that *bona-fide* occupational requirements (BFORs) must be based on the requirements for tasks performed on the job, rather than historical precedent and expert opinion. The CHRC requires that medical standards and subsequent testing procedures be based on:

- identification of essential tasks that are the requirements of the job;
- identification of relevant skills and capabilities required to perform the essential tasks of the job;
- methods that evaluate the ability of the individual to perform essential tasks of the job with regard to reasonable accommodation; and
- standards that do not exceed the minimum requirements of the job (CHRRS, 1982, TR/82-3).

The objective of this project was to support the CCG in the development of defensible, task-oriented, performance-based hearing standards relevant to CCG seagoing occupations. Hearing standards have been developed for this occupational setting for the following three reasons:

- to ensure the safety of the individual;
- to ensure the safety of others and of the vessel; and
- to ensure that an individual can perform the required tasks to complete the vessel's operational program.

2. METHODS

To address the needs of CCG, a project team was assembled with expertise in relevant subject areas, including: acoustics; audiology; signal processing; task analysis; and development of occupational standards. The project was completed in five phases.

- Phases 1 and 2 involved the application of a comprehensive task analysis methodology that identified the CCG seagoing occupations and operational tasks most important to safety and program completion and the critical aspects of hearing required to perform these tasks.
- In Phase 3, acoustic characteristics of the critical tasks identified in Phases 1 and 2 were collected with a representative sample of CCG vessels, regions and operations.
- Phase 4 involved analysis of the acoustic data based on the latest available technology and standards (Forshaw *et al.*, 1999; Hodgson *et al.*, 1999; Laroche *et al.*, 1999). The analysis methods used during the project also included the newly established *Speech Intelligibility Index* (SII) (ANSI S3.5-1997). Data were collected and analyzed to evaluate both speech discrimination and signal and alarm detection under a variety of operational conditions.
- In Phase 5, issues relative to the use of hearing aids in a marine environment were reviewed, specifically the impact of hearing aid reliability on safety and performance.

3. RESULTS AND DISCUSSION

Based on empirical study of the hearing requirements of the CCG seagoing environment, recommendations were provided for a minimum hearing requirement for three CCG departments: Deck, Engineering, and Logistics. The data on which these recommendations are based include the specific tasks identified for each department, as well as the common tasks identified as a requirement for all departments (i.e., Marine Emergency Duties). Minimum hearing threshold loss (HTL) profiles to meet the hearing requirements in each of the three departments were calculated. A limiting *Speech Intelligibility Index* criteria of 0.50 (on a scale of 0 to 1) was selected based on other international military standards and cornerstone research (Forshaw *et al.*, 1999).

The results indicated that the speech discrimination tasks required a more sensitive level of hearing than did the signal detection tasks. Therefore, the recommended overall minimum hearing requirement was based on the speech discrimination limits, which encompassed the hearing requirement to detect signals and alarms on board the vessels in CCG operations.

It must be emphasized that the HTL profiles recommended by this research are intended to represent the *minimum* HTL profile required to pass a first round of audiological testing. Those individuals whose pure-tone audiograms meet this minimum profile require no additional testing and should be considered to meet the medical requirement for hearing. However, those individuals who do not meet this requirement should be directed to additional otological/audiological assessment. The clinical assessment should include speech discrimination, signal detection, and localization evaluations.

The data collection and analysis methodology used for the current project was an adaptation of the latest research and standards that are relevant to the development of hearing standards, considering the issues and environments experienced in CCG seagoing operations. The interpretations within the project are subject to a number of limitations, including some related to data collection conducted in the field. Other limitations are related to the unique, groundbreaking research that was completed to develop BFORs in this type of environment. These limitations include the following:

- issues related to field data collection on board CCG vessels; including vessel and region scheduling availability, meteorological conditions, and the logistical and safe use of electronic equipment in a marine environment;
- the data were based on engineering analysis methodologies; consequently psychoacoustic normative data is required for further validation and development of the testing methodology; and
- the information available on the reliability of hearing aids in marine environments was limited and may require simulation testing and/or field evaluation as a further investigation.

Notwithstanding the project limitations and requirements for future research, the project methodology that was developed met the requirements of the CHRC to develop a task-oriented minimum medical standard that is focused on safety, performance and fairness.

4. ACKNOWLEDGEMENT

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5. REFERENCES

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