

Introduction

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Introduction

Adequate hearing protection and efficient speech communication is recognized as a critical capability in most military applications such as vehicle and aircraft operations, command and control, and in the battlefield. Advanced hearing protectors are required for a range of environmental conditions, especially those with extremely high levels of low frequency noise. Passive hearing protectors equipped with an additional active noise reduction system may offer sufficient sound attenuation and suitable speech communication capabilities for these harsh noise environments.

Application oriented assessment is required to guarantee optimal performance. Hence, a study was conducted to assess and select assessment methods for active noise reduction systems.

The study was organized as a Round Robin test where various laboratories performed the same test with the same test material. The reproducibility of the various methods can thus be determined. The laboratories involved in this study were: DRDC Canada; ISL France/Germany; TNO-HF the Netherlands; QinetiQ UK; AFRL/HECB USA. The HFM-panel of the NATO Research and Technology Organization authorized the study and formed a special Task Group (HFM-TG028). The Task Group has finished the project and reported the results (see NATO/RTO report TR-HFM-094, 2004). Further dissemination was initiated through the organization of Lecture Series 244.

The goal of this Lecture Series is to inform decision makers, scientists and human factors and medical staff on the requirements, performance and capabilities of the present state of the art of personal hearing protection.

Scope

A primary question is the human ability to cope with noise. What is a safe noise dose? What is the origin of noise induced hearing loss? The first lecture by Dr. Armand Dancer will describe the mechanical and metabolic effects.

Hearing protection starts at reducing the noise level at the source. However, this is in most cases not a valid possibility. Personal hearing protection is an alternative method. Already in the 1940s efforts were made to protect (military) personnel. This was always achieved with passive hearing protectors (plugs and muffs). The performance of these devices improved in the next decennia and even double protection (plug and muff) may be used. Mr. Richard McKinley will inform on the development and the present state-of-the-art of passive hearing protection.

Although the idea of active noise reduction (ANR, the addition of a similar noise in anti-phase) was born in 1934 by Lueg in Germany, practical realization was possible in the 1980. Two methods may be used: feedback and feed-forward system. Dr. Karl Buck will give a historical overview and a description of present system design. Also the performance and the integration of speech communication will be discussed.

Selection and/or development of passive and active hearing protectors require robust assessment methods. For this purpose subjective and objective methods have been developed. Each method has its specific

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advantages and restrictions. What does an attenuation curve tell us and how is it related to a certain noise condition and the degree of protection of a user? Also what is the quality of the speech communication in this condition? Dr. Herman Steeneken will describe subjective and objective assessment methods for hearing protection and speech communication and will report on the Round Robin assessment activity. Applications of hearing protection design in real conditions will be described by Miss Soo James. She will compare noise conditions in aircraft, particularly fast jets, helicopters, transport, surveillance and future aircraft. Predictions are made for near future legislation.

The program consists of:

- 1 Hearing and hearing protection (Dr. A. Dancer)
- 2 Passive hearing protectors and their performance (Mr. R. McKinley)
- 3 Active hearing protection systems and their performance (Dr. K. Buck)
- 4 Assessment and standardization (Dr. H.J.M. Steeneken)
- 5 Applications: overview of military noises, insertion loss, prediction of performance (Miss. S. James, Mr. R. McKinley)
- 6 Final panel discussion (all lecturers).

The lecture series will be held at three locations and hosted by:

1. CIOP, Warsaw, Poland (Central Institute for Labour Protection, Warsaw),
2. RMA, Brussels, Belgium (Royal Military Academy),
3. NEHC, Portsmouth VA, USA (Navy Environmental Health Center).