



embedded ACOUSTICS



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SoundDose II: Inflight sound exposure monitoring

Military personnel, and in particular aircrew, are exposed to potentially harmful levels of noise. This is not just due to the ambient noise inside aircraft interiors, but also to radio and intercom sounds presented through (in-ear) headsets. Monitoring the overall noise exposure can be a complex task. Only inside the ear canal can the exposure level physically be measured, which is not feasible in practice. The SoundDose II system circumvents this issue, by calculating the overall exposure levels based on measurements of the ambient noise as well as the electric intercom signal level.

Noise monitoring

To protect the hearing of workers against noise-induced hearing loss, legal restrictions are in place to limit exposure to harmful noises in terms of sound levels and/or exposure times. In the European Union, European Council directive 2003/10/EC defines maximum exposure limits. Military personnel are usually not exempt from these restrictions. Unfortunately, accurately assessing the sound dose incurred by military personnel can be a challenge, partly because of the fact that advanced hearing protectors are commonly used. Sound exposure measurements need to be corrected for the influence of these hearing protectors. Perhaps even more importantly, the influence of sound from radio

and intercoms also has a very significant impact on the overall noise dose. This contribution is completely ignored by the conventional approach towards noise dosimetry. Of particular concern is the use of in-ear devices known as Communications EarPlugs.

The SoundDose II system

The SoundDose II system was developed specifically for use with aircrew and other military headset (and Communications EarPlugs) users. It takes the ambient noise as well as the contribution of comms speech into account. The SoundDose II system consists of a hardware device, which was designed and tested not to produce electromagnetic emissions that could interfere with avionics,

combined with software for post-hoc analysis. The SoundDose II hardware is in fact a calibrated, robust audio recorder; the analysis software is used to compute the sound dose from the recorded signals.

Analysis software

Specific standalone software developed in Matlab is available for computing the overall sound dose from SoundDose II recordings. Additional data needed as input to this software is a combined attenuation curve (in octave band resolution) of the hearing protectors used (helmet + earplugs), and the sensitivity of the CEPs or earphones.



SoundDose II

Calibrations and sensitivity measurements

The SoundDose II recordings themselves are calibrated by simply recording a calibration tone (e.g. by means of a SLM calibrator).

As mentioned before, the sensitivity of CEP/earphones has to be known. CEP sensitivity is best determined by means of a subjective calibration procedure based on level matching. This procedure must be performed only once for each specific type of CEP or earphone; after that, the sensitivity data can be used for any number of SoundDose II recordings.

CEP sensitivity measurements are offered as a separate service by Embedded Acoustics.

Specifications

- Two-channel recording (ambient sound and CEP)
- Recording on micro SDHC card (2 GB - 32 GB)
- Seamless recording; breakdown of recordings in multiple files
- Complies with EN-IEC-61672 in terms of linearity, bandwidth and dynamic range.
- Frequency range 20 Hz - 20 kHz
- Dynamic range pre-amp 50-130 dB
- Temperature range 0 - 65 Deg
- 16-bit recording @ 44.1 kHz
- User control by two ruggedized buttons
- Real-time clock with Lithium backup battery (clock adjustable over USB)
- Operates at least 10 hours on a single 9V battery
- Complies with EN-55022 in terms of radiated and conducted emissions of electromagnetic fields

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Embedded Acoustics is committed to sparking innovation in the fields of acoustics, speech and hearing. Our mission is to translate scientific knowledge and high-tech engineering into working, real life products and services. We're not just talk - get in touch and find out what we are all about: expertise, experience and a practical mindset.



The SoundDose II recorder with miniature microphone for recording ambient noise.