DEFENSE

Anti-flash hoods vs. hearing protection – objective insertion-loss testing with GRAS 45CB



CUSTOMER
Institute of Naval Medicine and Institute of Sound and Vibration Research

PRODUCT
• GRAS 45CB

Customer / organizations

Institute of Naval Medicine (UK)
The Institute of Naval Medicine is a leading UK defense research organization specializing in the health, safety, and operational effectiveness of naval personnel. Its work includes human performance, environmental stressors, and protective equipment—ensuring sailors can operate safely and effectively in extreme and high-risk acoustic environments.

Institute of Sound and Vibration Research (ISVR), University of Southampton (UK)
ISVR is internationally recognized for excellence in acoustics, noise, and vibration research. With state-of-the-art facilities and deep expertise in objective acoustic measurement, ISVR supports industry and defense partners with scientifically rigorous testing and analysis that informs standards, product design, and operational guidance.

Application

Defense / naval PPE evaluation – **hearing protection performance in realistic operational wear conditions** (anti-flash hoods used during shipboard fire/explosion readiness and training).

GRAS
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The challenge

Navy personnel may need to wear **anti-flash hoods** together with **earmuffs or noise-excluding headsets.** In practice, earmuffs are sometimes worn over the hood for speed and convenience—but any disruption of the seal can dramatically reduce protection.

The project's objective was to **quantify how much noise protection is lost** when an anti-flash hood is worn:

1. **under** earmuffs/headsets,
2. **over** earmuffs (where fit allows),
   compared with earmuffs worn normally.



The Peltor H515FB earmuffs worn over and under the anti-flash hood.

The GRAS solution

To obtain repeatable, objective data, the team measured insertion loss in one-third octave bands using the **GRAS 45CB Acoustic Test Fixture (ATF)**—a head-and-shoulders simulator designed specifically for **objective measurement of insertion loss of active and passive hearing protectors** in continuous or impulsive noise, aligned with **ANSI/ASA S12.42** requirements.

Why 45CB mattered for this study

- Realistic ear simulators with microphones at the **eardrum position**
- Designed for **hearing protector insertion-loss** work (not just headphones/hearing aids)
- Supports consistent, controlled comparisons across configurations (no hood / hood under / hood over).

Test setup

- Measurements performed in a **reverberation chamber** at the University of Southampton (ISVR).
- Four hearing protectors commonly used by UK military were tested (including a noise-excluding headset).
- Insertion loss measured for:
  - Earmuffs/headset **alone**
  - Earmuffs/headset worn **over an anti-flash hood**
  - For one slim model, earmuffs worn **under the hood** (others could not fit).

Results and impact

Key finding: wearing an anti-flash hood under earmuffs/headset can severely reduce protection.

The study reported large reductions in protection when earmuffs were worn over the hood—on the order of:

- **~20–23 dB** at high frequencies
- **~17–20 dB** at mid frequencies
- **~12–16 dB** at low frequencies
- **~16–20 dB** overall

Using the study's summary metrics, overall single-number insertion loss (**SNRATF**) dropped dramatically when worn over the hood, e.g.:

- **Thunder T3:** from **32 dB** → **14 dB**
- **Peltor H10A:** from **31 dB** → **12 dB**
- **Inductive loop headset:** from **33 dB** → **13 dB**

Design insight: "hood over earmuffs" can work—if the geometry is right.

Only one earmuff model was slim enough to be worn under the hood, and in that configuration the insertion loss changed by only about **~1 dB** in high and mid frequency summary metrics (effectively maintaining protection).

Operational relevance

The authors note that reduced insertion loss increases noise at the ear and can degrade **speech-to-noise ratio and intelligibility**, particularly critical for headset users.

GRAS equipment featured

GRAS 45CB Acoustic Test Fixture (ATF)

GRAS 45CB >

Conclusion

This work demonstrates how **objective insertion-loss testing with GRAS 45CB** can reveal the real-world performance impact of PPE combinations—and provide actionable input for:

- **Procurement decisions** (what combinations are acceptable)
- **Training guidance** (how PPE should be worn)
- **Future PPE design** (hoods engineered to fit over specific hearing protectors while maintaining attenuation).



About GRAS

GRAS Sound & Vibration develops high-precision acoustic measurement solutions used worldwide in research, product development, quality assurance, and compliance testing. Known for traceable calibration, long-term stability, and robust instrumentation, GRAS helps engineers **turn sound into science**—so decisions are based on insight, not assumptions.

For more information,
please contact marketing@grasacoustics.com.

About GRAS Sound & Vibration

GRAS is a worldwide leader in the sound and vibration industry. We develop and manufacture state-of-the-art measurement microphones to industries where acoustic measuring accuracy and repeatability is of the utmost importance in R&D, QA and production. This includes applications and solutions for customers within the fields of aerospace, automotive, audiology, and consumer electronics. GRAS microphones are designed to live up to the high quality, durability and accuracy that our customers have come to expect and trust.
GRAS Sound & Vibration is represented through subsidiaries and distributors in more than 40 countries and is part of Axiometrix Solutions, a leading test solutions provider comprised of globally recognized measurement brands.

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