AEROSPACE & DEFENSE

U.S. Navy Advances Hearing Protection with 3D Ear Scanning Technology

CUSTOMER
The United States Navy: Naval Air Warefare Center Aircraft Division

PRODUCT
GRAS 45CB

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A Navy audio testing room at Naval Air Station Patuxent RTiver, Md. USNI News Photo

Customer

At the United States Navy, protecting personnel from extreme noise exposure is a mission-critical priority. Sailors operating on flight decks, around aircraft, and near weapons systems are exposed to some of the harshest acoustic environments in the world.

At the Naval Air Warfare Center Aircraft Division (NAWCAD), engineers and researchers are continuously developing new ways to safeguard hearing—ensuring that protection is not only effective, but also practical to deploy across a global force.

GRAS
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Challenge

Noise-induced hearing loss remains one of the most common injuries among military personnel. Despite the availability of hearing protection, real-world effectiveness has been limited by one key factor: fit.

Traditional foam earplugs are designed as a one-size-fits-all solution, but in reality, human ear canals vary significantly. For many users, this results in an imperfect seal and reduced protection. Custom-molded earplugs offer better performance, but the process of creating them is slow, labor-intensive, and difficult to scale. It requires physical impressions, trained specialists, and significant turnaround time.

For the Navy, this created a fundamental challenge:
How do you deliver consistent, high-performance hearing protection to large numbers of personnel—quickly, efficiently, and reliably?

Solution

To overcome these limitations, the Navy introduced a new digital approach based on 3D ear scanning and additive manufacturing.

Using advanced scanning technology, technicians can capture the full geometry of a sailor's ear canal in just minutes. Unlike traditional methods, this process is fast, non-invasive, and fully digital. The captured data is then used to design custom-fit earplugs, which can be produced using 3D printing technologies.

This approach transforms hearing protection from a manual, time-consuming process into a scalable digital workflow. It reduces dependency on physical molds, shortens production time, and enables more consistent results across users.

Most importantly, it ensures that each sailor receives hearing protection tailored precisely to their anatomy—improving both performance and comfort.

GRAS 45CB

As hearing protection becomes more advanced and individualized, ensuring its performance becomes increasingly critical.

The GRAS 45CB Acoustic Test Fixture is designed to meet this need. It provides a highly realistic simulation of the human ear, enabling engineers to test hearing protection devices under controlled and repeatable conditions.

With its anatomically shaped ear canal, soft silicone lining, and temperature-controlled environment, the 45CB replicates how earplugs behave in real use. This is particularly important for custom-fit solutions, where even small variations in fit or insertion can impact performance.

By supporting standardized test methods such as ANSI S12.42, the 45CB allows manufacturers and defense organizations to verify attenuation, detect leakage, and ensure that hearing protection delivers the expected level of performance.

In this way, it acts as a critical link between innovation and validation—ensuring that new technologies like 3D-printed earplugs perform reliably in the field.

GRAS 45CB
The GRAS 45CA is a versatile test fixture for measuring sound isolation of hearing-protectors according to ISO 4869-3 and ear- and headphones according to IEC60318-1 or 60318-4. For testing hearing-protectors according to ANSI/ASA S12.42, choose GRAS 45CB >



Results & Benefits

The introduction of 3D ear scanning has significantly improved how hearing protection is delivered across the Navy.

Custom-fit earplugs provide a more reliable seal, resulting in improved attenuation and reduced risk of long-term hearing damage. The digital workflow ensures greater consistency across users, minimizing variability that has traditionally limited performance.

At the same time, the process is faster and more efficient. Scanning takes only minutes, and digital files can be shared instantly, eliminating the need for physical impressions and reducing logistical complexity.

The improved fit also enhances comfort, increasing the likelihood that sailors will wear their hearing protection consistently—an essential factor in real-world effectiveness.

Who is GRAS

GRAS Sound & Vibration is a global leader in high-precision acoustic measurement solutions. For more than 30 years, GRAS has developed industry-leading microphones and test fixtures used in the most demanding environments, including aerospace, defense, and advanced manufacturing.

With a strong focus on accuracy, repeatability, and reliability, GRAS solutions enable engineers to measure and verify sound with confidence—ensuring that products perform as intended in real-world conditions.

Key Takeaways

The U.S. Navy's approach demonstrates a clear shift toward precision-engineered, human-centered hearing protection. By combining digital technologies with advanced validation methods, it is now possible to deliver both scalability and performance.

At the same time, the case highlights the importance of measurement. As solutions become more customized, the ability to verify performance under realistic conditions becomes essential.

Ultimately, protecting hearing in extreme environments requires more than innovation alone. It requires confidence that protection works—every time.

Precision hearing protection starts with precision measurement.

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.