

SWAT HEARING LOSS

Authored by Patrick Armstrong, CEO of Threat4

SWAT EQUIPMENT LIKE FLASHBANGS (STUN GRENADES), PISTOLS, SUBMACHINE GUNS, AND ASSAULT WEAPONS ARE DANGEROUSLY LOUD. According to a study conducted by Dr. William Clark, Ph.D., senior research scientist in charge of the Noise Laboratory at the Central Institute For The Deaf in St. Louis, noise from shotguns averaged slightly more than 150 decibels (dB), rifles 159.1dB and pistols 157.5dB. Each of these weapons are significantly less loud than a flashbang, yet well above the 140dB threshold of pain and more than sufficient to cause sudden hearing loss with complications, said Dr. Clark. These findings show, for example, that the damage caused by one shot from a .357 magnum pistol, which can expose a shooter to 165dB for 2msec, is equivalent to over 40 hours in a noisy workplace. The damage caused by these types of SWAT equipment is called Noise Induced Hearing Loss (NIHL), which can be immediate and permanent.

60%
of soldiers
who return from
Iraq or Afghanistan
suffer from noise-
induced hearing
loss, and 49 percent
also suffer from
tinnitus.

SOURCE: Many soldiers are returning from combat with hearing problems. June 2007.

<http://www.hearinglossweb.com/Medical/Causes/nihl/mil/mil.htm>



SWAT HEARING LOSS

WHAT IS NIHL EXACTLY?

“If you wear earplugs, you can’t hear what’s going on around you.”

Staff Sargent Rob Conley U.S. Army

Noise Induced Hearing Loss (NIHL) can be caused by two types of noises measured in decibels: impulse noise, like a gunshot or flashbang and continuous noises, like a loud engine. Decibels (dB) are measured on a scale where an increase of 10 means that the sound is 10 times more powerful and twice as loud to your ears. A normal conversation is about 60 decibels and heavy city traffic is about 85 decibels. Hearing damage, according to The National Institute for Occupational Safety and Health (NIOSH) and the Centers for Disease Control and Prevention (CDC), occur based on exposure time and decibels, as seen in FIG. 1. SWAT weapons and equipment far exceed the maximum decibel regulations as established by NIOSH and are all above the instant hearing loss threshold of 140dB.

| Permissible Exposure Time | Continuous dB |
|-----------------------------------|---------------|
| 8 hours | 85dB |
| 4 hours | 88dB |
| 2 hours | 91dB |
| 1 hour | 94dB |
| 30 minutes | 97dB |
| 15 minutes | 100dB |
| 7.5 minutes | 103dB |
| 3.75 minutes | 106dB |
| 1.875 minutes | 109dB |
| .9375 minutes (less than 1min.) | 112dB |
| .46875 minutes (less than 30sec.) | 115dB |

“You just can’t wear your radio and the plugs at the same time.”

Cavalry scout
Matthew Reardon U.S. Army

“While you want soldiers to protect their hearing, you also want them to be able to hear what’s going on around them to keep them safe.”

Staff Sargent
Rob Conley U.S. Army

“The official word is, you’re suppose to wear ear and eye protection at all times. But if you’re in the field and have to take your earplugs out to complete a mission, you do it.”

Staff Sargent
Rob Conley U.S. Army

SOURCE: Many soldiers are returning from combat with hearing problems. April 29,2007.

http://www.eagletribune.com/punews/local_story_119010140.html

SWAT HEARING LOSS

WHAT EFFECTS DOES NIHL HAVE?

Exposure to sounds that are too loud cause damage to sensitive structures in the inner ear called hair cells. This means that SWAT team members can lose the ability to hear clearly. It also may lead to tinnitus, which is a ringing, buzzing, or roaring in the ears or head. Hearing loss and tinnitus may be experienced in one or both ears, and tinnitus may continue constantly or occasionally throughout a lifetime.

NIHL AND SWAT OPERATIONS

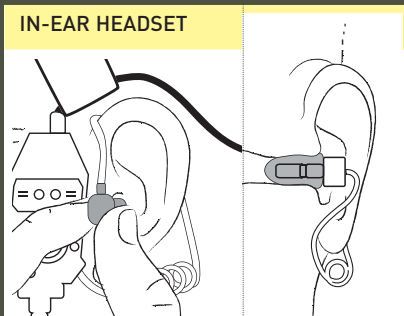
SWAT operations require tactical team members to be in close proximity to each other when they conduct entries. This means that weapons are typically close to the ears and that flashbangs are detonated within close proximity to the ears as well. The use of this equipment causes the tactical officer to be exposed to noises that cause instant hearing damage. At the instant of these impulse noises, tactical officers are at a disadvantage due to impulse noise numbing hearing and overpowering face to face and radio communications, and causing the officer to function with limited audio perception for a period of time thereafter. The effects of NIHL do not go away when the tactical officers day is over. NIHL can continue to worsen over time and eventually officers will no longer be able to hear properly in their personal life and will be unable to do their job effectively. This eventuality creates liability for the law enforcement agency in terms of potential litigation and disability payments, which will vastly surpass the amount of money required to prevent the issue at its inception.

WHAT SWAT IS DOING TO PREVENT HEARING LOSS TODAY

Most SWAT teams use hearing protection when training, but on live operations ears are usually left unprotected as officers need to hear their surroundings (situational awareness). That leaves the officers unprotected and at a disadvantage from hearing loss from impulse noise on operations. There are headsets available that allow the officer to hear their surroundings while having noise protection, but the ability to distinguish directionality of sound is far from the natural open ear. If the officers don't trust the effectiveness of these headsets to replicate ambient sounds, they won't use them. New technologies developed by Threat4 merges hearing aid technologies and their mathematical treatment of audio (algorithms) with hearing protection and radio communications. This allows the officer to protect their ears while maintaining the sensation and ear performance of having nothing in the ear. The tactical advantage is that officers are not subjected to the effects of hearing numbness, disorientation or missed communications, whether on operations or in training, and can hear as if ears were not protected, while maintaining face to face and radio communications.

SWAT HEARING LOSS

THE FUTURE OF TACTICAL HEARING PROTECTION?



IN-EAR HEADSET



MUFF STYLE HEADSET

The shortcomings of earplugs created new market opportunities for companies to develop better solutions, and in April 2008 a new army program to address the three key requirements, namely — Hearing Protection, Radio Communications and Situational Awareness, also called Tactical Communications and Protective Systems (TCAPS), was formed¹⁸ to address the growing epidemic.

Aside from standard electronic military muff-style headsets, which afford mediocre hearing protection and poor sound localization¹⁹ (ability to discern where a noise emanated from), the new players in the market were developing electronic in-ear headsets. These allowed ambient noise (voices, surroundings) to pass through the earplug at safe decibel levels, all while being connected to the radio and protecting wearers from impulse (like gun shots) and continuous noises (like engines). These innovations looked like a major step forward at first, however with time in the field, limitations started to become apparent.

Other than some of the obvious shortcomings of the typical in-ear solutions, like the fact that earbuds will pull out of the ear when snagged or when crawling on the ground, a little knowledge of their design is required. Most in-ear headsets on the market have a microphone lodged in the ear very close to the ear tissue which picks up ambient noises (voices, noises, etc) and plays them back at a safe level. This ability to hear your surroundings is known as Situational Awareness. Typically one of these microphones is also used to transmit your voice through to the radio, and this is where the drawbacks of the typical in-ear headset arise.

By abandoning the boom microphone for radio communications and using the in-ear mic for both situational awareness and radio transmit, three problems surface; 1) Body vibrations caused by tracked vehicles, rotary vehicles and running, resonate in the ear tissue and transmit over the microphone 2) Since one mic doubles as the situational awareness mic and radio transmit mic, when you transmit you lose all situational awareness in one ear...effectively becoming temporarily deaf in one ear. 3) To ensure human voices travel from the mouth to the in-ear microphones, manufacturers used audio compression technology, which attempts to make quiet and loud noises the same volume. This is like talking to someone on a cell phone in a loud environment where everything is the same audio level. So a user would have trouble having a face to face conversation wearing typical in-ear headsets when there is noise in the background.

SWAT HEARING LOSS

THE FUTURE IS NOW



The net effect is that solutions up until now are able to help with preventing hearing damage and do work, however they have clear limitations, a testament to this is that in January 2011 the US Government Accountability Office (GAO) released a report stating that hearing conservation programs needed improvement (see <http://gao.gov/products/GAO-11-114>). **Newer technologies and designs, such as Threat4's 62000 headset, have recently emerged onto the market, and have taken into account the shortcomings of previous in-ear headset designs and their predecessors.** These technologies capitalize on advances in DSP (digital signal processor) technology which allows for four (4) microphone inputs, which can enable algorithms to calculate where sound comes from, for near human sound localization. These advancements can also reduce noise far more effectively than traditional Adaptive Noise Reduction (ANR). This has led to the creation of a new category in headset design, which amalgamates the tried-and-true, old style boom mic headsets with the in-ear concept, creating a new hybrid design. This hybrid design looks to be the best use of technology yet to allow our soldiers to protect their hearing, perform at optimum levels on the battlefield and for the US Military to begin to tackle what has quickly become a billion dollar a year problem.

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