



BONE CONDUCTION HEADSET TECHNOLOGY OVERVIEW AND ITS APPLICATION IN PROFESSIONAL TACTICAL TEAMS

INTRODUCTION

Professional communication in the law enforcement community has evolved slowly over the past several years. It has long been the bane of many users. Tactical professionals are typically wary of new technology. They depend on their gear to save their lives, and when a solution works, they tend to stick with it.

One area we are seeing change is in the 2-Way radio communication arena for SWAT operators. It used to be the preferred headset solution was a standard “shooter’s” style ear muff headset. This type of headset amplifies ambient sound through speakers inside the ear muff. When the ambient sound level exceeds some preset threshold, usually around 70-80 dB, the amplification cuts out and the noise reduction rating of the ear muff protects the wearer’s hearing. The ear muffs typically have between 23 and 27 dB of Noise Reduction Rating (NRR). You will also see this type of headset used at shooting ranges.

One down side of this set up is that ear muffs can be hot and uncomfortable to wear for extended periods of time. A less anticipated issue is that the ambient sound is not truly directional. You can hear the sound, but you do not know where it is coming from. It is similar to being inside a sound room. All the ambient noise is amplified and your ears lose the 360 degree subtleties we take for granted having used our ears all of our lives. Also, as soon as the shooting starts you lose any sense of situational awareness because the ambient sound cuts out. You are essentially deaf to the world except for your radio chatter.

With the advent of suppressors being used on most departments’ tactical weapons these days, the need for hearing protection

is becoming less critical. This has allowed the use of different types of headset and listening device solutions. We have seen a dramatic increase in the use of bone conduction technology with a directional boom mic as the preferred solution for many SWAT teams around the country. Bone conduction is basically a set of speakers placed in front of the ears, driving sound through the bones of the skull into

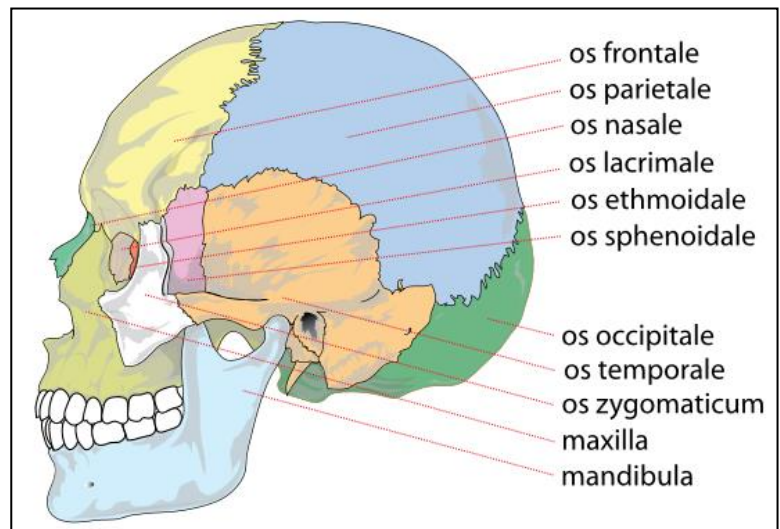




the ear canal. This leaves your ears open to hear any and all sound around you. The user can choose to wear foam ear plugs (NRR around 25-30 dB) in one or both ears if necessary, but you can remove the hearing protection without losing your radio communication. This can be extremely beneficial in low volume stealth operations. In fact, in the book “No Easy Day” by Mark Owen from Seal Team Six, recounting the raid on Bin Laden’s compound, he is particularly complimentary of the “Bone Phone” bone conduction technology and the role it played during their covert operations.

TECHNOLOGY BASICS

Bone Conduction technology is not new. It has been around since the early part of the 20th Century and is most commonly used in hearing aids. Fundamentally, the technology consists of transmitting sound vibrations, through the bones of the skull, into the auditory canal where the ear receptors pick up and process the vibrations as audible sound. Bones transmit lower frequencies more clearly than air. This is why we all think our voice is deeper than it really is.



Most bone conduction headsets have the speakers mounted directly in front of the ear, transmitting the sound into the ear canal via the forward protruding flange of the temporal bone (see picture, os temporale). These devices can have a traditional microphone to transmit sound, or a bone conduction microphone as well as speakers.

Usually the speakers will be covered in a polymer membrane which enhances the connection to the temporal bone. The sound is typically loud and clear, but if there is a lot of ambient noise, the two sound sources can fight for the attention of the ears. If the user employs the use of ear plugs, bone conduction performance is greatly enhanced. The user’s entire skull will transmit sound, making the listening experience very crisp.

ADVANTAGES

Conducting sound into the ear without having a speaker mounted directly on or in the ear has many advantages, which is why we are seeing more applications of this technology in everyday life. Some of the advantages are:



- **Hygiene:** When headphones are used every day, or shared between multiple users, they can get dirty quite quickly. With bone conduction technology there is a smooth surface that can be easily cleaned so that the part that contacts the user can be kept sanitary.
- **Safety:** Since the speaker is in front of the ears, the user can choose higher quality noise protection. You can also temporarily remove the hearing protection without losing your communications.
- **Situational Awareness:** With the speaker in front of the ears, the user can keep their ears open and will be able to hear surrounding noises and know from which direction they are coming.
- **Comfort:** Since there are no hard plastic or foam earpieces inside your ear, the headset is more comfortable than traditional earpieces. It is also easier to don a tactical helmet, since the headset is independent of the helmet.
- **Quality:** As mentioned above, when the ears are blocked with adequate noise protection plugs or ear muffs, the sound experience is transformed into high fidelity and clarity.
- **Compensation for Hearing Impairment:** Bone conduction technology can provide better sound for some types of hearing impairment. Additionally, if the user has asymmetric hearing loss (one ear only) it will be readily apparent, as the sound will be dominated on one side. The user can compensate for this by partially closing the ear on the most impaired side. This will “amplify” the perceived sound in the bad ear and balance your hearing.

DIS-ADVANTAGES

Although this technology may sound like a better way to listen, there are some inherent tradeoffs and compromises. Since the sound has to conduct through the bones and tissue of the head, there are some potential issues that can degrade the quality of the sound transmission. Some of the disadvantages are:

- **Facial Hair and Tissue:** The sound transmission is directly related to the quality of the connection between the speaker and the temporal bone. This means any facial hair or tissue between the two surfaces will have a tendency to degrade the sound transmission.
- **Speaker Power:** The power to drive the speaker can either come from the headset batteries or from the sound device itself, i.e. 2-way radio, music player, etc... If the sound device is low quality or has a low power output, the sound level may be low compared to other headsets. The TBCH-Pro does not use batteries and professional quality 2-Way radios have sufficient power to drive the speakers.
- **Optimum Use:** To get optimum quality and fidelity out of a bone conduction speaker, it is best to completely close the ears. This eliminates the advantage of situational awareness, so partially covering one or both ears may allow you to find the best compromise.



TWO WAY RADIO APPLICATIONS

Code Red Headsets offers different bone conduction headsets compatible with 2-Way radios. In the tactical professional application we have a Boom Mic (B/M) and a Bone Conduction Mic (S/R or Send and Receive). These two models have their individual benefits, and suitability for use will largely be in the perception of the user.

- **Tactical Bone Conduction Headset-Professional (TBCH-Pro-B/M and TBCH-Pro-S/R):**

This headset is aimed squarely at the tactical professional. It comes in two versions, one with a boom mic and one with a bone conduction mic. Boom mics are best in high noise situations as they have some noise cancelling properties and are directional: the mic is right in front of your mouth. The bone conduction mic eliminates the boom mic, which can be a distraction when sighting in a weapon or wearing a mask. It has a robust metal PTT button which is hard wired to the download. This PTT/Down lead combination can be swapped out to accommodate various 2-way radios. The TBCH-Pro also comes with a remote (wired) PTT button, which can be attached to your finger or directly mounted on a weapon. This way, you can actuate the PTT without interrupting your operation.

Code Red offers the TBCH-Pro series headsets in configurations that are compatible with all of the 2-Way radios used by professional departments across the country, including Motorola, Kenwood and Harris. We offer Test and Evaluation samples (T&E) for departments and encourage side by side comparisons of our products. For more information or to look into getting your team outfitted, please take a look at our website, www.coderedheadsets.com, contact us at sales@coderedheadsets.com or call us directly at (858) 486-9859.

