

## Communications Enhancement and Protection System (CEPS)

Communications & Ear Protection, Inc.  
Enterprise, AL

### Military Needs

- Need to Locate and Identify Opposing Forces
- Protection from Exposure to Hazardous Noise
- Need Capability to Communicate Face-to-Face
- Need Radio Communication in Noise
- Maintain Compatibility With Existing Equipment

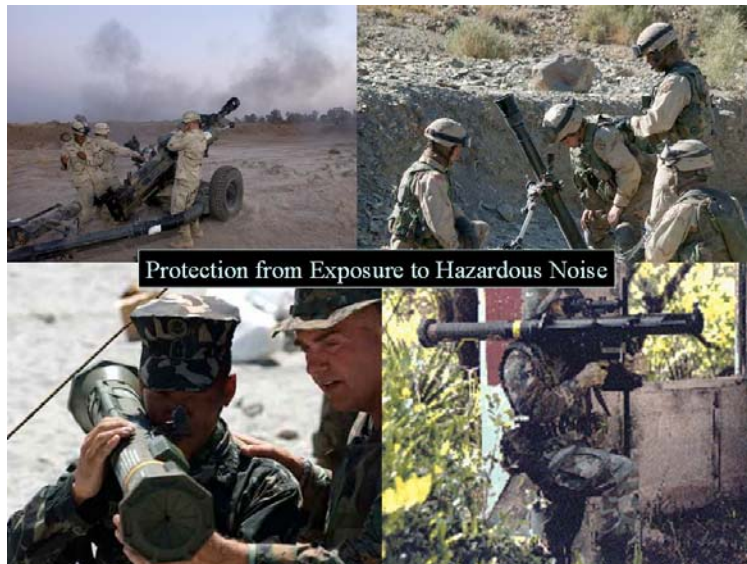
**Soldiers in combat must use all their senses to survive and perform on the modern battlefield. Their hearing must be protected from damage caused by hazardous impulse and continuous noise, (i.e. small arms fire, mortar, grenade and armor noise), without compromising their ability to hear and communicate in these environments. Hearing is often essential to detect, locate and recognize the enemy.**

**Soldiers must understand ambient sounds in their immediate environment and communicate between themselves both on a face-to-face basis and via radio in secure modes during mission operations. Operational contingencies, missions and environments, such as Military Operations in Urban Terrain (MOUT), Night Reconnaissance, Chemical, Biological and Nuclear (CBN) defence modes, or smoke, dust and haze during movement on the battlefield confound the soldier's ability to perform these tasks.**

**The specific needs of the combat soldier are to locate and identify the enemy, be protected from noise in the combat environment to maintain combat efficiency, to communicate and coordinate his mission both face-to-face and with radio transmission during engagements where high noise levels exist, and to maintain optimum effective use of his equipment (i.e. combat compatibility).**



One of the singular needs of the combat soldier is to locate, identify, and attack with such surprise, speed, mass and firepower that the opposing force is neutralized with minimal cost in manpower or materiel. Technologically enhanced detection and reconnaissance of the enemy without discovery or exposure increases the safety and effectiveness of any combat operation. While increasing technological advances in sensors, robotics, and smart weapons have redefined the modern battlefield, it remains the “boots-on-the-ground” soldier that decides the outcome of conflict. Enhancing the soldier's on-the-ground combat capability is a force multiplier.



During operations in Afghanistan and Iraq, there has been a high incidence of casualties related to temporary and permanent hearing loss caused by impulse noise. The nature of combat in urban environments often requires the soldier to choose between using hearing protection that will compromise his ability to hear subtle sounds that may indicate the presence of enemy forces or go unprotected and suffer from impulse noise exposure. Similarly, hearing protection for extremely high impact noise as in artillery, armor, mortar and hand fired rockets is absolutely essential to maintain hearing integrity. However, compromises in crew communication created by hearing protection requirements are always present in these environments.



**Both in training and in combat, soldiers must communicate with each other to coordinate their activities to maintain optimum efficiency and safety. Adequate communication/coordination decreases the potential for friendly fire incidents, poor operation execution and mission failure. Maintaining communications in high noise environments during these operations is presently degraded by the need to retain hearing protection or suffer hearing loss. A system to effectively permit unhampered communication and instruction in these environments is a critical requirement if the soldier's health and combat capability are to be maintained.**



**Continuous noise levels present in military aircraft and ground vehicles generally exceed the noise exposure limits established by DOD Instruction 6055.12, Hearing Conservation, and required physical hearing protection precludes effective face-to-face and radio communication in these environments without technology enhancement. Since its fielding for Army aviation in 1999, the Communications Earplug has substantially increased the aviator's ability to receive adequate speech signals at the ear, while receiving protection adequate to negate hearing loss from aircraft noise exposure. However, soldiers being transported either in military aircraft or ground vehicles are still not able to communicate with each other because of high noise levels in these environments without compromising their present hearing protection.**



## Problem

- Lack of situational awareness when dismounted
  - unable to locate source of sound
  - unable to identify sound source
  - face-to-face communications compromised
- Noise levels can exceed DRC
  - adjustable gain can allow for effective voice communications

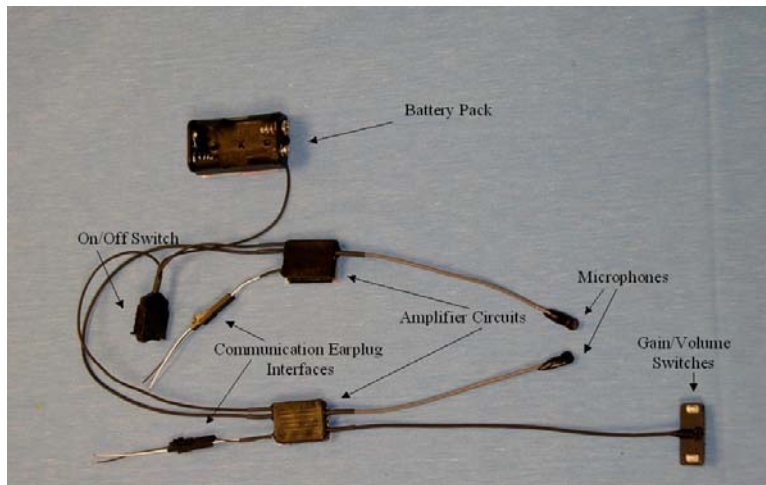
Equipment designed for the combat soldier's use must interlock/interface to provide optimum efficacy for combat efficiency, safety and survivability. New technology must not interfere with, but must improve fielded equipment and tactics. In short, it must improve effectiveness, safety, health and chances of survival in combat to prove useful to the soldier. Inadequate, unreliable, nonessential or logistically unsustainable technology or equipment will be discarded by the soldier during the battle.

In summary, the combat soldier needs an advantage in locating and identifying the enemy, while using hearing protection without compromising face-to-face and radio communications in a device that is compatible with all missions and mission equipment. The U.S. Army 160th Special Operations Aviation Regiment (SOAR) brought essentially this problem to CEP, Inc. During their missions, 160th crews are required to egress their aircraft to conduct ground operations. In executing these operations, they were either suffering degraded communication when they left the AC communication system (ICS) and retained their helmet and its mounted systems (i.e. NVG, sight systems, lip lights etc.), or they were taking off their helmets and communicating better face to face, but losing night vision capability and hearing protection while on the ground. Both these circumstances were considered unacceptable compromises to their safety and their mission. To alleviate this problem, CEP, Inc. developed the Communication Enhancement and Protection System (CEPS).

## CEPS Aviator Helmet Configuration

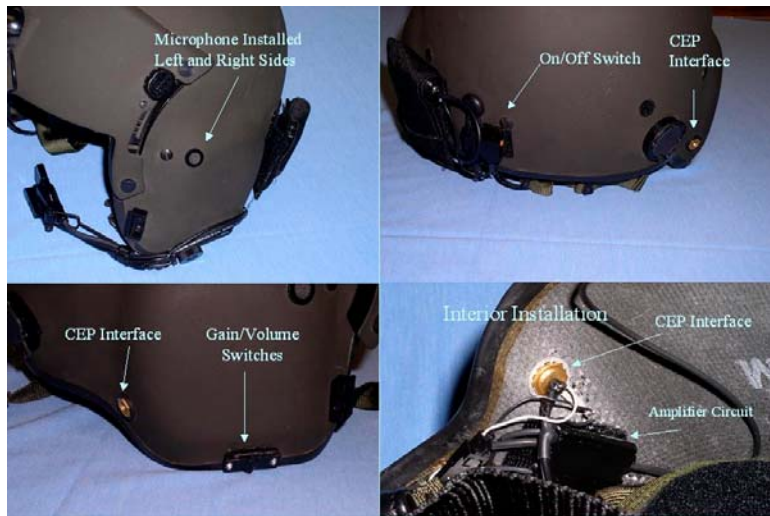


The Communication Enhancement and Protection System was interfaced in the HGU-56/P Aviator Helmet. The addition of this system permitted full auditory situational awareness for 160th SOAR crewmembers during dismounted missions. When activated after leaving the aircraft, it provided the aircrews face-to-face and radio communication, impact noise protection and enhanced sound localization. The CEPS in Aviator Helmet Configuration has been deployed and combat proven in Afghanistan and Iraq. 1000 units are presently fielded.



CEPS Aviator Helmet Configuration

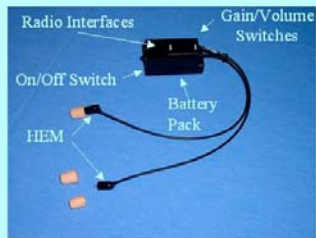
The CEP for the Aviator Helmet Configuration consists of microphones, amplifier circuits, gain/volume control switches, a rocker on/off switch, AA battery pack and CEP interfaces interfaced in a wiring harness designed to be installed within the HGU-56/P Aviator helmet shell. Microphones are placed at or near each ear at approximate inter-aural separation to transduce sounds arriving at the user's ear. The microphones are placed in this manner to preserve the localization capability of the user in order to maintain situational awareness within the environment. The sound signals received by the microphones are processed separately in a linear fashion through the system to maintain fidelity of the received sound. The sounds are then output to the Communications Earplug interfaced in the helmet to complete the intervention process. This process is conducted in a way that emulates the normal reception of sound when the individual is not wearing hearing protection.



CEPS Aviator Helmet Installation

Note the position of various components of the CEPS on and within the helmet.

The primary functions of the CEPS then, are to allow the user to listen to surrounding sounds, to listen to radio messages and to be protected from hazardous sound pressure levels. The user, using a pair of momentary contact switches that either increase or decrease the electronic output gain, controls reception and amplification of external ambient sounds. Increased gain permits the user to maximize his sound detection ability during “watch or lookout” activities, thereby increasing the probability of detecting and localizing enemy movement or activity without detection of his position. The throughput of the system is linear until the output level for a particular setting of the final gain reaches the limits established by the power supply. This system is coupled with the expanding foam earplug, which acts as a barrier to reduce the sounds outside the ear while permitting transduced sound to reach the user. Thus, hazardous impact noise does not reach the ear. This sound limiting permits the wearer to retain his ability to hear and communicate with complete effectiveness without either acute or long term hearing degradation caused by impact noise.

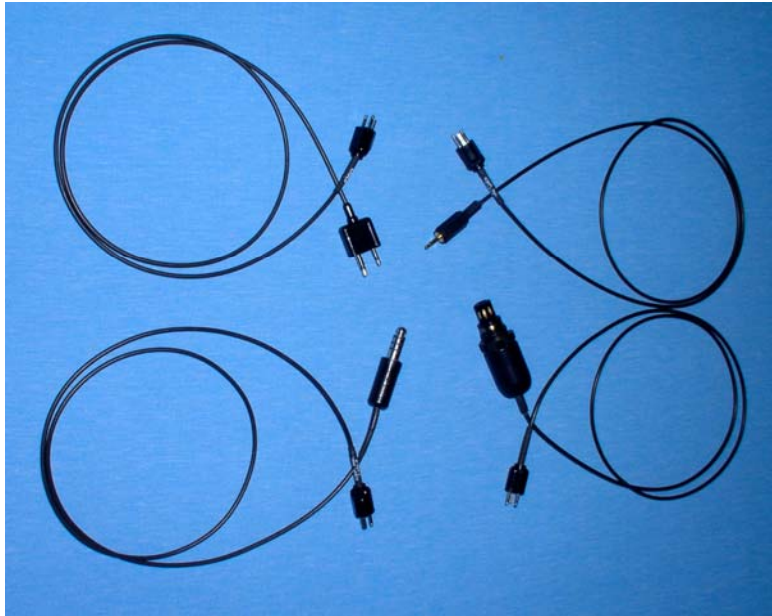


CEPS Module  
RECON or Headband  
Configuration



Hearing Enhancement Module  
(HEM)


CEP, Inc. has also developed the CEPS Module for ground combat use. This CEPS modular system performs in precisely the same manner as the helmet configuration but has undergone substantial redesign to compress the size of the system. The amplifier circuit boards have been stacked, molded and attached to the AAA power supply with on/off switch and 2 radio interface plugs have been molded into the circuit stack. Gain/volume switches have also been molded and mounted on the stack to provide a small compact rugged modular package. An additional design change brings the microphone and earphone together as one unit at the ear canal opening. The Hearing Enhancement Module (HEM) combines a microphone and earphone into a single package that is wired into the main CEPS module. The HEM allows the microphones to be placed near each ear, at approximately the inter-aural separation to transduce sounds arriving at the user’s ear. This preserves the localization capability of the user in order to maintain auditory situational awareness while working in the combat environment.




Two three-pin Nexus connectors are made available in the CEPS module to allow connection to two different external radio systems. The left and right sides of the CEPS module provide signals to Radio #1 and Radio #2 so the user can effectively differentiate which radio is active. The input to the radio is derived from the HEM microphone preamplifier and the radio output is directed to the HEM earphone on the same side. The user can adjust the radio volume to the desired level to meet the operational requirements of the situation, either for listening to the surrounding ambient sounds or the radio communications. Cables for connection to the various radios presently operational in military systems are illustrated here. Custom cables can be provided where necessary, to meet specific military requirements.

**CEPS**

**RECON Configuration**



**Headband Configuration**



Low Profile  
 Modular Package  
 Slide Power Switch  
 2 Nexus connectors for radio IO  
 Adjustable gain/volume control  
 AAA cell power supply

The CEPS can be worn on a yoke around the neck as illustrated in the RECON configuration or worn in a headband configuration with the module located slightly below the individual's headgear centered on the back of the head. Either configuration is comfortable and does not interfere with other equipment the soldier wears.

## Operational Parameters

- hearing protection 29.5 dB NRR
- gain range of 36 dB
- output level safe for 95 dBA input for lowest gain setting
- Impulse noise cut-off limit at 128 dBP

CEPS provides the following capabilities:

- **Real ear sound attenuation at 29.5 dB as provided by the foam ear tip.**
- **The ability to detect, locate and recognize sounds at four times the distance of normal hearing (gain range of 36dB.)**
- **Limit of 95 dBA input to the user at lowest gain setting**
- **Impulse noise cut-off limit at 128 dBP.**

## Functional Gain



- Maximum gain for detection
- Middle gain for face-to-face communications
- Low gain for higher continuous noise levels
- Lowest setting for very high continuous noise

**The CEPS is a self-test item that can be assessed for proper operation by simply wearing the device for a familiarization period. With some experimentation the user will use maximum gain for detection of sound, will adjust the gain to mid levels when communicating with others face-to-face, will use a lower gain for modest continuous noise levels where communication is still desired and the lowest setting in very high continuous noise. The CEPS is expected to operate about 4 weeks on one pair of AAA batteries using a 50% duty cycle.**



CEPS permits the user to:



- Detect, locate and identify surrounding ambient sounds
- Listen to and transmit radio messages
- Protect hearing from hazardous sound pressure levels

**In summary then, the CEPS user will acquire an exceptional capability to:**

- **Detect, locate and identify surrounding ambient sounds.**
- **Listen to and transmit radio messages.**
- **Protect his hearing from hazardous impact and continuous noise.**

CEPS provides:



- Enhanced sound detection capability and localization in "recon" or "watch" modes
- Enhanced face-to-face communication for night, MOPP or MOUT operations.
- Two-way radio communications in stealth mode
- Protection for both hazardous impulse and continuous noise environments

**The Communication Enhancement and Protection System will be a force multiplier; improving soldier safety, protection, and efficiency as they accomplish their missions.**

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