3D-AUDIO AND ACTIVE NOISE REDUCTION – ROTARY WING

Natural audio in noisy environments
Terma's 3D intercom solution improves situational awareness by reducing noise and enhancing communication through use of 3D-Audio and Active Noise Reduction technology.

The enhanced situational awareness from applying Terma audio technology significantly improves reaction times, intelligibility, and lowers the stress level of the pilot and crew – and hence increases mission effectiveness. By integrating 3D-Audio and Active Noise Reduction in the cockpit, audio communication can take advantage of our natural human ability to distinguish directional sound.

3D-Audio or spatial audio is used in two ways to improve the situational awareness of the pilot: channel separation and directional information.

First, the spatial separation of radio channels, intercom, and system messages allows the pilot to focus on one message or radio channel while still being aware of others. Pilot and crew members can avoid communication overload from mono-based intercom systems, where too much radio/intercom activity leads to disregard of the audio communication.

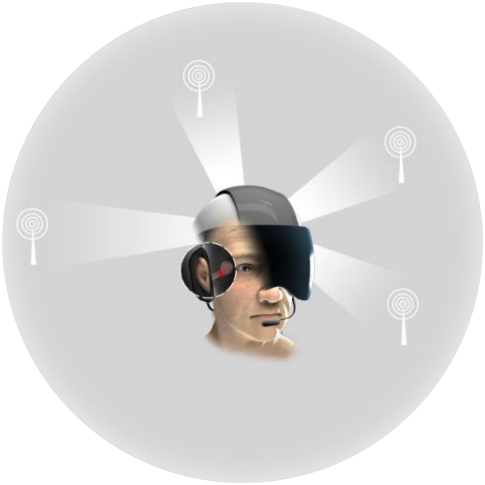
3D-Audio enables natural conversation on the intercom system between pilot, co-pilot, and crew members leading to more effective communication. Furthermore, the speakers will be identified by the direction of their voices making it easier to suppress background noise and irrelevant information.

When integrated with on-board sensors and head-tracking devices as found in modern helmet mounted cueing systems, Terma's 3D-Audio technology will further enhance situational awareness. Directional information to the pilot will be heard from the actual direction as indicated by the sensors, in correct relation to the listener's head and aircraft position. The audio from the actual threat direction enables the pilot to understand where a threat is coming from and react faster.

Another important feature of spatial audio is that a listener is aware of the full sphere, i.e. he/she notices sound from any direction. This is a major difference from visual indications on cockpit-mounted displays which require the viewer to direct his/her eyes towards the display. In fact, 3D-Audio is similar to helmet-mounted type displays, which keep the information available regardless of where the pilot is looking. In a similar manner, 3D-Audio will keep the pilot updated if the threat changes direction relative to his/her own platform.

3D & Active Noise Reduction

Aircrew also benefit significantly from Active Noise Reduction. Reduced cockpit noise lowers fatigue and stress during long missions while enhancing 3D-Audio performance. Reduced noise levels also allow pilots to lower the volume of the intercom system, yielding significantly reduced acoustical levels – and a chance to avoid the yellow earplugs. Terma has achieved a reduction in noise exposure through the development of a digital ANR-headset powered through a standard intercom interface. The headset has outstanding noise attenuation and is at the same time capable of reproducing 3D-Audio.



The Terma 3D-Audio solution includes a form-fit replacement for existing intercom systems, including the amplifier and the headset. Although designed for the F-16, the system can be integrated in other platforms, including the noisiest helicopter platforms. The Terma solution which includes 3D-Audio and Active Noise Production technology is operational and fielded in F-16s, including US.

Product specifications

3D-Audio	Generic database of Head Related Transfer-Function (HRTF). Full-sphere 1.5 degrees coverage
Angular Resolution	Better than 3 deg azimuth and 10 deg elevation (application dependent)
3D-Audio Channels	8
Audio Management	Play, stop, pause, priority, play list, etc.
Audio Storage (audio cues)	512 MB
Audio Sample rate	22 kHz - 48 kHz (Internal Sample Rate 48 kHz)
Analog Inputs	9 channels
Analog Outputs	3 (Record -, intercom - and command mic. out)
Headset Output	4-wire standard to U-92 A/U connector Analog Mode: Output for standard intercom headset / Digital Mode: Powered Digital Audio (auto detection)
Discrete Inputs	4 (Hot-Mic, Radios Keys and Analog/Digital Mode
Microphone Input	Low Impedance M-87 dynamic microphone and M-169 Microphone
Interface Control	Serial Communication RS-485
Max Sound Pressure Level	115 dB (@THD < 3%, ANR ON)
Frequency Response	20 Hz – 16 kHz
Distortion	0.5% (@ 85 dB, 1000 Hz)
HRTF Reproduction	+/- 1 dB (63 Hz - 16 kHz)
Noise Attenuation (active+passive)	20 - 30 dB
ANR	9 dB (A), 20 dB (peak)
Helmet Compatibility	HGU-55/P, JHMCS, and HGU-56
Helmet Kit Nominal Impedance	9.5 Ohms (Analog Mode)
Helmet Kit Weight	320 g
Operational Temperature	EIA: -40°C - +71°C: Helmet kit: -40°C - +55°C
Storage Temperature	EIA: -54°C - +95°C: Helmet kit: -40°C - +70°C
Vibration	EIA: Gun fire: 15 g peak sinusoidal, 0.06 g2/Hz background random. Method 519.5 of MIL-STD-850F
Electro-Magnetic	MIL-STD-461 rev. E