



Technology Focus: Communications

Noise-Canceling Helmet Audio System

Voice communication is enhanced by digital processing to suppress noise.

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A prototype helmet audio system has been developed to improve voice communication for the wearer in a noisy environment. The system was originally intended to be used in a space suit, wherein noise generated by airflow of the space-suit life-support system can make it difficult for remote listeners to understand the astronaut's speech and can interfere with the astronaut's attempt to issue vocal commands to a voice-controlled robot. The system could be adapted to terrestrial use in helmets of protective suits that are typically worn in noisy settings: examples include biohazard, fire, rescue, and diving suits.

The system (see figure) includes an array of microphones and small loudspeakers mounted at fixed positions in

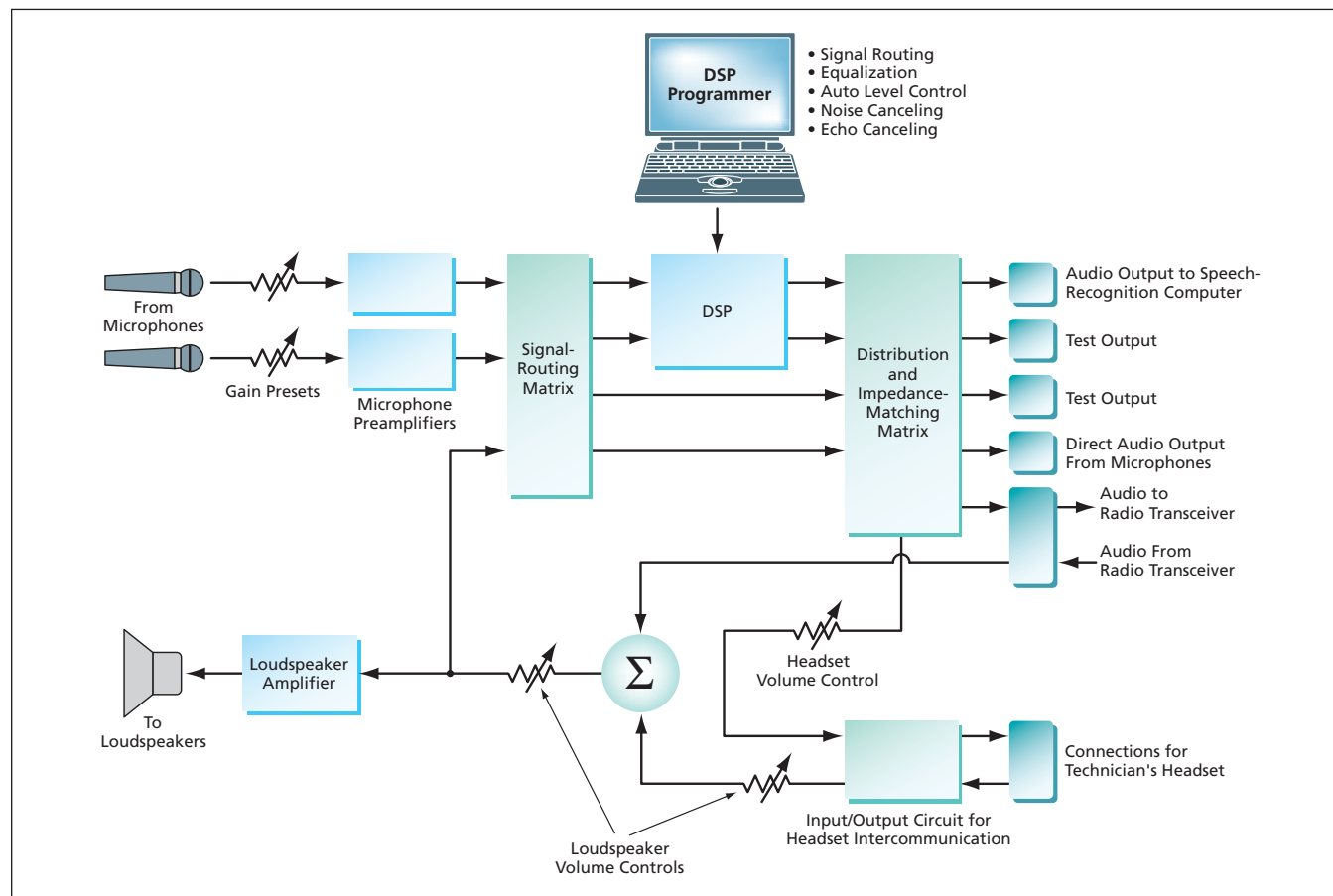
a helmet, amplifiers and signal-routing circuitry, and a commercial digital signal processor (DSP). Notwithstanding the fixed positions of the microphones and loudspeakers, the system can accommodate itself to any normal motion of the wearer's head within the helmet.

The system operates in conjunction with a radio transceiver. An audio signal arriving via the transceiver intended to be heard by the wearer is adjusted in volume and otherwise conditioned and sent to the loudspeakers. The wearer's speech is collected by the microphones, the outputs of which are logically combined (phased) so as to form a microphone-array directional sensitivity pattern that discriminates in favor of sounds coming from vicinity of the

wearer's mouth and against sounds coming from elsewhere. In the DSP, digitized samples of the microphone outputs are processed to filter out airflow noise and to eliminate feedback from the loudspeakers to the microphones. The resulting conditioned version of the wearer's speech signal is sent to the transceiver.

This work was done by Marc A. Seibert of Glenn Research Center and Anthony J. Cullotta of Analex Corp. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steve Fedor, Mail Stop 4-8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-17736-1.



The **Noise-Canceling Audio System** processes microphone outputs to maximize sensitivity to the wearer's speech, suppress feedback from loudspeakers to microphones, and filter out noise.