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Human Physiology in Space (2)

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# THE ACOUSTIC DIAGNOSTICS EXPERIMENT OF THE MISSION BEYOND: ADVANCED OTOACOUSTIC TESTS ON THE INTERNATIONAL SPACE STATION

**Abstract**

Acoustic Diagnostics is an Italian Space Agency (ASI) biomedical experiment exploiting the diagnostic

potential of otoacoustic emissions (OAEs) to monitor the astronauts' hearing health on board the International Space Station (ISS). It will be executed on the ISS (July-December 2019), during the Beyond mission sponsored by European Space Agency. The experiment is performed in the frame of a specific agreement between ESA and ASI, which allows Italian utilization of the ISS to be performed in the frame of the ISS resources available to ESA.

Both Italian astronaut Luca Parmitano and American astronaut Andrew Morgan have been subjected to Baseline Data collections before leaving for their six months mission, using a dedicated scientific instrument developed by University of Rome Tor Vergata and INAIL (as science team), collaborating with Aerospace Logistics Technology Engineering Company (ALTEC) for the payload development, test, verification and acceptance. These data are then compared with the equivalent measurements performed on the ISS, once per month during the 6 months of the Beyond mission. Finally, measurements are performed also post-flight.

The experiment consists in the measurement of Distortion Product OAEs (DPOAEs) high-resolution spectra in the 1-6 kHz range. Calibration of the forward pressure ensures reproducibility of the stimulus fed to the inner ear independently from the depth insertion in the ear canal. Time-frequency analysis of the response allows to sort different components of the DPOAE signal, with different diagnostic meaning, and improve the signal-to-noise ratio of the measure. The main hardware components are a preamplifier, a compact DAQ system for the in-flight monitoring of the hearing function, a miniaturized probe which houses two ER-2 loudspeakers delivering the stimulus and an ER-10B+ microphone recording the OAE response. Finally, dedicated software interface has been designed. The payloads selected for the mission "BEYOND" are funded and coordinated by ASI, resulting from a public call open to the industrial and scientific research communities. ASI, in the frame of its national mission of promoting and fostering the culture of space across the Country, provides access to the ISS as a laboratory in space. The utilization support services are provided thanks to a contract, awarded by ASI, to ARGOTEC/Telespazio (UTISS Team). This team supports safety evaluation and payload manifesting and qualification process leading towards a safe and efficient delivery, utilization, integration on board the ISS and recovery of the payload, allowing scientists to access and retrieve experimental data and instruments after they return to Earth.