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ULTRASOUND UTILIZATION TRAINING FOR APPLICATIONS IN MICROGRAVITY

Abstract

Ultrasound uses high frequency mechanical waves to generate images of the body's internal organ and flow. Ultrasound imaging or sonography is a non-invasive diagnostic technology used for medical applications since the early 1930 and it has been extensively used in microgravity as a diagnostic and scientific research tool. Its first use is dated back to the MIR Station and it is available on board of the International Space Station since its very beginning. The ADUM (Advanced Diagnostic Ultrasound in Microgravity) experiment aimed to demonstrate accuracy of ultrasound in potential medical contingencies, to optimize data compression and voice protocol guidance. The result was encouraging in showing how non-expert crew could operate an Ultrasound with guidance from an expert sonographer on ground. This opened to a series of further studies to better understand the reasons behind human physiology changes under microgravity conditions: ICV (Integrated Cardiovascular) , Fluidshift , SPRINT experiment performed by NASA, followed by European experiments like Vessel Imaging, Drain Brain, Sarcolab and the ongoing Myotones experiment. The ultrasound technology had an evolution over the time and so the first NASA HRF Ultrasound model present on board had to be replaced with a new General Electric compact model with more functionalities, that since 2017 is complemented by a new device (Sonoscanner) with motorized probes oriented remotely by an expert on ground. During the past 30 years, not only the ultrasound technology has changed but also the training of the astronauts. At the beginning, the astronauts had to be trained to be capable to perform the echography without any assistance from the ground. Then the astronaut training was reduce to give them the skills to recognize organ image (the acoustic window), but then performing the scan with a direct vocal assistance from the expert on ground. Lastly, with the last Echograph the fine tune to get the perfect organ view as well as the optimization of the image settings, was performed by the expert controlling the probes inclination from ground. This paper review the history of ultrasound use in microgravity and the evolution of the instructional methodology applied to the training over the past 10 years. The paper will conclude providing, lessons learned and training implication of the use of ultrasound in future exploration missions, where distance and latency will have an impact in communication between Astronauts and scientists on ground.