SPACE LIFE SCIENCES SYMPOSIUM (A1)
Medical Care for Humans in Space (3)

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INTEGRATED COUNTERMEASURE AND REHABILITATION EXERCISER (ICARE)

Abstract

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It is currently well established that long term exposure to microgravity induces impairment on human muscles, exercise capacity, bone and on the neuro-sensory system especially proprioception. Up to now, none of the currently existing physical countermeasures has proved to be fully efficient to counteract all these impairments. Some of them however, like bone or muscle loss, are still major issues to solve in view of the future long duration missions. Additional countermeasures need thus to be developed.

The challenge consists in developing integrated countermeasure systems targeting several physiological systems in one single device while ensuring the best time-effectiveness. The definition of efficient utilisation training protocols is also a key aspect to consider for the future countermeasures. Further on-ground research is required to define and validate both the types and the modes of utilisation of the future countermeasures.

The ICARE project (Integrated Countermeasure and Rehabilitation Exerciser), funded by ESA, aims to develop an integrated countermeasure system targeting the musculo-skeletal system and the neuro-sensory system. The device will be modular integrating several sub-systems to target different physiological systems. The project aims in a first step to develop a multi-purpose technological demonstrator to allow the scientific community to determine which combinations and settings of countermeasure sub-systems are the most efficient. Ground applications especially for prevention and rehabilitation purposes are also envisaged. After a state of the art review of existing countermeasure systems, the scientific requirements have been defined in different scientific workshops including scientific experts both from the space fields and outside the space field (rehabilitation, gerontology). A (ground based) ICARE demonstrator was developed and established. It includes an exerciser sub-system, a subsystem to generate impact loading on bones, a subsystem targeting the neuro-sensory system and a biofeedback sub-system. This device was developed by Verhaert Space and delivered to ESA in 2009. Ac first batch of clinical tests was performed by the MEDES space clinic in Toulouse (F) and the results can be reported.