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

Author: Ms. Angélique Verrecchia
MEDES - IMPS, France

Dr. Billette de Villemeur Rebecca
MEDES - IMPS, France
Dr. Guillaume Truong
MEDES - IMPS, France
Dr. Bernard Comet
MEDES - IMPS, France
Mrs. ANAIS LLODRA-PEREZ
MEDES - IMPS, France
Ms. Amandine Fabre
MEDES - IMPS, France
Dr. Alain Maillet
MEDES - IMPS, France
Ms. Audrey Berthier
MEDES - IMPS, France
Dr. Didier Chaput
Centre National d'Etudes Spatiales (CNES), France
Mrs. Cecile Thevenot
MEDES - IMPS, France
Mr. Théo Alexis
SAFRAN, France
Mr. Arnaud Runge
ESA - European Space Agency, France
Dr. Anne Pavy Le Traon
MEDES - IMPS, France
Mr. Jean-Philippe Cecille
SAFRAN, France

PILOT STUDY OF A NEWLY DESIGNED MOBILE LBNP

Abstract

Crewed space missions are getting longer and likely farther away, reinforcing the need both to better understand the physiological modifications caused by microgravity on the human body, and to find means of countering them.

One of the physiological responses to microgravity is a headward shift of body fluids which leads to a number of medical issues, including plasma volume loss, post-flight orthostatic intolerance and spaceflight-associated neuro-ocular syndrome (SANS). Those have the potential to compromise astronauts' health and success for future planetary space exploration.

A countermeasure, called the "lower body negative pressure (LBNP)" already benefits to astronauts on-board the ISS from the application of negative pressure on the lower parts of their body (legs and part

of the abdominal belt). Up until now, it has not been possible for astronauts to do any other activity during LBNP session, due to the LBNP fixed position when used.

Therefore, the European Space Agency (ESA), jointly with MEDES, SAFRAN Aerosystems and CNES-CADMOS, have initiated a project to develop a mobile version of the LBNP device, in order to mitigate the shortcomings currently associated with its use during spaceflight. A prototype composed of trousers and a control box has been manufactured. A pilot study will be held at the MEDES space clinic in June 2024 with volunteers to assess the capabilities of the mobile LBNP prototype.

This new design will provide physiological or medical benefits to the user. Additionally, the device intends to be operated without external support, to allow the user to move freely with in the space vehicle or habitat, and to not interfere with daily operations. Ultimately, the mobile LBNP will be compatible with physical exercise when not activated.

The main goal of this pilot study is the evaluation of the effectiveness of the mobile LBNP device, and the secondary objectives are to evaluate its acceptability, its mobility, and its compatibility with exercise.

Furthermore, it will be an occasion to collect preliminary data to prepare other studies more focus on, first, the detection of pre-syncopal states by monitoring the thoracic body fluid and systolic ejection volume changes combined with other physiological data such as the heart rate and the blood pressure; then, the prevention of Spaceflight-Associated Neuro-Ocular Syndrome (SANS) by monitoring the Optic nerve sheath diameter with ultrasound device.

At last, results of this study might be used to highlight possibilities for non-space applications of the LBNP for medical purposes, if any.