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THE HORT3SPACE EXPERIMENT: HYDROPONIC SYSTEM FOR LIFE SUPPORT

Abstract

Future space exploration and colonization missions of planets like Mars will involve man; therefore, simulations of the Martian environment through analog missions on Earth and the development of technological prototypes that support life on extraterrestrial planets will be fundamental for in-depth knowledge of the challenges that will arise and to ensure the safety of future astronauts. One of the greatest difficulties in future space exploration and long-duration missions will be the self-sufficiency of astronauts and their independence from any supplies coming from Earth. It is in this context that hydroponic systems for growing micro-greens address these challenges. These systems guarantee the development and growth in a short time of micro-greens, containing a higher concentration of nutrients and contributing to the needs of astronauts on a daily basis, providing enrichment to their food plan. Furthermore, hydroponic systems also meet the constraints that this type of mission imposes: weight reduction and space minimization. The Hort3space experiment, born from the collaboration between the ENEA research center (Biotechnology Laboratory, Casaccia), BIOAG (Biotechnology and Agroindustry Division) and Sapienza University of Rome - S5Lab research group (DIMA, Department of Mechanical and Aerospace Engineering), is made of a multilevel hydroponic system, partially automated, for the cultivation of micro-greens, integrated with sensors, full-spectrum LED light, a robotic arm and a control and management system. Verifying whether it is possible to conduct a production of micro-greens and test their effectiveness remotely is one of the main objectives of the experiment. This article discusses the possibility and feasibility of a hydroponic system meeting the needs of future missions. Through a hydroponics system it is possible to study the possibility of providing a reliable source of food for astronauts, minimizing the use of resources and maximizing space efficiency. Furthermore, through this experimentation, the possibility of integrating automation technologies to simplify the cultivation process and alleviate the load on crew members can be

verified, thus contributing to the development of sustainable space exploration strategies. Hort3Space is one of the experiments selected to participate in the Amadee24 mission organized by the Austrian Space Forum (OeWF) which will take place in Armenia in March 2024. This article will cover the Hort3Space experiment, providing a description of its concept, structure and experimental results expected.