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DEVELOPMENT AND TESTING OF THE CÓNDOR SPACE SUIT SIMULATOR

Abstract

Space Analog Missions have received a increased interest among different fields related to the aerospace industry like life support system, habits, and EVA systems; because of this, several countries and scientific groups are working on this area of knowledge. One of the issues that are of interest, is the design of spacesuit simulators that provide analogue conditions to crews that usually conduct their missions in extreme environmental conditions, similar to those found on extraterrestrial planetary surfaces. Recently, Colombia has made its first steps in this direction. As a result, the first Colombian space suit simulator has been designed and developed using locally found resources and COTS components. The space suit simulator was developed at the Universidad Nacional de Colombia in collaboration with scientists of the Colombian Air Force. The aim of this device was to accomplish the minimum requirements for training analog astronauts in conditions that resemble a real space suit, like partial hermeticity, and movement constraints. The suit comes complete with life support systems which include ventilation, refrigeration and data acquisition placed in both rigid and flexible structures. The suit was designed taking into account human physiological parameters including body temperature, metabolic rate and heart rate variability, as well as mission requirements such as length of Extravehicular Activity, minimum CO_2 concentration in the inner atmosphere and communications with analog command center station. In order to test its functionalities, two sets of controlled environment tests and two sets of field tests of short and long duration were carried out. The results and conclusions of these tests are presented. The laboratory tests were made in the Aerospace Medicine Center of the Colombian Air Force, a first short duration field test was conducted in the Candelaria desert, Colombia, and a long duration test was made during the crew 187 rotation at the Mars Desert Research Station (MDRS). During the tests, particularly the ones performed at the MDRS in 2018, it was observed that the overall performance of the suit was satisfactory, however some improvements are needed, including air distribution system, exhalation gases washout, battery issues and an ergonomic structure. The obtained results have provided relevant information about how the simulator works and improvements that must be made for a second version of the suit.