SPACE LIFE SCIENCES SYMPOSIUM (A1)
Astrobiology and Exploration (5)

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PRELIMINARY RESULTS FROM A CREWED MARS EXPLORATION SIMULATION AT THE RIO TINTO ANALOGUE SITE

Abstract

After a series of seven field tests of the Aouda.X spacesuit simulator, in conjunction with various biological and geophysical experiments, a five-day test series was conducted at the Rio Tinto Mars-analogue site in southern Spain. In the framework of the PolAres programme of the Austrian Space Forum, a first test of the Phileas rover was done, seven scientific and engineering experiments investigated selected aspects of a human exploration mission in an operational environment.

Rio Tinto offers an excellent location for mars analogue simulations. The surface topography as well as the mineralogical similarity to the MER Opportunity landing site at Meridianum Planum, the effects of the fine granular and dusty environment provided high fidelity simulation conditions to test operational procedures and candidate instruments for a human Mars mission. In addition to the technical tests, geophysical methods including Ground Penetrating Radar, Imaging Resistivity, Raman and NIR spectroscopy, a motorized drill, a quantification of potential contamination vectors was obtained.

We tested the mobility of the Aouda.X spacesuit simulator as well as the physical workload perception of the suit tester by using a standardized question catalogue addressing the physical well-being of the tester and compared it to objective physiological data such as heart rates, fluid balancing and ecg. With respect to the effects of field testing on the suit's life support system we collected air samples to check for stress markers or potential dangerous substances via proton-transfer mass spectroscopy. In addition, we studied the bacterial behaviour inside the spacesuit simulator in order to predict potential long term microbial effects for long-duration extra vehicular activities using the same equipment. The results from this experiment could be helpful in developing new strategies to reduce bacterial impact on the inside of the suit, as well as their influence on crew health. We developed a method to trace particulate contamination using flourescent microspherules as biological proxies, leading to a detailed understanding of the adhesive properties of the microspherules as well as robust statistical methods to determine the detection thresholds and contamination points.

The field crew was supported by a full-scale Mission Control Center (MCC) in Innsbruck, Austria. The field telemetry data was channelled to the MCC to enable a Remote Science Support team to study field

data in near-realtime and have the opportunity to influence the flight planning as the mission proceeded. This allowed external researches to obtain a high level of situational awareness.