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 Space Architecture: Designing Human Systems Interaction (3)

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OPERATION SCENARIOS AND CONSTRAINTS FOR JOINT HUMAN-ROBOT SURFACE EVA
 MISSIONS ON MOON AND MARS

Abstract

Moonwalk is a 3-year cooperative RD project funded by the European Commission. The goal of the project is to develop and test technologies and training procedures for astronaut-robot cooperation in earth-analogue environments as it applies to Extra-Vehicular Activities (EVA) on Moon and Mars. Surface EVA will primarily include geological material sampling, field exploration and exobiology activities. Robots can help carry material for the astronauts, assist in the installation of equipment, scout sites that

are too dangerous for humans, or assist in search and rescue activities. This paper will develop operation scenarios for human-robot joint missions.

For Moonwalk, the underwater site at the Marseilles Space Analogue site will serve as a Moon mission analogue, while the Martian-like landscape of Rio Tinto in Spain will be the Mars mission analogue. Earth-analogues will enable the Moonwalk team to analyze, research and test operations and technologies as well as train future astronauts with limited cost and risk. However, current analogue sites do not sufficiently represent all the constraints that astronauts, their robotic assistants and equipment will face during real EVA on a lunar or Martian surface. This paper will identify the constraints that the chosen Marseilles and Rio Tinto analogues will have to simulate in order to achieve the necessary level of reality, and present it in a form that is acceptable to the various actors involved. Additionally, we will describe some of the EVA activities such as sampling, instrument deployment and data recording, astronaut ingress and egress from a simulated habitat, or performing exobiological experiment with a Raman spectrometer and SOLID, a life detector instrument.