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# TESTING OF AN AUGMENTED REALITY TOOL FOR GEOLOGICAL FIELDWORK DURING TWO ANALOGUE MISSIONS

**Abstract**

The focus of space exploration is once again on human spaceflight. The Artemis program and the collective desire to land the first astronaut on Mars are fueling the research on long-duration crewed space missions. Extra-Vehicular Activities (EVAs) will become an essential part of the scientific operations to be carried out on a foreign body's surface, such as the Moon or Mars and there, real-time ground control support cannot not be provided. Therefore, novel human-machine interfaces must be developed and implemented to support future explorers.

The focus of this study is to present and compare results obtained from testing an Augmented Reality (AR) Internet of Things (IoT) tool for astronauts to carry out geological activities during two different analogue missions, with six different analogue astronauts each. The application was tested in different scenarios, and after each test, the analogue astronauts were required to complete a 27-statement questionnaire.

During Crew's 263 mission at the Mars Desert Research Station (MDRS) in Utah, USA, the tool was tested in three different scenarios: indoors; outdoors in the desert, while mapping the different modules of the station; and, finally, outdoors, while performing geological fieldwork. During Asclepios II mission, in

Sasso San Gottardo in Switzerland, testing was performed during EVAs, both in the open and in confined spaces such as inside a cave emulating a lunar lava tube.

Results from the questionnaire analysis show that the design factors that were mostly valued by astronauts were: the intuitive usage and possibility to access tutorials. Voice input was identified as the most intuitive input, in addition to the double-confirmation process, via a clicker on the astronaut's glove, being deemed necessary.

Future work is foreseen to include further testing at different analogue sites by senior experts and astronauts.