

SPACE OPERATIONS SYMPOSIUM (B6)
New Space Operations Concepts and Advanced Systems (2)

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ADVANTAGES OF 3D PRINTING TECHNOLOGY TO OPERATIONS IN FUTURE HUMAN
EXPLORATION OF MARS**Abstract**

Geological field work is an important goal that has to be executed during a human mission to Mars. To make sure that all experiments during a mission to Mars can be conducted properly, it is crucial that tools can be quickly repaired or replaced, and 3D printing can provide that capability. Additionally, 3D printing has the potential to produce tools on an as-needed basis as well as for newly identified needs. We tested the operational workflow of using 3D printing in the Poland Mars Analog Simulation (July 28th - August 14th, 2017) using an exact copy of the Additive Manufacturing Facility, currently aboard the International Space Station. Also, we investigated the differences between Earth-independent and Earth-dependent operations. An Earth independent approach for Mars operations was identified as an important consideration for further investigation in a number of previous analog studies, especially because of the time delay in Earth-Mars communications. Testing scenarios included: how quickly the operational procedures can be executed (from incident to printing), how efficiently can the analog astronauts use this technology during the mission, how the use of 3D printers can provide operational adaptability to print tools on demand and improve geological mission robustness. All of the proposed mission scenarios are subject to additional risk assessment and further evaluation. At the end, an assessment will be conducted on the effectiveness of the proposed procedures for the improvement of the operational efficiency and cost reduction. Preliminary results and analysis of the experiment will be presented at IAC 2017.