Paper ID: 86546
student

27th IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM (A5)
Human Exploration of Mars (2)

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USING 3D MAP TO IMPROVE ASTRONAUT EFFICIENCY DURING EVA

Abstract

To plan the next manned mission to Mars, we must invent a martian way of life. Therefore, we need to learn how we are going to displace ourselves, what type of instrument we are going to use... We especially need to define the way we perform Extravehicular Activity(EVA) on land : imagine what are the main dangers, plan the different steps, understand what fatigue an EVA provokes ... One of the best places to study EVAs is during analog missions. That is why we used two Supaero student-led MDRS(Mars Desert Research Station) missions to study the impact of using a 3D map on the astronaut performances during an EVA. Orienting oneself in a foreign terrain is essential to a manned mission and the type of map used impacts the efficiency. Would a 3D map significantly improve the performance, reduce the risk of a specific mission and the time spent in an EVA ? An MDRS EVA consists of going out of the station for a duration of about three hours wearing an EVA suit and being in contact with crewmates both in the EVA and in the station only by radio. The MDRS being in the Utah desert, the terrain is very close to Mars geology and landscape. During this experiment, the 3D map is generated thanks to photogrammetry. To generate a 3D map, one has to take pictures of an area from different angles before post-treating them with a specific software. The pictures are usually taken with drones but other means can be used. Ingenuity proved that a drone can fly on Mars therefore we can assume that a 3D map could be generated thanks to photogrammetry there.Access to Parrot drones provided us the ability to generate topographic and background 3D maps. To measure the orientation of the subjects, we place markers in the area of study. We then measure the time a subject takes to find the marker. We also measure the distance walked by the subject between the different markers. The subject has access to either a 3D or a 2D map to prepare the EVA. We then cross and compare these measurements to topographic map data to generate conclusions. Thanks to the preliminary results gathered during the first mission as well as the ongoing mission, we expect 3D maps to prove relevant for future EVAs.