HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)
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PRESSURIZED OR UNPRESSURIZED ROVERS FOR MARS SURFACE EXPLORATION

Abstract

A human exploration of Mars is expected around 2035. In order to maximize scientific returns, it is desirable to explore vast regions and to collect samples in various places. It is therefore necessary to use exploration vehicles. Many different rover concepts have already been proposed [2]. In the last NASA reference mission, surface exploration is undertaken by means of two to four astronauts onboard a pressurized vehicle [1]. The expected operating range is hundred kilometers around the habitat. It is also suggested sending more than one rover to enable a safe return and to ensure the safety of the astronauts [2]. The pressurized rover is indeed used as an extended habitat with small unpressurized rovers making the link between the base camp and the pressurized rover. However, there is still some debate to determine the best option. We propose to examine different kinds of rovers and explorations strategies and to determine which is the most adapted for a particular mission. In order to choose the best option, it is important to define a list of criterions and to assess all options accordingly. Some criterions are linked to the quality and efficiency of the exploration and some others concern the impact on the mission, the organization and the safety of the astronauts. The most important are: operating range, terrain adaptation, time-autonomy, usability, rescue plans, supplies requirements, maintenance requirements, weight and volume and deployment easiness. In most studies, the best choice includes at least one pressurized rover. However, if the constraints of the mission are stronger than expected in terms of mass, volume and deployment easiness (see [3]), it could be preferable to use only small unpressurized rovers. In that case, it is suggested here that an interesting trade-off could be to add a small and light inflatable habitat that could extend the explored region to several tens of square kilometers. Finally, we propose a classification of the different options according to their suitability for a given scenario. [1] Drake B.G., ed., Mars Architecture Steering Group, Human Exploration of Mars, Design Reference Architecture 5.0 (and addendum), NASA Johnson Space Center, 2009. [2] Hoffman S., ed. The Mars Surface Reference Mission: A Description of Human and Robotic Surface Activities, NASA report NASA/TP—2001–209371, 2001. —3] Salotti J.M., Simplified scenario for manned Mars missions, Acta Astronautica, vol. 69, 266–279, 2011.