HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)
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SMALL VEHICLE EXPLORATION CAPABILITIES

Abstract

In the problematic of human missions to Mars, an important question is to determine the best strategy for the choice of surface vehicles. Recent studies suggest that the first missions will be strongly constrained and that only small unpressurized vehicles will be available. The objective of this project is to analyze the capabilities and limits of the use of small surface vehicles. The problems have been addressed from the user perspective. Following the "human centered design" paradigm, the team focused on human systems interactions and elaborated a list of experiments:

- The Austrian Space Forum (OeWF) launched a Mars analog research program with a list of experiments in Morocco in February 2013. In the framework of this program, our team proposed a study of difficult terrains that could be encountered on Mars. Two persons wearing an analog spacesuit and driving quads had to reach different obstacles found in a desert region and answer a list of questions about their vehicle, the obstacle and possible options to go further. - Another member of our team participated to another simulation at Mars Desert Research Station in Utah during the same period of time. Though it was not possible to drive off road, a similar study with analog space suits and quads has been undertaken. - Other experiments have been conducted in an old rock quarry close to Bordeaux, France. An expert in the use of quads for all types of terrain performed a demonstration and helped us to characterize the difficulties, the risks and advantages and drawbacks of different vehicles and tools.

The vehicles that will be used on the surface of the planet have not been chosen in a precise way yet. Nevertheless, the results of our project already show that using a light and unpressurized vehicle (in the order of 150 kg) for the mobility on the Martian surface can be a true advantage. Part of the study was dedicated to the search for appropriate tools that could be used to make the vehicles easier to handle, safer to use and efficient in the field to cross an obstacle. The final recommendation is to use winches and ramps, which already are widely used by quad users. Several maps have been drawn to show the possible extension of the area than can be reached if such tools were available.