Mars Exploration (3)
Mars Exploration (1) (1)

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CAN AN AIRSHIP EXPLORE MARS ?

Abstract

The purpose of this study is to assess the conditions and performances of an airship based exploration of Mars. Compared to satellite based exploration an airship allows for more proximity to the ground and therefore smaller resolution as well as better observations of steep relief such as vertical walls in craters or canyons. This could enable for instance to distinguish geological layers or other small scale geological features, which are more challenging to observe with a satellite. Compared to rover based exploration, An airship can have a higher ground speed and can hover above over rough terrains. This gives the possibility to explore further range and difficult areas. In fact an airship based exploration bridges the gap of satellite based and rover based and can be lead in synergies with them.

The scope of this paper is to list the parameters that drive the design, analyse trade-offs and provide a preliminary sizing of the main subsystems. The focus of the study was aerostatic lift based system instead of an aerodynamic lift based system which shows limitations due for example to the unavailability of landing facilities. The first part was to collect a state of art on airships and relevant technologies as well as a summary of Martian environment's main characteristics. Then the main drivers for the sizing of the system were identified, and in a next step a model based system engineering will finalise a preliminary design.

The Design Reference Mission is to explore parts of Valles Marineris, a 7km deep canyon in the Northern Hemisphere of Mars, which was selected for several reasons. Firstly, this region shows interesting geomorphological context with potentially a history of abundance of water. Additionally the deepness of the canyon yields a higher air pressure. A higher pressure means heavier surrounding air which facilitates the aerostat design. Moreover in the longer run and in a perspective of human presence on Mars, the higher pressure makes this zone more suitable for pressurised habitable installations. The reference scientific goal would be to perform mineral mapping of the cliff walls using a hyperspectral sensor.