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HIGH EARTH ORBIT MISSION TO PREPARE THE FIRST HUMAN MISSION TO MARS

Abstract

Regarding life support systems and human factors, we are still not ready for a human mission to Mars. In spite of the experience that has been gained in the space stations or on Earth, several systems still have to be tested and some important questions remain to be addressed:

- Life support systems have to be optimized for a 3-years mission. The preferred life support systems configuration must be tested and qualified in space for a minimum duration of 3 years.
- There is a need to better understand the physiological impact of long radiation exposures beyond low Earth orbit and possible countermeasures.
- Long term effects of microgravity have to be studied and possible countermeasures have to be defined. A possible solution is to link two space modules and to make them rotate around each other in order to simulate a partial gravity. Such a system must be tested and qualified before a mission to Mars is undertaken.
- Long stays in space have already been tested but never in the context of a Mars mission: no visit by another crew, communication delays, several days away from Earth, etc. There is a need to study psychological, sociological and cognitive effects of such long missions and also to try different strategies for the control and adaptation of the astronauts.

A high Earth orbit mission is proposed. Two manned modules (service module included) similar to those of a future Mars mission can be launched by two SLS class launchers and sent to a high orbit. A rotation of the two modules can simulate a partial gravity. Long duration missions have to be conducted with the same constraints of a Mars mission (same preparation of crew, communication delays imposed, no resupply from Earth, etc.). The mission can be extended with the rotation of several crews sent by other SLS class launchers. Interestingly, numerous biological experiments can be carried out to study the impact of long stays in partial gravity. Finally this mission must take place beyond the Van Allen belt to enable experiments on radiations' effects and possible countermeasures.