HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)
Human Exploration of Mars (2)

Author: Prof. Jean-Marc Salotti
Laboratoire de l'Intégration du Matériau au Système, France

Mr. Richard Heidmann
Planete Mars, *(country is not specified)*

PRAGMATIC APPROACH TO A MANNED MARS EXPLORATION PROGRAM

Abstract

The complexity of the last NASA reference scenario for a human mission to Mars is so important that the roadmap to reach that goal is not clear and the costs are deemed very important. Remarkably, there is a consensus among all space faring nations that the ultimate goal is to undertake a human mission to Mars. Therefore, if a simpler and affordable mission existed with a clear roadmap to pave the way, a human Mars program could be implemented. A pragmatic approach is required. Based on previous works and recent investigations that have been carried out in the framework of a study group of the IAA (SG3.16), this mission should take into account the following principles: - The roadmap should be as simple as possible with two main missions: a Heavy Mars sample Return Mission (HMSR) should be sufficient for the tests and qualifications of the interplanetary vehicle, aerocapture, EDL, ISRU and Mars ascent ; a long duration manned mission to a high Earth orbit (or Lagrangian point or Lunar orbit) should bring the complementary tests and qualifications, especially for the interplanetary habitat. - The Mars landers should be as small as possible to facilitate the entry, descent and landing on Mars. - For Mars orbit insertion and all interplanetary vehicles, an aerocapture maneuver should be the preferred option. - If possible, interplanetary vehicles should be lighter than the maximum payload capacity of the heaviest available launcher (SLS class). - If possible, all vehicles should use chemical propulsion for interplanetary transit. - Backup options must exist at every step of the mission. The constraints are severe, but it is shown that it is possible to define a mission that complies with all of them. It is based on a crew of three astronauts, four heavy launches and four interplanetary vehicles. The first vehicle is a cargo. It brings to the surface of Mars ISRU systems and a Mars ascent vehicle. The second vehicle brings the main propulsion system of the Earth return vehicle to Mars orbit. The third and fourth vehicles are launched and sent to Mars two years later. The third brings the surface habitat and the fourth brings the crew with the interplanetary habitat. This pragmatic approach is feasible and can be integrated in a simple, clear and sustainable roadmap that takes into account the launchers that will be soon available, risks management and budgetary constraints.