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MANNED MARS MISSION RISKS EVALUATION

Abstract

Mars missions can be seen as a natural step in space exploration, as Earth-like environmental conditions and the length of the interplanetary flight are the most crucial for planetary exploration compared to other celestial bodies of the Solar System. On the other hand, these missions require detailed planning and worldwide collaboration, because of the need of extremely high financial resources and technical capabilities. Many researches focused on different aspects of Mars missions are being conducted in these recent years. They include flight preparation, lift-off, interplanetary journey, habitat and Life Support Systems (LSS) design, Extravehicular Activities (EVA), precise landing, planetary exploration, etc. This paper summarizes identified safety issues that can arise during future Mars missions. Based on the analysis of previous studies, where conditions of the interplanetary flight were studied, including environmental issues, Mars habitat and the spacecraft design were discussed and the spacesuit concept was analyzed, the most critical hazards have been defined and the whole mission has been taken into consideration. In particular, possible failures and hazards for the habitat on Mars, space station and spacesuit, including off-nominal situations and their influence on the safety of the astronauts have been investigated. This work is based on the results of previous projects carried out within the Space Generation Advisory Council's (SGAC) Space Safety and Sustainability project group, which aims to bring an international and interdisciplinary vision to this topic and discuss it from different perspectives, creating a foundation

for further studies on safety risk assessment. Technological gaps are identified for further discussion and possible solutions for risks reduction are proposed with regard to onboard systems (including LSS) and layout design.