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DEVELOPMENT (D3)Strategies & Architectures as the Framework for Future Building Blocks in Space Exploration and
Development (1)

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BACKUP STRATEGIES FOR MARS LANDING

Abstract

Entry, descent and landing (EDL) is probably the most difficult and risky phase of a human mission to Mars. Several complex maneuvers have indeed to be implemented with severe environmental and time constraints. It is in general acknowledged that once the vehicle enters the atmosphere, there is no abort to orbit option, the vehicle must land on the surface. Whatever the EDL systems for Mars, the qualification might be very difficult, very expensive and the risks could still be very high, especially for the first missions. Risks could nevertheless be mitigated if backup options existed during the last phase of EDL. If an important problem is encountered during the last minutes of the descent, a possible option is to eject the astronauts and to use individual parachutes for braking. Considering the density of the atmosphere and possible parachutes diameters, it is shown that parachutes are not sufficient to land safely on Mars. It is therefore proposed to add small propulsion systems, which could be attached to the seat of the astronaut. The feasibility of that proposal is examined. Specific conditions have to be respected to make that option viable but it might help a lot in reducing loss of crew risks without impacting much the payload of the vehicle.