

25th IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM (A5)
Interactive Presentations - 25th IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR
SYSTEM (IP)

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DIRECT OR NOT DIRECT, THAT IS THE CRITERION

Abstract

The criteria often put forward for the classification of manned missions to Mars architectures are the planetary configuration known as conjunction or opposition at the time of departure, the duration of the stay on the surface or the type of propulsion for the interplanetary maneuvers, which can be chemical, nuclear thermal, nuclear electric, solar electric or a combination of them. However, another criterion also deserves special attention: the ability of the manned interplanetary spacecraft to also be a lander. This criterion, put forward by Zubrin in the Mars Direct concept (direct to indicate precisely that the main spacecraft is sent directly from Earth to the Martian surface), seems to have been totally forgotten in the numerous NASA studies, as well as in the ESA study of 2004. An analysis has been carried out to determine the reasons of this omission: Weakness of the state of the art, lack of willingness to explore all-chemical options (nuclear or solar options preferred), as well as the habit of robotic missions, which introduces a methodological bias due to the separation of the payload and space systems teams. Many authors of mission architectures, e.g. Zubrin, Musk, Salotti, have however chosen the direct landing option, at least for the outward journey, because it has decisive advantages over other options. The advantages are in particular the simplicity of the concept (no complex assembly in low Earth orbit), the ability to implement aerocapture (as the spacecraft is a lander, a heat shield is already included and it is designed to enter the atmosphere), and a significant reduction of the total mass to be sent to low earth orbit (thanks to aerocapture and optimization capabilities). The choice of the direct access to the surface is thus structuring for the whole mission and should be considered at the highest level of the decision tree.