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STUDY OF ASCENT CAPABILITIES FOR A MANNED MISSION ON MARS

Abstract

Following the Artemis mission and its first successes, the next target for space exploration is to bring humans to Mars. Nowadays, a manned mission to the Red Planet represents one of the biggest technological challenges humanity faces in space exploration. As for every manned mission today, a safe return of the crew back to Earth needs to be guaranteed. Therefore, a mission to Mars must include ascending capabilities whose design can present several criticalities.

One of the main drivers for the design of a Mars ascent vehicle is the fuel availability. In this paper, a trade-off between different architectural configurations has been carried out with the aim of minimizing mass. In addition, the system must be sufficiently robust to withstand the harsh and unpredictable environment of Mars, which is characterized by dust storms, extreme temperatures and other potentially hazardous environmental factors. It should also be capable of interfacing with a potential transfer vehicle and ensure communication and life support systems to meet the needs of the crew. All the highlighted constraints and requirements have been taken into consideration in order to select the optimal solution.

This study of a preliminary design of ascent capabilities for a human Mars mission has been performed considering cost, complexity and mass of the system. In addition, the possibility of delivering different types of payloads, human and cargo, has also been taken into account. The work was carried out by students of the 15th Space Exploration and Development Systems (SEEDS) Specializing Master's Program, hosted by three different universities: Politecnico di Torino, ISAE SUPAERO, and the University of Leicester, in collaboration with Thales Alenia Space Italia and ALTEC, and endorsed by ASI and ESA.