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A MULTIPURPOSE MARS VEHICLE FOR PAYLOAD DELIVERY AND SURFACE OPERATIONS

Abstract

The research that went into this paper was the result of a yearlong collaboration between SICSA and Boeing into the design of a multifunctional Mars lander. The starting point of this project was to design a lander that is capable of delivering both human assets and separate supply caches to the surface of Mars. The paper presents research and analysis of project elements that included delivery of payloads to Low Mars Orbit (LMO), descent to the Mars surface and ascent back to the transfer vehicle. The study explored mission architecture options including delivering of crew and cargo payloads to the surface, the allocation of those payloads on the surface, and their individual missions before, during, and after the astronauts' arrival. The Boeing-SICSA collaboration resulted in a mission architecture that utilized the most well suited variables optimizing mission safety, efficiency and success. Key elements of this mission architecture are:

- 24-7 communication capabilities with a transfer vehicle in LMO;
- Power beaming from an orbiting satellite;
- Three strategically arranged supply assets that are delivered before the crew arrives.

This research resulted in a lander design that strayed from the tradition of past mission architectures and looked at a lander that can be optimized to satisfy every aspect of the mission. This design approach offers several benefits: the lander design uses three legs support instead of four providing better stability on an uneven surface, a centralized payload capability that allows for multiple shroud diameters, and the lander triples its functional uses as the ascent vehicle and rover. Adding roving capabilities allows crew to utilize the lander throughout the mission duration, giving the crew an anytime abort capability. This new era lander is derived from the successes and failures of incorporating various mission elements that allow for a lander that utilizes a more flexible design to achieve a high percentage of mission success.