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A RECOMMENDED LUNAR EXPLORATION CREW SURVIVAL INFRASTUCTURE

Abstract

From 2004 September 1 until 2005 September 9, Orbital Sciences conducted a NASA-funded Concept Exploration and Refinement (CER) study, designed to make recommendations on how to return humans to the Moon. An all-chemical Lunar Transportation system consisting of a Shuttle Derived Heavy Lift Launch Vehicle (SDHLLV), a Crew Module (CM), a Space Exploration Module (SEM) in-space propulsion system, and a single stage reusable Lunar Lander, was designed. This optimized transportation system delivered 140 mT to Low Earth Orbit (LEO), 38.8 mT (85,600 lbm) to Low Lunar Orbit (LLO), and 15.9 mT (35,000 lbm) to the Lunar surface. This architecture requires two launches: the first launch places the Lander in LLO, and the second launch places the CM in LLO. The Lunar Surface Activity fundamental objective was to construct and operate a Lunar Base with Permanently Manned Capability. All items needed to construct and operate the base, along with propellents, human consumables and base spares for base operation were manifested onto a Lunar Exploration campaign. A Crew Survival Infrastructure was included in the Lunar Exploration Architecture. The paper will discuss the salient aspects of the Crew Survival Infrastructure (CSI) design covering all near-Earth, trans-lunar, near-Lunar, and trans-Earth activities. The CSI includes elements for abort modes over all mission phases, pre-positioned safe havens at all mission locations, an alert-ready single launch crew rescue capability, design for all expected natural and induced environments, and contingency planning for each of the elements. The fundamental relationships between an exploration architecture design and inclusion of a CSI will be examined. An example of such a fundamental relationship is that each abort mode requires V. An appropriate total of all required abort Vs must be designed into the exploration architecture's transportation systems from the beginning, or the required performance will not be available when needed for crew survival. The paper additionally covers the time-phased deployment of the CSI elements for maximum effectivity as the exploration architecture is created, then operated. This will be the first paper presented on the Lunar Exploration Crew Survival Infrastructure concept in a public forum. The contents of this paper have not been presented at any previous meeting. Financing for the attendance of the author to present the paper at the 2012 IAC is assured, should the paper be selected for presentation.