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LUNAR LANDER INTEGRATION WITH GATEWAY

Abstract

In this exciting period of growing space exploration endeavors, the return of humans to the moon in the near term is a captivating goal that is stimulating innovations and enthusiasm. The recent NASA Commercial Lunar Payload Services contracts have energized a new generation of deep space technology development. The Human Landing System (HLS) activity within NASA's NextSTEP-2 cislunar Gateway endeavor is paving the way for an achievable and realistic lunar landing architecture by utilizing the advantages of the cislunar Gateway. This activity has invited a refinement of the mission architecture that serves the exploration of the cislunar space and the return of humans to the lunar surface. Furthermore, this plan invites industry to develop cooperative business plans that meet NASA's objectives while expanding US industry capability. Similar to the Gateway habitation development, international partners will contribute to lunar surface exploration architecture.

The HLS architecture is enhanced by its utilization of Gateway as a staging point for crew and elements in the system, enabling the potential reuse of elements, and reducing costs and increasing overall capability for exploration and science. The Gateway can serve as an aggregation point for multiple spacecraft, allowing for improvements in safety, flexibility in element synchronizing, and reusability of elements.

In this early period of development of the HLS, some architectural parameters are constrained while others are being optimized through analytical review. Boeing is carrying out studies to better understand the sensitivity of change to these parameters, and to illuminate possible optimizations of this architecture. These include studies in the areas of multi-stage lander systems, impacts and opportunities of launch vehicle capabilities including the Space Launch System (SLS), planning the lunar mission timeline, and assessing the level of utilization of the Gateway within a lunar mission.

This paper explores the above parameters of a lunar lander system including the Gateway system and potential commercial or further deep-space extensibility. Several areas are explored, such as the decision to focus design on a set of optimized, immediate missions versus expanding capabilities to a diverse set of operations including future opportunities. The system with expanded capabilities is expected to be less optimal for a single mission, but lower overall cost over a larger set of diverse missions. The utilization of the Gateway enables further consideration of a high capability lander system, which can achieve objectives and discover opportunities that will continue to be uncovered throughout our human space exploration.