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BENEFITS OF A DEEP SPACE GATEWAY IN SUSTAINABLE LUNAR EXPLORATION

Abstract

Human spaceflight is readying for its next big step and imminent decisions will shape the path of space exploration for decades to come. In this environment, it is useful to examine the role of a cislunar Gateway in lunar exploration and the impacts of various choices in an international exploration architecture. The Gateway, a small human-tended facility around the Moon, supports human and robotic lunar exploration in a manner which creates opportunities for multiple sectors to advance key goals. The lunar vicinity is an ideal location for exploration of the moon. It can support parking, refueling, and refurbishing reusable elements and serve as a point for direct observation of the lunar surface and control of robotic surface assets. It is, similarly, ideal for Mars missions by offering a location for the aggregation of Mars transit vehicles and a place to refuel and restore vehicles that have returned from Mars. Direct exploration of the lunar surface, i.e. not through the Gateway, will be an option that could appear to have a lower cost. However, direct exploration does not create any residual architecture for use in future endeavors. While the Apollo program was a crowning achievement in US spaceflight, it left no residual hardware behind for future use. This approach has left us now in the position of having to start future lunar exploration from scratch. Building a robust and sustainable architecture, such as a Gateway, enables future options and programs and avoids future costs. Most critically, commercial interests will be much more likely to appear in deep space when there is existing infrastructure to support them and defray mission costs. This paper discusses the implications of various choices in developing a lunar exploration architecture and will examine the role of a Gateway in a robust lunar exploration program, both robotic and human. The importance and value of a Gateway to all exploration options will be examined and compared to direct exploration of the lunar surface; this includes the value of supporting parking, reuse refurbishment of other exploration elements. Finally, the commercial options and advantages of a robust deep space architecture will be discussed. The paper will describe how investments in lunar exploration provide maximum value by leaving a residual architecture to enable commercial endeavors and provide maximum cost benefit both during and after lunar exploration.