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Space Architecture: Habitats, Habitability, and Bases (1A)

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BOEING NEXTSTEP EFFORTS IN SUSTAINABLE LUNAR EXPLORATION

Abstract

Human spaceflight is readying for its next great step where humans will once again venture beyond Low Earth Orbit (LEO). NASA is advocating for a lunar Gateway outpost that orbits the moon and serves as a base for exploration of the moon. Under NASA's leadership, discussion of Gateway as an international effort with multiple space agency partners has continued to advance and solidify. To this end, NASA has undertaken multiple efforts with US industry under the Next Space Technologies for Exploration Partnerships (NextSTEP) Broad Agency Announcement (BAA) to advance architecture and technology readiness for the construction of a lunar Gateway. The Boeing Company is one of several companies that were awarded NextSTEP BAA contracts to study the Gateway habitats and Power and Propulsion Element (PPE).

Under the NextSTEP Habitat effort, Boeing studied the overall Gateway architecture and developed a ground habitat demonstrator. The architecture studies advanced NASA's and Boeing understanding of the design, assembly and operations of the Gateway vehicle. The habitat demonstrator was built at Marshall Spaceflight Center and tested candidate Gateway technologies and operations that support human and robotic lunar exploration. Under the NASA NextSTEP PPE effort, Boeing developed a detailed design for the Gateway PPE, the first element in NASA's architecture that provides, power propulsion, communication and other vital services for the entire Gateway. Boeing's PPE study defined important PPE design trades and resulted in a credible design for the next phase.

This paper describes the results and current status of the Boeing NextSTEP efforts. For the Habitat effort, key findings and results will be presented. In particular, the ground testing in the habitat demonstrator will be discussed to highlight particular results of interest and describe the overall layout and capabilities of the demonstrator. For the PPE effort, key attributes and findings from the PPE study are presented and the current status of NASA's PPE contracting efforts will also be discussed. In closing, a complete picture of current Gateway efforts, including the recent lander developments, will be presented and the implications of various choices in developing a lunar exploration architecture will be discussed.