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From Earth Missions to Deep Space Exploration (05)
Habitation for Exploration Missions (3)

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DESIGN AND PARAMETRIC SIZING OF DEEP SPACE HABITATS SUPPORTING NASA'S HUMAN SPACE FLIGHT ARCHITECTURE TEAM

Abstract

NASA's Human Space Flight Architecture Team (HAT) is a multi-disciplinary, cross-agency study team that conducts strategic analysis of integrated development approaches for human and robotic space exploration architectures. During each analysis cycle, HAT iterates and refines the definition of design reference missions (DRMs), which inform the definition of a set of integrated capabilities required to explore multiple destinations. An important capability identified in this capability-driven approach is habitation, which is necessary for crewmembers to live and work effectively during long duration transits to and operations at exploration destinations beyond Low Earth Orbit (LEO). This capability is captured by an element referred to as the Deep Space Habitat (DSH), which provides all equipment and resources for the functions required to support crew safety, health, and work including: life support, food preparation, waste management, sleep quarters, and housekeeping.

The purpose of this paper is to describe the design of the DSH capable of supporting crew during exploration missions. First, the paper describes the functionality required in a DSH t support the HAT defined exploration missions, the parameters which affect its design, and the assumptions used in the sizing the habitat. Then, the process used for arriving at parametric sizing estimates to support additional HAT analyses is detailed. Finally, results from DSH design cycles are presented followed by a brief description of the remaining design trades and technological advancements necessary to enable the exploration habitation capability.