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Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Systems (2A)

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CONTINGENCY OPERATIONS ON THE DEEP SPACE GATEWAY: APPROACHES, AND CONSIDERATIONS TO ORBITING PLATFORMS FOR DEEP SPACE EXPLORATION

Abstract

Deep space architectures present several challenges for mission planners that range from orbital trajectories, to logistics resupply. Given the maturity and knowledge gained in the development of space systems up to the present, mission planning for nominal scenarios is almost a given. However, planning for contingencies allows mission designers, and programs to assess stress in system design early. With Deep Space Gateway (DSG) having undergone requirement definition - the environmental control and life support systems (ECLSS) have been drawn into the spotlight via assessment of these contingency scenarios. While pursuing nominal mission design, the Artemis ECLSS team identified several contingency scenarios where limits on system architecture, and cross platform design and integration have been discovered. DSG's architecture for the 2024 boots on the moon mission (BOTM) utilizes Orion's ECLSS as a means to implement Gateway's BOTM functions. After evaluation of the contingency Concept of Operations (ConOps) for this architecture, gaps in functionality for removing trace gases, controlling CO2, and heat exchange were discovered. Additional analysis of contingency scenarios for a fully assembled DSG also reveals stresses in the design, and provides the design architects with more tools for developing a robust design. This paper will focus on the analysis techniques used to reveal gaps in contingencies and discussion on a few key cases that may lead to a change in system design, and benefits acquired from early evaluation of contingency scenarios.