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# LUNAR SURFACE SYSTEMS ARCHITECTURE STUDY TO ENABLE POTENTIAL FOR THE LARGE SCALE INFRASTRUCTURE DEVELOPMENT

**Abstract**

A six-month lunar surface systems study sponsored by The Boeing Company was conducted by the students and faculty of Sasakawa International Center for Space Architecture of the University of Houston during 2020-2021 academic year. This paper presents the results of the study and outlines next steps for developing a comprehensive research for lunar infrastructure construction. The work presented in this paper aimed to develop conceptual design options for (1) Lunar Terrain Vehicle (Rover) and (2) Small Lunar Habitat.

For rover design development two rover operations scenarios were investigated: 1. Using a crew-operated rover to transfer cargo from a cargo lander to a habitat. 2. Using an autonomous rover to transfer cargo from a cargo lander to a habitat. For the autonomous rover cargo transfer scenario, the study provided recommendations on types of required robotic capabilities and identified design implications for robotic manipulation to the cargo and airlock. The evaluation and analysis of rover's optimal capabilities influenced the set of requirements for designing a Small Lunar Habitat that had to be designed for use in late 2020 and to be located at lunar South Pole. The habitat design aimed to be lander agnostic with an approximate 12m3 volume optimized for the crew of four during a two-week mission. The applied design evaluation strategy included using a physical, mixed reality, or virtual mockup of the habitat, simulating crew activities inside the habitat and/or its segments. The paper presents the results of the simulations and design analysis. Various personal, science, industrial, and exploration activities interactions suggested as evaluation criteria for development of design recommendations on the habitat layout. Limitations of the design evaluation approach using simulations in 1g environment were also identified and recognized.

The design of both elements, the rover and habitat, considered them as a system that evolutionary meant to become a part of an overall Lunar Surface Systems Infrastructure. The goal of the study was to provide a design concepts and their comprehensive evaluations. The derived from them design and development recommendations based on space architecture strategy of designing all surface elements interconnected with each other's capabilities, satisfying cross-elements requirements and interfaces compatibility, aiming for evolutionary growth of surface capabilities into a large scale sustainable infrastructure.