

Human Research Program Investigator's Workshop
CISLUNAR HABITAT INTERNAL ARCHITECTURE DESIGN CRITERIA

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BACKGROUND

In preparation for human exploration to Mars, there is a need to define the development and test program that will validate deep space operations and systems. In that context, a Proving Grounds CisLunar habitat spacecraft is being defined as the next step towards this goal. This spacecraft will operate differently from the ISS or other spacecraft in human history. The performance envelope of this spacecraft (mass, volume, power, specifications, etc.) is being defined by the Future Capabilities Study Team. This team has recognized the need for a human-centered approach for the internal architecture of this spacecraft and has commissioned a CisLunar Phase-1 Habitat Internal Architecture Study Team to develop a NASA reference configuration, providing the Agency with a “smart buyer” approach for future acquisition.

THE CISLUNAR HABITAT INTERNAL ARCHITECTURE STUDY

Overall, the CisLunar Habitat Internal Architecture study will address the most significant questions and risks in the current CisLunar architecture, habitation, and operations concept development. This effort is achieved through definition of design criteria, evaluation criteria and process, design of the CisLunar Habitat Phase-1 internal architecture, and the development and fabrication of internal architecture concepts combined with rigorous and methodical Human-in-the-Loop (HITL) evaluations and testing of the conceptual innovations in a controlled test environment.

The vision of the CisLunar Habitat Internal Architecture Study is to design, build, and test a CisLunar Phase-1 Habitat Internal Architecture that will be used for habitation (e.g. habitability and human factors) evaluations. The evaluations will mature CisLunar habitat evaluation tools, guidelines, and standards, and will interface with other projects such as the Advanced Exploration Systems (AES) Program integrated Power, Avionics, Software (iPAS), and Logistics for integrated human-in-the-loop testing. The mission of the CisLunar Habitat Internal Architecture Study is to become a forcing function to establish a common understanding of CisLunar Phase-1 Habitation Internal Architecture design criteria, processes, and tools. The scope of the CisLunar Habitat Internal Architecture study is to design, develop, demonstrate, and evaluate a Phase-1 CisLunar Habitat common module internal architecture based on design criteria agreed to by NASA, the International Partners, and Commercial Exploration teams. This task is to define the CisLunar Phase-1 Internal Architecture Government Reference Design, assist NASA in becoming a “smart buyer” for Phase-1 Habitat Concepts, and ultimately to derive standards and requirements from the Internal Architecture Design Process.

The first step was to define a Habitat Internal Architecture Design Criteria and create a structured philosophy to be used by design teams as a filter by which critical aspects of consideration would be identified for the purpose of organizing and utilizing interior spaces. With design criteria in place, the team will develop a series of iterative internal architecture concept designs which will be assessed by means of an evaluation criteria and process. These assessments will successively drive and refine the design, leading to the combination and down-selection of design concepts. A single refined reference design configuration will be developed into in a medium-to-high fidelity mockup. A multi-day human-in-the-loop mission test will fully evaluate the reference design and validate its configuration. Lessons learned from the design and evaluation will enable the team to identify appropriate standards for Phase-1 CisLunar Habitat Internal Architecture and will enable NASA to develop derived requirements in support of maturing CisLunar Habitation capabilities.

This paper will describe the criteria definition process, workshop event, and resulting CisLunar Phase-1 Habitat Internal Architecture Design Criteria.