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

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LESSONS LEARNED FROM SPACE STATION INTERIOR CONFIGURATION CONCEPTS FOR GATEWAY

Abstract

GATEWAY is planned as an international lunar-orbit space station providing a staging and technology development base for exploring the moon, Mars and other parts of the solar system. Elements such as the ESPRIT module and the International Habitat (I-HAB) module are foreseen to be designed and built by European partners. The structure for HALO will be built by Thales Alenia Space in Turin, Italy. HALO and I-HAB represent habitat modules with crew functions. Gateway in itself presents a unique opportunity to apply lessons learned from previous space stations within the given constraints. These constraints are partly due to the location of Gateway, a challenging timeline, limited budget and available launchers. This Paper discusses the commonalities and differences between designing a space station in LEO and a lunar orbital platform such as Gateway, and their implications on overall configuration and interior organisation. Factors like distance and radiation exposure, in connection with resulting cost drivers like the (re)development of suitable transport vehicles and other essential hardware, have major impacts on mission duration as well as on the amount of available habitable space that can be provided. At the same time, requirements regarding human factors remain the same, regardless of mission goals or application areas, leading to a range of necessary measures concerning interior layout and spatial organisation. Thus the evaluation of overall development progress of space station design in general must be set into relation to the according particular mission goal, which is the subject of this paper. It shall provide an overview on past space stations built to this day comparing them to the present gateway design status, with respect to mission scenario characteristics and their resulting implications on overall configuration architecture and interior layout.

- Determining design drivers to be analysed comprise - Operational parameters, mission scenarios, transport system, type of orbit; - Structural aspects, typology, maintainability, modularity; - Human factors, habitability, radiation load, safety;