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

Author: Ms. Michelle Rucker
NASA, United States, michelle.a.rucker@nasa.gov

Ms. Molly Anderson
NASA, United States, molly.s.anderson@nasa.gov

# ISSUES AND DESIGN DRIVERS FOR DEEP SPACE HABITATS

**Abstract**

A cross-disciplinary team of scientists and engineers applied expertise gained in Lunar Lander development to the conceptual design of a long-duration, deep space habitat for Near Earth Asteroid (NEA) missions. The design reference mission involved two launches to assemble a 5-module vehicle for a 380-day round trip mission carrying 4 crew members. The conceptual design process yielded a number of interesting debates, some of which could be significant design drivers in a detailed Deep Space Habitat (DSH) design. These issues include:

• Launch loads: Potentially drives layout of equipment mounted to module "floors" or walls, and whether temporary internal structure is required to distribute launch loads to minimize shell mass;

• Unmanned loiter time: When added to an already lengthy mission, loiter time further drives risk and reliability, and poses issues for equipment shelf life such as material degradation or cryogenic fluids boil-off;

• Pointing and Visibility: A habitat embedded in a 5-module stack may drive Communications, Tracking, Guidance, and Navigation equipment out onto long booms to maintain line-of-sight visibility with targets. However, long booms will be more susceptible to disruption from exercise-induced vibration, potential damage during docking/undocking operations, and increased power distribution mass;

• Water: although it is assumed that a water processor will collect and recycle water, several interesting question were posed, such as: How much water to start with? Should potable water serve double-duty as radiation protection? And if so, should it be stowed in a single large tank, or smaller, portable containers?

• Design for repairability: one of the worst-case scenarios identified was a cabin depressurization that required suited repair from inside the module, potentially driving the need for long umbilical hoses or special equipment to allow smaller, mated modules to be used as safe havens for up to 180 days;