

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

Author: Dr. Stephen Hoffman  
Science Applications International Corporation (SAIC), United States

Mr. Larry Toups  
National Aeronautics and Space Administration (NASA), United States

DEEP SPACE HABITAT CONCEPT OF OPERATIONS FOR EXTENDED DURATION TRANSIT  
MISSIONS

**Abstract**

NASA's Capability-Driven Framework (CDF) describes an approach for progressively extending human exploration missions farther into the Solar System for longer periods of time as allowed by developments in technology and spacecraft systems. Within this framework design reference missions (DRMs) targeted for several specific destinations are being used to assess different combinations of vehicles, operations, and advanced technologies to help understand which combination will best support expanded human exploration both efficiently and sustainably.

Several of the identified destinations have been found to require missions with a round trip duration exceeding one year. These mission durations exceed the capabilities of current human-rated spacecraft if resupply from Earth is not possible. This makes the design of an efficient and reliable deep space habitat (DSH) critical for reaching these destinations. The paper will describe the current understanding of DSH capabilities and functions that must be exhibited by any future habitat design for these missions. This description of the DSH is presented in the form of a concept of operation, which focuses on the functions that any DSH must provide, as opposed to a specific DSH design concept. Development of a concept of operations, based on DRM features, provides a common basis for assessing the viability of design concepts incorporating differing configurations and technologies. A study team with representation from several NASA Centers and relevant engineering and scientific disciplines collaborated to develop this DSH concept of operations for the transit phases of these missions. The transit phase of a mission is defined as the time after leaving Earth but before arrival at the destination and the time after leaving the destination but before arriving back at Earth. These transit phases were found to have many common features across all of the destinations being assessed for the CDF and thus arguing for a common concept of operations for all of the associated DRMs.

The paper first describes the CDF and potential destinations being considered within this framework. DRMs representative of those currently being assessed will then be discussed to illustrate the range of capabilities that the DSH must support. The 18 functions identified by the multi-discipline analysis team are then described at a summary level. Several specific examples are then discussed to illustrate how this concept of operations was used to inform the design of a specific habitat concept.