

Exploration of Mars (08)
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MARS SURFACE EXPLORATION CONCEPT OF EXPLORATION

Abstract

NASA's Capability-Driven Framework (CDF) describes an approach for progressively extending human exploration 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 specific destinations are used to assess different combinations of vehicles, operations, and advanced technologies to understand which combination best supports efficient and sustainable human exploration.

The most ambitious of these DRMs is the human exploration of Mars, which currently envisions three crews of six people exploring the Martian surface for 500 days each. Much of the work to date on this DRM has focused on transportation systems needed to get crews and their support systems to Mars and back safely to Earth. This paper discusses recent work to add more substance to the surface exploration portion of the mission.

The paper first briefly describes the CDF and all the potential destinations being considered within this framework to provide context for the Mars DRM. This is followed by a summary of the entire Mars DRM in its current state. The opening section of the paper concludes with a discussion of exploration objectives that will guide specific crew activities on the surface and the general strategy for achieving these objectives.

Because the current transportation strategy for this DRM envisions a split deployment of assets needed for an entire surface mission, the description of surface activities will be divided into two sections: those that occur before the crew arrives and those carried out by the crew. The second portion of the paper describes these activities in sufficient detail to understand the functions that must be accomplished and whether these functions will be accomplished by the crew or by one of the systems deployed to the surface. There are several activities critical for mission success that must be accomplished before crew arrival, which defines functional capabilities of pre-deployed systems. Once on the surface, the crew will engage in diverse exploration activities that include geology, hydrology, biology and study of the atmosphere and climate. In addition, the crew will also engage in maintaining their own health and welfare as well as that of the surface systems.

The final section discusses a preliminary assessment of systems and technologies needed to support this range of activities and functions, with a preliminary assignment of functions to these systems and how these systems will support the envisioned mission.