The Hardware Challenges for the Mars Exploration Rover Heat Rejection System

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ABSTRACT

The primary objective of the Mars Exploration Rover (MER) 2003 Project focused on the search for evidence of water on Mars. The launch of two identical flight systems occurred in June and July of 2003. The roving science vehicles are expected to land on the Martian surface in early and late January of 2004, respectively. The flight system design inherited many successfully approaches from the Mars Pathfinder Mission. This included the use of a mechanically-pumped fluid loop, known as the Heat Rejection System (HRS), to transport heat from the Rover to radiators on the Cruise Stage during the quiescent trek to Mars. While the heritage of the HRS was evident, application of this system for MER presented unique and difficult challenges with respect to hardware implementation. We will discuss these hardware challenges in each HRS hardware element: the integrated pump assembly, cruise stage HRS, lander HRS, and Rover HRS. These challenges span the entire development cycle including fabrication, assembly, and test. We will conclude by citing the usefulness of this system during launch operations, where in particular, the flight Rover battery was thermally conditioned by the HRS since there was no other effective means of maintaining its temperature.