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THERMAL DESIGN OF THE EMIRATES MARS MISSION (HOPE PROBE)

Abstract

United Arab Emirates has entered the space exploration race with the announcement of the Emirates Mars Mission (EMM), the first Emirati mission to another planet, in 2014. Through this mission, the UAE will be launching an unmanned probe in July 2020 that will reach Mars in February 2021 to coincide with UAE's 50th anniversary. The mission, called Hope, is unique and aims for novel and significant discoveries that contribute to the ongoing work of the global space science community. The design of the Hope Probe observatory includes 3 instruments to study the Martian atmosphere: 1) Emirates eXploration Imager (EXI) will measure the properties of water ice and dust aerosols, and abundance of ozone in Mars' atmosphere using a visible imager; 2) Emirates Mars Ultraviolet Spectrometer (EMUS) will measure the global characteristics of hydrogen and oxygen coronae; and 3) Emirates Mars InfraRed Spectrometer (EMIRS) will measure the global thermal structure and abundances of water ice, and water vapor in Mars' atmosphere. The success of the mission relies on varying aspects, including the thermal control system. This paper will describe the thermal design of the EMM observatory and how it maintains component temperatures throughout all mission phases from Launch, through Cruise, Mars Orbit Insertion, and Science Phase. The thermal design utilizes passive cooling to reject waste heat from high-powered components, as well as heater circuits to maintain minimum component temperatures. The heater control architecture will be described, as well as the MLI blanket design, spacecraft subsystem and science instrument thermal accommodations. Finally, the results of the thermal vacuum testing to qualify the EMM observatory thermal design will be discussed.