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EMIRATES MARS MISSION GROUND SEGMENT - OVERVIEW AND CURRENT STATUS

Abstract

Emirates Mars Mission (EMM) is considered the first planetary exploration mission of the United Arab Emirates (UAE). The project was announced in July 2014 by the government of UAE to send a probe to Mars by 2021 to coincide with the 50th anniversary of the country. The project is a national project funded by the UAE Space Agency (UAESA) and developed by the Mohammed Bin Rashid Space Center (MBRSC) through a collaborative partnership with the scientists and experts from three leading universities in the United States of America (USA): the University of Colorado and its Laboratory for Atmospheric and Space Physics (CU/LASP) in Boulder; Arizona State University and its School of Earth and Space Exploration (ASU/SESE) in Tempe; and the University of California and its Space Sciences Laboratory (UCB/SSL) in Berkeley.

Emirates Mars Mission, also known as "Hope", is planned to be launched in July 2020 on a Mitsubishi Heavy Industry (MHI) H-IIA rocket from Tanegashima launch site in Japan, and arrive at Mars in early 2021. The mission has been designed to operate for 4 Earth years (2 Mars years) in Orbit: 2 years of primary science phase then can be extended for 2 more years. The Hope probe will be inserted into a high elliptical orbit (20,000 x 44,000 km) with an orbital period of 55 hours allowing 3 orbits per week. It will have a total mass of 1500 kg at launch allowing it to carry a combination of three distinct instruments that will image Mars in the visible, thermal infrared and ultraviolet wavelengths. These instruments are the Emirates eXploration Imager (EXI), the Emirates Mars InfraRed Spectrometer (EMIRS), and the Emirates Mars Ultraviolet Spectrometer (EMUS).

The designed orbit and three instruments on the spacecraft will allow the Hope probe to achieve its main scientific objective to "explore the atmosphere at Mars and provide a global, seasonal, and diurnal (day-to-night) coverage of the Martian atmosphere". The mission is designed to answer the following three science questions: 1- How does the Martian lower atmosphere respond globally, diurnally, and seasonally to solar forcing? 2- How do conditions throughout the Martian atmosphere affect rates of atmospheric escape? 3- How does the Martian exosphere behave temporally and spatially?

The science and knowledge generated by the mission will be available for the global scientific community through the Emirates Science Data Center (ESDC), which will be the main platform to access and retrieve fully calibrated and validated data. The data products generation and pre-processing will be done at the Science Data Center (SDC). The operation of the mission will be performed from the main Mission Operation Center (MOC) located at MBRSC facilities in Dubai, and supported by the backup Mission Support Facility (MSF), based at LASP in Colorado. Both facilities will be interfacing simultaneously with the National Aeronautics and Space Administration's Deep Space Network (NASA's DSN) and Jet Propulsion Laboratory (JPL) which will provide the ground networks support for commanding, telemetry,and tracking services. Based in Tempe KinetX Aerospace, will use the tracking, ranging and Delta Door (DDOR) products delivered by DSN to provide navigation (NAV) services. Additionally, the mission will be supported by the Instrument Test Facilities (ITF) for each instrument, which will be responsible for instrument builds and tests, as well as building a repository of engineering information supporting the instruments.

The project has passed successfully the Mission Operations Review (MOR), and is currently moving

towards to the Observatory Thermal Vacuum Testing. Afterward, the mission operations team will begin Operations Readiness Test (ORT) followed by network testing with the DSN ground stations; this combined effort will ensure that the integrated team is fully trained and prepared for flight operations, and ready to conduct all critical mission activities and scenarios. The paper will be presenting the results of the MOR, highlighting the current development status of the ground segment, and introducing the latest design changes. It will focus on the ground segment operations, and present the functions and interfaces between the elements.