IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Advances in Space-based Communication Systems and Services, Part 3 (3)

Author: Mr. nasir Alnimr
Mohammed Bin Rashid Space Centre (MBRSC), United Arab Emirates

THE ROBUST TELECOMMUNICATIONS SYSTEM FOR THE EMIRATES MARS MISSION

Abstract

This work describes the design of the Radio Frequency (RF) telecommunications system for the Emirates Mars Mission, Hope Probe. The system includes a Deep Space Network (DSN) - compatible Applied Physics Laboratory (APL) transponder that has pre-programmed modes for each mission configuration, 20 dB L3-ETI Traveling Wave Tube Amplifier (TWTA), Dow Key RF waveguide and coaxial transfer switches, General Dynamics SATCOM bandpass filter, notch filter and diplexer. The 1.85-meter-high gain parabolic dish antenna is the primary science-phase and cruise communications antenna during the 2-year primary and 2 years extended mission, with three hemispherical low gain antennas used during launch, Martian orbit insertion, and contingency. The transmission paths, for both uplink and downlink, can be individually configured for either high or low gain antennas through waveguide and coax switches. The Frontier Radio is a spacecraft terminal to NASA Deep Space Network (DSN) and the functional interface to the spacecraft Command and Data Handling (CDH) subsystem. The telecommunication subsystem has the capability to simultaneously receive commands, downlink science telemetry and ranging from and to the ground network at X-band frequencies (7.151 GHz uplink and 8.402 GHz downlink) any time after launch vehicle separation. The antennas are configured for left-hand circular polarization (LCP) to avoid interference with other Mars missions. The downlink telemetry rate is selectable by command from 40 to 241 kbps bps and the receiver command rate ranges from 7.8125 to 2000 bps. This paper discusses the design of the Telecommunications System for Hope Probe as well as its development challenges.