IAF SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – missions current and future (3A)

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COMMUNICATION SYSTEM FOR MARS EXPLORATION

Abstract

Mars Exploration is indeed a step-by-step process achieved by in-orbit observations, in situ experiments and, hopefully in a short time, bringing Martian samples back to Earth. The next step for Mars exploration missions is now focused on characterizing the buried water-ice layers at middle latitudes, with identification and characterization based on a Synthetic Aperture Radar (SAR)instrument. Communication Services with high performance have become essential since scientific instruments with high resolution produce large data volumes that need to be transmitted to Earth for analysis. Raw and high-resolution SAR data and high-resolution optical imaging instruments are among the most data-generating instruments. In the context of the Mars International Ice Mapper (I-MIM) mission pre-phase A concept study, the Italian Space Agency (ASI), Thales Alania Space in Italy (TAS-I), and the Jet Propulsion Laboratory (JPL) are studying the Communication Subsystem specifically designed to operate in Mars sun-synchronous orbit and capable of delivering from the Ice Mapper satellite data volumes of at least 500 Gbit per day, with the potential to transmit higher volumes. I-MIM is a multilateral mission collaboration being developed by the Agenzia Spaziale Italiana (ASI), the Canadian Space Agency (CSA), the Japan Aerospace Exploration

Agency (JAXA), and the National Aeronautics and Space Administration (NASA) with the goal of identifying and characterizing accessible, near-surface water ice on Mars. Currently the mission is in the definition phase, with analysis of possible mission scenarios leading to the designations of two main communication links:

• Direct to Earth (DTE) link to exchange, at high data rate with Deep Space Network ground stations, the science data and telecommand and telemetry for the I-MIM orbiter's control, and operating primarily in assigned X-bands and Ka-bands, with data transmission above 10 Mbps.

• Proximity Link to communicate with the Martian surface, interacting with landers, rovers, and other future potential surface assets, as well as to connect the orbiter with other satellites in the Mars vicinity.

Both UHF and X-band are the primary bands considered for the proximity links on Mars. An optical link will be part of a trade-off study for future Mars exploration missions.