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USING THE CUBESAT AMBIPOLAR THRUSTER TO CREATE A MARS ARRAY OF RESEARCH SATELLITES: MARSCAT

Abstract

The MarsCAT (Mars Array of ionospheric Research Satellites using the CubeSat Ambipolar Thruster) Mission is a proposed two 6U CubeSat mission to study the ionosphere of Mars. The mission will investigate the plasma and magnetic structure of the Martian ionosphere, including transient plasma structures, magnetic field structure and dynamics, and energetic particle activity. The transit plan calls for a piggy back ride with a major mission using a CAT burn for MOI, the first demonstration of CubeSat propulsion for interplanetary travel. MarsCAT will make correlated multipoint studies of the ionosphere and magnetic field of Mars. Specifically, the two spacecraft will make in situ observations of the plasma density, temperature, and convection in the ionosphere of Mars. They will also make total electron

content measurements along the line of sight between the two spacecraft and simultaneous 3-axis local magnetic field measurements in two locations. Additionally, MarsCAT will demonstrate the performance of new CubeSat telemetry antennas designed at the University of Houston that are designed to be low profile, rugged, and with a higher gain than conventional monopole (whip) antennas. The two MarsCAT CubeSats will have five science instruments: a 3-axis DC magnetometer, a double-Langmuir probe, a Faraday cup, a solid state energetic particle detector (Science Enhancement Option), and interspacecraft total electron content radio occulation experiment. The MarsCAT spacecraft will be solar powered and equipped with a CAT thruster that can provide up to 4.8 km/s of ΔV , which is sufficient to achieve Mars orbit using flyby piggyback. They have an active attitude control system, using a sun sensor and flight-proven star tracker for determination, and momentum wheels for 3-axis attitude control.