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SWARM CUBESATS FOR MARTIAN ATMOSPHERE DETECTION

Abstract

Recent advances in propulsion technology and interplanetary navigation theoretically allow very small spacecraft to travel directly to planetary destinations from near-Earth-space. Because there are currently many launches with excess mass capability (NASA, and even commercial), we anticipate a dramatic increase in the number of opportunities for missions to planetary targets. Spacecraft as small as 12U CubeSats can use solar electric propulsion to travel from Earth-orbit to Mars-orbit in approximately 2-3 years. Space physics missions are particularly well suited for such mission architectures since state-of-the-art instrumentation to answer fundamental science questions can be accommodated in relatively small payload packages. For example, multi-point measurements of the Martian magnetosphere, ionosphere, and crustal magnetic fields would yield important new science results regarding atmospheric escape and the geophysical history of the Martian surface. It is necessary to have real time feedback to the Earth, a relay satellite will be in moving in orbit between the ground station and the CubeSats in the Mars orbit, thereby maintaining constant communication. This paper shall give a deep understanding of the mission analysis and architecture for the Mars Observation system. Using 3-4 sets of swarm CubeSats in different orbits and to have good understanding of the Martian atmosphere shall be used to have total coverage of the Mars' surface. CubeSats shall be equipped with payloads that provide hyperspectral imaging, gravity field mapping, atmospheric probing, and terrain mapping. Each CubeSat shall be equipped with long range laser based communication systems for inter-satellite link, also along with the relay satellite.