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TRAJECTORY DESIGN OF THE TIME CAPSULE TO MARS STUDENT MISSION

Abstract

Time Capsule to Mars (TC2M) is a student-led mission with collaboration across universities guided by industry volunteers that will deliver a time capsule of digital text, images, audio and video to Mars. TC2M intends to demonstrate the capability of CubeSats for interplanetary travel while leveraging new CubeSat subsystem technologies. This work highlights the TC2M trajectory design and optimization. Mission architecture considers the deployment of a 6U CubeSat as a secondary launch payload from geosynchronous or highly elliptical orbit. TC2M will employ a low-thrust ion Electro Spray Propulsion System for CubeSats (iEPS), warranting new propulsion modeling in the design and optimization process. The iEPS system enables TC2M to escape Earth orbit on its own propellant, and provides flexibility for the launch date and geometry. A study of the tradespace, namely mission event dates and thruster logic, is presented for a target launch in 2017. Nominal trajectories are selected to illustrate the Earth-escape spiral and interplanetary transit that can guide TC2M towards direct entry into the Martian atmosphere.