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Author: Mr. Mohd. Izmir Yamin
Independence-X, Malaysia, izmir.yamin@independence-x.com

MINIATURE HALL EFFECT THRUSTER BASED CUBESAT FOR LUNAR AND MARS ORBITER
EXPLORATION SPACECRAFT WITH ONBOARD CLOSED CATHODE HYDROGEN-OXYGEN
FUEL CELL SYSTEM.

Abstract

The research emphasis on the basis of miniaturized electric propulsion system using Hall effect thruster technology with specific impulse, I_{sp} of 1500 seconds. The technology utilizes a modified twisted helix RF magnetron channel for the propulsion unit. It is capable of generating thrust up to 10mN suitable for the incremental delta-V to achieve the required escape velocity at much lighter overall spacecraft mass. The light weight power plant is powered by onboard hydrogen-oxygen closed cathode PEM (proton exchange membrane) fuel cell. With the utilization of such power plant it will minimize the overall size of the spacecraft for reliable energy for enroute TLI (Trans Lunar Injection) or TMI (Trans Mars Injection) mission requirements and minimal usage for Li-Ion batteries and solar panel area. The propulsion unit driver generates beyond 500kHz resonance frequency. The miniaturization of the propulsion and power plant system enables the system to sufficiently accommodate the landing and re-entry modules on-board the spacecraft. The onboard power plant is able perform its secondary function as a chemical propulsion channeled to a thrust chamber for significantly higher thrust of 3N fired at specific timing during the perigee period toward helping the incremental bi-elliptical orbit to eventually achieve escape velocity. The proposed spacecraft format is a 12U cubesat with onboard phased array antenna for deep space communications.