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Nanospacecraft design and mission overview for statistical small asteroids prospecting

Iaroslav Iakubivskyi (1,2), Laurynas Mačiulis (3), Pekka Janhunen (4), Andris Slavinskis (1,2), Mihkel Pajusalu (5), Mart Noorma (1,2)

(1) University of Tartu, Institute of Physics, W. Ostwaldi 1-D601, 50411, Tartu, Estonia (iaroslav.iakubivskyi@estcube.eu)
(2) Tartu Observatory, University of Tartu, Department of Space Technology, Observatooriumi 1, 61602, Tõravere, Estonia
(3) Antanas Gustaitis' Aviation Institute, Linkmenu str. 28, 08217 Vilnius
(4) Finnish Meteorological Institute, Erik Palménin aukio 1, P.O. Box 503, FI-00101, Helsinki, Finland
(5) Massachusetts Institute of Tech- nology, Department of Earth, Atmospheric and Planetary Sciences, 77 Massachusetts Avenue, Rm 54-1728, 02139 Cambridge, MA

Abstract

This work describes the detailed design of small spacecraft for interplanetary mission. We present a selection of optimal materials and configurations for thermal and radiation environments. The main spacecraft consists of approximately three CubeSat units and includes an auxiliary unit for deployment of the electric solar wind sail (E-sail). E-sail is a primary propulsion employing 20 km aluminium charged tether. The minimum viable E-sail configuration can propel ~ 5 kg body to the main asteroid belt. The spacecraft will spin slowly (2 rpm) and maintain the tether stretched. It will be achieved by attaching a mass body or so-called remote unit on a tether's tip. Hence, the remote unit will orbit the main spacecraft in the unnatural way by means of centrifugal force. The remote unit utilizes wireless communication with the main spacecraft. The round trip will take 3-4 years. The structural and thermal requirements remain similar for both bodies. This study is performed for Multi-Asteroid Touring mission (Slavinskis, 2018[1]) but can be utilized for other similar mission.

[1] Slavinskis A. et al. (2018) *IEEE Aerospace Con- ference 2018*, 2.0209.