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Author: Mr. Franco Pérez-Lissi
University of Vigo, Spain

Mr. Ricardo Tubío-Pardavila
University of Vigo, Spain
Prof. Fernando Aguado Agelet
University of Vigo, Spain
Mr. Antón Vázquez
University of Vigo, Spain
Mr. Alberto González-Muiño
University of Vigo, Spain
Mr. Diego Nodar
Universidad de Vigo, Spain

ANALYSIS OF THE USE OF COTS BASED CUBESATS IN A DEEP SPACE MISSION: DUSTCUBE, A NANOSATELLITE MISSION TO 65803 DIDYMOS BINARY ASTEROID AS PART OF THE ESA AIM MISSION.

Abstract

COTS based nanosatellites are a promising option for the exploration of the solar system and near-Earth objects, providing an agile, reduced cost and mass solution, for interplanetary missions. This presentation summarises the analysis carried out during the Phase A study aimed at assessing the feasibility of a COTS nanosatellite-based mission concept for a 3U CubeSat to the vicinity of the 65803 Didymos binary asteroid.

The nanosatellite is meant to be part of The Asteroid Impact Mission (AIM) which is the European element of the NASA-ESA jointly developed Asteroid Impact Deflection Assessment (AIDA) mission. The inclusion of a scientific optical payload based on a Nephelometer, the selected orbital and navigation strategy, together with the differences found in between the Beyond-Earth space environments (radiation, micrometeoroids, ejected material, illumination conditions, communications access) and a typical LEO polar environment, unveils new technical challenges to be faced along interplanetary missions using COTS based small satellites.

All these challenges impact significantly the mission design and the spacecraft configuration. An increase of the minimum mass required for the spacecraft to guarantee its survival to the harsher space environment is found, since new thermal control and avionics shielding strategies are required, compared to those used on low Earth orbit in order to be compatible with the reuse of most of the COTS subsystems and payloads for deep space missions.

Moreover, nanosatellite dimensions impose strong constraints on surface utilisation for radiators and thermal control mechanisms. Thus, an efficient power design coupled with external faces configuration and orbital mission profile represents perhaps the biggest challenge on the spacecraft and mission design.

Thus, an efficient power design coupled with external faces configuration and orbital mission profile represents perhaps the biggest challenge on the spacecraft and mission design. These issues are caused by some peculiar aspects of the interplanetary environment (radiation, micrometeoroids, ejected material and illumination conditions) when compared to a typical LEO environment. Since the latter is the one for which the CubeSat technology was developed, the utilisation of COTS and the traditional CubeSat

development process must be adapted in order to cope with the new issues to be faced along interplanetary missions.