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MULTIDISCIPLINARY DESIGN GUIDELINES FOR A 12U CUBESAT DEPLOYABLE AEROSHELL FOR ATMOSPHERIC REENTRY MISSIONS

Abstract

In recent years, the use of the CubeSat class of satellites has increased exponen-tially and, while initially intended for the development of university projects, often lim-ited in ambition, it is now proving to be highly versatile and suitable for more complex applications. Ensuring a deorbiting capability to reduce the risks associated with the generation of new space debris and the ability to perform controlled reentry to enable new scientific and commercial missions in low Earth orbit is now becoming critical. This paper presents guidelines for the design of the reentry mission of a CubeSat capable of returning a payload to the ground that could consist of experiments con-ducted on LEOs, to name one conceivable scenario, focusing on spacecraft geome-try, mission design (orbits and maneuvers), and preliminary analysis of the main aero-thermodynamic coefficients. The project focuses mainly on the flexible heat shield de-sign of the SPLASH (Self-dePloyable fLexible AeroSHell for de-Orbiting and Space Re-entry), a project established as a joint technology development program, co-financed by Brazil and Italy. The aeroshell is meant to protect the bus and the mission payload, it must be stowed in the smallest possible volume of the CubeSat, seeking an optimized folding configuration, and must be able to unfold, deployed when re-quired and controlled by Shape Memory Alloy (SMA) actuators - facilitating deorbiting - stabilize during a controlled re-entry and finally be recovered.