SMALL SATELLITE MISSIONS SYMPOSIUM (B4)
Access to Space for Small Satellite Missions (5)

Author: Mr. Davide Bruzzi
ALMASpace S.r.l., Italy

Mr. Alberto Corbelli
ALMASpace S.r.l., Italy
Prof. Paolo Tortora
Alma Mater Studiorum - University of Bologna, Italy

DESIGN AND VERIFICATION OF AN OPTIMIZED SEPARATION SYSTEM FOR MICROSATELLITES: THE ALMASAT-1 CASE STUDY

Abstract

The time of separation of a satellite from its launch vehicle often signs the beginning of its operational life in orbit and this is especially true for micro- and nano- satellites. To preserve the integrity and the efficiency of the spacecraft during launch and perform a correct separation capable to grant safe operations of the spacecraft in orbit, it is necessary to design and manufacture an efficient and reliable interface and separation system from the launch vehicle. The VEGA Qualification Flight has now been postponed till the end of 2010 and several payloads will be released in orbit. First, a scientific payload named LARES will be released along a circular 1450x1450 km orbit, at 71 of inclination. ESA and ASI agreed on embarking a set of secondary payloads which will be released along an elliptic deorbiting trajectory, after the perigee of the upper stage will be lowered to about 350 km. The 10 secondary payloads include 9 Cubesats and ALMASat-1, the first microsatellite developed, manufactured and assembled by the University of Bologna, Forlì Campus. ALMASat-1 flight opportunity was granted to the University of Bologna under the obligation that the S/C adapter and separation system was part of the ALMASat-1 systems. This paper presents the activities that led to the design, manufacturing, verification and qualification of the ALMASat-1 separation system carried out at the Microsatellite Laboratory of the University of Bologna. The general architecture selected for the interface is the classical cylindrical canister adapter with a 2-clamps constraining system. This solution, common for micro- and nano- satellites, has a wide flight heritage, is typically simple and affordable and could be easily implemented for a wide range of launch vehicles. In order to reduce the power consumption and enhance the system reliability and safety, the release clamps will be retained by Non- Explosive electro-mechanical Actuators (NEA) that allow to preload two couples of springs, one pair for each clamp, until the separation signal is obtained by the LV avionics. Along with numerical simulations, experimental tests have been performed by means of a separation test-bed, specifically designed to reproduce the correct dynamics of both the separation system and the spacecraft. Finally, the structural optimization process performed on the ALMASat-1 Adapter and Separation System will be presented, focusing on the reduction of the system overall mass which, in turns, determines the launch costs and represents one of the most critical aspect in microsatellite missions.