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SA-4S – TRL INCREASE ACTIVITIES AND PRELIMINARY RESULTS FOR THE SAB AEROSPACE SEPARATION SYSTEM

Abstract

Thanks to the constant evolution of technology, nowadays small satellites are able to carry out increasingly complex missions that were once feasible only with very massive spacecrafts. For this reason, small spacecrafts constellations are growing in popularity and it has been estimated that about 7000 small satellites will be launched in the coming decade.

SAB Aerospace is developing a separation system (SA-4S) specific for this class of spacecrafts having mass in the range of 50 to 250 kg, whose strongest point is the extremely reduced cost, consequence of its very simple architecture. The peculiarity of this system is the use of a synthetic cable made of Ultra-High Molecular Weight Polyethylene (UHMWPE) to keep the two rings together during the launch phase and the presence of a commercially available non-explosive Hold-Down and Release Mechanism (HDRM) to trigger the separation event, which ensures a low level of shock generation.

In order to prove that the technology is fit to be used in space, all the steps of the Technology Readiness Level scale need to be demonstrated, up to TRL 7. The starting point is the identification of the system critical functions and the definition of relevant environment. The plan of activities described follows the philosophy of investigating separately all the sources of uncertainties present in the system. In particular, the dynamics of the system is defined through characterization tests on its critical elements such as the cable, clamps and springs, and a sensitivity study to understand how each of them affects the separation velocity and tip-off rate. The information acquired is then integrated in a SAB python-core tool developed for a basic analysis of SA-4S dynamics. Moreover, a multi-body dynamic model is built with the software ADAMS by MSC, with the purpose of predicting the complete behavior of the separation system and its performance in a mission environment, as a function of the MCI characteristics of the spacecraft to be deployed in orbit. Finally, environmental tests are foreseen to prove the separation system is able to survive the loads generated during launch and to satisfy stiffness requirements.

The development plan has the objective of producing the first flight model of the separation system in time for the Small Spacecraft Mission Service (SSMS) proof of concept flight on VEGA-C, with the goal of becoming the baseline choice, together with the SSMS dispenser, for economically affordable rideshare missions of the European small-lift launcher.