Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

Handout

MASCOT – Mobile Asteroid Surface Scout

Asteroid Sampling Mission

Asteroid missions are of high interest for finding a missing link in the development of life on earth. Still the step from atoms to the formation of higher molecules is not yet clear. One theory is the impact of asteroids on earth bringing these molecules with them. By an asteroid sampling mission this theory could be confirmed.

In this context the Mobile Asteroid Surface Scout (MASCOT), a small (295x275x195 mm^3) box shaped ~9kg lander, is developed to support and enhance larger S/C's scientific possibilities. Including a mobility mechanism, supporting 3 experiments and a wide angle camera with in total 3kg the estimated operational time is 16hrs. Being part of JAXA's Hayabusa 2 mission the launch date will be in 2014 heading the C-class asteroid 1999JU3.

Structural Concept

The MASCOT structure (Figure 1) consists actually of two parts, the mounting & support structure and the MASCOT lander itself. The support structure is a solid high modulus CFRP (Carbon Fibre Reinforced Plastic) framework structure with a main truss on top, made of CFRP-foam sandwich. It provides the separation mechanism and the electrical interface (I/F) to the mother space craft (S/C). This allows certain variability in the position of the separation mechanism between MASCOT and the support structure by shifting it along the truss axis. So the mechanical connection is realized by a central non-explosive actuator for separation and 4 bearing points. In order to ensure fixation and steady contact between the support structure and MASCOT the non-explosive actuator pulls with 2500N, which presses MASCOT's bearing points against the support structure's counter parts. To guide the load in between MASCOT's wall structure is made up of a very lightweight framework of sandwich trusses. They consist for the most part of an unidirectional (UD)-CFRP (0°) face sheet ply (high modulus fibers) and a foam core, which allows an optimal use of the UD-layer specific advantages / characteristics. Accordingly the structural design ensures that each truss of the wall structure is only loaded in its x-axis by tension / compression loads. Thereby the load induced by the NEA can be divided on each truss and lead to the 4 bearing points. The structurally integrated I/F between MASCOT and the support structure is in its shear loaded regions reinforced by an additional ±45° CFRP fabric. An additional feature is the completely insert less design by using resin threads to mount the radiator (being at the same time the top plate of MASCOT's wall structure) and local solid carbon substitutions as for instance for instrument's brackets.

DLR Partizipation

The MASCOT lander is realised by a cooperation of various DLR institutes lead by the Institute for Space Systems, Bremen. All structural components are developed and manufactured by the Institute of Composite Structures and Adaptive Systems which has already heritage in developing and manufacturing highly specialized lightweight structures as the PHILAE Lander Structure for ESA's ROSETTA Mission.

Recently the Structural Model has successfully passed its first mechanical tests. Furthermore the separation mechanism was tested within DLR's 19th Parabolic Flight Campaign (Figure 2). In a next step the Qualification Model will be finalised before tested in summer 2012.

Figure 1: MASCOT lander in launch configuration within its support structure (brown)

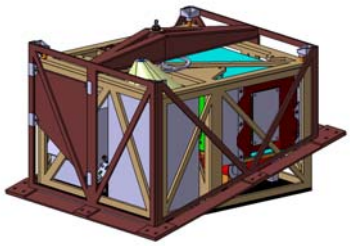
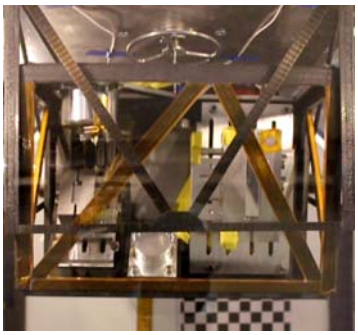


Figure 2: MASCOT separation test in parabolic flight campaign



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