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OHB REMEDIATION ACTIVITIES FOR A CLEANER SPACE – E.DEORBIT AND TENTACLE-BASED CLAMPING MECHANISM

Abstract

Reducing the number of space debris objects in the long run has to be achieved by a combination of remediation and mitigation actions. This paper presents an overview and results of the activities in the remediation category that OHB System is running or has recently finished.
In the first activity, OHB System led one of the consortia that performed an ESA Phase A study on the **e.Deorbit Mission** for active debris removal. The mission requirements dictate that the mission concept shall be able to remove a defunct resident space object with several tons of mass and a large dynamic behaviour uncertainty envelope from the low-Earth orbits. This lead to ENVISAT being the target, an ESA-owned Earth observation satellite of approximately eight metric tons of mass, launched in 2002 into one of the most populated low-Earth orbits at approximately 800 km altitude and 98° inclination, and non-operational since April 2012 due to an unknown failure.
In order to recommend a design for further evaluation, different designs were analysed for different concepts such as **robotic capture vs. flexible capture** methods and **de-orbiting vs. graveyard orbit** disposal. A trade-off based on cost and risk was then performed to inform a final recommendation.
In close relation to the e.Deorbit system study, the concept for a **tentacle-based clamping mechanism** was developed. Its purpose is to establish a rigid connection between the e.Deorbit chaser satellite and the space debris object for the controlled de-orbit. This clamping mechanism follows a "capture before contact" strategy. The design process was supported by a multi-body simulation of the capture process. Furthermore, the programmatics for the development and testing of the clamping mechanism were developed.
This paper describes the proposed designs and the recommendations for further investigation in a more detailed subsequent activity.