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TECHNICAL CHALLENGES OF THE DEBRIS DEORBIT DEMONSTRATOR AND ENVISAT OBSERVATION SATELLITE (D3EOS) MISSION

Abstract

Since the UN COPUOS has published its Technical Report on Space Debris“ it is finally clear that the increasing load of space debris is a rising danger for commercial and scientific orbits. All attempts to minimise the risk for future space flights are based on two pillars:

- Avoidance of space debris at future missions
- Active removal of existing space debris which needs an exact observation of uncontrolled elements in orbit consisting of old satellites or rocket engines

Different strategies for avoidance of more space debris in LEO are given in the “Code of Conduct for Space Debris Mitigation”. But these guidelines itself are not enough to prevent a worsening of this problem and have to be aided with active removal. Although active removal of old satellites, rocket engines and other debris is highly ambitious in a technological field as well as costly, there is no alternative to keep space as a valuable resource. Here the small satellite D_3EOS (Debris Deorbit Demonstrator and Envisat Observation Satellite) can play its part. The D_3EOS phase 0/A study is part of the Small Satellite Project conducted at the Institute of Space Systems (IRS) at the University of Stuttgart to provide the institute with the capability to perform a low cost, fast servicing and deorbiting mission using a green ADN based propellant. The mission objective is to observe the defunct satellite ENVISAT, to prepare a future deorbit mission and after that can catch another small satellite to perform a controlled re-entry to demonstrate the feasibility of such missions. The paper presents the mission goals, the critical design drivers and will highlight the aspect of the use of the FlyingLaptop as a platform (another IRS mission) as well as COTS components in general. As primary goal D_3EOS observes ENVISAT to gather information

for future deorbit missions. Since 2012, there is no more contact to ENVISAT which is an enormous risk. D_3EOS is able to check in which condition ENVISAT is and collects important information of its proper motion and possible damages. As secondary goal D_3EOS catches a disused small satellite of up to 30kg and re-enters controlled together with this caught satellite to serve as technology proveing for future missions with similar goals. Therefore D_3EOS applies a novel grappling-net with which the small satellite is catched. During re-entry this small satellite will be hauled by D_3EOS and both satellites burn up in the atmosphere.