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DEORBIT DEVICE AUTONOMY ANALYSIS FOR THE EOL OF SATELLITES IN LEO

Abstract

One of the most promising ways of minimising orbital debris is to use solar sails to produce drag on the satellites which have reached their EOL. By doing this, it rapidly decreases the orbit time of the satellite, helping to prevent the future build up of orbital debris. Currently there are a number of universities conducting research on different types of deorbit sails, these fall into three main categories; mechanical, inflatable and composite. These are all designed to be deployed when the satellite has reached its EOL.

Upon the satellite reaching its EOL, current designs for deorbit devices require that the power is provided by the satellite, along with a signal, for the deployment device to operate. By using an independent deorbit system, containing all subsystems required (TTC, power, communications) it may be possible to increase both the efficiency and reliability of the deorbit device. This involves producing the deorbit device as an autonomous subsystem of the satellite, or perhaps with an integrated level of autonomy with the satellite.

The ideal outcome of this research project will be a thorough analysis of whether or not it is beneficial for a deorbit device to be completely independent of the main satellite. If this is not the case, then to what extent of autonomy provides an advantage. Perhaps by only having its own power source, a substantial increase in the chance of a successful deployment will result. The parameters used to analyse these systems will be mass, cost, efficiency and reliability. The structure of the system required will be kept as basic as possible, as this is about increasing the reliability and efficiency of the deployment process.

The analysis will be conducted on the ESEO deorbit device which I am currently working on at Cranfield University. I will begin by identifying the power requirements, estimating the battery size required for the expected mission duration. Then I will identify the communications payload which best suits this mission conducting a trade off and how many antennas will be required to increase the chance of successful communication.

The final outcome of this research will be the most efficient and reliable system for the ESEO device. Although the results will not apply for every deorbit device, this will provide valuable research for future deorbit payloads, and perhaps a road map by which other designers can follow in the future.