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COMPARISON OF EFFICIENCY OF TWO DE-ORBITING SCHEMES FOR ADR MISSION IN LEO

Abstract

Modern projects to clean near-Earth orbits from space debris are mainly oriented to deal with large-size objects. These objects are mostly presented by last stages of launch-vehicles and by upper-stages while speaking about LEO region. Huge objects' de-orbiting is of high priority because the collision of several such objects can provoke the cascade augmentation of space debris population. To date, there are two de-orbiting schemes for large-size space debris (LSSD) objects in LEO which are under consideration. The first one suggests that a maneuvering SV equipped with special small SVs, thruster de-orbiting kits (TDK), executes flights between LSSD objects. TDKs are to be inserted into the nozzles of LSSD objects. The kits have autonomous control and a stock of fuel to produce a braking impulse sufficient for object's transition to the disposal orbit (DO). The second scheme suggests the usage of a single SV that executes flights between the objects and using its own propulsion system sequentially transfers the objects to the DO. The report contains a comparison of efficiency of two mentioned de-orbiting schemes in terms of total ΔV, mission duration, quantity of re-fueling operations and maximum quantity of TDK onboard. The analysis of results made it possible to formulate the required life-time of an active SV and its necessary reserve of ΔV for one charge. The optimal value of maximum number of TDKs onboard was determined. The choice of required type and parameters of DO allowed the calculation of amounts of fuel for each TDK. The results of de-orbiting schemes' comparison permit to preliminarily determine the main parameters of an active maneuvering SV-collector.