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THE COST-EFFECTIVENESS OF POST-MISSION DISPOSAL MANEUVERS

Abstract

The future space debris population is predominantly influenced by the number of catastrophic collisions. The reduction of potential collision options is considered to be an important measure for the long-term control of the population. The control can be made by removing risk objects from their orbits. Risk objects are long living, high-mass collision partners on orbits with high spatial density of debris. The results of a study concerning the sensitivity of the long-term evolution of the population as a function of post-mission disposal maneuvers (PMD) in conjunction with active debris removal (ADR) are presented. To simulate the effect of the measures, various PMD/ADR scenarios are compared. The effectiveness of the different scenarios is evaluated. Beside their effectiveness it is attempted to evaluate their cost-efficiency. Several scenarios are considered, either including a high or a low rate of disposed or removed objects. For the simulation results, a cost-benefit assessment is carried out. Special emphasis is placed on the cost model for PMD maneuvers. The initial approach is based on the enlargement of an on-board propulsion system to accommodate additional fuel required for the maneuver. In the next step, the increased demands on the technical reliability of the subsystems are described by complexity factors that simulate a cost increase caused for example by additional redundancies. The different scenarios are compared and evaluated in terms of their cost.