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SPACE DEBRIS SYMPOSIUM (A6)
Modelling and Risk Analysis (2)

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PRIORITY TARGETS FOR ACTIVE DEBRIS REMOVAL MISSIONS.

Abstract

With more than 93% of the catalogued in-orbit population consisting of debris, the safety of operational spacecraft is threatened by potential collisions that could result in a structural damage or complete disintegration. Hence, the numerous functional satellites carrying out essential tasks of Earth observation, communications, science and research, navigation, exploration, and defence, are threatened by a much larger number of defunct spacecraft, derelict rocket upper stages, intentional junk, and the aftermath of satellite collisions and explosions. Recent analysis on the instability of the LEO environment has emphasized the need for active debris removal (ADR) in order to ensure the long-term sustainability of outer space activities. One big question which ADR perpetuators must answer is: What are the high risk objects that will be considered as priority targets for removal? Several authors have proposed mass and probability of collision as suitable target selection criteria. In this paper, we will identify the top conjuncting objects for the past few years based on deterministic data from daily satellite conjunction alerts received. The identified objects, we believe, will serve as priority targets for active debris removal missions. We will also deduce in-orbit regions with high risk of collision, based on the available information.

Published reports on collision risk estimates for different regions of space are based on statistical data i.e. deductions based on modelled population density and/or flux, or deterministic data propagated ahead in time, thereby increasing the inaccuracy associated with propagating space object ephemerides. Statistical debris models are mostly adapted for analysis based on the sub-millimetre population and will not be suited for such a study. Analysis based on the collision probability calculated just before the predicted conjunction, combined with other parameters like mass, and relative velocity at closest conjunction, will provide the most accurate representation of the high risk objects and regions in space. This will also give an indication of the severity and implications of these identified conjunctions for the long-term sustainability of the space environment. We will compare what we can infer about regions which are more susceptible to future collisions and match our results to that from other studies.