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# PRIORITY TARGETS FOR AN AUTONOMOUS DEBRIS REMOVAL MISSION

**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.

During the past few years, several research programs have assessed the current state and future evolution of the low-Earth orbit region. These studies indicate that space debris density could reach a critical level such that there will be a continuous increase in the number of debris objects, primarily driven by debris-debris collision activity known as the Kessler effect. These studies also highlight the urgency for active debris removal (ADR) in order to ensure the long-term sustainability. In order to design and ADR mission, high priority targets must be identified.

In this paper, we will identify the high risk space objects based on deterministic data from daily satellite conjunction alerts received in 2012 and reported by the Center for Space Standards Innovation (CSSI) through the Satellite Orbital Conjunction Reports Assessing Threatening Encounters in Space (SOCRATES). The identified objects, will serve as preferred priority targets for future ADR missions. Moreover, based on our analysis of the available information, the orbital regions where the risk of collision is highest will be deduced.

The analysis will be carried out based on the collision probability calculated just before the predicted conjunction, combined with other significant parameters like mass and relative velocity at closest conjunction. The results will provide an accurate representation of the high risk objects and regions in space, thereby giving an indication of the implications of these identified dangerous conjunctions for the long-term sustainability of the space environment.

The result will be also compared with other research on collision risk estimates for different regions of space based on statistical data. The top conjunction events of 2012 will be then recreated and simulated on AGI's Satellite Toolkit, developing video files of for educational purposes.