

SPACE DEBRIS SYMPOSIUM (A6)  
Space Debris Removal Issues (5)

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## AN ACTIVE DEBRIS REMOVAL TRADE-OFF

**Abstract**

From 1957 more than 4,500 objects have been launched to space and more than 250 break-ups have been observed. The Space Surveillance Network (SNN) has catalogued more than 16,000 objects over 10 cm diameter. Of them only 6% are operative spacecrafts. Due to the risk of accidental collision with space debris, international community has agreed that space debris mitigation should be a priority. Simulations show that space debris population will grow although the no new-launches scenario was assumed. Therefore post-mission disposal of future missions is necessary but not sufficient to reduce space debris population and thus current debris population should be reduced with debris removal missions. A wide variety of methods to remove objects from orbit are being developed worldwide. Each of these methods has its own strengths and weaknesses. The purpose of the paper is to make a comparison of the potential of the most suitable methods and eventually chose and develops a sample mission analysis. The study includes: (i) A brief description of space debris environment and target selection, (ii) description of some of the most suitable techniques, (iii) Comparison and selection of a concept of mission, (iv) Model implementation, (v) Results and Conclusion. At the time of the submission the steps I, and II are done and the rest will be done in next months. Large objects in sun-synchronous orbits have been selected as main target. Up to the moment four techniques have been selected as the most promising; lasers, electrodynamic tethers, drag augmentation devices and solar sails. The current work is comparing these methods using preliminary simplified performances, technology readiness and estimated costs and masses from available similar mission designs. The paper will summarize the work done by the author as final thesis in the aerospace engineering grade curriculum. This final thesis has been supervised by a professor of the Aerospace Department of the UPM, who is also co-authoring this paper.