

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

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## SPACE DEBRIS REMOVAL

**Abstract**

Abstract— This paper deals with various technical issues related to space debris, risk assessment in space and on the ground, re-entry, hypervelocity impacts and protection, mitigation and space surveillance. The increasing number of man-made space debris of various sizes pose great threat to operational satellites and manned missions. There have been instances where functional satellites have been hit by hypervelocity debris rendering them useless and also increasing the debris count further. The manned and unmanned missions have been manoeuvred quite a few times. In a few cases astronauts had to hide in Soyuz capsules, the space lifeboats. The issue of debris removal from orbits is not only very expensive (as much as launching one space mission) but is also full of political challenges. Tests like ASAT have alone increased the number of debris to twenty-five per cent in LEO. Different approaches to either decay the orbits of debris or to change their orbit to altitudes higher than GSO are discussed in this paper. Space surveillance for a clearer picture of density of debris and warnings of cascading phenomenon is very essential. One most necessary requirement is to minimise debris or hardwares left in atmosphere, like, rocket propellants, upper stages, leftover fuel which expands and explodes causing further increase in smaller debris. Soon the LEO as well as the GSO orbits will be rendered congested and too dangerous for spacecrafts which will further increase the cost of launching satellites in higher orbits. The cascading predictions are a serious threat to future space missions. International collaboration between spacefaring nations is inevitable. The space law must ensure that all satellites that are being launched must not leave debris like upper stages or rocket propellants with leftover fuel to explode. Also the space law must ensure that the satellites re-enter earth's atmosphere after their life is over and that they should not be allowed to occupy any orbit posing further threat to operational satellites. Micrometeorite shields for hypervelocity impacts can be modified in such a manner that once the collision takes place, the debris get trapped instead of passing through. Space Surveillance camps like Hubble telescope and ISS should be equipped with further accessories. Keywords—ASAT-Anti satellite Tests; GSO-Geostationary; ISS-International Space Station; LEO-Lower Earth Orbit