SPACE DEBRIS SYMPOSIUM (A6)
Mitigation, Standards, Removal and Legal Issues (4)

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A COST ESTIMATE FOR ACTIVE DEBRIS REMOVAL IN LOW EARTH ORBIT

Abstract

A population cascade effect has been predicted for man-made debris in low earth orbit. It has been estimated [1] that to stabilise the population, at least five large pieces of space debris should be removed per year. An international team of postgraduate students at Cranfield University has undertaken a study to estimate the mass specific cost to de-orbit space debris in low earth orbit. This is a step towards quantifying, in monetary terms, the extent of the problem in the near space environment.

A baseline conceptual mission analysis has been performed, resulting in a complete mission architecture. The investigation has been restricted to European Union only targets and technology but is generally applicable. A high technology readiness level philosophy has been adopted to allow the mission to be achievable in the short term.

For the baseline mission, the study has focused on targeting tumbling Ariane 40 rocket bodies in the highly populated near-polar orbit environment. The baseline mission design involves a cluster of five chaser spacecraft inserted into a parking orbit above the targets. Each of the chaser spacecraft is to rendezvous, capture, and de-orbit one Ariane 40 target, using chemical propulsion. An evolution of the project applies the chaser spacecraft design to targets of different configuration and in different orbits to determine necessary design modifications and quantify implications on mission cost.

The first estimates of 'cost/kg' to actively de-orbit LEO debris emphasize the need to consider the full life cycle of space projects as well as the benefit of budgeting for end-of-life strategies early in the mission design process.

[1] Controlling the growth of future LEO debris populations with active debris removal, J.-C. Liou, N.L. Johnson, N.M. Hill, Acta Astronautica 66 (2010) 648-653.