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

Author: Dr. J.-C. Liou
National Aeronautics and Space Administration (NASA), United States, jer-chyi.liou-1@nasa.gov

A PARAMETRIC STUDY ON USING ACTIVE DEBRIS REMOVAL TO STABILIZE THE FUTURE LEO DEBRIS ENVIRONMENT

Abstract

Recent analyses of the instability of the orbital debris population in the low Earth orbit (LEO) region and the collision between Iridium 33 and Cosmos 2251 have reignited the interest in using active debris removal (ADR) to remediate the environment. There are; however, monumental technical, resources, operational, legal, and political challenges in making economically viable ADR a reality. Before a consensus on the need for ADR can be reached, a careful analysis of the effectiveness of ADR must be conducted. The goal is to demonstrate the feasibility of using ADR to preserve the future environment and to guide its implementation to maximize the benefit-cost ratio.

This paper describes a comprehensive sensitivity study on using ADR to stabilize the future LEO debris environment. The NASA long-term, orbital debris evolutionary model, LEGEND, is used to quantify the effects of many key parameters. These parameters include (1) the starting epoch of ADR implementation, (2) various target selection criteria, (3) the benefits of collision avoidance maneuvers, (4) the consequence of targeting specific inclination or altitude regimes, (5) the consequence of targeting specific classes of vehicles, and (6) the timescale of removal. Additional analyses on the importance of postmission disposal and how future launches might affect the requirements to stabilize the environment are also included.