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

Author: Mr. Frank Di Pentino
Integrity Applications Incorporated (IAI), United States, fdipentino@integrity-apps.com

Dr. Darren McKnight
Integrity Applications Incorporated (IAI), United States, dmcknight@integrity-apps.com

SENSITIVITY STUDY OF LEO DEBRIS HAZARD EVOLUTION

Abstract

Understanding the factors that contribute to the evolution of the debris population in Low Earth Orbit (LEO) is of critical importance to current and future spacecraft operations. By employing the PERSIST and PREVENT debris models, a long-term baseline projection of the LEO debris population for the next 50 years has been established. In this paper, a sensitivity analysis with regards to the baseline case is conducted that demonstrates the dependence of both the debris generation and debris re-entry rates on reasonable variations in PERSIST's and PREVENT's governing uncertainties. In addition, the effect of these variations in uncertainty will be compared against two debris mitigation philosophies, namely Active Debris Removal (ADR) and Just-In-Time Collision Avoidance (JCA). This analysis highlights the relative importance of refining collisional breakup models, orbital decay algorithms, derelict characterization, vulnerability analysis of operational satellites to debris impacts, space launch traffic model robustness, and other physical parameters. This approach will produce priorities for future work in these research areas.