SPACE DEBRIS SYMPOSIUM (A6)
Poster Session (P)

Author: Dr. Camilla Colombo
University of Southampton, Italy

Dr. Hugh G. Lewis
University of Southampton, United Kingdom
Ms. Francesca Letizia
University of Southampton, United Kingdom
Ms. Stefania Soldini
University of Southampton, United Kingdom
Dr. Massimiliano Vasile
University of Strathclyde, United Kingdom
Mr. Massimo Vetrisano
University of Strathclyde, United Kingdom
Mr. Willem van der Weg
University of Strathclyde, United Kingdom
Prof. Colin R. McInnes
University of Strathclyde, United Kingdom
Dr. Malcolm Macdonald
Advanced Space Concepts Team, United Kingdom
Dr. Elisa Maria Alessi
IFAC-CNR, Italy
Dr. Alessandro Rossi
IFAC-CNR, Italy
Dr. Linda Dimare
Space Dynamics Services s.r.l., Italy
Dr. Markus Landgraf
European Space Agency (ESA), Germany

END-OF-LIFE DISPOSAL TRAJECTORIES FOR LIBRATION POINT AND HIGHLY ELLIPTICAL ORBIT MISSIONS

Abstract

Libration Point Orbits (LPO) and Highly Elliptical Orbits (HEO) are often selected for astrophysics and solar terrestrial missions: Herschel, Planck and Soho are currently operating in Sun-Earth LPO, Integral and XMM-Newton in HEO, and future missions are under consideration, such as Gaia, Euclid and Proba 3. LPO and HEO offer vantage points for observation of the Earth, Sun and the Universe. Orbits around L1 and L2 are relatively inexpensive to be reached from Earth and they ensure a constant geometry for observation, in addition to advantages for telecoms and thermal system design. On the other hand, HEO about the Earth guarantees long dwelling times at an altitude outside the Earth's radiation belt; therefore, long periods of uninterrupted scientific observation are possible with nearly no background noise from radiation. As current and future missions are planned to be placed in LPO and HEO, it becomes critical to clear these regions when a mission is no longer active.

In this article an analysis of possible disposal strategies for such missions will be presented as a result of an ESA/GSP study. End-of-life disposal options considered for LPO and HEO exploit the multi-body perturbed dynamics in the Earth environment and in the Sun-Earth system. Moreover, a high accuracy approach is used for validating the optimised trajectories. For Earth re-entry options an analysis on the probability of collision with objects orbiting in the protected regions will be given. The proposed disposal strategies will be comparatively assessed in terms of cost, safety and sustainability. Existing and future planned missions will be used as test case scenario. Finally, general recommendations will be drawn in terms of system requirements and mission planning.