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CURRENT PRACTICES IN IMPLEMENTING MITIGATION MEASURES FOR LEO MISSIONS

Abstract

The major driver for future debris proliferation, besides the (un-)intentional release of objects, is the abundance of objects with large masses and sizes in orbit that could be involved in catastrophic collisions. Mitigation measures thus concentrate on the prevention of object release (explosions, mission-related objects, SRM (Solid Rocket Motor) exhaust products), the disposal of objects, and on active collision avoidance. This paper will display the efficiency of the various mitigation measures by their effect on long-term artificial objects environment simulations using ESA's DELTA software.

To further understand the contribution of the various mitigation techniques on the preservation of the environment, this paper will analyse to which degree these practice are implemented in a global view. For this purpose, ESA has developed a method to determine the operational status of running missions, by monitoring their manoeuvre activity with the help of the publicly available orbit data distributed by the US Strategic Command (USSTRATCOM). Missions that have been identified as having terminated their operational life will be processed to determine their remaining orbital lifetime. The available manoeuvre patterns will also be analysed to detect potential end-of-life re-orbiting. Objects released by these missions will be analysed w.r.t. their nature (mission related release, fragmentation debris) and considered in this analysis. A time frame of at least 15 years will be analysed to uncover potential trends in adhering to the recommended mitigation measures. The results will be presented in a statistical manner.

Based on these results, the environmental impact of the disposed upper-stages and spacecraft will be evaluated with a simple scheme. Attempts will be made to reveal potential trends in the cumulated environmental impact over the analysed time frame. Finally, the current level of adherence to guidelines shall be used as input assumption to a simulation of the future evolution of the environment of artificial objects.