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Mitigation and Standards: status, lessons learnt and future with smallsats and constellations (4)

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SPACE DEBRIS: ANALYSIS OF A LARGE CONSTELLATION AT 1200 KM ALTITUDE

Abstract

Several private companies, including OneWeb, Boeing, SpaceX and Samsung, have recently shown interest in deploying constellations of hundreds (or even thousands) of spacecraft in the Low Earth Orbit (LEO) region. Their objective is to provide global telecommunications services and internet coverage with low latency. However, the constant growth of the space debris population pose an increasing risk to those constellations, which could contribute themselves to increase the orbital density of specific altitudes. In this work, the "Model to Investigate control Strategies for Space Debris" (MISSD), an object-species oriented model for LEO population. This source-sink statistical model was used to study the environmental impact of large constellations at 1200 km altitude with sensitivity analysis on the constellations size (varying from 250 to 1000 spacecraft) and the residual post-mission orbital lifetimes of the spacecraft. Results suggested that, both the constellations size and post-mission lifetime increased the collision risk, especially at the constellation altitude due to self-induced collisions and in lower ones due to decayed objects. Reducing the spacecraft post-mission lifetime, from 25 to 5 years, more than halved the total collisions and prevented a step increase of the inactive spacecraft population. In this case, the lower number of generated fragments decreased the total end population by 41%, while a temporary increase in the population is always observed during the activity of the constellation.