Risk of Increased Fragmentation Events due to Low Altitude Large Constellation Spacecraft

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Orbital debris experts and industry leaders agree on the added hazard that thousands of additional spacecraft would have on the future orbital debris environment. Future proposals of large constellations plan to deploy spacecraft at altitudes from 1100 to 1300 km, where fragmentation debris can take thousands of years or longer to naturally decay, while other proposals include deploying spacecraft at station-keeping altitudes from 300 km to 400 km. Although these lower altitude spacecraft are compliant with the 25-year rule, there is still an increased risk of accidental explosions generating high velocity fragments that could damage international spacecraft assets.

The NASA Orbital Debris Program Office (ODPO) has conducted a parametric study that examines the potential negative environmental impacts of large constellation deployments, ranging in altitude from 1000 km to 1300 km in low Earth orbit, by showing long-term population increase and future collision activities. This paper will address the lower altitude constellations and the potential risk that they impose on the future space traffic. The projected future environment is generated as the average of 100 LEGEND Monte Carlo (MC) simulation runs while adjusting parameters such as average probability of explosion and operational lifetime per spacecraft. This paper provides an overview of the number of accidental explosions and number of fragments generated from these low altitude spacecraft.