

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

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EFFECTS OF SPACE DEBRIS ON THE COST OF SPACE OPERATION

Abstract

Space debris is a growing problem for satellite operators, but what will the effect of the increasing number of manmade debris objects on our satellite infrastructure? To help answer this question, a study was conducted where it was assumed that typical constellations of government and commercial satellites were put into space in 2010, 2020, and 2030 and maintained at full strength for 20 years. Satellite designs for each constellation type were based on typical practices for commercial and government satellites. The constellations were placed at an altitude of 850 km, with orbits inclined at 98 degrees, worst-case conditions from the debris flux perspective. Fluxes for 1 mm, 1 cm, and 10 cm particles at this altitude for the next 50 years were estimated based on the current launch history and assuming two energetic satellite collision events in this altitude range over each 10-year period. Spacecraft in each constellation were replaced when power from solar panels degraded below a nominal threshold due to small particle impacts, when critical components were penetrated by 1 cm fragments, and when satellites were destroyed by collisions with larger objects. The analysis estimated the costs of replacing satellites of each type to maintain the constellations and also enabled an assessment of the effectiveness of a satellite collision avoidance service that would prevent collisions of operating satellites with 10cm and larger objects in reducing costs. The analysis includes estimates of the number of collision avoidance maneuvers per year required by each satellite.