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# TRACKING REQUIREMENTS FOR SPACE TRAFFIC MANAGEMENT IN THE PRESENCE OF PROPOSED LARGE LEO CONSTELLATIONS

**Abstract**

Multiple constellations of large numbers of satellites are being proposed for low Earth orbit in the near future. SpaceX, OneWeb, Boeing, LeoSat, Theia, and others are proposing constellations that may include hundreds to thousands of satellites. While these large LEO constellations (LLCs) are currently planned to reside in distinct, well-defined altitudes, they could affect smaller operators during disposal and replenishment. One major concern for these LLCs, and for the space community in general, is the large number of collision alerts that will be generated by a space traffic management (STM) system as these satellites are operating and disposing. Previous studies performed by the authors have shown that over the long term the LLCs can be expected to generate approximately 1 collision per year for the operational satellites and another approximately 2 collisions per year for the disposed satellites (depending upon the disposal profile and disposal success rate). However, these same studies show that the number of collision alerts could be on the order of thousands of alerts per day each depending upon the threshold violation criteria that is selected. The goal of any STM system is to identify those few collisions that are going to occur (and hence avoided) without generating an excessive number of false alerts. The current study models the future orbital environment using the Aerospace Debris Environment Projection Tool (ADEPT) accounting for debris and satellite growth based on different levels of space activity. The resulting environments are used to determine the trade-off between the level of tracking and the number of false alerts for an actively managed STM system. The constellations examined consist of the aforementioned SpaceX, OneWeb, Boeing, LeoSat, and Theia, and the currently operational Iridium Next, Globalstar 2, and Orbcomm 2. Preliminary results indicate that it is not sufficient to reduce the uncertainty on the primary (LLC) satellites only, but rather that improvements are necessary for all catalogued objects. The effect of proposed tracking systems will also be examined. Understanding the relation between tracking and alerts is crucial in developing requirements for a useful future STM system.