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PRELIMINARY ANALYSIS OF TWO YEARS OF THE MASSIVE COLLISION MONITORING ACTIVITY

Abstract

It is hypothesized that the interactions between many of the most massive derelicts in low Earth orbit are more frequent than modelled by the traditional combination of kinetic theory of gases and Poisson probability distribution function. This is suggested by the fact that there are clusters of derelicts where members' inclinations are nearly identical and their apogees/perigees overlap significantly resulting in periodic synchronization of the objects' orbits. In order to address this proposition, an experiment was designed and conducted over the last two years. Results from this monitoring and characterization experiment are presented with implications for proposed debris remediation strategies. Three separate clusters of massive derelicts were examined that are centered around 775km, 850km, and 975km, respectively. In aggregate, the constituents of these clusters contain over 400 objects and 650,000kg of mass; this equates to a third of all derelict mass in LEO. Preliminary analysis indicates that encounter rates over this time period for these objects are at least 30-40 percent greater than is estimated by traditional techniques. Hypothesized dependencies between latitude of encounter, relative velocity, frequency of encounters, inclination, differential semi-major axis, and walk-in closure rate were established and verified. This experiment also identified specific repeatable cluster dynamics that may reduce the cost/risk of debris remediation activities and enable new remediation operational options while enhancing their effectiveness.