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

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ORBITAL PROPAGATOR: REFINED ORBITAL PROJECTIONS OF A SUBLIMATING ICE PARTICLE

Abstract

The behavior of ice particles generated by venting liquid waste in low Earth orbit (LEO) is very complex and depends on numerous factors. Previous analysis performed by the International Space Station (ISS) Program Integration Office has shown that frozen particles generated at ISS altitude and inclination may survive long enough to pose a significant threat to other spacecraft in lower orbits. Sensitivities to atmospheric parameters, physical characteristics of the particle and initial velocities significantly compound errors in final calculations thus it is important to bound the uncertainty of each parameter and provide comprehensive treatment of all factores to reduce the cumulative uncertainty of the model. This paper discusses the architecture and initial results of a new ice particle propagation forecasting tool developed by the ISS Program Integration Office in response to these changes. This tool predicts the varying ballistic characteristics and rapid altitude decay in a precise density profile considering the sensitivities to particle characteristics, geographic location, local altitude, as well as daily and long term solar and geomagnetic parameters. It also provides an analytical method to identify the predicted range of altitudes and phase angles of a vented stream of particles, such that planned ventings can be timed to preclude contamination of vehicles in coplanar orbits or prevent the intersection of vented particles with any spacecraft in a crossing orbits below the vent.