23rd IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Interactive Presentations - 23rd IAA SYMPOSIUM ON SPACE DEBRIS (IP)

Author: Dr. Patrick Kelly
The Aerospace Corporation, United States

Mr. Greg Henning
The Aerospace Corporation, United States
Mr. Juan Maldonado
The Aerospace Corporation, United States
Mr. Dominick Bologna
The Aerospace Corporation, United States

PROJECTIONS OF THE LUNAR DEBRIS ENVIRONMENT: LUNAR POPULATION AND LONG-TERM ORBIT MODELING

Abstract

The anticipated population of resident space objects in the lunar vicinity is expected to grow considerably in the coming decade. This emergent cislunar initiative presents several challenges with regard to space object tracking, collision avoidance, and mitigation and disposal policy; each of which have far reaching implications on the sustainability of cislunar space operations. In contrast to near-Earth space, our understanding of these effects is comparatively limited for the lunar environment. Building on the capability of the Aerospace Debris Environment Projection Tool (ADEPT), this paper presents developments on a new lunar debris environment prediction methodology. Using data from current and future forecasted missions, a lunar population model is developed, and its long-term behavior is simulated over extended propagation intervals of several decades using multiple lunar propagators. Conjunction statistics are generated by Monte Carlo using representative disposal and launch traffic rates for each propagator. The performance and predictive capability of each propagator is assessed by comparison to results obtained from high-fidelity simulation. In the absence of empirical data for conjunction rates in the lunar vicinity at anticipated population densities, this work aims to inform us on how various practices may affect the sustainability of space operations in the cislunar environment.