

SPACE DEBRIS SYMPOSIUM (A6)
Mitigation and Standards (4)

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DEBRIS CREATION IN GEOSTATIONARY TRANSFER ORBITS: A REVIEW OF LAUNCH
PRACTICES 2004-2012

Abstract

Objects left in Geostationary Transfer Orbit (GTO) pose a threat to operational satellites in Low Earth Orbit (LEO) and Geostationary Earth Orbit (GEO). In addition to regularly crossing both of these belts at high relative velocities, objects in these orbits are often large in size and mass (i.e. upper stages, fuel tanks and payload adaptors). Each successful satellite launch to GEO can generate 1-4 large pieces of debris (dependent upon the launch vehicle), a significant portion of which is left in transfer orbits that do not decay.

This paper analyses the past practices of all launch vehicles that placed satellites in GEO from 2004-2012. The orbits of the 294 pieces of debris that were identified are discussed further in depth with reference to their threat to the Low and Geostationary Earth Orbits and the likelihood of their decay in 25 years as per international guidelines. Results are grouped for each of the 17 distinct launch vehicles used, and rankings of launch vehicles with regards to the amount of intentionally created debris are developed.

Furthermore, the physical mechanisms with regards to orbital decay are investigated in order to ascertain the impact of various orbital parameters on re-entry time. The European Space Agency's (ESA) Debris Risk Assessment and Mitigation Analysis (DRAMA) tool specifically is used to conduct Monte-Carlo analyses on nominal upper stages in GTO.