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PRACTICAL AND LEGAL CONSEQUENCES OF SPACECRAFT END OF LIFE DISPOSAL

Abstract

IADC guidelines and resulting normative implementations include that satellites in the low Earth orbit (LEO) protected region be removed within 25 years of mission end, and those in the Geostationary Earth orbit (GEO) protected region be removed at end of mission to an orbit from which the protected region would not be breached for 100 years. The necessity or the procedure of disposing obsolete satellites from other orbits has not yet been addressed, particularly on the regulatory level.

Safe disposal includes depleting spacecraft energy in all forms such as remaining propellants, batteries, flywheels, and momentum wheels. Dissipating energy changes the orbit. Maneuvers must be coordinated with passivation and avoiding encounters with resident spacecraft and debris. This is a complex choreography that has a reasonable probability of failure even if each contributing element enjoys high probability of success. For example, unanticipated collision avoidance may deplete propellants to the extent that further maneuvers are infeasible. Energy stores must be reserved to control the descent. If further maneuver is infeasible, potential subsequent encounters could have explosive consequences. Unanticipated strong solar activity might facilitate disposal through increased drag or unexpected long periods of low solar activity might render propellant stores inadequate for normative disposal. Operators might exploit the latter to plan disposal during high solar activity, which requires less energy, while anticipating low solar activity and knowingly making safe disposal less likely.

This paper will examine the operational and legal consequences of satellite disposal from Earth orbit and will demonstrate the vulnerabilities of safe disposal, demonstrating how it might be compromised despite exquisite diligence and best intentions. The paper will also study the legal consequences of such events, exploring application of the Liability Convention, issues surrounding joint and several liability, and possible alternatives for the mitigation of sanctions if disposal is not conducted in the expected or planned manner.