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A REVIEW OF PROPULSION METHODS FOR CONTACT CAPTURING END-OF-LIFE
SATELLITE DISPOSAL TECHNOLOGY

Abstract

The present study is a continuation of previous research on On-Orbit Servicing as part of the Space Generation Advisory Council's Space Safety and Sustainability initiative. Satellite safety is at significant risk due to space debris's rising population. Currently, approximately 58% of satellites in orbit constitute defunct satellites. On-Orbit Servicing is expected to minimise the risks of satellite collisions, which could produce more debris and spur a chain reaction of collisions, by actively removing space junk or reducing its growth rate. The latter approach is supported through Mission Life Extension and was covered in the prior studies as part of this initiative. The research discussed herein focuses on End-of-Life, a different type of On-Orbit Servicing mission that aims to remove derelict satellites from congested orbits using a servicer spacecraft. Particularly, the feasibility of satellite disposal through contact capturing with a client satellite and the subsequent towing for removal are studied. This paper is a technical analysis of disposal methods that include de-orbiting or manoeuvring a client satellite into a graveyard orbit, including an investigation into the feasibility of a reusable servicer spacecraft. The analysis is conducted for satellites that operate in the Low Earth Orbit (LEO) and Geosynchronous Earth Orbit (GEO) regions. After the most viable disposal method is suggested for satellites in both orbits, further analysis is undertaken to conclude whether mass-efficient electric propulsion or conventional chemical propulsion is preferred for every mission profile. In addition to the technical study, economic and legal aspects related to the implementation of End-of-Life services are discussed.