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ELSA-D: OPERATIONAL PRACTICE FOR END-OF-LIFE MISSIONS

Abstract

The ELSA-d (End-of-Life Services by Astroscale - demonstration) mission, launching in 2020, promises to be a major step forward in proving technology necessary for Rendezvous and Proximity Operation (RPO), capture, and removal of orbital debris. As the world's first commercial demonstration of Active Debris Removal (ADR) which goes through core operational phases of a realistic ADR mission (client search, rendezvous, capture and de-orbit), the mission sets a precedent for operational practice in ADR missions.

ELSA-d will consist of two satellites launched together – a servicing satellite that will perform the RPO and capture and a small client satellite that will serve as a model for a piece of orbital debris. After launching together, the two satellites will repeatedly separate and dock in orbit, each time showcasing a different capability that will be applicable to the commercial market. The servicing satellite will be equipped with rendezvous guidance, navigation, and control (GNC) technologies and a magnetic docking mechanism, whereas the client has a Docking Plate (DP) which enables it to be captured.

This paper will address three areas. Firstly, the paper will introduce operational preparation and procedures for the mission. ELSA-d will demonstrate semi-autonomous capture of both non-tumbling and tumbling clients, the latter being novel in the space environ-ment. Tumbling capture is operationally complex and the preparations for this phase will be presented.

Secondly, the paper will address the Collision-Avoidance Manoeuvre (CAM) philosophy on the mission and how in practice this func-tion works. An area of interest in the future is autonomous collision avoidance. We will explain how ELSA-d is a stepping stone opera-tionally towards this capability.

Finally, the paper will present some novel operational practices and functions considered for the post-demonstration phase of the mission including attitude controlled drag adjustment.

The capabilities stemming from ELSA-d, and the knowledge gained through operational periods,

will lead to safe and effective solu-tions to maintain a sustainable global space environment and thus accessibility of LEO in the future.