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TOWARDS COMMERCIAL ADR SERVICES: THE ELSA-M MISSION

Abstract

The rise of large commercial satellite constellations in low Earth orbit (LEO) will provide services that improve quality of life on Earth. They will also lead to an increase in the number of objects in key orbits, raising the risk of further debris creation and threatening the very services space systems provide. Strategies for post-mission disposal are required to maintain the safe use of LEO orbits for the benefit of humankind.

Astroscale's ELSA-d mission is due to be launched in March 2021. Utilising two spacecraft, a servicer (175 kg) and a client (17 kg), launched stacked together, the mission goes through a series of dockings and undockings to mature a range of key technologies and capabilities. ELSA-d will perform key Rendezvous and Proximity Operations (RPO) demonstrations critical for future ADR missions including client search, client inspection, client rendezvous, and both non-tumbling and tumbling docking.

This paper considers the design of Astroscale's next generation vehicle called ELSA-M (where "M" stands for multi-client), which has been under development for well over 2 years, partially under the ESA Sunrise programme with OneWeb. ELSA-M leverages ELSA-d technology to work towards a commercial debris removal solution which can remove assets in a multi-client approach. This involves moving to the clients sequentially to dock with them, lower their orbits and drop them off for uncontrolled re-entry before moving on to the next client.

Like ELSA-d, ELSA-M uses a magnetic capture system to dock with constellation satellites prepared with a Docking Plate (DP). However, ELSA-M has both and chemical propulsion and electric propulsion; the latter needed for efficient orbital transfers between entities. ELSA-M is also designed with a range of constellation customers directly in mind, as opposed to ELSA-d which uses a smaller client to establish in orbit demonstrations of key technology.

This paper will broadly provide an overview of the concept of operations (CONOPS) and key aspects of the preliminary mission design. An ELSA-M IOD is planned in the upcoming years with a representative

customer satellite – this will be the first time a commercially developed ADR satellite would go through the full CONOPS of a removal service with a full-sized representative customer.

Keywords: end of life, active debris removal, ELSA-M, OneWeb, rendezvous proximity operations