17th IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Post Mission Disposal and Space Debris Removal (1) (5)

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THE ELSA-D END-OF-LIFE DEBRIS REMOVAL MISSION: PREPARING FOR LAUNCH

Abstract

Since the beginning of the space era, the amount of debris generated in low Earth orbit has been steadily increasing. Founded in 2013, Astroscale's mission is to provide reliable and cost-efficient spacecraft retrieval services to satellite operators in order to secure long-term spaceflight safety and achieve orbital sustainability for the benefit of future generations. Astroscale is one of the few com-panies in the world proposing to aid in the removal of orbital debris through the provision of two services: end-of-life (EOL) targeting the LEO constellations, and active debris removal (ADR) targeting existing larger space debris.

The ELSA-d (End of Life Services by Astroscale-demonstration) mission is late in its assembly, integration and test (AIT) stages and due to launch in the early 2020 timeframe. ELSA-d will demonstrate technologies for rendezvous and proximity operations (RPO) by launching a chaser satellite attached to a small target satellite, which will then repeatedly separate and dock in orbit. The chaser is equipped with rendezvous guidance, navigation, and control (GNC) technologies and a magnetic docking mechanism, whereas the target has a docking plate (DP) which enables it to be captured.

This paper will initially provide an overview of each phase of the concept of operations (CONOPS). Whereas existing space missions have performed rendezvous with cooperative targets either manually or semi-autonomously, ELSA-d will demonstrate semi-autonomous capture of both non-tumbling and

tumbling targets; the latter being novel in the space environment. ELSA-d will also demonstrate target search and inspection capabilities validating key RPO capabilities such as passively safe trajectories and absolute-to-relative navigation handover.

The paper also provides an overview of the general mission design and elements of mission production as the project progresses through AIT. The latest updates from Astroscale Japan's clean room are provided as Astroscale finalizes the vehicle for its upcoming launch.

The ELSA-d mission promises to be a major step forward in demonstrating RPO capabilities applicable to future debris removal services.