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COSMIC (UK ADR) - TOWARDS THE REMOVAL OF 2 UK-OWNED DEFUNCT SATELLITES

Abstract

Since the beginning of the space era, the amount of debris generated in low Earth orbit (LEO) has been increasing. ESA statistics show there are an estimated 130 million objects in the 1 mm to 1 cm size classed as lethal non-trackable debris (with the potential to damage key infrastructure) and more than 2,700 non-functioning satellites. Analysis has shown that stabilising the space debris population can only be achieved by maintaining high PMD (post mission disposal) rates on future constellation satellites, plus removing a set number of defunct satellites per year from orbit, termed Active Debris Removal (ADR) – the focus of this paper.

In 2022 the United Kingdom Space Agency (UKSA) committed to continue funding towards a mission to remove two defunct pieces of UK-owned debris with a multi-client removal servicer. The mission, due for launch in 2026, thus needs to capture and remove unprepared debris (satellites with no existing preparation, docking plate or servicing interface). The paper focuses on Astroscale's mission — named COSMIC (Cleaning Outer Space Mission through Innovative Capture) and its design to a PDR level. Astroscale's consortium includes 10 partner organisations including MDA, Thales Alenia Space, Nammo, GMV, Raytheon, among others responsible for different parts of the mission.

COSMIC is a variant of Astroscale's ELSA-M mission, which has been in development for 5 years under the ESA Sunrise programme, under prime OneWeb. While ELSA-M is developed to enable magnetic servicing to prepared clients, COSMIC will enable robotic servicing to unprepared clients and thus the mission requires adaptations to capture mechanism (inclusion of robotics), GNC (guidance, navigation and control) and software. The paper will explore the way in which heritage and best operational practice can be leveraged from ELSA-M (and our pre-cursor demonstration mission, ELSA-d) for this mission and

will address the mission design, concept of operations (ConOps), additional mission functionalities, and roles of partners in the consortium. In ConOps we will briefly address client selection, before exploring the operational sequencing, including rendezvousing with one client before bringing it to a lower altitude and dropping it off for uncontrolled re-entry, before orbit raising to the second client to perform a similar operation.

COSMIC promises to be one of the first, or the first institutionally funded debris removal mission to be able to capture existing debris in space, and will be a breakthrough mission in the field of ADR.