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Author: Mr. Toby Harris
Astroscale Ltd, United Kingdom

Dr. Aleksander Lidtke
ASTROSCALE JAPAN Inc., Japan
Ms. Cristina Pérez Hernández
CDTI (Centre for the development of Industrial Technology), Spain
Mr. Alexis Petit
France
Mr. Florian Delmas
Centre National d'Etudes Spatiales (CNES), France
Mr. Cassien Jobic
CNES, France
Mr. Daniel Sáez Bo
G.M.V. Space and Defence, S.A., Spain
Mr. Jorge Fonseca
Deimos Space SL, Spain

# SSA OBSERVATION CAMPAIGN OF THE ELSA-D MISSION

**Abstract**

Astroscale's ELSA-d mission, the world's first commercial demonstration of end-of-life (EOL) remediation capabilities, was successfully launched in March 2021. ELSA-d is being used to demonstrate the core technologies necessary for future active debris removal (ADR), including rendezvous and capture. The uniqueness of the mission provides an exclusive opportunity to explore both the Space Situational Awareness (SSA) demands as well as the associated operational safety and orbital coordination aspects of Rendezvous and Proximity Operation (RPO) missions.

ELSA-d consists of two spacecraft, a Servicer and a Client, initially attached together using a ferromagnet docking mechanism. The mission comprises a series of demonstrations, starting in August 2021. These demonstrations include the separation, maneuvering and capture of the Client by the Servicer through use of remote tele-commanding and autonomous on-board GNC software. The unique nature of the demonstration and availability of telemetry for both spacecraft make this an excellent opportunity to explore SST capabilities for spacecraft in close proximity. To maximize the benefit of this, several space agencies and commercial SSA service providers performed observations and measurements of the spacecraft during their activities.

This paper first considers the ELSA-d demonstration from an operator perspective, starting with details of the demonstration activities and operations. The observations performed from ground-based SSA capabilities tasked to observe the demonstrations are then discussed. SSA capabilities from a variety of sources and using several instruments, such as radar and optical telescopes, were involved in the observation campaign. An analysis of the observations and data, including fusing data sources and comparing to ground-truth data provided from ELSA-d telemetry are presented. Finally, conclusions on key areas of future SSA development that are essential to support future RPO missions, and underpin developing on-orbit servicing missions, are then considered.