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Space Debris Detection, Tracking and Characterization - SST (1)

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ON-ORBIT SSA: BESPOKE AND MULTI-PURPOSE OPTICAL SENSORS TO SUPPORT IN-ORBIT SERVICING

Abstract

Astroscale is developing capabilities to address and mitigate the risk associated with space debris through a number of On-orbit Servicing (OOS) techniques including Active Debris Removal (ADR), Life Extension (LEX) and End-Of -ife (EOL). These activities rely on space situational awareness (SSA) in order to be conducted safely and effectively, but they themselves also facilitate the use of sensors on orbital platforms to conduct on-orbit SSA (OSSA) observations. OSSA has potential to enable a range of observations not possible from the ground, with the capabilities to characterise objects in new ways. This paper aims to provide an overview of optical cameras' applications to OSSA observations.

Astroscale's spaceborne platforms offer the opportunity for a number of optical OSSA observations that ground-based sensors cannot achieve. Spaceborne imagers can observe objects from significantly shorter ranges than ground-based telescopes, allowing detailed characterisation of a range of properties. Favourable observation conditions with no atmospheric interference, indifference to weather, and the potential for observation durations exceeding ground-based best-cases can extend the number and type of objects that can be observed and improve the possible analyses.

Some OSSA observations can be conducted with RPO (rendezvous proximity operations) sensors – whose primary purpose is to support RPO and OOS activities – effectively extending the utility of essential hardware. Other OSSA observations require dedicated instruments with abilities such as sensitivity to faint objects, or multispectral imaging. Astroscale is therefore working to understand the OSSA capabilities of a range of different sensor setups, including 'flexible use sensor payloads' which utilise a combination of RPO and dedicated bespoke ISSA sensors, in order to develop capabilities to support and enhance future IOS missions.

This paper introduces some key areas of OSSA, describes their benefits to OOS and discusses their technical challenges. The technical requirements that optical cameras must meet to address these objectives is discussed, along with physical limits on observation capabilities. Additionally, some concept sensor architectures have been studied and are presented.

Keywords: SSA, IOS, space-based, SBSS, RPO