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Mitigation - Tools, Techniques and Challenges - SEM (4)

Author: Ms. Harriet Brettle
Astroscale Ltd, United Kingdom, h.brettle@astroscale.com

Ms. Rosemary Linehan
Astroscale Ltd, United Kingdom, r.linehan@astroscale.com

Mr. Neil Yarr
Astroscale Ltd, United Kingdom, n.yarr@astroscale.com

Mr. David Gentles
Astroscale Ltd, United Kingdom, d.gentles@astroscale.com

Mr. Gediz Hussein
Astroscale Ltd, United Kingdom, gediz_hussein@live.co.uk

Mr. Mark Brown
Astroscale Ltd, United Kingdom, m.brown@astroscale.com

Dr. Jason Forshaw
Astroscale Ltd, United Kingdom, j.forshaw@astroscale.com

Dr. Yijun Xiao
Astroscale Ltd, United Kingdom, y.xiao@astroscale.com

Ms. Morgane Lecas
Astroscale Ltd, United Kingdom, m.lecas@astroscale.com

FUTURE-PROOFING LEO MISSIONS WITH DOCKING PLATES

Abstract

Space debris poses a direct threat to the future of space activity, leading to higher risks, increased costs and potentially unusable orbits. As space becomes busier and critical orbits become crowded, there is a pressing need to remove debris from orbit and ensure responsible use of the space environment.

There is an urgent need to ensure future satellites can be safely decommissioned. The complexity, and therefore cost, of satellite decommissioning may vary dramatically depending on the asset's health and capabilities at end of life. In practice, satellites are not always decommissioned and can remain in critical orbits indefinitely.

A key challenge associated with debris removal is that satellites historically have not been designed with decommissioning in mind, rendering debris removal services more complex and costly. One practical method of enabling remediation is to ensure that all LEO satellite systems are prepared for future servicing. Incorporating docking plates before launch allows satellites to be retrieved when needed to be de-orbited safely (at end of life or in case of failure). Docking plates are a simple, low-cost, "bolt-on" solution that can mitigate further, higher costs at end of life.

Astroscale's first generation docking plate will be flown and demonstrated in orbit as part of the ELSA-d mission that launches in March 2021. This paper presents the distinctive features on the docking plate that make a defunct satellite easier to identify, capture, and de-orbit, thus minimizing future costs of removal. In addition, this paper presents Astroscale's next generation docking plate that will be designed specifically for commercial adoption by constellation customers, uses a robust supply chain to enable high volume production, has wide capture-system compatibility, whilst maintaining a lean, cost effective, and minimally intrusive design.

Preparing for late life operations during the design stage holistically integrates decommissioning into the space life cycle to ensure a sustainable future. However, at the present time, there is no real pressure on government or commercial satellite operators to take concrete remediation action of this type. This paper will also address such aspects and evaluate the role of governments, satellite manufacturers, and satellite operators in committing to future-proof LEO space missions by installing 'standardised' docking plates onto LEO spacecraft. This will ensure that subsequently derelict or defunct LEO spacecraft can be more easily removed by planned servicing space missions over the coming decade and beyond.