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COMMERCIAL INCENTIVES FOR DEBRIS REMOVAL SERVICES

Abstract

As the threat of space debris grows, so does the potential market for debris removal services. This paper assesses commercial incentives for satellite operators to pay for debris removal services and quantifies their willingness to pay.

The amount of orbital debris generated in low Earth orbit has been steadily increasing over the years and whilst on-orbit collisions are rare, historical trends cannot be used to infer future risk. The nature of low Earth orbit (LEO) is set to change considerably, with satellite constellations projected to launch tens of thousands of new satellites over the next decade.

As the number of satellites in key orbits increases, so does the likelihood of collision, posing a risk to the sustainability of the entire orbital environment. The challenge of space debris can be considered as a tragedy of the commons, whereby individual actors damage the shared orbital environment through their contribution to space debris, even though it is not in their long-term interest to do so.

Whilst governments and international frameworks may be able to shape the discussion, the missing enabler has been identifying commercial incentives that could address the problem. As technological solutions to address the threat of space debris become feasible, so must the commercial incentives for satellite operators to use such solutions. In addition to being an environmental concern, space debris also poses a direct threat to the service provision and safety of satellites for a given satellite constellation operator. In addition, ensuring that debris is removed from operational orbit can enable satellite operators to utilise more efficient orbits and optimise their satellite design for operational service.

This paper presents quantitative analysis justifying action by commercial satellite operators to remove failed satellites from orbit, strengthening the business case for this new market. Firstly, we will assess the value of debris removal services in removing mass and thus the potential for lethal, non-trackable (LNT) debris from the operational vicinity of the customer's system. Secondly, we assess how debris removal services can reduce an operator's capex by enabling longer satellite lifetimes. Thirdly, we quantify the value to satellite operators of having access to higher orbits that give them a better satellite efficiency, with debris mitigation risks offset by third-party debris removal services. Finally, we analyse the trade-off between satellite reliability and cost, demonstrating how the consideration of third-party debris removal services can outsource end-of-life capabilities to third-party debris removal services.