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TOWARDS A FUTURE DEBRIS REMOVAL SERVICE: EVOLUTION OF AN ADR BUSINESS  
MODEL**Abstract**

The amount of orbital debris generated in low Earth orbit has been steadily increasing over the years. Recently, the rise of plans for large satellite constellations in low-Earth orbit (LEO) means that the number of satellites in key orbits will increase at a much higher rate than today, raising the likelihood of collision. This poses a risk to the sustainability of the entire orbital environment.

In-orbit collisions are low-probability, high-impact events which makes them difficult to risk-mitigate. 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.

The paper will describe the key components of a commercial active debris removal service including: customer identification, developing the business case, and quantifying the value of a debris removal service to end-users.

This paper will first evaluate and identify potential customers for a debris removal service. We identify satellite operators that plan to launch hundreds of satellites into LEO as prime customers given their potential contribution to future space debris and their aligned incentives in maintaining their orbital environment. There are also many other actors in the satellite value chain that have a vested interest in maintaining the orbital environment. In this paper we will also consider the small satellite operators, national agencies and the insurance market as possible users of active debris removal services, and articulate why the incentives might be aligned for them to do so.

This paper will present quantitative analysis justifying action to remove failed satellites to maintain the orbital environment. We will evaluate the financial value of a debris removal service including quantifying: lost revenue from satellite failures, reputational risk of creating space debris, cost of collision avoidance manoeuvres, and other relevant factors.