

Economic Incentives in Space: The Offset Market Solution to Space Debris

Authors: M. Wills – Sustain Space, S. Wills – Sustain Space, Z. Liao – Cranfield University, M. Spaeth – Earthdaily, Dr N. Garzaniti – Cranfield University

Executive Summary

This white paper is written to discuss a Debris Offset Market as an incentivised market for funding the remediation of space debris.

The space environment is becoming increasingly congested with space debris and operational payloads, posing greater risk to its continued use for humanity's benefit. Whilst the space industry is fully aware of its impact, the mechanisms to protect its future sustainability and profitability aren't agreed and the timescales on which to act are decreasing. There is already economic impact from space debris and this will only increase if not enough is done to remedy it.

Space debris is a problem akin to other environmental problems, such as plastic pollution and global warming. Offset markets are already established in the carbon market and they have seen significant growth and investment toward reducing the effect of humans on our environment and developing technology to limit our pollution. There are concerns as to the 'greenwashing' of these markets, but a space offset market would be tackling an eminently more trackable problem. Applying lessons learned from other environmental markets can create a transparent and trustworthy means of funding remediation of space debris.

There are currently around 8,500 operational and 2,000 non-operational satellites in orbit, and already conjunctions and collisions are an issue. Estimates vary but some predict there could be as many as 60,000 satellites in orbit and this could potentially lead to a further increase of 2,340 non-operational satellites left orbiting Earth as debris.

In this paper we demonstrate that through the LEO market alone a debris offset fund could have raised enough money in 2021 to remove 3 high risk debris objects, whilst only costing approximately 0.9% of the LEO satellite market revenue for that year. This would have kick-started the growth of active debris removal missions and significantly increased the speed with which capacity could be built. Subsequent years would be able to fund higher numbers as the space market grows and remediation costs reduce. We therefore argue for the creation of an offset market as soon as possible to at least start the catch-up.

The process for a space operator to offset their direct impact on the environment would involve assessing their current sustainability levels before calculating their likely debris contribution. This would be combined with an average cost of debris removal, based upon debris removal companies' estimates, which produces an offset cost. Through purchasing an offset, an operator would be granted the means to vote on which debris are removed from space, as well as benefit from government incentives to act sustainably. This would therefore provide risk based and financial incentive to offsetting. The offsets are collected into

a trust that is then used to fund debris removal missions to remove the targets posing highest risk and voted on by those that paid to offset themselves.

This paper goes on to discuss challenges and solutions to the market, such as investment in the regulation and technology to deliver debris removal missions. An offset market serves to provide incentive for investment as it represents a pool of cash to be won by those able to deliver cost effective debris remediation. This incentive to develop the technology and regulation currently does not exist, or relies on offshoots from other markets, and until the remediation market is economically viable the achievement of space sustainability will remain distant.

Finally, a roadmap to market realisation displays a route to operation by 2030. Whilst later than ideal, this is seen as an achievable date and would help the industry build ADR capacity to address the debris issue before it is too late. The implementation of an offset market has the potential to provide significant economic and social impact and, alongside mitigation practices, enables true space sustainability through remediation of our debris.

For the full whitepaper, please email:

matt.wills@sustain-space.com