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Policy, Legal, Institutional, Economic and Security Aspects of Debris Mitigation, Debris Remediation and
STM (8-E9.1)

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A COST AND BENEFIT ANALYSIS OF ORBITAL DEBRIS REMEDIATION, MITIGATION,
TRACKING, AND CHARACTERIZATION

Abstract

Orbital debris poses a growing risk for spacecraft operations. This risk has most often been measured by proxies, like the number of debris or expected collisions, but few have attempted to quantify the consequences of orbital debris or the costs and benefits of different methods to address the problem. This has made it difficult to assess the trade-offs and relative value among proposed actions for the mitigation, tracking, and remediation of debris.

In March of 2023, the NASA Office of Technology, Policy, and Strategy (OTPS) took a step toward quantifying these relative values when we released Cost and Benefit Analysis of Orbital Debris Remediation. Since that time, OTPS has continued to build on this work. We have increased the fidelity of our risk model. For example, we added an ensemble of risk models that use varying assumptions of debris populations and lethality, included debris as small as 1mm, and incorporated atmospheric drag to naturally deorbit debris. We have also expanded our cost-benefit calculations to include action that mitigate and track debris, both large and small. The analysis has several important findings regarding the conditions under which debris remediation is more cost-effective than mitigation and tracking, the value of increased shielding of spacecraft and faster timelines for post-mission disposal, and how changes in the portfolio have interdependent effects. This presentation summarizes the body of work, with a particular focus on the risks and benefits to the global spacecraft population.