Design of an Orbital Debris Remediation System

Benjamin Noble, Yahya Almanee, Abdulelah Shakir, and Sungmin Park

George Mason University

Corresponding author's Email: bnoble2@masonlive.gmu.edu

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Abstract: The space environment, with over $200 billion in annual revenue, is threatened by the risk of orbital debris. The population of potentially dangerous objects has risen 124% over the past 10 years, thus increasing the risks and costs associated with spaceflight. This paper studies seven major Active Debris Removal (ADR) designs, four grappling and three de-orbiting. These designs are evaluated via a utility analysis with attributes of performance, risk, political viability, and technology readiness level, the first three of which are further rigorously decomposed. The EDDE design has a high utility of 5.92 but has a cost of $500,000. If costs could be reduced by 50%, then EDDE becomes a competitive design. The harpoon, with a utility per dollar of 72, dramatically outperforms the other designs. A plan for deployment and implementation of the selected ADR method is described, with focus on business case feasibility.

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