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SPACE DEBRIS SYMPOSIUM (A6)
Mitigation and Standards (4)

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GROUND-BASED LASER: THE OPTIMAL SOLUTION FOR INITIAL SPACE DEBRIS REMOVAL

Abstract

Human activities in space over the past fifty years have produced a large and potentially dangerous debris field in Earth orbit. While numerous technologies have been proposed for a full scale clean-up of the space environment, the practical implementation of a debris removal system remains to be realized. The purpose of this project is to present a feasible debris mitigation solution without losing sight of the balance between technological and economic concerns as existing proposals have. The team examines the current space debris environment and its impact using MATLAB simulations, performs a comparative analysis on proposed technologies, calculates the initial requirements for debris removal, and addresses the market potential value in developing a removal system.

It was found that a partial space clean-up using a ground-based laser system is the optimal solution. Therefore, a 20.8 kJ 1Hz solid-state neodymium glass ground-based laser system is proposed. This high power laser will target 1-10cm (diameter) debris traveling at altitude range of 300-400km within Low Earth Orbit region. The concept of laser photoablation is used to redirect the orbital path of the debris back into the atmosphere. A system operating at 1.062 micron wavelength and 2ns pulse duration is predicted to provide a required delta-v of 0.368 km/s to reduce the perigee of the targeted debris for reentry. While the laser system would need to be built, the technology behind the system is completely feasible and economical, as it has already been used on multiple preexisting systems. Thus, the implementation of the laser system may potentially serve as the first step towards developing of a fully realized space debris removal system.

This statement is to certify that the paper was not presented at a previous meeting and assure that financing and attendance of the author at the IAC at Daejeon to present the paper is assured.