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SPACE DEBRIS SYMPOSIUM (A6)
Space Debris Removal Concepts (6)

Author: Mr. Joao Lousada
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, jmclousada@gmail.com

Mr. Niels van der Pas
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), The Netherlands, niels.vanderpas@gmail.com
Mr. Marc Bernabeu
Deutsches Zentrum fur Luft- und Raumfahrt e.V. (DLR), Germany, marc.bernabeu@dlr.de
Mrs. Claudia Terhes
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, claudia.terhes@dlr.de
Mr. Waldemar Bauer
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, waldemar.bauer@dlr.de

AN OVERVIEW AND EVALUATION OF ACTIVE SPACE DEBRIS REMOVAL CONCEPTS

Abstract

Since the first spacecraft was launched, orbital space (i.e. LEO) has become a busier place. Many nations and commercial enterprises have launched their own spacecrafts in orbit around Earth, and many are still in orbit. Only 6% of the manmade objects in space are still operational, while almost 60% are fragments of explosions and collisions. These uncontrolled fragments, e.g. rocket bodies and retired satellites, can collide with each other and form more debris, which forms a large risk for operational satellites. This can lead to the cascading effect which is also popularly known as "the Kessler syndrome". After a critical point, the space debris population will grow exponentially. Simulations have shown that even without future launches this situation is now unavoidable and the debris field will still continue to grow caused by collisions of already existing debris in orbit. With regular launch rates and no mitigation measures, the debris field would become more and more dangerous for future missions. Thus, an active removal of current debris is of crucial importance.

The Advanced Study Group (ASG) is an interdisciplinary student group working at DLR, serving as a "think tank". Its main tasks include the collection of existing ideas and an analysis of their innovative content, as well as the development of new ideas into sustainable concepts The focus of the ASG's last study was to analyse existing methods and innovative ones for active space debris removal.

The focus of this paper is an overview of the existing concepts proposed for active space debris removal and the presentation of the ASG own generated ideas for this problem. Furthermore, a model for evaluating active debris removal concepts is presented. This entailed defining a set of parameters of both technical and financial aspects and a weighting matrix according to the importance of each evaluation parameter. Finally this evaluation model is applied to existing and ASG generated concepts and the results are presented.