 Paper ID: 22566

SPACE DEBRIS SYMPOSIUM (A6)
Poster Session (P)

Author: Mrs. Susanne Peters
Universität der Bundeswehr München, Germany, susanne.peters@unibw.de

Dr. Hauke Fiedler
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, hauke.fiedler@dlr.de
Prof.Dr. Roger Förstner
Universität der Bundeswehr München, Germany, roger.foerstner@unibw.de

MISSION CONCEPT FOR MULTI SPACE DEBRIS REMOVAL

Abstract

About every space-faring nation has accepted space debris being a serious problem for future space missions. Due to on-going launch activities and objects which are not designed to de-orbit within a decent timeframe, favorable orbits like the sun-synchronous ones become crowded with debris such as e.g. non-functional satellites or rocket bodies. These objects are likely to collide, to increase the debris density, and, hence, pose a growing critical threat to current missions. Avoidance maneuver can be performed in limited cases, but eventually, this issue will end in difficult-to-use orbits which again will restrict satellite availability and, consequently, restrict the standard of living that people are used to today due to well-functioning satellites.

Active Debris Removal (ADR) is one possible contribution to solve this problem. Along with post-mission disposal, ADR is capable to stabilize the space environment and to suspend the predicted cascade effect. To accomplish that, ADR has to be implemented as soon as possible. If space nations fail to clean up these orbits, space debris might become a cost-intensive challenge if not an unsolvable problem; simulations predict an acting timeframe of 20-40 years.

The idea presented of this paper is based on a multi target removal scenario. The mission consists of a main satellite (chaser) and smaller suicide-packs, which will be attached to the targets independently. The setup will be placed at a transfer orbit before the chaser starts collecting the first suicide-pack. The satellite will connect the pack with the first target, leaving them to deorbit together while it goes back to the transfer orbit to collect the next suicide-pack.

With the targets being uncooperative objects, a very high probability exists for the need to react in critical moments in short time. This includes e.g. real-time maneuvering during close approach. Therefore, the key role in this setup is the autonomy that needs to be implemented. The paper discusses the difficulty of contradictory goals, displayed by examples. Moreover, it gives an idea of the complexity necessary for the high level autonomy with respect to the whole setup. The system needs to meet requirements such as high fault tolerance, noise immunity, and independent decision-making in critical situations without direct ground station support, which is also considered in this paper.

Based on the scenario, examples for a high level autonomy are presented and discussed. At a later stage of the project, the studies will be extended to algorithms and their simulations.