

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

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VIBANASS TEST RESULTS AND IMPACTS ON KAYSER-THREDE ACTIVE DEBRIS REMOVAL
STRATEGY**Abstract**

As key orbits such as the SSO are congested by ever-increasing populations of space debris, cascading collision effects described as the Kessler syndrome are threatening to become reality. To avoid this worst-case scenario of unusable orbital regions, Active Debris Removal missions will need to be performed. For such missions, vision-based sensors are required for rendezvous, for close-range distance and attitude determination as well as for target inspection. With this in mind, Kayser-Threde has developed the VISION BASED NAVIGATION SENSOR SYSTEM (VIBANASS). For the system's qualification, a demonstrator representative of the actual flight hardware has been built and subjected to an extensive test campaign in the European Proximity Operations Simulator (EPOS).

The full VIBANASS system as verified in the EPOS tests consists of two Camera Systems, a Target Illumination System (TIS) and a Ground Operation System. The Camera Systems are made up of three cameras - one each for far-, mid- and close range operations. At close range, VIBANASS's two camera systems are operated in stereo mode. The general weakness of optical sensor systems being reliant on good illumination conditions is overcome by the laser-based Target Illumination System. The TIS is modular in design and can be configured to support mission-specific requirements on illumination power. For maximum efficiency of the Target Illumination System, the close range cameras operate only in the TIS's spectral range.

In the EPOS tests performed in early 2013, the system has been used successfully with its ground-based image processing software to automatically evaluate the distance and attitude of the target. Also, a closed-loop control algorithm has been successfully applied.

VIBANASS is a key element in Kayser-Threde's strategy for Active Debris Removal (ADR) mission preparations. Possible applications are seen in the well-known OLEV concept as well as for the ongoing

ESA studies DragON and Active Debris Removal Service (ADRS). The scope of these studies and the applications of VIBANASS are described in more detail in the paper.

VIBANASS is a Kayser-Threde development project co-funded by the German DLR Space Agency (Förderkenzeichen 50RA1001) and is carried out in cooperation with DLR-RM (DLR Institute for Mechatronics and Robotics) and DLR-RB (DLR Institute for Space Operations and Astronaut Training). Both the DragON study (led by OHB Sweden) and the Active Debris Removal Service study (led by Kayser-Threde) are funded by the European Space Agency (ESA).