SPACE DEBRIS SYMPOSIUM (A6)
Measurements (1)

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ADDITIONAL OPTICAL SURVEYS FOR SPACE DEBRIS ON HIGHLY ECCENTRIC AND INCLINED MEO ORBITS

Abstract

In the frame of ESA projects several optical surveys campaigns were performed by the Astronomical Institute of the University of Bern (AIUB) to improve the knowledge about the debris environment in the geostationary ring (GEO), the geostationary transfer orbit (GTO) region, and in the medium Earth orbit (MEO) region of the global navigation satellite constellations. For all these campaigns observation strategies, processing techniques and cataloguing procedures have been developed and successfully applied. Comparably less experience (both, in terms of actual observations and strategy definition) is available for eccentric orbits in the MEO region, in particular for Molniya-type orbits. Several breakup events and deliberate fragmentations are known to have taken place in such orbits. Different survey scenarios for searching space debris objects in highly-eccentric MEO orbits, and follow-up strategies to acquire orbits which are sufficiently accurate to catalogue such objects and to maintain their orbits over longer time spans, were developed. Simulations were performed to compare the performance of different survey and cataloguing strategies. Eventually, optical observations were conducted in the framework of an ESA study using ESA's Space Debris Telescope (ESASDT) the 1-m Zeiss telescope located at the Optical Ground Station (OGS) at the Teide Observatory at Tenerife, Spain. In addition to the ESASDT, also instruments available at the Zimmerwald observatory, such as the 1-m ZIMLAT and new 0.4-m ZimSPACE telescopes were used for additional follow-ups and surveys.

The paper will discuss the specific observation strategies and processing techniques developed for optical surveys of the Molniya region. Although the survey observations were sampling the Molniya orbit region only sparsely due to the very limited number of observation nights, a substantial number of uncatalogued small-size debris could be discovered. The follow-up observations allowed the determination of 6-parameter orbits and area-to-mass ratios which, together with the estimated magnitudes, consists the first step towards a physical characterization of this debris population. A comparison of the observation results with the number of expected objects based on ESA's MASTER-2009 model shows, that the population of objects in Molniya type orbits is underestimated in this statistical model.