SPACE DEBRIS SYMPOSIUM (A6)
Measurements (1)

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CAPABILITY OF A SPACE-BASED SPACE SURVEILLANCE SYSTEM TO DETECT AND TRACK OBJECTS IN GEO, MEO AND LEO ORBITS

Abstract

Part of the recently performed ESA study "Assessment Study for Space Based Space Surveillance (SBSS) Demonstration System" (Airbus Defence and Space consortium) consisted in investigating the capability of a space based optical sensor orbiting in LEO to detect and track objects in GEO, MEO and LEO and to determinate orbits from such observations. The primary observation mode of the proposed SBSS demonstrator is GEO surveillance, i.e. the systematic search and detection of unknown and known objects. GEO orbits are specific and unique orbits from dynamical point of view. For an efficient survey, a leak-proof GEO fence strategy has been developed. Simulations were performed to assess the performance of the proposed GEO strategies with respect to detection coverage for GEO and MEO populations, as well the accuracy of the determined orbits for GEO. These were calculated from three days long observation arcs, with one and two tracklets per day, depending on observation scenario, with tracklet length from 15 s to 2 minutes. Simulating different observation scenarios of one or two fences, as well as different declination coverage and scan speed, showed that the determined orbits can be between 10 km to less than 2.5 km in position for the majority of the simulated GEO population of 300 objects. Furthermore, an interesting result of the assessments has been that the optical sensor can be used to collect in-situ unique statistical information about small LEO debris (mm size). A considerable amount of such debris can be detected and characterized during nominal GEO survey. LEO objects can reach high apparent angular rates due the high relative velocities between SBSS and the objects and due their short ranges. Initial obit determination for such objects can be very demanding, as there is usually only one observation tracklet with a length of a few seconds available. To investigate the accuracy of the orbits determined from the short tracklets, we simulated one day of LEO-LEO survey observations in the scope of a different ESA study, dedicated to the Active Pixel Sensors capabilities. For simulations we again used ESA's program

PROOF-2009 and the MASTER-2009 population. From simulated observations, we determined initial orbits for more than 5,000 LEO objects (d ¿ 1cm). All orbits were calculated with the program ORBDET which is part of AIUB's orbit determination and propagation tool suite CelMech. The resulting accuracies were for the positions less than 54 km for more than 50