Paper ID: 28491
poster

66th International Astronautical Congress 2015

SPACE DEBRIS SYMPOSIUM (A6)
Interactive Presentations (IP)

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PASSIVE OPTICAL SPACE SURVEILLANCE SYSTEM FOR INITIAL LEO OBJECT DETECTION

Abstract

In order to avoid collisions of active satellites with space debris, the low earth orbit (LEO) must be continuously scanned. Passive and active optical observation methods can deliver high accuracy measurements to increase orbit precision. Such space debris laser ranging stations need a priori orbit information of the object in order to observe it.

The Institute of Technical Physics at the German Aerospace Center in Stuttgart runs an observatory to perform passive as well as active optical measurements to LEO objects. To detect unknown objects a wide-angle imaging system with 15 field of view and an astronomical CCD camera was designed to continuously observe the sky for LEO objects. The system is capable of detecting 25 objects per hour on observation campaigns during twilight at the observatory in city center. The position of detected objects is measured roughly without any a priori information. Thereupon the preliminary measurement is used to instantly track the object with the space debris laser ranging station. This system will allow high precision position measurements of unknown space debris objects in LEO using passive and active optical measurement.

This paper evaluates the properties of such a “stare and chase” system using measurements conducted between September 2014 and July 2015. Additionally simulations are performed with ESA PROOF software to validate the measurements and obtain system performance. The simulation indicates that the smallest detected object size is 24 cm and that 50