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SPACE-BASED SPACE SURVEILLANCE AND TRACKING DEMONSTRATOR: MISSION AND SYSTEM DESIGN

Abstract

This paper presents the capabilities of a Space-Based Space Surveillance (SBSS) demonstration mission for Space Surveillance and Tracking (SST) based on a micro-satellite platform. The results have been produced in the frame of ESA's "Assessment Study for Space Based Space Surveillance Demonstration Mission" performed by the Airbus Defence and Space consortium. Space Surveillance and Tracking is part of Space Situational Awareness (SSA) and covers the detection, tracking and cataloguing of space debris and satellites. Derived SST services comprise a catalogue of these man-made objects, collision warning, detection and characterisation of in-orbit fragmentations, sub-catalogue debris characterisation, etc. The assessment of SBSS in a SST system architecture has shown that both an operational SBSS and also already a well-designed space-based demonstrator can provide substantial performance in terms of surveillance and tracking of beyond-LEO objects. Especially the early deployment of a demonstrator, possible by using standard equipment, could boost initial operating capability and create a self-maintained object catalogue. Furthermore, unique statistical information about small-size LEO debris (mm size) can be collected in-situ. Unlike classical technology demonstration missions, the primary goal is the demonstration and optimisation of the functional elements in a complex end-to-end chain (mission planning, observation strategies, data acquisition, processing and fusion, etc.) until the final products can be offered to the users. Also past and current missions by the US (SBV, SBSS) and Canada (Sapphire, NEOSSat) underline the advantages of space-based space surveillance. The presented SBSS system concept takes the ESA SST System Requirements (derived within the ESA SSA Preparatory Program) into account and aims at fulfilling SST core requirements in a stand-alone manner. Additionally, requirements for detection and characterisation of small-sized LEO debris are considered. The evaluation of the concept has shown that an according solution can be implemented with low technological effort and risk. The paper presents details of the system concept, candidate micro-satellite platforms, the instrument design and the operational modes. The detailed results of performance simulations for space debris coverage and

cataloguing accuracy, including GEO, MEO, LEO and other orbital regions are presented in a separate paper "Capability of a Space-based Space Surveillance System to Detect and Track Objects in GEO, MEO and LEO Orbits" by J. Silha (AIUB) et al.