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TELECOMMUNICATION SUBSYSTEM FOR THE GEOSCAN SSA MISSION

Abstract

The Geostationary orbit (GEO) is important for satellite operators due to its characteristics. Satellites in GEO stay constantly above one particular place over Earth without active tracking and this advantage is well exploited by telecommunications and weather monitoring satellite operators, among others. Despite its advantages, the resident space objects (RSO) are increasing considerably due to the number of debris that have been generated and the number of spacecraft that have been sent to GEO during the last years. Additionally, the long distance between Earth surface and GEO orbit makes identification and characterization of RSO more difficult, especially for small objects. All these may pose a risk for current and future operators that rely on GEO orbit for the generation of revenues.

The GEOScan spacecraft is proposed by participants of SpaceTech Master's programme 2020/2021 by TU Graz as a potential Space Situational Awareness (SSA) commercial solution to overcome these drawbacks. The main purpose of GEOScan is to monitor and characterize the space environment in GEO orbit. Due to its advantageous position in space, it may serve different SSA purposes based on the mission requirements defined by its customers (e.g. detection and tracking, inspection, etc.).

The objective of this study is to propose a viable solution for the design and dimension of a telecommunication subsystem for GEOScan. The communication link of a spacecraft is essential in order to allow the reception of commands from the ground station and the transmission of the housekeeping and mission data. One of the main challenges of the GEOScan telecommunication subsystem is to have a robust and well established Telemetry and Telecommand (TM/TC) link in order to ensure the correct transmission of the data volume generated by the payload to the ground station. In consequence, a detailed analysis on the TM/TC link requirements and the data volume for the mission is developed together with a risk assessment of the different parameters of the subsystem. In addition to this, a relevant industrial research and assessment of European space technology providers is carried out in order to find the relevant hardware and software that can provide a suitable cost-effective and lightweight implementation for the telecommunication subsystem of GEOScan.

Keywords — Geostationary orbit, spacecraft, Telecommunication subsystem, TM/TC link, GEOScan, SSA