EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Sensors and Technology (3)

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A COMPACT AND HIGH PERFORMANCE CAMERA FOR SMALL EARTH OBSERVATION SATELLITES

Abstract

The growing interest in multispectral space imaging applications, at the same using small satellite platforms, poses very strict and challenging requirements for the optical payloads. In the frame of an ESA technology development program, aimed at addressing the growing small satellite market for Earth observation, an innovative mid-to-high resolution multispectral optical payload, named STREEGO, is under developing by Media Lario Technologies as prime, and Techno Systems Developments (TSD) for the Focal Plane Assembly (FPA) and Camera Electronics. STREEGO is characterized by a compact envelope (320 × 600 × 600 mm^3), reduced mass (<20kg.), and competitive cost. The optical design is based on a Three Mirror Anastigmatic (TMA) configuration, which adopts a 12Mpixel large two-dimensional CMOS sensor, in order to provide, at a nominal altitude of 600 km, a Swath of 11.3 km, a Ground Sampling Distance (GSD) of 2.75 m for panchromatic images and 5.5 m for multispectral images. In this paper, we describe in details the very innovative, compact, low power and high performance Camera Electronics that TSD has developed specifically for the STREEGO Payload. The original design solution allows the integration of all the electronics directly on the Telescope structure, thus avoiding the need of external electronic units and minimizing the overall Payload SWAP (Size, Weight and Power). The high performance architecture, adopts a powerful XQR5XVFX130 FPGA System-On-Chip (SOC), high speed memory chipset and data links, and provides a complete and extended set of functionalities as: detector configuration and control/synchronization, image data acquisition, re-assembly pre-processing, compression and additional on board data reduction techniques, aimed at overcoming the data downlink limitations of small satellites. The Camera Electronics consists of two sections, electrically interconnected by means of flexible PCBs: the detector proximity electronics section, located into the FPA, and the main electronics section integrated on the telescope structure, but thermally decoupled from it. The form factor of the main electronics, specifically designed for STREEGO, and its compact volume of only 262 × 216 × 25 mm^3, have a minimum impact on the overall payload envelope and the power consumption and mass of the entire camera electronics are respectively 17W and 1.5kg, thus resulting compatible also with very small satellite platform. The expected throughput is 180Mpixel/s at 10bit/pixel and 132Mpixel/s at 12bit/pixel. The FPA has been already integrated into the telescope and successfully tested, while the integration and testing of the camera electronics are foreseen within Q1 of 2016.