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BREAKING THE MOLD: A 15KG EARTH OBSERVATION MISSION

Abstract

This paper presents a concept for an optical mission in a 12U CubeSat that demonstrates the feasibility of useful, operational capabilities on a platform based on CubeSat technology, but fitting in the small satellite arena.

When one combines the CubeSat modular design, scalability and standardization and apply this to bigger form factors such as 6U and 12U satellites a highly effective small satellite system can be formed. Using this approach allows the definition of very effective platforms that can support 5-10 kg payloads. Such a platform can provide the satellite bus resources for several high performance payloads and can sustain significant duty cycles and data transfers. Furthermore the cost of these systems is an order of magnitude lower than conventional systems.

The presented concept is based around a 12U system (330x220x220 mm) with an innovative payload that can provide high quality EO data based on a revolutionary new technology. Traditionally, mirror based systems are intrinsically multispectral, much lighter and compact than refractive based ones, but still complex and costly to produce. Conventional Three-Mirror Anastigmat (TMA) systems have limited compactness, relatively slow f/number, and marginal aberration correction. Signature augmentation and/or low distortion imply aperture limitation to achieve high performance and aberration correction for TMA operating in visible becomes more difficult to attain in a compact design. The presented design overcomes the above limitations by using non-rotationally symmetric mirrors providing compact, fast aperture and high contrast optical systems at the desired spatial frequencies over multiple wavebands. Furthermore the cost of production of these optical systems is vastly reduced as they are ideally suitable for mass production.

The satellite platform is based on the next generation of CubeSat systems and provides a redundant architecture with power systems capable of ≥ 50 Wh, onboard storage and data handling of data volumes in excess of 4Gb and downlink rates in excess of 10Mbps. High performance avionics offer 3-axis pointing performance to 1deg or better. The system uses the CubeSat building blocks to create a high performance system to support an innovative payload. This provides a great example of the synergy that can be achieved when miniaturized technologies are combined into new systems with significant benefits over solutions that needs to be developed from scratch for specific payloads.