23 - LAMP: Low Altitude Modular Platform

With the advent of CubeSats, the space industry has seen a growing trend towards smaller satellites. However, this trend is less apparent for Earth observation satellites. This is due to the difficulty of scaling down instruments but also due to the lack of available high-performance small satellites. The performance of most Earth observation payloads depends on both the diameter of the aperture and the distance to the target. A smaller aperture, which is usually a consequence of scaling down an instrument, needs to be compensated by being closer to the target. Furthermore, the platform in which the instrument is placed needs to be able to comply with the pointing, volume, and power requirements of the instrument. This is something that the current 1 to 12u CubeSats cannot achieve.

Mission Objective

The objective of LAMP (Low Altitude Modular Platform) is to provide a high-performance small (27u) satellite platform which can accommodate different types of Earth observation payloads. A demonstration mission will be followed by a production of a minimum of 50 LAMPs, each of which could host different payloads or some could host the same payloads in a constellation together. The LAMP platform shall fly in Very Low Earth Orbit (VLEO) at 300 km to be closer to the observable target. LAMP will also be designed to comply with the pointing, volume, and power requirements of high-performance instruments.

System Design

LAMP will consist of an aluminium monocoque structure to which all subsystems are mounted. As the VLEO environment causes relatively high drag values, a hall-effect propulsion system is selected which uses iodine propellant, as it is denser than the traditional xenon. To provide attitude determination capabilities, LAMP is equipped with both star trackers and magnetometers. Attitude control is provided by a set of reaction wheels and magnetorquers which allow for desaturation to recover from tumbling. Guidance, navigation and control capabilities are provided by a Global Navigation Satellite System (GNSS) receiver which links to GNSS satellites using a passive patch antenna in combination with a C/A code GNSS receiver. Cooling for instruments is provided by heat pipes connected to a radiator. The radiator is protected by an Earth shield to reduce heating by the Earth's infrared. Heating for the gaseous iodine feed lines is provided by patch heaters. All subsystems are covered by multi-layer insulation to thermally isolate them from each other. The external structure is coated in white paint for better thermal properties. All internal data handling and connection to communications will be performed by an in-house developed onboard computer (OBC). Developing this in-house allows for all required interfaces to be present. The OBC contains a dedicated microprocessor for attitude determination and control operations, next to that there are 3 smaller microprocessors in charge of housekeeping and functioning as a backup in case one fails. Downlink of payload and housekeeping data is provided by an inter-satellite link using SpaceX's Starlink network. The connection is provided by a patch antenna mounted on the top side of LAMP responsible for both up- and downlink. Using Starlink gives the possibility for a live link and wide coverage throughout the orbit for sending commands.