Aspera Satellite Technical Description

Overview

The goal of the Aspera mission is to create the first maps of warm-hot coronal gas in nearby galaxies to constrain properties crucial to understanding galaxy evolution.

The satellite will be launched as the primary payload aboard a Rocket Lab Electron from Launch Complex 1 in Mahia, New Zealand, no-sooner-than January 29, 2027. It will be inserted into Sun-Synchronous circular 600 km orbit on an inclination from the equator of 97.5 degrees. Transmission will begin when a command is received from a ground station, and cease at the end of the mission in 2027. Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs about 17 years after launch. See the Orbital Debris Assessment Report for details.

The spacecraft is a single unit with deployed overall dimensions of about 1.5 m x 0.53 m x 0.4 m - see Figure 2 below. The total mass is approximately 54.5 kg.

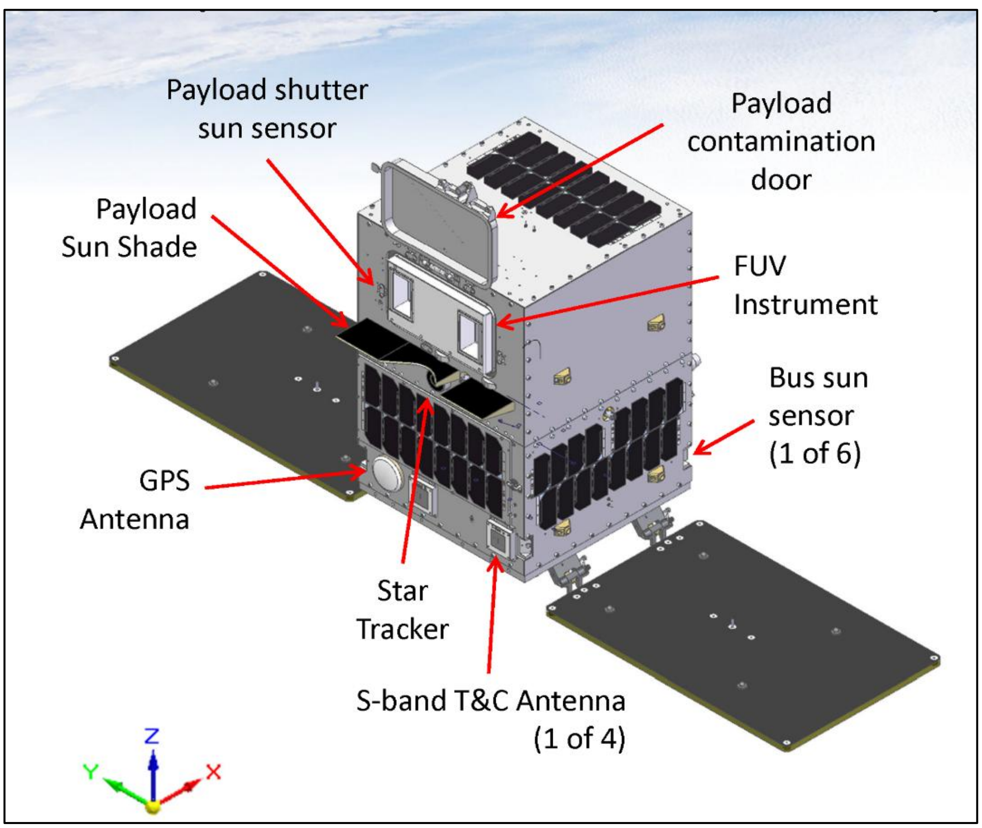

Figure 1: Aspera External Layout View 1

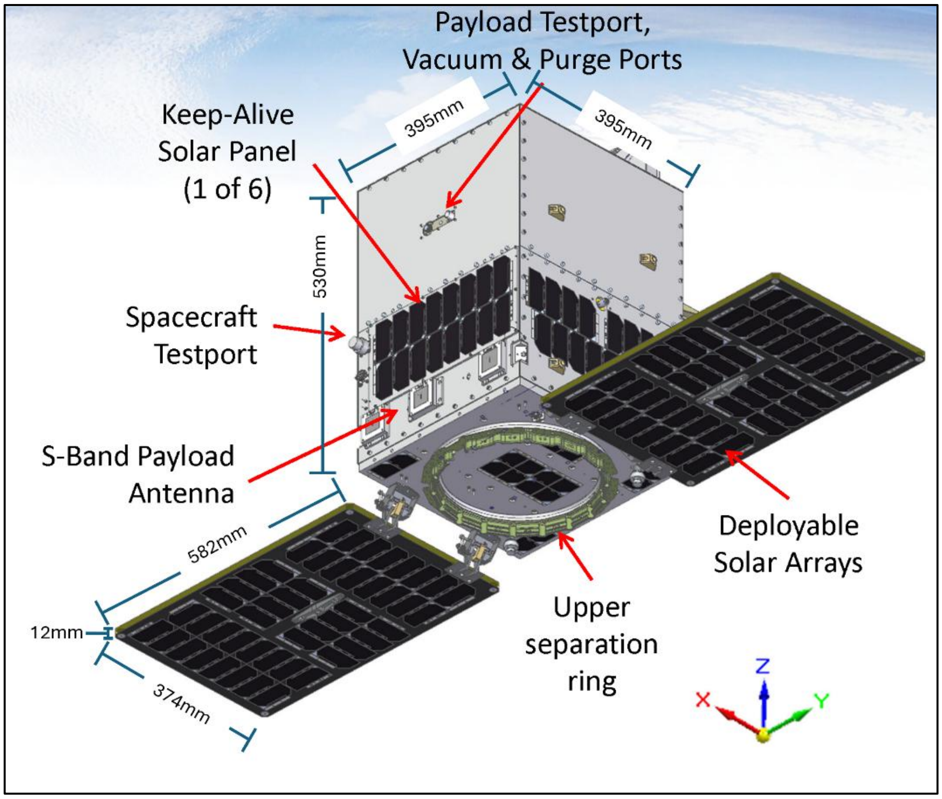

Figure 2: Aspera External Layout and Dimensions View 2

Subsystems

The satellite contains the following systems:

Command and Data Handling (C&DH)

The C&DH subsystem includes a House Keeping Computer (HKC) and an Attitude Determination and Control Computer (ADCC). The HKC and ADCC have identical hardware, and their independent functionality is defined by software. Each computer is connected to all subsystems via multi-drop buses.

Attitude Determination and Control (ADC)

The Aspera spacecraft operates in a three-axis stabilized control mode with fine attitude determination provided by a star tracker, and coarse attitude determination provided by sun sensors and a magnetometer. Reaction wheels and magnetorquers provide attitude control actuation.

Payload Computer

The off-the-shelf payload computer supports the interface to the payload and the rest of the command and data handling subsystem. The payload computer supports the S-band data downlink and coordinates between the payload and the S-band data downlink. 64GB of storage is provided.

Power

The power subsystem consists of solar panels, a lithium-ion battery pack and power control and regulation and distribution electronics. The bus power rails of 28V unregulated, 12V regulated and 5V regulated to power the spacecraft electronics.

Communication (COMMS)

The Comms subsystem consists of the following equipment:

- S-band Command Receiver, using a pair of S-band patch antennas mounted on opposite faces of the spacecraft to provide omni-directional coverage.
- S-band Telemetry Transmitter, using a pair of S-band patch antennas mounted on opposite faces of the spacecraft to provide omni-directional coverage.
- S-band Payload Data Transmitter, using a single S-band patch antenna

Ground station support is provided by third party operated stations in Svalbard Norway, and Punta Arenas Chile.

Structure

The structure is composed of a machined aluminum tray structure, with aluminum panels and deployable CFRP panels hosting the solar photovoltaic array.

Thermal Control

The spacecraft thermal control is primarily passive. with spacecraft temperatures moderated by the application of thermal tapes and coatings with defined and controlled thermo-optical properties. The payload instrument is thermally controlled with resistive heating elements to maintain a consistent temperature while it is in operation. The spacecraft battery is thermally controlled with resistive heating elements to maintain a minimum temperature suitable for battery operations.

Payload Instrument

The payload instrument is an ultraviolet (UV) detector designed to map OVI (five-times-ionized Oxygen) emissions from nearby galaxy halos for the first time. It will combine a simple optical design using highly UV-reflective optics with an advanced UV MCP detector to optimize throughput and sensitivity. It measures the 1032 Å (103.2 nm) line emission using two parallel channels. This design supports efficient detection and mapping of the 2D spatial distribution of OVI coronal gas in nearby galaxies using a step-and-stare concept observation strategy. Aspera will accumulate multiple days of exposure time on each target to ensure spectroscopic detection of OVI emission and produce 2D morphological maps of galaxy halos, and direct measurements of their physical parameters such as kinematics.

The supporting infrastructure of the instrument is composed primarily of 6061 Aluminum, with some Invar, Copper, Stainless Steel, and small Titanium components. The optical components are ULE glass. The overall dimensions of the instrument are about 39 cm x 34 cm x 27 cm.

Propulsion

No propulsion subsystem is included.