RAPSat-1 Technical Description

The goal of the RAPSat-1 mission is to demonstrate the RAPSat (Rapid Agile Production of ThinSats) platform on orbit. The RAPSat-1 mission comprises 3 individual spacecraft, RAPSat-1A, RAPSat-1B, and RAPSat-1C, with solar panels that deploy upon release into orbit.

RAPSat-1 will be launched out of VSFB, on SpaceX TSIS-2 (BLAZE), NET 2/13/2025, into an SSO orbit. Transmission will begin 45 minutes after deploy. The satellites will remain active for 2 years. Atmospheric friction will de orbit the RAPSat-1 elements, within 5 years after launch. See the ODAR for details.

RAPSat-1 is stowed in the deployer in a volume equivalent to a 6U CubeSat. The individual spacecraft (-1A, -1B, and -1C) each respectively weigh 3.2, 3.9, and 3.2 kg. See Figures 1, 2, 3 and 4 for the stack as stowed, and the individual satellites.

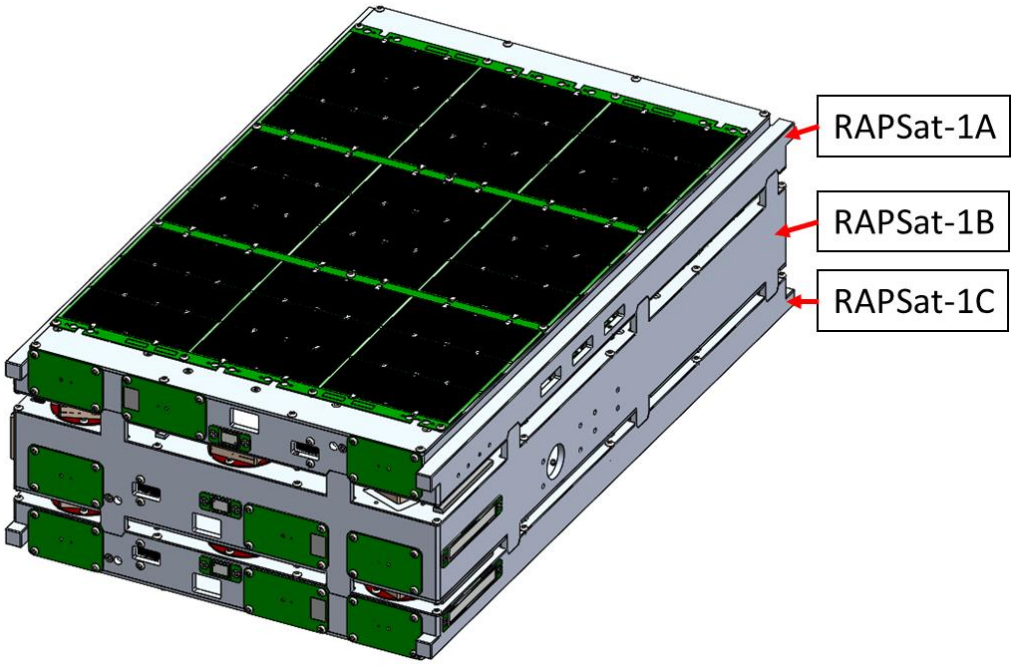

Figure 1 RAPSat-1 Overview showing all 3 stowed RAPSat-1 spacecraft.

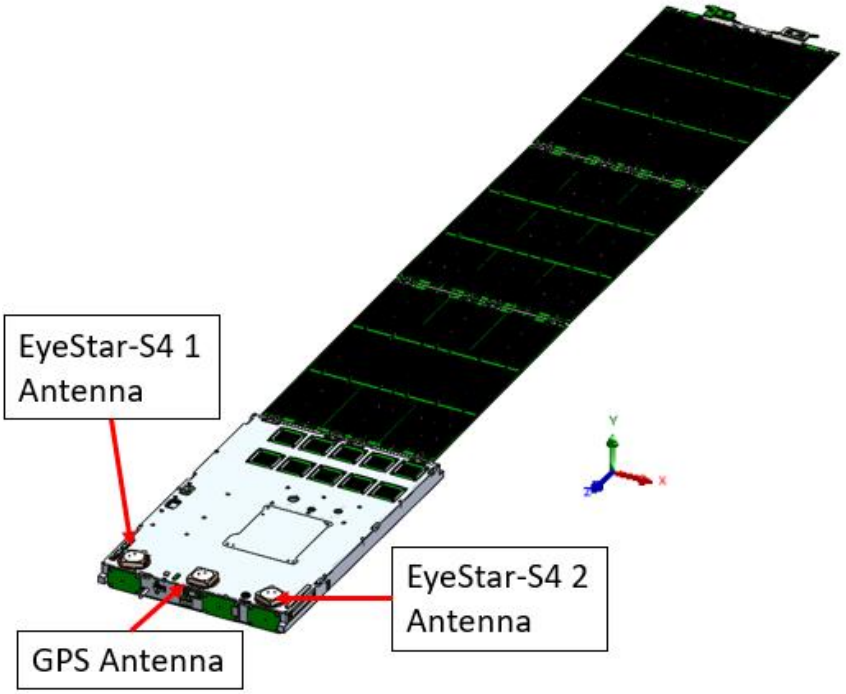

Figure 2 RAPSat-1A with solar panels deployed.

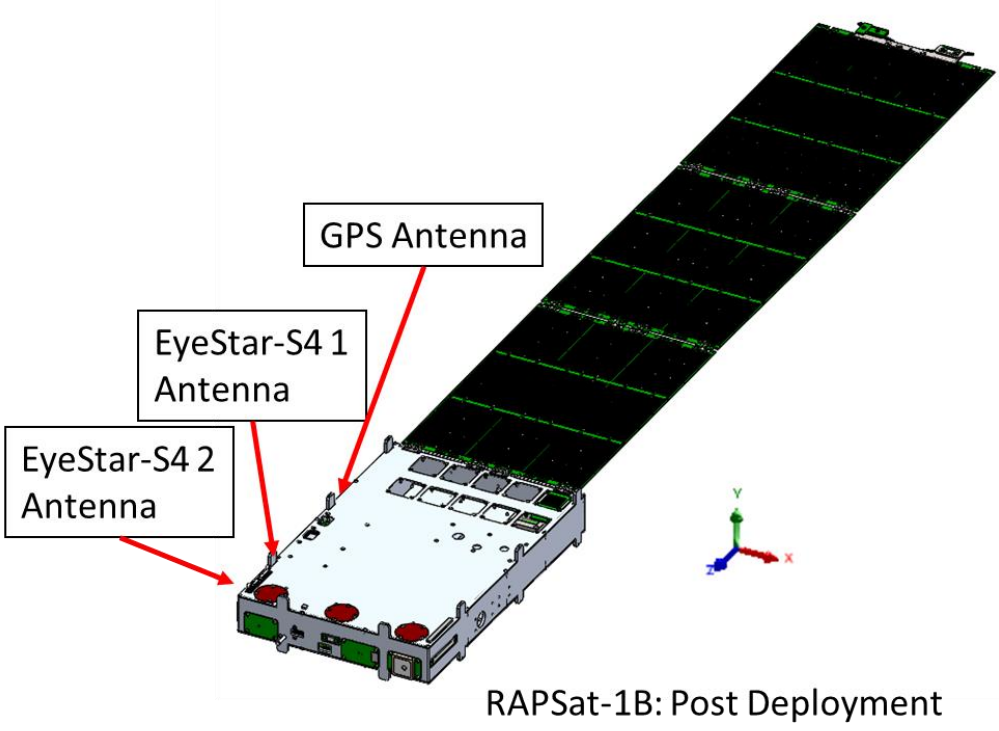

Figure 3 RAPSat-1B with solar panels deployed.

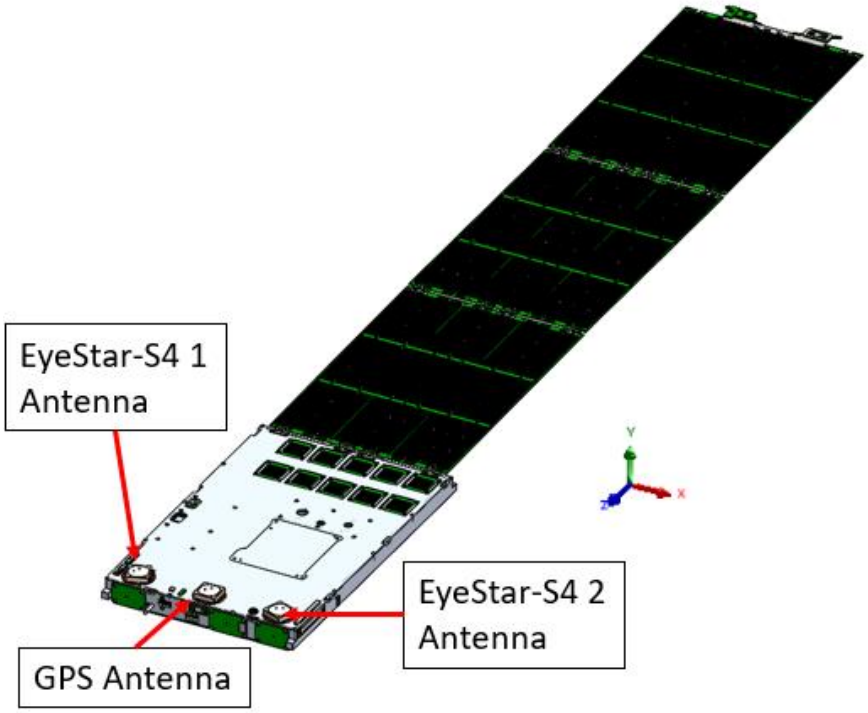

Figure 4 RAPSat-1C with solar panels deployed.

Each RAPSat-1 spacecraft (-1A, -1B, -1C) contains the following systems, identical except where otherwise noted:

Navigation and Attitude Subsystem: Attitude determination is made using a GridEye infrared horizon sensor. A GPS receiver is also included. From the GPS inputs, the CDH determines position and velocity, and orbit parameters are derived. Transmitted to Earth, these will provide accurate orbital TLEs, which will support accurate ground station antenna pointing, as well as updating of the SpaceTrack database to allow CSPOC to catalog and maintain the location of the spacecraft.

Full 3-axis ADCS is used for all 3 RAPSats. These utilize IR sensors for sun sensing and horizon sensing, and 3 axis torquers for actuation.

Command and Data Handling (CDH) Subsystem: The CDH function shares hardware with the EPS function. The hardware includes dual processors with onboard diagnostics supporting both the EPS and CDH functions. Commands from NSL mission operations, transmitted by the NSL ground station, are received through the receiver module.

Communications System:

1) Two EyeStar S4 transceiver modules manufactured by NSL, each using a patch antenna, and communicating with the Iridium constellation on the established Iridium channels. Two are provided, only one is used at any given time.

In conformance with § 5.107 Transmitter control requirements, all transmissions from the satellite can be suspended with a command transmitted via the Iridium constellation, from mission

operations to the satellite.

Electrical Power Subsystem (EPS): The EPS is a direct energy transfer system using 1 3x2U NSL solar arrays, producing approximately 3 W of orbit average power to charge the battery system.

The total energy storage capacity For RAPSat-1A and -1C is 60 Wh, while RAPSat-1B has 80 Wh.

The solar arrays utilize standard Micro Link flexible photovoltaic cells; the batteries are COTS Tenergy 925050 Li-Polymer cells. The Advanced EPS board controls the charging through four MPPT modules and load switching of the system.

Thermal Monitoring Subsystem (TMS): The TMS consists of (4) thermocouples located throughout the electronics boards and on each solar array. There are no active heating mechanisms. The thermocouples are wired to the Advanced EPS board, which hosts algorithms to monitor and record the temperatures, and the EPS can shut down modules based on temperature.

Structure Subsystem: The structure is fabricated of 6061 Aluminum alloy. Solar panels extend upon deployment.

Payload Subsystem: The payloads are experiments.

For RAPSat-1A and -1C, these include:

- Connector sealing test
- RadStar radiation detector
- 8x NSCAP solar cell coupons for direct cell comparison

For RAPSat-1B, these include:

- Connector sealing test
- 2x RadStar radiation detectors
- 4x Zero Volt Test Batteries, not used for providing power to the satellite bus. These can in theory be discharged down to 0 volts without damage to the cells.

Propulsion Subsystem: No propulsion subsystem is included.