TROOP-3 Technical Description

The goal of the Train Rapid On Orbit Payload (TROOP-3) mission, is to obtain flight heritage testing for a prototype payload host platform. Features that will be tested for use in supporting future payloads, include an S Band transceiver, as well space environmental instruments to characterize the radiation and plasma densities to which the payloads will be exposed. TROOP-3 is self powered and operates independently of the larger Sherpa-FX Transporter 3 spacecraft ("Sherpa") to which it is permanently attached. It demonstrates a platform that may in the future be used to host payloads; it is an experimental activity.

The Sherpa, owned by Spaceflight Inc., will be launched on SpaceX SXRS-6, NET December 1, 2021, into a near-circular, sun synch orbit at 525 km altitude. Transmission from the TROOP-3 will begin 30 minutes after the payloads are deployed from the Sherpa, activated by deployment switches, and remain active for 2 years. Atmospheric friction will de orbit the Sherpa and attached TROOP-3, approximately 4 years after launch.

TROOP-3 is a single unit attached to the Sherpa, see Figure 1.

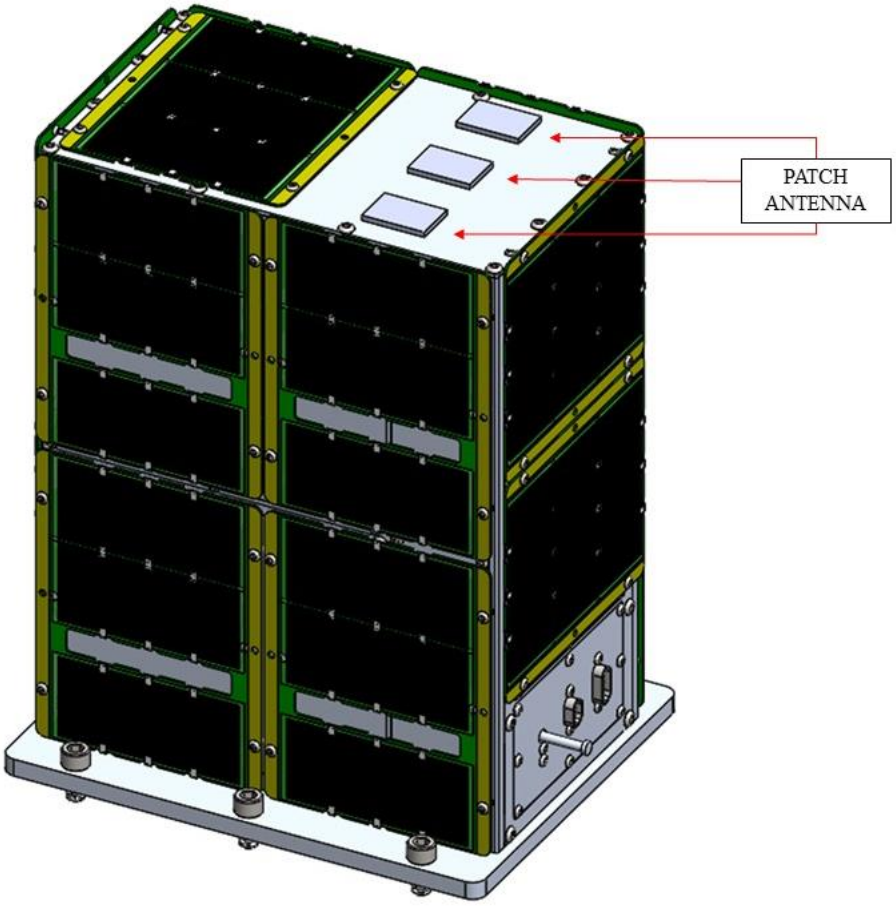

Figure 1 TROOP-3 Overview

TROOP-3 Technical Description

TROOP-3 contains the following systems:

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. These can be transmitted to Earth to provide accurate orbital TLEs. This 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.

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) An EyeStar S3 Simplex module manufactured by NSL, using a patch antenna, and transmitting to the Globalstar constellation on the established Globalstar channel 1616.25 MHz. A GridEye Horizon Sensor on the patch antennas, allows transmitting only when the antenna is pointing away from the earth.
2) All transmission can be terminated on command from the NSL ground station, transmitting in the range of 2467 MHz.
3) A Kratos SDR 1 S band transceiver will operate on 2425 MHz frequency. It will communicate with a second unit of the same transceiver at the NSL ground station.

Electrical Power Subsystem (EPS): The EPS is a direct energy transfer system using 2 1U NSL solar arrays, producing approximately 1.6 W of orbit average power to charge the 5.6A-hr battery system. The total energy storage capacity is 41.44 W-hrs. The solar arrays utilize standard Alta Devices 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. There are no extensible antennas, solar panels, or other items.

Propulsion Subsystem: No propulsion subsystem is included.

Payload Subsystem: The payloads are the Kratos radio, the radiation detector and the plasma detector. The mission will demonstrate use of the Globalstar Simplex transmitter and the Kratos S band transceiver, as a communications suite that will allow future TROOP systems to become hosting platforms, as well as the space environmental monitors.