BSS1 Satellite Technical Description

The overall goal of the BSS1 mission, is to demonstrate the performance of Benchmark Space System's DFAST propulsion system. Performance measurements include; on-orbit pressurization time and power required, pressure tank temperature profiles and thruster induced velocity changes.

The satellite will be launched as a secondary payload aboard Firefly Aerospace's Alpha rocket, from Vandenburg AFB, mid 2020. It will be inserted into an orbit at 300 km apogee and 300 km perigee, on an inclination from the equator of 137 degrees. Transmission will begin at least 30 min after deployment from the rocket, and cease at end of life. Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs about 4 months after launch. See the Orbital Debris Assessment Report for details.

The spacecraft is a single unit with the dimensions of 100mm x 100mm x 340.5mm. The total mass is about 5 Kg.

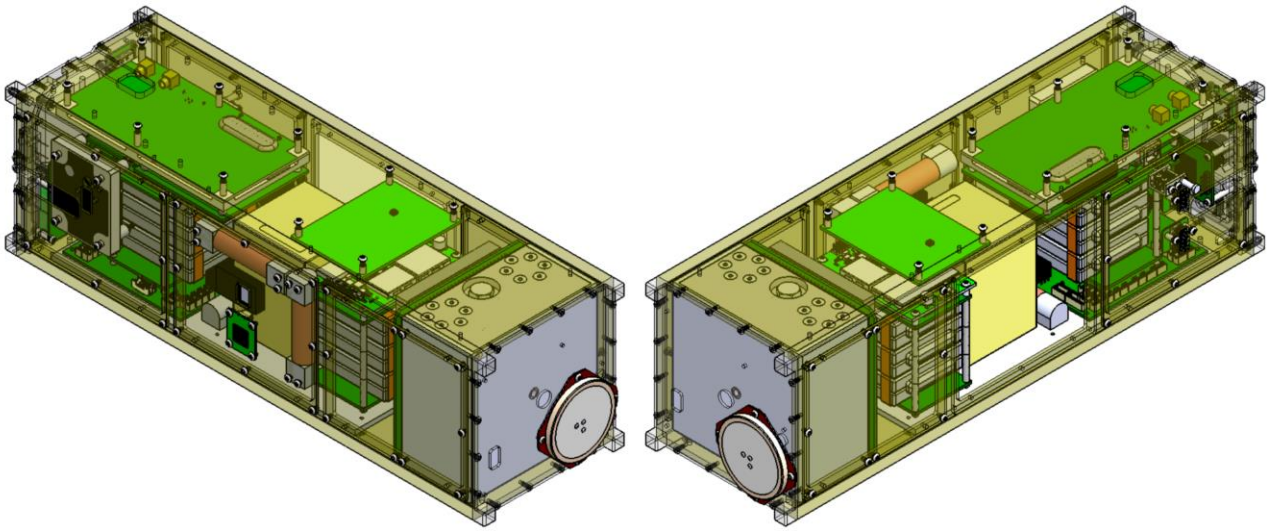

Figure 1 BSS1 Overview

The satellite contains the following systems

Guidance, Navigation and Control (GNC) Subsystem: Attitude determination and control features include a horizon sensor, magnetorquers, a magnetometer and a reaction wheel. Also, a passive neodymium permanent magnet is located at the CG of the spacecraft, which provides general orientation throughout the orbit. GPS data is also used.

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. Ground commands are received through the EyeStar D2 Duplex Module.

Communications System: The primary communication system consists of a Near Space launch EyeStar D2 Duplex module for two way communications to ground operations, via the Globalstar Constellation. In addition, a transmit only radio is included: EyeStar S3 Simplex module

manufactured by Near Space Launch. Each radio uses a separate patch antenna. All transmission can be terminated on command. If communication with the Globalstar constellation is lost, transmission will be terminated until communication is regained.

Electrical Power Subsystem (EPS): The EPS is a direct energy transfer system using a solar array producing approximately 3.47W of orbit average power to charge the 8.8 A-hr battery system. The total energy storage capacity is 65 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 (12) 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.

Propulsion Subsystem: Benchmark Space System's DFAST propulsion system, approximately 0.5U in volume is mounted near one end of the spacecraft. The propellant is an inert, non-toxic powder stored unpressurized for launch. In orbit, the system heats up propellant to above 200C, to initiate a reaction that converts the powder into gas made up primarily of nitrogen, carbon dioxide, and carbon monoxide. The gas is stored, then upon command, flowed thru a pressure regulator and a valve, and ejected from the spacecraft via the rocket nozzle to generate thrust.