ThinSat-1 Mission Technical Description

The overall goal of the ThinSat-1 mission, is to orbit 60 small experiments to advance STEM education, and promote space science research and systems engineering for grades 4 – 12 and universities. It includes approximately 70 schools from nine states. The student teams will analyze the data collected by their experiment and submit a report detailing their findings. The students will track their experiment and receive data in near real time through the Globalstar network and the Space Data Dashboard website. Online content and resources will enhance the educational experience.

The experiments will be deployed aboard 12 satellites, ThinSat-1A through ThinSat-1L, launched as a secondary payload aboard the Orbital ATK OA-10 on the Antares second stage, from the mid-Atlantic Regional Spaceport, Wallops Island, Virginia, November 1, 2018. The satellites will be inserted into Extremely Low Earth Orbit (ELEO), at 250 km apogee and 203 km perigee, on an inclination from the equator of 51.6 degrees. They are deployed from 4 canisters mounted externally on the second stage of the launcher; they unfold accordion style as they exit the canister. Transmission will begin upon deployment, and cease less than 14 days later, when de-orbiting occurs. See the Orbital Debris Assessment Report for details.

Each spacecraft is comprised of between 3 and 6 ThinSat units, one unit per experiment. Figure 1 shows a typical single unit. Three of the units have two frames layered together containing a single payload, Figure 2. Figures 3, 4, and 5 show dimensions of each spacecraft type.

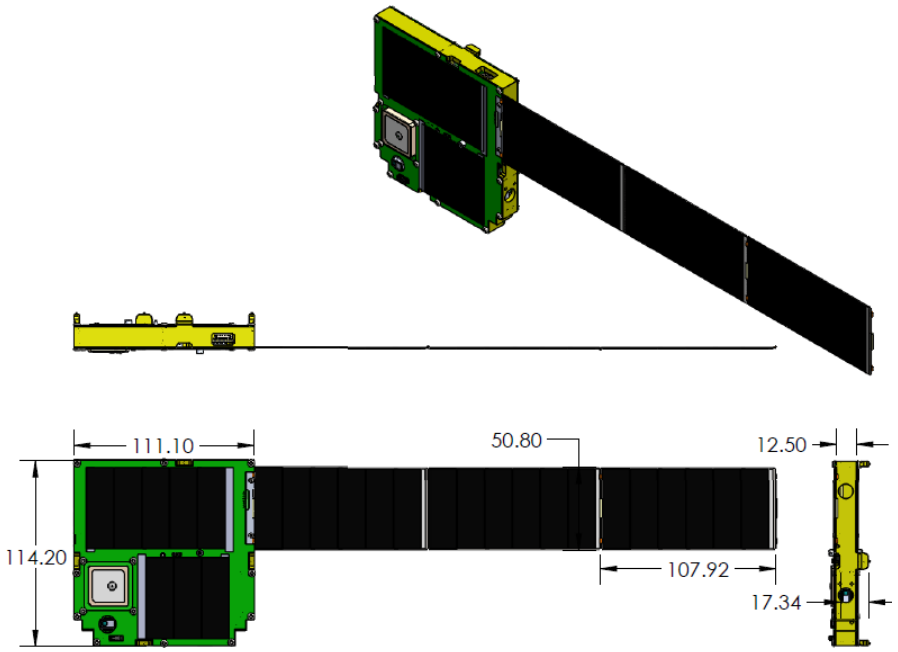

Figure 1 Single Frame ThinSat Unit Detail, Dimensions in mm

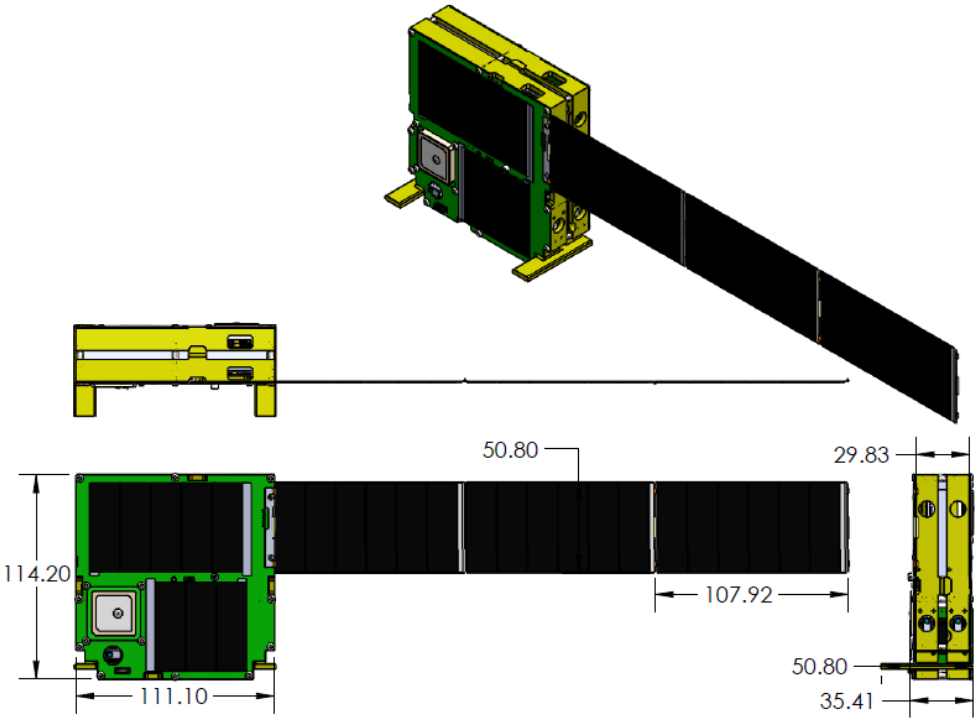

Figure 2 Double Frame ThinSat Unit Detail, Dimensions in mm

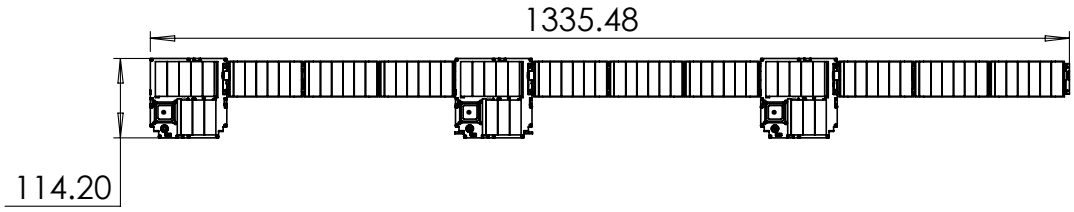

Figure 3 ThinSat 3T Spacecraft, Dimensions in mm

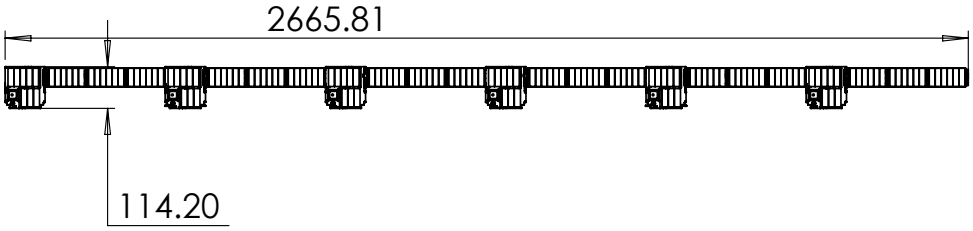

Figure 4 ThinSat 6T Spacecraft, Dimensions in mm

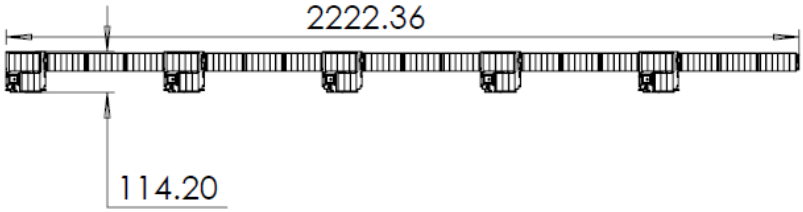

Figure 5 ThinSat Double Frame Plus 4T Spacecraft, Dimensions in mm

Subsystem Description:

Each unit will carry the following subsystems, as well as experiment-specific components. See the ODAR for a complete list of all components in each spacecraft.

Guidance, Navigation and Control (GNC) Subsystem: Navigation sensors consist of the infrared Horizon sensor, and the Star tracker, a 60 x 80 pixel center cross point module.

Aerodynamic pressure will cause the spacecraft to orient in an "arrowhead and tail" configuration in the ram direction, restricting 2 axes of movement along the velocity vector. A small permanent magnet will rotate the spacecraft about the long axis, to align with the earth's magnetic field. Mu metal plates will dampen the tumbling rate. This is the primary attitude control. Also, each unit will include a magnetorquer coil capable of producing up to 0.2 Am^2 of magnetic moment. These magnetorquers will act upon the earth's magnetic field to restrict the rotation of the spacecraft about the velocity vector, aligning the Simplex transmitter antenna to face in the zenith direction.

Command and Data Handling (CDH) Subsystem: Consists of two microprocessors which facilitate data transfer between the payload and the COMMS subsystem. The CDH can receive serial data packets, or sample dedicated analog and digital input lines.

Communications Subsystem (COMMS): The ThinSat S band receiver supports command and control, and provides a means to command termination of transmission if necessary, by receiving transmissions from the ground station.

Data is transmitted from the spacecraft via the Globalstar constellation, using an EyeStar S3F Transmitter.

Electrical Power Subsystem (EPS): Includes mechanical RBF switch, deployment switch, and solar detection circuit which inhibit power from the battery. Charging circuit supplies solar power to the battery and a regulator transfers battery power to the rest of the system. E-fuses limit current supplied to the payload to 100 mA per line.

Thermal Control Subsystem (TCS): Al 7075 unit body frame thermally shorts internal and external surfaces. Copper ground planes in external PCBs, including solar arrays, provides good radiation surfaces.

Structure Subsystem: The external frame structure is fabricated of 7075 aluminum.

Propulsion Subsystem: No propulsion subsystem is included.

Payload Subsystem: The payloads include printed circuit boards of varying design, to conduct experiments for the participating schools and universities.