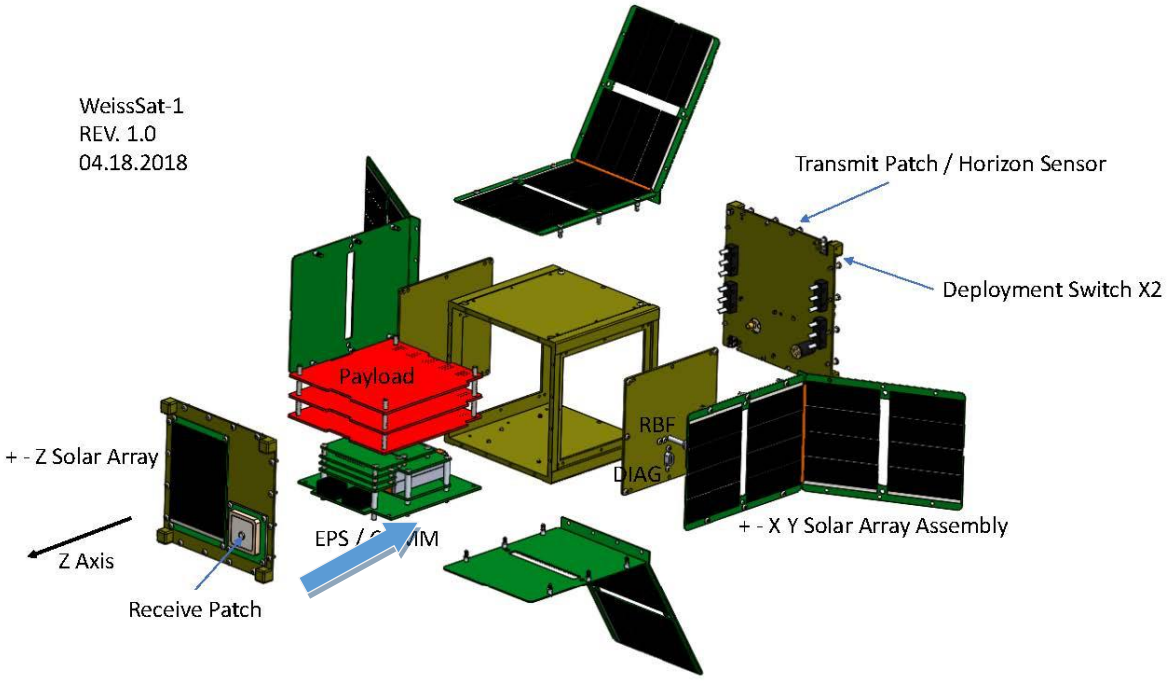
WeissSat-1 Satellite Technical Description

The overall goal of the WeissSat-1 mission, is to establish The Weiss School hardware heritage based on the NearSpace Launch FastBus by collecting inflight telemetry and validating a novel lab-on-a-chip for investigating extremophile bacteria viability in space.

The satellite will be launched aboard a SpaceX Falcon 9 rocket, from Vandenberg AFB, California, no earlier than October 1, 2018. It will be inserted into an orbit approximately 575 km apogee and perigee, on an inclination from the equator of 97.7 degrees. Transmission will begin 30 minutes after deployment, and cease 2 years later. Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs at a maximum of 4.5 years after launch. See the Orbital Debris Assessment Report for details.

The spacecraft is a single 1U CubeSat unit with the dimensions 10 cm x 10 cm x 10 cm. The total mass is 1.33 kg.

Figure 1. WeissSat-1 Overview



The satellite contains the following systems:

<u>Guidance, Navigation and Control (GNC) Subsystem:</u> The WeissSat-1 will not use active GNC. A permanent magnet will encourage the orientation of the Globalstar patch antenna upwards, and the S band receiver antenna downwards. A horizon sensor on the transmit antenna will support control of the Globalstar transmitter so that it only transmits in an upward direction.

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Command and Data Handling (CDH) Subsystem: The two critical printed circuit boards in the CDH subsystem are the Level Zero (L0) and the Flight Computer (FC) boards. The L0 board is the operates regardless of flight computer operating state. The L0 includes all communications interfaces to the transmitter, receiver and the FC, and performs basic spacecraft state of health maintenance.

Communications Subsystem (Comms): The EyeStar S3F transmitter will transmit up to 200 kbytes of data per day to Weiss School mission control, via the Globalstar system. The transmit patch antenna shown in Figure 1 is for the transmission to Globalstar.

The NearSpace Launch NSLR25F S band radio receiver will receive command and control packets from the ground station, using the receive patch antenna shown in Figure 1. NSL provides the uplink service for The Weiss School, using the NSL ground station, and operating under the direct control of Weiss School.

Electrical Power Subsystem (EPS): The electrical power system uses solar panels which will generate up to 3.6 W in sunlight. A maximum power point tracker (MPPT) charges the batteries. The EPS distributes nominal 5V and 3.3V output to the spacecraft. Idle current is expected to be below 20 mA during the mission, transmission power will be lower than 1.9 W and the idle power is expected to be less than 250 mW.

The EPS is a direct energy transfer system using a solar array producing approximately 1.4W of orbit average power to charge the 15.8 W-hr battery system. The solar arrays utilize standard AltaDevices photovoltaic flexible cells; the batteries are COTS Tenergy 32089 UL listed cells. The L0 board sends signals to the Power Switch Boards to control charging and load switching.

Thermal Control Subsystem (TCS): The TCS controls hardware temperature through cold biasing of the thermal design, utilizing a heater to stabilize payload temperatures during post-deployment experiment start-up procedure. Sensors are wired to the L0 board, which hosts thermal control algorithms to control the heaters.

Structure Subsystem: The unibody structure is fabricated of anodized aluminum and is approved for use with PPOD and NANORACKS dispensers. The 1U structure includes access panels, inhibit switches, and antenna mounts.

Propulsion Subsystem: The WeissSat-1 has no propulsion subsystems.

Payload Subsystem: The payload is a novel lab-on-a-chip designed to evaluate the viability of extremophile bacteria. On orbit lyophilized bacteria will be rehydrated, stained, and illuminated with a 488 nm (blue) LED which will produce fluorescence in both live (green) and dead (red) stained bacteria. Wavelength specific photodetectors will count flashes of green and red fluorescence. The payload processor will hand off experimental data to bus processor for transmission.