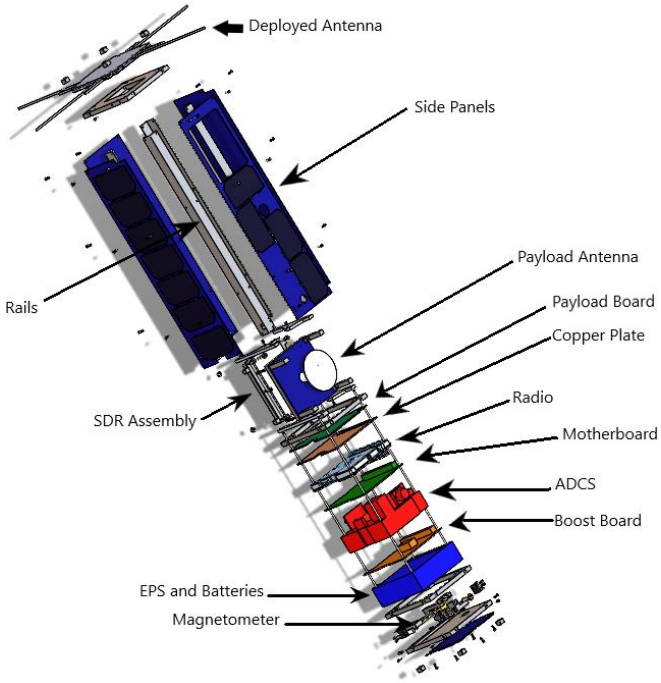
CYSAT Satellite Technical Description

The overall goal of the Iowa State University CYSAT mission is to perform a technology demonstration of a software defined radiometer in low Earth orbit to collect soil moisture data through passive surveyal and transmit that data back to Iowa State University for analysis.

The satellite will be launched as a secondary payload aboard SpaceX-24, from Kennedy Space Center, December 2021. It will be deployed from the International Space Station (ISS), and inserted into an orbit at 426 km apogee and 415 km perigee, on an inclination from the equator of 51.6 degrees. Transmission will begin 45 minutes after deployment and cease approximately one year following first transmission. Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs about 1 year after launch. See the Orbital Debris Assessment Report for details.

The spacecraft is a single unit with the dimensions of 3U stacked 10 cm X 10 cm X 10 cm CubeSat modules (giving an overall dimension of 10 cm X 10 cm X 30 cm.) The total mass is about 2.25 Kg.

Figure 1 CYSAT Overview



The satellite contains the following systems:

Attitude Determination and Control (ADCS) Subsystem: The ADCS is comprised of reaction wheels, magnetorquers, a single magnetometer, and connections for photodiodes (sun sensors) that are fixed to the side panels. The magnetometer is located at the bottom (-Z) of the satellite, where it is connected to the ADCS..

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Flight Operation Subsystem (OBC): The Endurosat onboard computer (OBC) is the main controller of the CubeSat. It holds all the mission functionality software and commands the rest of the subsystems. The OBC will be remotely controlled with commands from the ground station.

Communications Subsystem (COMMS): The communication system onboard consists of two key components: the UHF transceiver II and the UHF antenna, both manufactured by Endurosat.

Electrical Power Subsystem (EPS): The Endurosat EPS is a direct energy transfer system using a solar array producing approximately 18W orbit-averaged power. The solar arrays are comprised of 26 Spectrolab XTJ solar cells placed on all faces of the satellite excluding the top of the antenna (+Z). The power is transferred from the solar arrays to the EPS. Power is commuted to the rest of the subsystems via power rails within the PC104 connectors.

Thermal Control Subsystem: Thermal control is only required for the batteries in the EPS. Each battery within the EPS has an individual heater for automatic temperature control. The heaters also may be remotely activated using Endurosat's EPS software.

Structure Subsystem: The structure is fabricated of Aluminum 6061-T6.

Propulsion Subsystem: No propulsion subsystem is included.

Payload Subsystem: The payload system includes three critical components - the radiometer antenna, software-defined radio (SDR), and low-noise amplifier (LNA). Together, these three components passively detect emissions between 1400-1425 MHz, amplify the signal and filter noise, and organize data into transmittable packets that are queued in the data storage of the on board computer until commanded to download the data to the ground station.