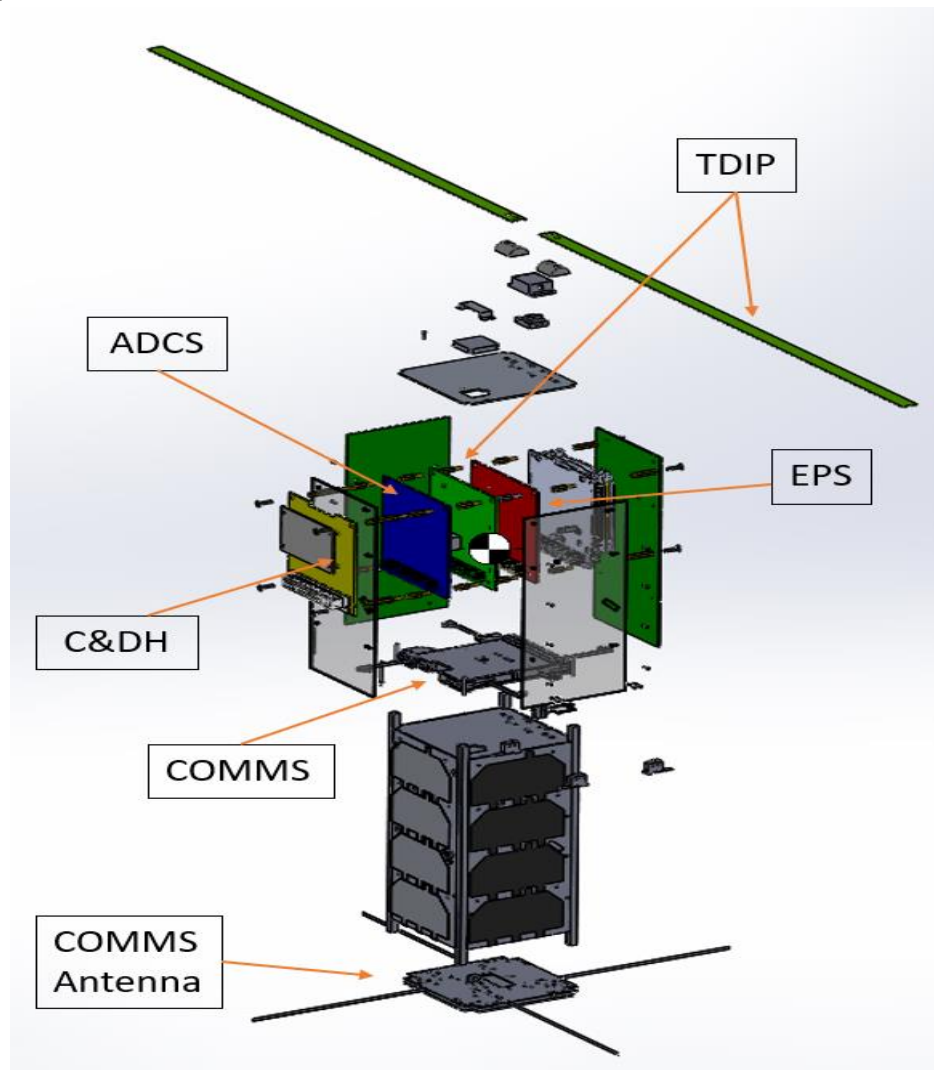


## JAGSAT Satellite Technical Description

The JAGSAT mission, designed and built at University of South Alabama (USA) will provide a hands on learning project for the students involved to design, build, test and operate a small satellite. It will also support scientific investigation to measure plasma electron density at sub-meter level resolution. This will use a fast time domain impedance probe (TDIP) designed to operate in the upper F layer, and in the equatorial and mid-latitude ionosphere.

The satellite will be deployed from the ISS No Earlier Than January 1, 2022. It will be inserted into a circular orbit at 410 km, on an inclination from the equator of 51.6 degrees. Transmission will begin 30 minutes post completed ejection and cease upon demise. Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs about 9 months after deployment. See the Orbital Debris Assessment Report for details.

The spacecraft is a single unit with the dimensions of 2U; 2 stacked 10 cm X 10 cm X 10 cm CubeSat modules (giving an overall dimension of 10 cm X 10 cm X 20 cm.) The total mass is about 2.6 kg.



**Figure 1 JAGSAT Overview**

# JAGSAT Satellite Technical Description

The satellite contains the following systems:

## **Electrical Power System (EPS) Subsystem:**

The EPS converts, maintains, and stores power. It consists of 4 solar panels with a total of 16 solar cells, delivering power to the 30Whr Clyde space battery through the Power Control Board. The batteries are charged at peak power of 5 W using the LT8490 battery charger. The battery then provides power to the battery bus, and through it to all of the systems.

## **Command and Data Handling (C&DH) Subsystem:**

The C&DH receives commands, maintains control, and systematizes the satellite's processes. The C&DH is the central planning and decision-making board with ability to use non-volatile memory for scheduling events in calendar. Kinetis K22P100M120SF5 is the microprocessor, programmed in C, that has up to 1MB flash and 128 KB SRAM, powered from the 3.3V rail. C&DH uses the I<sup>2</sup>C for COMMS, SPI for SD Card, UART for debugging and CAN to communicate with other boards with general status updates.

## **Attitude Determination and Control System (ADCS) Subsystem:**

The ADCS determines and manages the satellite's attitude and handles detumbling procedures using two magnetorquers. The ADCS orients JAGSAT prior to an upcoming transmission window as well as orients to sun for the EPS to enter charging stage. Attitude is determined using RREF  
\*\*Define RREF and controllers that measure the magnetic field.

## **Communications Subsystem (COMMS):**

The COMMS is a half-duplex COTS radio from Endurosat AD with a deployable COTS antenna from the same company, operating in the UHF band up and down. It will provide telemetry, tracking and control, and enable the science data transfer. The ground station will be located on the South Alabama University campus in Mobile, Alabama. A backup ground station operated by University of Colorado Boulder, may also be used.

## **Payload: Time Domain Impedance Probe (TDIP) Subsystem:**

The TDIP measures plasma electron density in the ionosphere to get a clearer picture of the effect of scintillation on RF signals. The TDIP works by sending out a pulse, receiving the response, taking the response's Fourier transform, and then plotting impedance versus frequency. The relationship between impedance and frequency can be used to determine the plasma's absolute electron density.