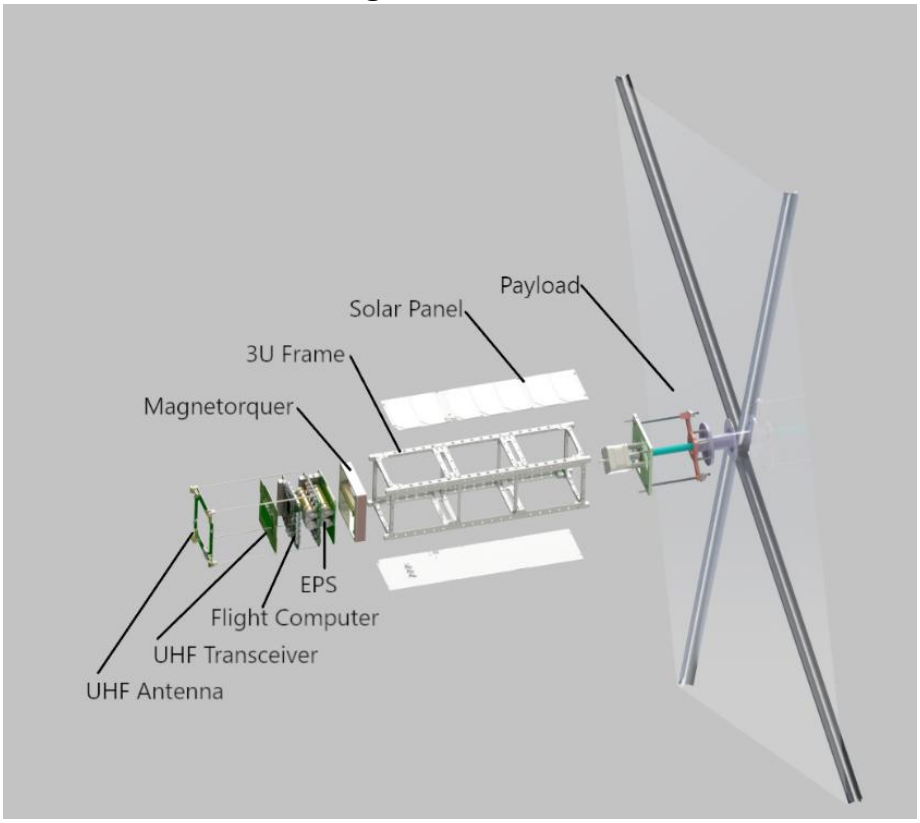
# BAMA-2 Satellite Technical Description

The overall goal of the BAMA-2 mission, operated by the University of Alabama, is to demonstrate a deployable 1 $m^2$ drag sail which will be stored in the aft 1U. BAMA-2 aims to use the drag sail to decrease its orbital lifetime from an estimated five years, to five months.

The satellite will be launched aboard an ISS resupply mission, No Earlier Than December 1, 2026, and stowed in the ISS for a period of 1 to 3 months after launch. It will then be inserted into an orbit with 422 km apogee and 413 km perigee, on an inclination from the equator of 51.6 degrees. Transmission will begin 4 hours and 30 minutes after deployment from the ISS and cease upon demise. Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs about 0.5 years after launch. See the Orbital Debris Assessment Report for details.

The spacecraft is a single unit with the dimensions of 3 stacked 10 cm X 10 cm X 10 cm CubeSat modules (giving an overall dimension of about 10 cm X 10 cm X 30 cm.) The total mass is about 2.19 kg.

**Figure 1 BAMA-2**



The satellite contains the following systems:

**Attitude Determination and Control (ADCS) Subsystem:** BAMA-2 will use a CubeSpace CubeMag Compact magnetometer to determine its attitude during orbit. This data will be transmitted to the Endurosat Onboard Flight Computer via UART and will be processed, interpreted, and acted upon by the flight computer. Attitude control will be carried out with 2 CubeSpace CR0003 coreless electromagnetic torquer rods placed orthogonally along the X and Y axes of the satellite and one CubeSpace CubeCoil Single in the Z-axis to allow active orientation during flight. The CR0003 rods and CubeCoil can operate continuously with a current of 150mA at 5V, generating a magnetic moment of 0.3 Am2 about the X- and Y-axis or 0.13 Am2 about the Z-axis. The interface between the flight computer and the ADCS system is a custom electrical switching PCB that allows logic and power control of the ADCS via the PC-104 stack.

**Command and Data Handling (C&DH) Subsystem:** The critical printed circuit board in the C&DH subsystem is the Flight Computer (FC). The FC uses the Endurosat Onboard Flight Computer which has a 400 MHz ARM Cortex M7 32-bit processor. The FC has 1MB integrated SRAM, 2MB Integrated FLASH Memory, and access for a MicroSD card. It has support for CAN, SPI, I2C, and UART/USART. These communication interfaces are primarily accessed through the standard PC 104 rail in addition to USB ports. The primary form of communication between the local circuitry is over CAN and I2C. The FC also has a real time clock.

**Communications Subsystem (COMMS):** The radio on BAMA-2 is a half-duplex Endurosat UHF transceiver. The satellite antenna consists of 4 monopoles.

The ground station located at the University of Alabama campus in Tuscaloosa Alabama, will use an Ettus B210 SDR transceiver with two Yagi antennas.

**Electrical Power Subsystem (EPS)**: The EPS consists of four solar panels, a battery pack, and an EPS mainboard and daughter board. The solar panels use GaAs Triple-junction solar cells from AZUR Space. The battery pack and electronics are the ISI Space Compact Electrical Power System 2. The EPS communicates locally over CAN bus using CSP and sends current, voltage, and temperature telemetry back to FC. The solar panels communicate locally over I2C using CSP and send magnetometer and temperature telemetry back to the FC.

**Thermal Control Subsystem (TCS):** The TCS will control hardware temperature actively with heating resistors to keep the battery above a certain temperature. Temperature sensors are mounted on the radio, batteries, and solar panels.

**Structure Subsystem:** The structure is fabricated of aluminum 7075-T651.

**Propulsion Subsystem:** No propulsion subsystem is included.

**Payload Subsystem:** A stepper motor will extend a drag sail deployment mechanism clear of the CubeSat frame. Once extended, a burn wire will release the coiled drag sail booms, which will then uncoil and deploy the 1 $m^2$ drag sail. The stepper motor controller is connected to the flight computer.