ARCE-1 Satellite Technical Description

The overall goal of the ARCE-1 mission is to develop technology and algorithms related to networked satellite communications and demonstrate on-orbit operations of a network using lowcost hardware. The mission consists of Qty (3) identical 0.5U CubeSats, as described below, flying in formation.

The satellites will be launched in late 2020 and inserted into an orbit at nominal 525 km apogee and 525 km perigee, on an inclination from the equator of about 97.5 degrees. Transmission will begin upon deployment from the launch vehicle and continue for the nominal mission lifetime of 6 months, with transmissions to extend for up to two years pending spacecraft operational status. Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs approximately 4.5 years after launch. See the Orbital Debris Assessment Report for details.

Each individual ARCE-1 spacecraft is a 0.5U CubeSat (nominally 10 cm X 10 cm X 6.3) with mass of about 0.9 Kg.

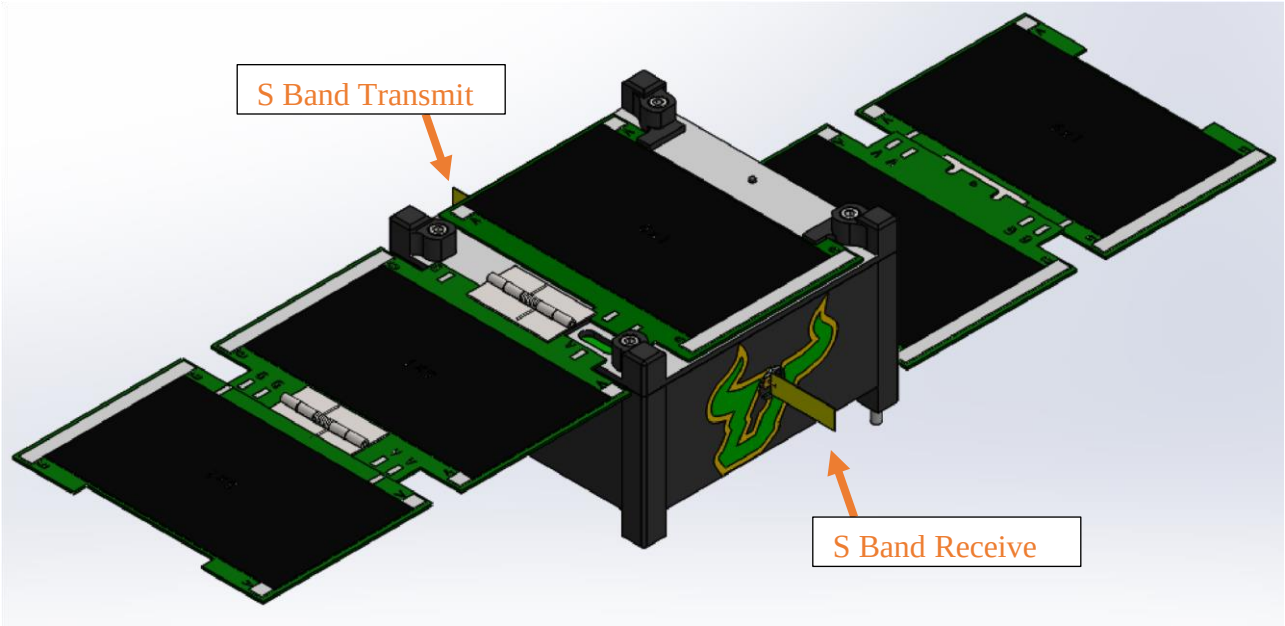

Figure 1 ARCE-1 Overview

Each ARCE-1 satellite contains the following systems:

Communications (COM) Subsystem: The COM is a software defined radio (Epiq Solutions Sidekiq Z2) connected to a custom RF board that includes bandpass filtering and a low noise amplifier for receive and a power amplifier for transmit. One monopole antenna is used for transmission, and a second monopole antenna on the opposite face is used for reception.

Command and Data Handling (CDH) Subsystem: One printed circuit board serves at the host for the flight computer module (Raspberry Pi CM3+), data interfacing for other components, onboard telemetry sensors including voltage and temperature, as well as the battery charger and power distribution circuits.

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Electrical Power Subsystem (EPS): The EPS consists of the solar panels, battery charger circuit, battery, and power distribution circuits. The solar panels are Alta Devices cells bonded to custom printed circuit boards. The battery charger circuit is based on the LT3652. The battery is made up of four Tenergy 30016-004 cells, with two cells in series and two of these sets in parallel, with nominal voltage 7.4V and total energy storage of 38.48Wh. The distribution circuits are based on LM2596 and provide 5V, 3.3V and 1.8V as required.

Guidance, Navigation, and Control (GNC) Subsystem: The GNC includes a NovAtel OEM615 GPS, a LSM9DS1 IMU that contains an accelerometer, gyroscope, and magnetometer, and a set of torque coils for three-axis attitude control.

Thermal Control Subsystem (TCS): Thermal control is managed by internal conduction and radiation to space as well as selectively disabling components to reduce thermal power generation. There are no heaters on board.

Structure Subsystem: The structure is fabricated of 6061 Aluminum that is hard-anodized.

Propulsion Subsystem: No propulsion subsystem is included.