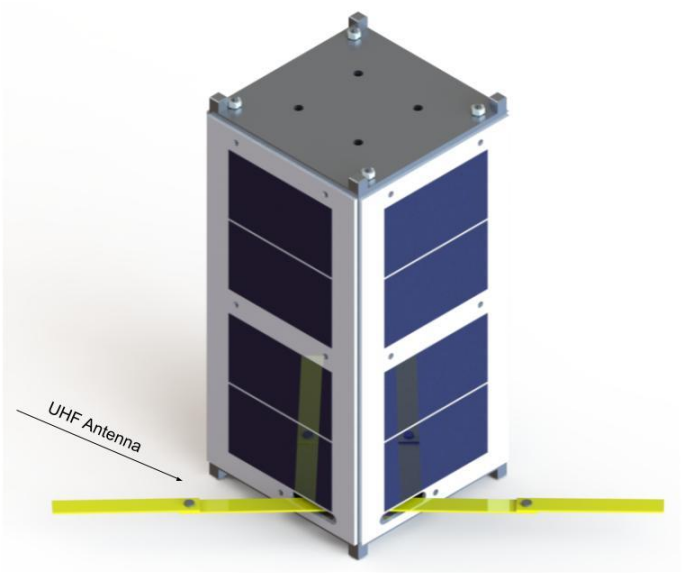
QubeSat Satellite Technical Description

The overall goal of the University of California – Berkeley QubeSat mission, is to research the effects of space environment on a quantum gyroscope based on NV– centers in diamond. NV– centers are defect points in the diamond lattice, where a neighboring pair of lattice positions consists of a nitrogen atom, and a lattice vacancy. NV– centers in diamond can also be used to create magnetometers and other sensors, which are also critical in space missions; this project could provide a platform for further qualification of these sensors.

The satellite will be launched as a secondary payload aboard the VCLS Demo 2 Astra mission, No Earlier Than December 1, 2021. It will be inserted into a 500 km circular orbit, on an inclination from the equator of 41 degrees. Transmission will begin 45 minutes after launch, and cease approximately after 1 year. Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs about 4 years after launch. See the Orbital Debris Assessment Report for details.

The spacecraft is a single unit with the dimensions of 2 joined 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 2.54 Kg.

Figure 1 QubeSat Overview



The satellite contains the following systems:

Guidance, Navigation and Control (GNC) Subsystem: The GNC uses magnetorquers for detumbling and providing torque for payload experimentation. It consists of two torque coils and an air coil along with an Inertial Measurement Unit (IMU).

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Command and Data Handling (CDH) Subsystem: The main printed circuit board in the CDH subsystem is the PyCubed Flight Computer (FC) board. The FC performs all major functions related to operating the QubeSat including communication interfaces, spacecraft state of health maintenance, and communicating with the payload board.

Communications Subsystem (COMMS): The COMMS system uses an OpenLST transceiver along with a tape measure dipole antenna operating on the UHF band at 435-438 Mhz. The QubeSat will communicate with a ground station on top of UC Berkeley's Electrical Engineering and Computer Science building.

Electrical Power Subsystem (EPS): The EPS is a direct energy transfer system using a solar array to charge the 10.2 A-hr battery system. The solar arrays utilize standard Spectrolab XTJ photovoltaic cells; the batteries are COTS Panasonic 18650B cells. The FC board has built in circuits to control charging and load switching.

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

Propulsion Subsystem: No propulsion subsystem is included.

Payload Subsystem: The payload is a quantum gyroscope based on NV- Center Diamonds. The hardware used includes a 50mW laser, signal generators, a photodiode, two permanent magnets, and a payload printed circuit board to control the experiment.