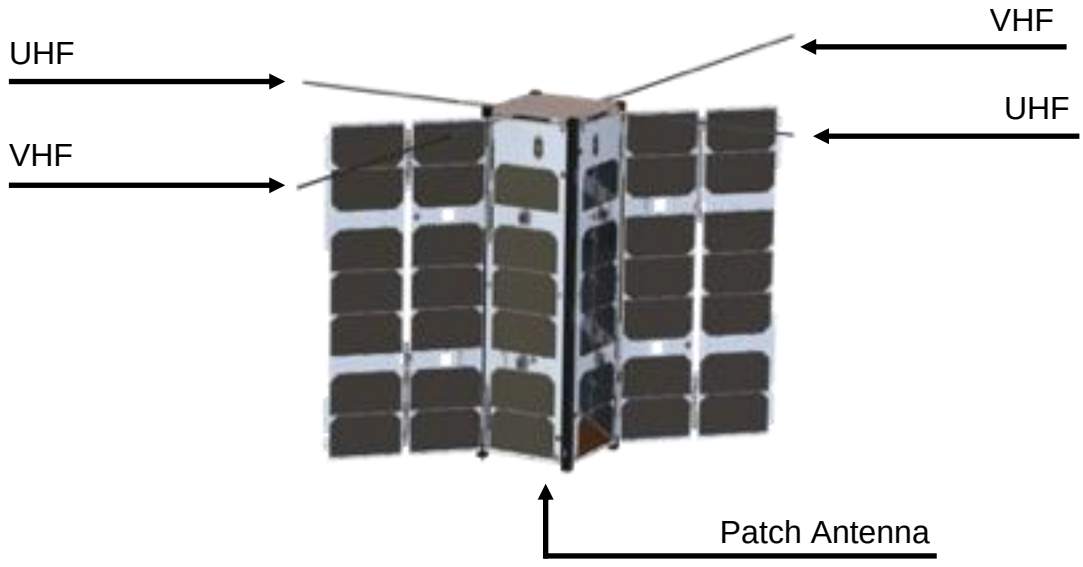
PROJECT DA VINCI Satellite Technical Description

The overall goal of the Da Vinci Mission is educational and global STEM outreach to students to learn more about space and communications. Schools will build a receiver kit, and receive and decode the UHF transmissions from the spacecraft.

The satellite will be launched as a secondary payload aboard ELaNa XIX, from Rocket Labs Launch Complex 1, Mahia, New Zealand, in November 2017. It will be inserted into an orbit at 500 km apogee and 500 km perigee, on an inclination from the equator of 85 degrees. Transmission will begin 15 minutes after launch, and cease 24 months after launch. Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs 3.9 years after launch. See the Orbital Debris Assessment Report for details.

The spacecraft is a single unit constructed of 3 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 3.4 Kg.

Figure Spacecraft DaVinci Overview



The satellite contains the following systems:

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Structures and Mechanisms

DaVinci is constructed using a 3U COTS aluminum frame. Two dipole antennas and two double deployed photovoltaic panels deploy from diagonally opposite long edges of the satellite, after the dispenser ejects the satellite into orbit. DaVinci has 5 mechanical switches that act as inhibits to deployment while the spacecraft is in the dispenser.

Pressure, Propellant and Propulsion Systems

DaVinci contains no pressurized containers, and no propellants or propulsion system. The electrical subsystem includes a Clyde Space 40Whr LiPF6 battery; the cells are not pressurized.

Attitude Determination and Control System (ADCS)

The ADCS is used for attitude and pointing adjustments. The main components are a motherboard, horizon IR sensors on solar panels, solar integrated magnetic torquers, 3 axis reaction wheels and sun sensors for solar tracking.

Communications System

The communication system consists of two radios, and associated antennas:

1. A Near Space launch EyeStar Duplex Module for two way communications to ground operations, via the Global Star Constellation. A patch antenna is used.

2. A Clyde Space Model CPUT VUTRX transceiver, supporting a UHF downlink, and a VHF uplink. Each link uses a dipole antenna pair.

Command and Data Handling On Board Computer (OBC)

The OBC subsystem has controllable and protected power delivery. Includes 4GB flash memory for mission data storage, Memory Protection Unit, processor, and real time counter. The OBC includes all communications interfaces to the transceiver and duplex modules (payload) and performs basic spacecraft state of health monitoring.

Electrical Subsystems (EPS)

The EPS consists of: body mounted and double deployed photovoltaic panels for solar energy conversion, a 40 W/hr lithium-ion (Li-ion) battery for energy storage, and EPS control electronics for power switching and telemetry gathering. .

Thermal Control Subsystem (TCS): Passive control through conduction only.

Payload Subsystem:

The payload consists of an Arduino MiniCam for low resolution imaging of the earth. Also, a metallic plate engraved with the names of donors to the DaVinci project, is mounted to the frame of the spacecraft.