Passive Inspection Cube Satellite – Technical Description

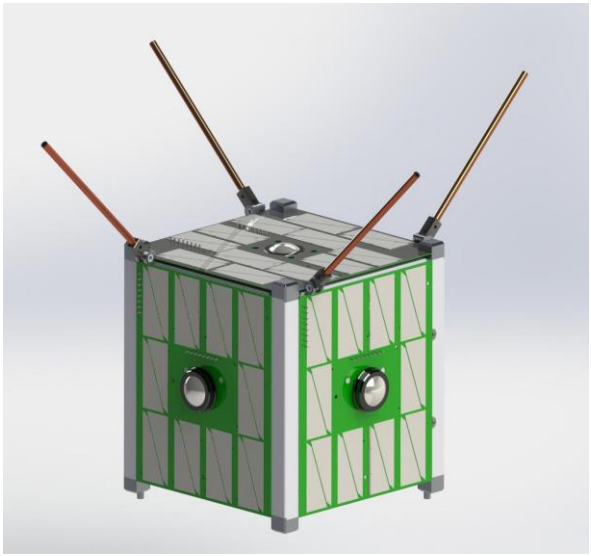
The overall goal of the Passive Inspection Cube Satellite (PICS) mission, is to image the launch vehicle to evaluate structural condition, validate state vector models, identify potential separation debris, and confirm separation. There are two identical Passive Inspection Cube Satellites, PIC A and PIC B.

The satellites will be launched as a secondary payload aboard Virgin Galactic LauncherOne, from a 747-400 flying out of Mojave, CA, in the winter of 2017. They will be inserted into a circular orbit at 500 km altitude, on an inclination from the equator of 98 degrees.

Transmission will begin 45 minutes after deploying, and cease transmission 2 years after beginning of operation. During this time, the spacecraft will be transmitting image and diagnostic data. De-orbiting occurs about 6.6 years after launch. See the Orbital Debris Assessment Report for details.

The spacecrafts are each 1U CubeSat modules. (10 cm. X 10 cm. X 10 cm.) The mass of each unit is about 1.65 Kg

Figure 1. 1U Passive Inspection Cube Satellite Overview



Each of the identical satellites contains the following systems:

Guidance, Navigation and Control (GNC) Subsystem: The GNC is an experimental set of torquing coils.

Command and Data Handling (CDH) Subsystem: The two critical printed circuit boards in the CDH subsystem are the Level Zero (L0) and the Flight Computer (FC) boards. The L0 board is the

most critical spacecraft control hardware, and operates regardless of flight computer operating state. The L0 includes all communications interfaces to the transceiver and the FC and performs basic spacecraft state of health maintenance. The FC board manages the cameras and data storage. It also handles transmissions and uplinked commands.

Electrical Power Subsystem (EPS): The EPS is an energy transfer system using six (6) solar panels (one on each face) to collect a total 2-3.3W of power in the sun, depending on orientation. The panels will be connected to a 2.2A-hr battery system, with over-current and overvoltage protection on input and output. These systems will then be connected to the EPS distributor board, which will regulate power to needed voltages and distribute it to the rest of the CubeSat as needed.

Thermal Control Subsystem (TCS): The TCS controls hardware temperature through cold biasing of the thermal design, utilizing heaters to stabilize temperatures. Sensors are wired to the L0 board, which hosts thermal control algorithms to control the heaters.

Structure Subsystem: The structure is fabricated of aluminum.

Propulsion Subsystem: No propulsion subsystem is included.

Communications Subsystem: This system is comprised of an Adamant Aerospace Elysium Full Duplex radio, and a carrier interface board. It is connected to BYU designed antennas; a turnstile design for transmit and a slot antenna to receive. This turnstile antenna will deploy approximately 45 minutes after launch. It will communicate on 903 MHz downlink, 459 MHz uplink, with the ground station on the BYU campus.

Imaging Subsystem: On each face is an ArduCam camera, designed to capture images in a hemisphere. During deployment, one or more of these will image the launch vehicle. After deployment is finished, they will continue to image the vehicle and other deployed satellites. Once far enough away, other images of the earth will be taken as well as possible flybys of other satellites.