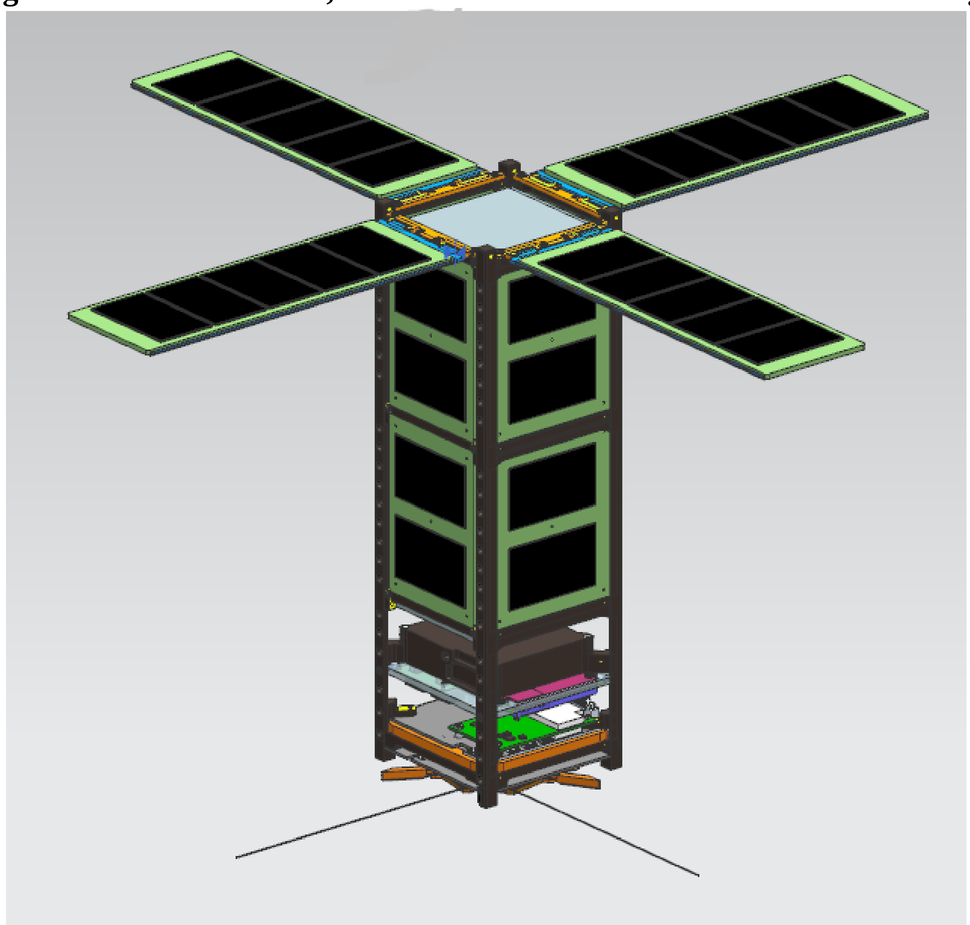
INCA Satellite Technical Description

The overall goal of the INCA mission, is to detect the density of solar neutrons, to fill a gap in our current space environment data. The on board neutron detector will differentiate between neutrons and other charged particles which pass through the instrument.

The satellite will be launched as a secondary payload aboard Virgin Orbit's LauncherOne, from an air launch over the Pacific, in June 2018.   It will be inserted into a 500 km circular orbit, with an inclination of 90 degrees. Transmission will begin 45 minutes after deployment, and cease upon command from the ground station, within 2 years after initiating operation. Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs 6 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 10 cm X 10 cm X 30 cm.) The total mass is about 4 Kg.

Figure 1 INCA Overview, Antennae are located at the bottom of the image



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The satellite contains the following systems: Attitude Determination and Control (ADC), Command and Data Handling (CDH), Communications (COM), Electrical Power System (EPS), Thermal Control System (TCS).

Attitude Determination and Control (ADC) Subsystem: The ADC is a purely electromagnetic system to keep INCA at the proper attitude for the onboard experiment to get proper data, and cancel environmental torques. The system consists of 3 torque coils, triaxis magnetometer, triaxis rate gyros, and a sun sensor. The mission calls for the attitude of the satellite to spin about the sun vector.

Command and Data Handling (CDH) Subsystem: The CDH system is primarily run by a Tyvak Intrepid system. The Intrepid system controls the operating state of the spacecraft, controls the UHF radio, interfaces with GPS and all spacecraft sensors, and monitors spacecraft health. The CDH system also includes a custom payload interface board and BeagleBone Black processor that are used to interface with the neutron detector and control the Globalstar Simplex radio.

Communications (COM) Subsystem: Most of INCA's communication is done with the Tyvak Intrepid UHF Half-Duplex transceiver and L-dipole antenna. This radio will be used to communicate with a ground station at New Mexico State University in Las Cruces, NM, for most of the telemetry data and all of the command data. The satellite also carries a separate sci-Zone LinkStar STX-3, transmitting to the Globalstar constellation. The STX-3 transmits location, and a small amount of spacecraft health and neutron detector data for a limited amount of time (limited by a deadman timer). Transmissions will be made from the Globalstar radio only if the antenna beam is not pointed towards Earth.

Electrical Power Subsystem (EPS): The INCA Electrical Power Subsystem will rely on four identical deployable solar module arrays, one on each side of the satellite. All four modules together will produce a total of 11.45 watts, orbit average.   A lithium ion polymer rechargeable battery pack will operate at 3.7 volts nominal, with a nominal capacity of 5 amp-hours. Power management is provided by the SPV1040 high efficiency maximum peak power tracker.

Thermal Control Subsystem (TCS): The TCS controls temperature passively, using a heat sink. Coupled with flight attitude control, this will control the temperature of the spacecraft.

Structure Subsystem: The structure is fabricated of Aluminum 6061.

Propulsion Subsystem: No propulsion subsystem is included.

Payload Subsystem: The payload will consist of a neutron detector that will differentiate between neutrons and other charged particles which pass through the instrument. The detector will interface with the BeagleBone Black processor.