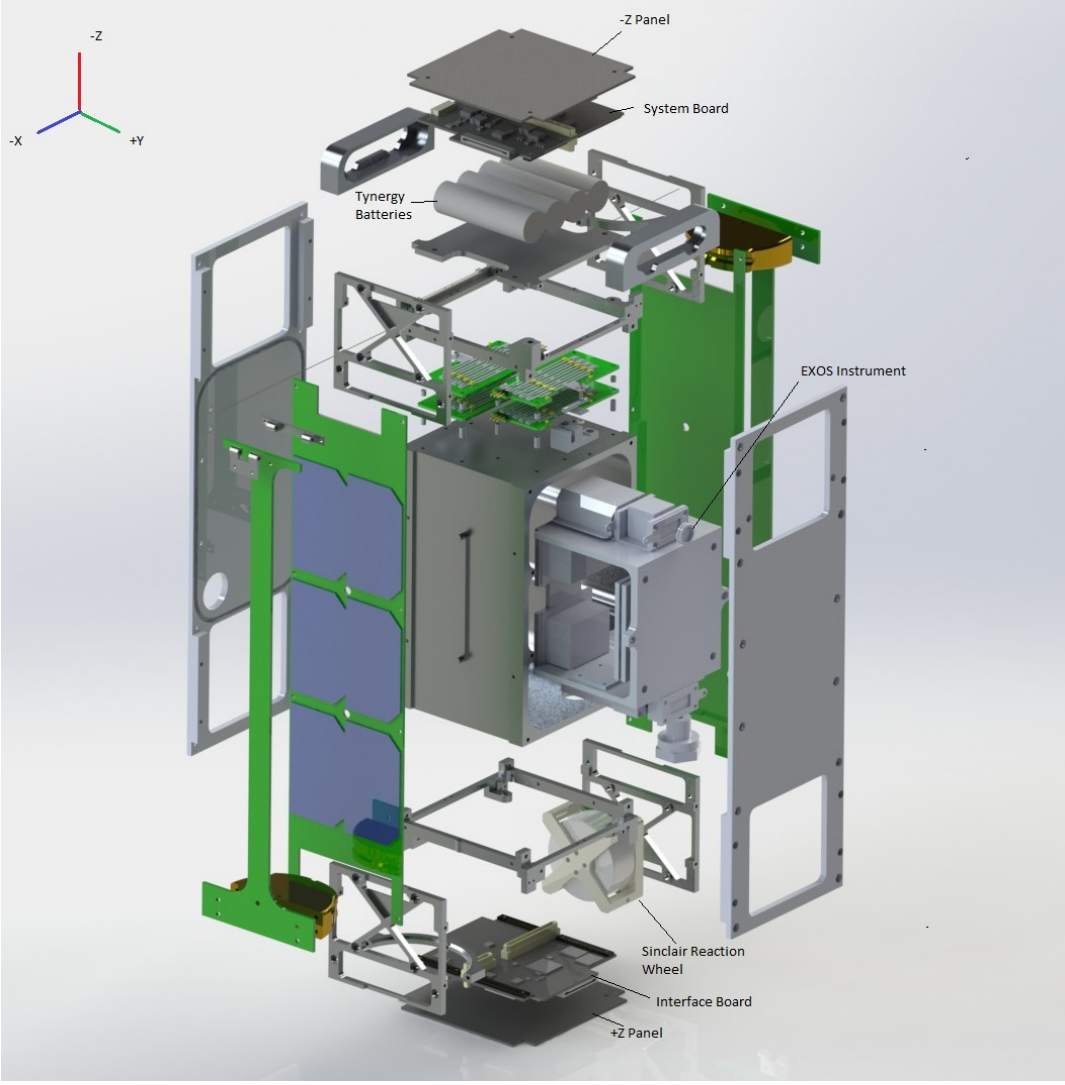
ELaNa X ODAR

ExoCube (CP10) – California Polytechnic State University – 3U



ExoCube will measure in-situ densities of various ions and neutrals in the upper ionosphere and lower exosphere. The densities are measured using a gated time-of-flight mass spectrometer designed and built by NASA Goddard. These measurements will be used to characterize the climatology of the upper ionospheric and lower exospheric composition. They will help validate current empirical and climatological atmospheric models. A satellite bus to house the mass spectrometer was designed and built by Cal Poly. The bus includes an environmental chamber to protect the instrument and a 3-axis attitude determination control system (ADCS) that will maintain stable Nadir and Ram pointing necessary for accurate data measurement. The ADCS uses gravity gradient stabilization with deployable booms and a Sinclair momentum wheel to stabilize the roll axis and Ram pointing. The mission life is expected to be 6 months to a year.

After deployment from the P-POD, the satellite will power on. Approximately 40 minutes later, antenna deployment will occur. Upon verification of antenna deployment, the beacon will be activated and the satellite will acquire with the ground station. The ground station will uplink the current time and TLEs. The detumble process will then begin using magnetometers and magnetorquers. Once the rates have been reduced, the PD controller and Kalman Filter will be activated and the booms will be deployed. Once Nadir pointing is acquired, the momentum wheel will begin spinning up. Around 4 hours later, the wheel will be at full speed and then satellite will reacquire Nadir and Ram pointing. The camera on the –z panel will take pictures to verify the correct pointing. Once the correct orientation is verified, the instrument will be powered on. On every pass over a ground station (approx. every 12 hours), the satellite will downlink data from the instrument and uplink the current time for the clock and new TLEs to maintain accuracy of the orbital propagator.

The structure is made entirely of 6061-T6 Aluminum. The deployable booms are made of FR4 with the tip masses being brass. The Antenna is made of NiTi and Delrin. The satellite contains mostly standard commercial off the shelf materials, electrical components, PCBs, and solar cells. The cathode inside of the instrument is made of tungsten, but the tungsten is small enough that it does burn up during re-entry.

There are no pressure vessels, hazardous materials, or exotic materials.

There are 4 1-cell batteries on the satellite. They are all Tenergy Li-Ion, 3.7 V 2600 mAh batteries (Item number 30011-02). The UL listing number is MH48285. There is battery protection circuitry and over-charge protection circuitry. All batteries are connected in parallel. These are the same batteries used on CP8.