

COSMIC X-RAY BACKGROUND NANOSAT PRE-FLIGHT



CUBESAT DEVELOPER'S WORKSHOP

SPRING 2012 – APRIL 18, 2012

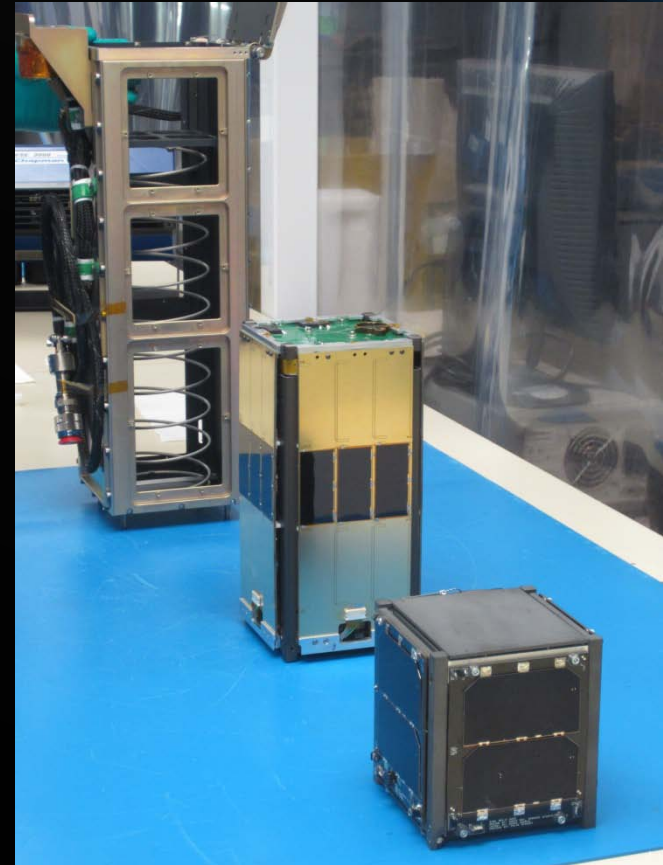
CXBN – OVERVIEW

- Scientific 2U CubeSat – CZT X-Ray Detector System
- Store and forward architecture mission
 - Constantly powered payload
 - Spin-stabilized
 - Sun-pointing
 - Foldout panels
 - High inclination (60°)
 - UHF: 4 contacts per day ~ 10 minute window
- S/C built entirely in-house @ MSU



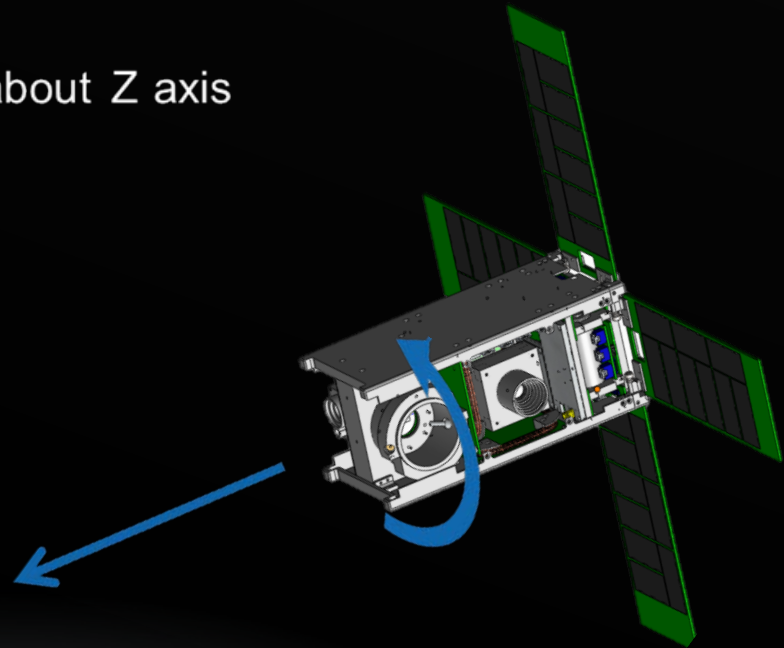
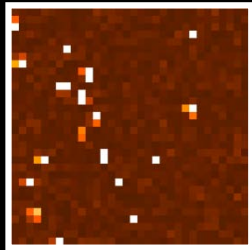
TIMELINE – MILESTONES

- 01/31/11 NASA Award Letter Received
- 02/09/11 Kickoff Webinar
- 04/21/11 PDR
- 08/31/11 CDR
- 11/18/11 MRR
- 12/31/11 Delta-MRR
- 01/04/12 Delivery
- 08/XX/12 Launch Date

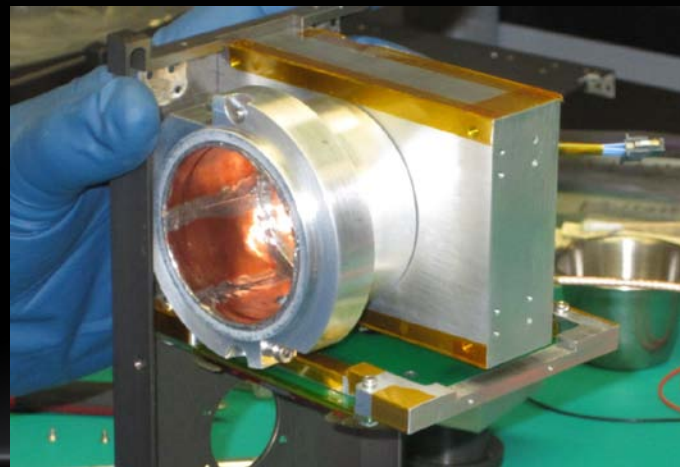
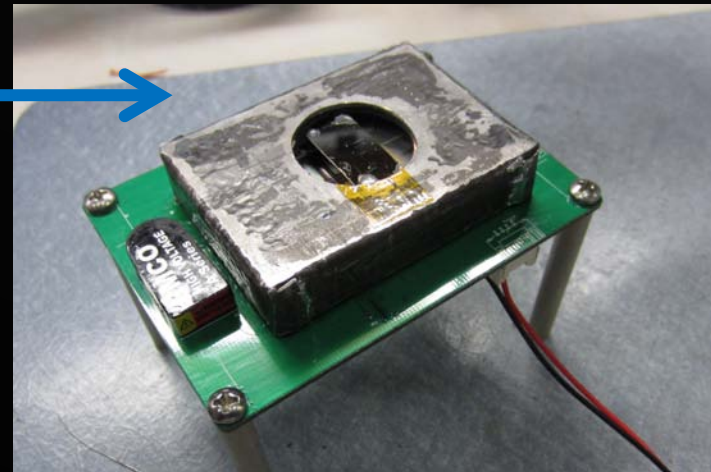
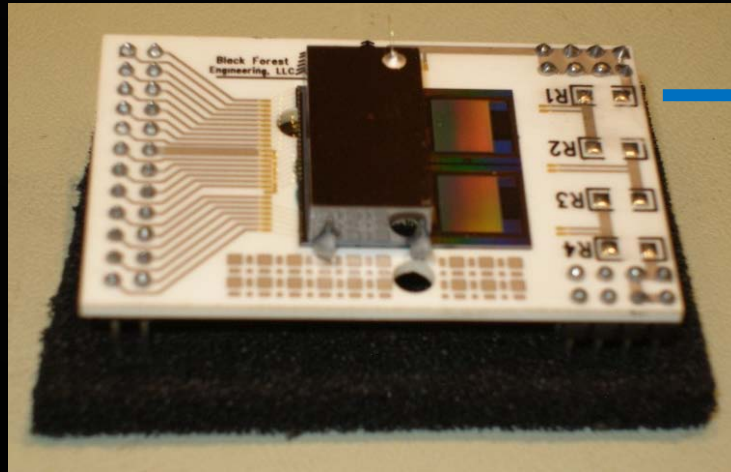


CZT ARRAY – SCIENCE PAYLOAD

- X-Ray detector system – 30-50 keV
- Graded-Z shield – Lead, Tin, Copper
- Collimator set 36° field of view
- Sweeps out sky as satellite spins about Z axis
- 2cm x 1cm block of CZT

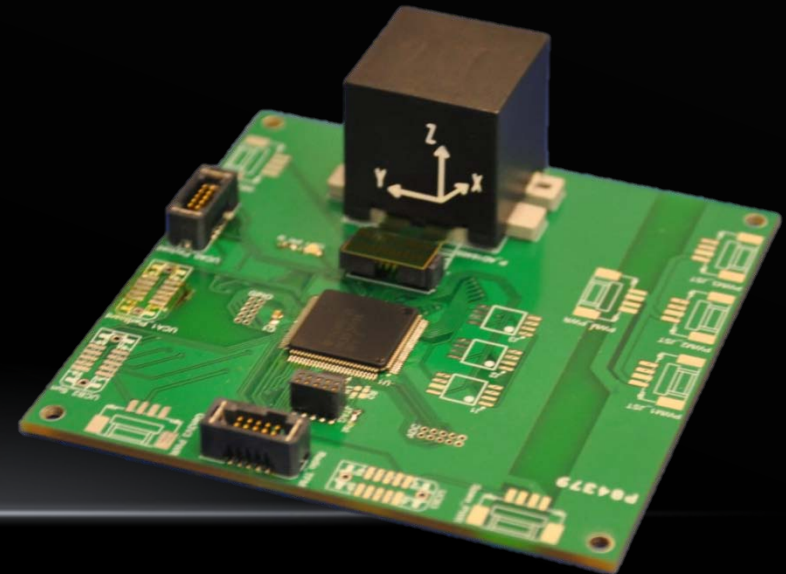
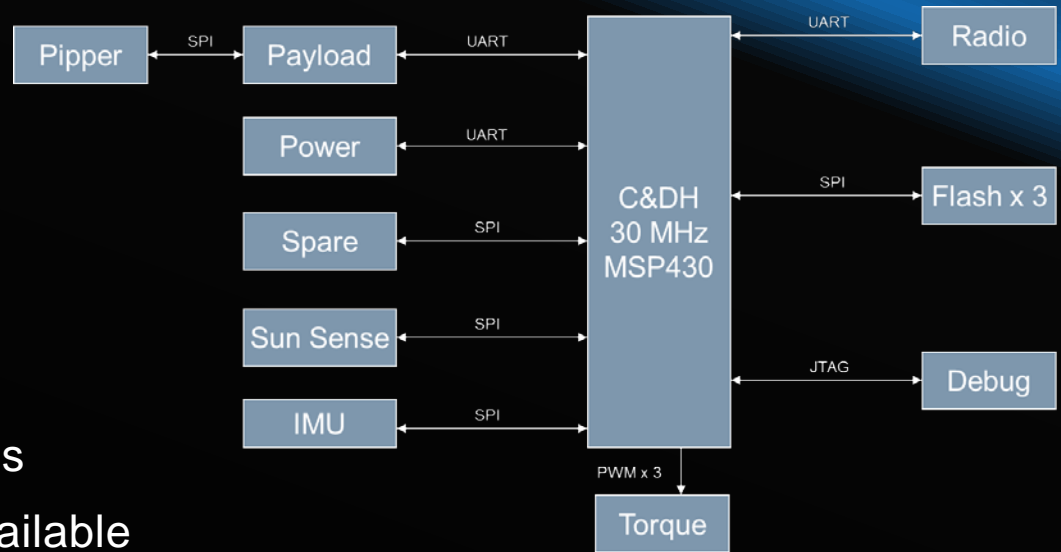


CZT ARRAY – SCIENCE PAYLOAD



C&DH

- MCU – MSP430
 - 65 mA – active
 - 3 – 16-bit timers
 - Direct memory access
 - 100-pin packages available
 - Up to 8 communication interfaces
 - LQFP package
- Reprogrammable
- Provides BSL entry
 - Payload
 - EPS



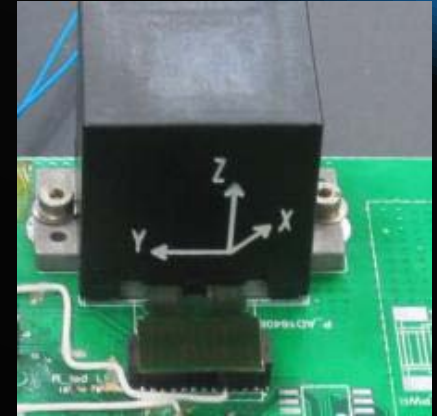
ADS – PITCH AND YAW

- Dual Sun Sensor (DSS)
 - +Z Boresight accuracy
 - Quadrant photodiode system
 - Medium and Fine field of views
 - Less than 100 mA draw
 - Dedicated MSP430

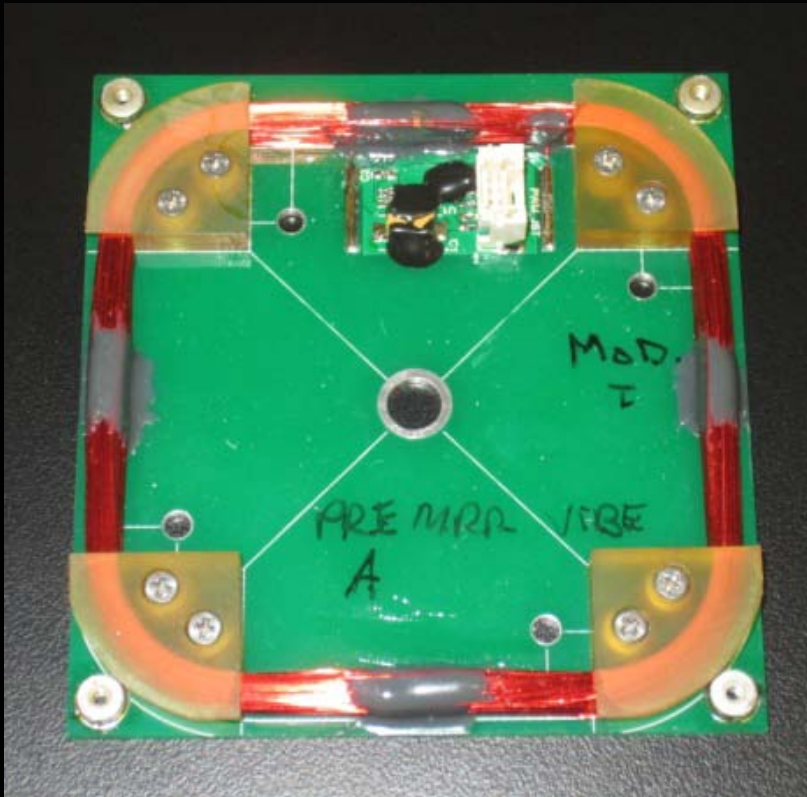


ADS – ROLL DETERMINATION

- MEMS IMU package – roll rate
 - Tri-Axis Gyros
 - Tri-Axis Magnetometers
 - Temperature Sensor
- Canopus Pipper – roll position
 - Photodiode array system
 - Differential measurements
 - Run by payload – synchronized data



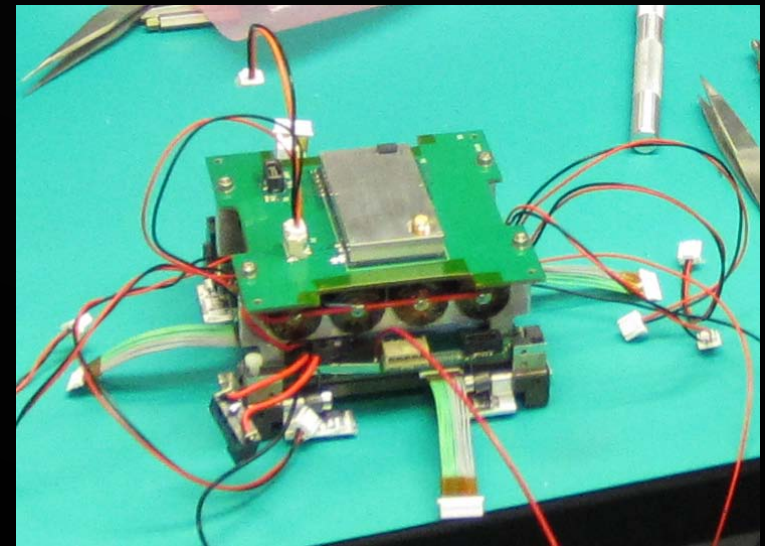
ACS



- Magnetic Torque Coils
 - 3 Axis Control
 - H-Bridge driven by PWM from C&DH
 - Checked polarity in single axis Helmholtz chamber
 - ~500 mA average
 - 1.6×10^{-4} Nm torque

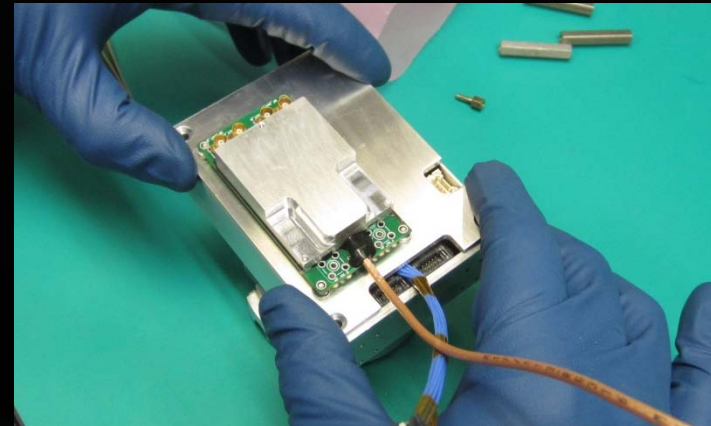
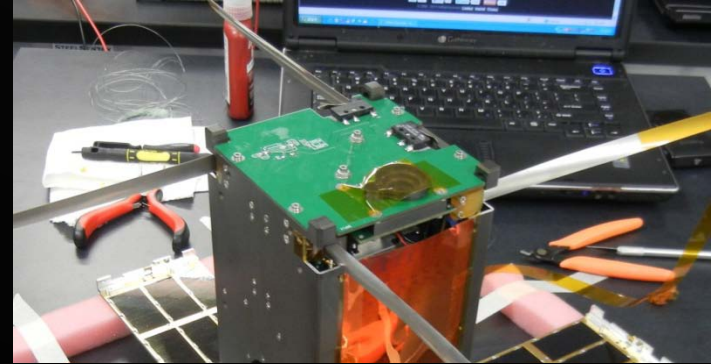
COMMS – RADIO

- UHF Transceiver – AstroDev Li-1
 - Flight heritage
 - GFSK
 - 437.525 MHz
 - Transmit power: 31.5 dBm
 - Beacon
 - Backdoor reset
 - Ping
 - Ping w/ telemetry
 - Provides BSL entry to C&DH



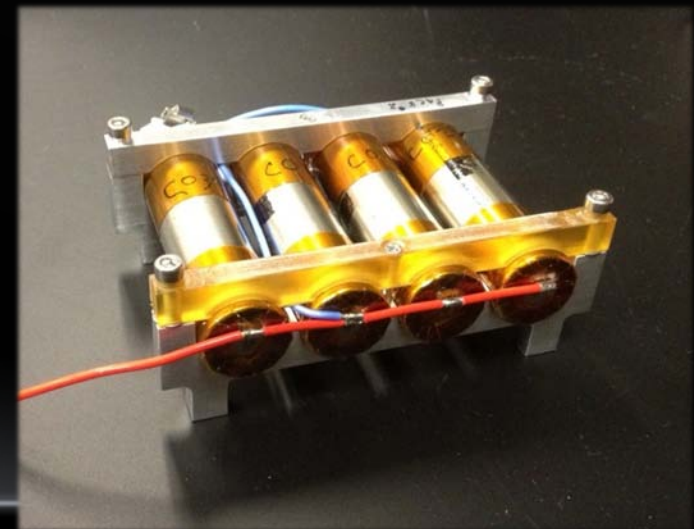
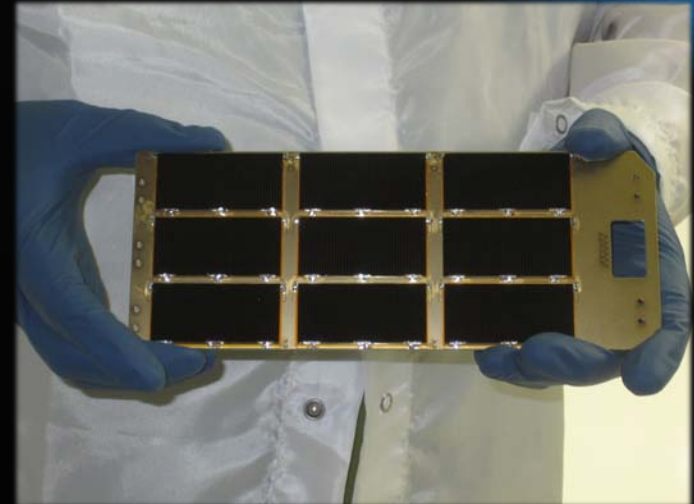
COMMS – ANTENNAS

- 1/4 Wave Steel Blades
 - Quadrature monopole array
 - Phase network for RHCP
 - Tune to S_{11}
 - Verified in anechoic chamber



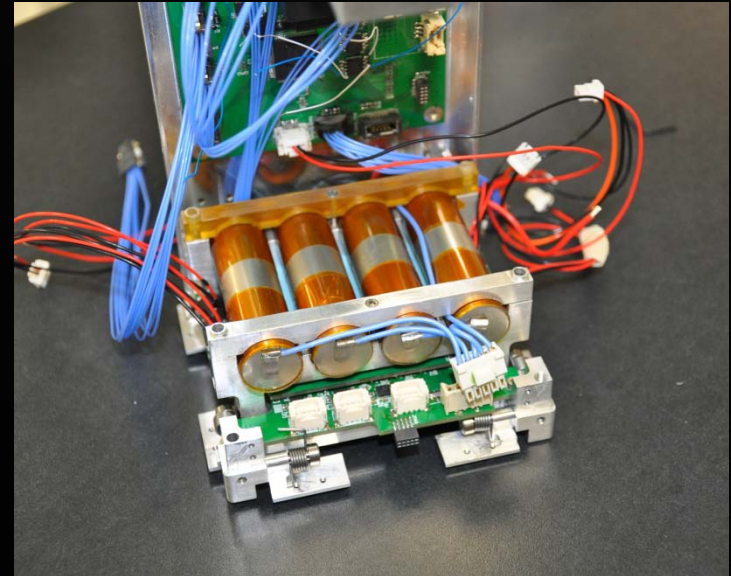
EPS

- Generation
 - 4x Deployable Solar Panels
 - ~15 W total after sun pointing
- Storage
 - Molicel 18650 Li-ion batteries
 - 1S4P configuration – buck/boost
 - 2200 mAh



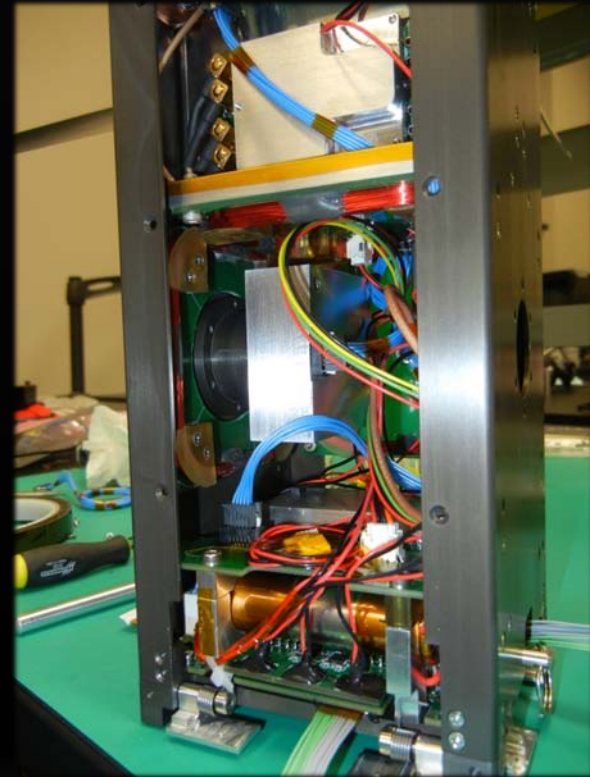
EPS

- Management and Distribution
 - Direct Energy Transfer
 - Dedicated MSP430
 - Shunt regulation
 - 3.3V and 5V regulated rails
 - Current limiting on all subsystems
 - Deployable cut circuit
- 7 Revisions !!!



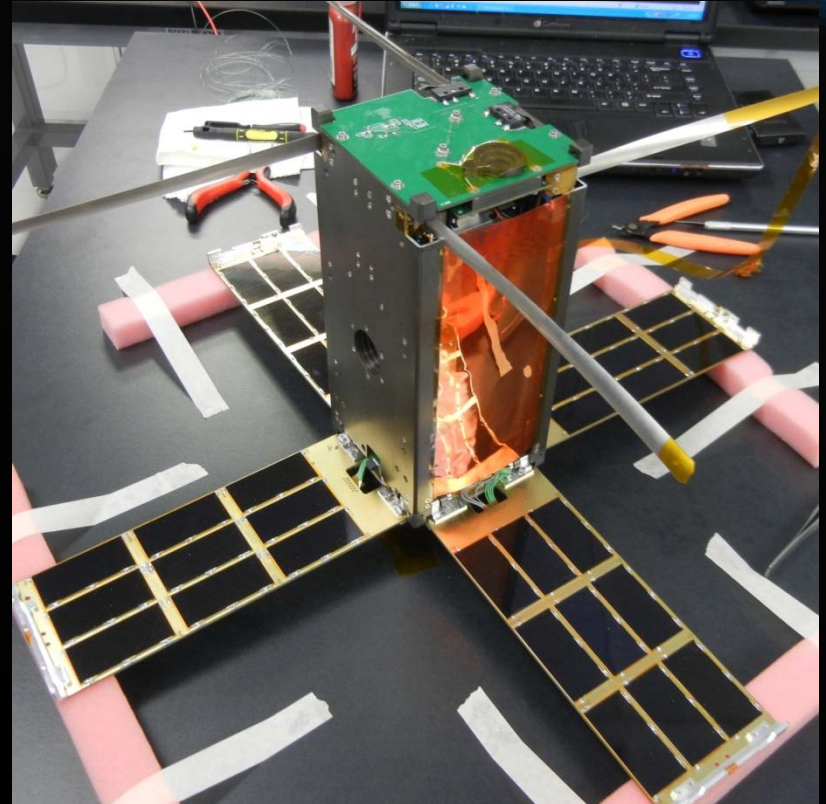
STRUCTURES

- Aluminum 6061-T6
- Type III Hard Anodized
- Central mounting concept
 - “Mounting block”
 - 2 Walls
- RBF pin slot



CXBN ASSEMBLY

- Resets and static
- Easily accessible radio and C&DH
- Expanding after shake





CONCLUSION



QUESTIONS?