QB50 Science Units

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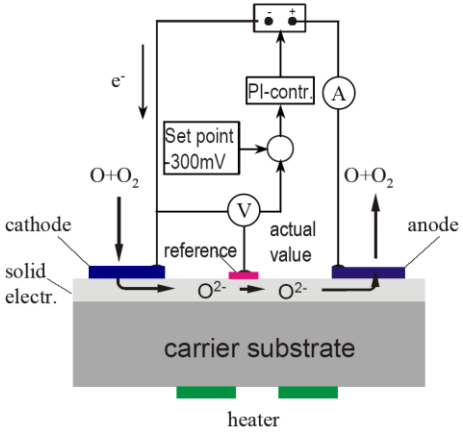
Selected Sensor Sets

- Set 1
  - Neutral Mass Spectrometer
  - Flux-Φ-Probe Experiment (FIPEX)
  - 2 corner cube laser retroreflectors (CCR)
  - Thermistors/thermocouples/RTD
  - Volume 770 cm^3
  - Mass 660g
  - Qty in QB50 network: 20
- S et 2
  - Ion Mass Spectrometer
  - A set of 4 Langmuir probes
  - 2 corner cube laser retroreflectors (CCR)
  - Thermistors/thermocouples/RTD
  - Volume 717 cm^3
  - Mass 680g
  - Qty in QB50 network: 20

Estimated values based on details provided by sensor providers.
Science/resource envelope trades in progress
Mass, power, volume, duty cycle, funding

Flux-Φ-Probe Experiment – FIPEX

T. Schmiel, S. Fasoulas, Dipl.-Ing. Andreas Weber, TU Dresden



Au-cathode

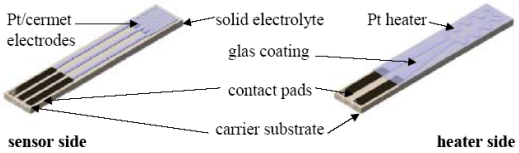
- non-dissociative adsorption
- detection of (AO)
- cathode reaction (simplified)

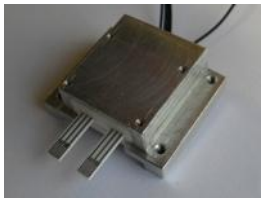
$(O_2) + O + 2e^- \rightarrow O^{2-} + (O_2)$

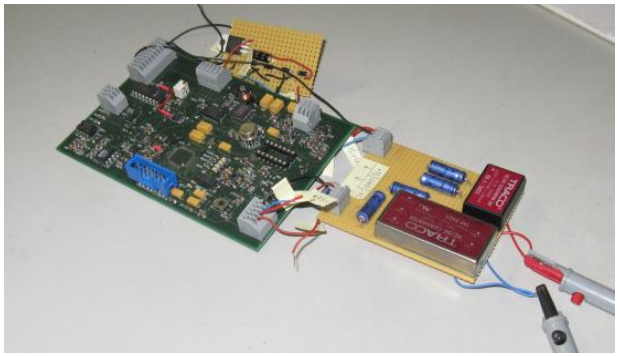
Pt-cathode

- dissociative adsorption
- detection of AO and O_2
- cathode reaction (simplified)

$O_2 + O + 6e^- \rightarrow 3\ O^{2-}$



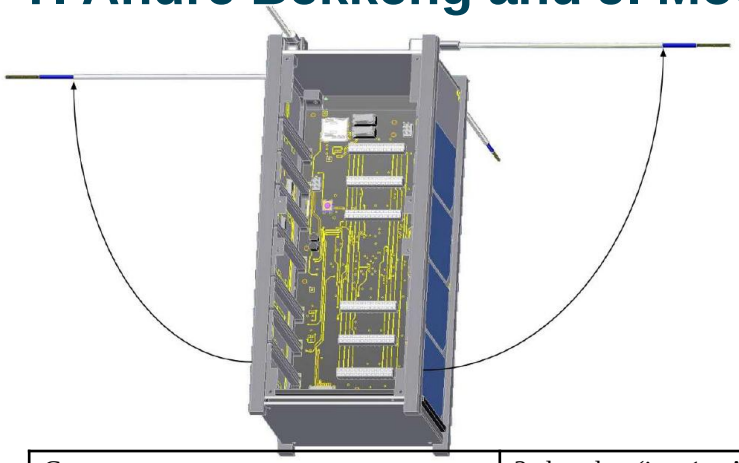


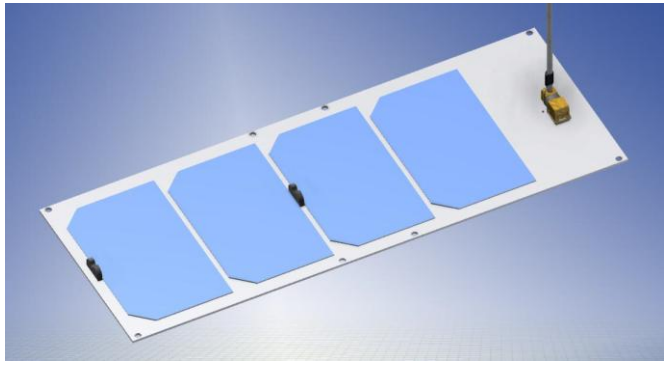


Sensor unit	
Dimension	36 x 30 x 12 mm³
No. of sensors	2
Type of sensors	AO (atomic oxygen)
Mass	15g (excluding harness)
Field of View	~180 deg (free flow)
Heating Power	< 1,6 W
Electronic / PCB	
Sensor	1 + 1 spare, no parallel operation
Dimension#1	80 x 100 x 10 mm³
Power (includes sensor heating power)	12 V: 2700 mW#2 5 V: 100 mW 3,3 V: 200 mW
Mass	70g (excluding harness)

Multi-needle Langmuir probe – mNLP

T. André Bekkeng and J. Moen, University of Oslo





Current measurement range	3 decades (i.e. 1 nA to 1 μA), but adjustable by in-flight automatic gain control
Electron density range	$10^{8}m^{-3}$ to $10^{12}m^{-3}$ (adjustable to match mission requirements)
Accuracy	16 bit raw data, but downsampled to 8 / 10 / 12 bit data product
Sampling rates	Up to 7 kHz, adjustable by uploadable selection commands

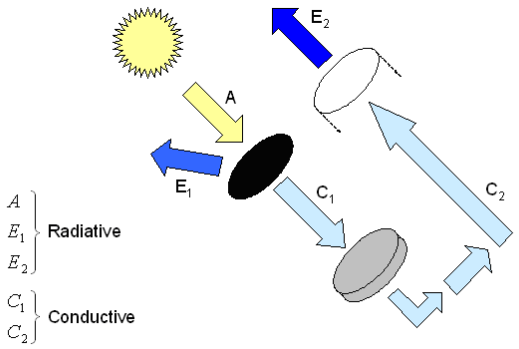
Mode: Complete scientific coverage On-board processed: 100% Duty cycle:	~1.25 MB per orbit
Mode: Partial scientific coverage On-board processed: 25% Duty cycle:	~312.5 kB per orbit
Mode: Irregularity survey mode 100% Duty cycle	8.6 kB per orbit

Microcalometric irradiance monitoring - QBOS

M.van RUYMBEKE, JPh.NOEL, Royal Observatory of Belgium

Abstract:

The bolometric part of the SOVAP instrument (SOVAP-BOS) embarqued on the PICARD satellite will be a space premiere. Its sensing element is based on the monitoring with micro-temperature differential thermometers placed on a thermic shunt. A 120dB dynamical range could be achieved with a ten seconds sampling rate integrator based on the counting of frequency modulated output. A second paper published in the next Ciel&Terre will overview some preliminary examples of results achieved with the BOS.



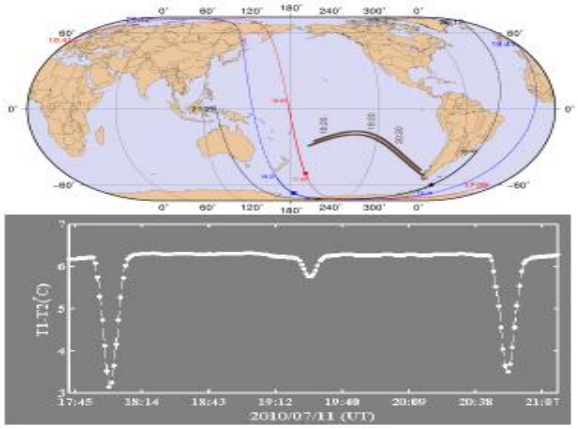
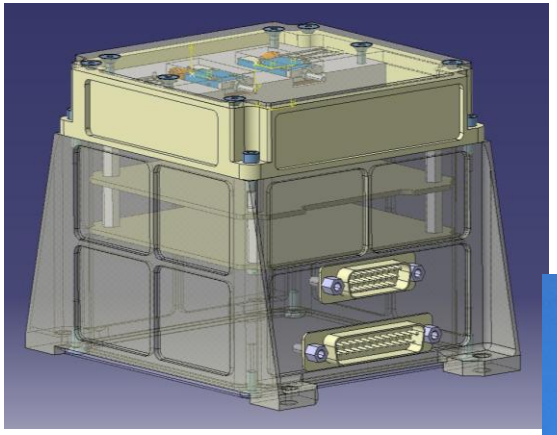


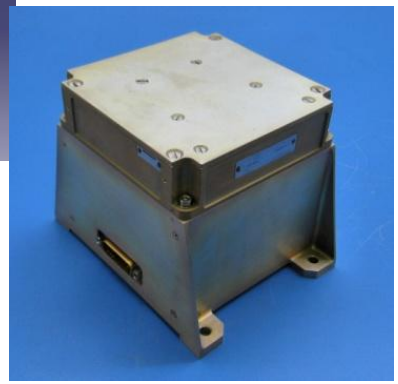
FIGURE: The solar eclipse.

Ion and Neutral Mass Spectrometer – INMS

D. O. Kataria, Alan Smith, MSSL, UK

- CubeSat compatible “standalone” package
  - 10 x 10 x 4 cm^3

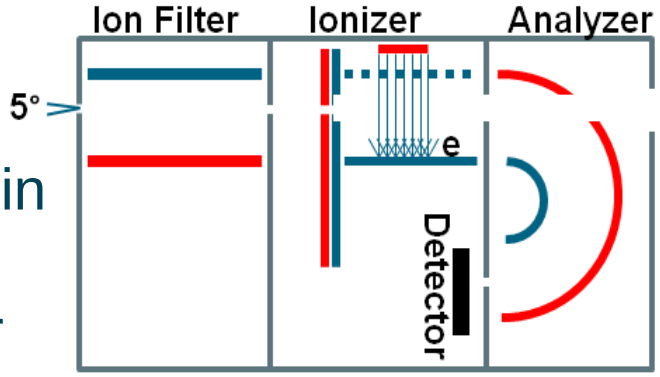




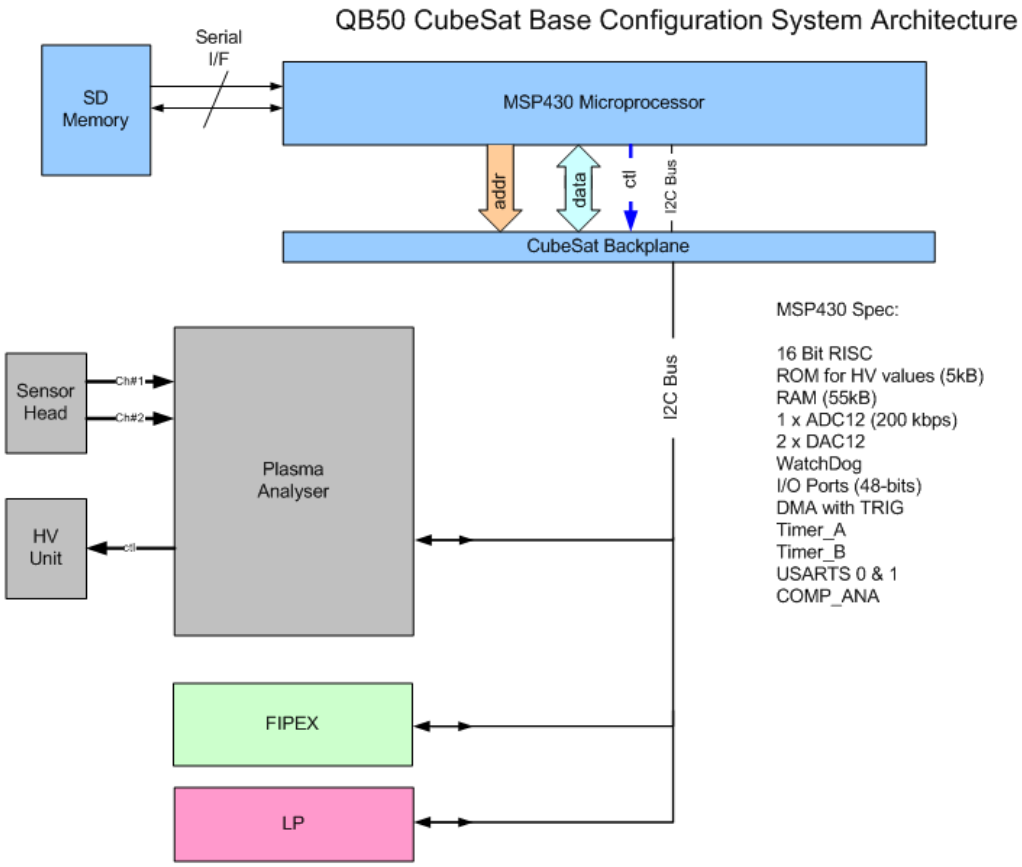
	Mode B Ionosphere
Particle Type	Ions
Key View direction	Ram
PROPERTIES	
Energy range (eV)	0.1 to 28
Energy resolution (%)	< 3
Elevation resolution	5°
Azimuth resolution	5°
Sample Time	4ms
Energy Sweep time	1s
Energy Sweep steps	256

Neutral Particle Analyser development

- ChaPS analyser combined with Ioniser
- Optimised for resolving the major constituents in the lower thermosphere, i.e., O, O_2, N_2
- Ionizer development
  - Proof-of-concept testing completed
  - Design definition and Electron Optics in progress
  - Integration and testing in late summer



Science Unit: Design philosophy



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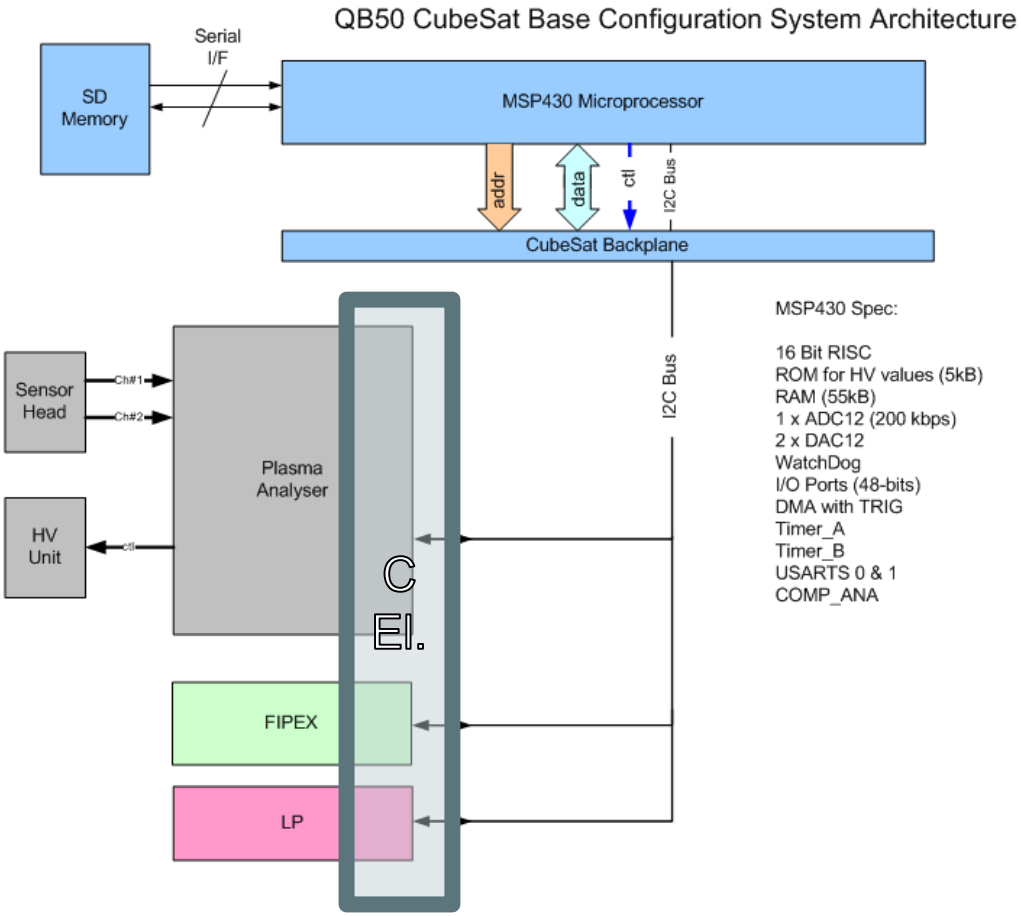

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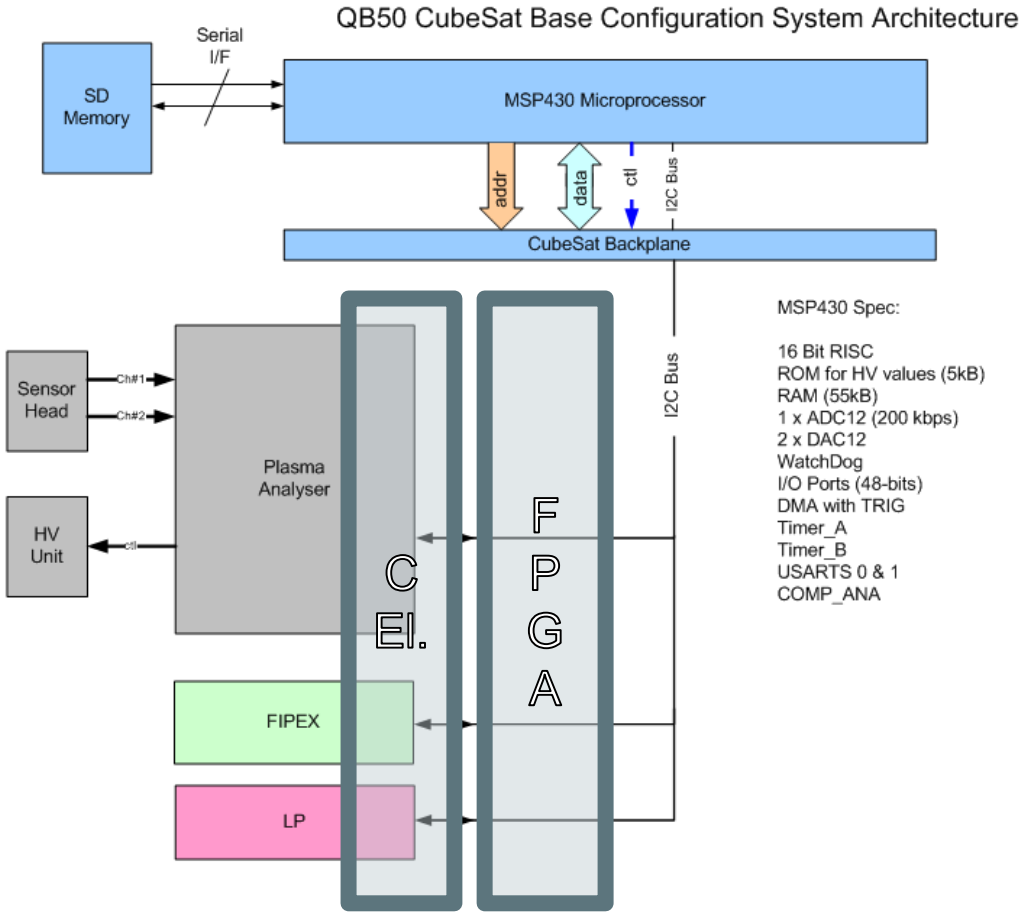
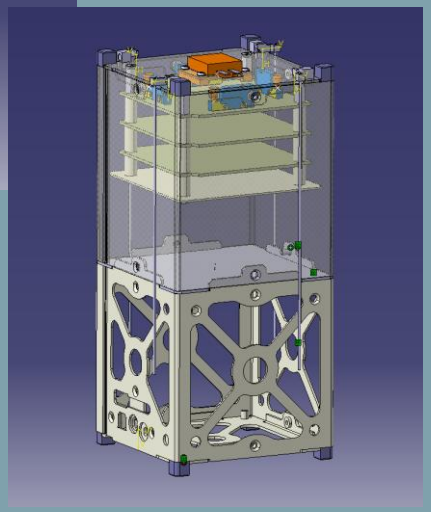
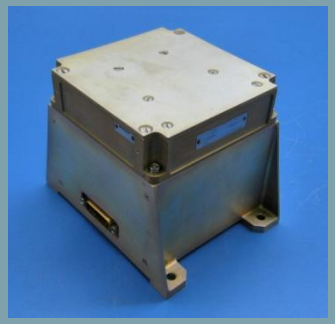
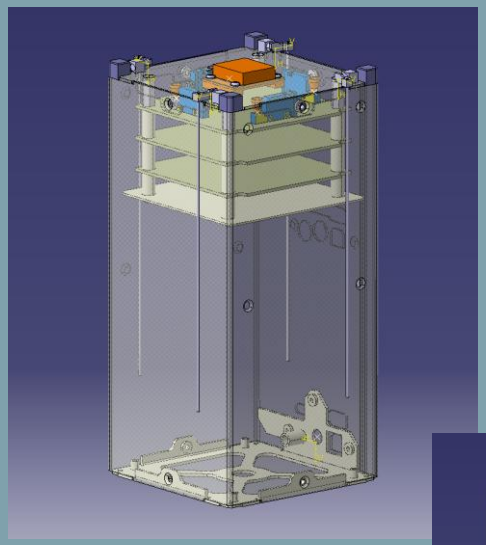
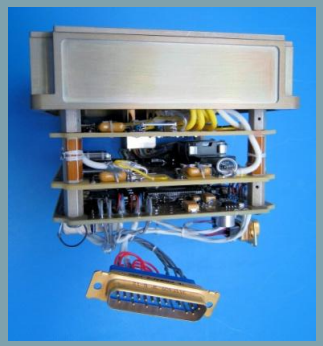


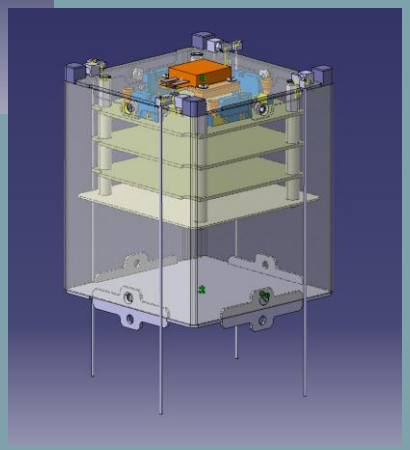
Accommodation trade











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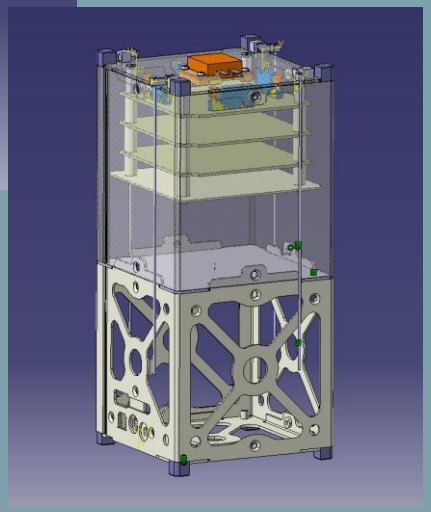

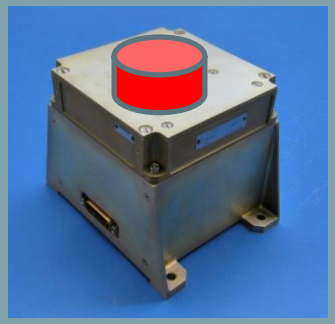

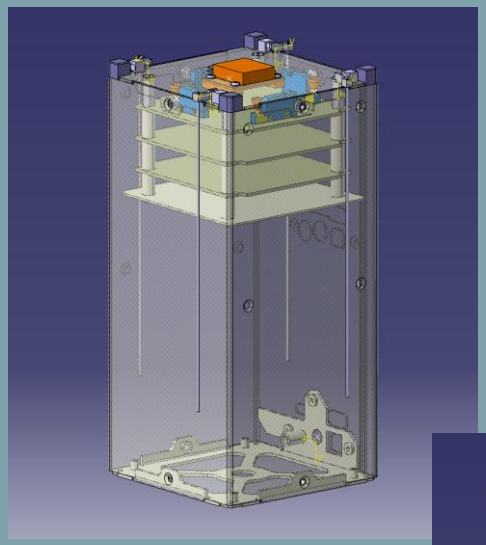

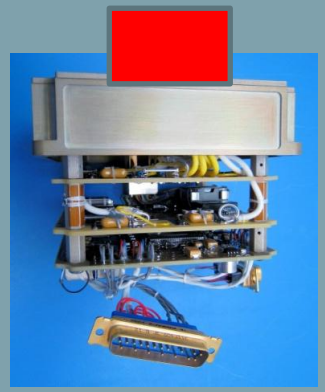

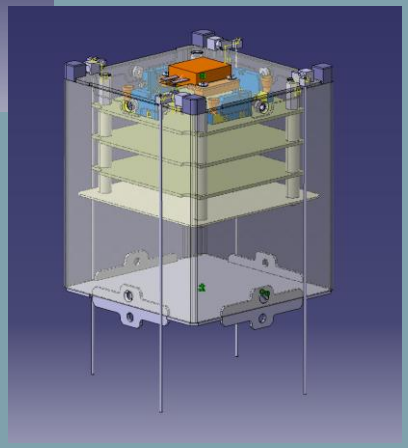

Interface Control Document

- Preliminary ICD
  - Based on current sensor sets
  - Resource envelope not expected to increase
- “Living” document
  - Not for long though
- Update to be released 5th March
  - Will include final release date

Summary

- Sensor selection summary
- Science/resource envelope trade
  - Mass, power, volume, duty cycle, funding
- Accommodation trade
- Timeline