



Progress and Update of UNSW ECO: Australia's First Cubesat Trio in Orbit

Joon W Cheong

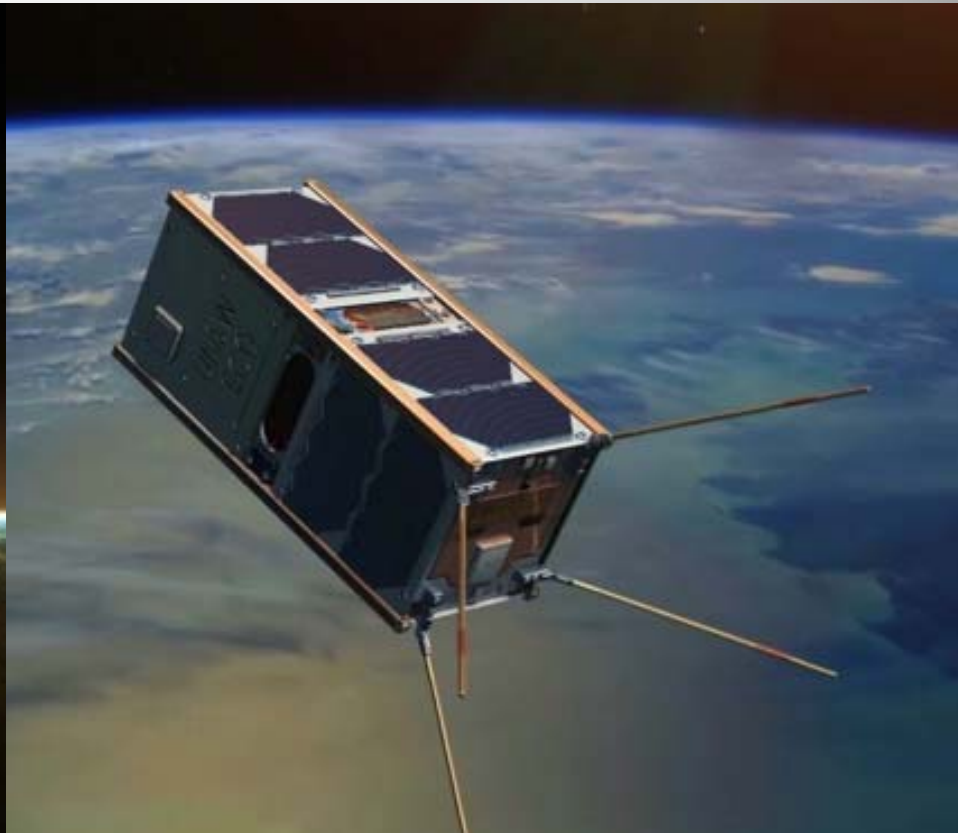
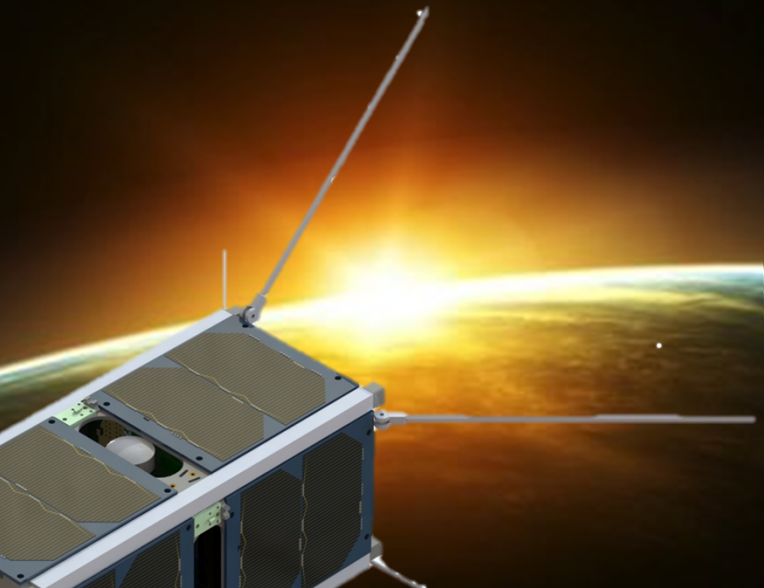
Never Stand Still

Faculty of Engineering

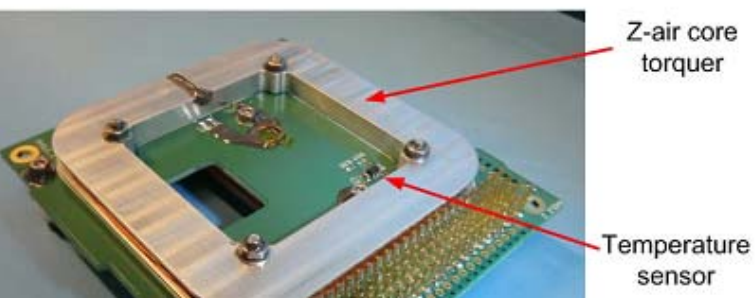
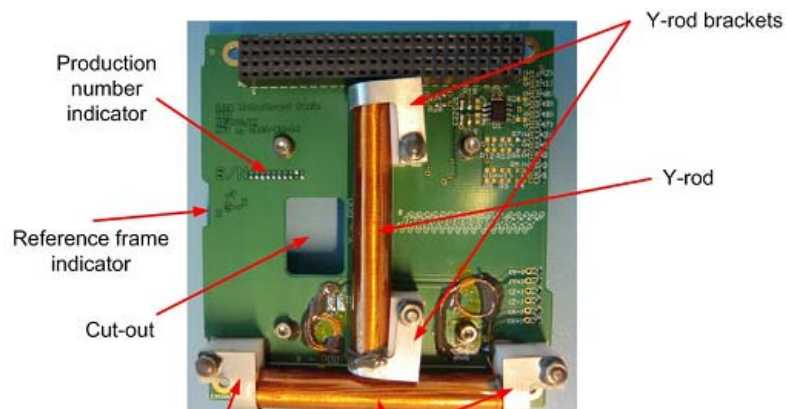
Australian Centre for Space Engineering Research (ACSER)



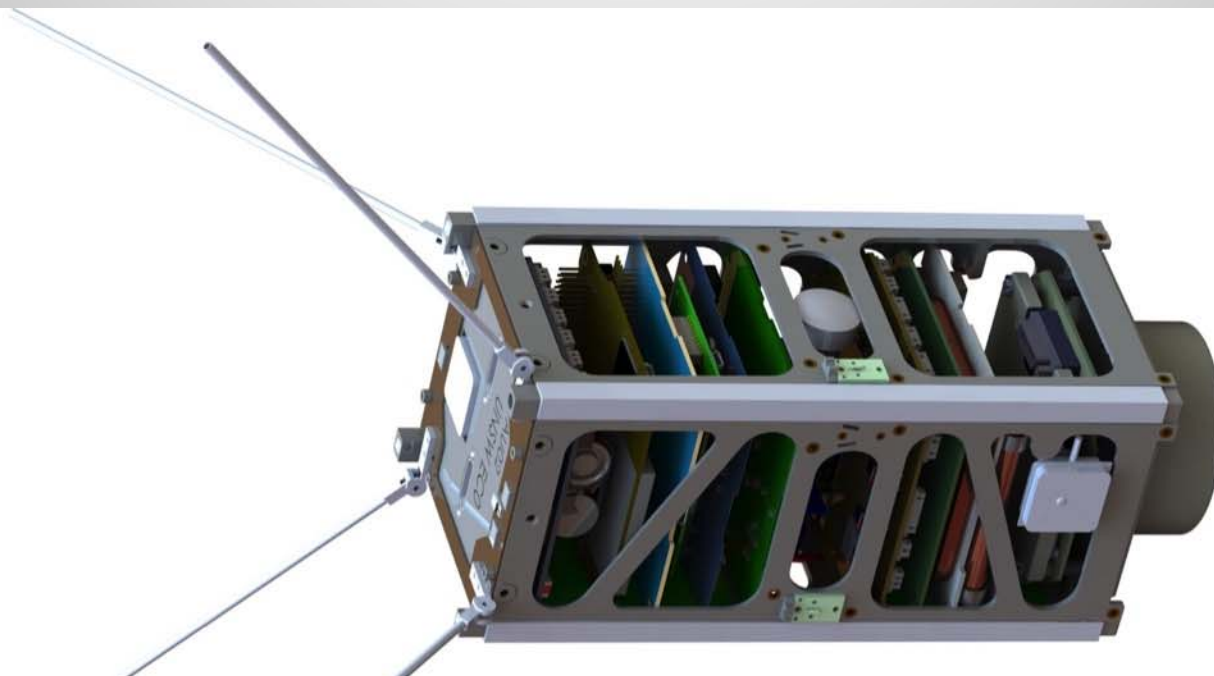
Sat Name: UNSW-EC0
Designation: AU02
AD ID: 42723



Attitude Sensing & Control

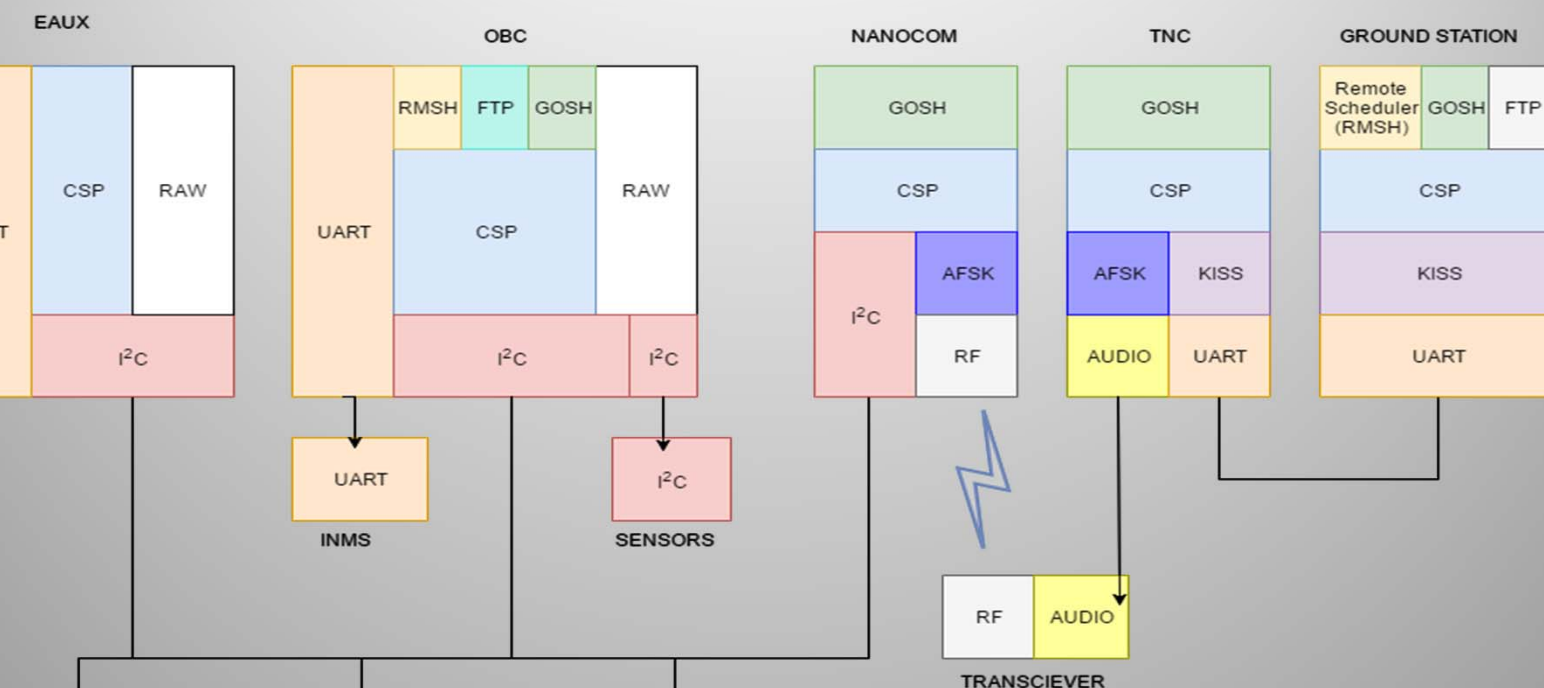


Experiment: 3D printed Structure

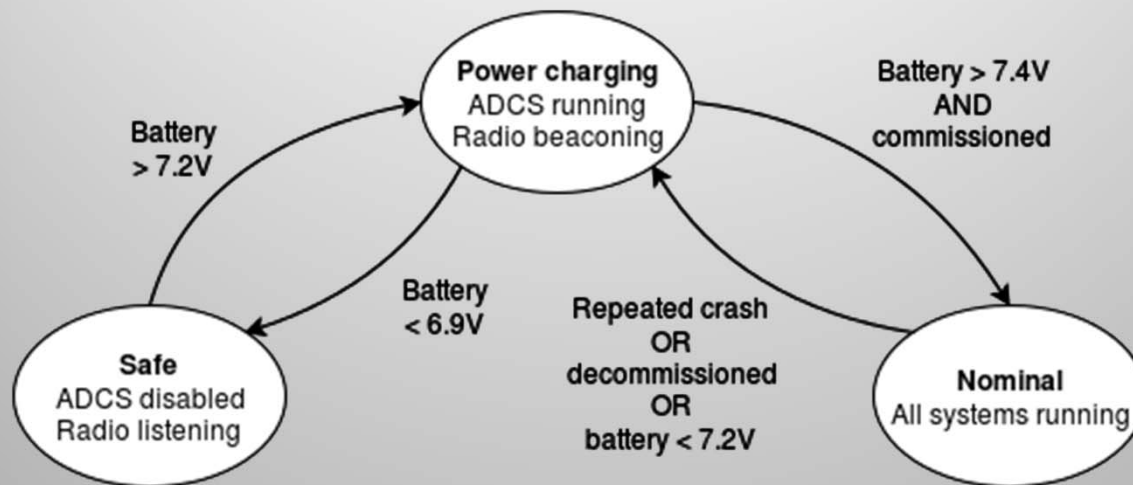


Partially Developed @ UNSW Sydney

SP Bus Communications



Power & Mode Management



On Board
Computer

Launch to ISS

smartcompany | StartupSmart Business Advice Lists

StartupSmart News and Analysis StartupSmart Advice

First Australian-built satellites launched in 15 years

CONVERSATION / Monday, April 24, 2017

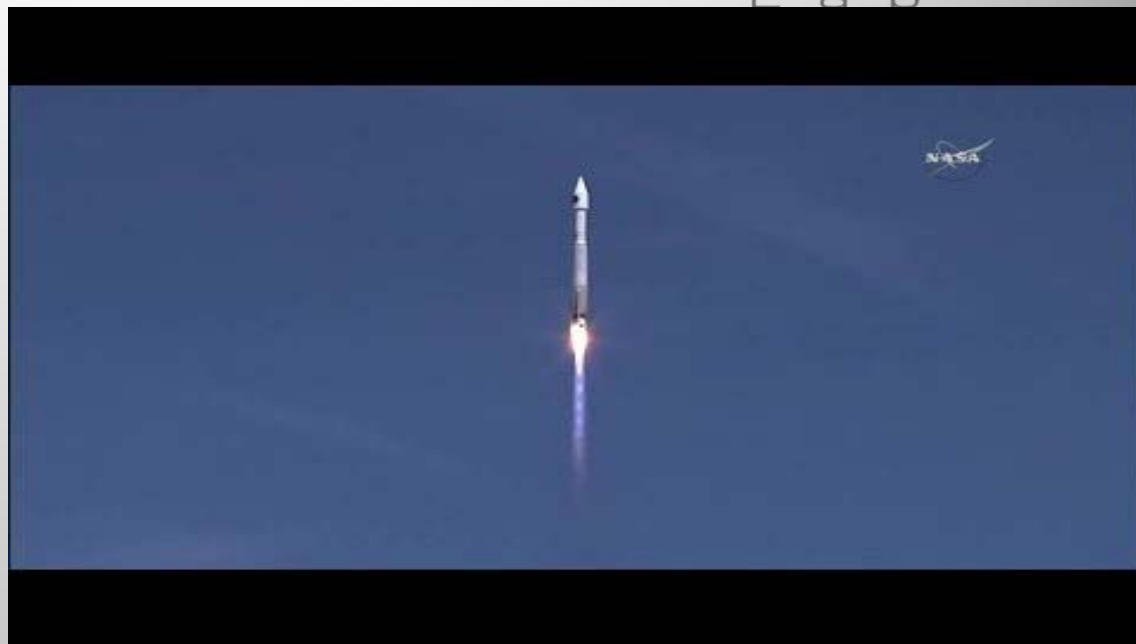


Ben Southwell working on the loaf-sized UNSW-ECO satellite at AITC. Source: UNSW, author provided

NEWS

Australia World Business Sport Science Arts Analy

SNAP
Lab



The Sydney Morning Herald

NEWS SITE OF THE YEAR

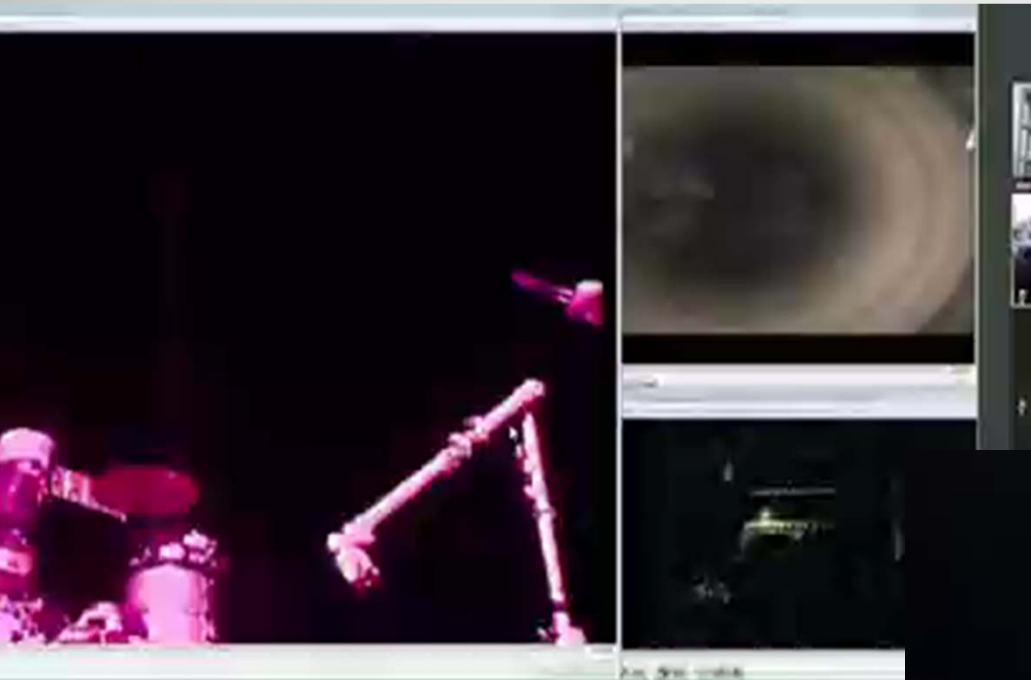
Technology

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Deployment from ISS – Orbit Insertion



Revising a rescue plan

Dominant scenario that would unintentionally prevent antenna deployment:

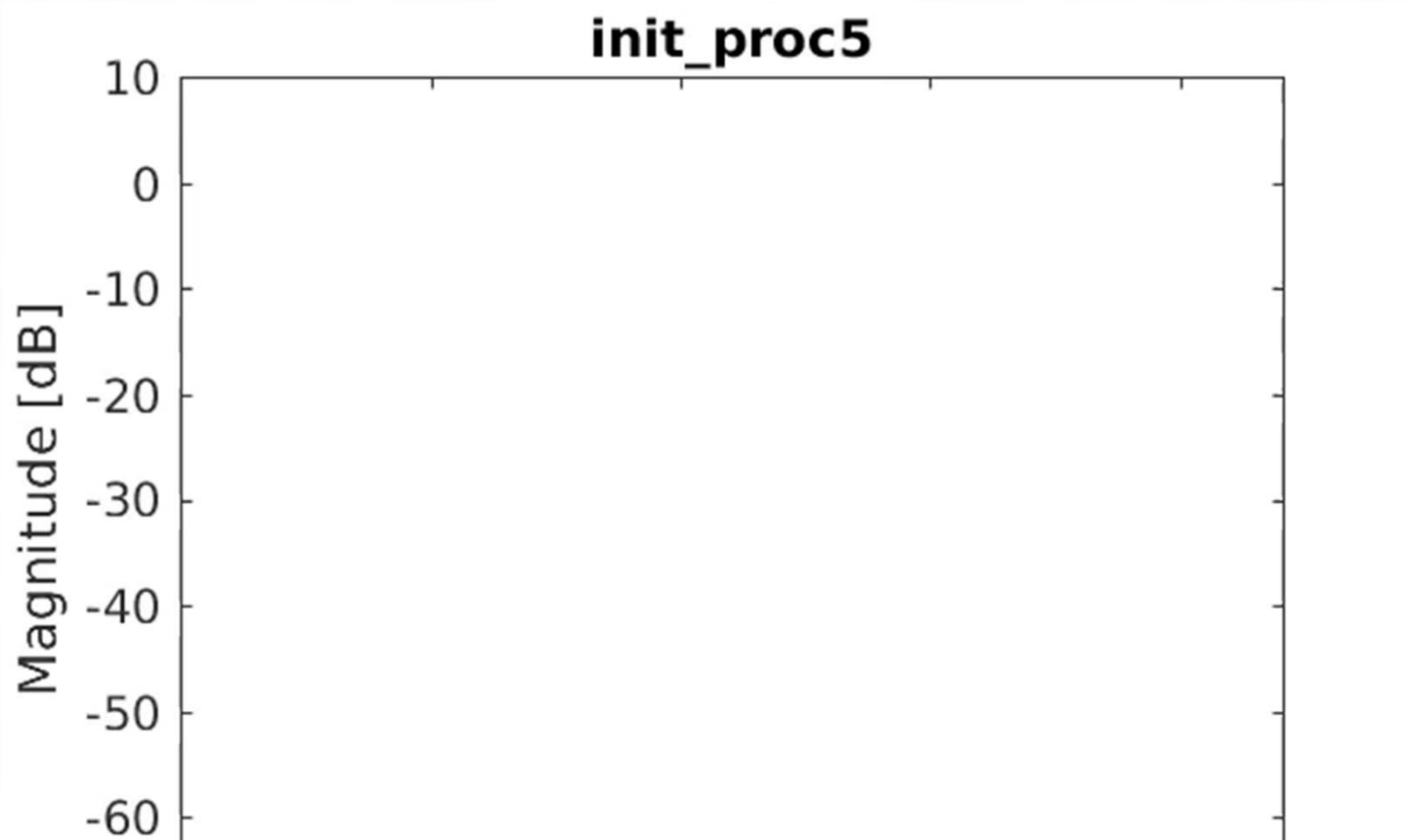
- **EPS I2C WDG reset triggered re-initialisation of the 30-minute deployment countdown timer**

Replicated scenario on Engineering Model

Solution:

- **Reconfigure OBC to disable 30-minute deployment countdown timer.**

Replicated recovery command uplink on Engineering Model




ACSER
 AUSTRALIAN CENTRE FOR
 SPACE ENGINEERING RESEARCH

Assistance from Radio Amateurs

	Location	Radio Amatuer	Pow er	Antenna Description
	Czech Republic	Mirolav Kasal	300 W	21el RHCP
0	Toowomba, QLD	Phil Moat	500 W	4x 28 el Hpol (25dBi)
0	Toowomba, QLD	Phil Moat	500 W	4x 28 el Hpol (25dBi)
2	Netherlands	Jan Van	400	25m dish





June 2017

CAMRAS transmitted the recovery commands to UNSW-EC0 and I-INSPIRE2

First beacon from I-INSPIRE2 detected

No beacons heard from UNSW EC0

Confirmed that UNSW-EC0's TLE (Norad ID: 42721) is currently being used by CHALLENGER (Univ. Colorado)

Instructed CAMRAS to retry recovery procedure using CHALLENGER's TLE (Norad ID: 42723).

June 2017

UNSW EC0 transmitted its first beacon in orbit. Detected at UNSW GS and other GS

The beacon has been continuously transmitted throughout its life in orbit since

Log: successful recovery of UNSW-EC0

```

977612] BKUP: bkup:288
977612] BKUP: loc:3623 16
977641] DEPLOY: Knife 1 chn 1 activation
977642] DEPLOY: wait 30 seconds
977673] DEPLOY: Knife 0 chn 0 activation
977674] DEPLOY: wait 30 seconds
977705] DEPLOY: Knife 1 chn 0 activation
977706] DEPLOY: wait 30 seconds
977737] DEPLOY: Knife 0 chn 1 activation
977738] DEPLOY: wait 30 seconds
977769] DEPLOY: Knife 1 chn 1 activation
977770] DEPLOY: wait 30 seconds
982384] CADCS: M72
982387] CADCS: M74
988660] ANTDPLY: SD: 0, Time: 10858, V: 8304
988661] DEPLOY: Knife 0 chn 0 activation
988662] DEPLOY: wait 30 seconds
988693] DEPLOY: Knife 1 chn 0 activation
988694] DEPLOY: wait 30 seconds
988726] DEPLOY: Knife 0 chn 1 activation
988728] DEPLOY: wait 30 seconds
988759] DEPLOY: Knife 1 chn 1 activation
988760] DEPLOY: wait 30 seconds
988791] DEPLOY: Knife 0 chn 0 activation
988792] DEPLOY: wait 30 seconds
[2090988887] DEPLOY: Knife 1 chn 1 activation
[2090988888] DEPLOY: wait 30 seconds
[2090988919] DEPLOY: Knife 0 chn 0 activation
[2090988920] DEPLOY: wait 30 seconds
[2090988951] DEPLOY: Knife 1 chn 0 activation
[2090988952] DEPLOY: wait 30 seconds
[2090988983] DEPLOY: Knife 0 chn 1 activation
[2090988984] DEPLOY: wait 30 seconds
[2090989015] DEPLOY: Knife 1 chn 1 activation
[2090989016] DEPLOY: wait 30 seconds
[2090992365] CADCS: M5
[2090992376] CADCS: M6
[2090992387] CADCS: M5
[2090992397] CADCS: M6
[2090992408] CADCS: M5
[2090992419] CADCS: M6
[2090996788] CADCS: M72
[2090996791] CADCS: M74
[2090997892] CADCS: M5
[2090997903] CADCS: M6
[2090997914] CADCS: M5
[2090997925] CADCS: M6
[2090997936] CADCS: M5
[2090997946] CADCS: M6
[2090997957] CADCS: M5

```

Link Failure: Issue

Difficulty in commanding with UNSW-EC0 and I-INSPIRE2 from UNSW GS

- Commanding is an uplink-downlink procedure

Able to consistently downlink beacons

Uplinked commands does not trigger any downlink response

Identified potential issues

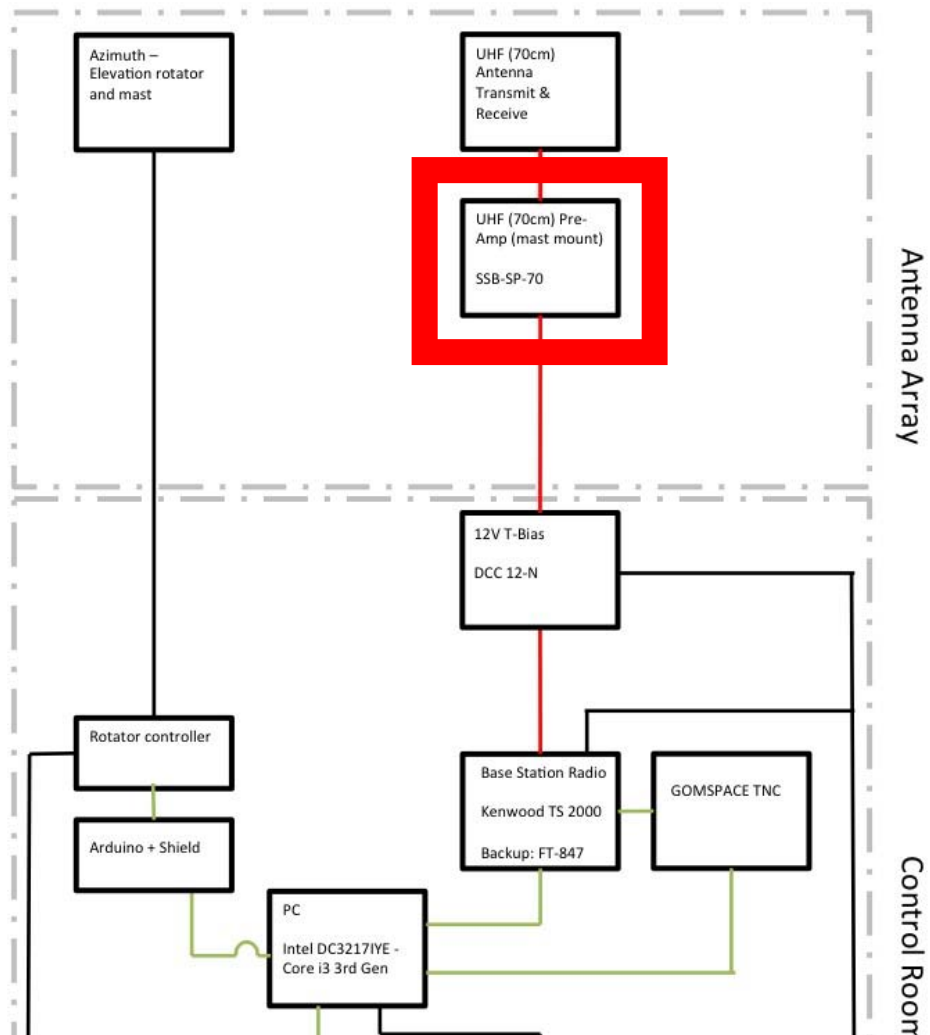
- **Intermittent Tx/Rx switching anomaly of LNA**

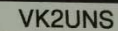
- Slippage at various parts of the antenna rotator and harnesses

Link Failure: Solution

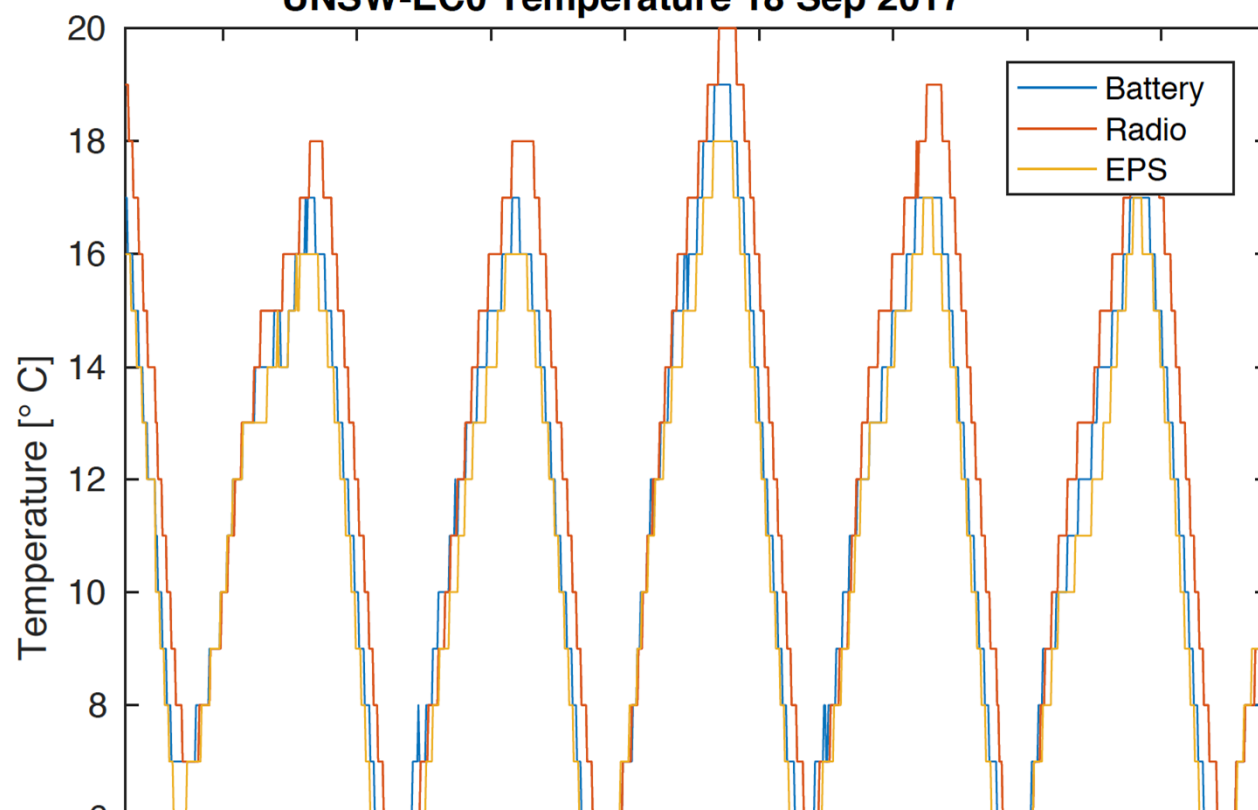
**Replace current
SSB SP-70 with
Minikits EME221**

**Revamped the
mechanical
mounts of UNSW
GS**

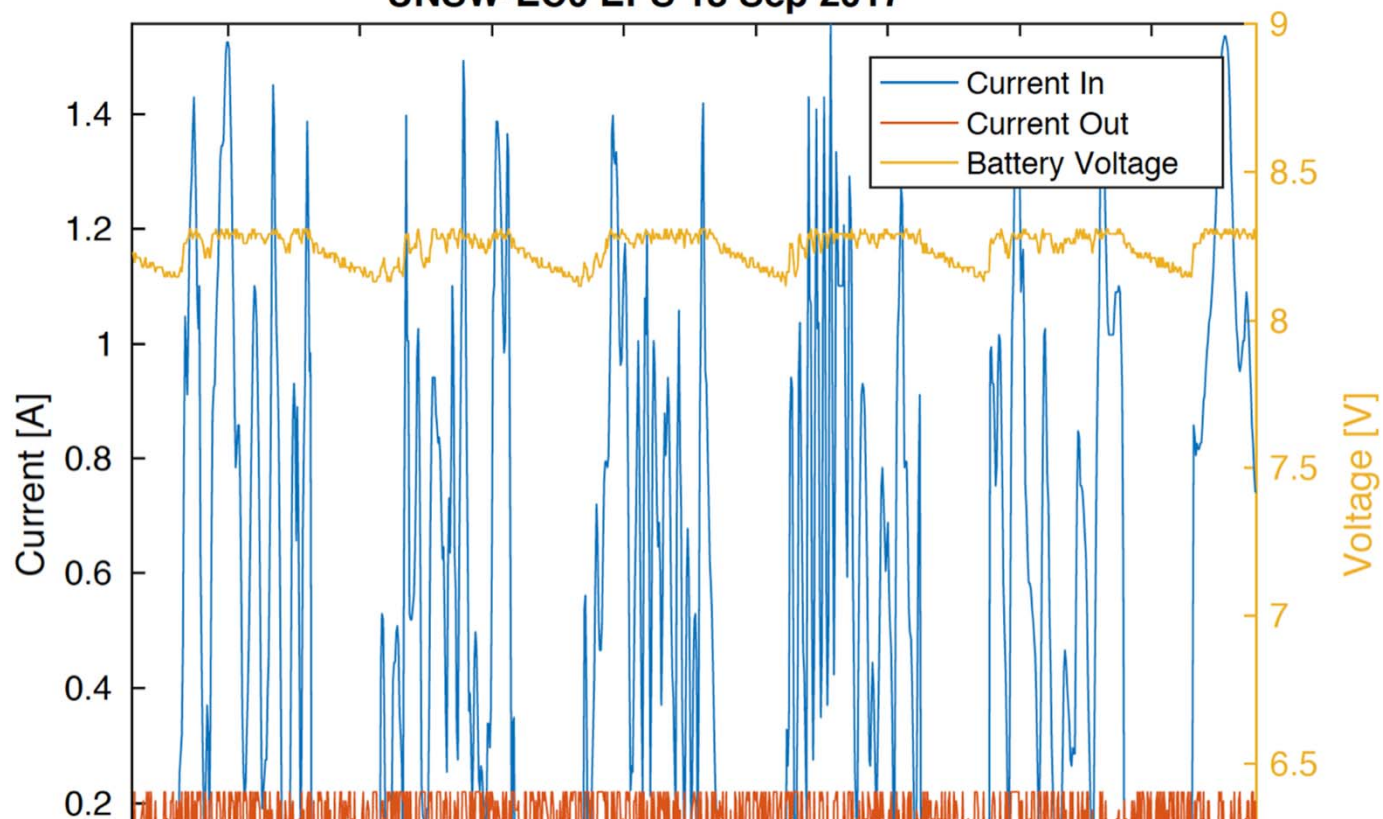




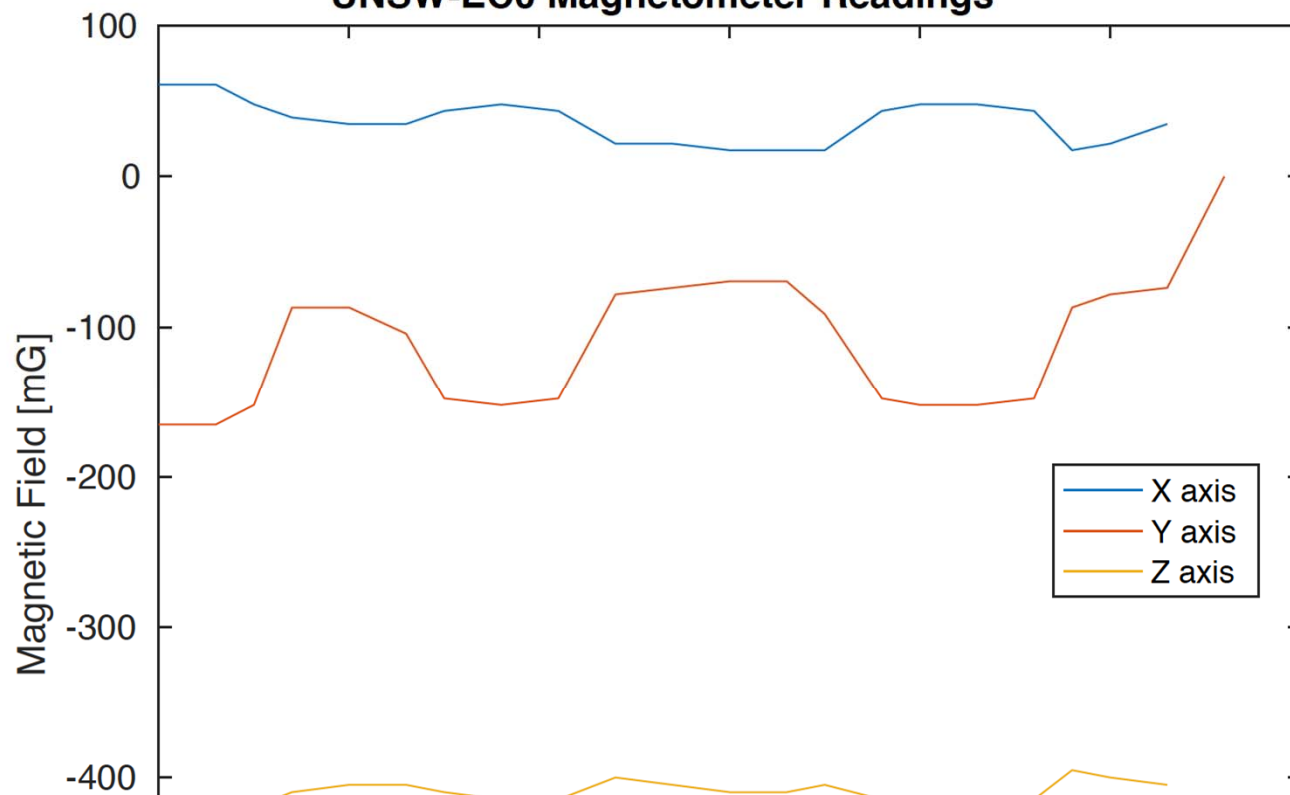
UNSW-EC0 Temperature 18 Sep 2017



UNSW-EC0 EPS 18 Sep 2017



UNSW-EC0 Magnetometer Readings





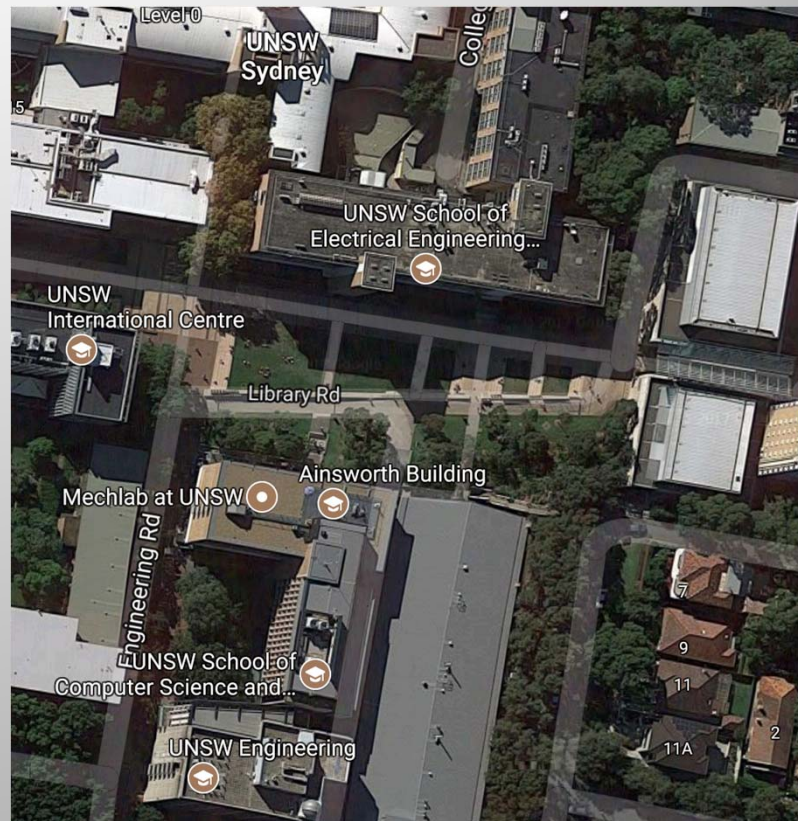
UNSW Ground Station

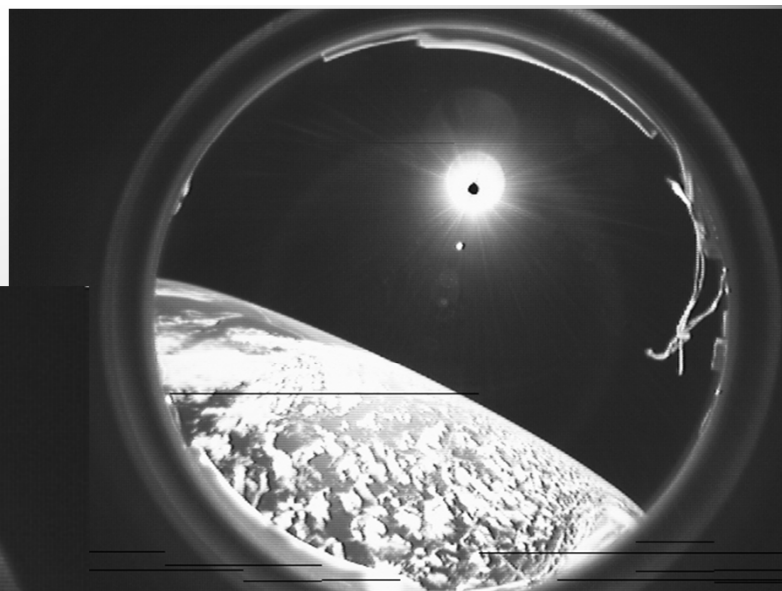
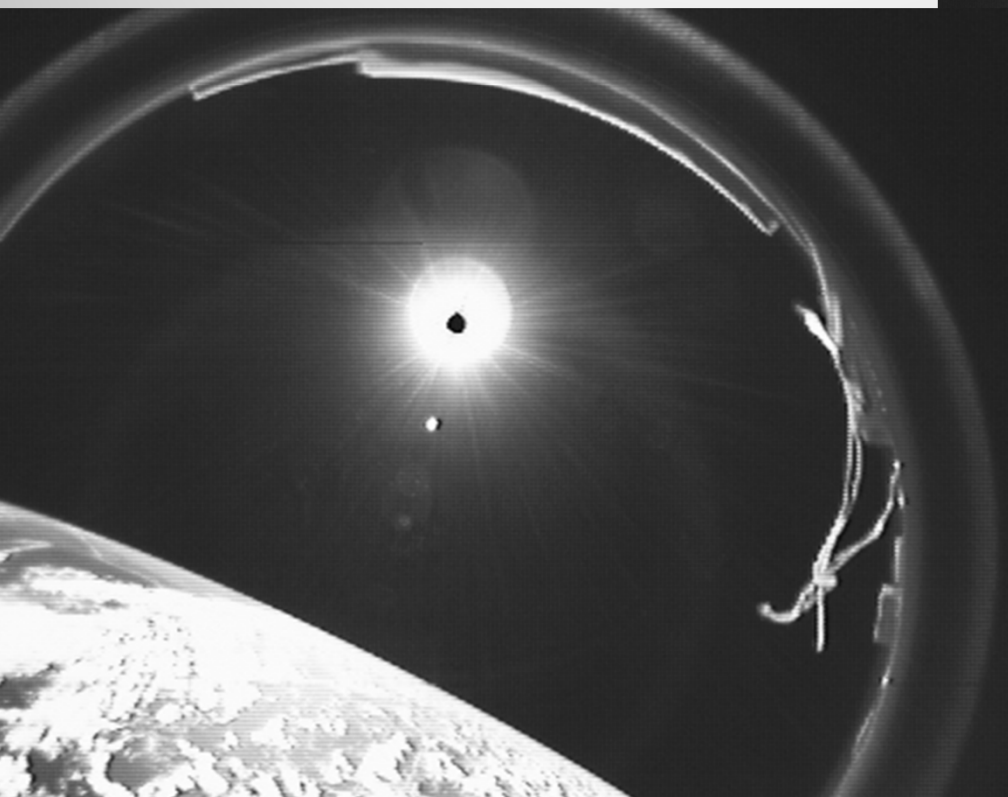
UNSW Faculty began renovating Elec Eng building in December 2016

May 2017: UNSW Ground Station was relocated from Elec Eng building North wing to South wing

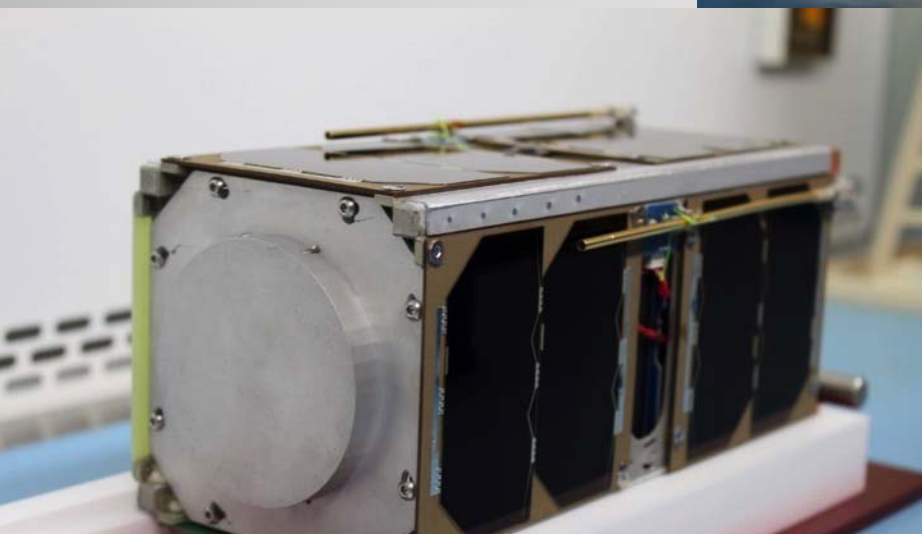
Nov 2017: UNSW Ground Station relocation from Elec Eng building to Computer Science building

June 2018: CSF building

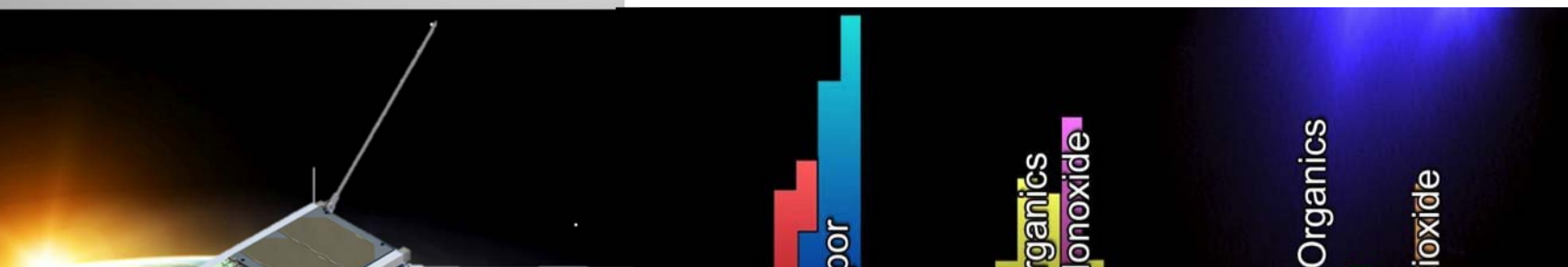
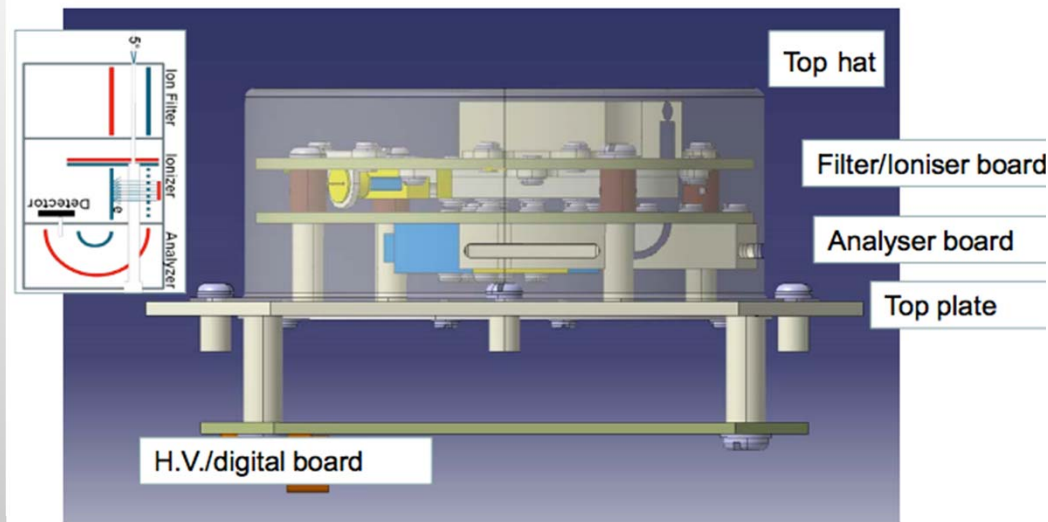




Questions?



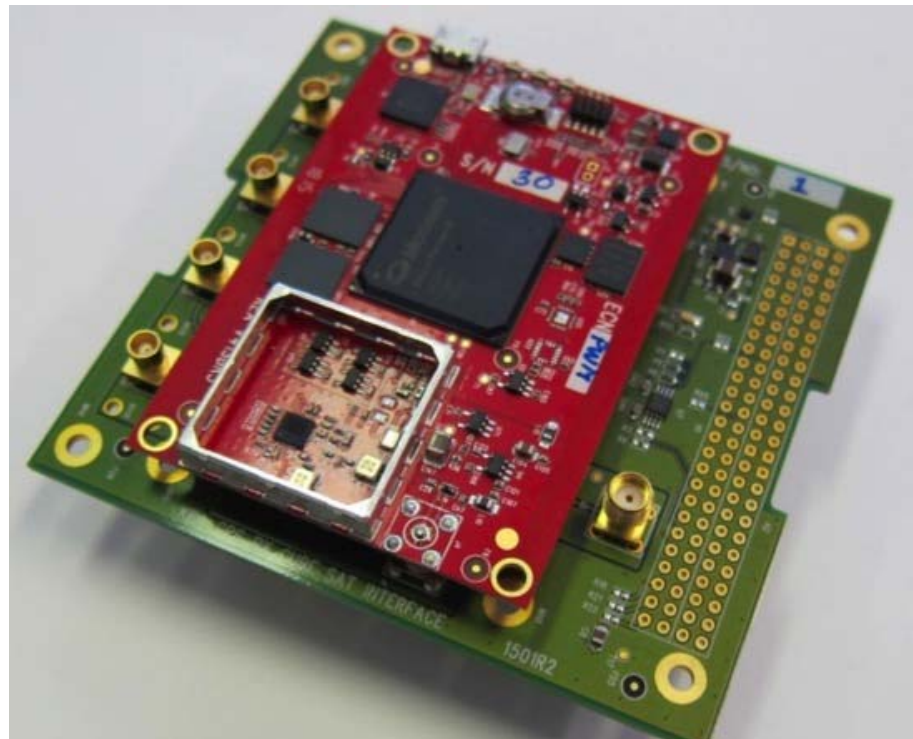
Ion and Neutral Mass Spectrometer
Sole Primary Payload
Measure dominant species
– O, O₂, N₂, NO

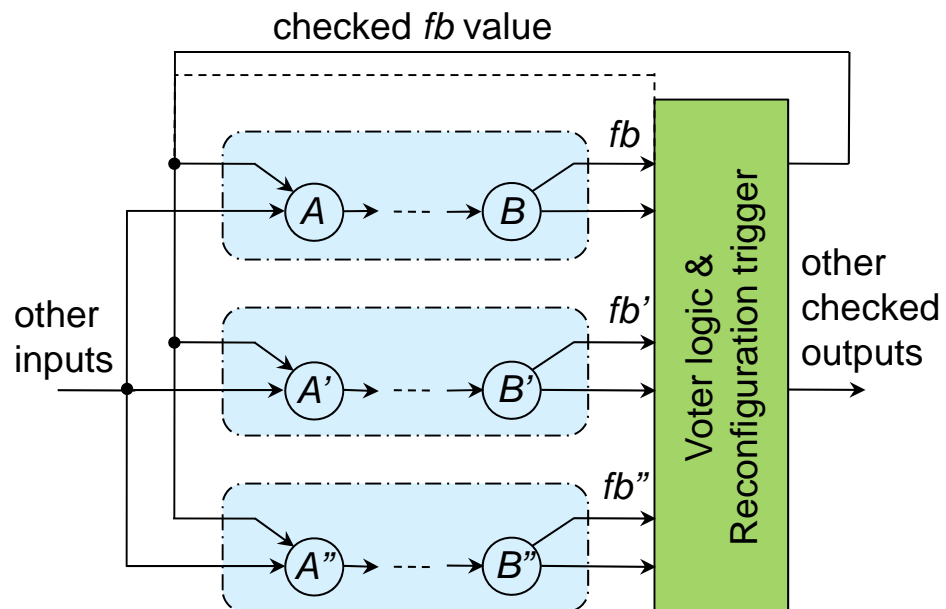
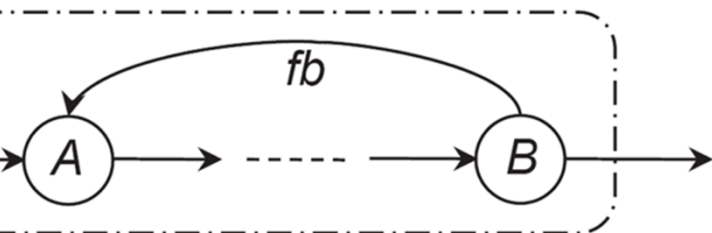


: Custom GPS (On-board Navigation)

Designed & Built @ UNSW Sydney

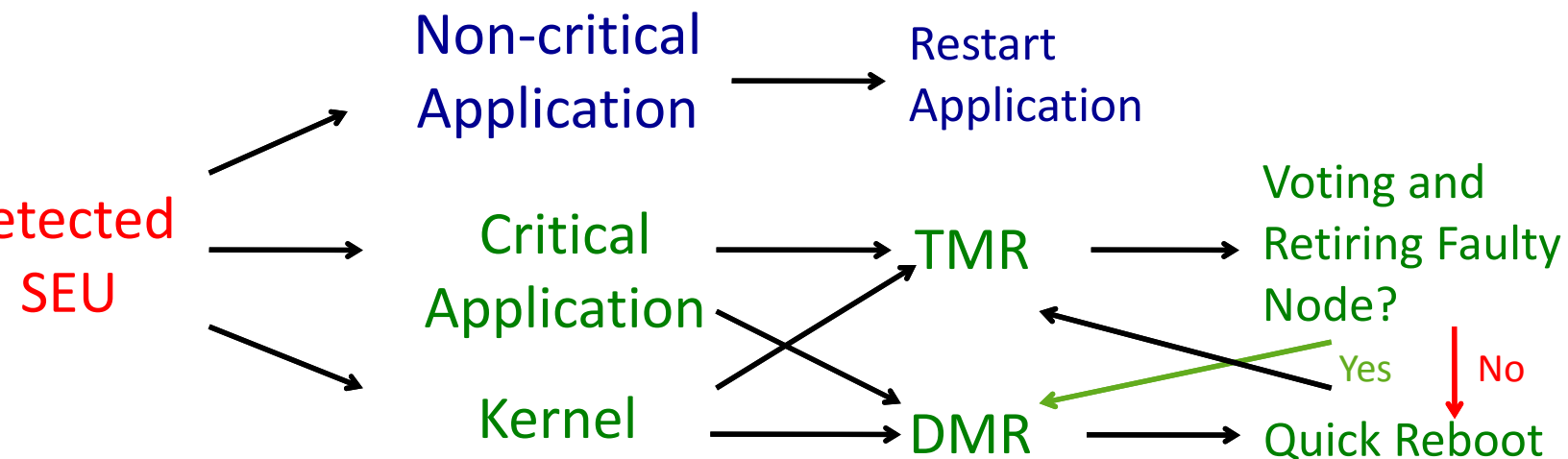
receiver's primary
purpose is navigation
to monitor position/velocity
of the EC0 spacecraft
to perform single frequency
Precise Orbit
Determination" (POD)
with **spaceflight heritage**
for the design





P3: seL4bit

U Detection and Handling in Software



frequency/severity of SEU.