

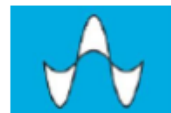
Inspire-2, ARC Training Centre for CubeSats, UAVs, & Their Applications...and Beyond

James Harpur, Iver Cairns, Inspire-2 and CUAVA-1 teams

Partners in the Training Centre



THE UNIVERSITY OF
SYDNEY



AIR@WAVE



Australian Government
Bureau of Meteorology



Australian Government
Department of Defence
Defence Science and
Technology Group

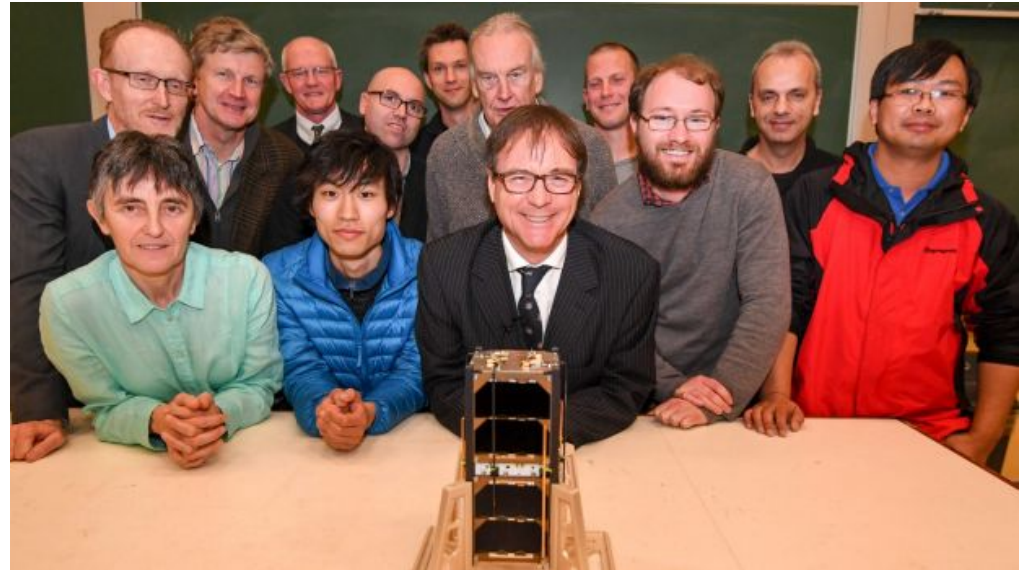


R·I·T

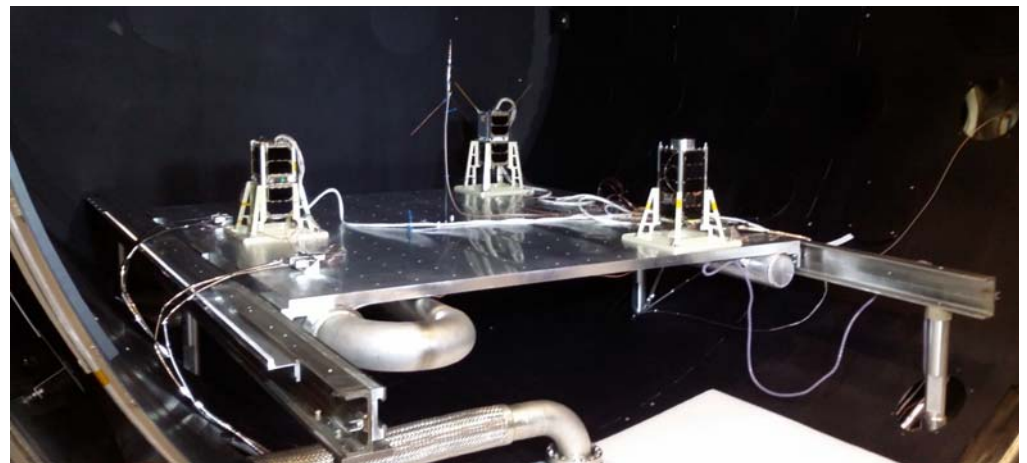


The INSPIRE-2 / AU03 Cubesat for the QB50 Project

- Inspire-2 Team



- The 3 Australian QB50 CubeSats after thermal vacuum testing in Wombat-XL at ANU's AITC:



The INSPIRE-2 / AU03 CubeSat

- Started 30/9/2015 & delivered 19 August 2016 < 10 months

USydney: 3+ payloads, components, assembly, integration, testing, launch, overall project, legal, leadership,

- QB50 multi-Needle Langmuir probe (mNLP)
- Nanophotonic spectrograph (Nanospec)
- Radiation counter
- Microdosimeter

UNSW - Sydney: Spacecraft design, integration, testing, software

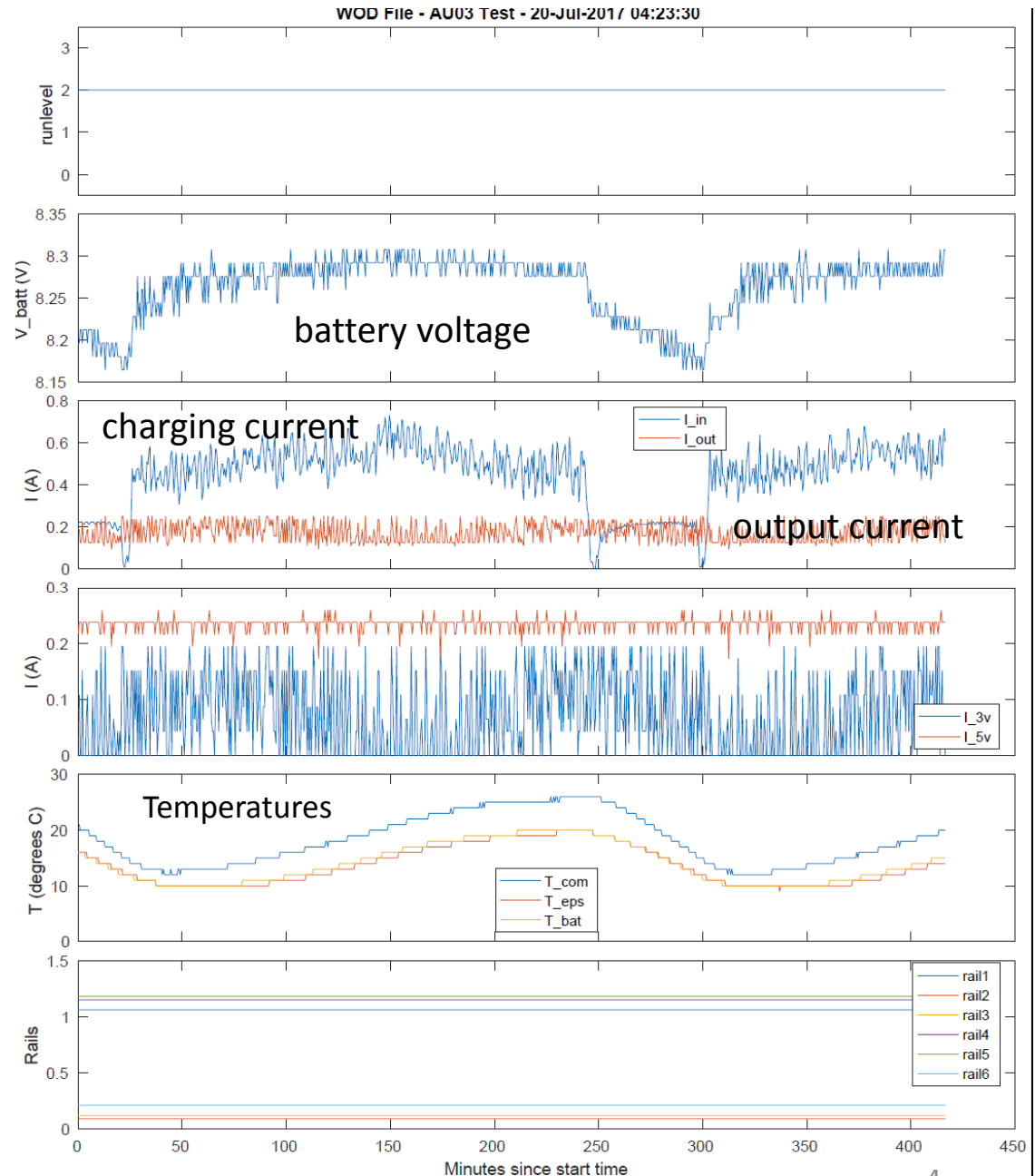
- Kea GPS instrument

ANU: Spacecraft COTS parts, groundstation, advice, AITC ...

Groundstations: ANU and UNSW

9. First spacecraft health data for INSPIRE-2

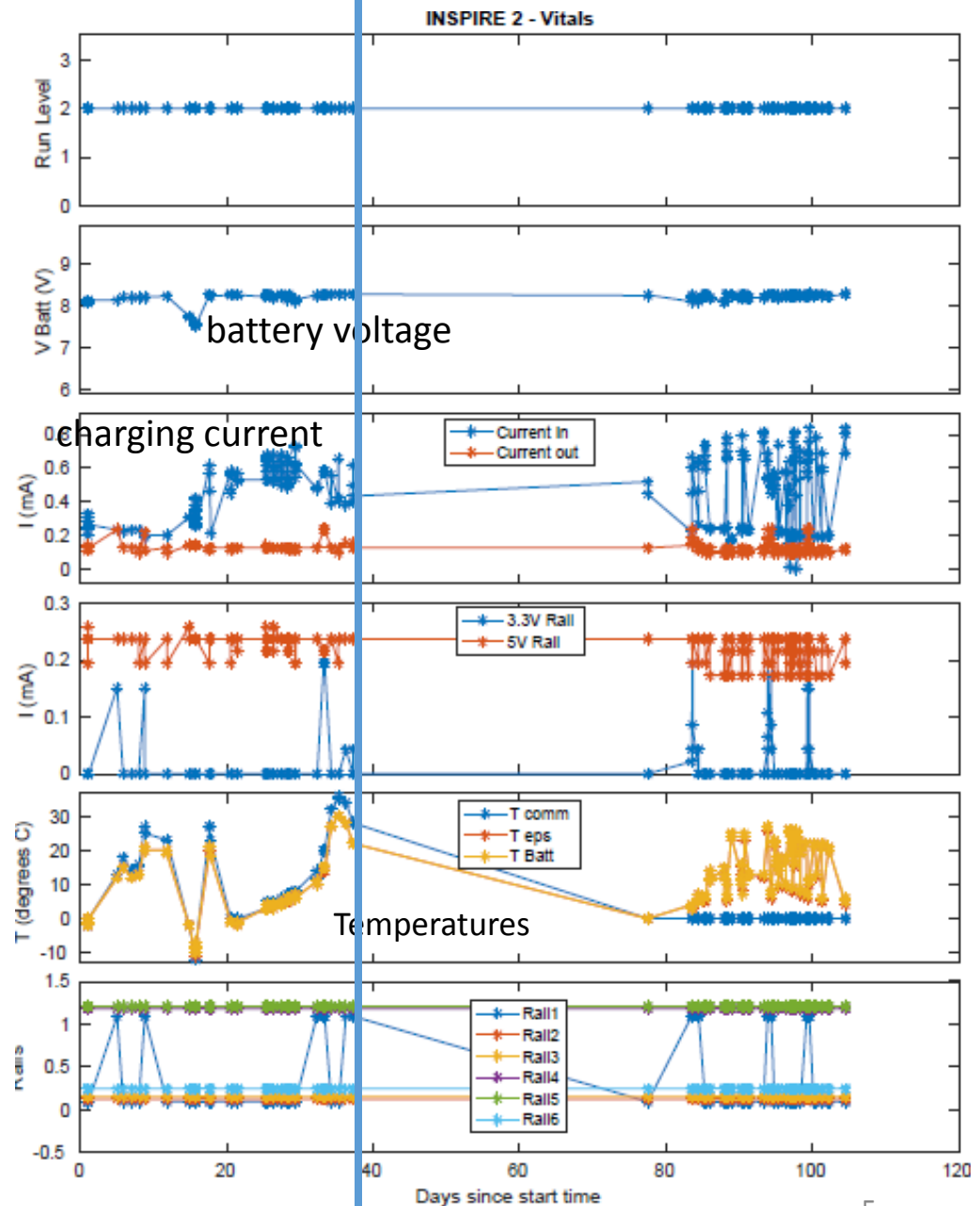
- Spacecraft battery, solar cells, and temperatures all fine.
- Can see expected effects of day – night transitions
- Lots of media attention due to original contact issues.
- Do have downlink issues



All Beacon Data to 3 October

- Stable battery voltage
- See day-night variations
- Large changes in temperature with time. Why?
- **Spacecraft went quiet for about 1.5 months. Why?**
- Subsequently recovered INSPIRE & reset beacon.
- Filesystem corrupted. Why?
- $T_{com} = 0$ now \rightarrow Comms board damaged. Why?

Last beacon day 37 ... Day206 2017

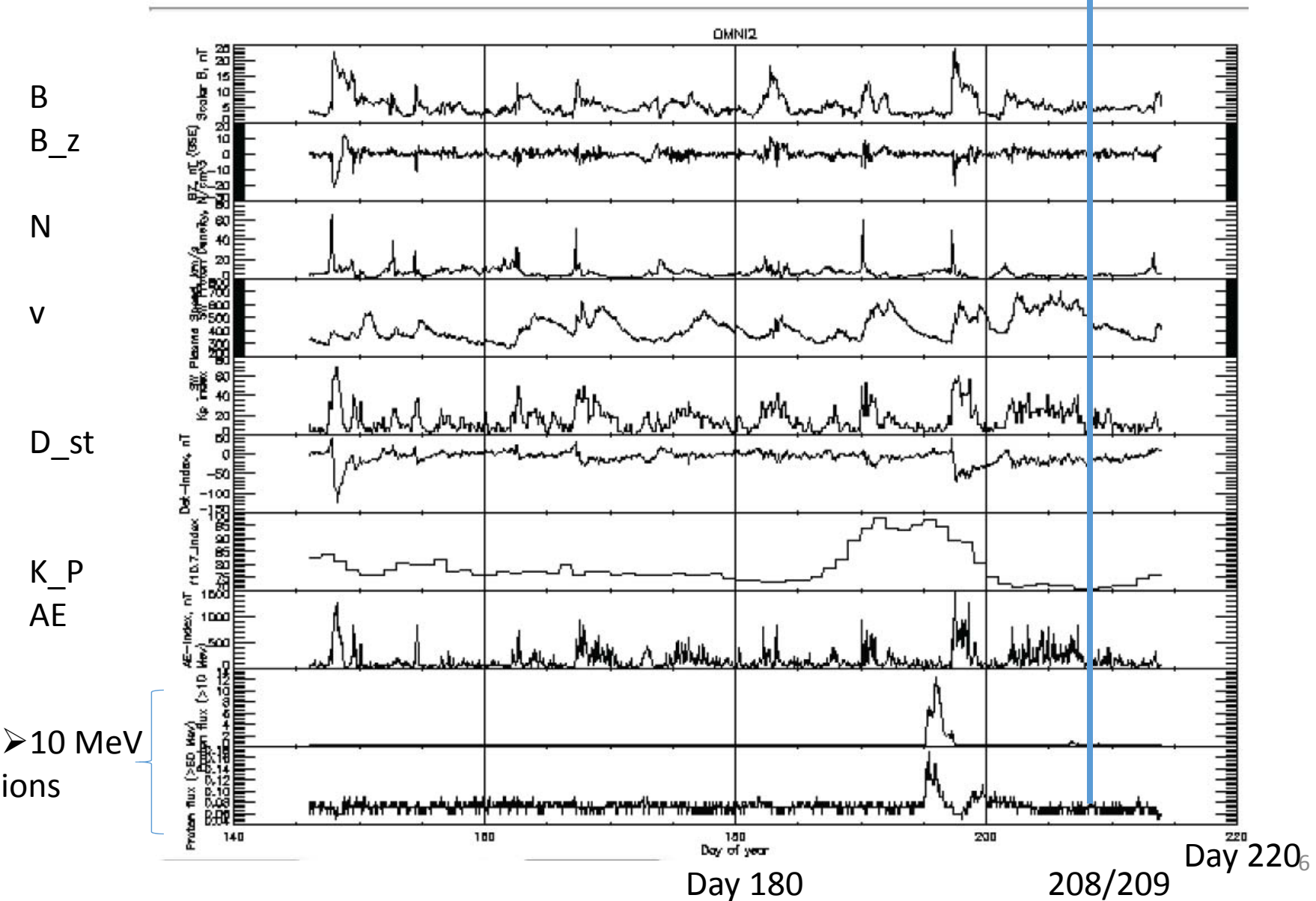


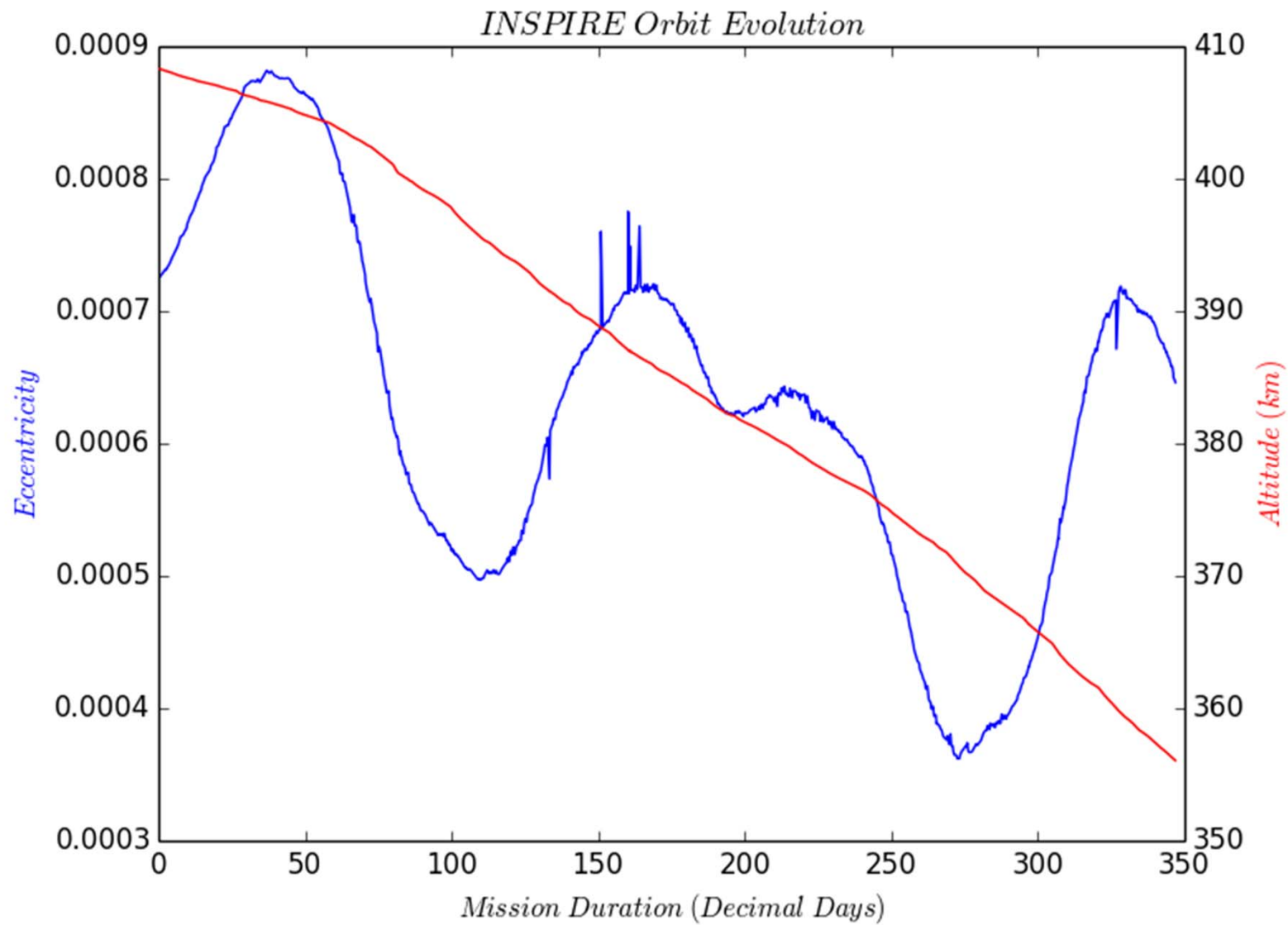
Day 0 = 19 June 2017

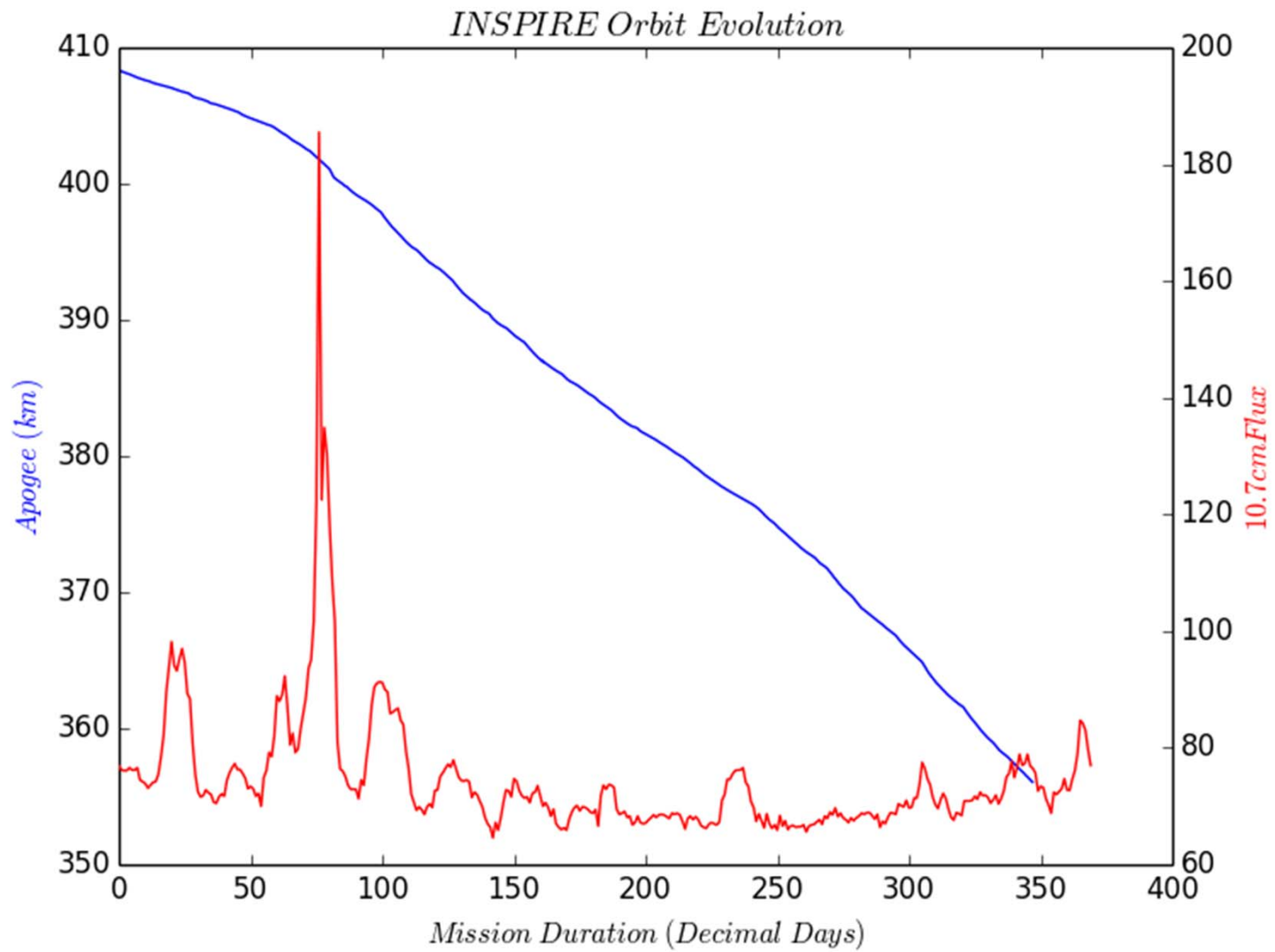
OMNIWeb Plus Results

Plot omni2 data from 20170526 to 20170801

Last INSPIRE beacon







The ARC Training Centre for CubeSats, UAVs, and Their Applications

- Proposed 8 December 2016
- Announcement of award 8 June 2017.
 - 97% of request
 - \$4.6M from ARC + \$1.2 M partners
- Primary elements:
 - 12 partners (2 Australian Unis, 4 Australian companies, 4 Government units, & 2 US unis)
 - 5 postdocs and 11 PhD students
 - 1 CubeSat campaign per year (5)
 - 1 UAV campaign per year (5)
- Multi-Institution Agreement signed 13 December 2017 → legal start of Centre.

Qualitative Goals

1. Train the next-generation of workers in cutting edge advanced manufacturing, entrepreneurship, and commercial space & UAV applications,
2. Develop new instruments, technology, and products to solve crucial problems, &
3. Develop a world-class Australian industry in CubeSats, UAVs, and related products.

3 Themes and 12 Projects

- **SYSTEMS**

- Plasma Thrusters
- High Speed Communications
- Snap-together, Plug-and-play, Assembled CubeSats

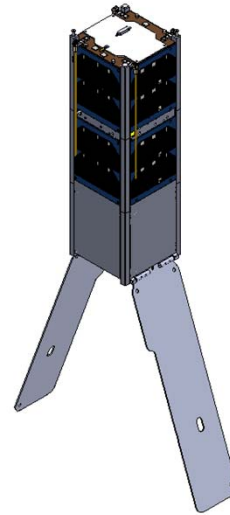
- **INSTRUMENTS**

- Compact Imagers
- Photonic Spectrometers and Hyperspectral Imagers
- Calibration and validation (cal/val)
- Retractable Tether

- **PRODUCTS**

- Remote sensing: Coastal/marine
- Remote sensing: Land/agricultural/forestry/ minerals
- GPS sea-state reflectometry
- GPS radio occultation and space weather
- Space weather control systems.

CUAVA-1



CUAVA-1

- Mission: Earth observations, GPS, space environment, technology demonstrator (comms and EO payloads)
- Late 2018/Early 2019 launch
- Integration to be carried out at the University of Sydney with testing later this year.

CUAVA-1

- Innovative Solutions in Space as the main supplier
- 2U -> 3U with two deployable panels
- Air@wave payload $\sim 0.8U$, aiming to give gigabit/sec comms
- New comms package with Innovative Solutions overcoming 'handshaking' issue from Inspire-2
- Payloads: Kea-GPS, Radiation Counter and dosimeter, nanospec plus Air@Wave
- New Integrated ADCS system with one reaction wheel from Maryland Aerospace

InSitu UAV Project

- Comms package (Air@wave)
- GPS instrument (UNSW),
- Imaging spectrograph (USyd)
- Commercial hyperspectral cameras (USyd, ArborCarbon, DSTG, HyVista)



Conclusion

- Inspire-2 and the other Australian CubeSats demonstrated existence of Australian space capability and breaking economic barrier of Australia entering the space community.
- Inspire-2 is still alive after over 1 year in space with health data being received.
- A new funded ARC Training Center for CubeSats, UAVs, and Their Applications aims to launch 1 CubeSat per year for the next 5 years, to train the next generation of Australia's space engineers, and are open for collaboration on space science, technology, and commercialisation.
- The Center's first satellite -> CUAVA-1 for 2018/2019 launch.

Thank You

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