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 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?
- $T_{\text{com}} = 0$ now $\Rightarrow$ Comms board damaged. Why?

Day 0 = 19 June 2017
OMNIWeb Plus Results
Plot omni2 data from 20170526 to 20170801

- B
- B_z
- N
- v
- D_st
- K_P
- AE

- 10 MeV ions

Day 180
208/209
Day 220
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 ~ 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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