



ARC TRAINING CENTRE FOR CUBESATS,  
UAVs, AND THEIR APPLICATIONS

**Embargo – 20th March**

## **CUAVA-2 Satellite – Results and Radiation**

20th March

CUAVA, the Australian Research Training Centre for CubeSats, UAVs and their Applications led by the University of Sydney, announces the CUAVA-2 satellite has now exceeded its anticipated lifespan, remaining in orbit for over 200 days.

CUAVA-2 is the third satellite built by CUAVA in the School of Physics at the University of Sydney. The satellite was launched alongside Waratah Seed-1 and built by the same team at CUAVA. To provide redundancy and fail-safes, some of the instruments were also flown on the Waratah Seed-1 mission.

The technology payloads on board CUAVA-2, including a GPS experiment from UNSW dubbed 'Harry-3' and a HyperSpectral Imager (HSI), CROSS Star Tracker, Charge eXchange Thruster (CXT), and a solar cell experiment PORT from the University of Sydney, have all showed power draws and in some cases evidence of generating data.

Five days after its 16 August 2024 launch, CUAVA-2 sustained radiation-induced damage, causing the onboard computer's primary SD card to fail. A backup SD card initiated automatically to boot up the onboard computer. After this, though, the satellite's path to operational status was smoother and faster than for Waratah Seed-1.

Two weeks after starting to commission the payloads, on November 10 the payload computer became unresponsive, ignoring commands from the onboard computer and S-band radio. Repeated attempts to recover the payload computer have been unsuccessful, indicating radiation damage consistent with a space weather event which occurred 8-11 November.

The foresight of the CUAVA team in flying identical or similar payloads on both CUAVA-2 and the Waratah Seed-1 has served the missions well, demonstrating space readiness for virtually all the technology on board the two satellites.

The Electron Density and Debris Instrument (EDDI), ElectroPermanent Magnetorquer (EPM), GPS experiment Harry-3, and the PORT solar cells flown on CUAVA-2 have performed well on Waratah Seed-1, providing excellent data via the payload computer, itself an identical system to that onboard CUAVA-2.

Prof. Iver Cairns, Director of CUAVA and Waratah Seed, said:

“Space is indeed hard. CUAVA-2 was our poster child, with fewer issues and a more rapid commissioning of the satellite systems and payloads than Waratah Seed-1 until the payload computer problem. We have not given up on CUAVA-2!

Space weather effects and radiation are not predictable or entirely preventable and the lessons learned here on mitigation via multiple flights are for everyone. Working together has allowed us to successfully develop space heritage for almost all payloads on both our satellites and to obtain data from most.”

Prof. Andrew Dempster, Director of the Australian Centre for Space Engineering Research (ACSER) at the University of New South Wales and Deputy Director of CUAVA and Waratah Seed, said:

“Space is a difficult environment; the challenges with CUAVA-2 demonstrate a number of things. We were lucky enough to be flying our Harry-3 payloads on both CUAVA-2 and Waratah Seed, giving us redundancy across platforms. When only one satellite was able to support that payload, that was enough!

Small satellites using commercial grade components, while at more risk of succumbing to that challenging environment, cut down on the cost of demonstrations in the space environment, and are essential to these research and trial missions.”

CUAVA-2 carries payloads produced by CUAVA’s academic research teams and university-based start-ups.

CUAVA-2 Payloads Current Status:

- The Radiation Counter and Data Over Power-Bus payload on CUAVA-2, designed by a team from the University of Sydney’s School of Aerospace, Mechanical, and Mechatronic Engineering to measure variations in the energetic particles around the Earth and demonstrate the transmission of data over power channels rather than dedicated network cables. This payload is currently operational on CUAVA-2 and providing data, in communication via the Onboard Computer (OBC).

These CUAVA-2 payloads have already demonstrated that they are operational and space-ready on the Waratah Seed-1 mission:

- The Electron Density and Debris instrument (EDDI), designed by a team from the University of Sydney’s Schools of Physics and Electrical Engineering to

measure Earth's plasma density and temperature by monitoring the electric field spectrum around the satellite. Changes in the ionosphere can disrupt the radio and GPS signals we rely on for navigation and communications systems on Earth. It can also detect hits by space debris on the satellite, allowing monitoring of space debris.

- The ElectroPermanent Magnetorquer (EMP) designed by a team at the Schools of Aerospace, Mechanical and Mechatronic Engineering and Physics at the University of Sydney to demonstrate using magnetisation technology for changing a satellite's spin and orientation, providing potential for a product which reduces the amount of energy required to stabilise satellites in orbit.
- The GPS Reflectometry Receiver (Harry-3), designed by a team from the Australian Centre for Space Engineering Research at the University of New South Wales (UNSW) to monitor ocean waves and land characteristics remotely by measuring GPS signals scattered from the Earth's surfaces. The payload has strong potential for applications in shipping, off-shore oil rigs, sea-ice discrimination, and agriculture.
- The Perovskites in Orbit-Readiness Test (PORT) payload designed by EurokaPower, a startup led by 2024 Space Scientist of the Year Anita Ho-Baillie, and her team in the School of Physics at the University of Sydney. PORT is intended to demonstrate in space the capabilities of perovskite solar cells, high-efficiency, high-performance space-grade solar cells which can be manufactured at greatly reduced cost.

The remaining CUAVA-2 payloads on board are connected to the payload computer and drew power prior to the November radiation event.

- The Charge Exchange Thruster (CXT), invented and built by a team from the School of Physics at the University of Sydney to demonstrate a prototype plasma thruster that can move small satellites in orbit using plumes of high-velocity neutral particles. The technology aims to address the shortage of electric propulsion systems on CubeSats; it is easy to manufacture and has potential as a commercial product.
- The Cross-reference of Stellar System (CROSS Star Tracker) designed by a student-led team from across the University of Sydney to capture highly accurate satellite positioning data using images of known stars in a compact, cost-effective and commercialisable payload for CubeSats.
- The HyperSpectral Imager (HSI) designed and built at the University of Sydney's School of Physics and SAIL Lab to capture images of marine and coastal environments at many wavelengths. These observations have many

potential applications for agriculture, forestry, coastal and marine monitoring, and mineral exploration.

CUAVA-2 is an Australian-made and Australian-owned space system. It shows a capacity to serve the emerging Australian space sector and to grow Australia's space capabilities and knowledge through researchers and students in CUAVA's many partner organisations. The technical demonstration payloads on board address the needs of niche export markets in the international space sector.

## About CUAVA

CUAVA is funded by the Australian Research Council and working with Industry Partners. Its mission is to train the next generation of workers in advanced manufacturing, commercial space, and Uncrewed Aerial Vehicle (UAV) applications. In doing so CUAVA has developed new instruments and technology to solve crucial problems, and develop a world-class Australian industry in CubeSats, UAVs, and related products. CUAVA has been in operation since December 2017, with headquarters based in the School of Physics at the University of Sydney, Camperdown Campus.

CUAVA is the home of the Waratah Seed Consortium and the Waratah Seed-1 satellite.

Contact: [info@cuava.com.au](mailto:info@cuava.com.au)

W: [www.cuava.com.au](http://www.cuava.com.au) | LinkedIn: CUAVA Arc Training Centre

