

A Dual-Redundant CubeSat Flight Computer Based on Raspberry Pi

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The DualPi Flight Computer is a low-cost CubeSat on-board computer design based around a redundant pair of Raspberry Pi Compute Module 3 devices, for fault-tolerant operation in warm-to-hot redundant modes. This OBC design is the outcome of a long-running project developed at the Surrey Space Centre by undergraduate Electronic Engineering students from the University of Surrey. The design files have been made available for use by the open-source community.

The OBC was designed to the specifications of the AAReST (Autonomous Assembly of a Reconfigurable Space Telescope) mission's Payload Interface Computer. AAReST aims to demonstrate on-orbit assembly of large mirrors for space telescopes from smaller modular mirrors. The Payload Interface Computer's system interface capabilities include shared UART, I2C master and slave buses, a shared embedded USB Wi-Fi device (as an intersatellite link), and redundant support for Raspberry Pi Camera Modules.

This talk will present a development roadmap of the OBC, including planned future development, followed by a top-down discussion of the system design and concept of operations. This will include a functional-level technical overview of the key subsystems required to support the Raspberry Pi Compute Modules on the board and provide heightened fault-tolerance. A key area of interest is the embedded monitoring system, built around an MSP430 FRAM microcontroller; this detects critical errors within the main system through continuous state-of-health monitoring and responds to protect hardware from damaging faults such radiation-induced latch-up.

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