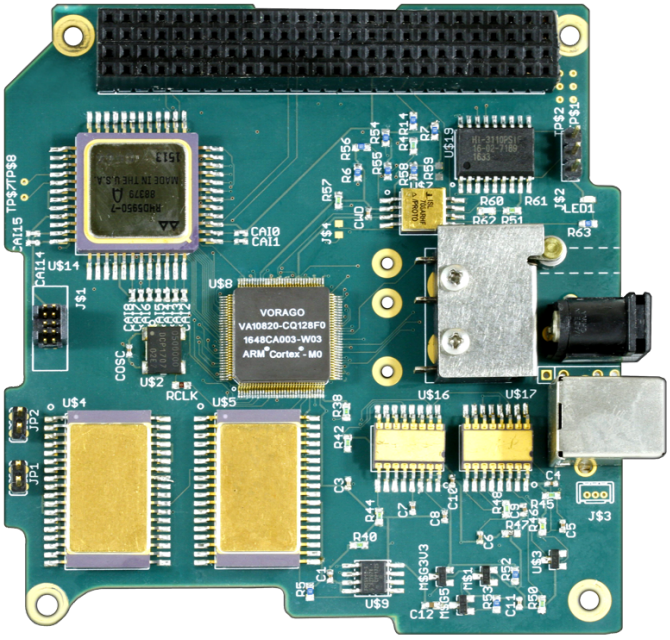
Frequently Asked Questions about the RH-OBC-1



What is the purpose of the board?

There are lots of options for engineers to choose an off-the-shelf CubeSat On-Board Computer that does not use radiation-hardened components. We were encouraged to create an option for engineers that uses rad-hard ICs. The motivation was to provide a design that provides a longer mission life expectancy than typical non-radiation-hardened solutions and allows flight beyond LEO through radiation effects mitigation.

Do you expect people to fly the board as is?

We expect so. We designed and built the board carefully using good quality materials and established industry standard practices. We wanted to keep the cost of the board as low as possible but still use radiation-hardened integrated circuits. We could spend more money on further component upgrades, testing and qualification but we think that we have achieved a robust level and further price increases of the board would lead to diminishing returns.

Has it flown already?

As of February 2019, the board has not yet flown. At least one of our customers has plans to launch the board in a LEO mission later in 2019.

What sort of testing and qualification has been done on the board?

We built and tested the board to comply with best industry practices for industrial grade PCBs. The boards are manufactured and tested on-shore in the USA. We have not yet performed any environmental or vibration testing on the board. NASA is planning on doing board-level radiation testing on the RH-OBC-1 in 2019. We will make the radiation testing results public.

Are all the components flight grade radiation hardened ICs?

The VORAGO microcontroller is a rad-hard VORAGO Hi-Rel Qual device (Based upon MIL-STD-883, AEC-Q100, JEDEC specifications & radiation tested). We have used 'prototype grade' Cypress FRAM and Flash, Intersil supervisors and LDOs and Cobham ADC. We used 'prototype' grade to keep the price of the board as low as possible ('flight grade' devices are typically >2X the price of 'prototype' grade components). We also have an automotive grade Cypress FRAM, automotive grade CAN transceiver and a commercial grade USB IC. The USB IC was never intended to be used in Space. It was intended for code development and potentially data collection on the bench. The USB IC is not powered from the 5V supply from the CubeSat bus and would not be a liability in a radiation environment.

Are there any high reliability circuit design techniques used?

Yes. Even though all of the key ICs are rad-hard, we still use a (rad-hard) supervisor IC that monitors supply voltages and has an independent watchdog function. The USB IC is not intended to be operated in-flight and is disconnected when the board is not used on the bench. The automotive grade CAN transceiver is monitored externally using discrete components so that it can be reset if it is observed to be succumbing to radiation effects. The microcontroller also observes register contents of the CAN IC ensure that it is operating to expectations.

Why did you choose the Pumpkin CubeSat Kit Bus interface?

There are lots of plug-and-play CubeSat components and boards available from Pumpkin Space Systems. We responded to requests for the creation of a rad-hard OBC that could be used with the other Pumpkin CubeSat Kit Bus components. We have tested the RH-OBC-1 with Pumpkin boards for compatibility.

Is this a product for sale by VORAGO or a reference design?

It is actually both. It started off as a reference design to make it easy for designers to use the VORAGO VA10820 microcontroller and we were asked by customers to build a few units to sell to them. We understand that one-size-doesn't-fit-all, so we expect that a lot of folks will want to modify the basic design. We supply all of the relevant files to make it as easy as possible for designers to accomplish those modifications. These modifications are often things like different power supplies required leading to a change in voltage regulator on the board or different interfaces required leading to a change in transceiver type connected to the microcontroller.