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Alan Johnston edited this page 2 weeks ago · **148 revisions**

Welcome to the AMSAT® CubeSatSim Project Wiki, the CubeSat Simulator

The CubeSatSim is a low cost satellite emulator that runs on solar panels and batteries, transmits UHF radio telemetry, has a 3D printed frame, and can be extended by additional sensors and modules. This project is sponsored by the not-for-profit Radio Amateur Satellite Corporation, AMSAT®.

This page is for the new v2.0 hardware (blue boards, v2.0 and later).

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https://github.com/alanbjohnston

If you have the v1.2 hardware (white PCBs) or earlier, then you need these wiki pages: https://CubeSatSim.org/wiki-v1

If you have the beta v1.3 hardware (blue PCBs), the v2.0 instructions are almost the same, but you can use these wiki pages: https://CubeSatSim.org/wiki-beta

The Bill of Materials (BOM) is here:

https://cubesatsim.org/bom

NOTE: If you use the Octopart links in the BOM, the Digikey parts will have the step and identifier information printed on them.

The hardware information including Gerbers is available at: https://github.com/alanbjohnston/CubeSatSim/tree/master/hardware/v2.0

Here you will find documentation about this project and detailed install instructions.

The CubeSatSim has the following features:

- Working solar panels and rechargeable batteries
- Multi-channel voltage, current, and temperature telemetry transmitted in the Amateur Radio UHF band
- Telemetry decoding using FoxTelem software or APRS software
- Payload microcontroller Raspberry Pi Pico and sensors
- Tape measure monopole, dipole, or SMA antenna
- Integrated Low Pass Filter
- 3D printed frame and solar panels

Here are the changes between the v1.2 and the v2.0 hardware and software.

- New FM transceiver module for better frequency stability and simple command and control receiver to change telemetry mode
- More modern and cheaper Raspberry Pi Pico micro controller
- Easily connect additional sensors for the Pico using the Qwiic connector system https://www.sparkfun.com/qwiic
- SSTV camera images now display callsign and battery status overlay
- Can be modified to fly as a balloon payload

with 500mW FM output for SSTV, APRS, or CW transmissions with software support on Pico for a serial GPS module

- Lower parts cost and easier to source. All parts can now be sourced from electronics distributors and Amazon including easy to find solar panels. New BOM uses Octopart electronic part inventory site with one click distributor ordering
- Redesigned for blue INA219 voltage and current sensors instead of more expensive purple ones
- Battery board now has integrated voltage and current sensor and stronger holder with better performance
- Simpler electrical power system with no boost converter or charge control circuit
- Kits can be built with through hole parts except for a few SMT parts. Fully assembled boards will be available in the future using SMT parts
- Easily connect additional sensors for the Raspberry Pi Zero the Qwiic connector system
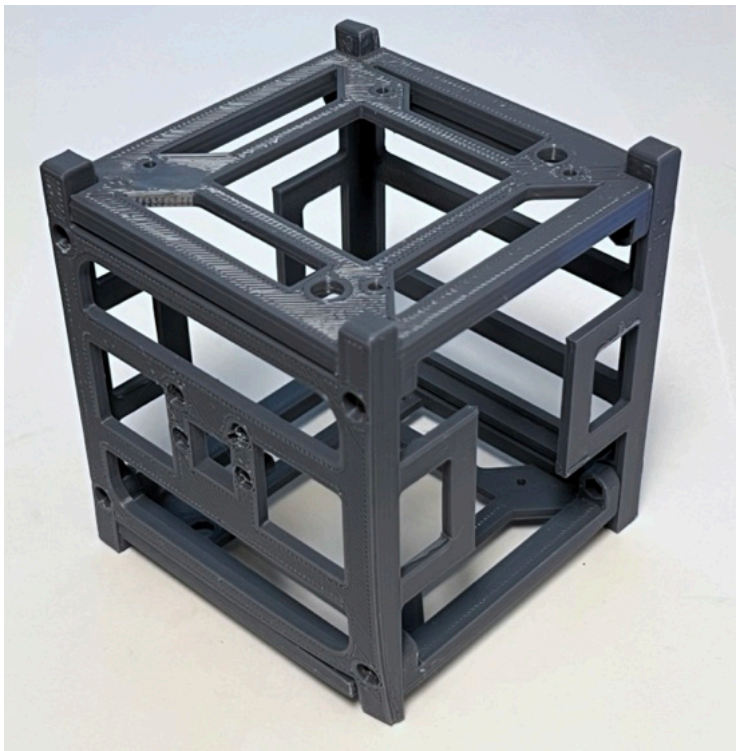
Here are the four boards that make up the complete board stack. Left to right: Raspberry Pi Zero WH with Pi Camera, Battery Board, Main Board with FM module, and Solar Board.
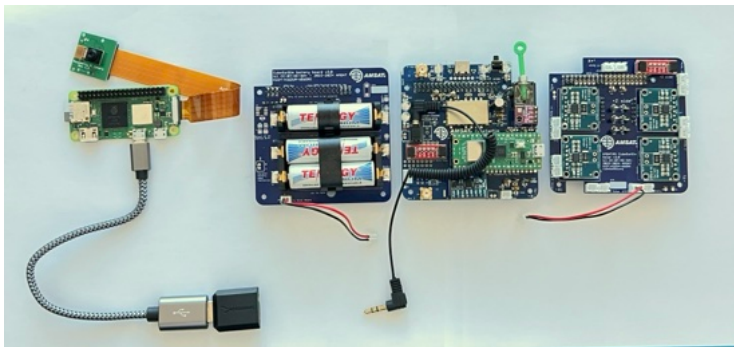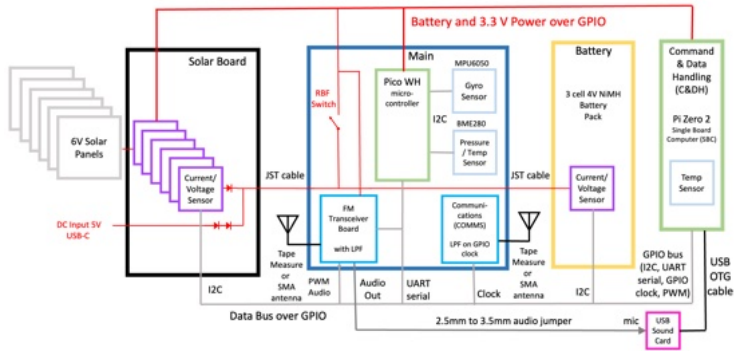

Here is the built board stack:
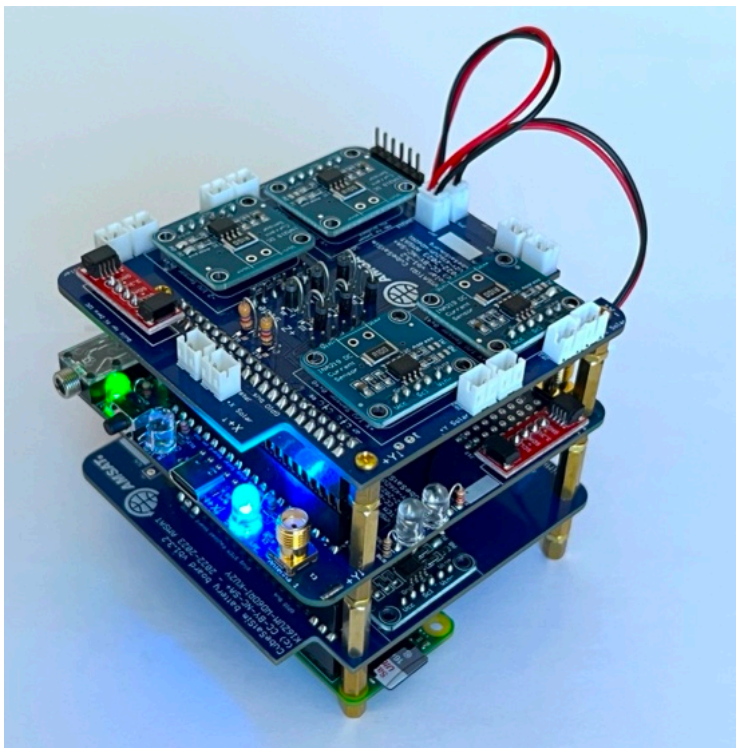
There is a 3D printed frame:

Here is a block diagram of the design:

CubeSatSim Block Diagram v2.0

Parts List Bill of Materials (BOM) to build the CubeSatSim is available here. Make a copy of this spreadsheet: https://CubeSatSim.org/bom

Here is a photo of a kit of parts. Boxed in red are the parts from Digikey, yellow parts from Amazon, blue parts from AMSAT, green parts from various places (use rpilocator.com to find in stock Pi Zero WH), and pink is the 3D parts you print yourself:
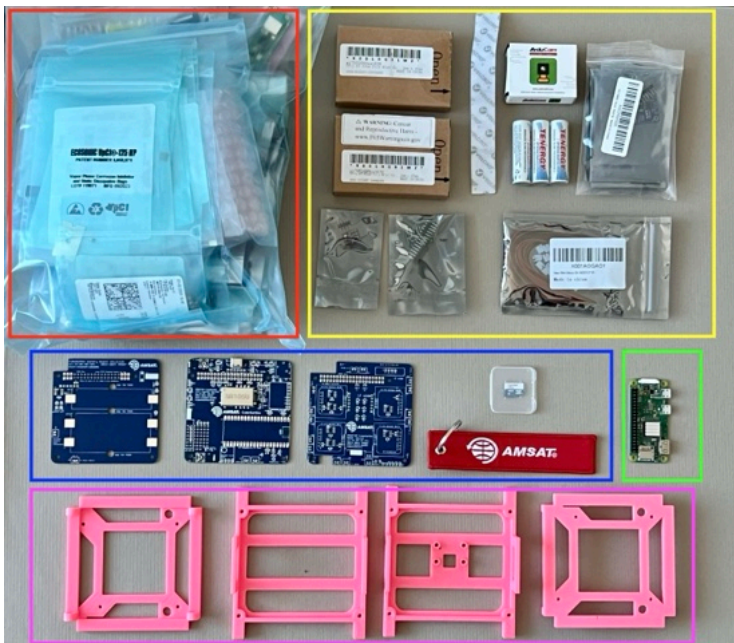
Here are the steps to build a CubeSatSim:

1. Build the Main Board Part 1

2. Install the Software

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