EDUCATION AND CUBESAT SIMULATOR UPDATE

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You might have heard me talk about it or demo it at Hamvention or Symposium this year, but the official release of the new beta CubeSatSim hardware and software is finally here!

The new beta PCB board set is shown in Figure 1; the new board stack in Figure 2; and the new frame and solar panels in Figure 3.

The software for the beta release is here: https://CubeSatSim.org/beta.

The beta wiki instructions are here: https://CubeSatSim.org/wiki-beta. The beta Bill of Materials (BOM) is here: https://CubeSatSim.org/bom-beta.

The beta hardware files are here: https://CubeSatSim.org/hardware-beta. The beta frame STL files for 3D printing are here: https://github.com/alanbjohnston/CubeSatSim/tree/beta/hardware/frame/v1.3.2.

Information about the latest beta software release is here: https://github.com/alanbjohnston/CubeSatSim/releases/tag/v1.3.2.

The AMSAT CubeSatSim is a low-cost, fully functional open source model of a CubeSat nano-satellite. It has the following features:

- Working solar panels and rechargeable batteries
- Multi-channel voltage, current, and temperature telemetry transmitted in the Amateur Radio UHF band generated by a Raspberry Pi Zero single-board computer
- Telemetry decoding using AMSAT's FoxTelem software or APRS software
- STEM Payload board with Raspberry Pi Pico microcontroller with sensors
- Tape measure dipole or SMA antenna with integrated Low Pass Filter
- 3D printed frame

Here is a summary of the changes with the new beta hardware and software:

- New FM transceiver module for better frequency stability and simple command and control receiver to change telemetry modes using RF;
- More modern and cheaper Raspberry Pi Pico microcontroller on STEM Payload board;
- Easily connect additional sensors for the Pico or Pi 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 500 mW 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 now available from electronics distributors and Amazon, including easy-to-find solar panels;
- New BOM uses Octopart electronic part inventory site with one-click distributor ordering (https://CubeSatSim.org/bom-beta);
- Redesigned for blue INA219 voltage and current sensors instead of more expensive purple ones;
- Battery board now has integrated voltage and current sensor;
- Simpler electrical power system with no boost converter or charge control modules;
- Kits can be built with through-hole parts except for a few surface mount parts;
- Fully assembled boards will hopefully be available in the future using SMT parts;
- Transmit and receive frequencies easily configurable from default 434.9 MHz and 435 MHz.

During this beta period, we ask for your help testing the new hardware and software and ensuring that all the instructions and documentation are accurate. To help with this, I am pleased to announce that past purchasers of the CubeSatSim v1 PCB board sets are eligible for a free beta v1.3.2 set of PCB boards. Just email me ku2y@arrl.net! I will verify the order and ship you a new set of 3 blank boards. The boards will have the surface mount components already mounted. The first one hundred who contact me in the next three months will be eligible to receive them. For other orders, you can choose between the v1 boards or the new beta v1.3.2 boards.

I'm looking forward to hearing back from beta builders so we can improve and refine the design and documentation ahead of an official release in 2024.
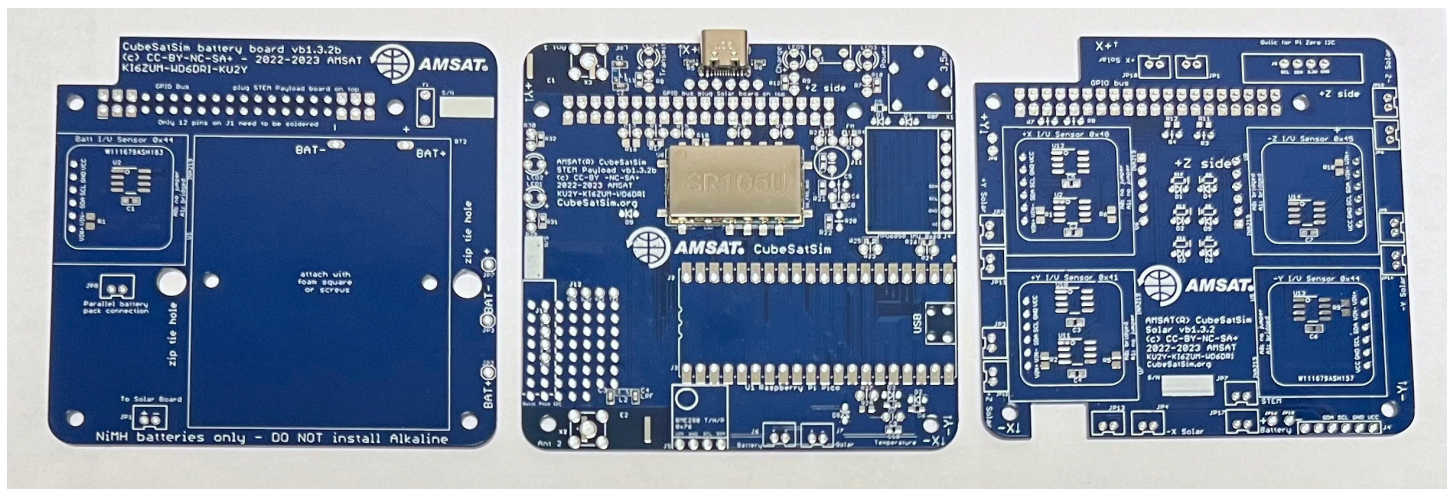

Figure 1 — AMSAT CubeSatSim Beta PCB Board Set. From left to right, battery board, STEM Payload board, and Solar board (the replacement for the Mainboard).
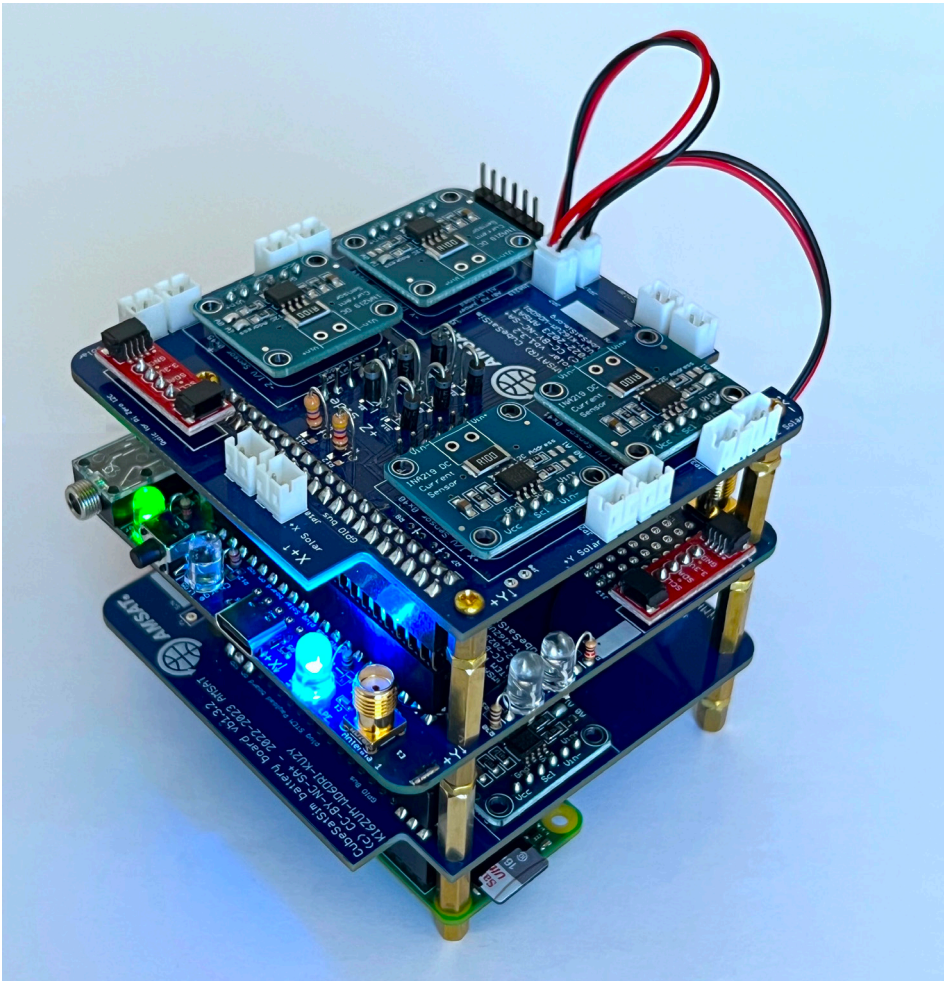
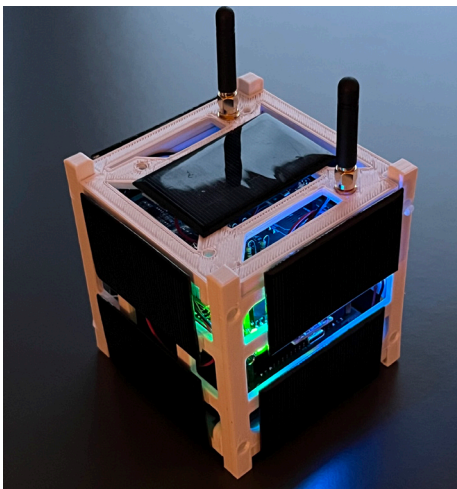**Figure 2 — AMSAT CubeSatSim Beta Board Stack.**

Figure 3 — AMSAT CubeSatSim Beta Board Stack.

As with everything in this project, it was a team effort. A special thanks to the CubeSatSim Educational Materials Team, who have been helping me test and debug the new design for many months. Team members are Paul Graveline, K1YUB; Fredric Raab, KK6NOW; Mark Samis, KD2XS; and David White, WD6DRI.

I see more and more hams on Mastodon these days, including many of my friends from Twitter. You can find me there at @ ku2y@mastodon.radio along with ARISS @ARISS_Intl@mastodon.hams.social. If you make the move, contact me so I can follow you!

If you are interested in doing a demo for a group or school, I can ship you a loaner – contact me at ku2y@arrl.net. I'm always interested in your CubeSatSim projects; feel free to share them via email or social media. ⊕