

AMSAT CubeSatSim – Group Building Activity Guide

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Group: _____ Date: _____

Introduction:

In this activity, you will build a CubeSatSim in a group of 4 or more participants.

This is based on this paper:

Materials:

You will need all the parts to build the CubeSatSim in the Bill of Materials (BOM)

<https://CubeSatSim.org/bom>

You will need the parts in the BOM and these tools:

- Safety glasses (to protect eyes while soldering or trimming leads)
- Soldering iron and solder (I use lead-free solder, but leaded solder is easier to work with)
- Needle nose pliers (to bend leads and hold parts)
- Side cutters (to trim leads)
- 3D printer to print frame parts

Other tools that are helpful:

- Blue mounting putty(to hold components in place while soldering) such as <https://www.amazon.com/Loctite-Fun-Tak-Mounting-Putty-Blue/dp/B0DD1HWWHY/>
- Hot glue gun to secure wires to solar panels

Organization:

If you plan to build a CubeSatSim with a group of 4 or more participants, you will want to break the work up into components, and have a small team work on each component.

This breakdown into four components or Subsystems has been used multiple times in a classroom setting:

- **Main Board:** Assemble and test the Main PCB board. Most soldering.
- **Solar Board:** Assemble and test the Solar PCB board. Second most soldering.
- **Frame and Power:** 3D print frame and assemble. Solder the Battery PCB board, solder wires on solar panels.
- **Sensors and Software:** Solder and test sensors, install software on microcontroller and single board computer. Setup ground station software.

Each team is ideally 2-4 students.

Here is an example work breakdown by 1 hour session.

Sessions with a colored background involve more than one team.

Session	Main Board	Solar Board	Frame and Power	Sensors and Software
1	Start Main Board Part 1	Start Solar Board	Battery Board Solar Panel Soldering but don't do Camera	Sensors (Install software on Pico, Setup Arduino IDE, solder sensors, test sensors with Pico)
2	Finish Main Board Part 1 Start Main Board Part 2	Finish Solar Board	3D print frame parts https://CubeSatSim.org/frame (might take more than an hour to finish)	Pi Zero Software Install Software on Pi Zero 2L Install the Camera
3	Finish soldering but don't start Step 4.4 Testing Main Board Part 2	Solar Board Testing (Testing Solar Board and Solar Panels by plugging in Pi Zero)	Solar Board Testing (Testing Solar Board and Solar Panels by plugging in Pi Zero)	Learn to use the Raspberry Pi Ground Station https://youtu.be/68ULJdP5OZw Learn to interpret CubeSatSim Simulated Telemetry https://youtu.be/B6_iN_OZBmbg
4	Main Board Testing (Step 4.4) (Testing the Main Board including Sensors and Camera and Ground Station)	Frame Test Assembly (Mount solar panels on Frame and test assemble Frame)	Frame Test Assembly (Mount solar panels on Frame and test assemble Frame)	Main Board Testing (Step 4.4) (Testing the Main Board including Sensors and Camera and Ground Station)
5	Flat Sat Testing (Flat Sat testing with Main, Solar, and Battery Boards with Pi Zero)	Flat Sat Testing (Flat Sat testing with Main, Solar, and Battery Boards with Pi Zero)	Flat Sat Testing (Flat Sat testing with Main, Solar, and Battery Boards with Pi Zero)	Flat Sat Testing (Flat Sat testing with Main, Solar, and Battery Boards with Pi Zero)

6	Stacking the Boards (Stacking Main, Solar, and Battery Boards with Pi Zero and installation in Frame)	Stacking the Boards (Stacking Main, Solar, and Battery Boards with Pi Zero and installation in Frame)	Stacking the Boards (Stacking Main, Solar, and Battery Boards with Pi Zero and installation in Frame)	Stacking the Boards (Stacking Main, Solar, and Battery Boards with Pi Zero and installation in Frame)
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