RASCUBE
EDUCATIONAL SATELLITE

QUICK START GUIDE
WITH SAFETY + WARRANTY INFORMATION

ROBINSON
AEROSPACE SYSTEMS

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CONTENTS

Assembly video link (recommended) is available via:
www.robinson-aerospace.com/assembly

GLOSSARY

EPS   Electrical Power System: A module to charge batteries and distribute power

OBC   On-Board Computer: The module which completes most of the satellites processing

RBF   Remove Before Flight

RF   Radio Frequency

UI   User Interface: Computer software used to display data.

Telemetry   Wireless data transmission
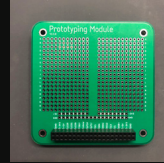
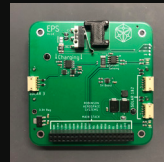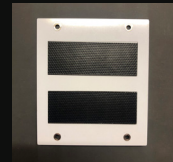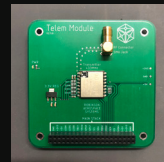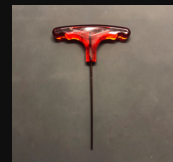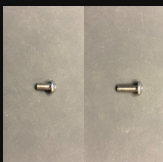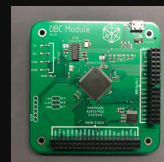|				
x1 RBF Pin	x2 18650 Battery	x1 Top Plate	x1 Prototyping Board	x1 Antenna Board
x18 12mm M-F Standoff	x2 2P Jumper	x1 Base Plate	x1 Sensor Module	x1 Side Access Panel
x5 19mm F-F Standoff	x1 Short Antenna	x2 Side Panel (A - No Inserts)	x1 EPS Module	x3 Solar Panel
x10 Felt Feet	x2 RF Cable	x2 Side Panel (B - With Inserts)	x1 Telemetry Module	x2 Hex Key
x25 6mm and x40 8mm Screws	x3 Ribbon Cable	x1 Receiver with Antenna	x1 OBC Module	x4 Edge Rail

Your parts may slightly differ depending on your version numbers and stock/supplier availabilities.

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NOTE

Push the hex key through the screw hole on the opposite side of the side panel to ensure the screw goes in straight. Insert both screws loosely before tightening properly. Do not over-tighten!
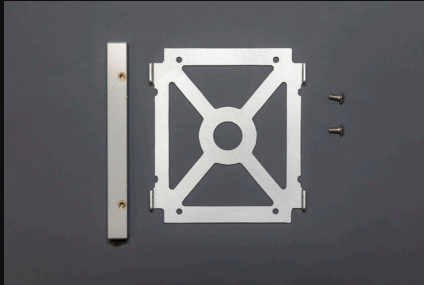
PARTS
x2 Edge Rail
x2 Side Panel (A - No Thread Inserts)
x4 6mm Screw

STEPS
Screw the side panel to the edge rail in the orientation shown below. Note the position of the brass thread inserts on the edge rail.

Repeat this step with the remaining edge rail, side panel and screws to ensure you have x2 of these assemblies.

Ensure threads are facing towards you
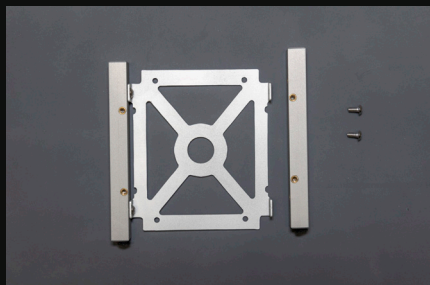
PARTS
x2 Edge Rail
x4 6mm Screw
x2 Assembly from Step 1

STEPS
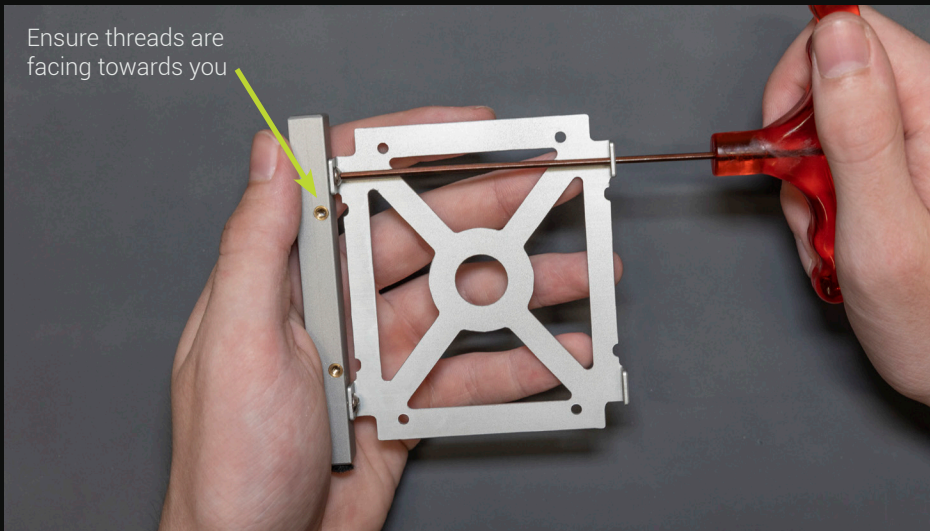Screw the edge rail to the assembly from Step 1, using two 6mm screws, as shown below.

Repeat this step for the remaining edge rail and assembly from Step 1 so you have two of these.

NOTE
If the felt feet are already installed on the edge rails, ensure they are facing the same direction! This will be the bottom of the satellite.

Note the felt feet face the same direction
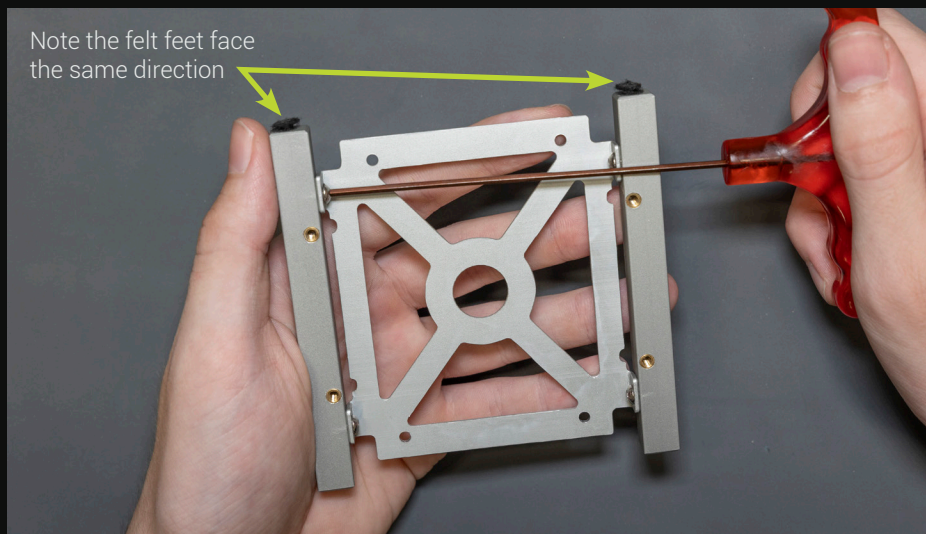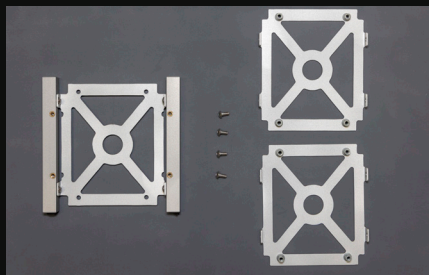
PARTS
x2 Side Panel (B - With Thread Inserts)
x4 6mm Screw
x1 Assembly from Step 2

STEPS
Screw two side panels onto one of the assemblies from Step 2, in the orientations shown below.
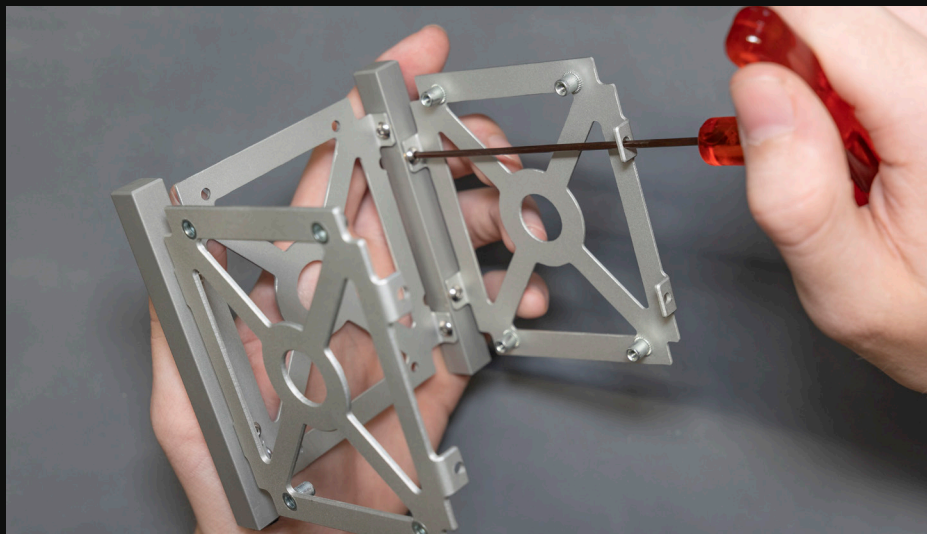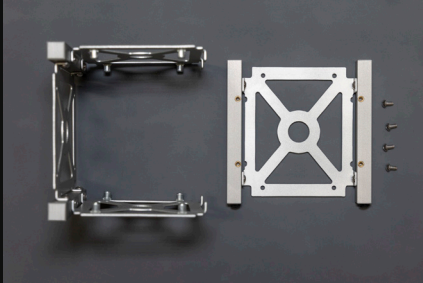
PARTS
x4 6mm Screw
x1 Assembly from Step 2
x1 Assembly from Step 3

STEPS
This step can be very tricky, take your time to carefully understand how to do it!

Position the hex key in the designated slots in the assembly from Step 3. Screw both of the Step 2 and Step 3 assemblies together, along both edge rails.

NOTE
Ensure the hex key stays in the designated slots, otherwise it may get stuck. Ensure the felt feet are facing the same direction.

Note the hex key placement
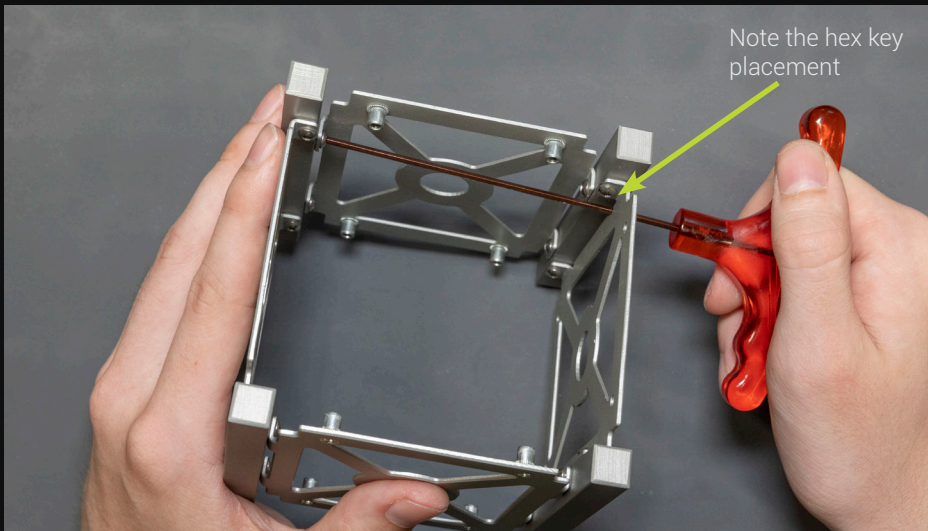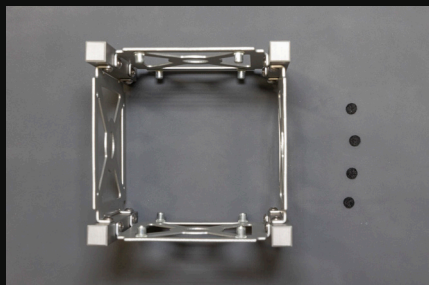
PARTS
x4 Felt Feet
x1 Assembly from Step 4

STEPS
If the felt feet are not yet installed (this is the first time the kit is being assembled), peel off the adhesive protection and stick felt feet onto the base of each edge rail.

PARTS
x1 EPS Module
x2 18650 Battery

STEPS
Install the two batteries into the EPS module. Ensure the batteries are orientated correctly, by matching their polarity to the symbols on the underside of the EPS module. Incorrect battery placement may damage the EPS module's electronics.
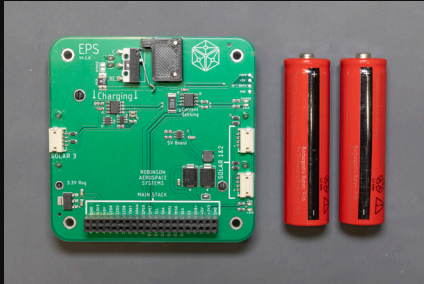
NOTE
Failure to insert batteries correctly may damage RASCube's electronics or become a safety hazard!

Battery +
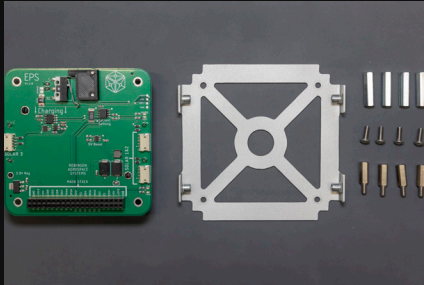
PARTS

x1 Base Plate
x4 19mm F-F Standoff
x4 12mm M-F Standoff
x4 8mm screw
x1 Assembly from Step 6

STEPS

Screw each of the 19mm standoffs to the inside of the base plate, one in each corner. Then, attach the EPS module onto the 19mm standoffs by using the 12mm standoffs. This is the beginning of the electronics stack.

12mm M-F Standoff

19mm F-F Standoff
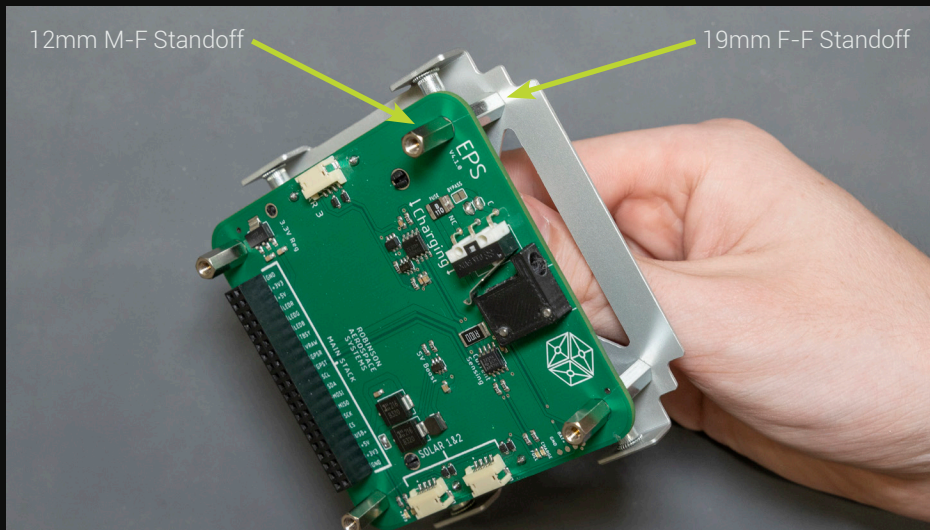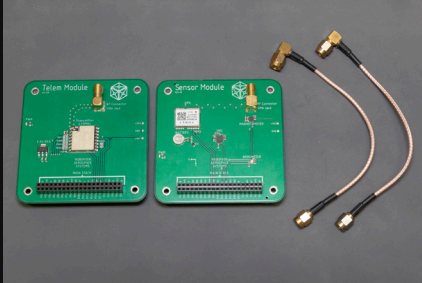
PARTS
x2 RF Cable
x1 Sensor Module
x1 Telemetry Module

STEPS
Notice one end of the RF cable is a right angle. Screw these right angle ends of the RF cables into the RF connectors on both modules. Ensure the cables are facing upwards, away from the circuit boards.

Right angle connector

PARTS
x1 OBC Module
x8 12mm M-F Standoff
x4 8mm Screw
x1 Assembly from Step 7
x1 Assemblies from Step 8

STEPS
Continue stacking the remaining modules on top of the EPS and base plate, with 12mm standoffs in between each module. The module order is EPS (bottom), then OBC, Sensors and Telem (top). Once all modules are stacked, secure the final module with screws, using the hex key.

NOTE
To avoid major damage, carefully ensure the 40x pins labelled 'Main Stack' are aligned perfectly before pushing the modules together.

'Main Stack' pins

PARTS
x3 Ribbon Cable
x1 Assembly from Step 9

STEPS
Connect a ribbon cable to each of the
3 solar connectors on the EPS module.
Ensure the connector is pushed all the way
in, they can be a tight fit.
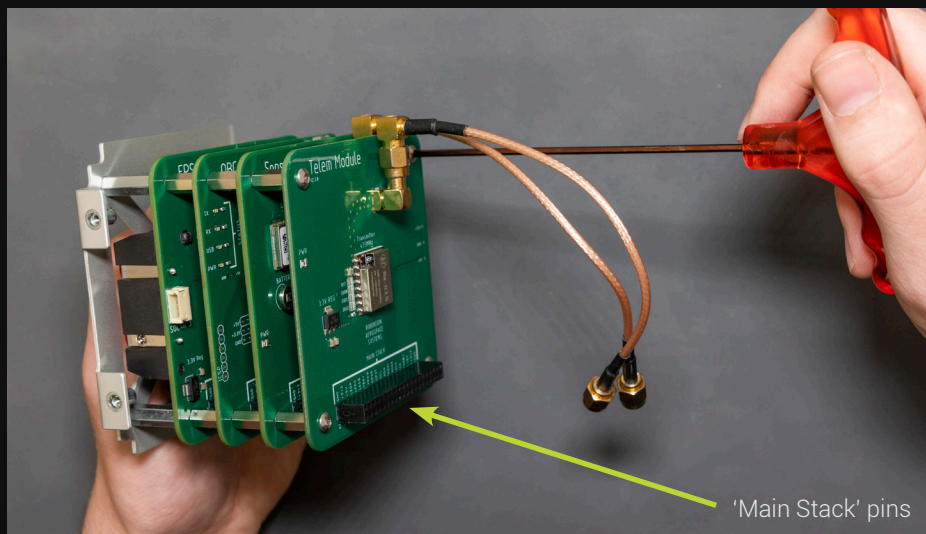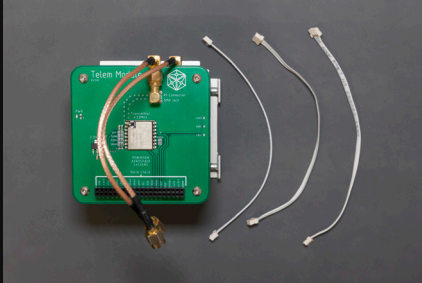
NOTE
To avoid damage, do not
excessively bend cables.
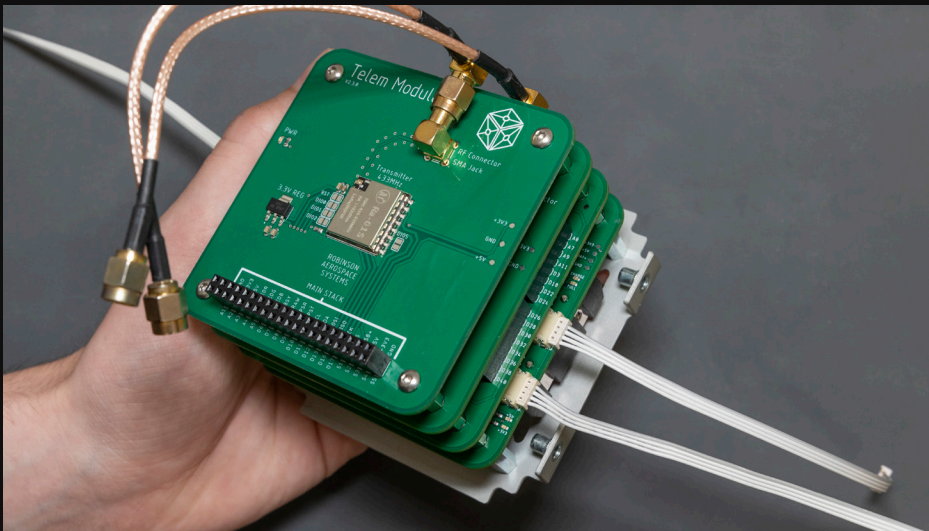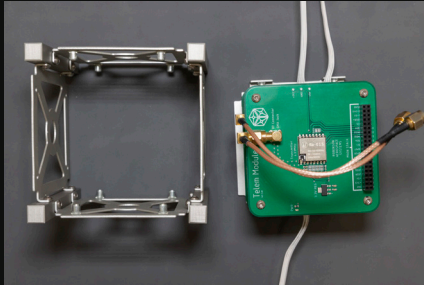
NOTE

A solar panel will not be installed on the side containing the OBC module's USB connector and the EPS module's on/off pin. Do not put a cable for a solar panel on this side.

PARTS

x1 Assembly from Step 5
x1 Assembly from Step 10

STEPS

Align the electronics stack and aluminium structure as shown below. Note the thread inserts on the aluminium structure and the USB connector on the electronics stack facing upwards.

Feed the RF cables through the structure. Feed the ribbon cables through the bottom cut-outs in the side panels, where a solar panel will be installed.

USB connector and thread inserts facing upwards
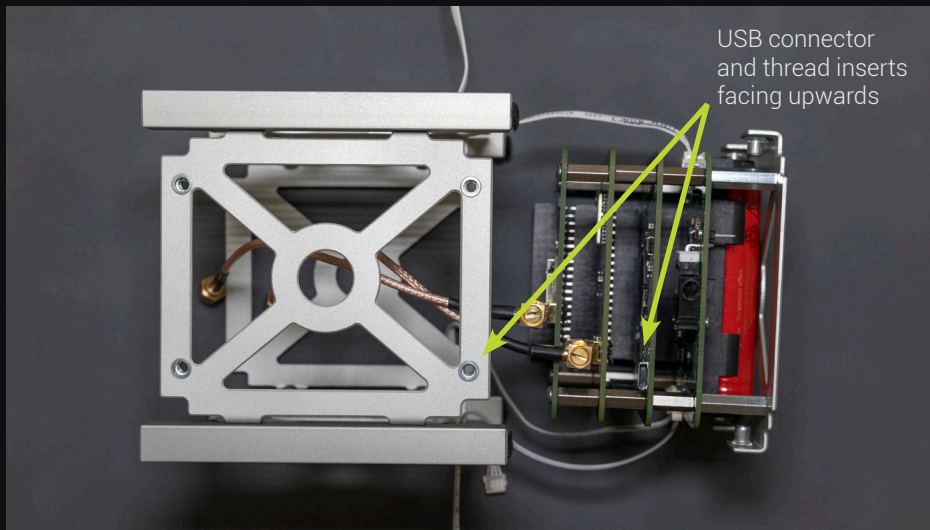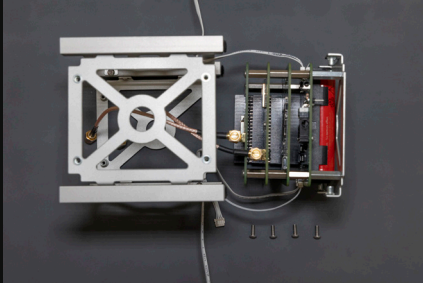
PARTS
x4 8mm Screw
x1 Assembly from Step 11

STEPS
Carefully slide the electronics stack into the aluminium structure, pulling each cable through slowly. Once the electronics stack is in place, screw 4x screws through the side panels and into the base plate.
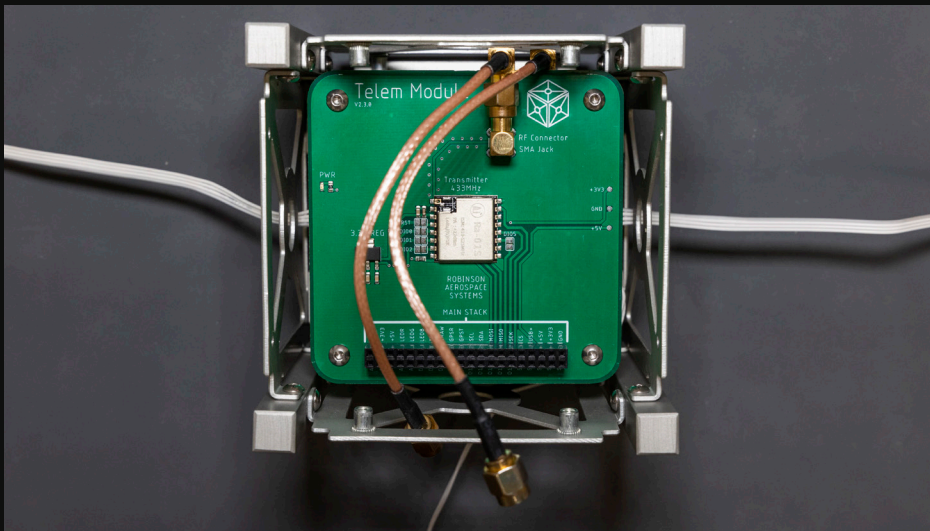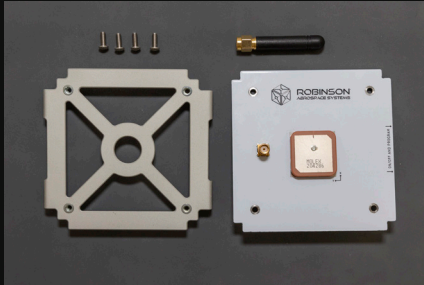
PARTS
x1 Top Plate
x1 Antenna Board
x1 Short Antenna
x4 8mm Screw

STEPS
Screw the antenna board to the top plate in the orientation shown below.

Screw the communications antenna onto the antenna connector.

Note location of
aluminium tabs
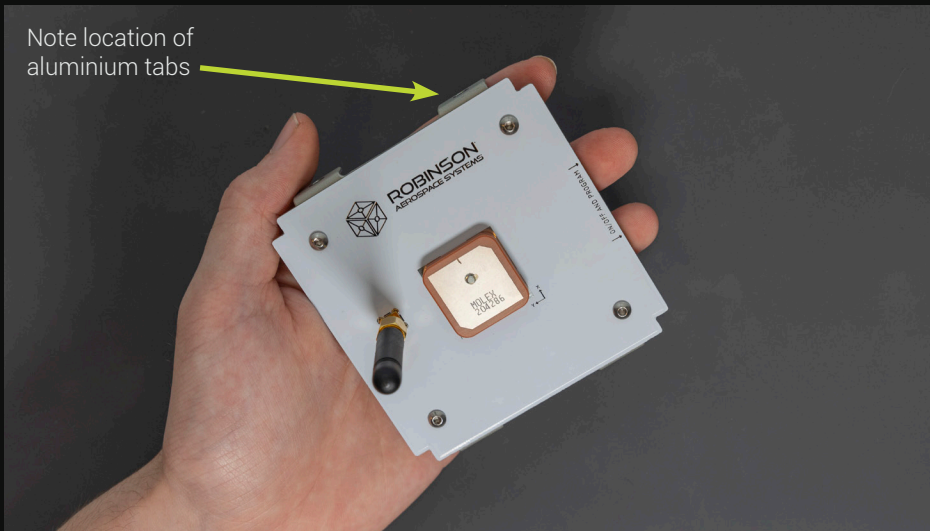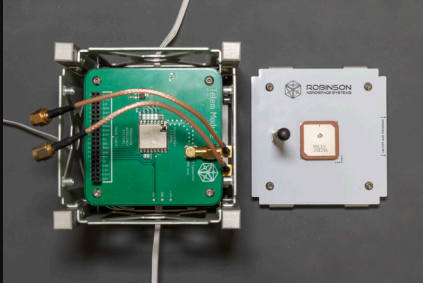
PARTS
x1 Assembly from Step 12
x1 Assembly from Step 13

STEPS
Screw the RF cables from the electronics stack onto the appropriate connectors on the antenna board.

The cable from the Sensor Module goes to the connector labeled 'GPS'. The remaining cable (from the Telem module) goes to the connector labeled 'Telem'.

NOTE
It is critical to attach the cables to the correct connectors, otherwise the satellite will not have GPS data or wireless communications!
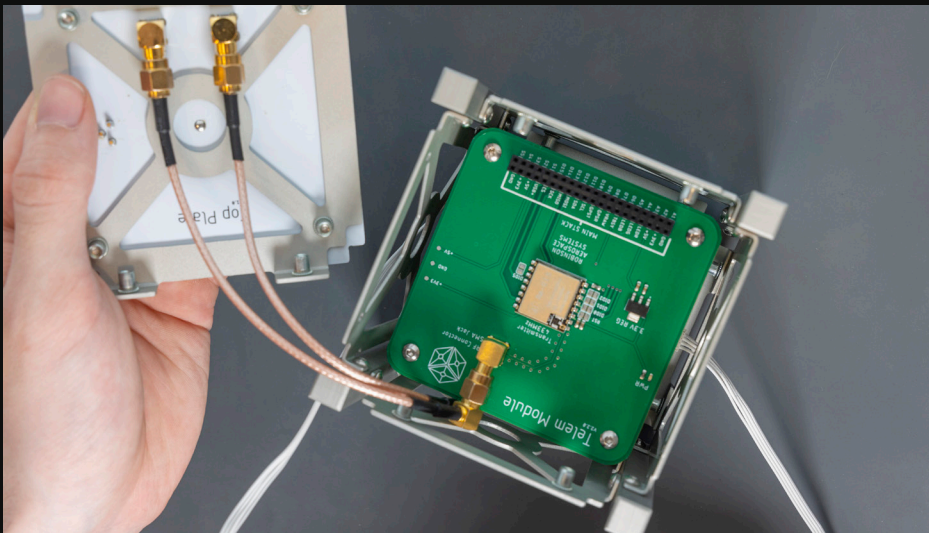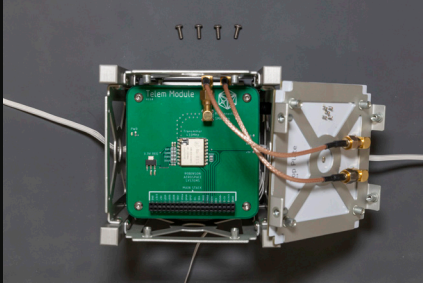
PARTS
x4 8mm Screw
x1 Assembly from Step 14

STEPS
Position the antenna board onto the top of the satellite and attach with screws.

NOTE
Ensure the arrows saying 'on/off and program' on the antenna board point to the side where no solar panel will be installed (no ribbon cable).

This side has no ribbon cable and has the USB connector on the OBC

PARTS

x1 Side Access Panel
x8 8mm Screw
x3 Solar Panel
x1 Assembly from Step 15

STEPS

Screw the side access panel to the aluminium structure. Connect a ribbon cable to each solar panel, feeding the excess cable into the satellite as you move the solar panels into position. Screw the solar panels in place.
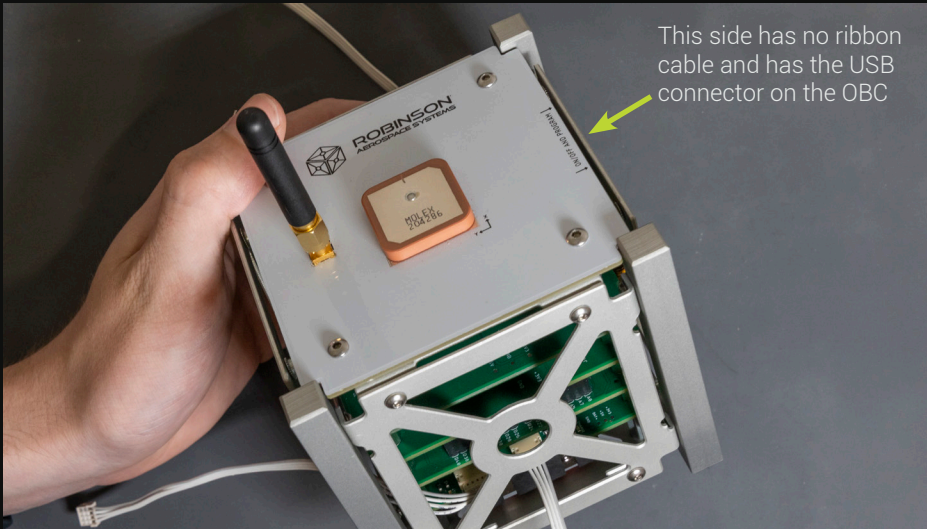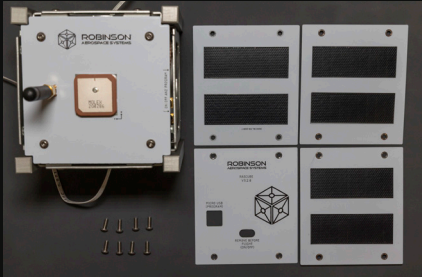
NOTE

Two of these solar panels will require existing screws to be removed for installation, as these solar panels and the top and bottom plates use the same screws.
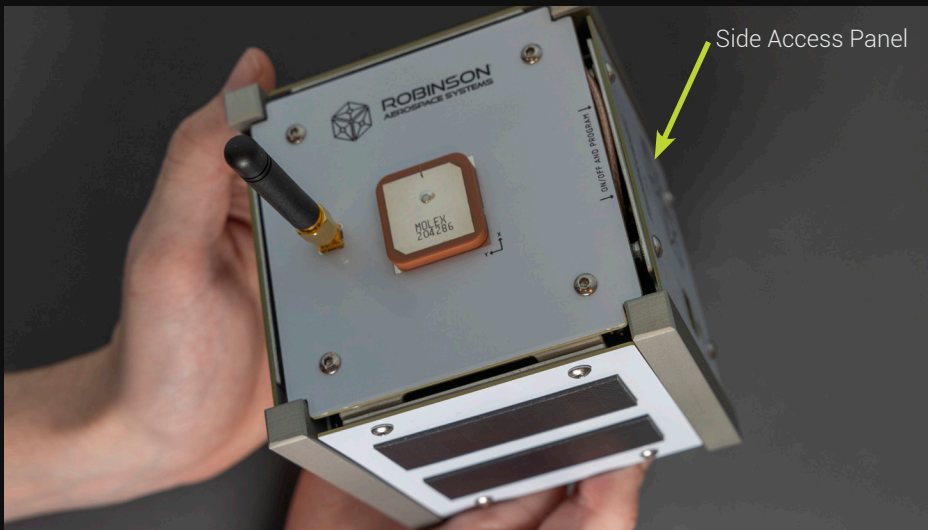
Side Access Panel

PARTS
x1 2P Jumper
x1 RBF Pin

STEPS
Slide the RBF pin into the satellite, at the side access panel. Insert the 2P jumper onto the header labelled 'Isolation' on the bottom of the EPS Module. The 2P jumper should cover both of the exposed pins.

2P Jumper

PARTS
x1 Receiver
x1 Assembled CubeSat

STEPS
Insert the receiver into a computer's USB port. Open an internet browser and go to 'ui.robinson-aerospace.com'. Select your USB receiver from the drop-down menu, then type in the Serial Number of your satellite. Remove the RBF pin to turn on the satellite, do not touch the satellite until the red LED starts blinking blue.

Supported browsers: Chrome, Edge

NOTE
In the drop-down menu, your USB receiver should say 'USB Serial Port'.

EPS LEDS

The EPS has four green LEDs to show voltages and charging status. The LEDs indicate batteries charging ('CHARGE'), charging complete ('FULL'), 5V power ('+5V') and 3.3V power ('+3V3').

OBC LEDS

The OBC has four green LEDs and one RGB (colour changing) LED. 'RX' and 'TX' will flash when data is being received or transmitted respectively. 'USB' indicates the USB cable is plugged in and providing power, while 'PWR' indicates if the OBC is on/off. Note that if the EPS is not connected, the 'USB' LED will turn on, but there will be no power to the OBC ('PWR').

The RGB LED (located next to the USB connection) will be solid red when RASCube is first turned on, indicating the sensors are calibrating and RASCube should not be moved. This will then flash blue every time RASCube transmits data, this is typically five times per second. Future versions of RASCube's software will show other colours and patterns to signal various actions or problems.

RGB LED

4x LEDs
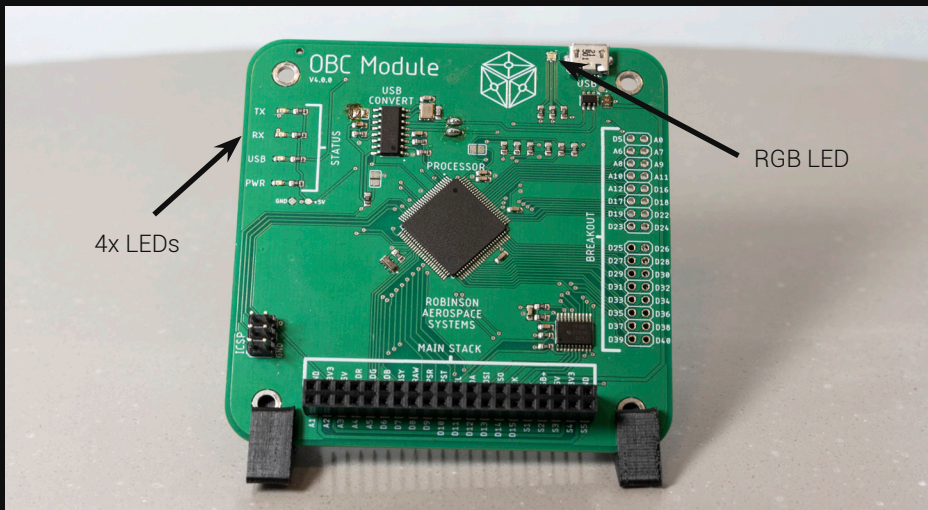
TWO WAYS TO CHARGE

RASCube V1.0 includes two main ways to charge the batteries:

Solar   When put in bright light conditions, the solar panels will generate
                    power and charge the batteries.
USB Charging   RASCube V1.0 does not support charging through its USB connector
                    Instead, we've included a small adaptor which charges the batteries
                    by replacing a solar panel with a 5V USB cable. See below diagram.

Adaptor
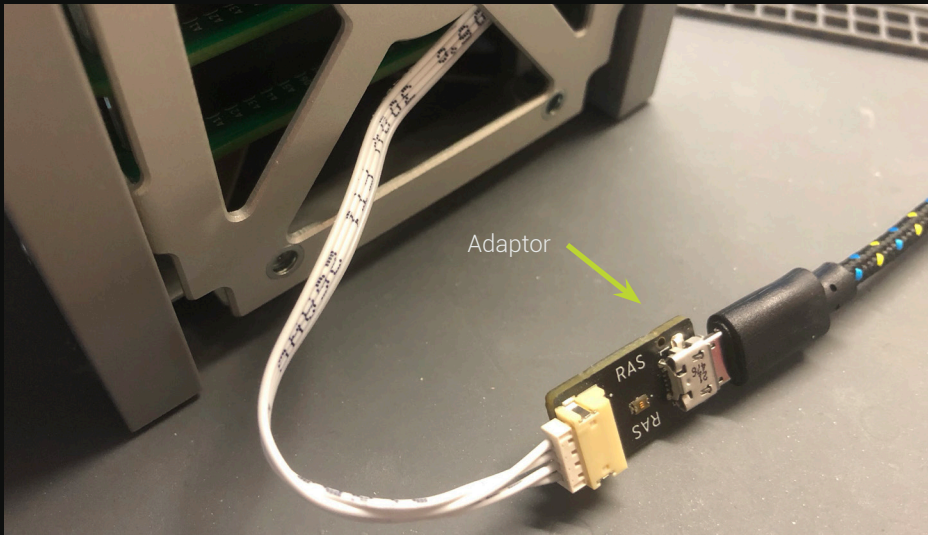
GENERAL BATTERY INFORMATION

The batteries can also be removed and charged using a Li-ion battery charger
which is designed to be used with 18650 battery cells.

If you require new batteries, please contact Robinson Aerospace for advice on
which batteries to purchase.

Note: The batteries will continue to charge when RASCube is turned off and/or the
isolation connector is removed.

WIRELESS SYSTEMS

RASCube communicates through LoRa, at 433MHz. Each Serial Number communicates at a slightly different frequency, which is why the User Interface asks for your SN. This is to ensure multiple units in one area will not interfere with each other.

WIRELESS SYSTEMS AREN'T WORKING

There are many reasons your wireless communications may not be working.
Check the following:
1.   Cables or antennae may not be connected properly. Check all connections.
2.   The battery voltage is too low. Charge the batteries or try using the USB cable to power RASCube.
3.   Another device in the area may be interfering. This is very unlikely, but if you suspect this is happening, do not use RASCube.

RASCube can send data to the User Interface through the USB cable in replacement of the wireless system if needed.

REFERENCE IMAGES

If you are disassembling RASCube for the next group/person to use, you may want to put RASCube's parts in their respective places. Here are some reference images to help. The work mat and documentation package rests on top of the top foam insert, so they are seen first when the lid is opened.
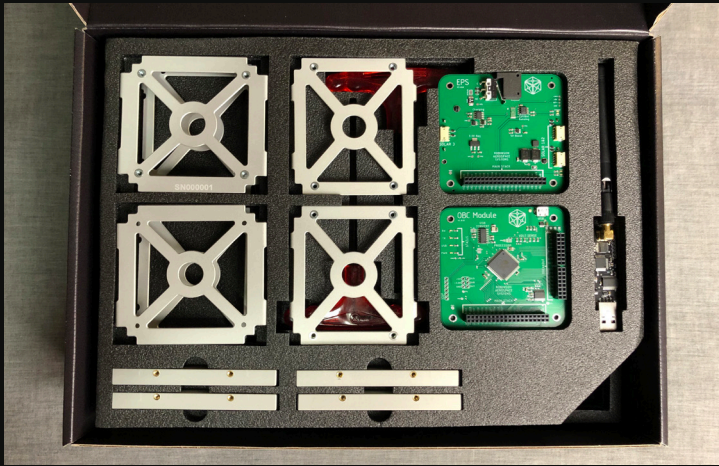
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BATTERIES

RASCube uses two (2) 18650 Li-Ion battery cells to power its systems. When misused, these cells can become damaged and cause harm.
1. Do not tamper with the batteries.
2. If you notice your operating time has greatly reduced, replace the batteries.
3. Do not short battery terminals. This may result in fire, burns or overheating.
4. Do not store or use batteries where the ambient temperature may exceed 50 degrees Celsius.
5. Dispose of batteries responsibly. Never incinerate or crush battery cells. Always follow local regulations.
6. Only use 18650 cells which include protection circuitry. All unprotected cells are highly volatile.
7. When not using RASCube for long periods of time, remove the batteries and put tape over the battery terminals.
8. Always switch off RASCube before removing batteries.

ELECTRICAL CONTACTS

Never short any electrical contacts.
1. Shorting contacts may damage components or batteries.
2. Contacts may be sharp, avoid touching when possible. Handle with care to avoid injury.
3. Always ensure all forty (40) header pins align correctly to avoid damage.

TOOLS

Misuse of included tools may result in physical harm.
1. Hex keys should only be used for screwing in the provided screws and should always face towards RASCube.
2. Never point the sharp end of a hex key towards a person or yourself.

FLIGHT AND LAUNCH

RASCube is designed to be used in-class, on a table or bench.
1. RASCube is not designed for launch to space. It will not survive the harsh environment, including temperatures and radiation.
2. RASCube can be used on flights involving weather balloons, however we do not encourage this. Safe recovery of RASCube is the responsibility of the user. RAS has not tested weather balloon flights.

AGE RATING

RASCube is designed to be used by ages 12+. Younger ages may not understand the use of tools, the assembly process or the dangers involved. Small parts may be of risk to young children.

WATER AND WEATHER

Water may damage RASCube's electronics. Do not use in wet conditions. If water is spilt on RASCube, immediately isolate and remove the batteries.

ELECTRONICS

RASCube's electronics can be damaged when misused, or cause harm.
1. Electronics may become hot. Avoid touching electronics when hot.
2. Handle electronics carefully to ensure small parts do not become detached from the Printed Circuit Boards (PCB).

ALUMINIUM STRUCTURE

Aluminium parts may have sharp edges as a result of manufacturing variations or misuse. Regularly inspect each piece for sharp edges and contact Robinson Aerospace if you are concerned. Sharp edges or burrs may cause injury.

WIRELESS SYSTEMS

1. Avoid turning on RASCube without an antenna installed. This can damage the wireless transmitter.
2. If you are aware of other devices in the area using the 433MHz LoRa band, do not use RASCube. This may cause interference of potentially important data.

DATA PRIVACY

All data sent to RASCube's User Interface (UI) is saved locally (temporarily, on your computer).
1. Note: No data is saved offsite on servers, for your privacy. This includes GPS location.
2. Never use RASCube to track someone's location without their permission.

MANUFACTURER'S WARRANTY

RASCUBE EDUCATIONAL SATELLITE KITS - LIMITED WARRANTY

HEAD OFFICE - ADELAIDE
Suite 43, Stone and Chalk
Marnirni-Apinthi Building, Lot Fourteen
North Terrace, Adelaide SA 5000

Robinson Aerospace products are manufactured to high quality standards and are thoroughly inspected and tested before dispatch. In addition to any statutory rights you may have, Robinson Aerospace warrants its products sold new in Australia against defective workmanship and faulty materials from the date of purchase by the customer, for two (2) years.

Robinson Aerospace will repair or replace as necessary, free of charge, each product or part which qualifies on the condition that:
- The complete product is returned to Robinson Aerospace in person or via freight paid for by the customer and found on examination to be suffering from a manufacturer defect.
- The product or part has not been subject to misuse, neglect or abuse.
- The repairs are not required as a result of normal wear and tear.
In Australia, "Robinson Aerospace" means ROBINSON AEROSPACE SYSTEMS PTY LTD, ACN: 658 664 414.

IMPORTANT NOTE FOR AUSTRALIAN CUSTOMERS
Robinson Aerospace products come with guarantees that cannot be excluded under the Australian Consumer Law (ACL). You are entitled to a replacement or refund for a major failure and for compensation for any other foreseeable loss or damage. You are also entitled to have the products repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure.

Please go to www.robinson-aerospace.com to contact Robinson Aerospace support.
Please retain a copy of your tax invoice for warranty.

RASCube is an educational satellite kit that is designed to look, feel, function and assemble just like a real satellite, but not go to space. It is a 1U CubeSat, which means once assembled, it forms a 10cm cube. This kit includes all circuit boards, aluminium pieces and hardware required to assemble and use RASCube.

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