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Tracker Hardware - Traquito Jetpack

Jetpack is a custom Traquito-designed pico balloon WSPR tracker aimed at beginners and experienced alike.

The hardware design and software are freely available to all -- you order, assemble, and fly.

Fly cheap - \$14 per-tracker, shipped!

- Uses [Raspberry Pi Pico](#) as base board
- Solder on the Add-on Module to complete the Jetpack tracker

Simple to set up and use!

- Hardware setup takes 5 minutes and a soldering iron
- Plug into USB to drag/drop the tracker software (UF2)
- Stay plugged into USB and use the [webpage-based configuration utility](#)
- Great for schools or beginners

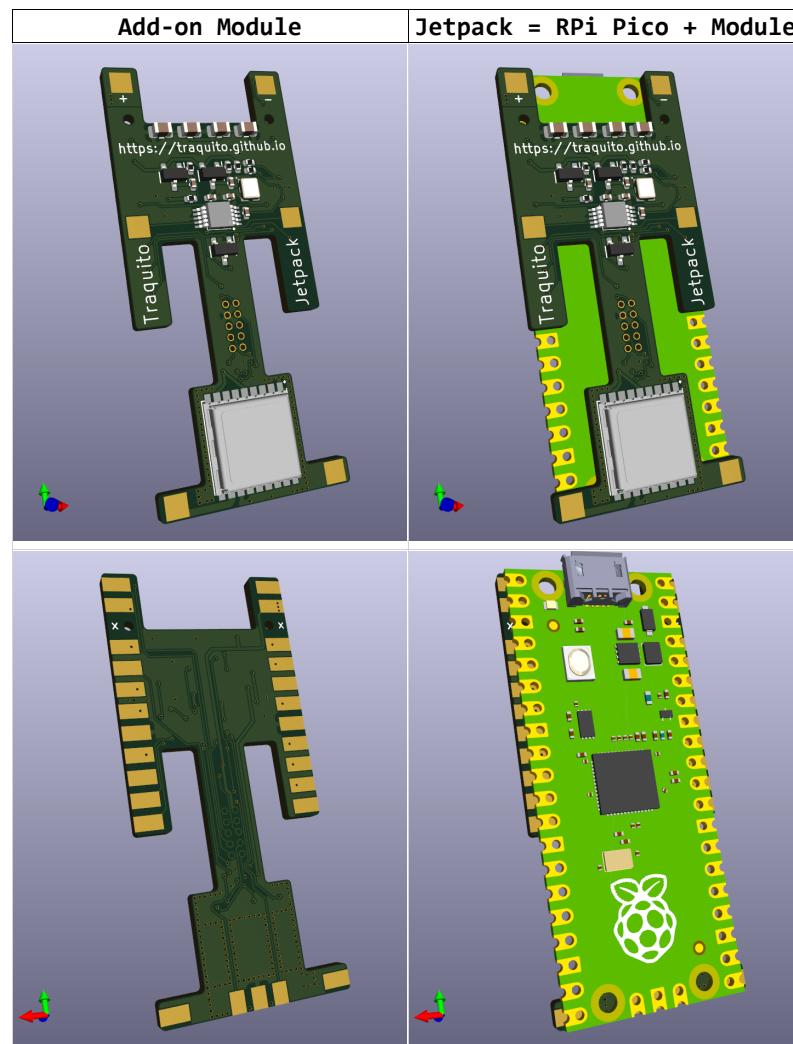
Works with the U4B-protocol telemetry of GPS coordinates, Altitude, Speed, and Voltage.

Pick a free [channel](#), then [track](#) your flight!

Supports all WSPR bands (20m and all others).

Wide range of input voltages (3.0V to 5.5V) thanks to buck/boost regulator. This allows significant flexibility in powering the unit, such as by:

- Solar
- LiPo
- 2 or 3 AAA/AA lithium cells in series



Jetpack Hardware, Software, and Feature

Descriptions

[See this page for details](#)

How do I get it?

The tracker comes in two parts that you will assemble (solder together) yourself:

- Raspberry Pi Pico
- Add-on Module

Getting the Raspberry Pi Pico means buying it from somewhere, [Adafruit](#) is a good option.
(Get the cheapest no-header version, should be \$4).

Getting the Add-on Module means submitting an order to the PCB Assembly service at JLCPCB -- See here: ([link](#))

Solder the Add-on Module to the back of the RPi Pico to create the Jetpack tracker.

Assembly

It is best to assemble (solder together) on a breadboard, using two header pins to lock together the alignment of the Add-on Module and the RPi Pico.

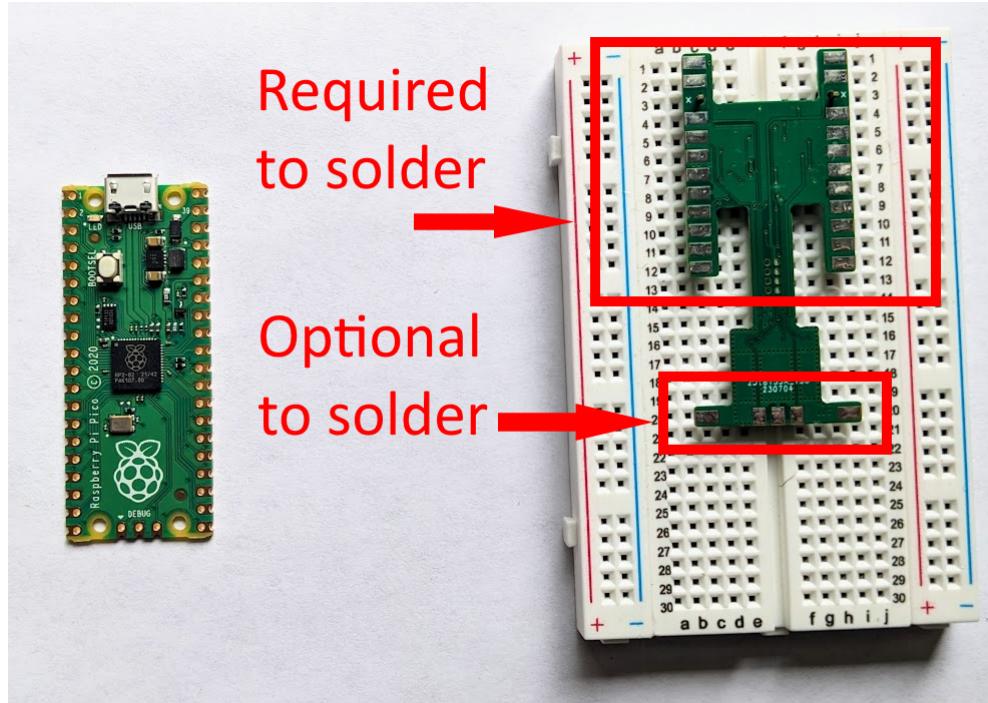
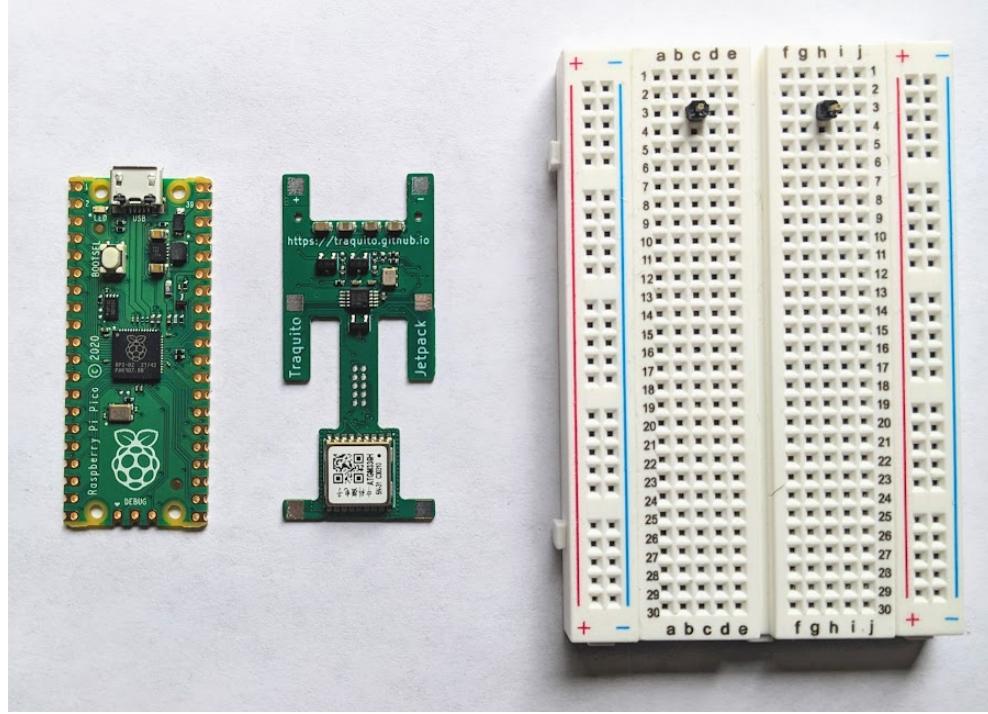
- Place the header pins on the 3rd row and 3rd column of each of the two halves of the breadboard
- Place the Add-on Module, flipped, so the back pads are facing upward
- Place the RPi Pico on top
- Now you are ready to solder the two parts together
- (See image below for guidance on which pads to solder)

Just make sure you don't solder the pins to the tracker!

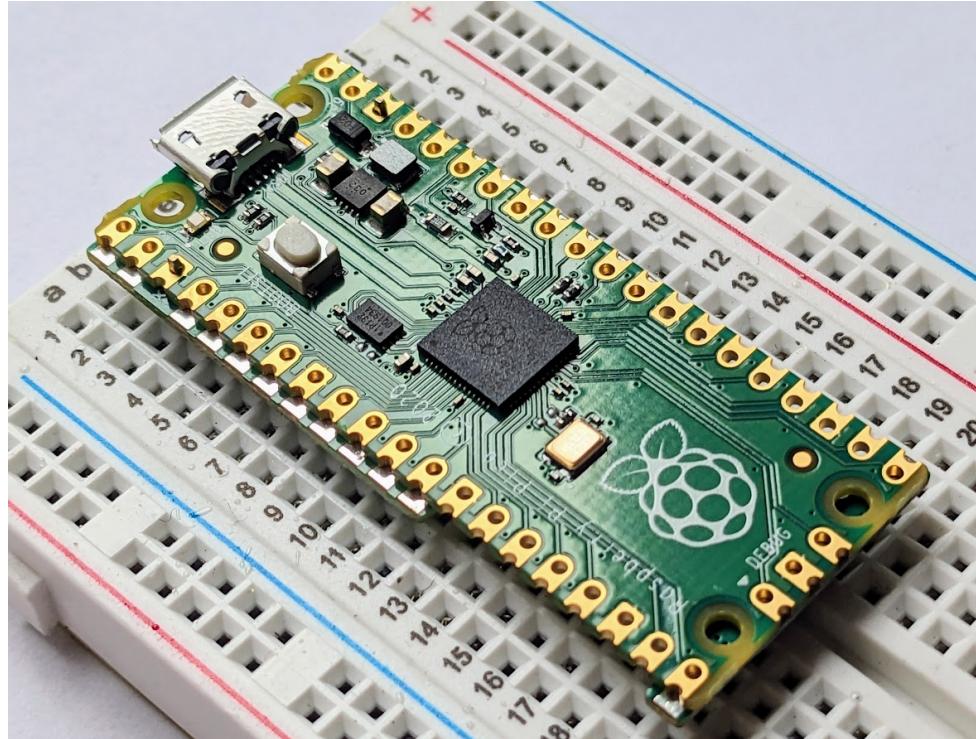
Solder all other pads first, then remove the tracker from the breadboard and solder the final two pads that were used for alignment.

Please take note of the orientation!

The RPi Pico and Add-on Module must be aligned as shown.

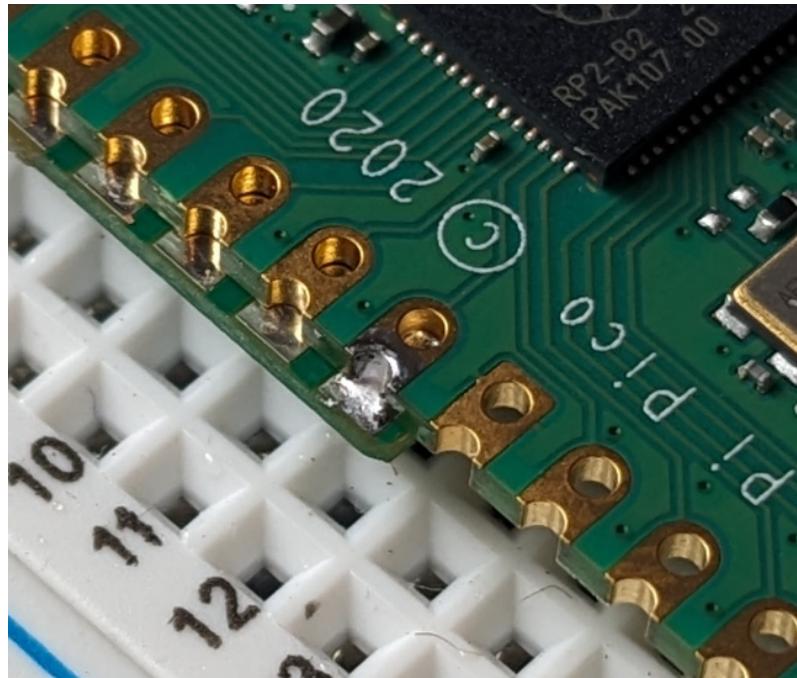


Notice there is a silkscreen "X" on the alignment hole pad. You do not need to solder this.



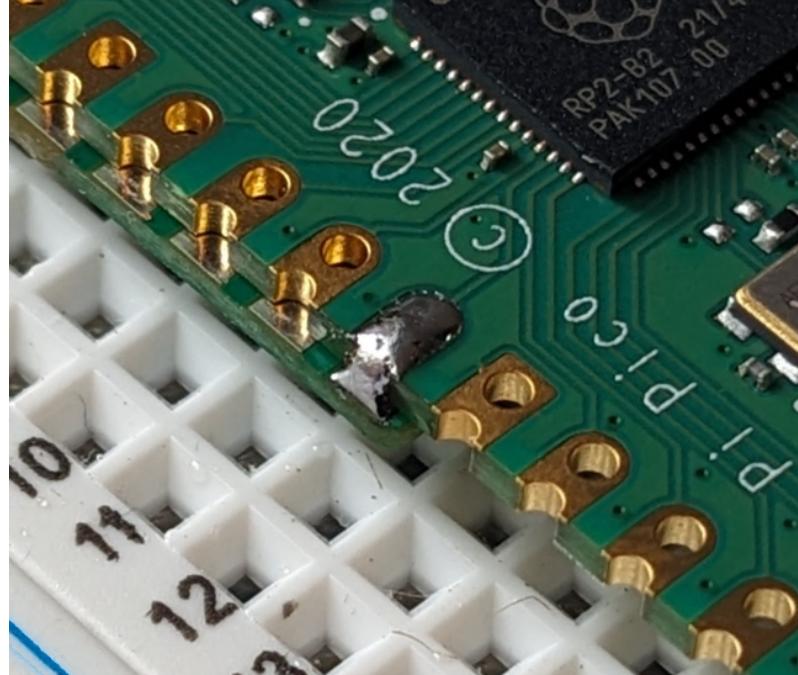
You want to make sure the pad of the Add-on Module is soldered to the edge of the RPi Pico. Look for a nice connection.

Here is an example of a single pad having been soldered. No need to "fill in" the hole.



You are welcome to pile on the solder if you want to. Any increase in weight will be small, so not a big deal.

This may be the preferred approach for students or those with less precise soldering equipment.



Programming

Once you have assembled (soldered) your tracker, you must program it.

Programming means putting the tracker software onto the physical device hardware. Without software, the tracker hardware does nothing.

The steps to program your tracker are:

- Plug the tracker into the computer via USB
- (a removable drive appears, you can ignore the contents)
- Drag/Drop the tracker software (.UF2 file) onto that removable drive
- (the drive disappears, you are now done programming)
- (there is no need to reboot or unplug the tracker, proceed to configuration)

The .UF2 file download is available at the end of this page.

Configuration

You now have a functioning tracker, congratulations! You can't fly yet, though, you have to configure it first!

Configuring the tracker means telling the tracker the information it needs to do its job.

You use this same information later to search for the tracker's path and telemetry, so write it down.

You need to tell the tracker:

- The frequency band (usually 20m)
- The channel (pick one someone else isn't using)
- Your callsign

Plug your tracker into USB and configure your tracker through the [Configuration GUI](#).

Flight Configuration

Save Show Saved Show Default

WSPR Configuration

Band: 20m
Channel: 1
Callsign: callsign

If you want to send test WSPR messages during configuration, solder on a short wire (eg 3 inches) to each antenna pad. This will get replaced by a full-sized antenna later.

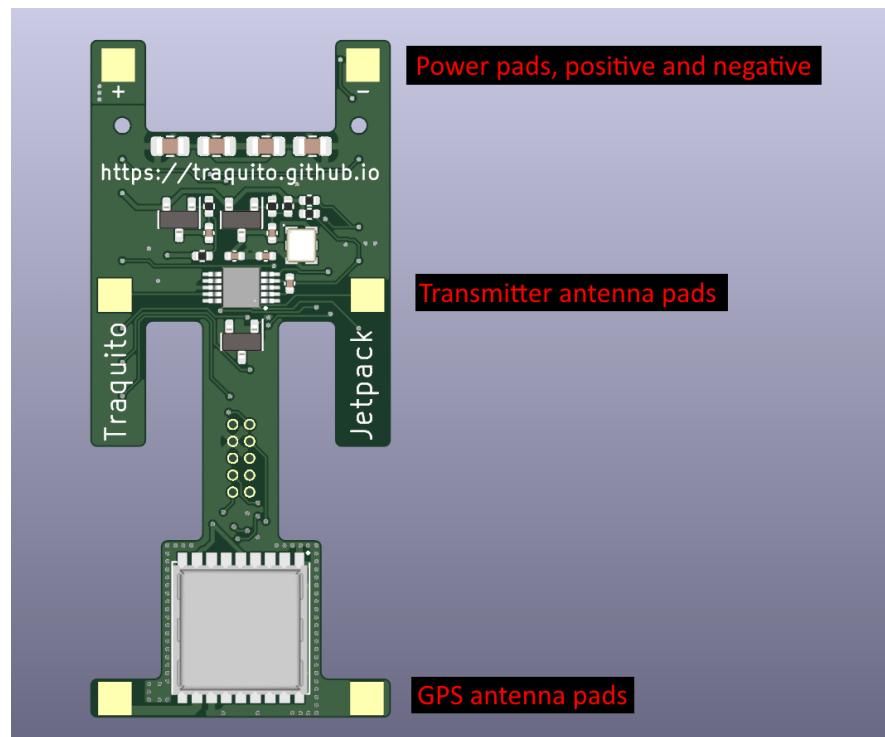
Once you have configured your tracker, disconnect it from the computer.

Power and Antennas

Jetpack has 6 pads on its front that are used for:

- Providing power during flight (top two)
- Transmitter antenna (middle two)
- GPS antenna (bottom two)

Jetpack must have power and antennas before it will work correctly.

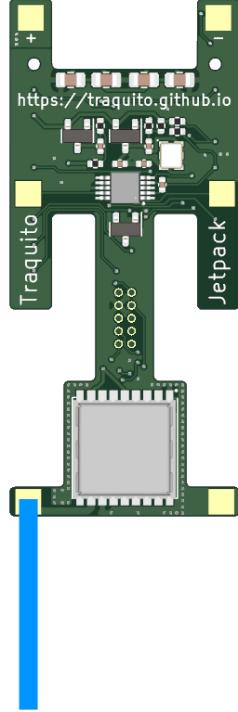


GPS Antenna

The GPS antenna can have one leg, 5cm or 2 inches in length, on the left pad, extending away from the tracker.

I use [solid core 20 AWG wire](#) but really most anything works.

Example image (not to scale):



Transmitter Antenna

The Transmitter antenna needs to have two legs, each 199.2" long (quite long) for 20m (different length for other bands). This is due to the relationship between the transmission frequency and the antenna length. This length is a "half wave" dipole.

A common approach is to use a very thin (36AWG) enameled [magnet wire](#). I don't even scrape the enamel off before soldering, it just melts away when you push inside a solder blob.

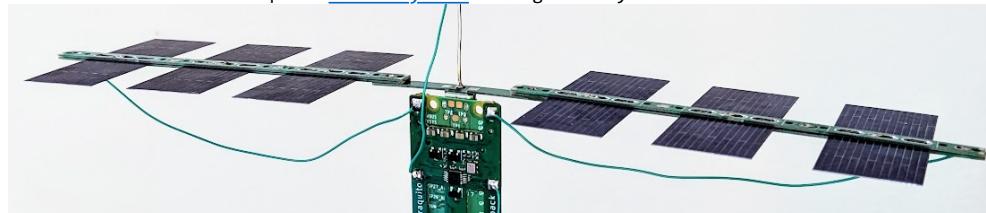
You can read some tips on how to manage long lengths of wire like this, and launch tips, here: <https://www.picoballoons.com/trackers/wspr-launch-process>

You can also use the [Wind-O-Matic 5000](#) to do the winding for you!

Solar Power

You're going to need to power your tracker when in flight and during testing.

Consider whether the Traquito [Solar System](#) is right for you!



Testing

Once your tracker is configured, antennas attached, and powered, you should do some testing before flying.

A great way to do this is to set up your computer to [receive WSPR messages](#) and run your tracker in the window (so the GPS has a clear view of the sky).

You will see your tracker's transmitted messages exactly as they will be when your tracker is flying for real.

The ideal testing setup is powering your tracker with the same solar panels you

will use in flight. Using (for example) a power bank to power the tracker can be helpful for early testing, but doesn't prove the whole system works when flying.

When your tracker transmits while in Flight Mode you will see 2 types of messages transmitted:

- Regular Messages
- Encoded Messages

You can review more about these messages on the [Channels FAQ](#).

Usage Policy

Please see the [About](#) page for more information.

Hardware Design File Downloads

Use these to order the Add-on Module from JLPCB -- See here: ([link](#))

JLPCB Assembly Files	Description
bom_jlpcb.2023-09-22.csv	
cpl_jlpcb.2023-09-22.csv	Released 2023-09-22
TraquitoJetpack-gerbers.2023-09-22.zip	

Hand assembly is possible but not recommended.

If desired, using the designators in the bom file, you can find the [placement](#) of all necessary components.

Tracker Software Downloads

Use this to program the tracker.

Note -- you must solder the Add-on Module to the RPi Pico before the software will work.

The RPi Pico cannot run the software without the Add-on Module soldered on.

Tracker Software	Description
TraquitoJetpack.2023-06-20.uf2	Initial Release
TraquitoJetpack.2023-07-10.uf2	<p>General Changes:</p> <ul style="list-style-type: none"> - Channel 0 supported now - Hot/Warm/Cold GPS reset uses CASIC commands not UBX - Startup blink shows system component power tests <p>Configuration Mode Changes:</p> <ul style="list-style-type: none"> - Radio not active on startup (auto on during send) - All GPS NMEA sentences enabled - False lock duration fix <p>Flight Mode Changes:</p> <ul style="list-style-type: none"> - Regular message reports 13 dBm instead of 17 dBm
TraquitoJetpack.2023-07-11.uf2	<p>General Changes:</p> <ul style="list-style-type: none"> - performance update prevents dropped NMEA messages

Troubleshooting

[Tracker not showing up in configuration selection window?](#)

Some USB cables are "power only" -- this won't work for Jetpack. You need a USB cable which has both data a

Questions / Comments?

Please see the [About](#) page for more information.

