

Community Drone Kits (CDKs)

Overview manual



Fig. 1. CDK training in the Loreto region of the Peruvian Amazon (2019).

SPEC Lab **Community Drone Kits** (CDKs) are designed to enable quick data collection over small areas using cheap drone technology and nearly fully automated approaches, enabling amateur drone pilots to collect visual imagery for post-processing in photogrammetric software, such as Pix4D. We have developed multiple versions which function at different price points, and with different resulting deliverable areas.

Any use of CDK hardware, approach, or content, including as in this overview guide or otherwise requires correct reference to this manual and the CDK website. The SPEC Lab and affiliated institutions expressly bare no responsibility for incorrect usage of any

content in this guide and/or any damages that might result from the use of the educational materials provided here and otherwise.

Citation: Broadbent, Eben N. & Almeyda Zambrano, Angelica M. Online. Community Drone Kits (CDKs) for rapid, efficient, and cost-effective monitoring of study sites. Version X accessed on <http://www.speclab.org/cdk.html> on month/day/year.

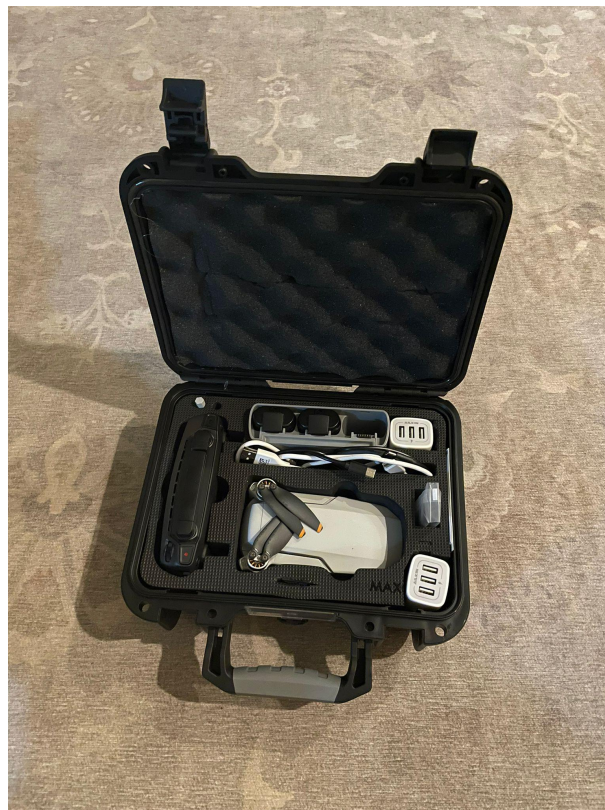
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Version

- 0.9 - 12/15/18 - CDK program initiated by SPEC Lab
- 1.0 - 09/02/22 - CDK Google Docs version of dynamic manual started
- 1.1 - 09/15/22 - ongoing improvements

Hardware overview

Kit 1 - DJI Mini SE





Drone setup software parameter changes

In DJI Fly change max altitude to be 500 m, and max distance to be 2000m.

Kit 2 - DJI Air 2S

Components

3 drone batteries

DJI Mavic Air 2S Drone

Charger (3 port) w/ USB cable for smart controller

Pelican case

External hard drive with built-in battery

Kit 3 - DJI Mavic Pro

Software setup

Litchi

Once installed, on the controller, the settings should be as follows:

All default button settings to 'disabled'

Main settings to defaults (see photos below).

DJI Fly

Data collection

Safety considerations

Power lines. Consier on take off and landing and also during mission planning, in particular valleys which could result in power lines being very high off teh ground! More than 120 m easily.

Overhead obstacles. None!

Direction of sun on take-off and landing. Have it always at your back!

Radius of take-off and landing area (must be 10+ meters in all directions open), as the drones (in particular the Mini SE) do not have great GPS units and will return to home to land somewhere within about 8 meters of where it takes off.

Air 2S smart controller notes

- Have to 'force stop' DJI Fly within the 'Apps' in order for Litchi to connect properly.
- Best when the kit is setup to make DJI Fly not open during auto-start, rather set this to 'none'.
- Litchi requires moving the physical mode switch from N to C and back to N prior to loading and launching a mission (a safety feature).
- The mission must stop at the waypoint, NOT engage RTL automatically via Litchi. Litchi engaged RTL will auto land NOT at the home point, but rather maybe at the last waypoint location.
- The drone should not be picked up by the attached battery, as if the two buttons on the sides are pushed in during this process the drone will fall to the ground.
- Opening and closing the drone is tricky and requires an instructor video - thai is on Eben's to do list.
- All kits should include microfiber cloths, they do not currently.
- DJI Fly enables addressing common errors like compass recalibrations. I can make video or instructions on thi.

Opening missions in Litch app

on the Smart Controller (DJI Air 2S kit shown) but similar to if used on a phone as well.









Data upload

Data processing





Fig 2. Restoration area orthomosaic from CDK using Pix4D.

Various options exist, however, one preferred approach is Pix4D, and specifically the

<https://cloud.pix4d.com/demo>

Enables rapid and easy processing to This is an advanced photogrammetry solution suitable for rapid assessment of Community Drone Kit data collects for basic orthomosaic outcomes.

One recommended free Phottogrametery software version is the WebODM software

<https://www.opendronemap.org/webodm/>

Mission planning (advanced)

Parameters

Flight speed: 8 m/s (approximatley 28 km/hr)

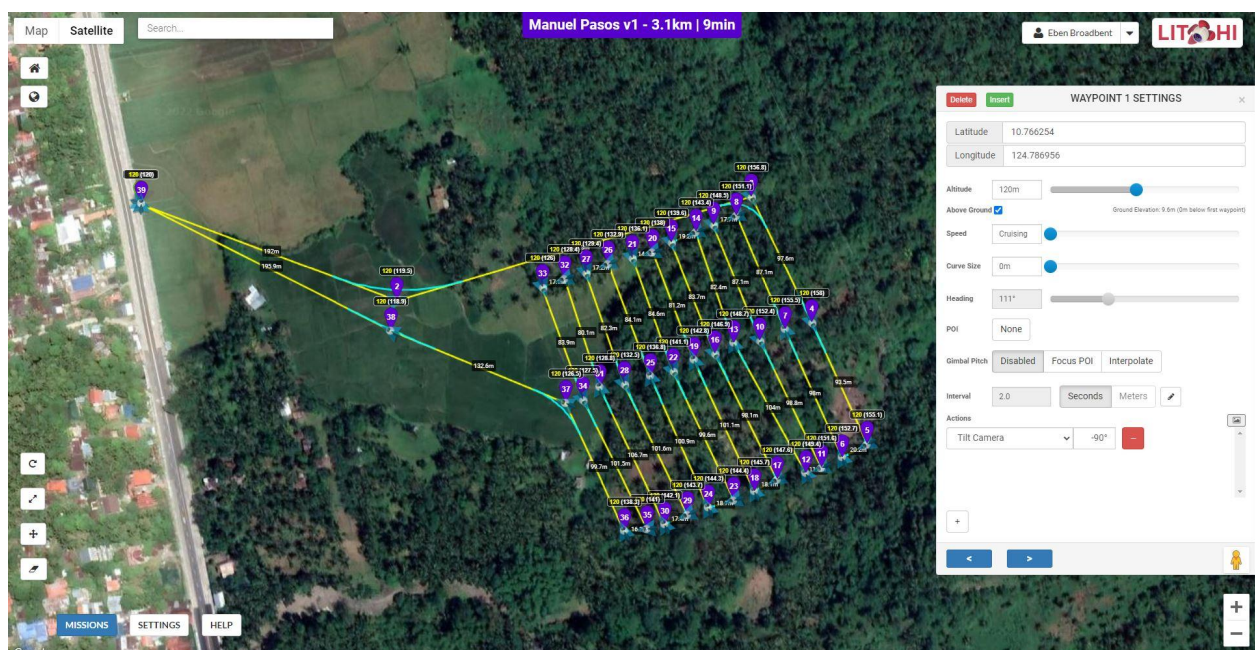
Height AGL 120 m (400 ft) above ground level

Distance between flightlines: 20 m (max) but 15 might be better depending on height of vegetation.

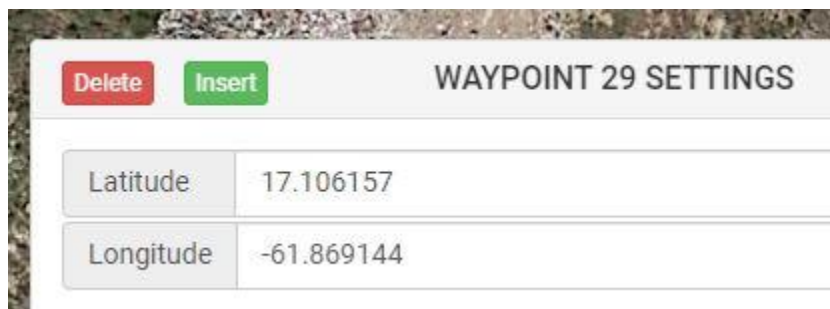
Photos: every 1-2 seconds. 2 max, less preferred depending on camera trigger hardware speed capabilities

Max mission time = 15 minutes (and this depends on wind speed, amount of elevation, etc.. might be less)

See top of Litchi Mission planner hub



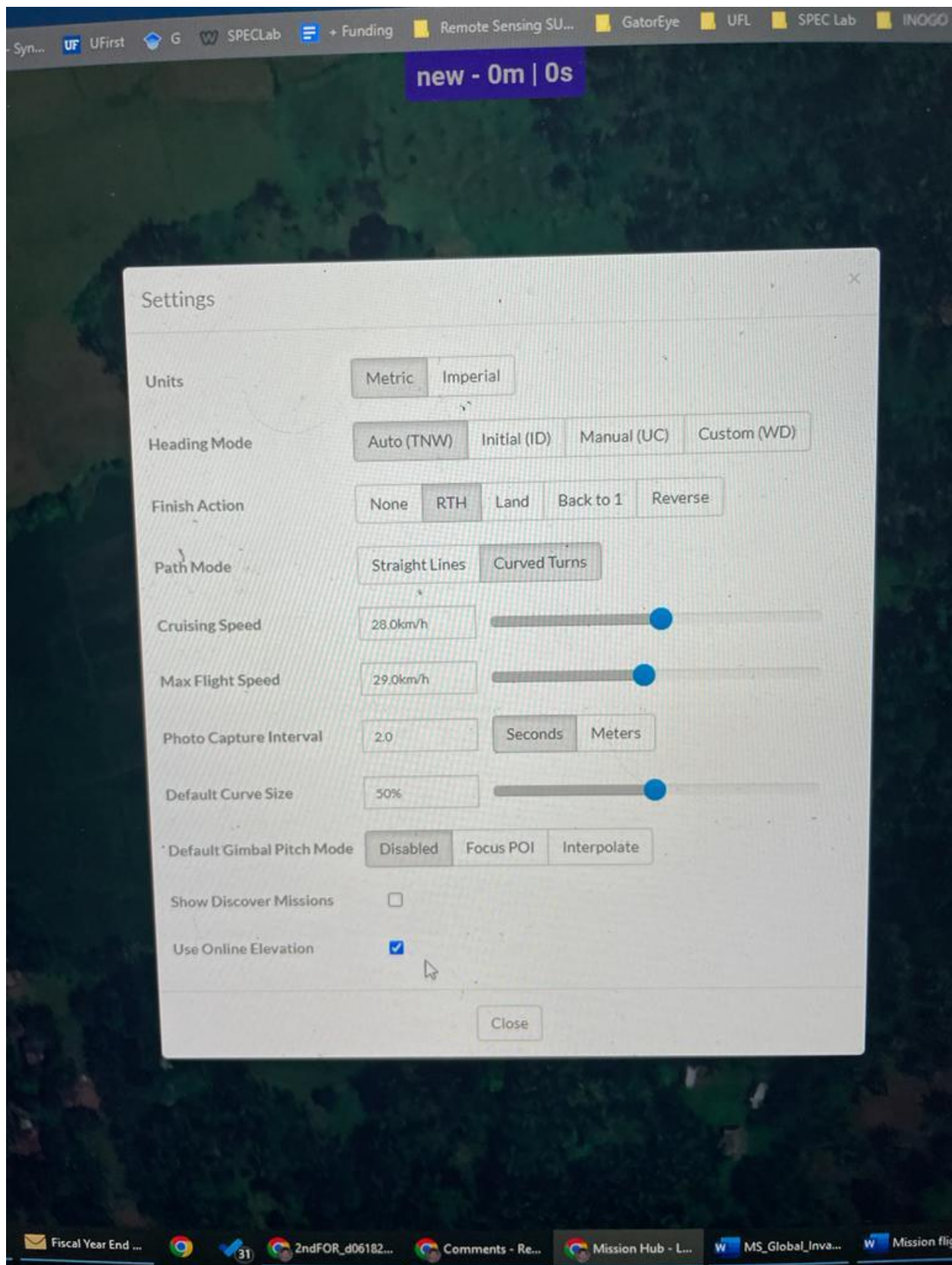
Note that you can insert a waypoint, but must use the ‘insert’ button shown below and above



Before completing a mission, always confirm all
Waypoint are 120 m above the online topographic map.

The first waypoint only always has a waypoint action of tilt gimbal -90 degrees.

Settings



First Litchi waypoint settings

Delete **WAYPOINT 1 SETTINGS** ×

Latitude

Longitude

Altitude

Above Ground ☒ Ground Elevation: 7.8m (0m below first waypoint)

Speed

Curve Size

Heading

POI

Gimbal Pitch

Interval

Actions

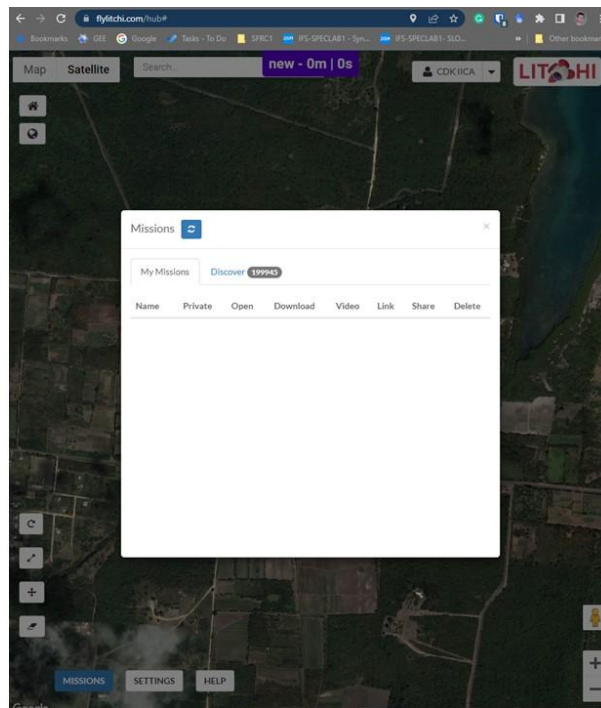
The curve size is determined automatically by the software

A sample good mission can be downloaded at:

https://www.dropbox.com/sh/olv3rjhzhzsgzhw2/AAC_XGGNE3Z8uTAjXZo-_i7Ua?dl=0

Save mission

once completed and confirmed to Litchi folder, from which it will sync automatically (when WIFI connected) to the Litchi app (on the phone or smart controller).



First and last waypoint should be within about 50 meters of where you anticipate taking off and landing. If in the field the location changes greatly then best is to fly the mission a different time following updating the mission in the lurch hub to a new version with correct take off and landing locations.

Landing is always initiated by using the RTH button.

After loading each mission best to use settings below the folder icon to select final waypoint action to be 'none' as litchi triggered RTH is working incorrectly in their firmware and will land potentially quite far from the actual home location.

Common questions and issues

Mission Planning in the Litchi Hub!

-How accurate is it to use the online elevation models for the option of “altitude above ground” in the Litchi Mission Hub?

Sufficient for planning missions at 120 m above-ground level (AGL) as is used for the CDK flights.

-What is the difference between using the overall settings function to set for example flight speed versus doing it in each way point?

Easier and more reliable to do it overall.

-What are POIs and why would one to set them?

For videography or photography work, not useful for mapping as is used for the CDK.

-How do you start a mission from the farthest point, which you mentioned is important to ensure avoiding battery issues?

Simply start with the mapping waypoint the farthest away and then work your way back towards launch when planning the mission.

-I am not sure where I can set the camera to 90 degrees tilt?

It can be added using the plus sign at the bottom of the first waypoint only.

-Is it going to be automatically taking pictures thru the mission or I have to activate that somewhere?

If properly setup in settings (see Litchi section above) then the drone will automatically start and stop taking photos every 2 seconds.

-How to plan a mission for KML areas shared by users?

View the KML in Google Earth Pro and cover that areas when you plan the mission in Litchi (using a satellite base map).

-As you create the flying lines the distance of 20 in between points in the line will likely not remain at 20 m is that ok?

It is just an approximate, some deviation of plus minus 5 meters is not an issue.

-Do I always have to create a point close to take off for it to return?

It is best practice, but not required, as the drone should automatically RTL (return to launch) once it finishes the last waypoint of the mission (if the settings are correct, as described in the Litch section above).

-How to import a KML from a partner to locate where the mission needs to be planned?

Make sure if it is a KMZ that it is converted to a KML to load into Litchi. But easiest is to simply view the area covered on the satellite base map in Google Earth, then cover that with buffer of 20 meters around the area of interest, in Litchi.

METADATA WHEN SHARING DRONE TILES OR ORTHOMOSAICS

Can you please provide the information below, to the best of your abilities, when sharing the drone images with us.

This is an example how to complete it:

Provider organisation: "restor"

name: "John Doe"

email: "user@example.com"

license: "restor" or "private" or "commons property"

capture_date: "20220725"

capture_time: "20:14:00"

platform:

drone: "DJI Mavic 2"

camera: "built in"

site:

intervention: "enrichment"

mean_tree_height_m: 10

tree_species_count: 4

flight:

altitude_m: 20

weather: "sunny" or "overcasted"

speed_ms: 5

TO DO

Instructions on how to calibrate the compass.

Litchi, switch lever back and forth

Force stop the DJI fly before Litchi

Before each Litchi mission flight, need to go to the settings and turn off (after its been loaded) the settings and make the 'end action' be 'none', change from the default setting which is "Return Home" (which has a firmware issue and lands in random locations).

Images here of this setting change process.

Include basic controller overview (where is the home button and how and when to use it)

In hardware setup, the parameter of max altitude and how to set to 500 meters relative height, required to follow terrain at 120 AGL during flights (up hill from a launch site) - to this the controller needs to be connected to the drone

Mention that no need to open DJI Fly unless compass calibration or other

And litchi you want to make sure that for each of your waypoints, you see two numbers, one which is the absolute altitude, and the other one is the altitude above ground

Describe max distance typically acceptable from controller to drone for different CDK models.