



Drone Mapping - Short Course

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Setup - Unboxing

Components



Clockwise: remote controller (transmitter), batteries, Phantom 3 Professional, propellers, charger, gimbal guard (centre).



Clockwise: storage case, Mavic pro drone, batteries, multicharge connector, charge adaptor, propellers, charger.

Calibration - Firmware

After unboxing, remove battery from drone and charge. Note: charger has two connectors, one to the battery and one to the remote controller. You should charge only one at a time.

You will need a tablet or smart phone to connect to the transmitter. For Android download and install *DJI Go for products before P4* for the P3 Advanced and Professional. For P4 and Mavic download and install *DJI Go 4*.

Turn on the tablet. Connect your tablet to the transmitter with the USB cable. Turn on the transmitter then turn on the drone. It should link and turn on the DJI Go application. If you see the selection of the Phantom 3 Professional camera option, you are connected.



Note: if you do not have the latest firmware the app will prompt you to upgrade to the latest firmware. We do not recommend this if you have poor wifi reception because it is very easy to have a partial firmware upgrade which will make it impossible to link the transmitter to the drone. If you are connected it is recommended that you work with the default firmware you have.

Setup Parameters

For aerial mapping it is recommended that you work with the factory default parameters for camera settings, etc. You will need to change the altitude limit setting to 150 to 200 m. The normal flight altitude you will be using is 120 m. The transmitter should be set to P mode (GPS controlled), and the remote controller should be in Mode 2 setting for the left and right joy stick settings. The left is rotation and the right is the throttle or accelerator. The camera settings are left to default.

Testing

Testing indoors you start the remote controller then the drone (without the propellers). When the DJI app launches select the upper left corner for the tutorial and run the simulator. This will allow you to test the controls with a simulated flight mission. Do not install the propellers.

What can we use the drone for?

FPV video

Most amateur drone pilots use their drones for first person view (FPV) video capture. The P3 Advanced can capture videos up to 1080 p and the P3 Professional can capture 4K video. Generally we will not be using the drone for FPV video capture.

Aerial Mapping (GIS)

The main objective of this course is to train you to use the drone for aerial mapping and to create orthophoto imagery for geographic information system (GIS) analysis. Orthophotos can be generated using mission planning applications like DroneDeploy which defines waypoints along flight lines to capture overlapping photos (vertically aligned) that can be downloaded and processed using online web applications like DroneDeploy or workstation based applications like Open Drone Map.

Steps for Drone Mapping

Note: you will have to install the DJI Android or iOS app on your smart phone or tablet before you can connect the radio controller to the drone. There are two apps DJI Go for drones before Phantom 4 (need this app for Phantom 3 Advanced and Professional) and DJI Go for drones after Phantom 4 (need this app for the Mavic Pro).

Flight check drone

1. **Systems check** - Before starting a flight mission the drone should be checked. Make sure all devices and batteries are charged. Plugin the tablet to the remote controller, power it up, then power up the drone. Make sure the gimbal guard is off. Check and fix any warning notices.
2. **Batteries charged** - This is important especially if you will be travelling away from home. It will be difficult to charge your tablet, remote controller and drone batteries in the field. It will also delay your mission and limit the flight time for the drone if batteries are not charged.
3. **Firmware updates** - generally you should get the firmware updated at home before you leave on your mission. However, if your drone is a P3 version and it currently links to the controller then we recommend you ignore the request for firmware updates because DJI has mainly added more restrictions to the drone in their latest updates.
4. **Check SD card memory** - make sure the old images and videos are backed up and deleted. You should have full memory capacity to capture your mission in the field. It would be very disappointing if you fly your mission only to find that there is not enough free space on the card for the photos. If possible bring a spare empty SD card with you.
5. **Calibrating the compass** - only calibrate the compass when the DJI Go app or status indicator prompts you to do so.

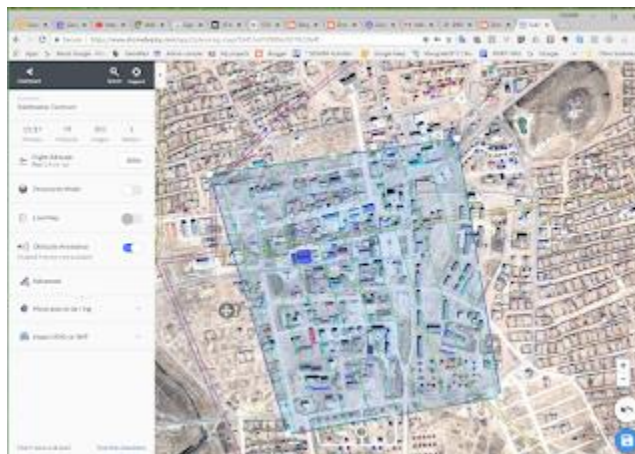
The DJI manual suggests the following preflight checklist:

Preflight Checklist

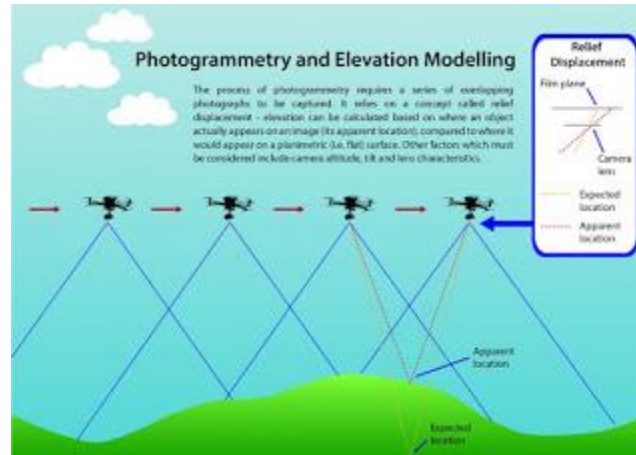
1. Remote controller, Intelligent Flight Battery, and mobile device are fully charged.
2. Propellers are mounted correctly and firmly.
3. Micro SD card has been inserted, if necessary.
4. Gimbal is functioning normally (make sure you remove the gimbal holder).
5. Motors can start and are functioning normally.
6. The DJI GO app is successfully connected to the aircraft.

Mission Planning

1. Review project location using Google Maps or satellite imagery.
2. Prepare a flight plan using DroneDeploy or other mission planning application.
3. Check flight duration, height, pixel resolution, etc.
4. Save mission.



Mission Planning with DroneDeploy

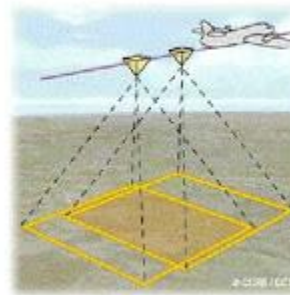


Drone photos with elevation



STEREO PHOTOGRAPHY

- Adjacent but overlapping aerial photos are called stereo-pairs and are needed to determine parallax and stereo/3D viewing



Stereo Overlap for Orthoimage processing

Mission Planning Applications

1. DroneDeploy (Android & iOS)

www.dronedeploy.com

DroneDeploy is one of the leading drone software platforms that provides users with unlimited flying, mapping and sharing. They provide image processing online for a monthly fee, with limited processing for free. However, they provide a free mobile app for Android and Apple tablets.

2. DroneHarmony (Android)

www.droneharmony.com

DroneHarmony is currently a free Android app that can be used for flight planning. There is future proposal to charge for the application. We have not tested this product yet.

3. DJI GS Pro (iOS)

www.dji.com/ground-station-pro



This is also known as Ground Station Pro it is an iPad app designed to control or plan automatic flights for DJI aircraft.

4. Map Pilot (Maps Made Easy, iOS)

www.mapsmadeeasy.com

Maps Made Easy is a web based online site for drone image processing like DroneDeploy. They have developed an application called Map Pilot which only works on iOS. Unlike DroneDeploy Maps Made Easy charges for their app and they charge map processing on a point basis. Approximately \$8 USD for 300 points which equates to 120 acres or 48.5 hectares.

Mission Execution

1. Proceed to launch location
2. Final drone pre-flight check
3. Launch mission flight app and connect to drone
4. Start mission
5. Retrieve drone on completion
6. Download photos for drone SD card for processing.

Orthophoto Processing

Web based orthophoto generation

1. DroneDeploy

1. Log into, or create, your DroneDeploy account
2. Launch the DroneDeploy dashboard on your browser
3. Enter a project map name
4. Drag and drop photos to upload
5. Upload for processing
6. Check and view results when completed.

The free processing options are limited.

2. Maps Made Easy

This is an web based online drone mapping provider. You will need to create an account by signing up for free. You will be given some point credits to test the system out.

Desktop Applications

1. OpenDroneMap (FOSS4G)

OpenDroneMap (ODM) was developed as a Linux application, which was then ported and distributed in a Docker container. As a result it can run on multiple operating systems including Windows. In Windows you



will need to be able to run it in Docker if you enable simulation with Windows 10 Professional. Other versions of Windows will have to run it on a virtual machine like VirtualBox using the Docker Toolbox for Windows.

https://docs.docker.com/toolbox/toolbox_install_windows/

You can also check the following blog on how to install Docker on Windows:

<https://trainingquadcopters.blogspot.com/2018/06/opendronemap-with-docker-toolbox-on.html>

2. Agisoft Photoscan

www.agisoft.com

Agisoft is a good commercial off the shelf (COTS) software that has supported our training program by providing a license for non-commercial use. We have used it on previous training in Mongolia and it has produced good orthophoto output and we can recommend this for map production purposes.

Agisoft Photoscan Professional Edition is listed at USD \$3,499 for stand alone license.

3. Pix4Dmapper

www.pix4d.com

Pix4D offers its license on an annual fee basis. A one year license is USD \$3500, consequently we do not recommend this product to our clients.

Orthophoto Mapping

Google Earth

Google Earth is a useful application for you to locate your project site and mission flight planning. Once you have used it to check out the project area you can also use Google Earth to overlay the new drone orthophoto for use by yourself and others who do not have GIS experience.

GIS Applications

There are a number of desktop applications that you can use to review your project area. You can use Google Earth for the before condition and the drone orthophoto for the existing condition of the project site. GIS tools can be used to analyse and examine the project area for environmental impacts and changes to the rivers, forests and land use.

1. QGIS (FOSS4G)

QGIS is a powerful GIS application. It is distributed under the free open source software for geospatial. This means anyone can download and use it for free. It is highly recommended as a tool that anyone can download and use.

2. ArcGIS (COTS)



ArcGIS is a commercial off the shelf (COTS) application that requires an annual license from ESRI. It is used by many government entities worldwide, however it has strong competition from FOSS4G applications like QGIS.

There are many other FOSS4G and COTS GIS applications QGIS and ArcGIS are the two main ones. The difference is one is community supported and the other is commercially supported. If you do not have the budget to pay large license fees annually then QGIS is the application you should invest human resources in for your day to day geomatics requirements.

Summary & Conclusion There are now cost effective recreational drones like the DJI Phantom and Mavic series that you can use to survey small scale areas and there are semi-commercial online websites that you can use to generate orthophoto images from these drones. In addition there is FOSS4G application, Open Drone Map that you can use to create the orthophoto from your desktop.

If you have the budget you can use the commercial websites or buy COTS applications for map processing and GIS analysis. If you don't then you will need to spend the time to use the FOSS4G applications which are free.

Augusto Ribeiro
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