
ENTERPRISE

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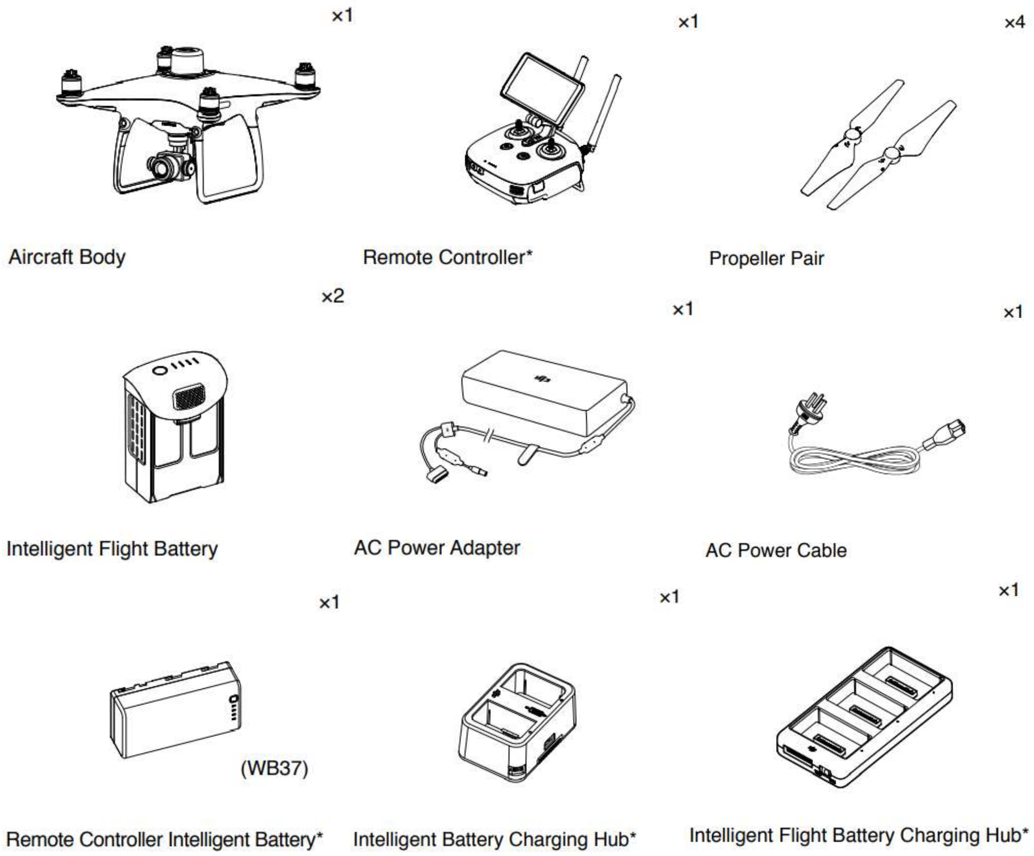
I. List of P4R Test Items

List of Phantom 4 RTK Items

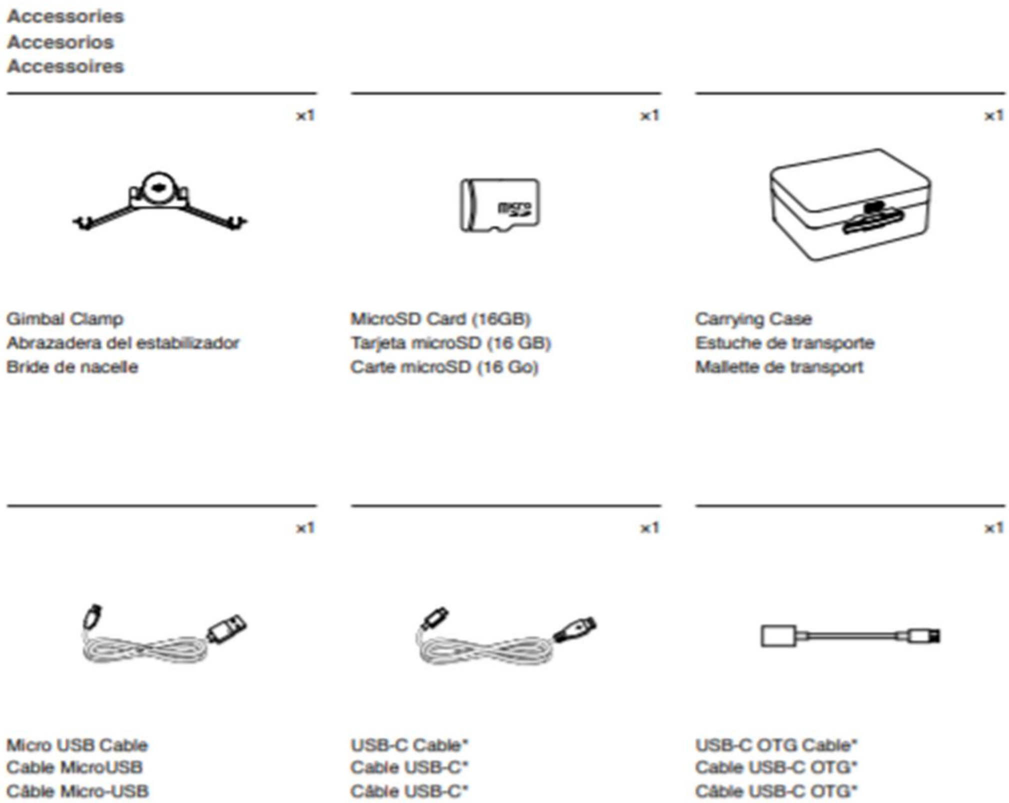
Before using this product, confirm that the following items are in the package. If any item is missing, please contact DJI or your local agent.



Aircraft
Remote controller
Propeller
Intelligent flight battery
Power adapter
AC power cable
The number of batteries depends on the kit purchased.
Remote controller’s intelligent battery (WB37)

Intelligent battery charge manager
Intelligent flight battery manager

The following items are provided free of charge, and they are not covered by the warranty.



Gimbal clamp
Micro SD card (16GB)
Micro USB cable
Phillips screws
(In the wireless network card compartment of the remote controller)
Portable case
USB-C OTG cable
USB-C cable
Wireless network card

II. Instruction:

Firmware upgrade:

1. Upgrade the firmware by using PC
2. Upgrade the firmware by using RC

Note: Please make sure that the firmware of your RC is higher than v10.04.0330 and the App version is higher than v1.8.10.

1) Preparation:

   Upgrade the firmware of RC to v01.04.0330 and the App version to v1.8.10. Connect to the internet by using WIFI or 4G dongle.

   Please make sure the dump energy is more than 30% and the RC turned on

   The RC and UAV need to be connected by using the USB cable

   When there is a new firmware available, the lower-right corner shows "new firmware", click to see all the available firmware.

2) A firmware list shows the available firmware. Current firmware would show green "current" in the list. The option should be "check". For new firmware, the option would be "upgrade" with green, and for old firmware "downgrade" with orange.
3) Select the latest firmware and choose "upgrade". Firmware information such as RC version, UAV version (if connected to the UAV) would be shown. Device connected to RC will be described as "not connected". Click "download" to download the firmware (the firmware of all connected devices will be downloaded at the same time.).
4) After the download, click the green button to upgrade.

A. RC Upgrade:

   Click "upgrade/install" and waiting for the upgrade is done.

   The process of install contains compression, transmission and upgrade. The RC will reboot once during the installation, a reminder appears after the installation. After rebooting the RC can be used.

B. UAV Upgrade:

   Click "upgrade/install" and waiting for the upgrade is done.

   The process of install contains compression, transmission and upgrade. The RC will reboot several times during the installation, keep the connection between UAV and RC, a reminder appears after the installation. After rebooting the UAV can be used.

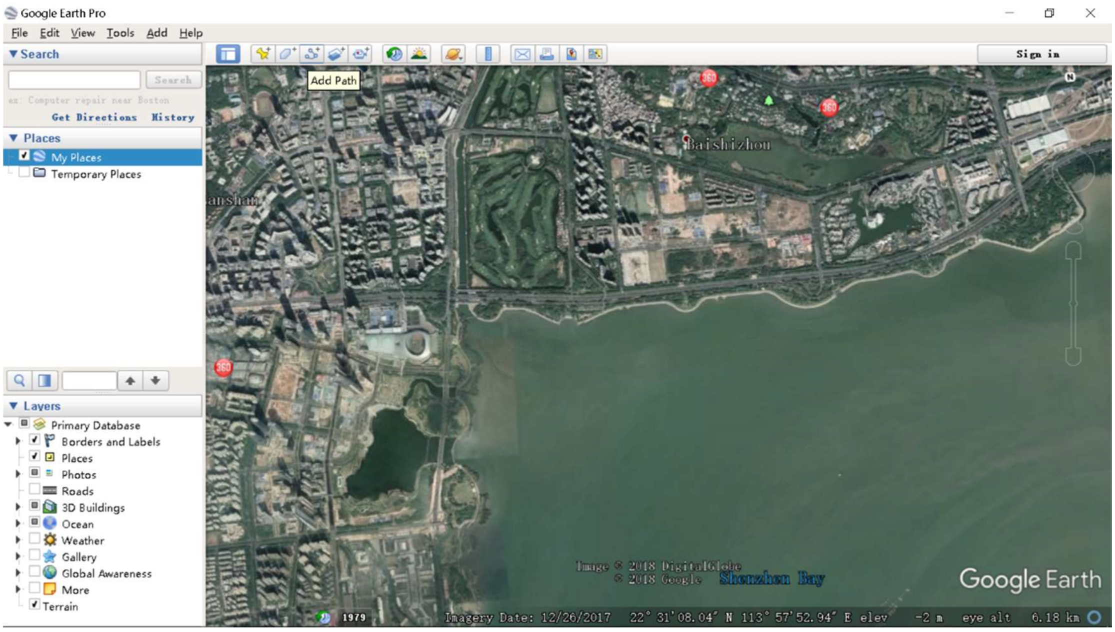
C. After the upgrade, the button in the firmware information page will turn to be grey, described as "upgraded".

KML import

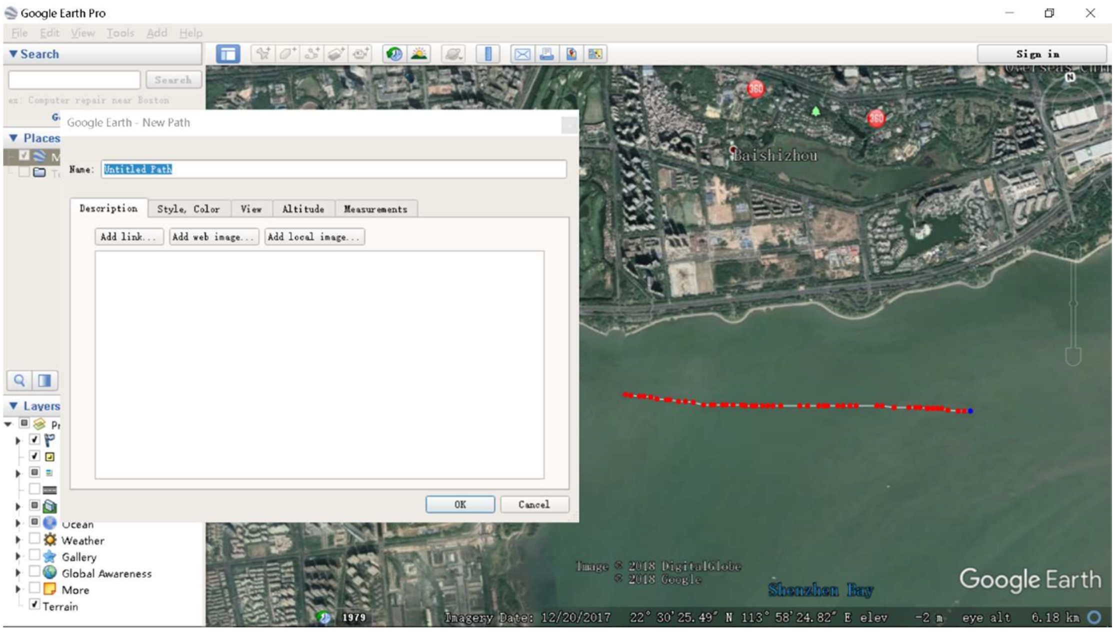
Video:

How to create KML file (by using Google Earth):

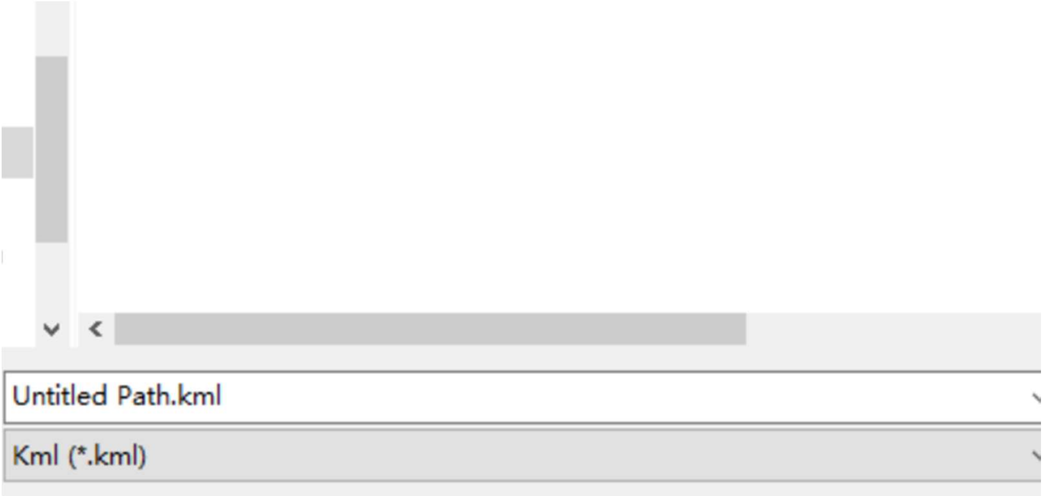
1. Open Google Earth and local the mission area:



2. Define an area or a path.



3. Save the file as KML/KMZ.



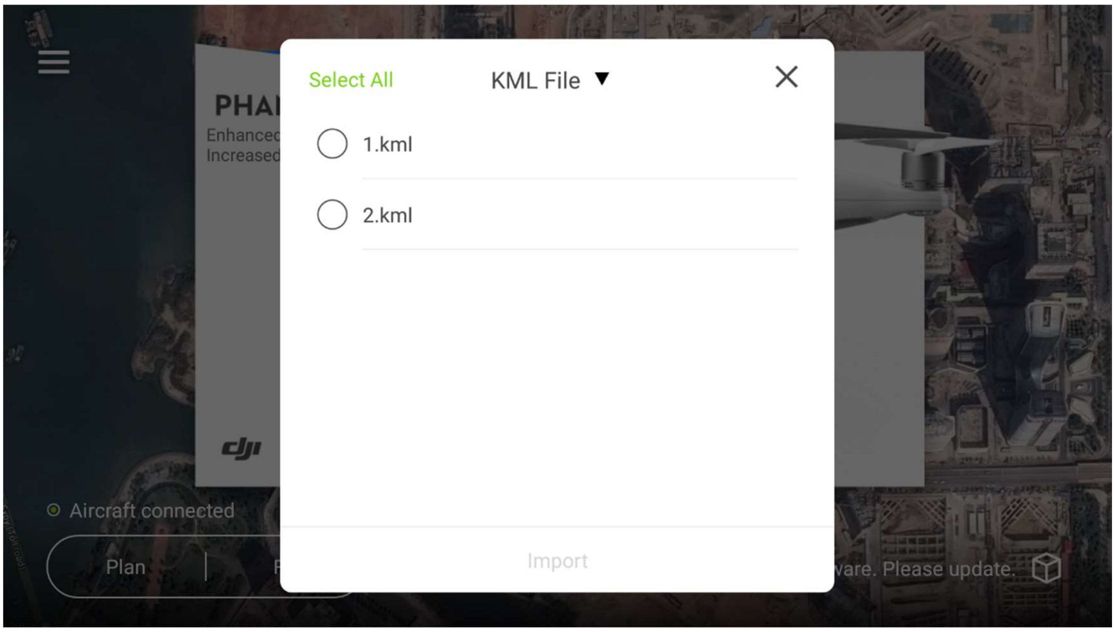
How to import KML/KMZ file to RC:

1. Create a folder named “DJI” in the Micro SD card.
2. Create a folder named “KML” under “DJI”

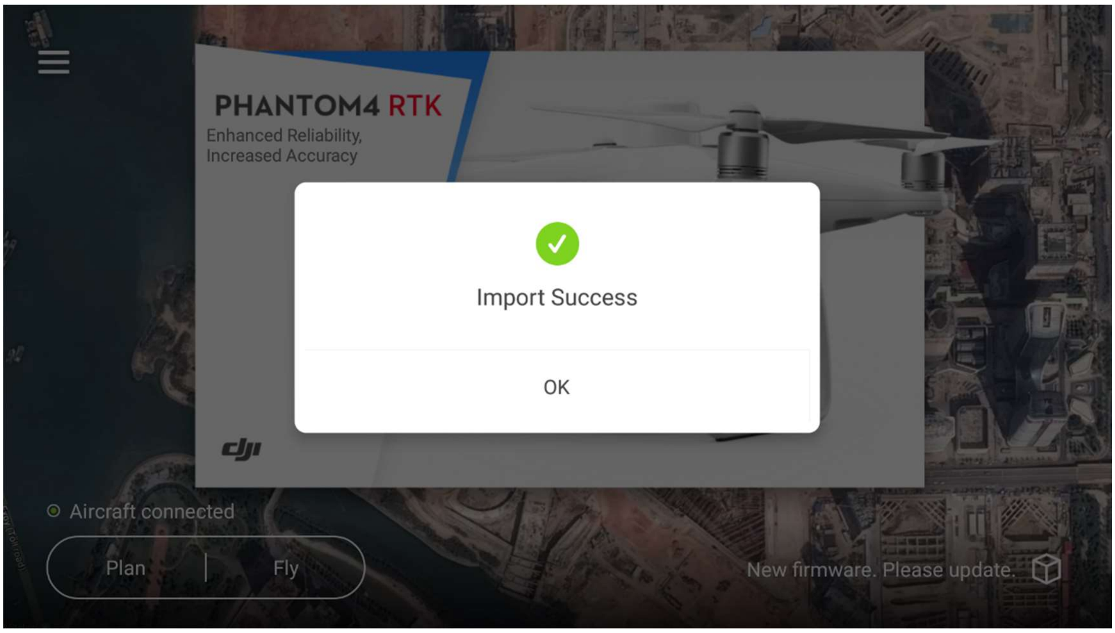
3. Put KML/KMZ file in folder “KML”

How to use KML/KMZ file in the mission:

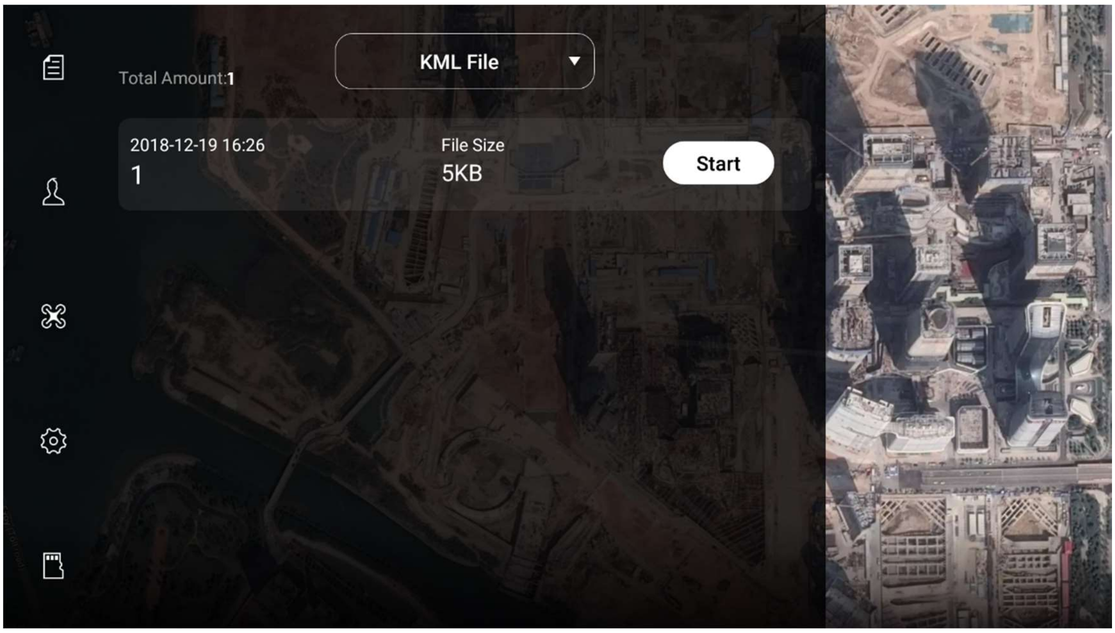
1. Insert SD card containing “KML/KMZ” file, a dialog appears as below:



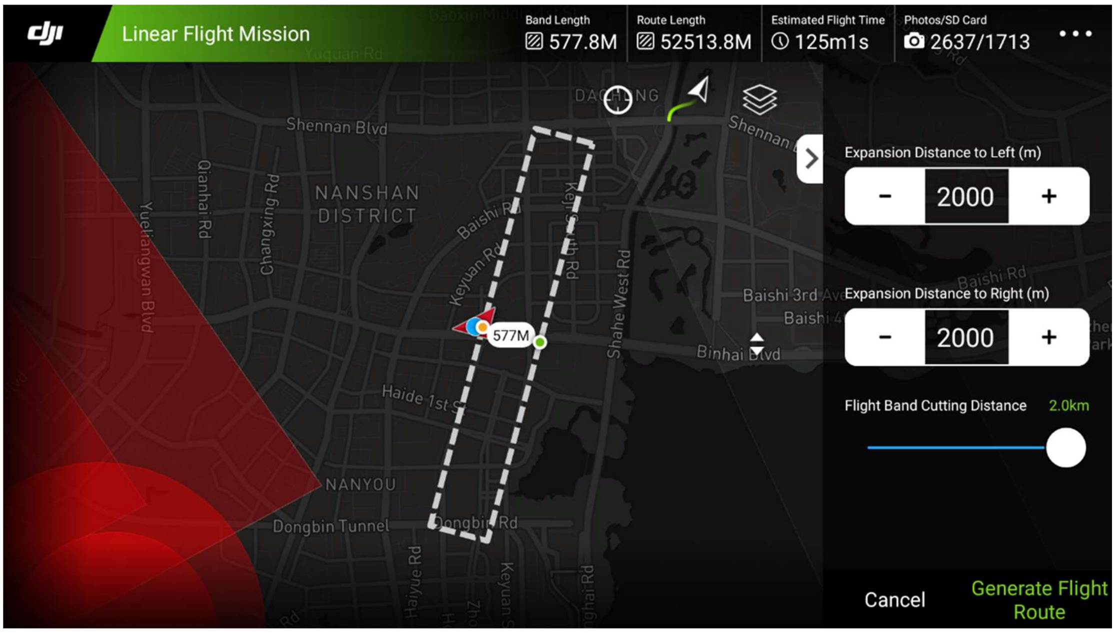
2. Or click the SD card icon in the lower left corner to import the data.



3. Click the right side to check the KML files, if the KML file contains several missions, the first mission will be shown automatically.



4. Click "Edit" to edit the mission (maximum 99 waypoints).



5. The mission can be stored and check in the left side-“taskbar-planning”.

RTK connection

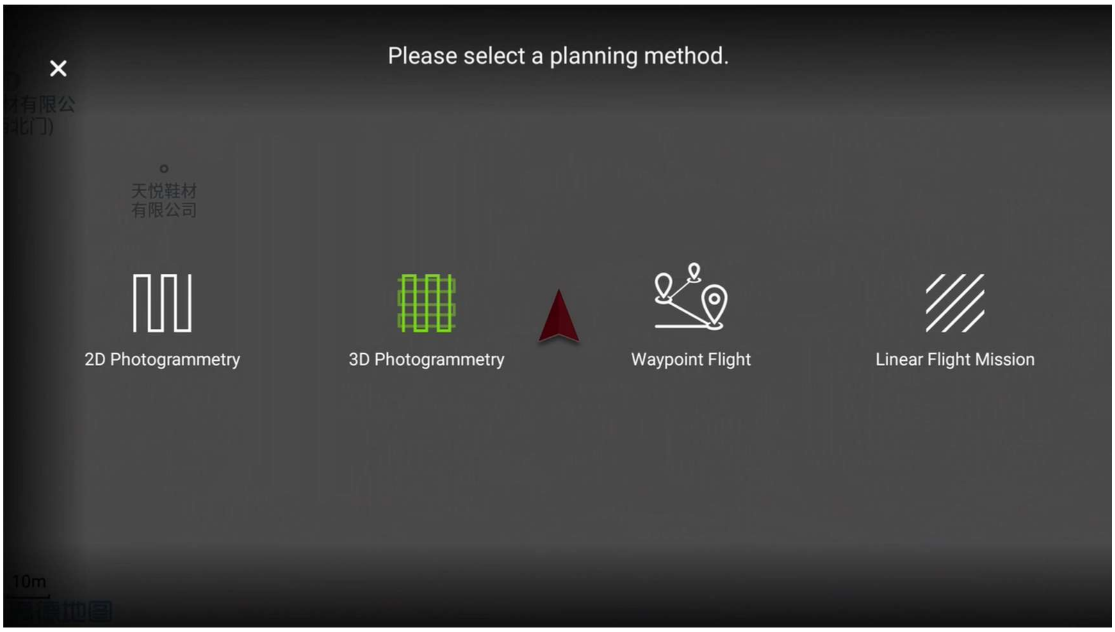
Video:
https://www.djivideos.com/watch/59d20cd2-8cb3-4d6a-a0ef-30fee22894ae?autoplay=false&poster=

Photogrammetry 2D

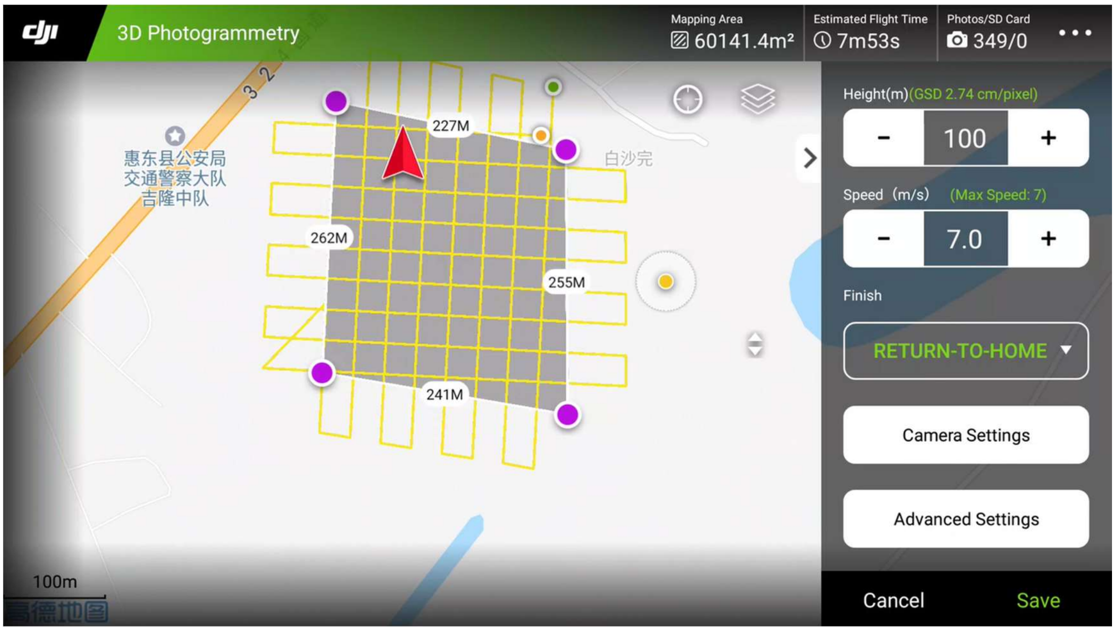
Video:
https://www.djivideos.com/watch/8510c00f-9a24-4077-86d1-c8c0f530a9d3?autoplay=false&poster=

Photogrammetry 3D

1） Go to mission planning page and select “3D Photogrammetry”

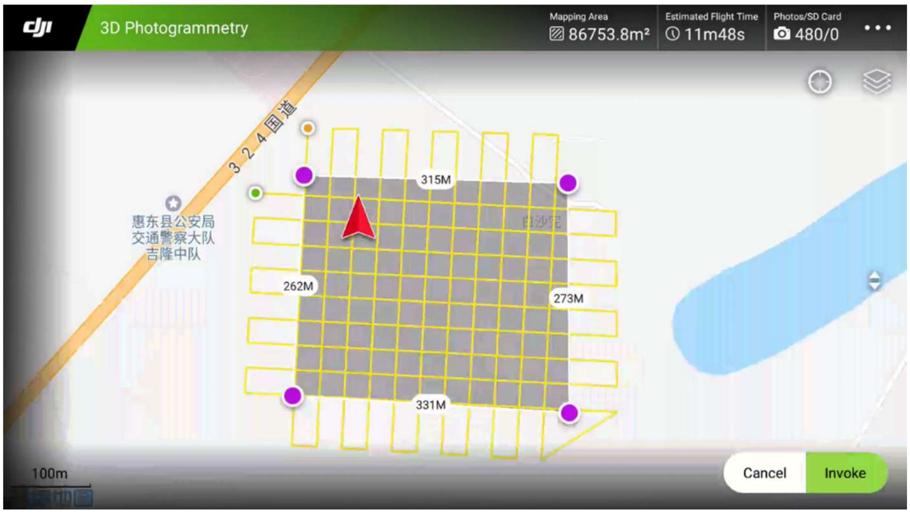


2) Import a KML file or set a mission area manually, double grid airline will be generated automatically.



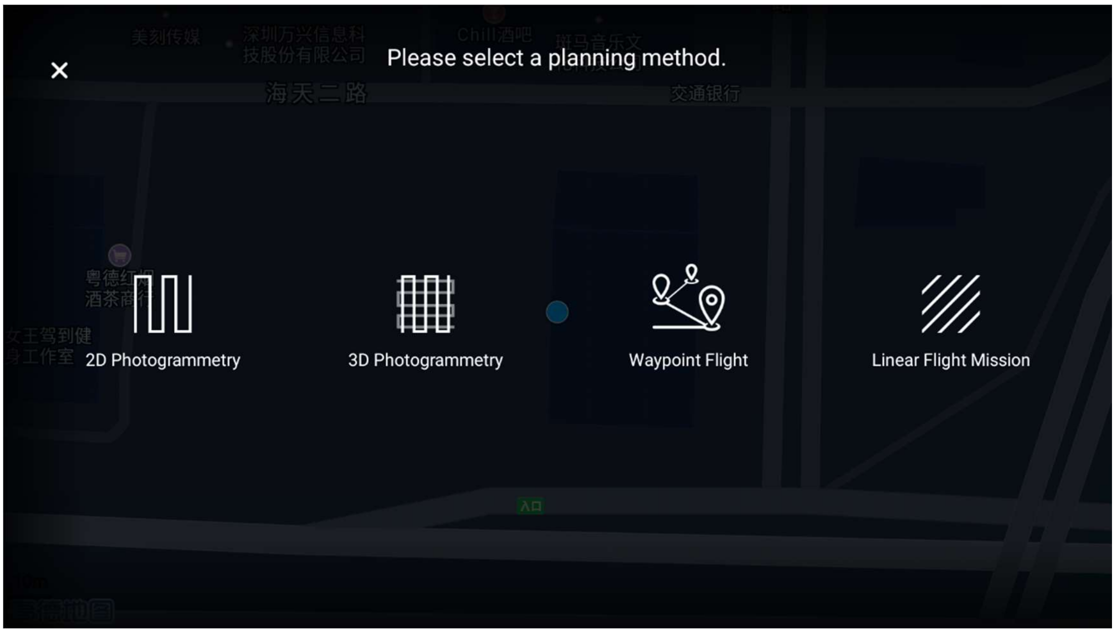
3) Set the parameters of the mission

5) Save the setting for later usage, and invoke

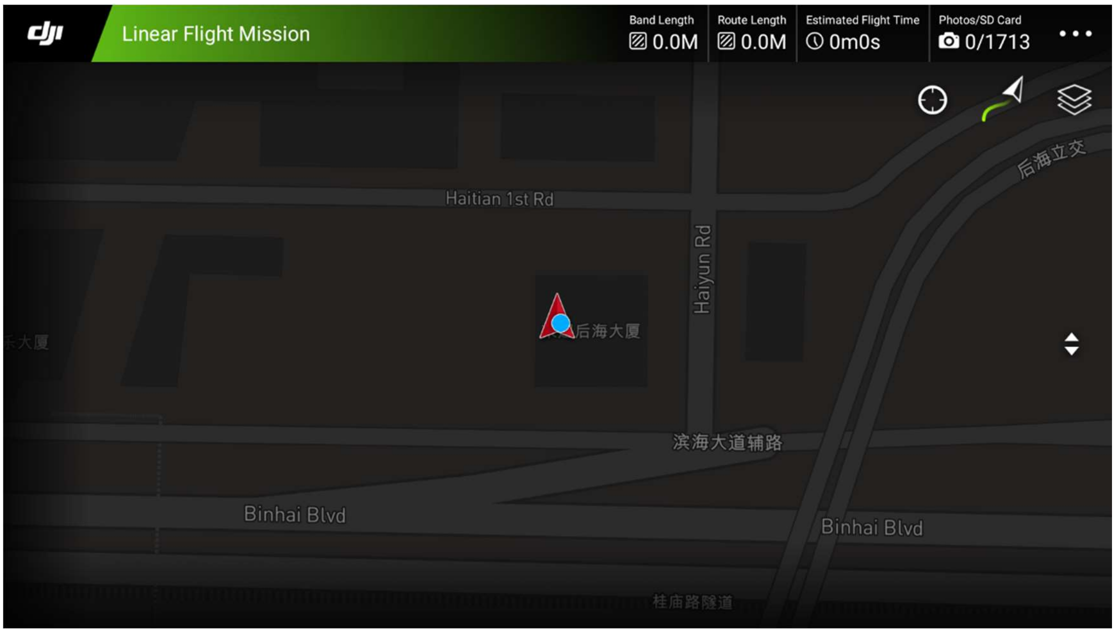


Linear flight mission

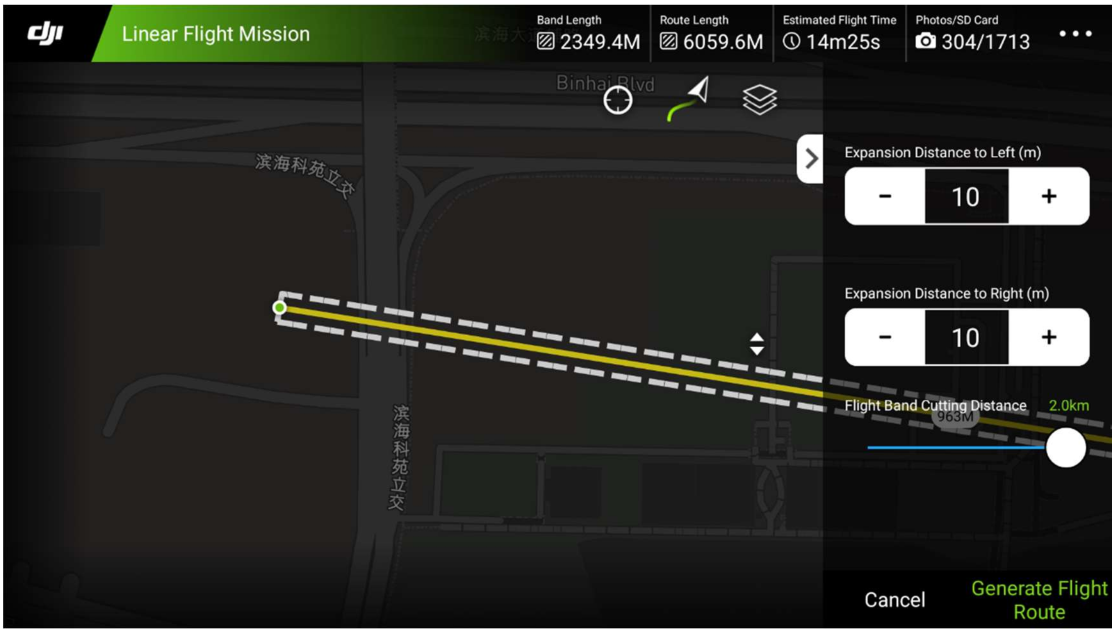
1) Select "Linear Flight Mission" in the mission plan page.



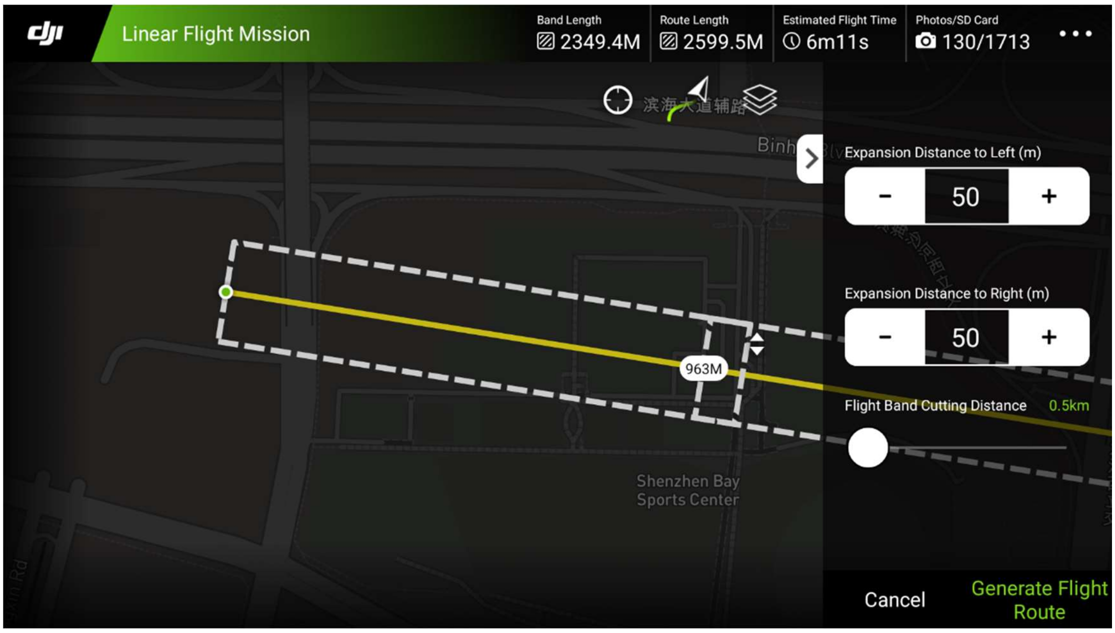
2) Tape the background map to create a linear element or import the KML/KMZ as a data resource.

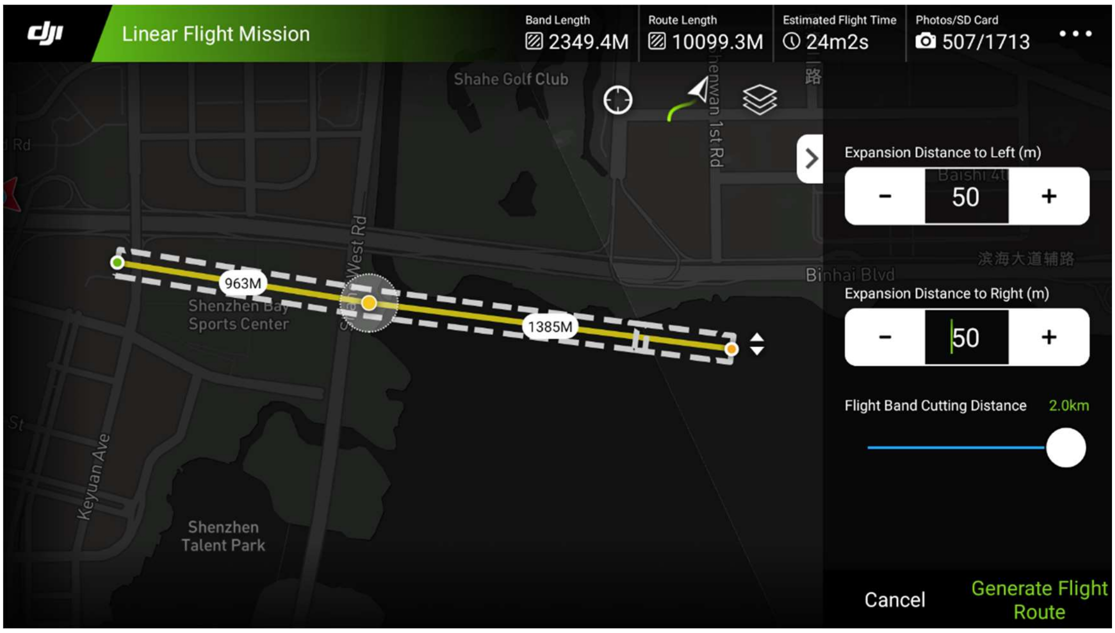


3) Use the linear element as reference, expand the buffer in both left and right direction. The buffer distance in each side is min 10m, max 2000m.

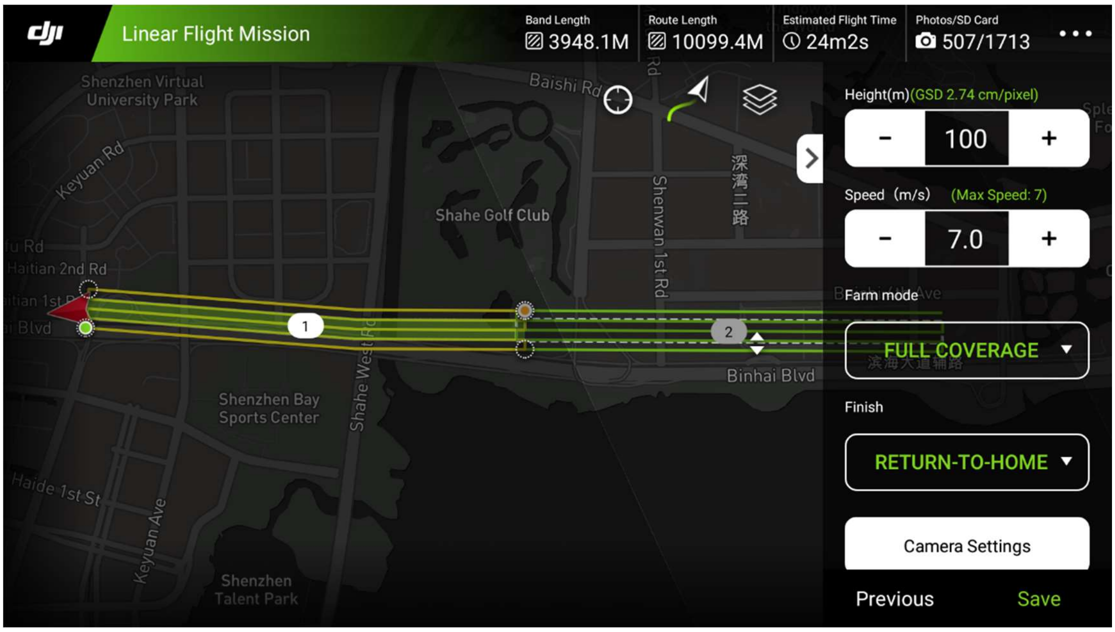


4) If the linear element is too long, it could be cut in to several sub-missions with min 0.5km and max 2km.

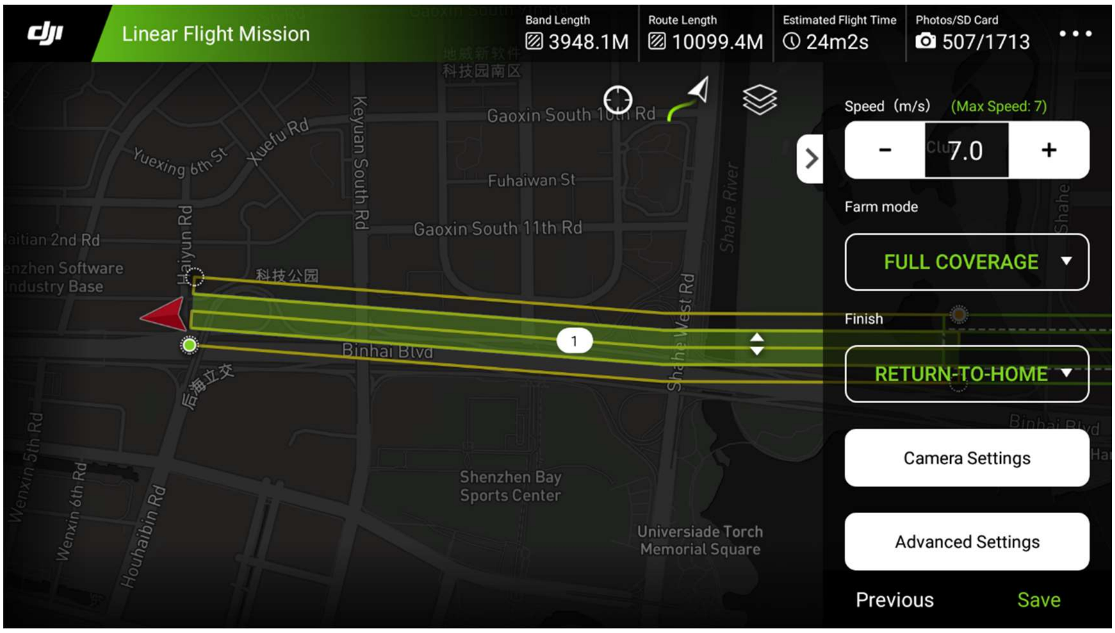




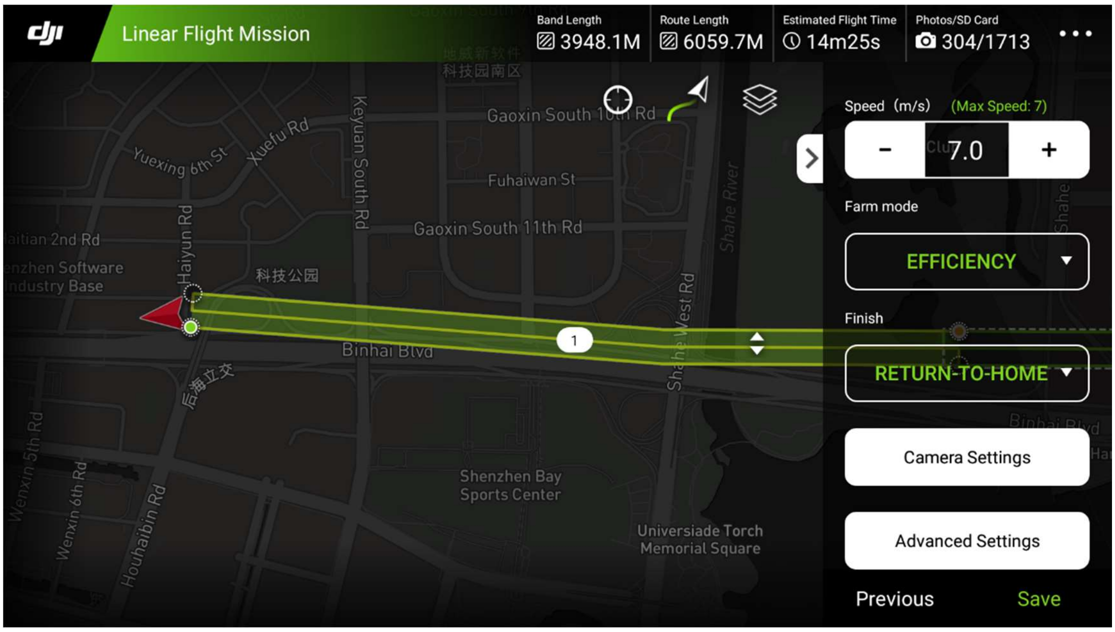
5) Set the flight height, speed, camera parameters, overlap rate etc.



6) There are to modes in the linear flight mode: Full Coverage and Efficiency. “Full coverage ” mode has 1 or 2 airlines more than Efficiency mode.

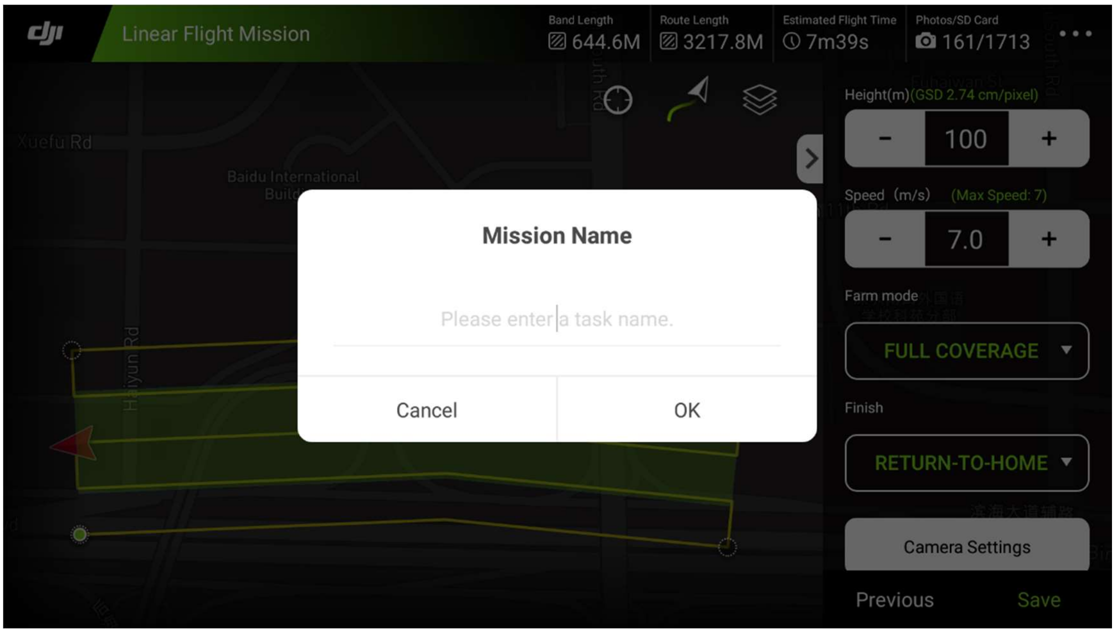


Full Coverage

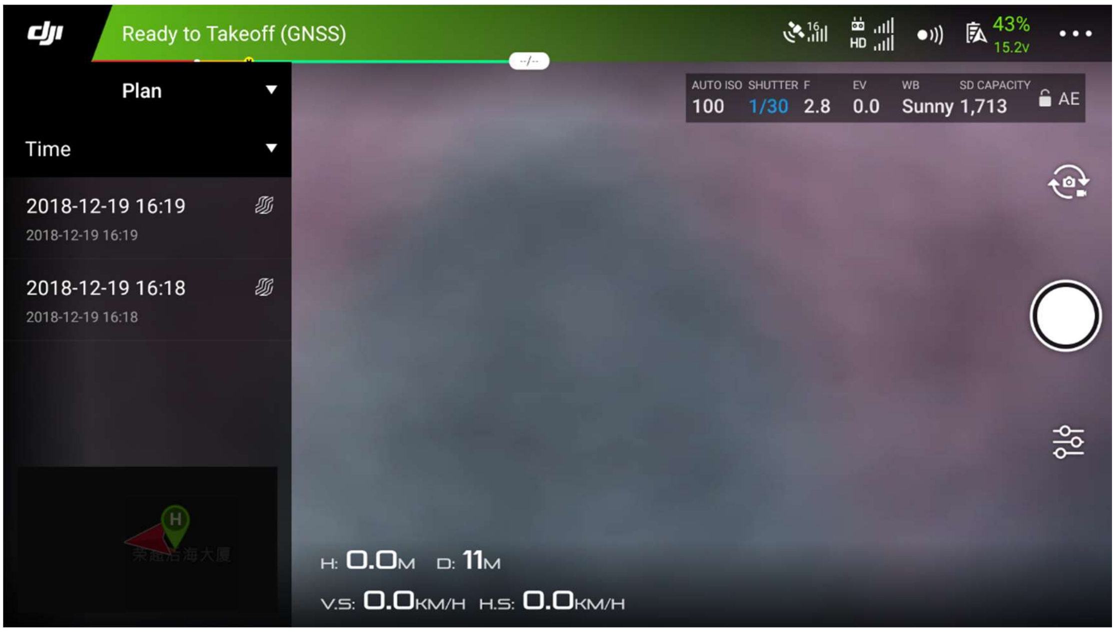


Efficiency

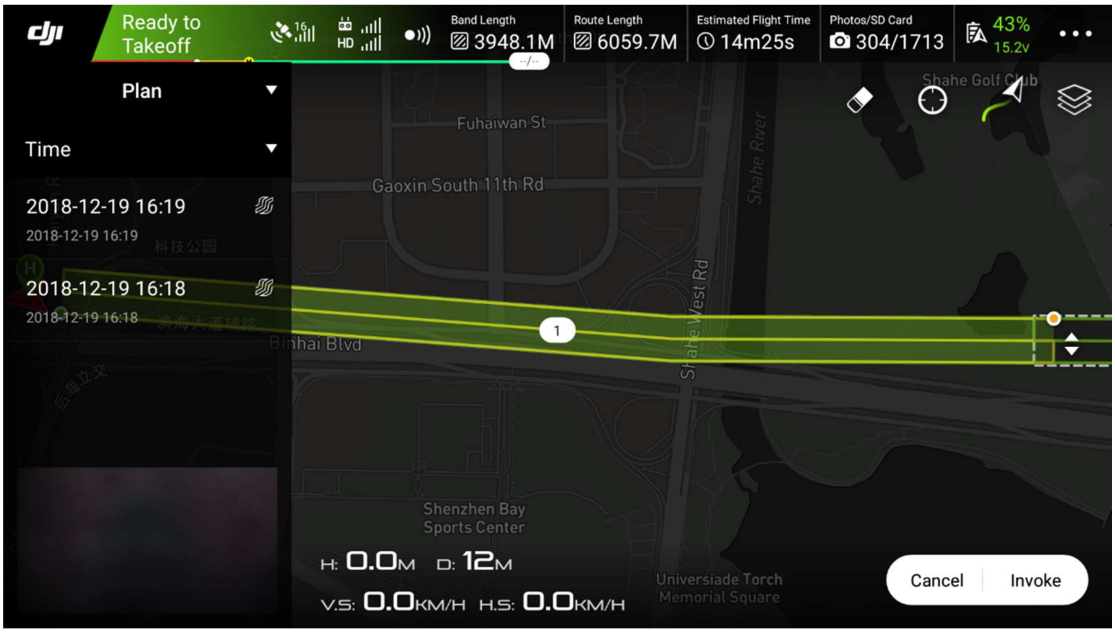
7) Name the mission when the parameter setting is done.



8) Select "Invoke" or go to "Flight" page, the missions list is on the left side of the page.



9) When select a sub-mission, the sub-mission will be high-lighted.



III. P4R Data Files

Photogrammetry Mode

In the photogrammetry mode, the lens focuses to infinity. The default focal length of the camera is 8.8mm; the equivalent focal length of the 35mm camera is 24mm, and the FOV is 84 degrees.

After the mission is done, the camera's SD card can be read via the reader or by connecting it to a PC. The subfolders under the "Survey" folder are sorted according to sequence and named like 100_0001. Each file contains JPG photos and satellite observation data files for post processing.

If the photogrammetry mode or waypoint mode, the original satellite observation file and exposure timestamp file will be recorded in the SD card, regardless whether "RTK" is switched on. The file format and content are described as below.

The following files are generated in the survey task folder:

"PPKRAW.bin" file (satellite observation data and ephemeris data stored as RTCM3.2 MSM5 format);

"EVENTLOG.bin" file (exposure timestamp record file in binary format);

"Rinex.obs" file (Rinex observation file generated by means of real-time transcoding(without ephemeris));

"Timestamps.MRK" file (camera exposure timestamp record file in ASCII format).

If the customers take image manually, the survey folder and related satellite observation and exposure timestamp files will not be generated.

The images and files stored in the SD card are shown as below:

100_0008_0183.JPG	2018/10/21 16:26	JPEG 图像	9,010 KB
100_0008_0184.JPG	2018/10/21 16:26	JPEG 图像	8,677 KB
100_0008_0185.JPG	2018/10/21 16:26	JPEG 图像	8,778 KB
100_0008_EVENTLOG.bin	2018/10/21 16:26	UltraEdit Docum...	12 KB
100_0008_PPKRAW.bin	2018/10/21 16:27	UltraEdit Docum...	1,576 KB
100_0008_Rinex.obs	2018/10/21 16:27	OBS 文件	8,957 KB
100_0008_Timestamp.MRK	2018/10/21 16:26	MRK 文件	24 KB

The RTCMv3 data (PPKRAW.bin) can be converted into standard Rinex data via transcoding tool.

The information of each photo in the EXIF field can be found in the right-click menu- “Properties” -“Details,” including the size (pixels), camera model, aperture value, exposure speed, ISO value, 35mm equivalent focal length, shutter priority, latitude and longitude (degree/minute/second), and altitude (absolute altitude based on the WGS84 ellipsoid). Note: The absolute altitude is based on the ellipsoid (default: WGS84 ellipsoid) instead geoid.

Access to Photo Information in XMP Field:

Open an image by using text editor (such as Notepad or WordPad; recommended mode: WordPad), and search “XMP” by pressing Ctrl+F to find the following information fields:

<x:xmpmeta xmlns:x="adobe:ns:meta/">
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
<rdf:Description rdf:about="DJI Meta Data"
    xmlns:tiff="http://ns.adobe.com/tiff/1.0/"
    xmlns:exif="http://ns.adobe.com/exif/1.0/"
    xmlns:xmp="http://ns.adobe.com/xap/1.0/"
    xmlns:xmpMM="http://ns.adobe.com/xap/1.0/mm/"
    xmlns:dc="http://purl.org/dc/elements/1.1/"
    xmlns:crs="http://ns.adobe.com/camera-raw-settings/1.0/"
    xmlns:drone-dji="http://www.dji.com/drone-dji/1.0/"
  xmp:ModifyDate="2018-08-09"
  xmp:CreateDate="2018-08-09"
  tiff:Make="DJI"
  tiff:Model="FC6310R"
  dc:format="image/jpg"
  drone-dji:AbsoluteAltitude="+150.09"
  drone-dji:RelativeAltitude="+109.86"
  drone-dji:GpsLatitude="22.63093244"
  drone-dji:GpsLongtitude="113.93793694"
  drone-dji:GimbalRollDegree="+0.00"
  drone-dji:GimbalYawDegree="-38.00"

drone-dji:GimbalPitchDegree="-89.90"
drone-dji:FlightRollDegree="+4.70"
drone-dji:FlightYawDegree="-36.10"
drone-dji:FlightPitchDegree="+0.80"
drone-dji:FlightXSpeed="+6.60"
drone-dji:FlightYSpeed="-5.20"
drone-dji:FlightZSpeed="+0.00"
drone-dji:CamReverse="0"
drone-dji:GimbalReverse="0"
drone-dji:SelfData="Undefined"
drone-dji:CalibratedFocalLength="3666.666504"
drone-dji:CalibratedOpticalCenterX="2736.000000"
drone-dji:CalibratedOpticalCenterY="1824.000000"
drone-dji:RtkFlag="50"
drone-dji:RtkStdLon="0.01160"
drone-dji:RtkStdLat="0.01095"
drone-dji:RtkStdHgt="0.02918"
drone-dji:DewarpData=" 2018-05-28;3660.530000000000,3653.770000000000,11.350000000000,8.970000000000,-0.266866000000,0.107210000000,0.000387290000,-0.000530069000,-0.028853100000"
drone-dji:DewarpFlag="0"
crs:Version="7.0"
crs:HasSettings="False"
crs:HasCrop="False"
crs:AlreadyApplied="False">
</rdf:Description>
</rdf:RDF>
</x:xmpmeta>

The desired core information is listed in the table below:

ModifyDate="2018-08-09"	Photo modification date
CreateDate="2018-08-09"	Photo creation date
Make="DJI"	Manufacturer
Model="FC6310R"	Camera model
format="image/jpg"	Photo format
AbsoluteAltitude="+150.09"	Absolute altitude of the camera based on the ellipsoid model used (typically WGS84 or CGCS2000).
RelativeAltitude="+109.86"	Relative altitude of the camera based on Home point.
GpsLatitude="22.63093244"	Latitude of camera position, positive in the north and negative in the south, in degrees.
GpsLongtitude="113.93793694"	Longitude of camera position, positive in the north and negative in the south, in degrees.
GimbalRollDegree="+0.00"	Gimbal roll angle (in the north-east-ground frame,

	with north as True North).
GimbalYawDegree="-38.00"	Gimbal yaw angle (in the north-east-ground frame, with north as True North).
GimbalPitchDegree="-89.90"	Gimbal pitch angle (in the north-east-ground frame, with north as True North).
FlightRollDegree="+4.70"	Flight roll angle (in the north-east-ground frame, with north as True North).
FlightYawDegree="-36.10"	Flight yaw angle (in the north-east-ground frame, with north as True North).
FlightPitchDegree="+0.80"	Flight pitch angle (in the north-east-ground frame, with north as True North).
FlightXSpeed="+6.60"	Ground speed northern vector (m/s).
FlightYSpeed="-5.20"	Ground speed eastern vector (m/s).
FlightZSpeed="+0.00"	Ground speed vertical (m/s).
CalibratedFocalLength="3666.666504"	Design focal length of the lens, in pixels (one pixel corresponds to 2.4 microns).
CalibratedOpticalCenterX="2736.000000"	X-axis coordinate of the design position of optical center, in pixels (one pixel corresponds to 2.4 microns), with the coordinate origin as the image center.
CalibratedOpticalCenterY="1824.000000"	Y-axis coordinate of the design position of optical center, in pixels (one pixel corresponds to 2.4 microns), with the coordinate origin as the image center.
RtkFlag="50"	RTK status (0 - no positioning; 16 - single-point positioning mode; 34 - RTK float solution; 50 - RTK fixed solution). It is recommended not to use a photo for mapping unless its flag bit is 50.
RtkStdLon="0.01160"	Standard deviation (in meters) of the photo recording position in longitude direction. When the standard deviation of the image is greater than 0.1, it is recommended not to use this photo.
RtkStdLat="0.01095"	Standard deviation (in meters) of the photo recording position in latitude direction. When the standard deviation of the image is greater than 0.1, it is recommended not to use this photo.
RtkStdHgt="0.02918"	Standard deviation (in meters) of the photo recording position in the height direction. When the standard deviation of the image is greater than 0.1, it is recommended not to use this photo.
DewarpData=" 2018-05-28;3660.530000000000,3653.770000000000,11.350000000000,8.970000000000,-0.266866000000,0.107210000000,0.00038729000	Internal parameters and distortion parameters Keyword order: “calibrate_date;fx,fy,cx,cy,k1,k2,p1,p2,k3”

0,-0.000530069000,-0.028853100000"	Where the calibrate_date is the date of calibration. fx and fy are the focal length in pixels (one pixel corresponds to 2.4 microns). Comprehensively, the focal length of the camera can be calculated as: (3660.53+3653.77)/2=3657.15 (pixels), or 3657.15 (pixels) * (2.4*0.001)mm/pixel=8.77716mm. cx and cy are the coordinates (in pixels) of the principal point (the coordinate origin is the image center; for some types of mapping software, such as Pix4D and Context Capture, the default origin point is the upper left corner of the image, so conversion needs to be carried out. Example of conversion: assuming that the photo scale is 3:2, the photo pixel is 5472*3648, the pixel coordinates of the image center relative to the upper left corner are 2736.0 and 1824.0, and the coordinates of the principal point to be entered in the mapping software should be 5472/2+11.35=2747.35 and 3648/2+8.97=1832.97). k1, k2, and k3 are radial distortion parameters, corresponding to radial distortion R1/R2/R3 of Pix4D mapper. p1 and p2 are tangential distortion parameters, corresponding to the tangential distortion T1/T2 in Pix4D mapper.

About Photo Distortion

P4R is configured with two lens undistort modes. First, real-time undistort of the camera is carried out based on the design parameters of the lens. When the “Distortion Correction” option of PC GS Pro or GS RTK is enabled, a photo with its distortion corrected will be directly provided for the user to conduct mapping. Visually, the image acquired in this way has no wide-angle effect.

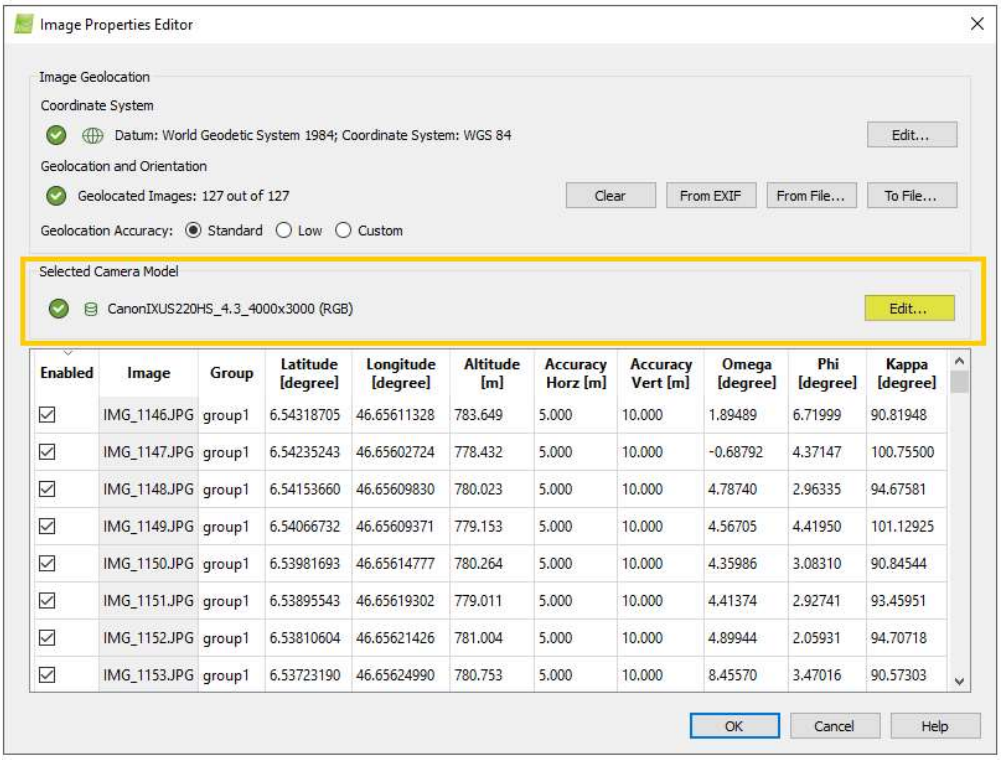
Second, the “distortion correction” option of GS RTK or PC GS Pro is disabled. In this case, an original image with distortion will be provided, with “wide-angle” or “fisheye” effects, as shown below:

Calibration were performed on each lens, and distortion correction parameters and camera parameters written into the DewarpData field in the XMP of each photo in the factory.

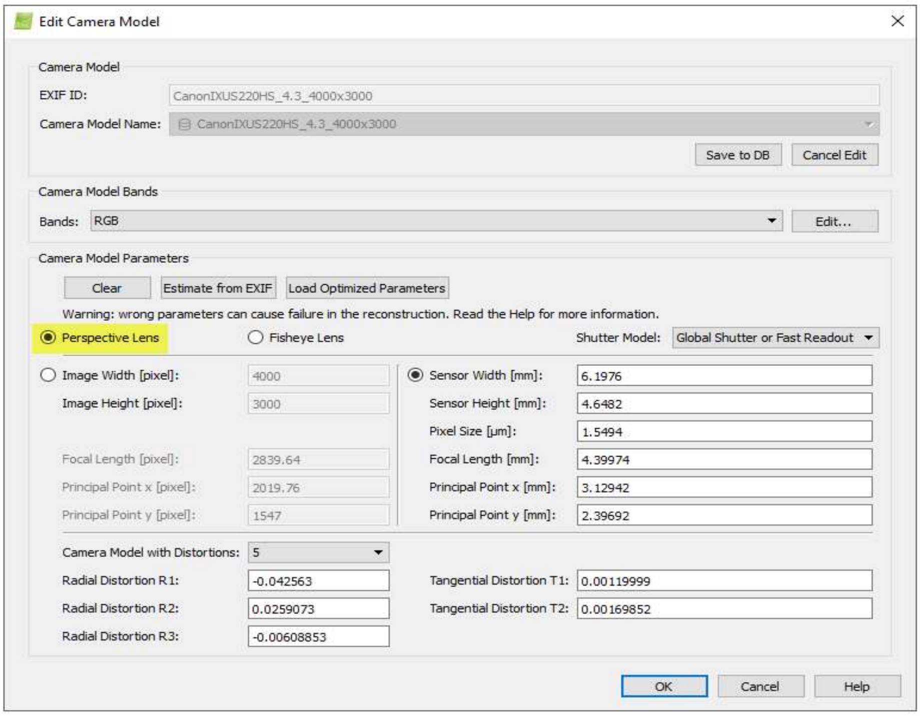
If PC GS Pro is used for mapping, an original photo can be directly imported into PC GS Pro automatically, which can identify the photo type to set the internal parameters and correct distortion. That is, distortion correction is conducted prior to mapping.

If third-party mapping software is used, original images with distortion can be directly imported into the software, then aerial triangle processing errors may occur. In this case, distortion parameters and camera internal parameters need to be set in the “image editor” during processing with third-party software, in order to undistort the original image. Taking Pix4D as an example:

Use of distortion parameters and camera internal parameters:



Click “Edit” in the above dialog box and then edit as below.



Select the “Perspective Lens” and “Global Shutter”.

Set the sensor width as 13.13mm, sensor height as 8.755mm, and pixel size as 2.4 microns.

The DewarpData field is “calibrate_date;fx,fy,cx,cy,k1,k2,p1,p2,k3”, as shown above.

Focal length: (fx+fy)/2=24µm.

Principal point: x=(5472/2+cx)*2.4µm; y=(3648/2+cy)*2.4µm (cx and cy of the calibrated principal point use the image center as the origin, and the principal point of an image in Pix4D

is the upper left corner as the origin).
Radial Distortion: corresponding to k1, k2, and k3.
Tangential Distortion: corresponding to p1 and p2.

Timestamp.MRK Information

When in group photo mode (photogrammetry or waypoint mode), the Survey folder is as follows:

100_0008_0183.JPG	2018/10/21 16:26	JPEG 图像	9,010 KB
100_0008_0184.JPG	2018/10/21 16:26	JPEG 图像	8,677 KB
100_0008_0185.JPG	2018/10/21 16:26	JPEG 图像	8,778 KB
100_0008_EVENTLOG.bin	2018/10/21 16:26	UltraEdit Docum...	12 KB
100_0008_PPKRAW.bin	2018/10/21 16:27	UltraEdit Docum...	1,576 KB
100_0008_Rinex.obs	2018/10/21 16:27	OBS 文件	8,957 KB
100_0008_Timestamp.MRK	2018/10/21 16:26	MRK 文件	24 KB

The “Timestamp.MRK” file describes the exposure time, exposure position, and attitude and so on.

```
1 353069.714933 [2024]       3,N     -79,E     177,V  22.78672501,Lat 114.89895223,Lon  82.485,Ellh 0.009475, 0.008898, 0.024306  50,Q
2 353072.026790 [2024]      20,N     -46,E     188,V  22.78675509,Lat 114.89902936,Lon  82.488,Ellh 0.009740, 0.009126, 0.024969  50,Q
3 353074.315543 [2024]      17,N     -52,E     187,V  22.78679448,Lat 114.89913392,Lon  82.475,Ellh 0.009844, 0.009289, 0.024841  50,Q
4 353076.636276 [2024]      14,N     -52,E     186,V  22.78683281,Lat 114.89923905,Lon  82.514,Ellh 0.009502, 0.009091, 0.026609  50,Q
5 353078.916678 [2024]      15,N     -53,E     186,V  22.78687166,Lat 114.89934172,Lon  82.549,Ellh 0.009617, 0.009240, 0.026681  50,Q
6 353081.226411 [2024]      20,N     -42,E     189,V  22.78691125,Lat 114.89944738,Lon  82.601,Ellh 0.009846, 0.009439, 0.026901  50,Q
7 353083.517403 [2024]      19,N     -48,E     187,V  22.78694989,Lat 114.89955113,Lon  82.555,Ellh 0.009376, 0.008939, 0.026373  50,Q
8 353085.831312 [2024]      18,N     -52,E     187,V  22.78698887,Lat 114.89965537,Lon  82.549,Ellh 0.010154, 0.009691, 0.026866  50,Q
9 353088.111881 [2024]      16,N     -49,E     187,V  22.78702692,Lat 114.89975825,Lon  82.542,Ellh 0.011286, 0.010719, 0.027934  50,Q
```

Column 1: Image sequence.
Column 2: Second of week of the exposure timestamp in UTC time, with seconds expressed in GPS time format.
Column 3: GPS week of the exposure timestamp in UTC time, with seconds expressed in GPS time format.

Column 4: Offset (in mm) of the antenna phase center to camera CMOS sensor center in the north (N) direction at the time of exposure of each photo. It is positive when the CMOS center is in the north direction of the antenna phase center and negative when in the south direction.
Column 5: Offset (in mm) of the antenna phase center to camera CMOS sensor center in the east (E) direction at the time of exposure of each photo. It is positive when the CMOS center is in the east direction of the antenna phase center and negative when in the west direction.
Column 6: Offset (in mm) of the antenna phase center to camera CMOS sensor center in the vertical (V) direction at the time of exposure of each photo. It is positive when the CMOS center is below the antenna phase center and negative when the former is above the latter.
Column 7: real-time position latitude (Lat) of the CMOS center acquired at the time of exposure, in degrees. When the aircraft is in the RTK mode, its position is the RTK antenna phase center position plus the offset of the antenna phase center relative to the CMOS center at the time of exposure, with the RTK accuracy (centimeter level); and when the aircraft is in the GPS mode, its position is that detected by GPS single-point positioning plus the offset of the RTK antenna

phase center relative to the CMOS center at the time of exposure, with GPS single-point positioning accuracy (meter level).
Column 8: real-time position longitude (Lon) of the CMOS center acquired at the time of exposure, in degrees.
Column 9: real-time height of the CMOS center acquired at the time of exposure, in meters. The height is a geodetic height (commonly known as the ellipsoid height), relative to the surface of the default reference ellipsoid (WGS84 is the default and can be set as other ellipsoids such as CGCS2000 via a different CORS station system/reference). Note that the above height is not based on the national 85 elevation datum or 56 elevation datum (normal height) or commonly used EGM96/2008 elevation datum (orthometric height) worldwide.
For correlation of orthometric height, normal height, and geodetic height, refer to the following link:
http://www.esri.com/news/arcuser/0703/geoid1of3.html

Columns 10 to 12:
Standard deviation (in meters) of positioning results in the north, east, and the vertical direction, describe the relative accuracy of positioning in the three directions.
Column 13:
RTK status flag. 0: no positioning; 16: single-point positioning mode; 34: RTK floating solution; 50: RTK fixed solution. When the flag bit of a photo is not 50, it is recommended not to use this photo directly in map building.

Rinex.Obs file: real-time decoded satellite observation file (GPS+GLO+BDS+GAL) received by the UAV, in RINEX 3.02 format. This file can be directly imported into PPK post-processing software for post-processing.

PPKRAW.bin file: binary data file (GPS+GLO+BDS+GAL) of satellite observation data, stored in the MSM5 format of RTCM 3.2 and received by the UAV. It includes satellite observation data and broadcast ephemeris. The satellite observation data and broadcast ephemeris of different systems can be decoded to RINEX format.

Waypoint Flight Mode

When the waypoint flight mode is used for image acquisition, the camera will work in the group image acquisition mode is on.
When the video mode is enabled, the files are as follows:

The subtitles of the video are as below:

Camera parameter: F/SS/ISO/EV

RTK position information (longitude, latitude, satellite number): longitude accurate to six decimal places, latitude accurate to six decimal places, and the number of satellites.

HOME point information (longitude, latitude, height): longitude accurate to six decimal places, latitude accurate to six decimal places, and absolute altitude to two decimal places.

D: horizontal distance to the home point.

H: relative height to the home point.

H.S: horizontal forward speed (Y speed) of the aircraft.

V.S: vertical upward speed (Z speed) of the aircraft.

F.PRY (Pitch Roll Yaw): aircraft attitude angle (north-east-ground coordinate system).

G.PRY(Pitch Roll Yaw): gimbal attitude angle (north-east-ground coordinate system).

IV. Post-processing Tips

Data Required for Post-Processed Kinematic

1. Satellite observation data of UAV side.
2. Exposure timestamp record of UAV side.
3. Satellite observation position of base station side.
4. Ephemeris data.
5. Base station position.
6. Position compensation between aircraft antenna phase center and camera CMOS center.

Satellite Observation Data of Aircraft

The RINEX.OBS file is generated in the group photo mode, including satellite observation data in RINEX 3.02 format. The PPKRAW.bin file contains satellite observation data and broadcast ephemeris in RTCM3 format. Meanwhile, RTCM data can be exported from the DRTK2 base station via DJI Assistant 2 for Phantom.
When post-processing software is unable to process satellite observation data directly in the RTCM format, data in the RTCM format needs to be converted into standard post-processing RINEX data.

Exposure timestamp record of UAV:
The first three columns of "Timestamp.MRK" in the group photo Survey folder show the exposure timestamp record (UTC time) of each image. The position of each exposure time can be calculated by import Timestamp.MRK file

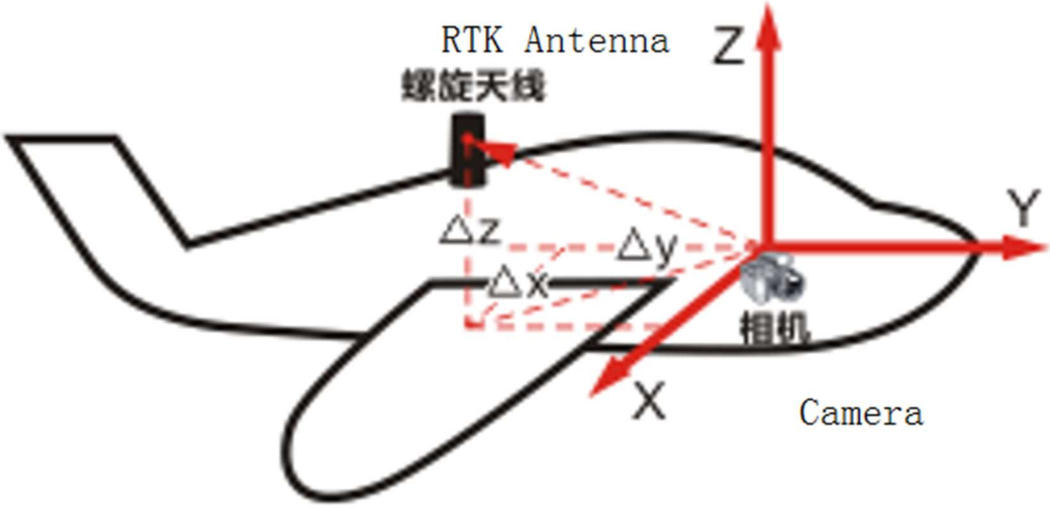
Satellite observation position of base station:
The satellite observation data of the DRTK2 base station is stored in RTCM3 format. It can be exported via Assistant 2 and converted into RINEX format for post-processing.
If the user adopts data acquired by a third-party base station for PPK, PPK software needs to be able to analyze the data format of the third-party base station.

Ephemeris data:
The PPKRAW.bin folder in the Survey folder contains the broadcast ephemeris file, which is received by the aircraft and can be transferred using transcoding. For higher accuracy, precise ephemeris can be downloaded from website like IGS or Wuhan University and used in the post processing.

Base station position:
1. The base station may be set at an existing control point.
2. A base station may also be set at a given point and connected to the network RTK. The position of the point can be obtained through RTK positioning.
3. The position of the set-up point can also be achieved by precise point positioning(PPP).

Position compensation between the UAV RTK antenna phase center and camera CMOS center:

36mm in the heading direction, 192mm in the height direction, and 0 perpendiculars to the heading, as shown below:



The offset from RTK antenna phase center and camera CMOS center in the body system can be define as below:

$$\Delta X = 0.0m$$
$$\Delta Y = 0.036m$$
$$\Delta Z = -0.192m$$

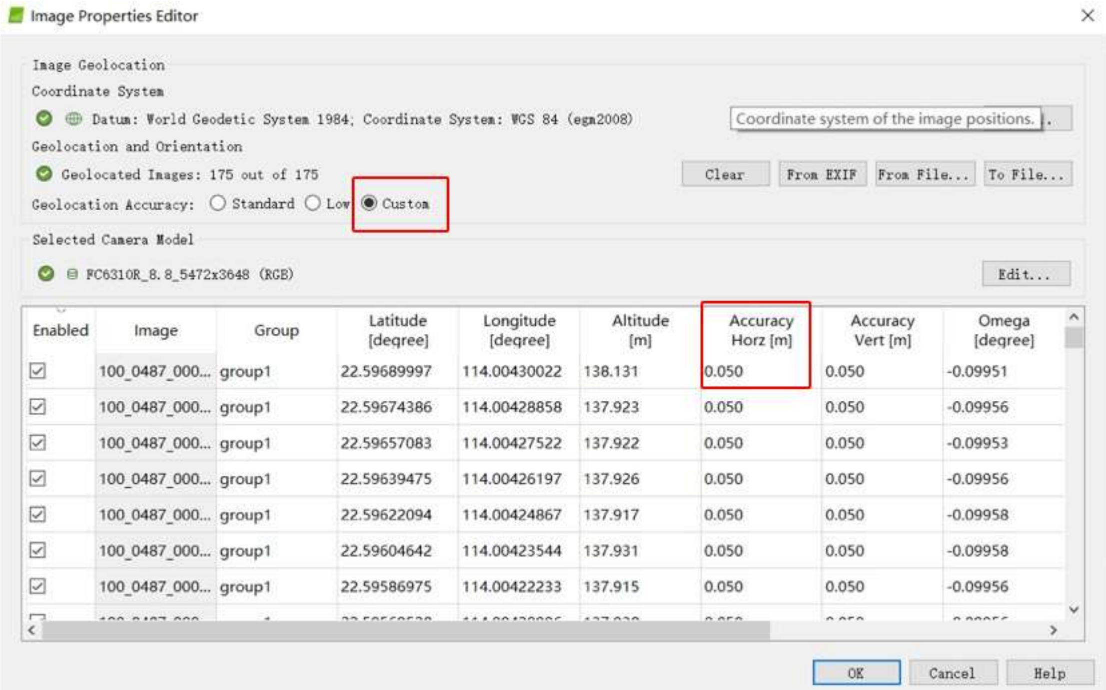
The Timestamp.MRK file contains the offset of the antenna phase center to camera CMOS center in the north-east-down coordinate system at the time the photo was taken, and compensation of the north, east and vertical directions are included in the MRK file for direct compensation to the post-processed latitude, longitude, and height. In this case, the correction in three directions (x, y, and z) are all 0, and the acquired position is the position of the antenna phase center. Then the compensation in the .MRK file are used and the position will be compensated to the camera CMOS center.

The height can be compensated by direct deduction. For compensation in the east and north direction, it should be noted that the compensation value is in mm while the coordinate value is in degrees. The user may first perform projection, and then compensate the value of the east/north direction to that of the projection.

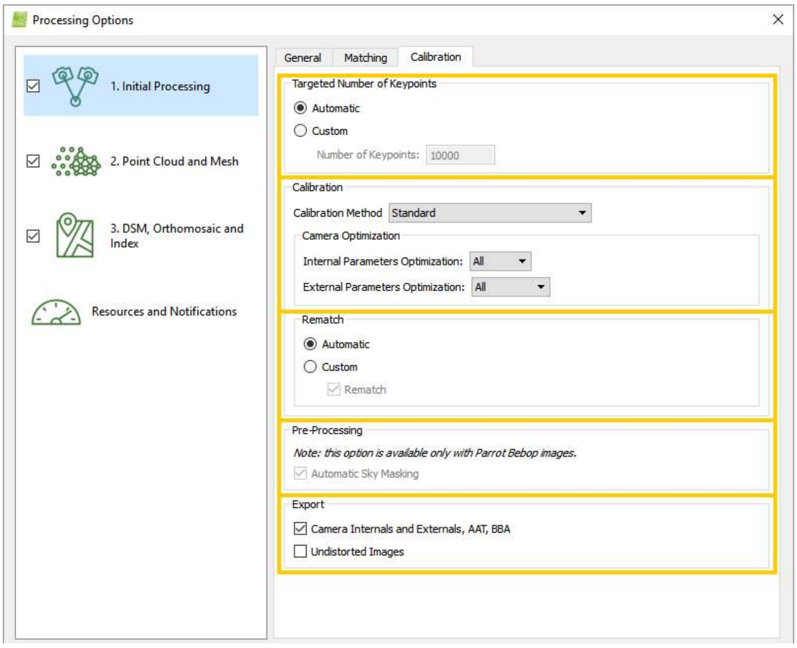
V. Mapping Tips

Operational Tips

1. The position accuracy of the photos captured by P4RTK is about 0.05m. Therefore, the image position accuracy should be set as 0.05m when third-party software is used in 2D mapping or 3D modeling. Taking Pix4D as an example:

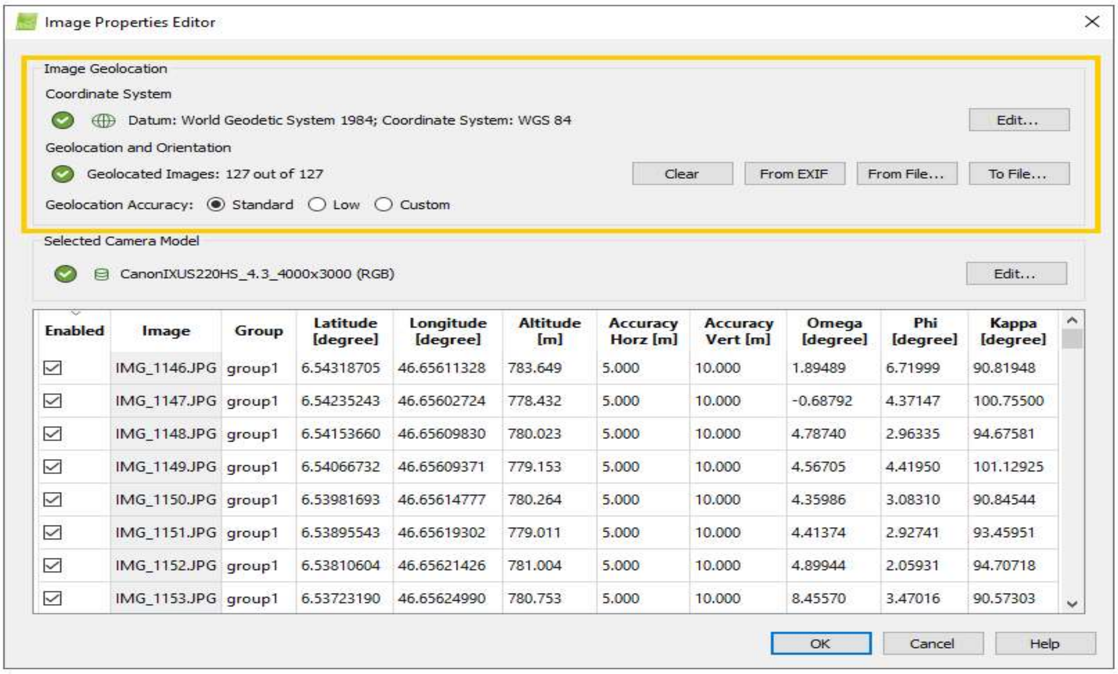


2. Select “**Accurate Geolocation and Orientation**” in the “Calibration” options under Processing Options-Initial Processing Calibration. That is, the POS information written in the image is used as priori knowledge to aerial triangle solution.
   Select “Default” or “All Priori” from the options of Internal Parameters Optimization.
   Select “None” from the options of External Parameters Optimization.

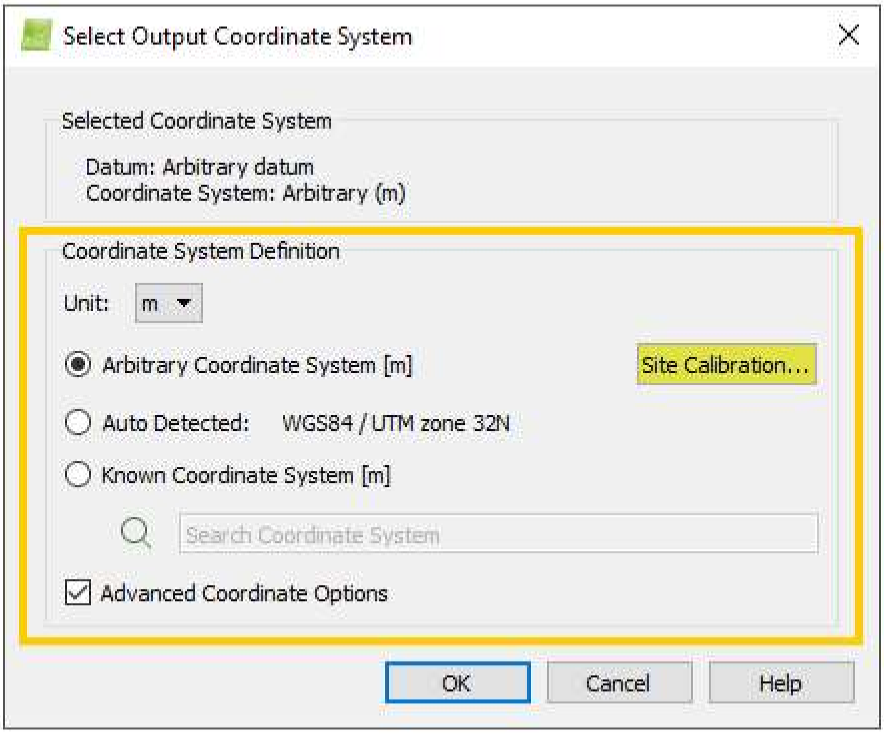


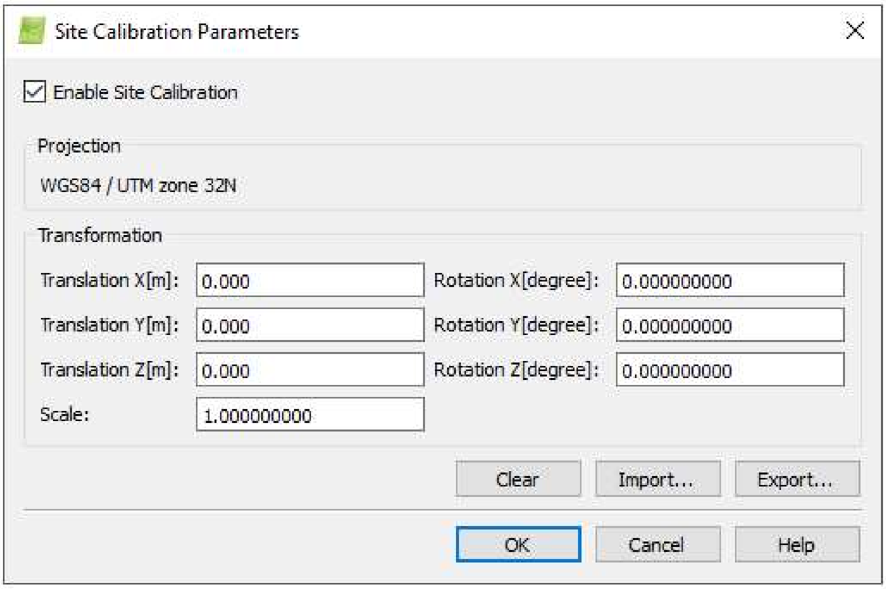
3. Set the photo position coordinate system in the photo position settings screen. The user must select the coordinate system based on the own mission. When the default WGS84 coordinate system is used, the user should select the WGS84 coordinate system. For the elevation system, the ellipsoid height is adopted, so "**Geoid Height above WGS84 Ellipsoid [unit]**" should be selected in "Advance", and the value should be 0. If the CGCS2000 coordinate system is used, the China 2000 coordinate system must be selected, and the elevation reference in the photo is 0 meter above the ellipsoid. Note: please do not use the default parameter select EGM96/2008 as elevation reference.

   When the wrong coordinate system or a wrong projection surface is used, the waypoint will not be displayed normally in the background, and coordinates will not be used properly during map building.



4. If the user needs to plan the map into a specific local coordinate system, the longitude, latitude and height data in the Timestamp.MRK file may be used, followed by a seven-parameter conversion and transfer of the coordinates of WGS84/CGCS2000 into the local coordinate system and third-party software for mapping. The “Import from file” must be selected in the mapping process. The user should obtain conversion parameters and conduct coordinate conversion.
5. If supported by post-processing software, the user may also enter conversion parameters into the software for coordinate conversion. As shown below (Pix4D), seven conversion parameters should be entered.





6. The user may apply a number of image control points and obtain their positions in the local

coordinate system. The points are made in the mapping process. If the image control points used are in another ellipsoid frame, at least three image control points should be made to ensure the correct ellipsoid conversion, with no upper limit.

7. Regardless of the coordinate system used, the P4R output coordinates are the geographic coordinates in the coordinate frame, expressed in Lat, Lon, and Height format. If the user normally enters the X, Y and Z coordinates after photo projection, they must perform projection manually.

8. The output coordinate system selected may be different from the photo input coordinate system. When the GCP is used, the output coordinate system will automatically match the GCP coordinate system. In the absence of GCP, the output coordinate system will automatically become consistent with the photo input coordinate system. **Note: The default setting is the WGS84 coordinate system and UTM projection. If a different coordinate system (such as C2000) is used, the coordinate system setting should be C2000. The post-processing software is unable to identify the coordinate system automatically in photos!**

The geographic coordinate system or projected coordinate system may be used in the output map. The Gauss-Krüger 3-degree projection is usually used in China and is the default in WGS84. Attention should be paid to the center longitude and zone number when a project method is selected.

Selection of the UTM ZONE of the WGS 1984 coordinate system:

(1) Northern hemisphere: select a zone with the last letter "N".

(2) Formula: number of zones = integer part of (integer part of longitude/6) + 31.

Take a survey unit in Xinjian County, Nanchang, Jiangxi. Longitude: 115°35′20″ to 115°36′00″;

Number of zones: 115/6+31=50; 50N is selected, i.e. WGS 1984 UTM ZONE 50N.

If Gauss-Krüger projection is applied, the projected zone number is:

6-degree zone number = (longitude+6°)/6, rounded into an integer.

6-degree center longitude = (6-degree zone number * 6) -3

About Coordinate System

When the RTK or PPK mode is used, and a base station is in the WGS84 frame, the photo position acquired by P4R is in the WGS84 frame. When a base station is in a different coordinate system (like CGCS2000 frame), the photo position acquired by P4R will be in the CGCS2000 frame. Their ellipsoid definitions are similar, and errors are negligible. However, errors arising from different epochs may reach 20cm in some areas, which cannot be ignored. Using the network RTK data source in the WGS84 or CGCS2000 frame is recommended. Then position (geographic coordinates, i.e., latitude, accuracy and height coordinates without projection) accuracy of photos captured directly by the aircraft will be at the centimeter level of WGS84 or CGCS2000. The user can perform 7-parameter conversion to acquire the coordinates in the local coordinate system.

About Accuracy Verification

Horizontal accuracy verification: the coordinate system of the verification point must be consistent with that of the P4R map. (If more than three image control points are provided, the coordinate system of the verification point should be consistent with that involving the image control points; and if no image control point is used, the coordinate system of the verification point is deemed the same as the image coordinate stem by default. Note the output coordinate system should be configured the same as the input image coordinate system in the absence of image control points. When a projected zone is adopted, the correct projected zone type and center longitude should be selected.)

The WGS84 coordinate system, the national 80 geodetic coordinate system, CGCS2000, and 54 geodetic coordinate system must not be used simultaneously! The coordinate system must be checked first and then the coordinate accuracy! If there is a significant deviation, the coordinate system must be checked first!

In addition, local CORS stations in various provinces/cities/autonomous regions must not be combined with WGS84 or CGCS2000 coordinate systems. When there are less than three image control points, the aircraft coordinate system, mapping coordinate system, and checkpoint coordinate system must be consistent with each other.

A system deviation (coordinate verification of all checkpoints is performed in the same direction) is probably caused by the inconsistency of coordinate systems in a previous step.

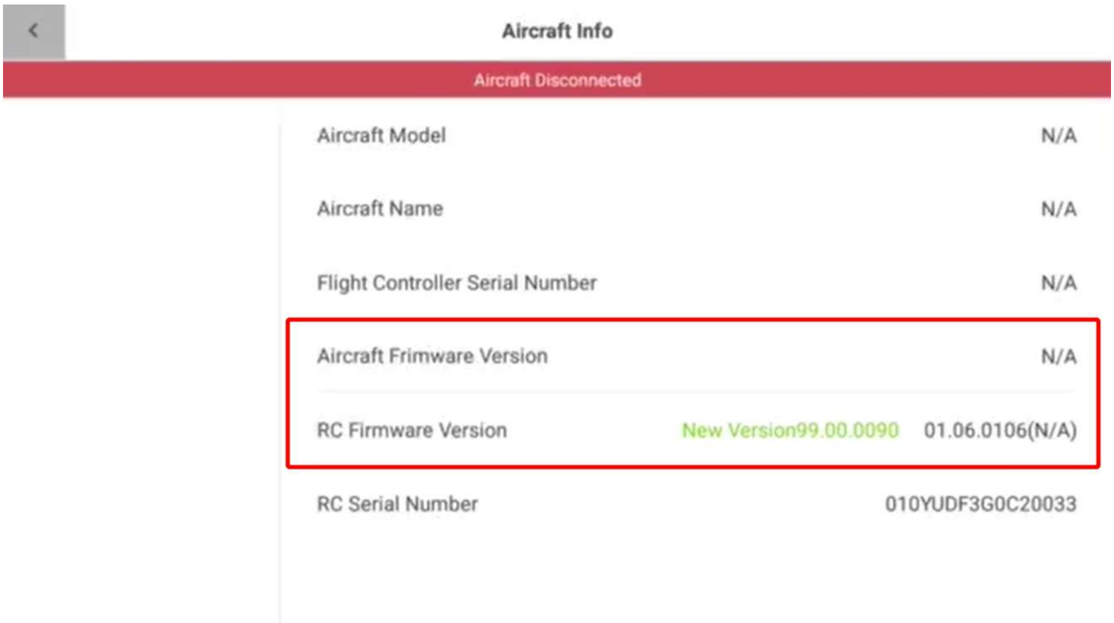
Height accuracy verification: the default height of P4R is based on the ellipsoid height. If the user plans to use an elevation system in another elevation datum, image control points should be made, or the custom height datum should be the same as the ellipsoid height.

A system deviation (coordinate verification of all checkpoints is performed in the same direction) is probably caused by the inconsistency of coordinate systems in a previous step.

VI. Problem Feedback and Log Uploading

Information Required in User's Problem Report

The problem report of the user should include the versions (shown below) of the remote controller/aircraft firmer and national code.



The user should describe the problem, workflow, and the job scene. E.g. If a coordinate deviation is found during map building, please submit the workflow and scene (video, etc.). We expect the user to upload the relevant information (data, log (normally the flight controller data + remote control data + data of camera SD card), environment, etc.) related to specific problems

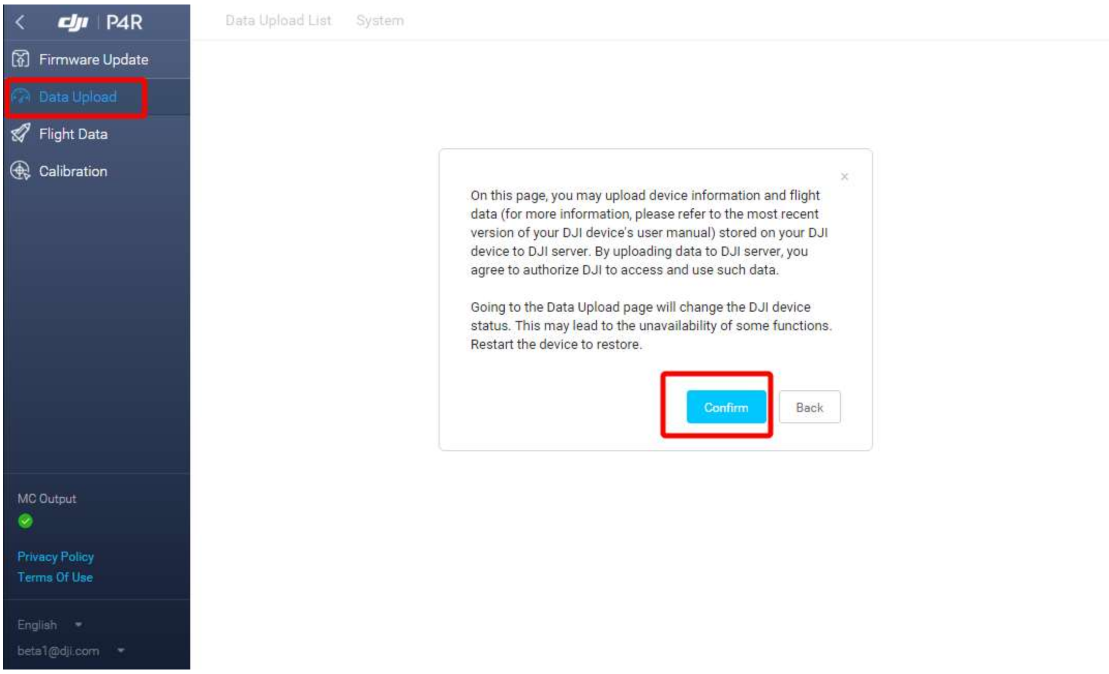
Log Uploading Method

Flight control Log:

When a problem related to UAV function is found, the user must upload flight control log for analysis.

Step 1:

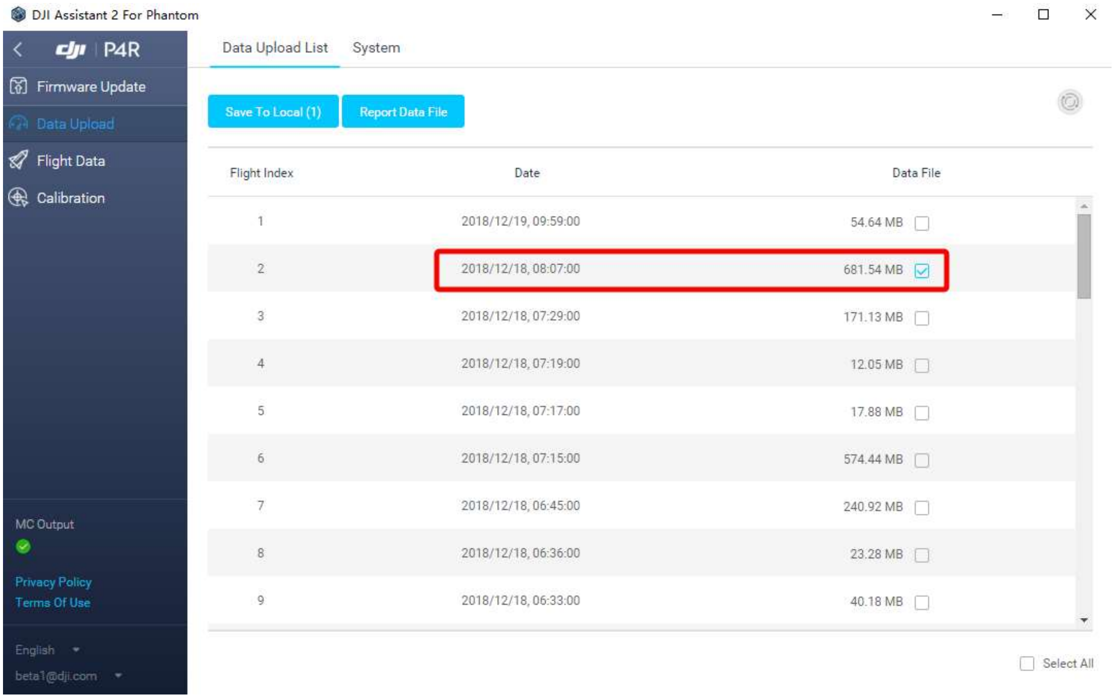
Connect the aircraft to a computer, open the "DJI Assistant 2 For Phantom". Click "Data Upload", read the description and then click "OK".



When the aircraft is powered on, data will be recorded, and the data number will increase. If any issue is found during the flight (control issue, no images, wrong position etc.), we expect the user to upload the flight control log.

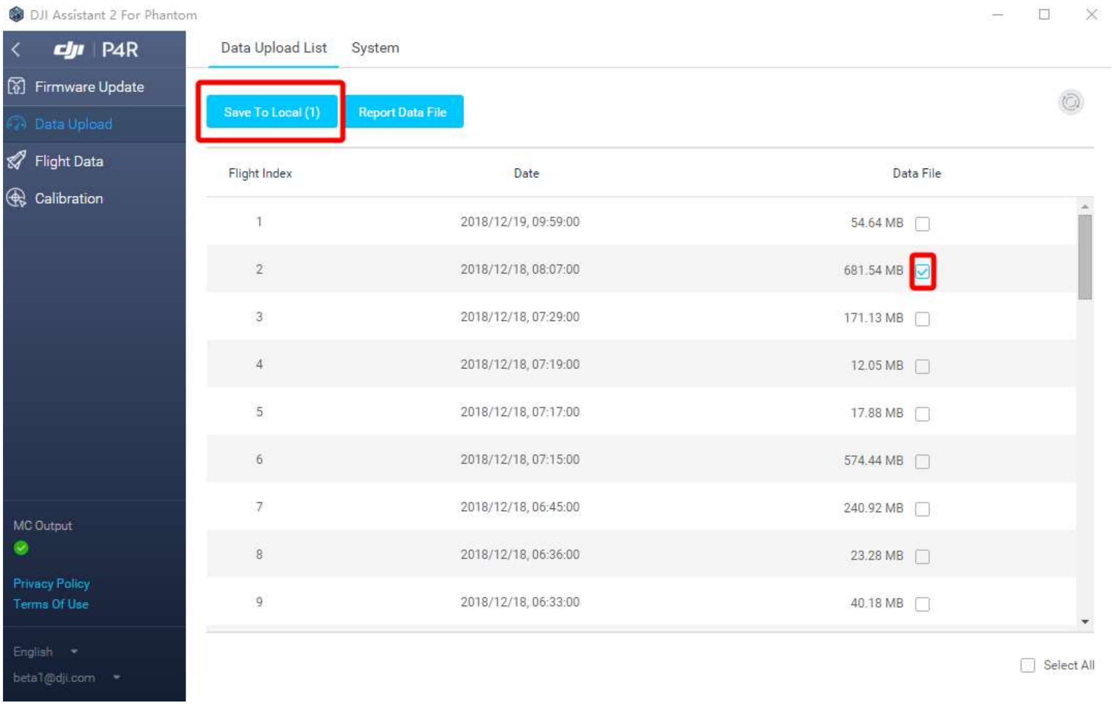
Step 2:

Click "OK". The number of flights and corresponding time and data file will be refreshed, followed by the identification of the data corresponding to the occurrence time of the abnormality. (If the user is not sure of the specific time, the corresponding data must be exported. As the data involved is a lot, it is not necessary to export the data for normal operations.) Refer to the figure below:

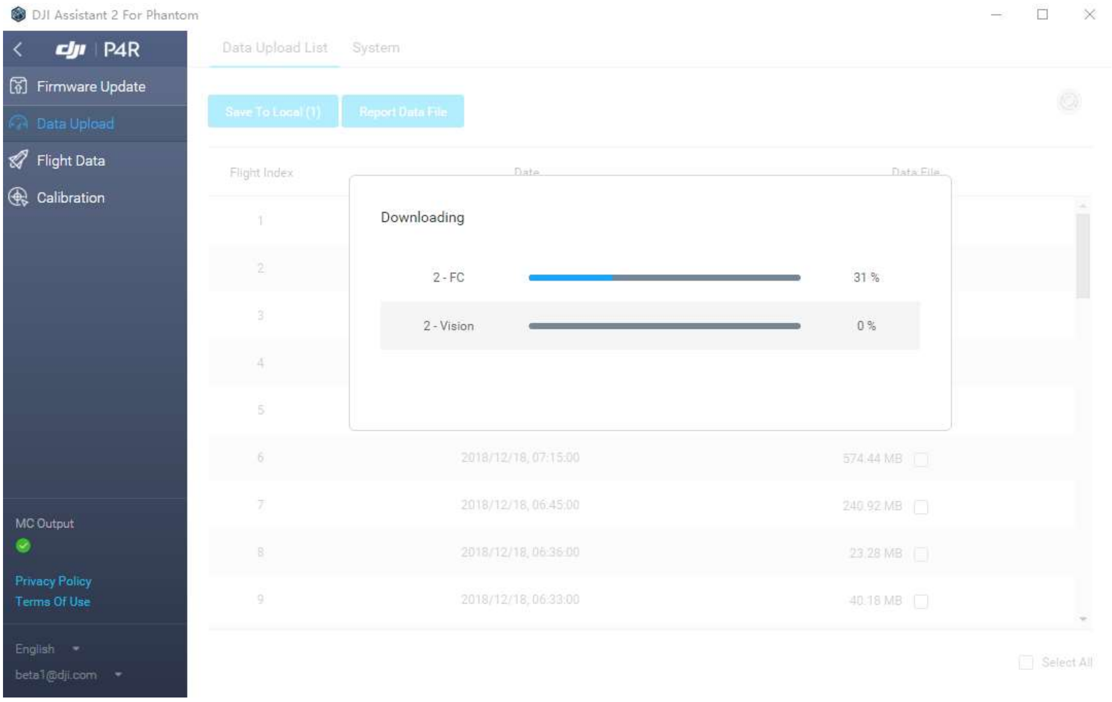


Step 3:

Select the data file to be exported and click "Save to Local". The flight record corresponds to sepecific flight control log.



Select the export folder path, and check the data export progress.



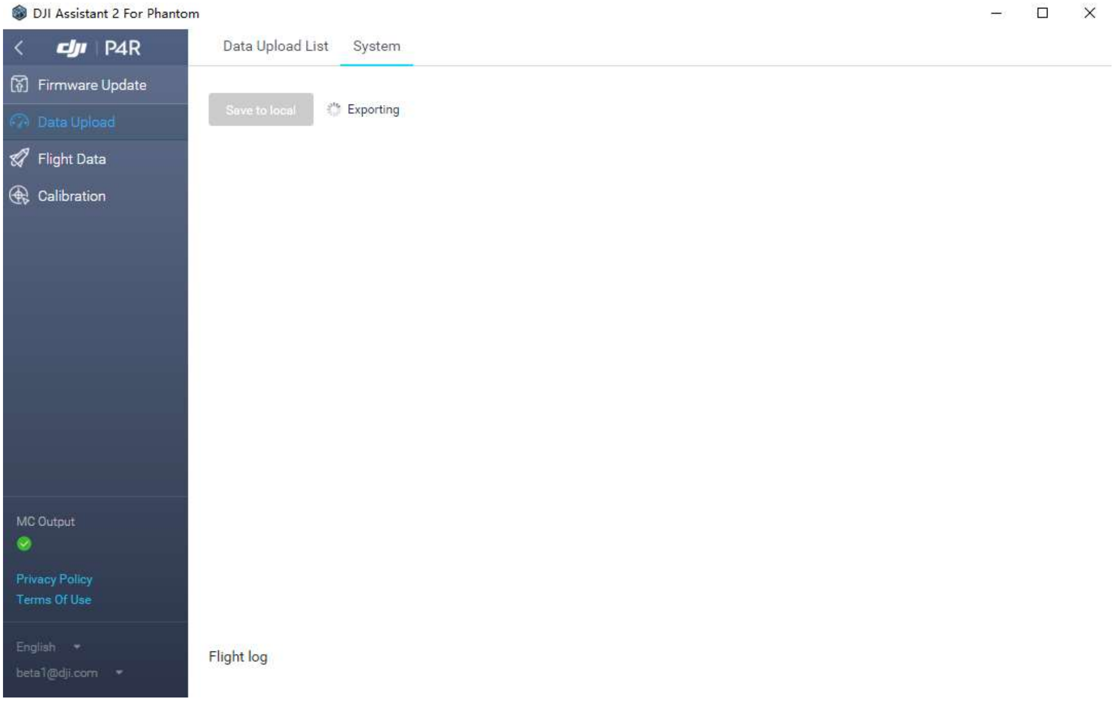
Step 4:

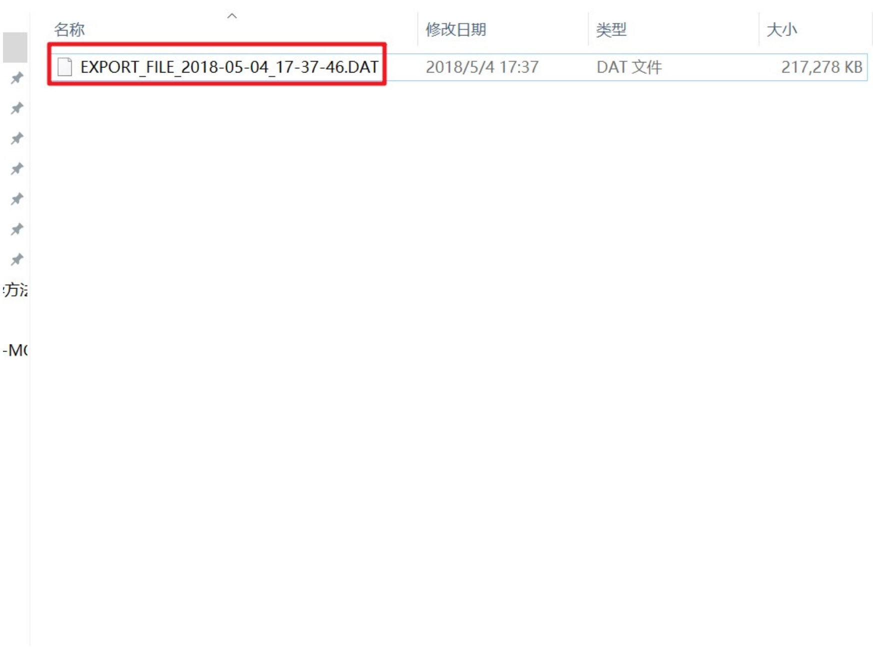
After the log is exported, open the folder and select the data to be exported. The export data file is named as: EXPORT_FILE_201X-XX-XX_XX-XX-XX.DAT. The time is the PC system's time.

Image transmission Log:

Image transmission data should be exported and uploaded in the event of an control issue, disconnection and loss of communication, image obscurity, etc.

Connect the aircraft to a PC and export the image transmission data.



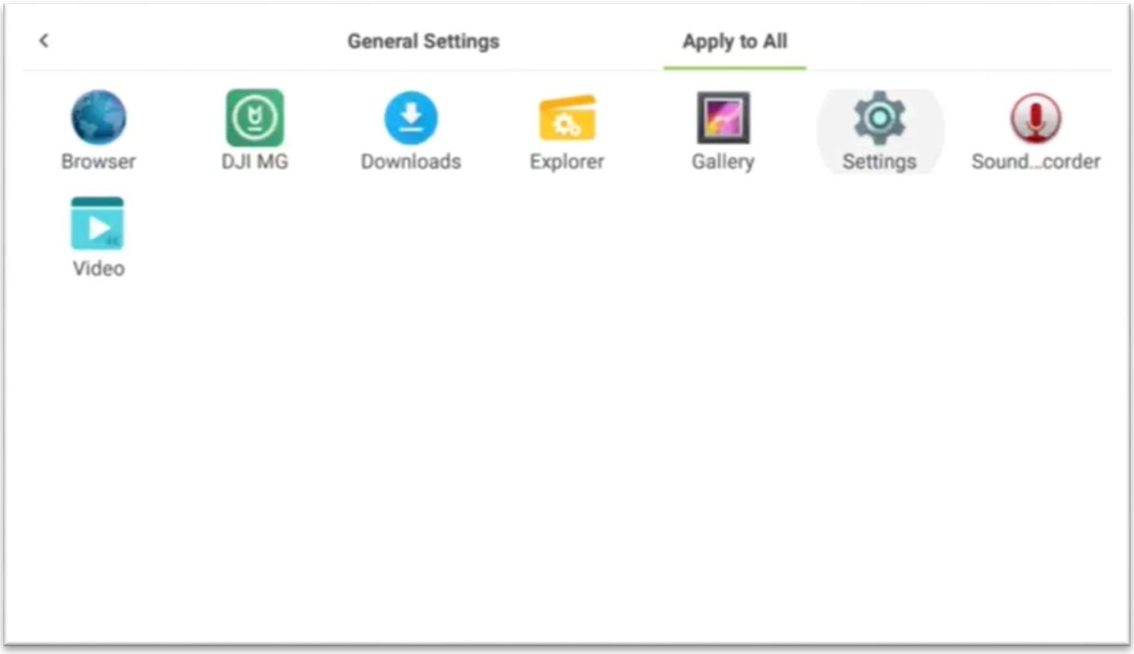


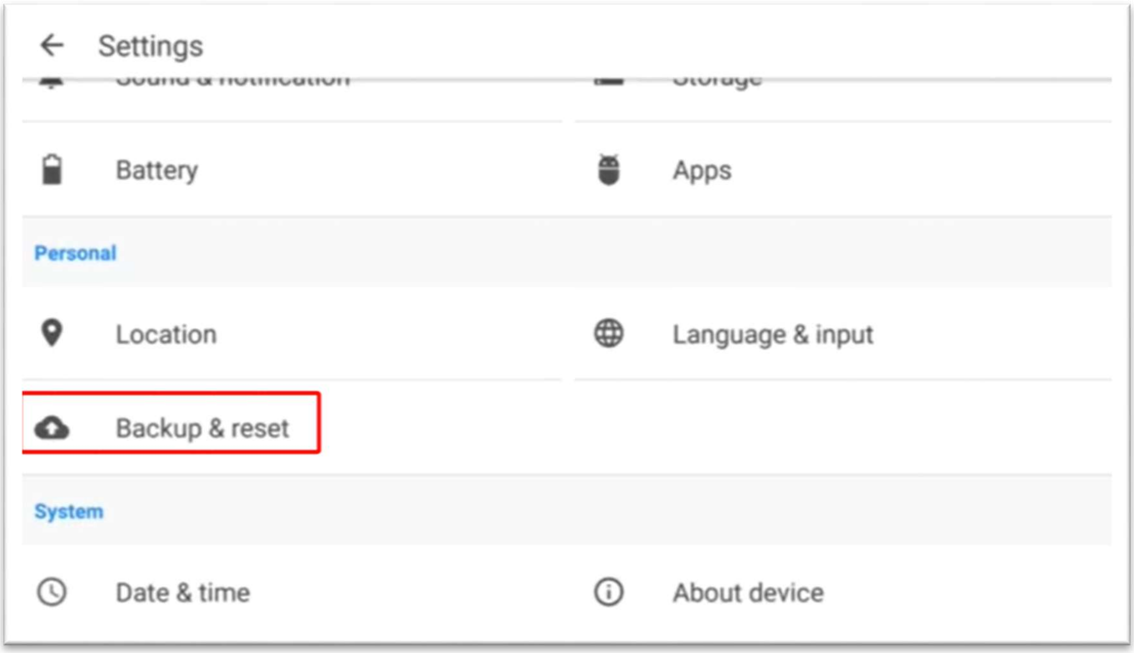
Remote controller data:

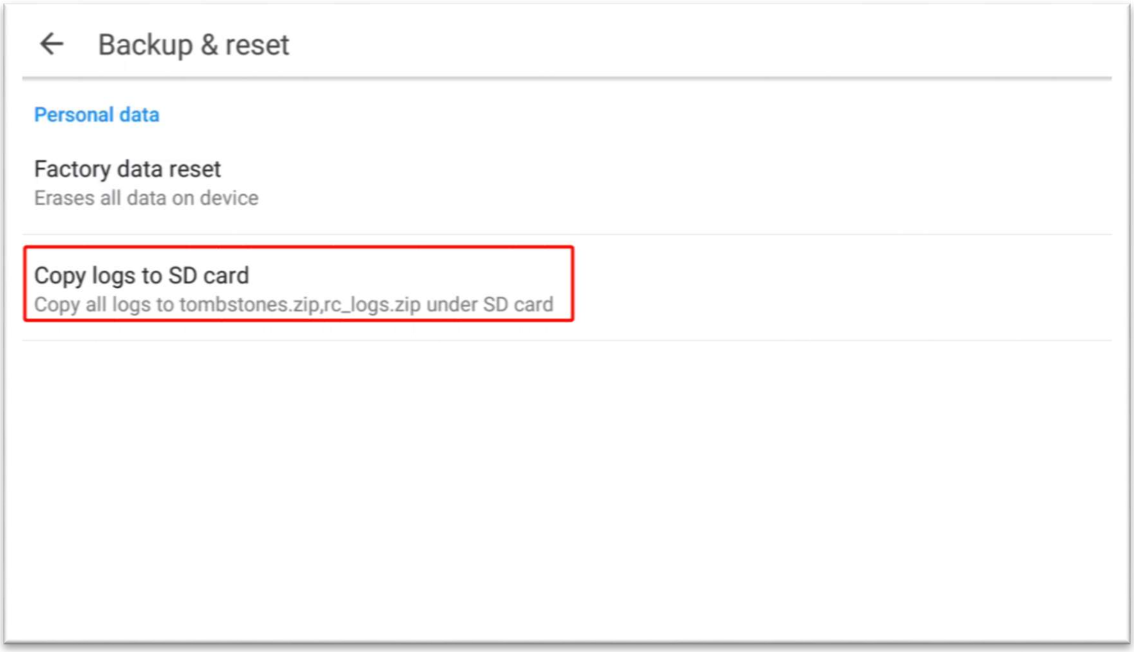
A problem related to transmission, such as UAV out-of-control, disconnection and loss of communication, image obscurity, paring fails, RTK purchase fails, abnormality of RTK activation, the absence of network card signals, etc. In this case, the remote control data should be exported and uploaded.

Go to the App page. Click Settings - General Settings - Android System Settings - Backup and Reset - Copy Log to SD Card, as shown below.

Step 1:

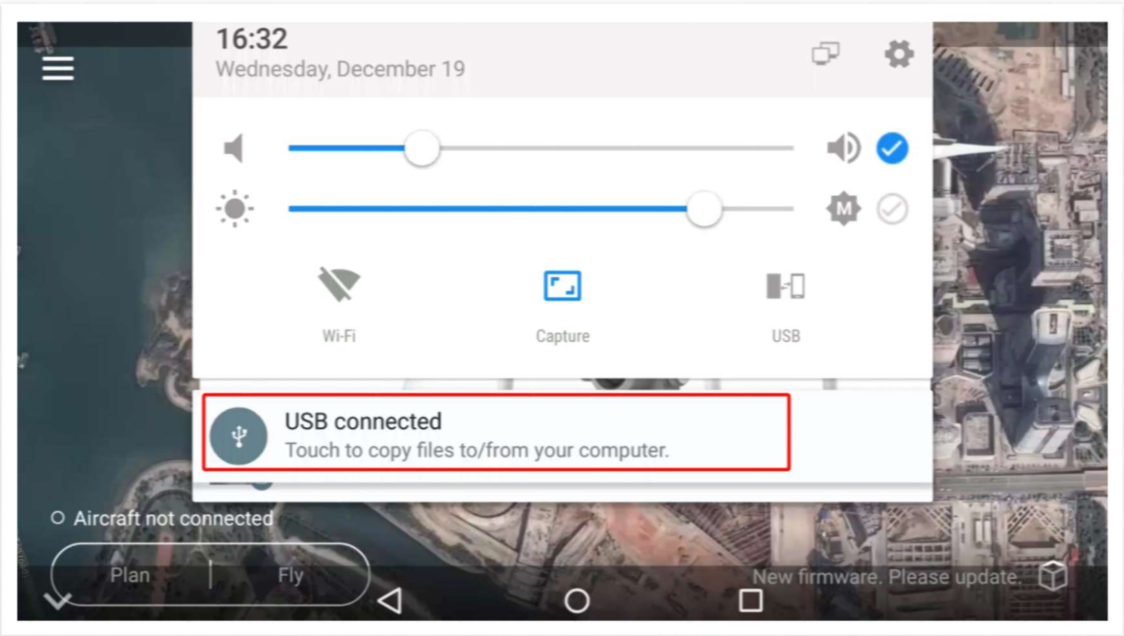




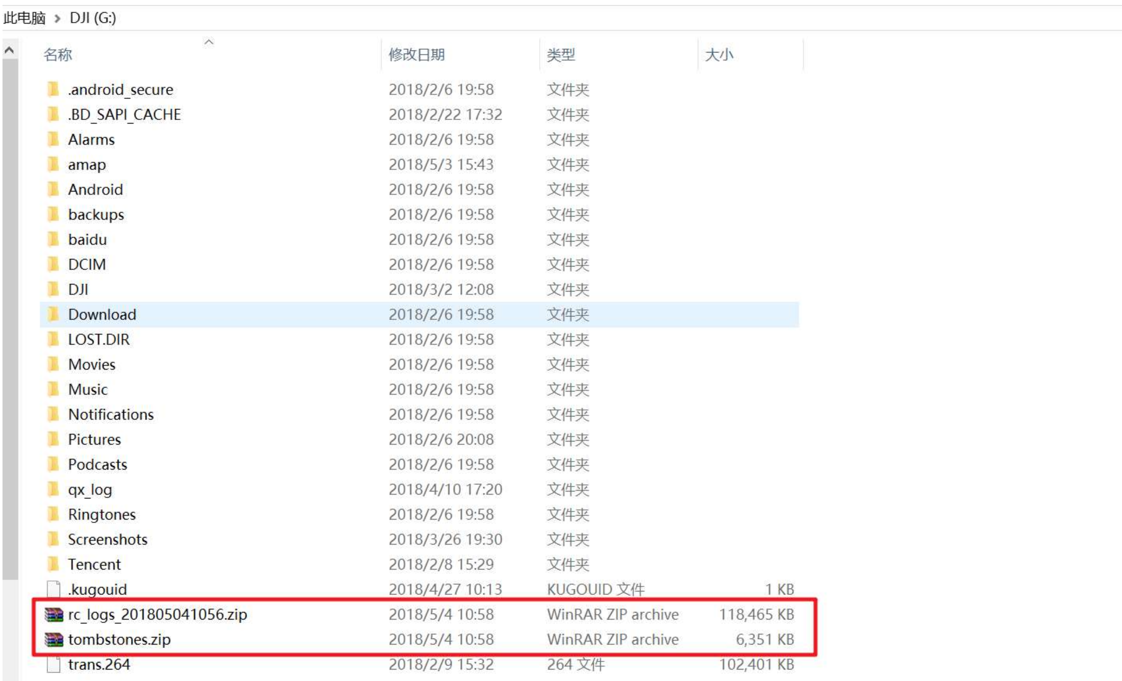


Step 2:

Connect the remote controller to a PC, and enable the remote controller's USB flash drive mode. Export Log-rc_logs_2018xxxx.zip and tombstones.zip.



Open “My Computer”, find the file corresponding to the remote control Log, and copy the file therein.



此电脑 > DJI (G:)

名称	修改日期	类型	大小
.android_secure	2018/2/6 19:58	文件夹	
.BD_SAPI_CACHE	2018/2/22 17:32	文件夹	
Alarms	2018/2/6 19:58	文件夹	
amap	2018/5/3 15:43	文件夹	
Android	2018/2/6 19:58	文件夹	
backups	2018/2/6 19:58	文件夹	
baidu	2018/2/6 19:58	文件夹	
DCIM	2018/2/6 19:58	文件夹	
DJI	2018/3/2 12:08	文件夹	
Download	2018/2/6 19:58	文件夹	
LOST.DIR	2018/2/6 19:58	文件夹	
Movies	2018/2/6 19:58	文件夹	
Music	2018/2/6 19:58	文件夹	
Notifications	2018/2/6 19:58	文件夹	
Pictures	2018/2/6 20:08	文件夹	
Podcasts	2018/2/6 19:58	文件夹	
qx_log	2018/4/10 17:20	文件夹	
Ringtones	2018/2/6 19:58	文件夹	
Screenshots	2018/3/26 19:30	文件夹	
Tencent	2018/2/8 15:29	文件夹	
.kugouid	2018/4/27 10:13	KUGOUID 文件	1 KB
rc_logs_201805041056.zip	2018/5/4 10:58	WinRAR ZIP archive	118,465 KB
tombstones.zip	2018/5/4 10:58	WinRAR ZIP archive	6,351 KB
trans.264	2018/2/9 15:32	264 文件	102,401 KB

Satellite observation data (PPKRAW.BIN), Timestamp.MRK and images:

When a map building error occurs, image and satellite observation data are required.
The RTK data is saved on the SD card, together with images. The RTK data is generated in each flight.

100_0008_0183.JPG	2018/10/21 16:26	JPEG 图像	9,010 KB
100_0008_0184.JPG	2018/10/21 16:26	JPEG 图像	8,677 KB
100_0008_0185.JPG	2018/10/21 16:26	JPEG 图像	8,778 KB
100_0008_EVENTLOG.bin	2018/10/21 16:26	UltraEdit Docum...	12 KB
100_0008_PPKRAW.bin	2018/10/21 16:27	UltraEdit Docum...	1,576 KB
100_0008_Rinex.obs	2018/10/21 16:27	OBS 文件	8,957 KB
100_0008_Timestamp.MRK	2018/10/21 16:26	MRK 文件	24 KB

PC GS Pro log:

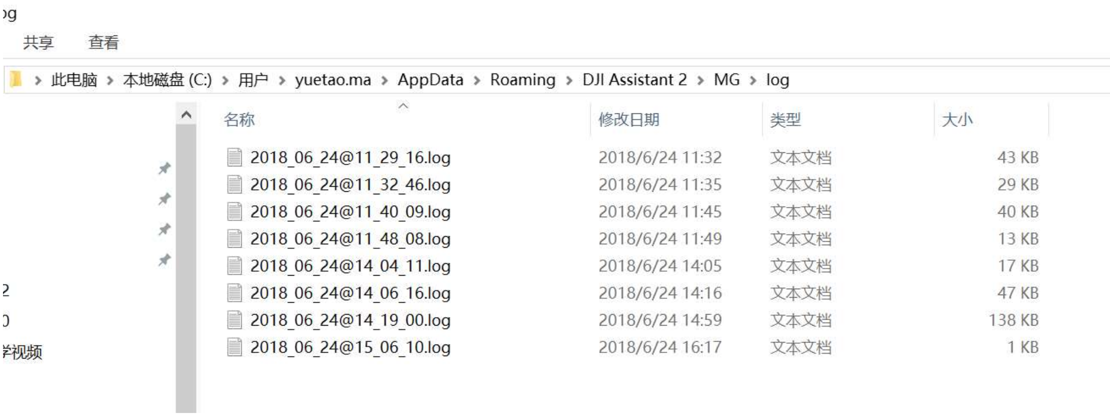
Please upload the PC GS Pro log when there is an issue with PC GS Pro (Crash, map building issue, airline planning error, control error by using PC GS Pro etc.).
Ground station data is uploaded from the folder C:\Users\AppData\Roaming\PC GS PRO\log, according to the sequence of time.

C:\Users\yuetao.ma\AppData\Roaming\PC GS PRO\log 搜索"log"

名称	修改日期	类型	大小
2018_04_07@10_20_17.log	2018/4/7 10:20	文本文档	2 KB
2018_04_07@10_23_36.log	2018/4/7 10:24	文本文档	2 KB
2018_04_08@12_44_21.log	2018/4/8 12:54	文本文档	2 KB
2018_04_08@12_54_28.log	2018/4/8 12:54	文本文档	2 KB
2018_04_08@12_56_42.log	2018/4/8 14:19	文本文档	2 KB
2018_04_08@14_19_34.log	2018/4/8 14:20	文本文档	1 KB
2018_04_08@14_20_31.log	2018/4/8 14:32	文本文档	2 KB
2018_04_08@14_43_27.log	2018/4/8 15:13	文本文档	4 KB
2018_04_08@22_56_52.log	2018/4/8 22:57	文本文档	3 KB
2018_04_09@12_00_34.log	2018/4/9 12:05	文本文档	2 KB
2018_04_09@17_01_49.log	2018/4/9 17:02	文本文档	2 KB
2018_04_09@19_49_10.log	2018/4/9 19:51	文本文档	4 KB
2018_04_10@11_14_51.log	2018/4/10 11:17	文本文档	2 KB
2018_04_10@17_16_35.log	2018/4/10 17:40	文本文档	276 KB
2018_04_10@17_45_42.log	2018/4/10 18:06	文本文档	204 KB
2018_04_10@18_08_04.log	2018/4/10 18:48	文本文档	237 KB
2018_04_11@11_13_00.log	2018/4/11 12:31	文本文档	891 KB

Log of DJI Assistant 2 for Phantom:

Log of DJI Assistant 2 is uploaded from the folder C:\Users\Username\AppData\Roaming\DJI Assistant 2\MG\log or from C:\Users\Username\AppData\Roaming\DJI Assistant 2\PHANTOM\log, according to the sequence of time.



共享
查看
此电脑 > 本地磁盘 (C:) > 用户 > yuetao.ma > AppData > Roaming > DJI Assistant 2 > MG > log
名称
修改日期
类型
大小
2018_06_24@11_29_16.log 2018/6/24 11:32 文本文档 43 KB
2018_06_24@11_32_46.log 2018/6/24 11:35 文本文档 29 KB
2018_06_24@11_40_09.log 2018/6/24 11:45 文本文档 40 KB
2018_06_24@11_48_08.log 2018/6/24 11:49 文本文档 13 KB
2018_06_24@14_04_11.log 2018/6/24 14:05 文本文档 17 KB
2018_06_24@14_06_16.log 2018/6/24 14:16 文本文档 47 KB
2018_06_24@14_19_00.log 2018/6/24 14:59 文本文档 138 KB
2018_06_24@15_06_10.log 2018/6/24 16:17 文本文档 1 KB