



TAP2MAP[©]

An IOS 3D flight planner for DJI drones



TAP2MAP

“Never leave a picture behind”

The usage of Tap2Map application is done under your sole responsibility. You acknowledge that you are habilitated to fly and that you are respectful of your country's aerial rules for drone usage, that you fully comply with your State laws and your Civil Aviation Authorities (CAA) laws regarding the usage of a drone under this application. You acknowledge that you agreed to our "Terms and Conditions". You acknowledge that Tap2Map is not responsible of any law breaking, of any accident due to your behavior, and that it is your sole decision to fly where you intend to.



TAP2MAP - Application Start guide

Welcome in Tap2Map application. This Application only works with **IOS devices**.

On the first connection you will be prompted to log in your DJI account, then you'll have to provide a mobile phone number where you will receive an authentication code which will allow you to open the App.

GENERAL INFORMATION

Before entering in the technical details of each type of missions, **please note that our application is one of the only Application on the market that is offering the option of TERRAIN FOLLOWING**. This option will popup once all parameters of a particular mission will have been set up by the user an "NEXT" will have been pressed.

Supported DJI drones (sept.2019):

Inspire1, Inspire2 – Phantom 3, Phantom 4, Phantom 4 Pro, Phantom 4 Pro V2 – Matrice 100, Matrice 200, Matrice 600, Matrice 600 Pro, Matrice 210, Matrice 210 RTK - Mavic Pro, Mavic 2 Pro/Zoom/Enterprise - Spark

Note: Avoid to open/run another Drone dedicated Application at the same time on your IOS device, this may cause interferences with the present application.

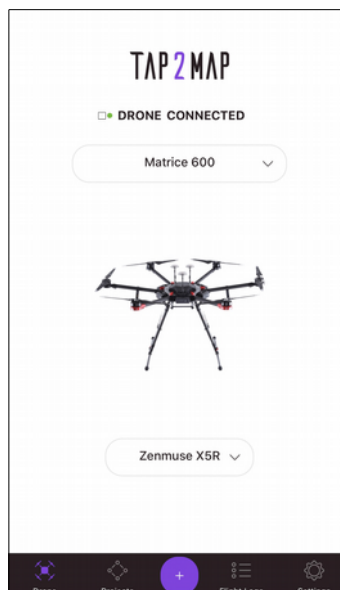
Images triggering:

In our Application the automated images triggering is not linked to a time interval, itself related to the aircraft speed. The position of each triggering point comes from precise math related to the chosen camera effective sensor footprint, the focal length, the choice of the GSD and the parameters chosen for the longitudinal overlap.

This provides an accurate image position based on precise computed position (Lat, Lon, Elevation) along the flight line coordinates, the camera is triggered as soon as the aircraft enters a very small buffer centered on those coordinates.

Note: be aware that using a « slow » memory SSD or having a too small time intervals between 2 consecutive images (low flight +high speed) may result in an issue in the writing of the image data on the SSD despite the size of the camera buffer.

The Application keeps in memory all project that have been flown unless they are deleted by the user, this allows to interrupt the operations for any reason (batteries, wind, weather,...) and restart later where the flight has been interrupted



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About “Terrain Following”:

Terrain following is one of the most important thing to have in this kind of “close range” aerial imagery.

The influence of terrain variation is tightly related to the size of the GSD, in terms of ratio GSD/AGL. So, the closer (lower) the flight, the more sensible is the terrain elevation variation.

The advantage of the terrain following option is double:

- You keep the GSD more regular compared with an application where you don't have this option,
- You keep the image footprint nearly constant, and so your overlaps will really be abided.

It might be possible that some users have not completely weighted how big is the influence of terrain variation under the aircraft on their chosen overlaps... In Tap2Map we have this photogrammetrists sensibility, which is completely math related.

First, be aware that poor overlaps will completely jeopardize your project: if a photogrammetrist can't find enough tie points between two images, a software will not either.

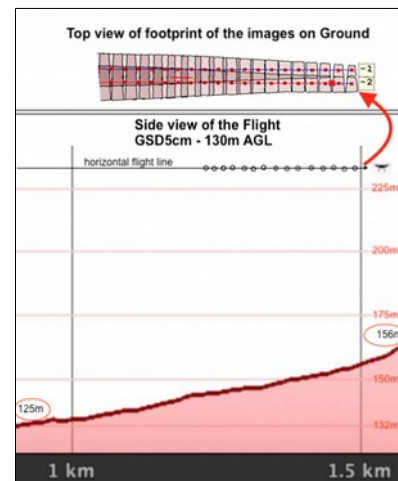
In order to make things clear, let's have a look on a terrain elevation variation on a flight that was schedule at a constant elevation AGL (above the start point altitude)...

This image shows the influence of a terrain variation in elevation of +21 meters (68 Ft) on a flight which started at 130m AGL (426 Ft), say a GSD of $\pm 4\text{cm}$ (± 1 inch)...

On the upper part, one can see a top view of the images footprints overlaps:

- at the beginning of the line, the forward overlap was set to 65% and the lateral overlap was 55%,
- far before the end of line, there is not enough or no more image overlaps.

The project is completely unusable, and there is no real solution... the only solution that should mitigate this kind of situation is to increase the lateral and longitudinal overlaps... but it wont be a real solution as the overlaps will again change, and it will obviously increase the number of lines and images to process.



The only way to definitely cure this issue is a “terrain Following” solution: Tap2Map offers this solution in all its missions type.

Be aware that there are many sources to get a DTM (Digital Terrain Model) that can be used in the applications to offer this type of option. The most known is the so called SRTM (Shuttle Radar Topography Mission), which is widely used by all the GIS community.

Unfortunately the data sourcing of all the online realtime upload providers is a bit “blurry”, and nobody can really guarantee “what is the DTM/DSM accuracy in which place”. Nevertheless, our choice was to integrate as much chances as possible to get a 3D data as we could, this was not for free, but it's 100% transparent for our users as it's a built-in solution in the Application – **Note: This option makes compulsory to have an internet connexion when you create you mission as the DTM/DSM data are in a third party cloud, then you can work without internet on the field.**

Note: This Terrain Following option uses a third party data in order to maintain a relatively constant altitude above ground (AGL). The accuracy of the 3D model used is not under our control, Tap2Map will not be responsible for any drone collision/accident occurring due to the use of this option.

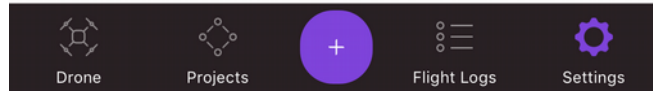
In the future versions of Tap2Map, we do think to develop the possibility to **import your own DTM or DSM** grid under a specific format.



TAP2MAP - Application Start guide

Once the App. is opened, you will have to choose a DJI drone from the drone list (this can be changed later on) and/or a camera which will depend on the type of drone you choose. Please note that as far as no drone is turned on and connected with the App, it might be possible that some option/display of this Application will not work properly.

The bottom bar, offers 5 choices:



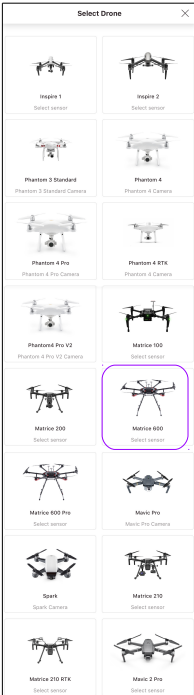
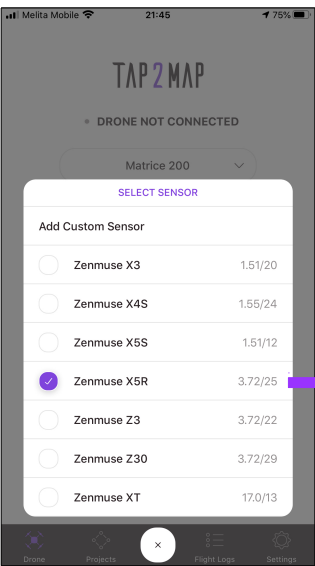
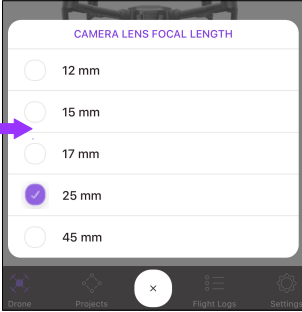
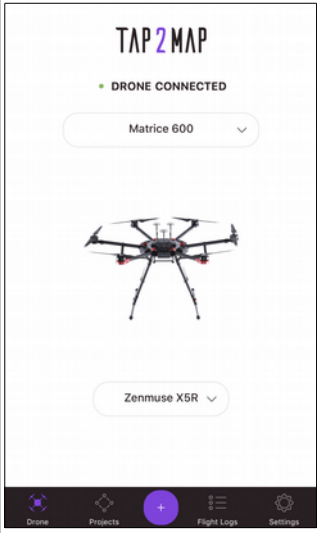
- **Drone:** which will reopen the drone list for another aircraft or camera choice,
- **Projects:** Which opens a list of already created/started projects, with the percentage of completion, and offers the possibility to export the flight and images position,
- **The ADD (+) button** where one can choose among a number of 6 possibilities to create a new project,
- **Flight Logs:** where the final log after a flight will be stored. This is an important one as the image tags (position, elevation, time) are stored in the corresponding files of each project,
- **Settings:** where the user will be given the possibility to set a number of options and read our terms and conditions.

DRONE

This choice will open a list of the supported drones.

According to which drone you choose, another list might popup for the camera choice.

If you use your own camera, please create your "Custom Camera Sensor" (in Settings) prior to choose the drone.

Select drone:	Select sensor:	Select Lens: <i>(for Zenmuse Cameras)</i>	Custom Camera Sensor
			

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TAP2MAP - Application Start guide

PROJECTS



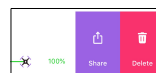
Opening this tab will allow to see the list and the percentage of completion on all the projects that are in the IOS device: get a list of all existing projects, Share a KML file of the flown part, See the project settings, Erase the project.



A simple touch on the project will open a project overview where one can see:

<p>Overview:</p> <p>The global project completion information</p>	
<p>Sub-blocks:</p> <p>The individual completion per sub-block</p>	
<p>Settings:</p> <p>This display shows the project flight settings used for the acquisition</p>	
<p>Drone:</p> <p>Shows the aircraft used and some other parameters</p>	

Any project can be shared or erased by swiping to the left:

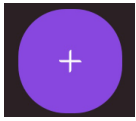


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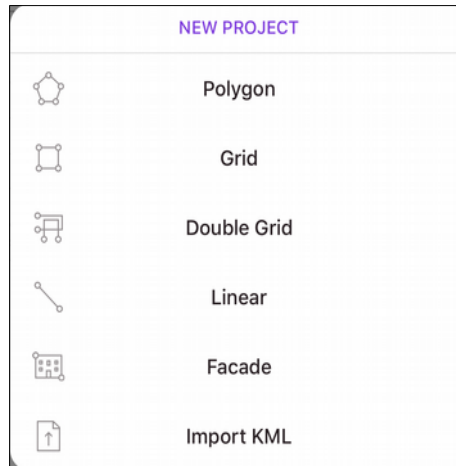


MAIN BUTTON (ADD/CREATE A NEW MISSION)

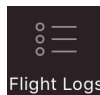
The main button allow the user to add a new mission.



This button will open the following menu:



The different functionalities of each type of mission will be described in the next pages.



FLIGHT LOGS

The flight logs come in a **[.csv] format** and can be exported to the dropbox.

In the logs, one can find for each image triggering all necessary information of position, elevation, time tag, etc...coming from the images EXIF - The raw Log file looks like this:

```
#,Time,Action Type,Project Name,Sub-block,File Name,Error,Latitude,Longitude,Altitude,Bearing,Yaw,Pitch,Roll,Gimbal Yaw,Gimbal Pitch,Gimbal Roll,Velocity X,Velocity Y,Velocity Z
Start new Flight line
2,Dec 06-2019-03:19:15 PM,Save Photo,gyjn,,DJI_0201.jpg,,35.863741,14.556000,50.90,-91.0,-91.00,-9.50,2.30,-102.60,-90.00,0.00,0.00,-4.90,0.10
3,Dec 06-2019-03:19:18 PM,Save Photo,gyjn,,DJI_0202.jpg,,35.863738,14.555857,50.50,-91.1,-91.10,-9.80,1.70,-102.10,-90.00,0.00,0.00,-4.90,0.00
4,Dec 06-2019-03:19:22 PM,Save Photo,gyjn,,DJI_0203.jpg,,35.863736,14.555659,49.80,-91.0,-91.00,-8.80,2.00,-101.80,-90.00,0.00,0.00,-5.00,0.00
5,Dec 06-2019-03:19:25 PM,Save Photo,gyjn,,DJI_0204.jpg,,35.863733,14.555454,49.40,-91.2,-91.20,-9.10,2.40,-101.60,-89.90,0.00,0.00,-5.00,0.00
6,Dec 06-2019-03:19:29 PM,Save Photo,gyjn,,DJI_0205.jpg,,35.863730,14.555260,48.90,-91.1,-91.10,-9.30,2.00,-101.50,-89.90,0.00,0.00,-5.00,0.00
7,Dec 06-2019-03:19:32 PM,Save Photo,gyjn,,DJI_0206.jpg,,35.863728,14.555061,48.70,-91.1,-91.10,-9.90,2.00,-101.40,-90.00,0.00,-0.10,-4.90,-0.10
8,Dec 06-2019-03:19:36 PM,Save Photo,gyjn,,DJI_0207.jpg,,35.863724,14.554868,48.70,-91.2,-91.20,-10.20,2.40,-101.40,-90.00,0.00,0.00,-4.90,-0.10
```

from where one can extract the proper/essential camera attitude which can be used in third party softwares:

File Name	Error	Latitude	Longitude	Altitude	Gimbal Yaw	Gimbal Pitch	Gimbal Roll	Velocity X	Velocity Y	Velocity Z
Start new Flightline										
DJI_0201.jpg		35.863741	14.556000	50.90	-102.60	-90.00	0.00	0.00	-4.90	0.10
DJI_0202.jpg		35.863738	14.555857	50.50	-102.10	-90.00	0.00	0.00	-4.90	0.00
DJI_0203.jpg		35.863736	14.555659	49.80	-101.80	-90.00	0.00	0.00	-5.00	0.00
DJI_0204.jpg		35.863733	14.555454	49.40	-101.60	-89.90	0.00	0.00	-5.00	0.00
DJI_0205.jpg		35.863730	14.555260	48.90	-101.50	-89.90	0.00	0.00	-5.00	0.00
DJI_0206.jpg		35.863728	14.555061	48.70	-101.40	-90.00	0.00	-0.10	-4.90	-0.10
DJI_0207.jpg		35.863724	14.554868	48.70	-101.40	-90.00	0.00	0.00	-4.90	-0.10
DJI_0208.jpg		35.863722	14.554668	48.80	-101.40	-90.00	0.00	0.00	-5.00	0.00
DJI_0209.jpg		35.863719	14.554469	48.80	-101.30	-90.00	0.00	-0.10	-5.00	-0.10
DJI_0210.jpg		35.863716	14.554268	48.90	-101.30	-90.00	0.00	0.00	-5.00	0.00
DJI_0211.jpg		35.863713	14.554074	48.90	-101.30	-90.00	0.00	0.00	-5.00	-0.10
DJI_0212.jpg		35.863710	14.553874	48.90	-101.30	-90.00	0.00	0.00	-5.00	0.00
DJI_0213.jpg		35.863707	14.553675	49.00	-101.30	-89.90	0.00	0.00	-4.90	0.00
DJI_0214.jpg		35.863704	14.553465	49.00	-101.20	-90.00	0.00	-0.10	-4.90	0.00
DJI_0215.jpg		35.863703	14.553349	49.00	-101.30	-89.90	0.00	0.00	-1.50	-0.20
Start new Flightline										
DJI_0216.jpg		35.863993	14.553342	52.70	75.50	-90.00	0.00	0.10	4.90	0.10
DJI_0217.jpg		35.863996	14.553445	52.60	76.70	-90.00	0.00	0.00	4.90	0.20
DJI_0218.jpg		35.863999	14.553644	52.40	77.50	-90.00	0.00	0.00	5.00	0.10
DJI_0219.jpg		35.864001	14.553842	52.30	77.90	-89.90	0.00	0.00	5.00	0.10

As you may know: DJI "altitude" given in the EXIF files is NOT a GPS absolute altitude reading, but a barometric elevation above the takeoff point. This is a pity that this information doesn't come from GPS as it may be available...

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SETTINGS

At the bottom of this page, one can see the App version number.

Prior to choose a flight mission type, we recommend to go into this settings page.

This will allow you to access the following option and/or information:

- **DJI:** will show the status of your login,
- **DropBox:** will show the status of your connexion,
- **Custom camera sensors:** where you can create your own camera sensor > Naming, Focal length, effective sensor width (in final image pixels), effective sensor height (in final image pixels), CMOS size in microns (μ) which is the size of a photo-site on the sensor.
- **Flight Settings** section, where to tune all your standard flight preferences. This includes a lot of choices such as:
 - Measurement Units (metric or Imperial),
 - Photo file format to be saved (Jpeg, Raw, Jpeg+Raw)
 - Drone collision sensor switch,
 - RTH elevation (above Take-off point),
 - Drone Max Flight Time estimated safe flight time according to your battery knowledge,
 - GSD choice (GSD is linked to AGL according to your camera choice),
 - AGL choice (AGL is linked to GSD according to your camera choice),
 - Facade preferred distance,
 - Across (Lateral) overlap (% between images of 2 adjacent flight lines)
 - FWD (Longitudinal) overlap (% between images of a same line),
 - Drone speed (in meters per second m/s),
 - Longitudinal buffer (how many images to overlap the next sub-block or line).



STARTING A MISSION

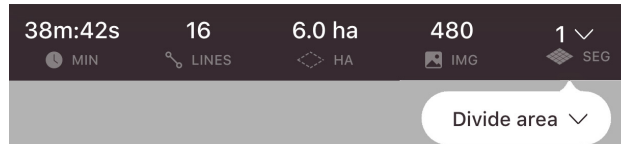
Once you'll chose a mission type, here are the usual steps to follow that are described below for the first mission type of the list: Polygon.

Nearly all these steps and settings can be used in all other types of missions, the slight changes will be explained in each corresponding chapters.

POLYGON

In this mission, one can draw any type of shape, add/delete AOI edges by using the small "+" dot between 2 existing vertices.

The block can also be rotated directly from the finger on the screen. Selecting "Next" will prompt to give a name to the project and the App will calculate and display the flight lines and the images' triggering position according to your basics settings.





The upper display bar will show:

- Flight time estimation,
- Number of lines to be flown,
- Total area size of the AOI,
- Number of images to complete the mission,

It will automatically open the possibility to divide the area when the estimated flying time will reach the battery endurance that you choose to enter in the settings.

Note: flight time estimation do not take into account any wind conditions, which may drastically affect the total endurance of a battery. We recommend to stay conservative in the setting of the "Drone Max flight time" in your preferences!





After validation of your area, type "NEXT". The Application will calculate and display the lines and the images centers position according to your settings preferences. The parameters can now be changed through the setting button at the bottom left. 

The flight lines orientation can also be changed by using the small icon directly on the  screen: At this stage it's still possible to change the drone type: the App will recalculate the lines position and the image position for this new drone/camera/lens.

Moving the virtual RTH point that appeared, will help the user to check his flight time according to a supposed take off point. In all cases the "real" RTH point will be fixed on site when taking off and final real flight time will be calculated accordingly.

The entry point of the flight lines (green mark), is linked to the drone's take-off position once on the field: it is always at one end of the farthest line. The flight initial direction is calculated in order to end up the flight and go out of the block (red mark) as close as possible from the take-off place.

On the bottom of this screen, there a four (4) icons:

-  Settings: This will allow to check/adapt/change the acquisition parameters
-  Drone: allows to change aircraft.
-  Map: allows to switch from image background to vector background
-  Next: will drive you to the "flight screen".

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Divide area:

If the block is too large for a single battery endurance (time chosen in the settings): then the **Divide Area** option will popup a window where the battery flight time can be set and/or confirmed, Tap2Map will then adjust a number of sub-blocks accordingly, in order to have a flight time value over AOI not bigger than the battery estimated time setup.

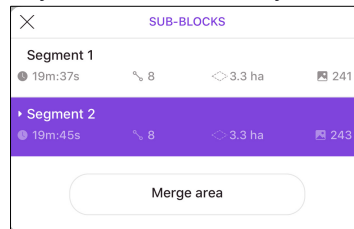
When the divide area has been set, the **Longitudinal buffer** that has been set in the Flight Settings Preferences (how many images in overlap) will then apply, and all the blocks will get a common imagery overlapping between them accordingly. This great option opens a very good safety in the final product accuracy by giving a large redundancy by linking each block to the next one through images tie points and possible GCPs location (*will soon be available in the next version*)

Once you press on “Divide Area”, the App will popup your battery endurance for you to confirm the proper desired duration (make it lower in case of strong winds, or postpone the flight). After validation, the block will be divided in as many sub-blocks as needed.

The upper bar will then show how many sub-block you have:



Press on this icon to choose which block you want to select/fly, or to merge the whole block again:

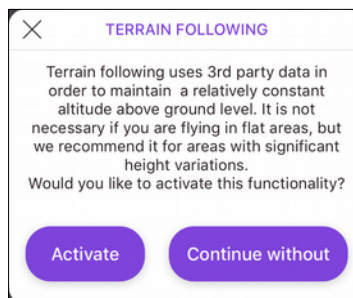


Alternatively, you can press on the desired block directly on the IOS device screen.

Now press NEXT to go in the “flight screen:



TERRAIN FOLLOWING Option: The App will prompt you to choose if you need option to be activated:



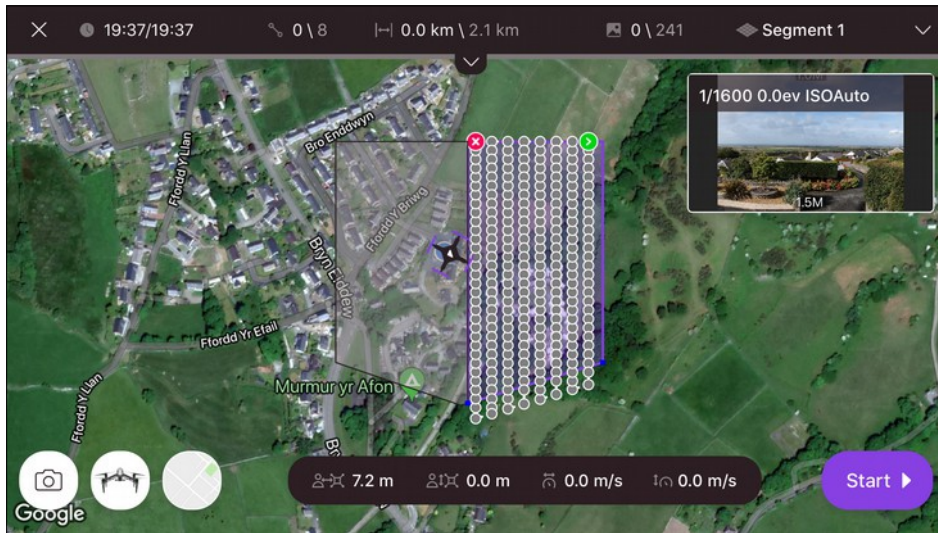
You can either choose “Activate”, then the drone will follow terrain at a relative constant altitude above Ground... or choose “continue without” if your AOI to fly is nearly flat.

Note: This option of Terrain Following uses a third party data in order to maintain a relatively constant altitude above ground (AGL). The accuracy of the 3D model used is not under our control, Tap2Map will not be responsible for any drone collision/accident occurring due to the use of this option.

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FLIGHT ACQUISITION SCREEN:



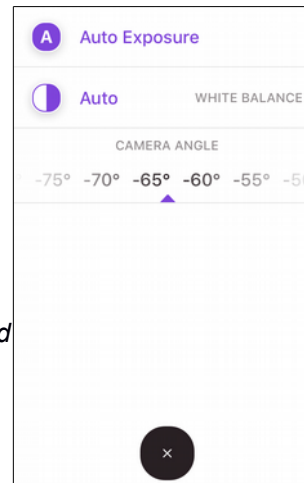
Once in the “flight acquisition screen” it will be possible to adjust the settings on a technical point of view, and also play on the image exposure choice.


The small “camera view” can be switched with the global view (tap on it), and can also be moved (maintain and slide) to another part of the main screen.

Press on Camera icon: 

- Change the exposure (from AUTO to MANUAL): will open the possibility to choose the shutter speed and the ISO setting,
- Switch the White Balance to AUTO or Clouds
- change the camera vertical orientation angle: from -90° to 0° by 5° steps.

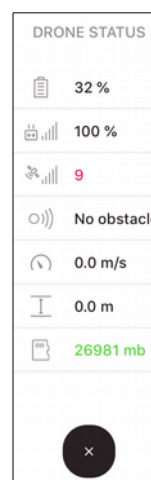
Note: in Double Grid mode the camera angle is preset to fixed values: -30°, -45° and -60°



Press on Drone icon: 

This display shows:

- the drone battery charge status,
- the remote control signal strength,
- the number of visible GNSS satellites,
- the obstacle indicator,
- the aircraft ground speed,
- the height above start point,
- the memory card status.



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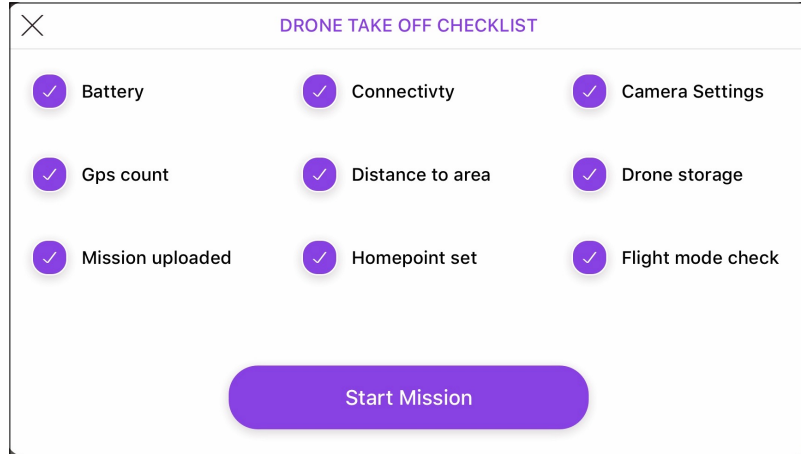


Press on **START**:

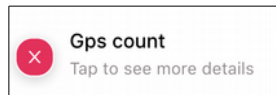


This last action before flight will open the final “Drone Take Off Checklist” screen where all nine crucial parameters will be validated.

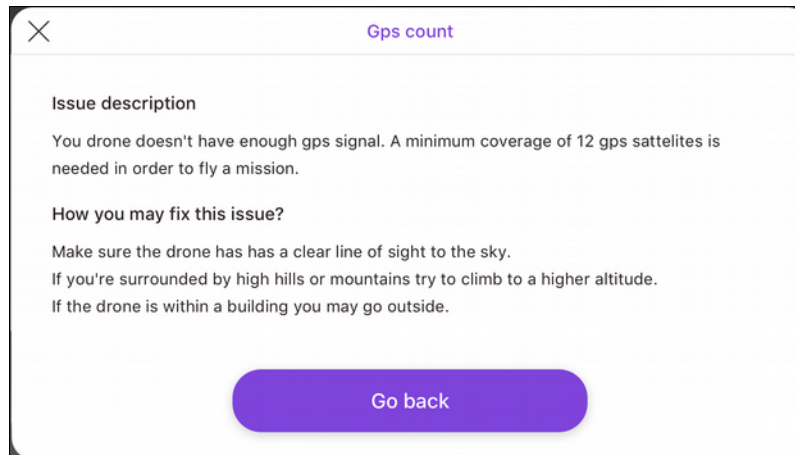
Note: it may take some times to upload the mission.



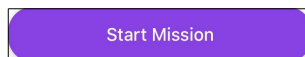
If one of the parameters displays an error:



There will be a short recommendation appearing when tapping on the error sign, this will help to mitigate/solve the error:



When everything looks good, you can start the flight by pressing “Start Mission” button on the previous screen.



Note: this button will NOT be ACTIVATED as long as an error message will remain red.

The App.will will then automatically: start the drone's engines, take-off, reach its nominal elevation, and ferry to the entry point (green on the display), execute the whole mission flight, come back and land.

At any time, the mission can be paused and/or cancelled

All the above description/options will be available for all the other missions configurations (sometimes with some slight differences) EXCEPT for facade survey missions.

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TAP2MAP - Application Start guide

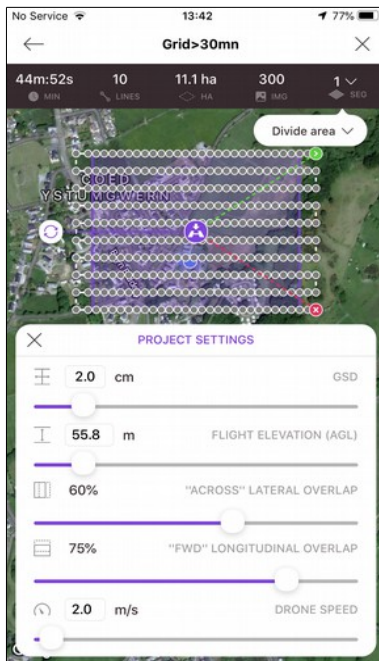
GRID

In this mission type, the Application generate an **orthogonal AOI** that can be adjusted in size, but where it is not possible to add a vertices to the AOI. The images will be set with a chessboard pattern.

The block can be rotated directly from the finger on the screen. All the other options from the above Polygon mission type will be available.

Divide Area option is available, this option will divide the block in as many sub-blocks as necessary according to the battery endurance.

i.e. a block that has been divided:



Each individual block can then be flown independently, with a battery change between the blocks.

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TAP2MAP - Application Start guide

DOUBLE GRID

This option generates 2 sets of flight lines perpendicular to each other, within an orthogonal shape. This type of cross flight is useful for 3D modeling in urban areas. **The camera is preset to fly with OBLIQUE imagery.**

The Application is programmed to fly the 2 perpendicular sets of lines in one go in order to keep the same GPS initialization, under the condition that the time needed is less than the battery endurance (!). If not see below.

This mission doesn't have the "divide Area" option yet... This will come in a next coming version. For the time being, after a battery change, the mission will restart at the previous interruption point.

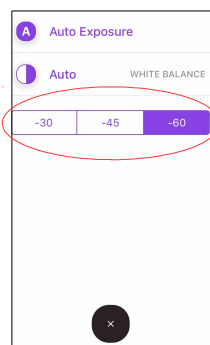
The sequence is to set all parameters needed and the App will design the 2 sets of lines



Once the flight screen appears, the camera settings



will allow you to choose your the OBLIQUE angle which you desire:



It is possible to change the angle in flight (during a turn i.e., or between the two flights). Because of the oblique shooting it is important to think about a buffer of area that is a little larger than the AOI.

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TAP2MAP - Application Start guide

LINEAR (also known as “corridor”)

In this mission type, the user draws a multi-segment line along a linear object (road, river, power-line,...)

Once validated by “NEXT” the App will show the images position.

The user can then make a choice on the width coverage of the corridor and tune it:

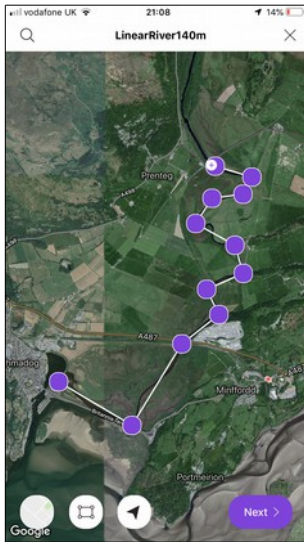
At a certain point, linked to the GSD and lateral overlap settings, the App will automatically add parallel lines on both sides of the main line, in order to cover the needed width.

To be on the safe side and help the operator to keep in the range of VLOS (Visual Line Of Sight), the App offers the possibility to divide the area (or the line) according to a developed length along the route.

Once divided, the Longitudinal Overlap that was chosen in the settings will apply.

The *terrain following* option is also available.

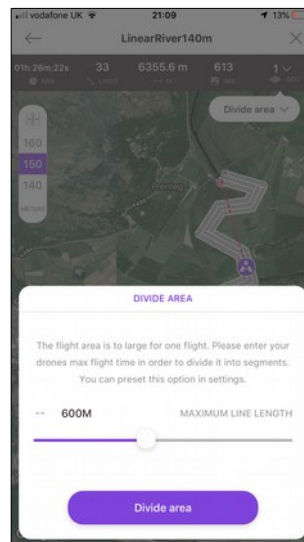
Create Line



Choose width:



Divide Area (for VLOS)



Here are the sub-blocks with Longitudinal overlap:



Hint: in case of power lines linear flight, be aware that the height of the cables are not constant Above Ground Level (AGL) particularly in hilly areas. This can be a real issue for the flight safety as the drone will follow the terrain, and not the cables elevation!

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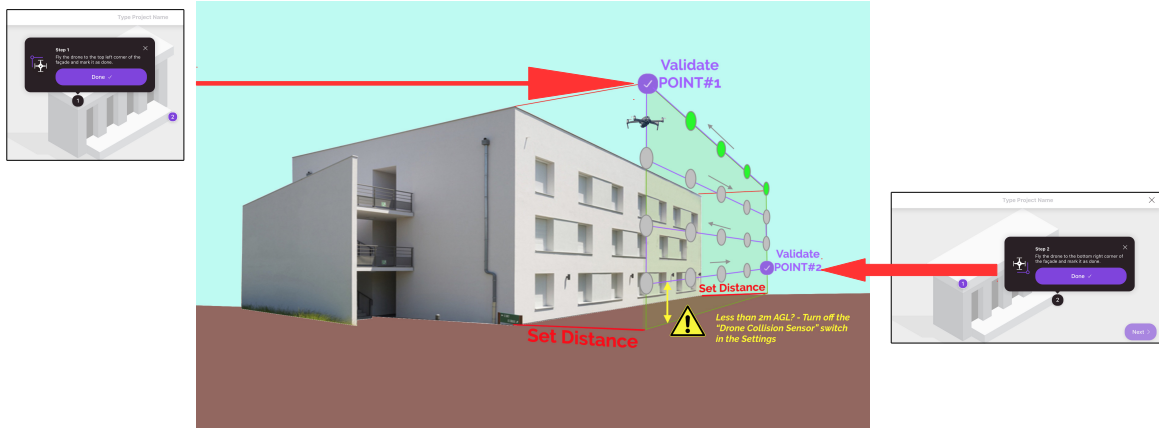


TAP2MAP - Application Start guide

FACADE:

In order to offer the possibility for building modeling, inspection or architectural purpose, this option offers a choice to acquire vertical facade objects. This mission works for individual facades only, not for combined or complex facades shape.

- The facade flight distance: This distance has to be set between 3m to 20m according to your possibilities on the site. Choose it once on the field according from the facade environment and obstacles clearance. The distance will be set by the live validation position of Poin1 and Point#2 (see image below). During positioning to validate the point #1 and #2, the drone has to face the facade with its camera looking forward horizontally.

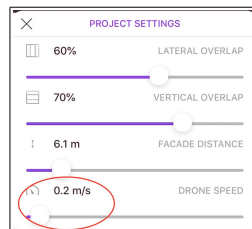


Take care to validate Point #1 **then** Point #2 , in this order, the chosen distance will have to be confirmed in the flight settings table in order to get the proper chosen images overlapping.

If the lowest flight line is at $\pm 2m$ AGL or even less: Prior to enter the mission one have to switch off the obstacle detection sensors in the general setting (*Settings/Flight Settings/Drone Collision Sensors*>OFF / «Yes»)

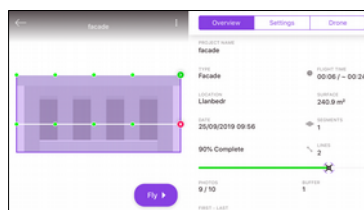
- For this particular mode pay a particular attention to set the drone speed at a minimum speed (0,2 - 0,3 m/s recommended) due to the very close range of such a flight, in order to avoid blurry images.

Once point#1 and #2 recorded, access the settings tab Down Left and check or set tthe flight parameters :



Then « Next » - The mission will upload

The App will create a FP with horizontal lines, the drone will move along these horizontal lines through a lateral movement, with the camera looking forward. Triggering will occur « on the fly » without any hovering.



Then press « **Start Mission** »

Once the flight completed, the drone will hover at the last image position, no RTH is schedule for this mission.

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IMPORT KML:

It is possible to import KML files from the Dropbox, please note that KMZ files cannot be imported.

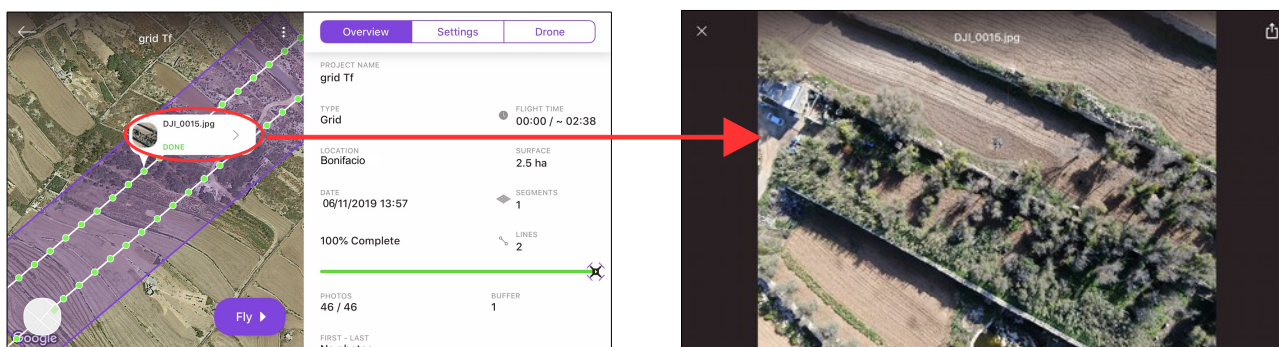
Only closed polygons will be considered as a block.

A line which looks like “closed” on its own start point will not be considered as a closed surface, and will be considered as a linear object which needs a linear flight.

TAP2MAP TIPS AND TRICKS:

How to **check your imagery on the field?**

Of course, you will not have access to full definition images, but just open your job in “Project” (*while keeping your drone connected with the App*), then you can tap on any image of the flight, then select it, you’ll see a big enough thumbnail, where you can zoom-in.



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