



10. MAPPING MISSIONS AND CREATING 2D MAPS

Difficulty Level: Difficult

Completion Period: 2 course hours

Objectives

In this exercise, students will acquire hands-on expertise in planning and executing mapping missions using Unmanned Aerial Vehicles (UAVs) for the creation of 2D maps. Through practical engagement, students will learn the process of mission planning, route optimization, and data collection using drones equipped with mapping software. They will gain proficiency in analyzing and processing captured imagery to generate accurate 2D maps. By the end of this exercise, students will be adept at utilizing drones for mapping applications, demonstrating their ability to leverage technology for spatial data collection and visualization.

Achievements

The skills that our students will gain are:

- Learning how to plan mapping missions considering factors like area coverage and flight altitude.
- Understanding the importance of a well-defined flight path for accurate data collection.
- Developing skills to optimize flight routes for efficient data capture.
- Understanding how to input waypoints and adjust parameters.
- Understanding the concept of georeferencing and its importance in accurate mapping.

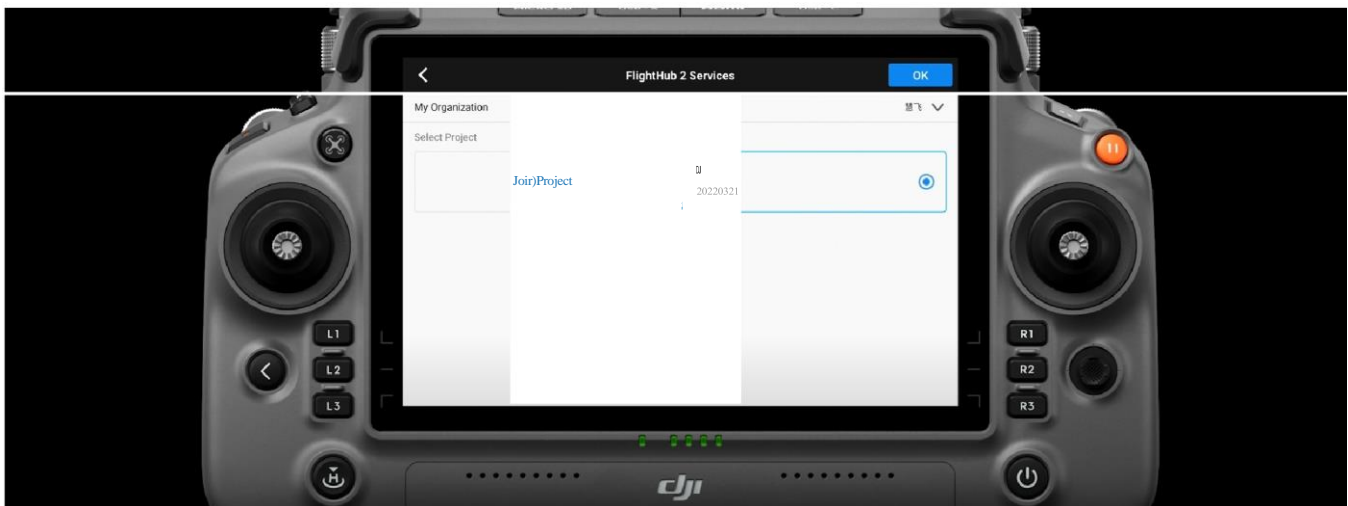
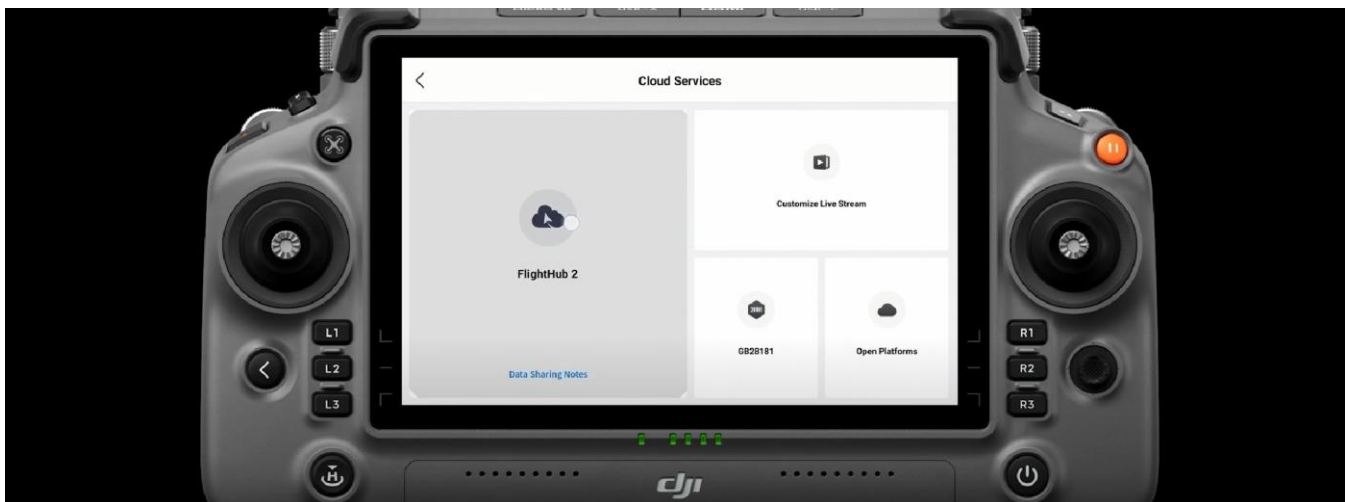
Required material

- Drone Mavic Pro
 - DJI Mavic Pro Remote Controller
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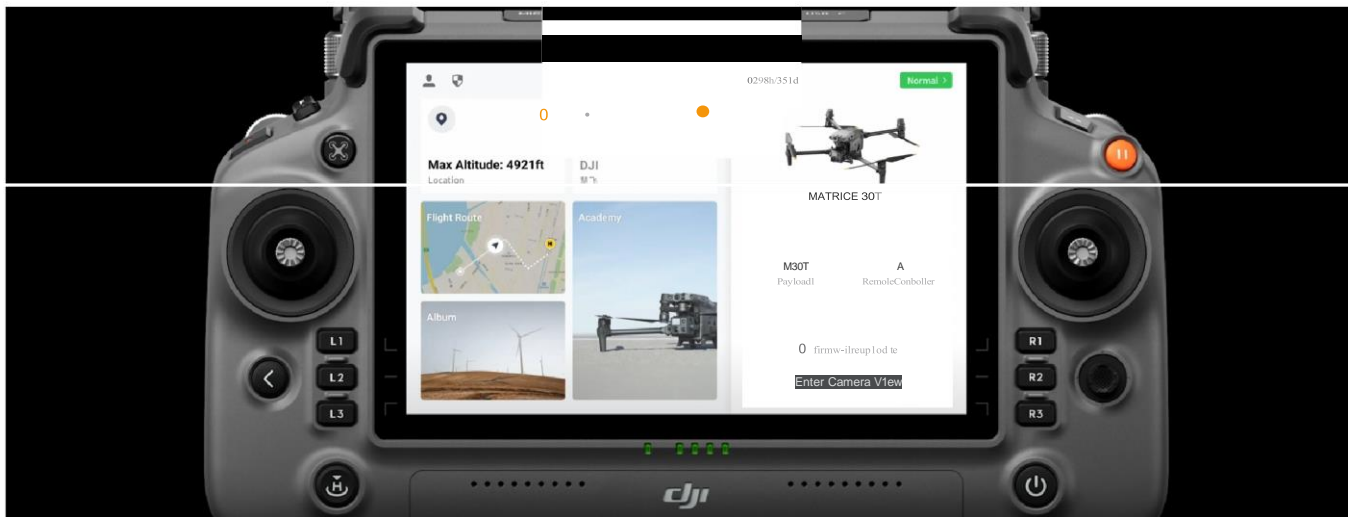
Implementation - Mapping Missions and Creating 2D Maps

1. To perform Cloud mapping you need to login in to DJI Flight Hub 2.

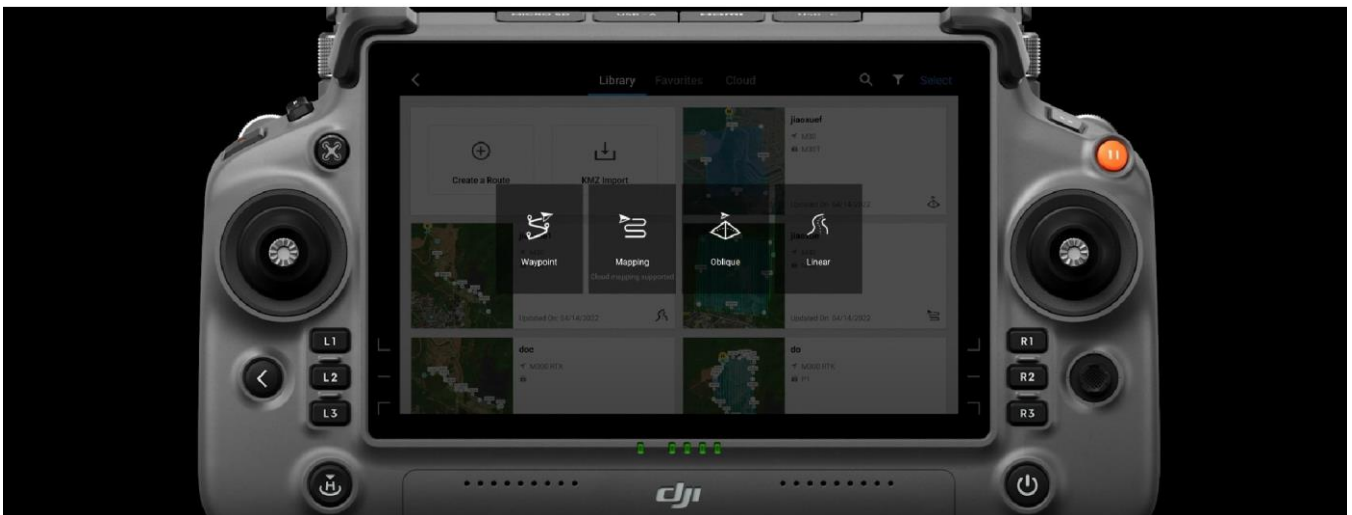




2. Open DJI Pilot and click Flight Route.



3. Select Create a route to view the Mapping options.





4. Within Mapping function, you can delineate your mission area and set the route parameters.



5. Then Pilot will generate a s-shaped flight route automatically.



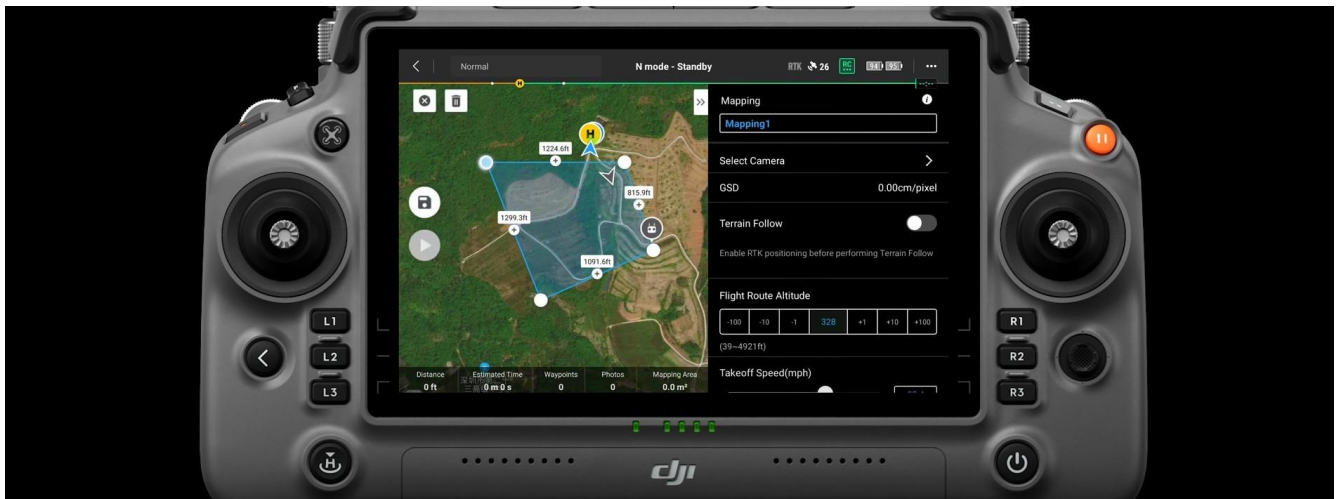


6. After importing the planned route into the Aircraft, the Aircraft will start to collect data.

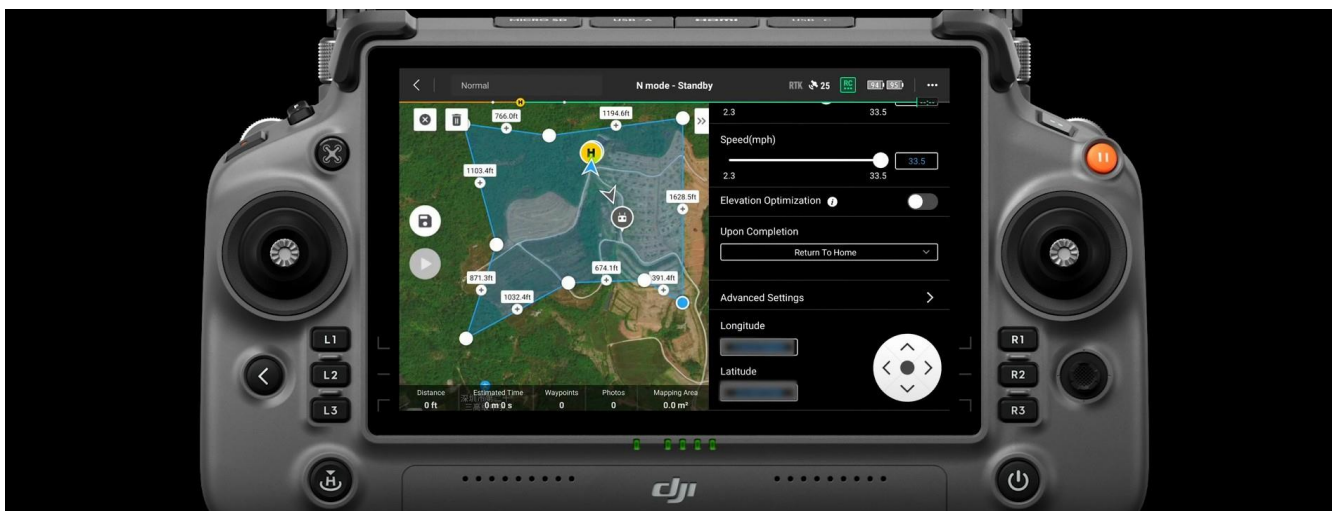


7. Then Pilot will generate a s-shaped flight route automatically.



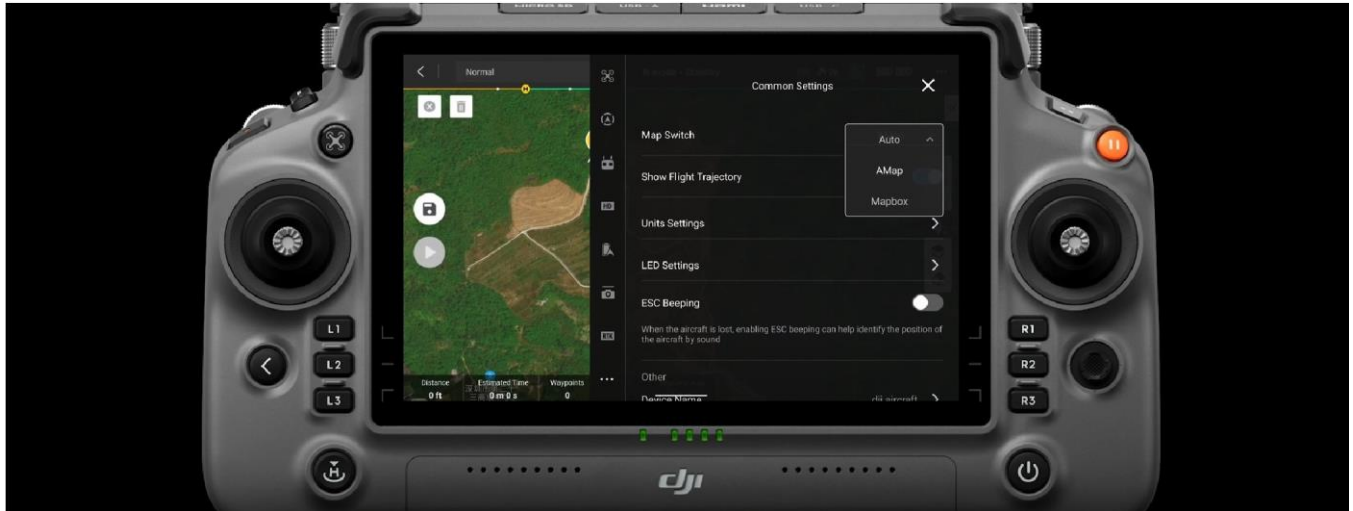


8. Drag the boundary point to the frame of the area or click the plus sign to add boundary point. You can also generate boundary points by entering their longitude. Delete button can delete the selected boundary points and clear button allows you to delete all the boundary points.

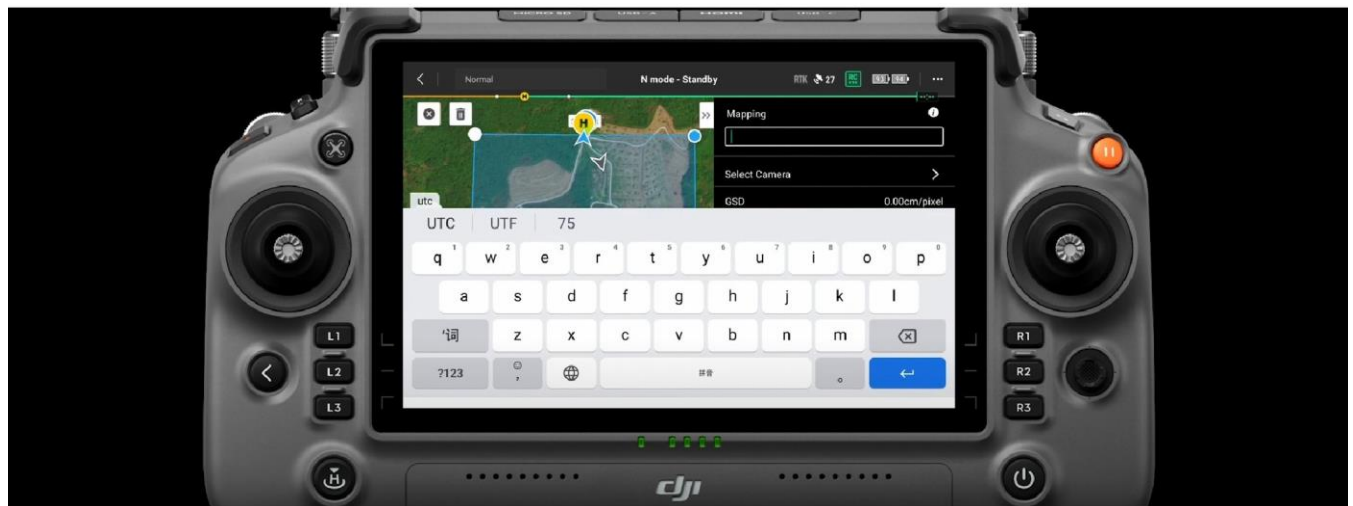




9. Select the base map source in common settings.

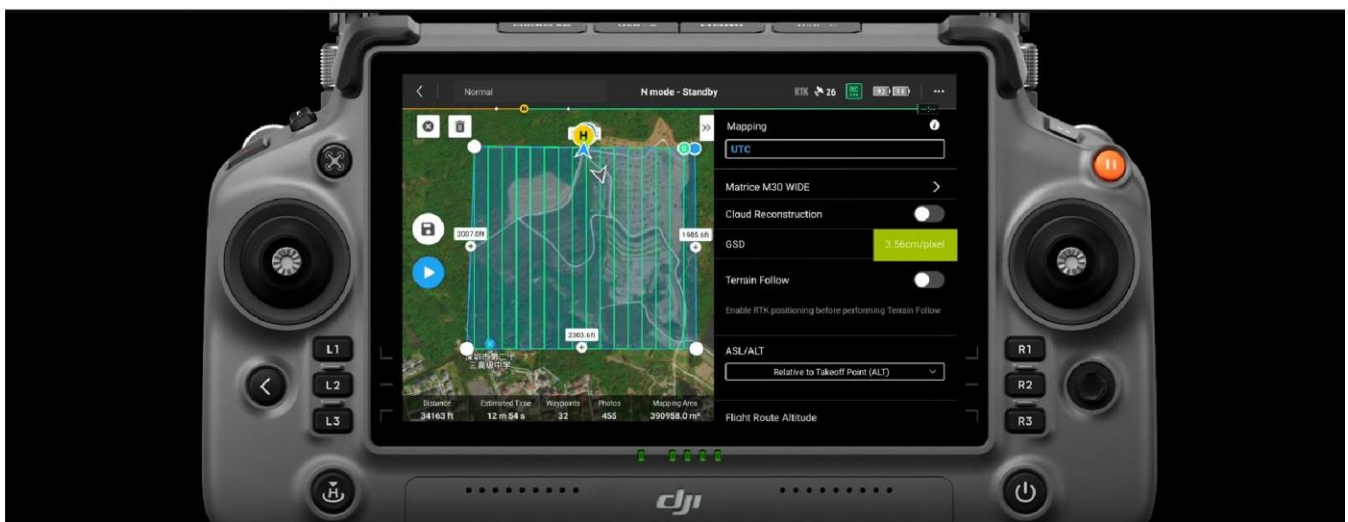


10. After the mission set you can rename the mission and mission name will also be used as the file name of the data storage



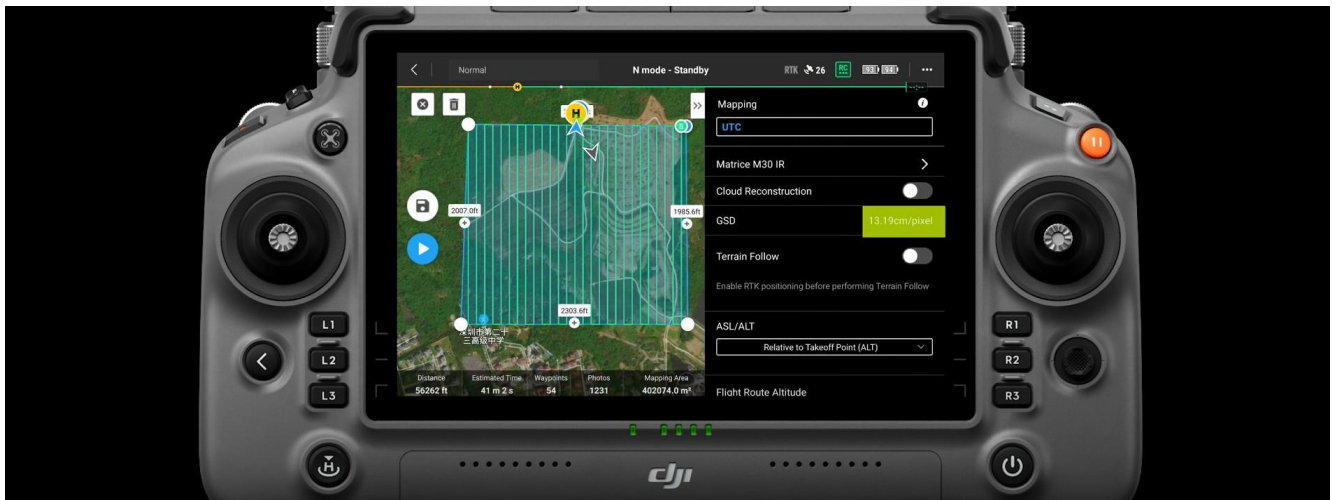


11. Wide + IR. Refers to the wide-angle infrared and wide-angle plus infrared camera. Wide angle camera can capture visible light photos and be used for 2-dimensional map reconstruction. When it's 100 meters away the GSD is 3.56 cm per pixel.

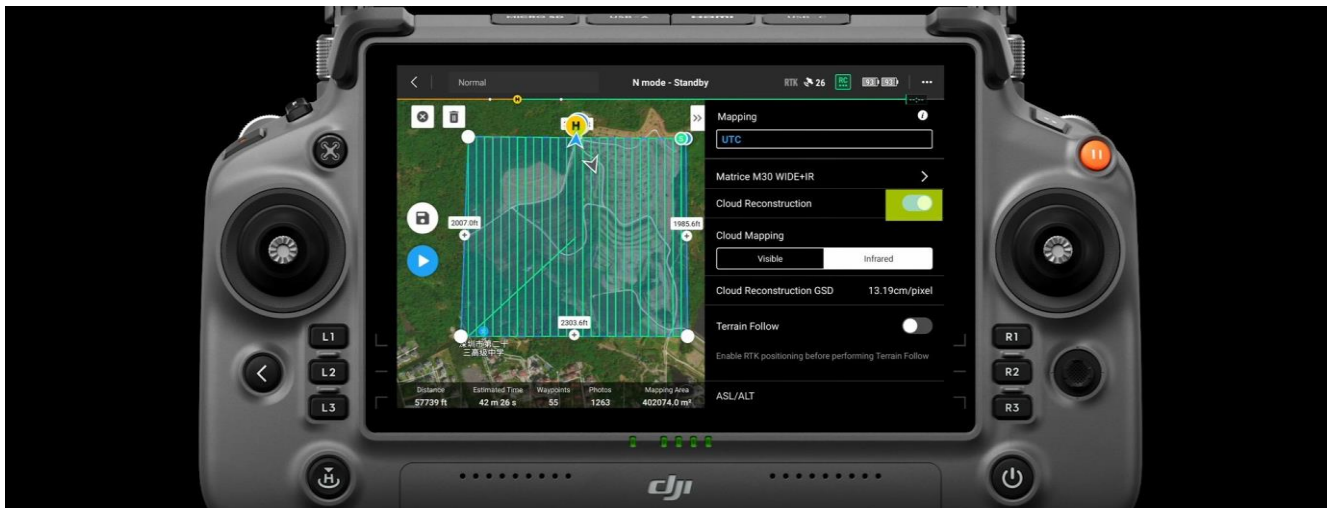




12. Select IR to capture infrared which can be used for reconstruction of infrared models. When it's 100 meters away the GSD is 13.19 centimeters per pixel. When white plus IR is selected the GSD data of the infrared camera is displayed.



13. By enabling cloud mapping you can complete real-time reconstruction of the DJI Flighthub to cloud platform.

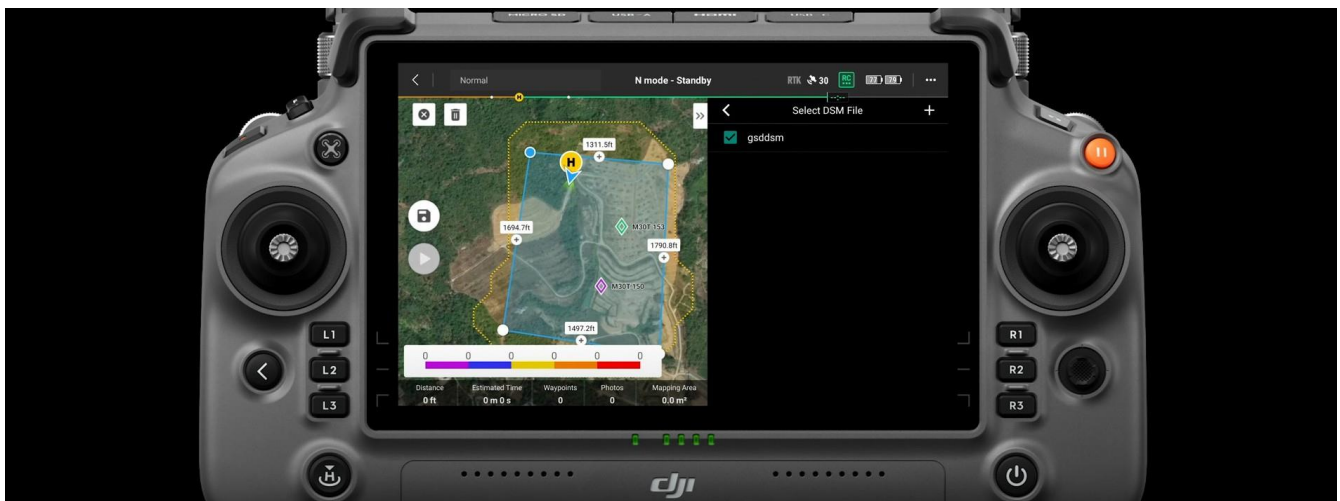




14. When the mission landscape is heavily undulating the tear and fallow function can be used. After importing the DSM file the Aircraft can fly up and down along the undulating terrain, always maintaining a fixed shooting distance from ground.



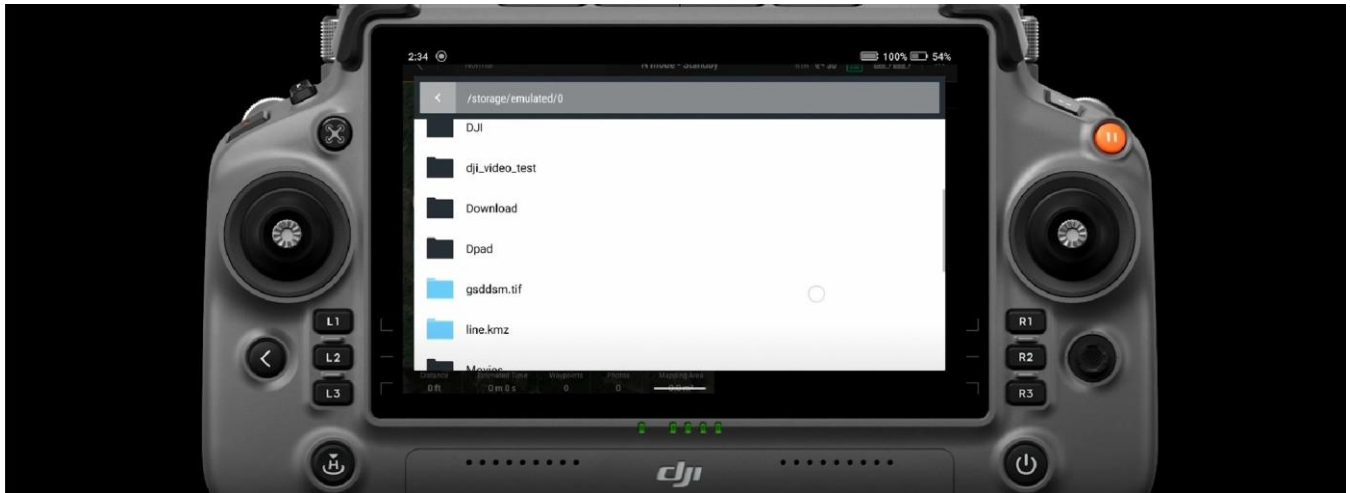
15. When using terrain follow function it is recommended to enable the RTK function. Select GSM file page. Select the desired DSM file.





16. There are two ways to acquire DSM files.

The first method is obtaining the 2D data of the measurement area and modeling them through DJI Terra among all generated modeling files the gsdgsm.tif.

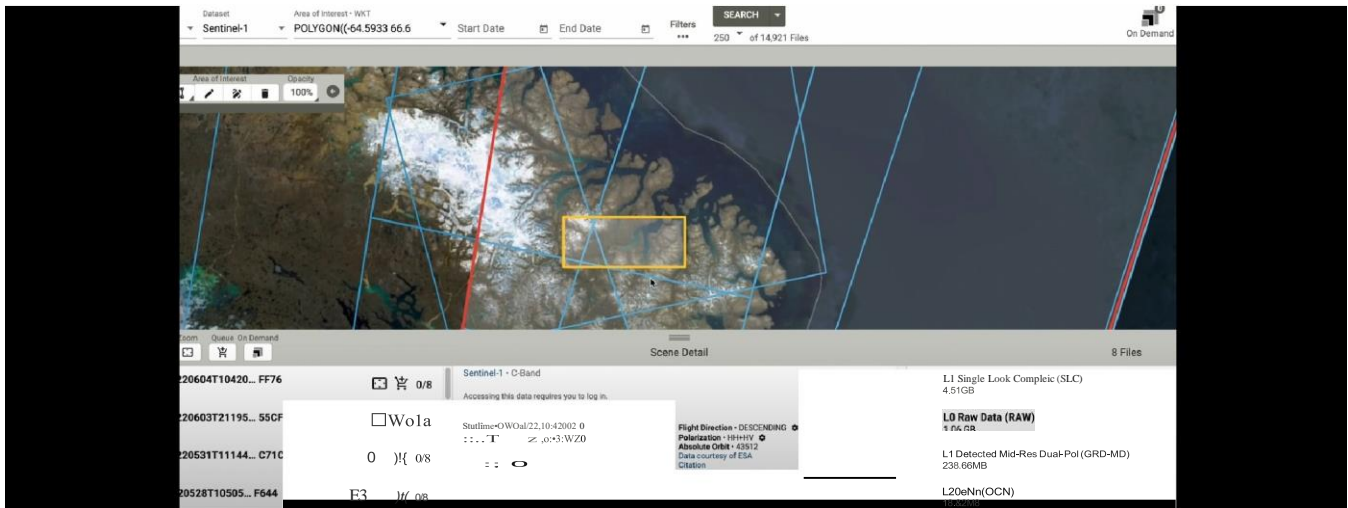


File can be used as an elevation reference for the terrain follow flight. It can be copied to the microSD card of the remote controller.

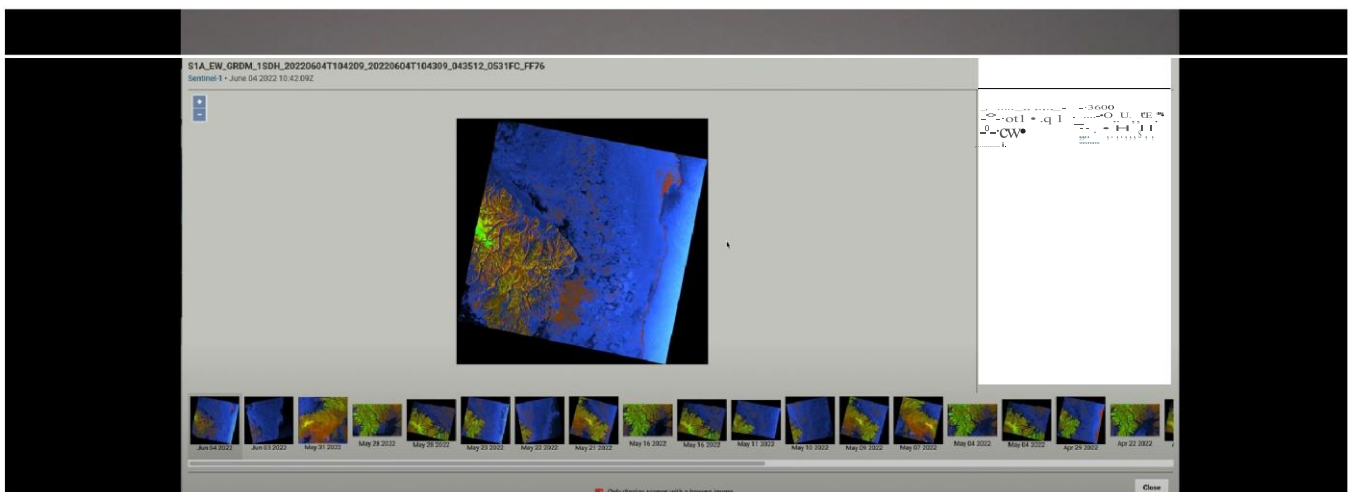




The second way is to download the public term file and copy it to the remote controller's microSD card.

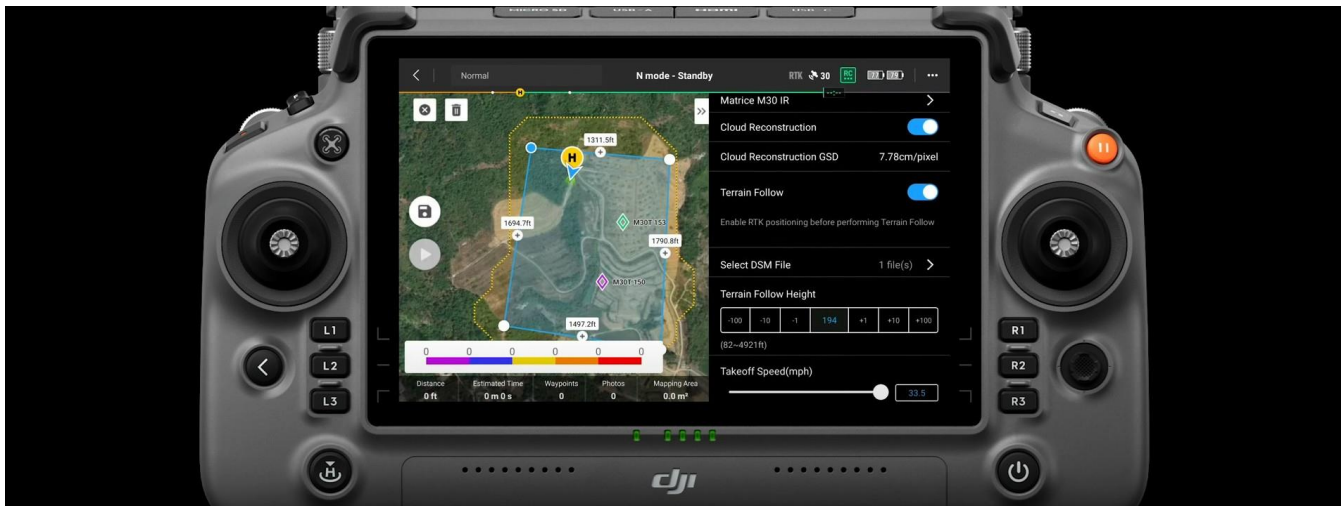


Please note only DSM files with geographic coordinate systems can be recognized by pilots too. Meanwhile the resolution of importing data is recommended to be less than 10 meters.





17. After importing the data successfully you can plan tasks in the imported area and generate tear and follow flight routes. Tap adding or subtracting buttons to the set of the tearing follow heights or enter the altitude value directly.

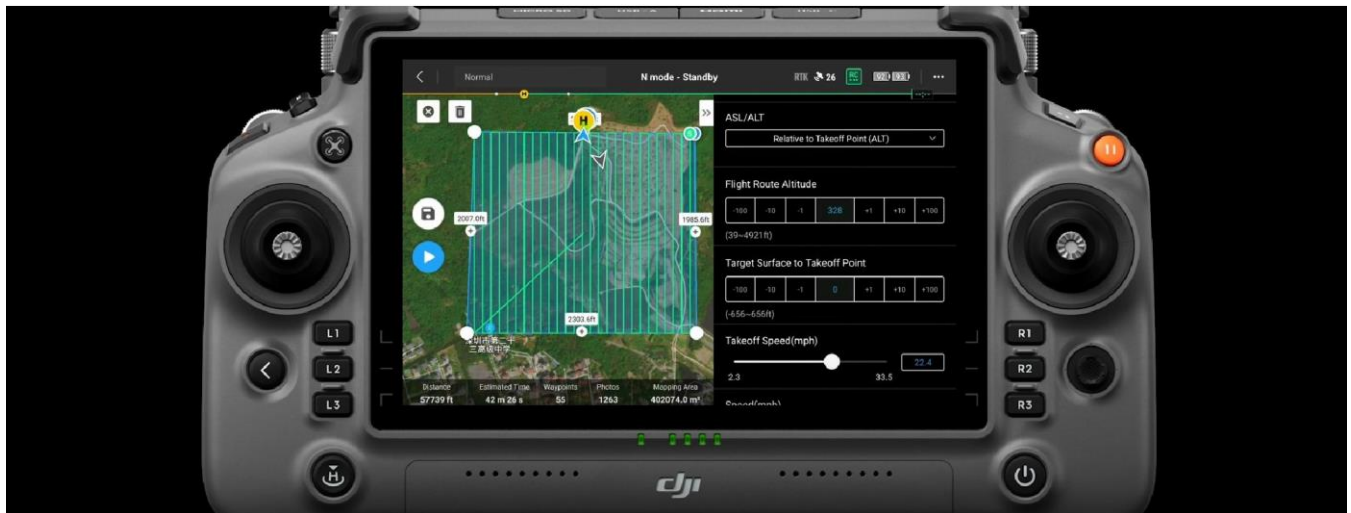


18. When flying without tear and follow ASL/ALT menu will appear. ASL/ALT menu includes relative to the take-off point and ASL which determines the datum for calculating route altitude.



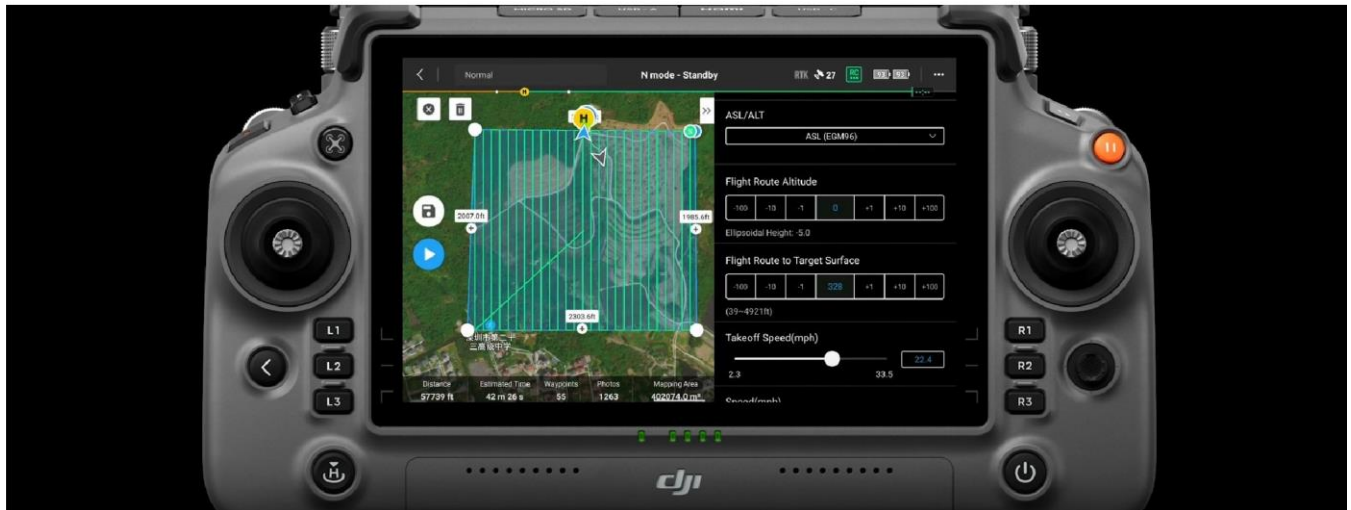


The route altitude in the relative takeoff point mode indicates the fly height from the takeoff point to the Aircraft when the Aircraft is operating.



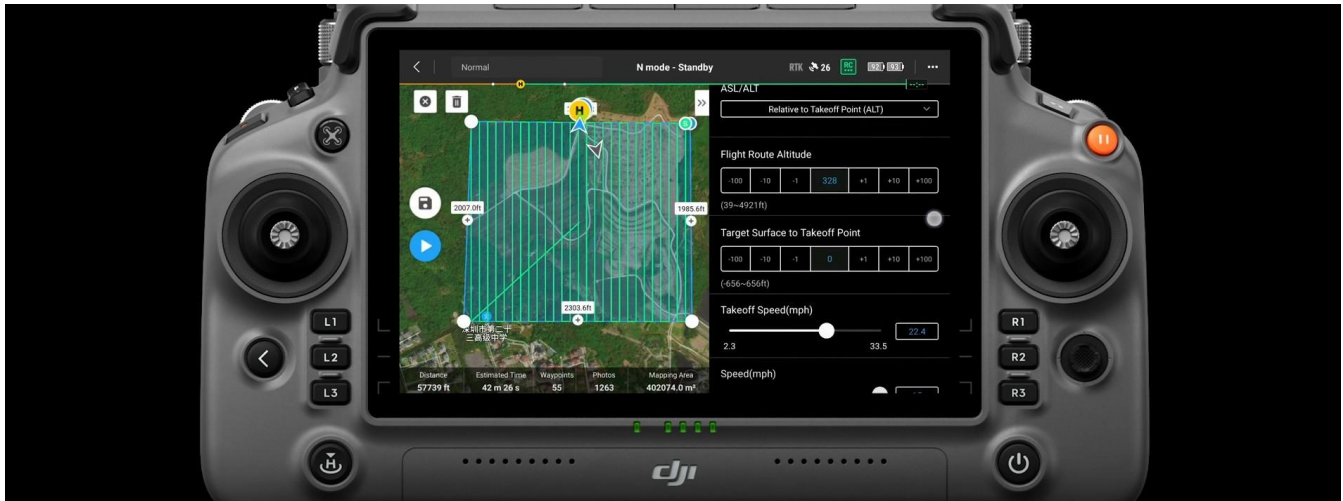


The route altitude in ASL mode refers to the altitude of the Aircraft to the joid of EGM-96.

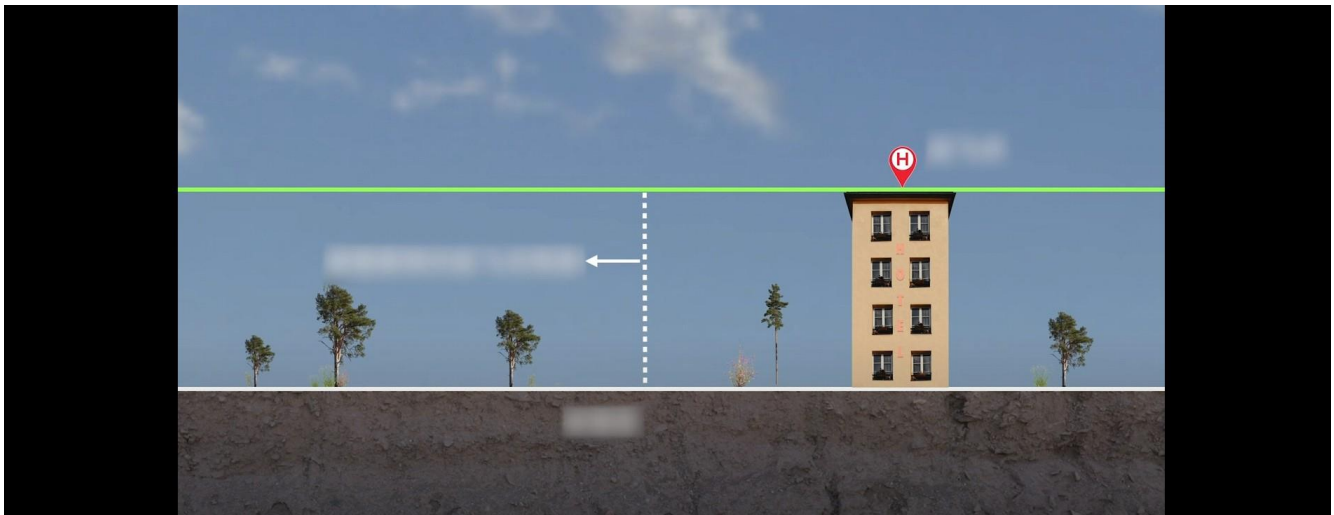




19. When performing an aerial photogeometry work the relative to the Takeoff point mode is generally selected. Target surface to the Takeoff option appears in relative to Takeoff point mode. The height of the target surface to take off points is the height of the target surface minus the height of the takeoff point.

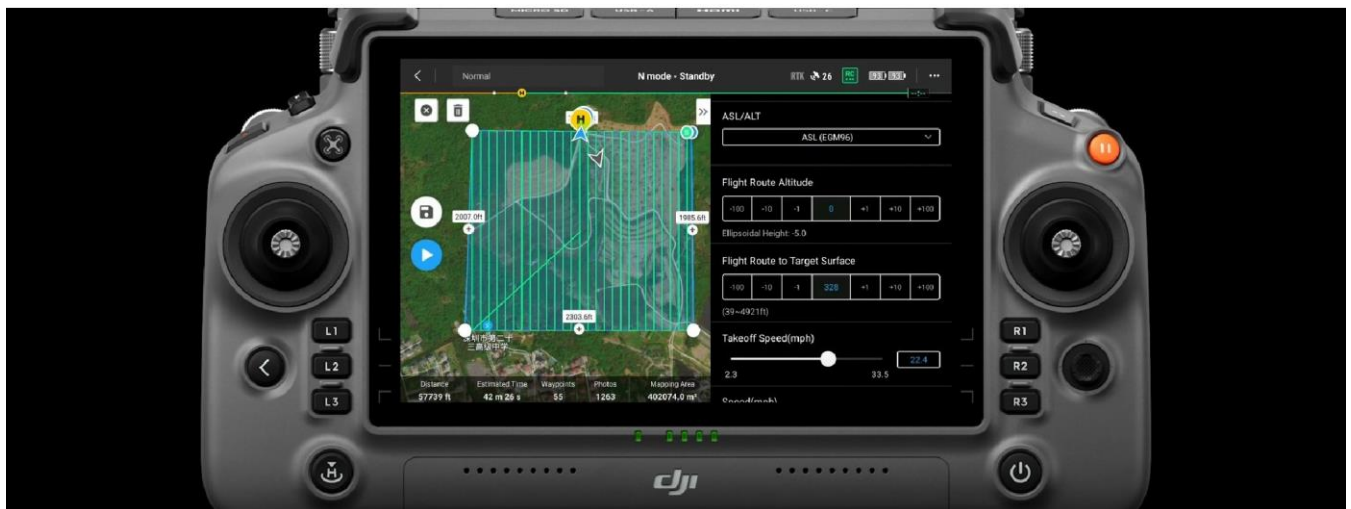


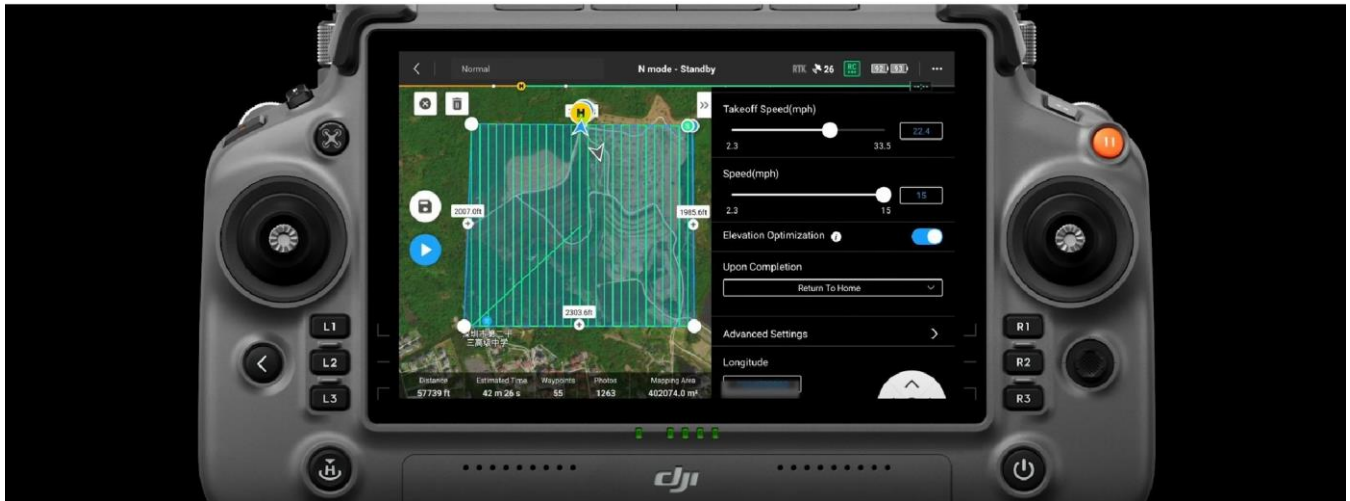
For example, if you Takeoff the Aircraft from the root of a building of 10 meters high above the target surface you need to set the height of the target surface to Takeoff point to minus 10 meters.



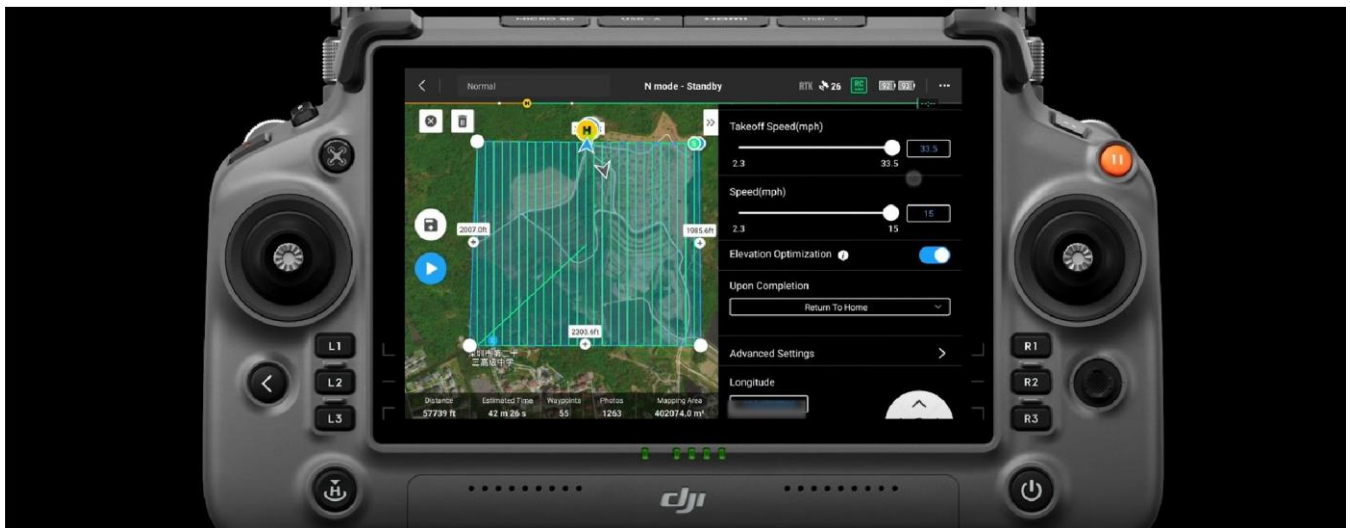


When ASL is selected the fly route altitude option appears which is the height of the flybrow minus the height of the target surface. We use this height to calculate the GST value.



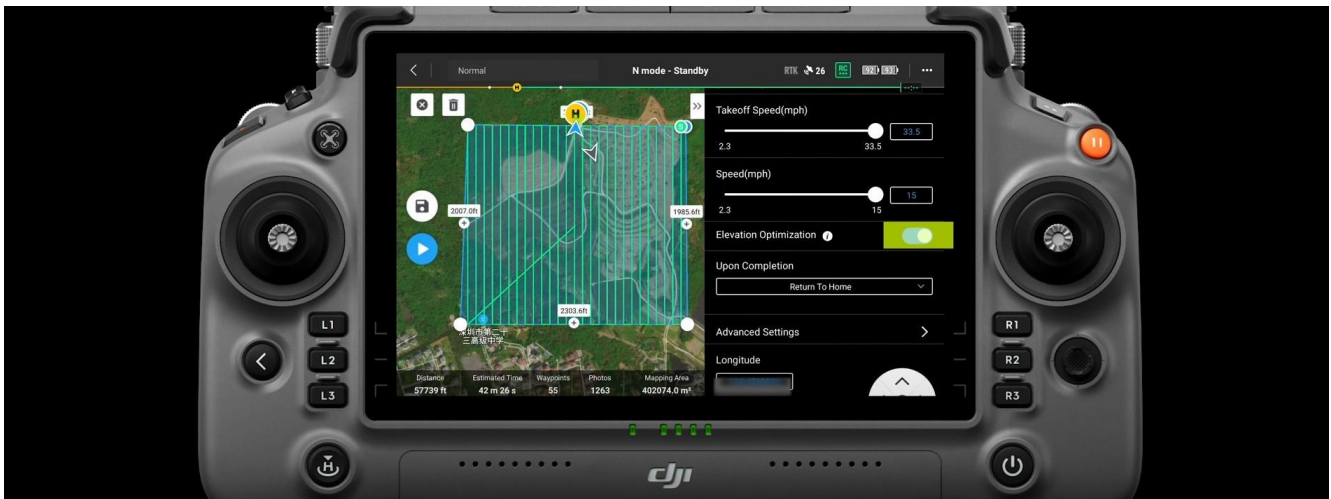


20. Takeoff speed is the flight speed of the Aircraft reaching assigned height of the route but not entering the route. It is not the speed at which the Aircraft takes off vertically it can be set to the maximum to improve the operation efficiently.



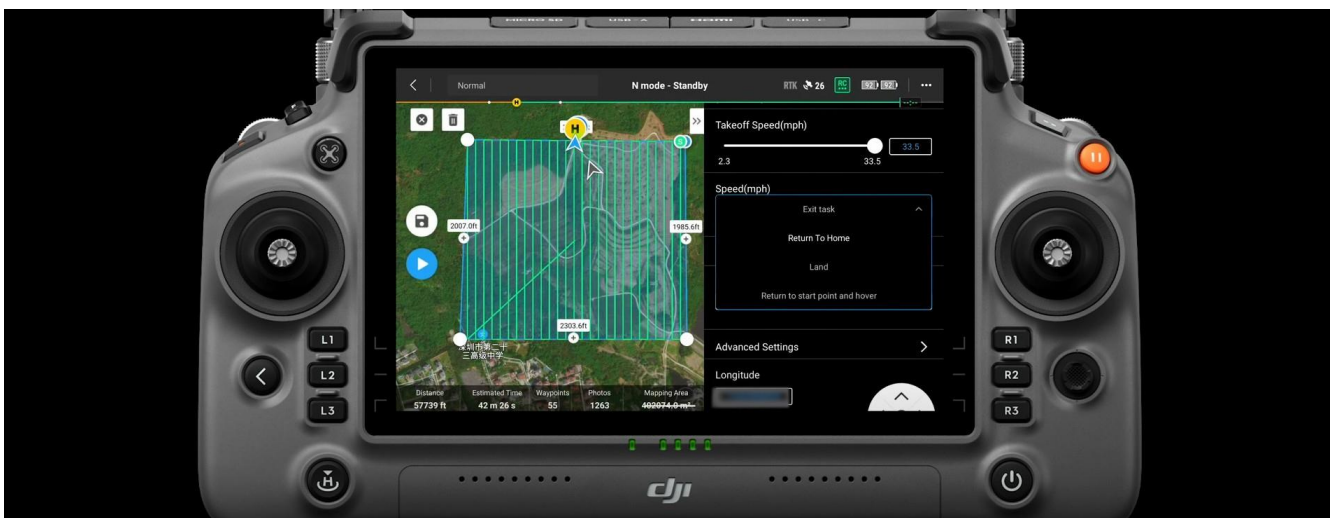


21. Speed is the operating speed of the Aircraft during the route and the maximum speed is related to the GST and frontal overlap ratio.



22. Elevation Optimization means that when the mission ends the Aircraft will fly towards the center of the mission area and continue to take a set of oblique photos to optimize the accuracy of the elevation data which is applied to the elevation accuracy needed scenarios.

23. Upon completion is the flight action when the Aircraft has completed the mission. It includes four options. Exit task / Return To Home/ Land / Return to start point and hover.

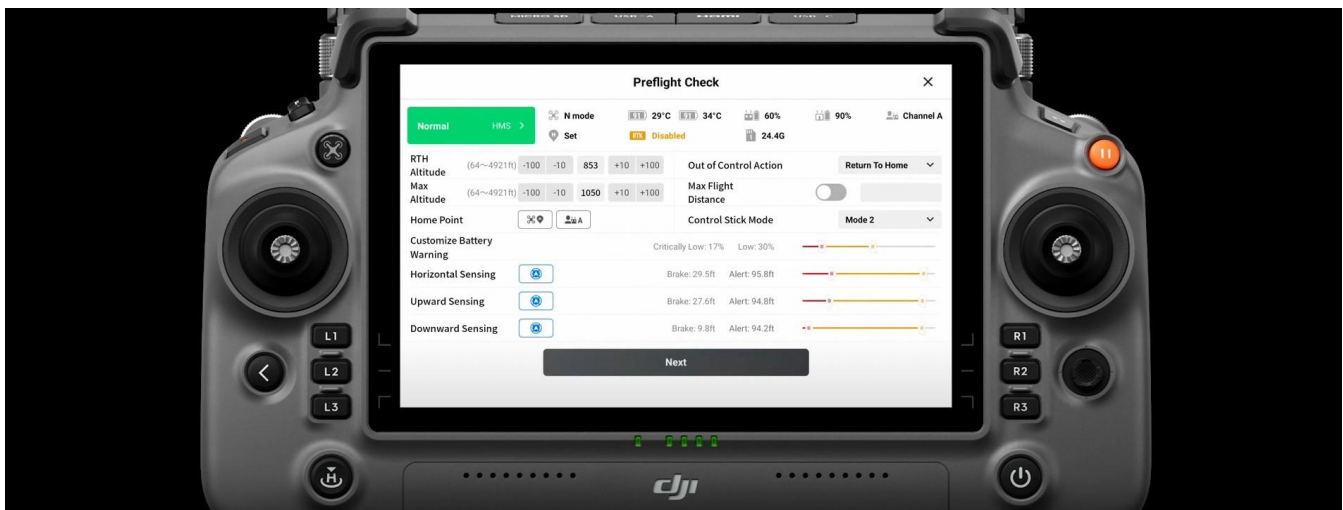




The default option is Return to Home. Return to Home is recommended when takeoff and landing are at the same location.

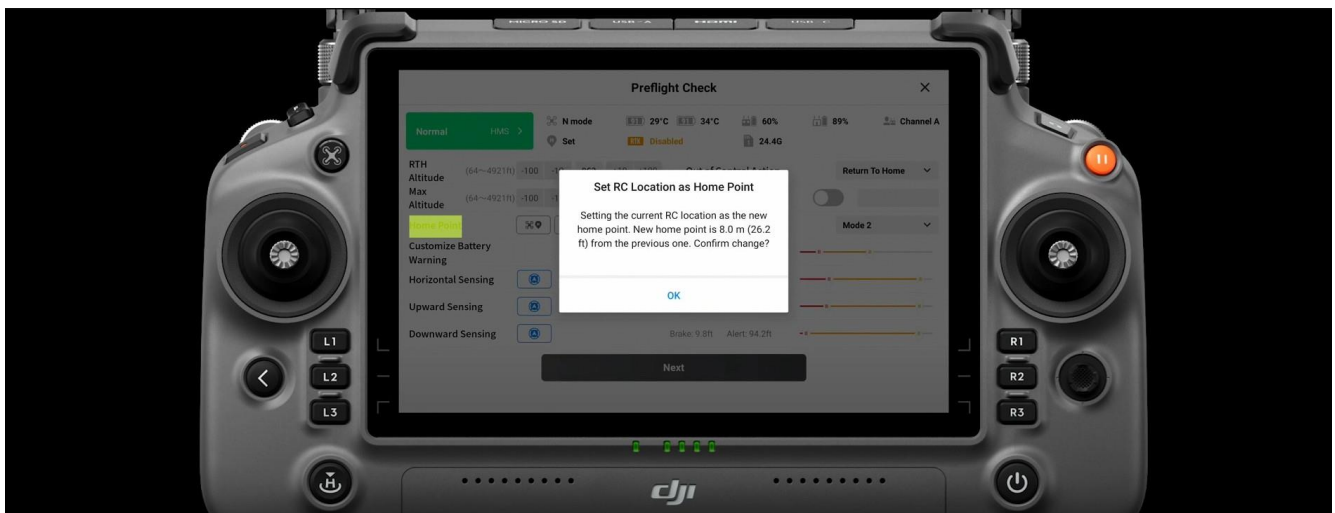
Flight mission

1. Find and open space to start your flight mission. The ground of takeoff point should be flat and clean. Make sure there are no small pebbles, plastic bags and other levers.
2. Expand and power the Aircraft. Retrieve the task in the DJI Pilot app and click upload flight mission.
3. In Pre-flight check menu check the perimeters of the Aircraft and the status of the UAV health management system and confirm that everything is working properly.



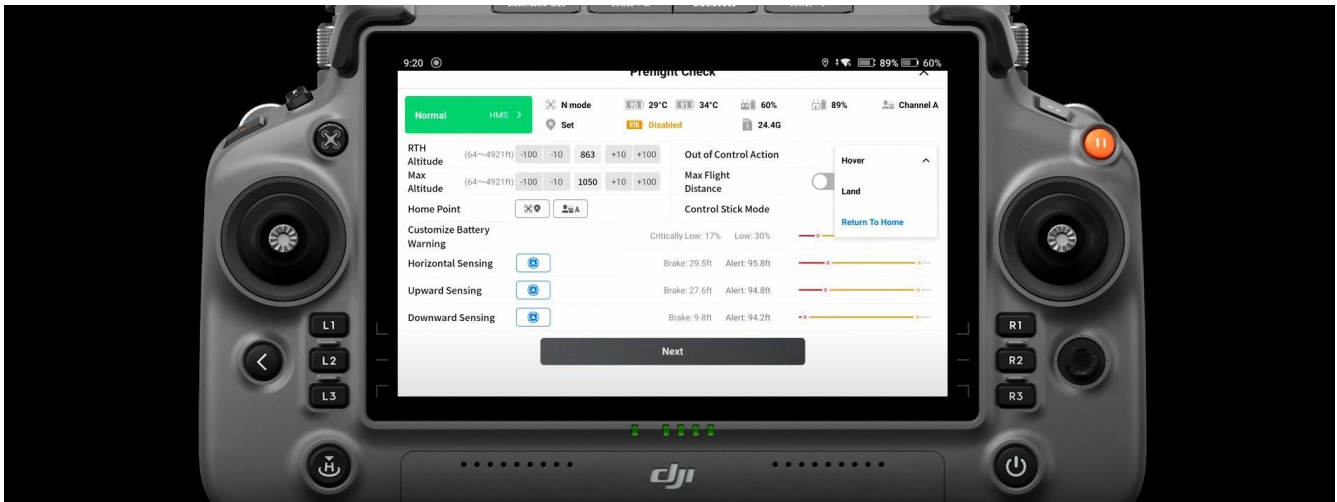


4. Exit the HMS module and make sure the remote controller is in end mode. The Aircraft and the remote controller receive enough power and the positioning information is normal. If the RTK solution is needed the RTK status should be fixed before starting to work.
5. Make sure the SD card has enough space for this task. If not, it is necessary to replace or format it.
6. RTH altitude and Max altitude need to be higher than the flight route altitude.
7. The Home Point setting is determined by actual situation. If the take-off and landing position is changed it is recommended to update the Home Point.

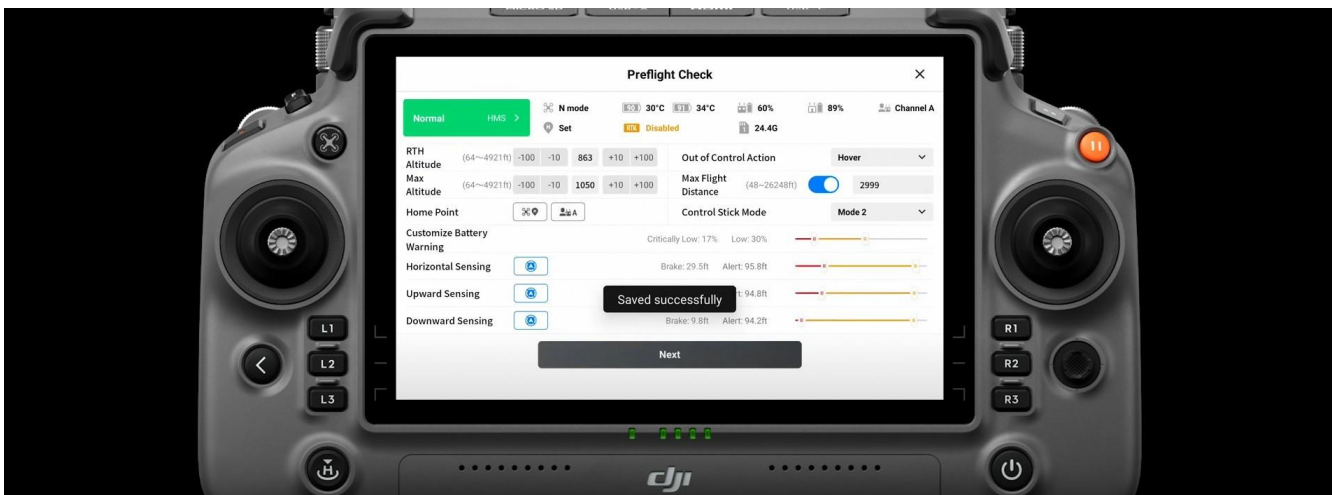




8. Out of control action is the losing control behavior when the Aircraft is not executing the flight mission.

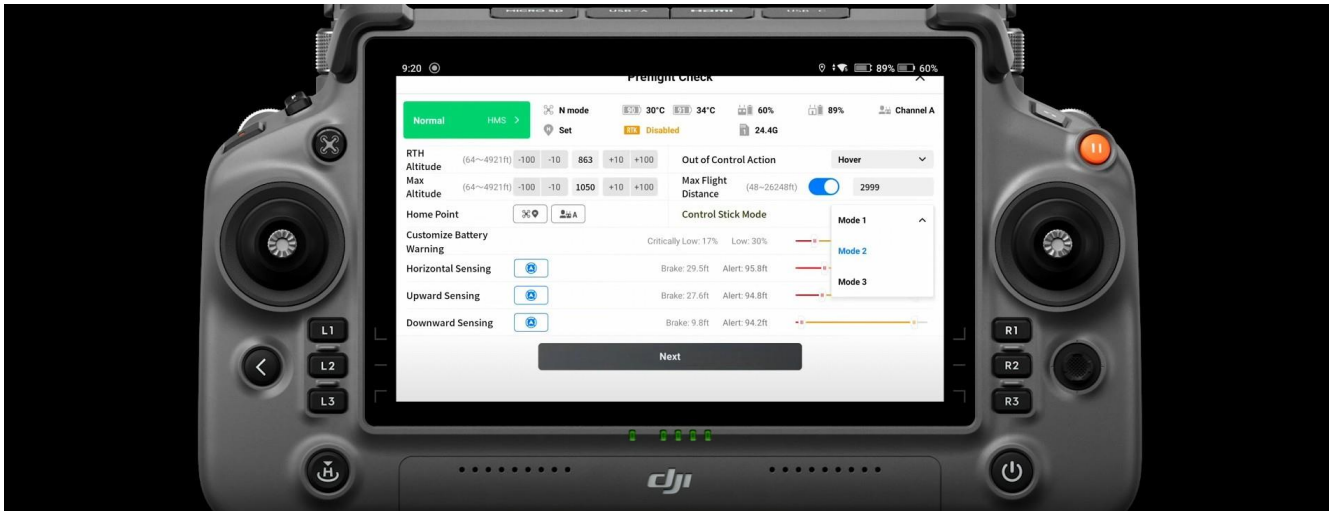


9. You can choose Hover / Land / Return To Home. The default option is Return To Home.
10. If you turn ON Max Flight Distance you need to make sure the distance between the furthest waypoint and the home point is less than your maximum flight distance.



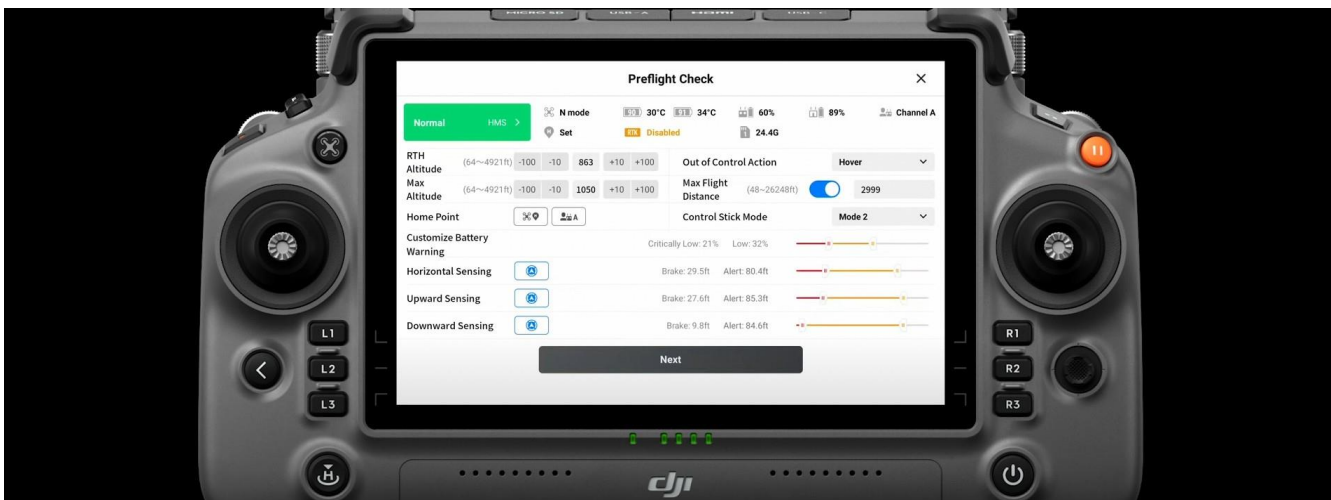


11. Select your control stick mode based on the actual situation. The default mode is mode 2.



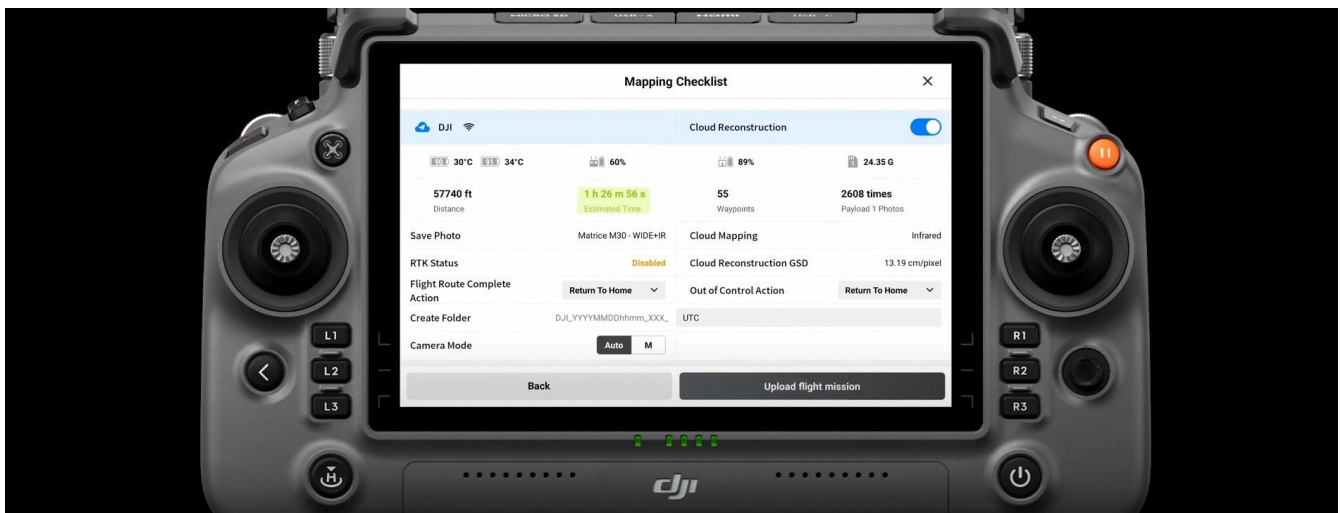
In scenarios with strong winds or the batteries have large number cycle counts it is recommended to increase the power alarm values of customized battery warning.

12. When there are many objects around the takeoff for landing sites the obstacle sensing settings can be adjusted to ensure a smooth takeoff process.

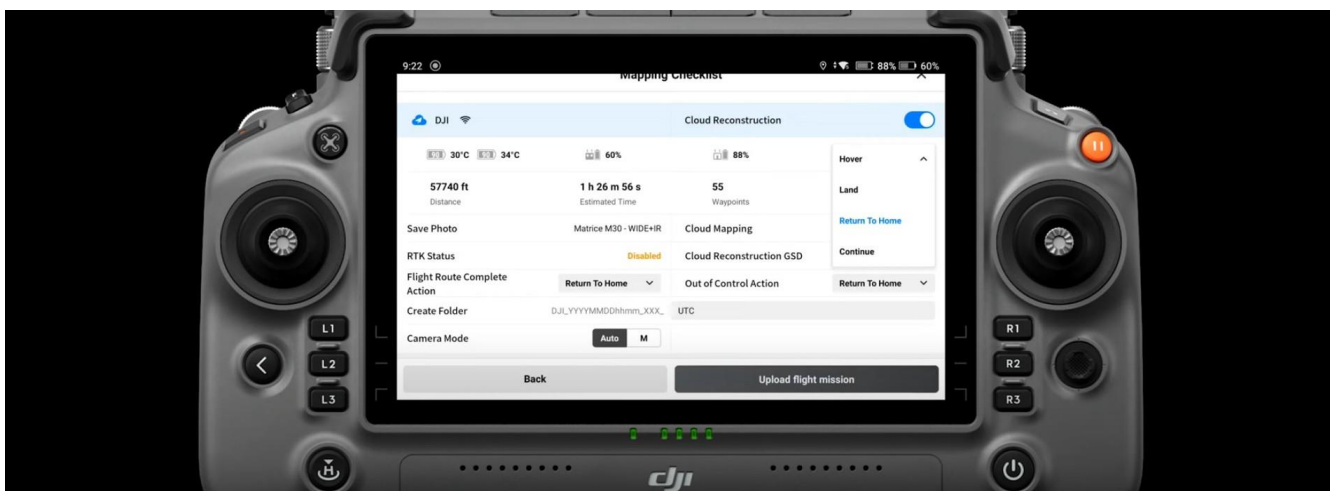




13. Click Next, confirm the route length estimated operation time, number of waypoints and photos taken. Confirm save photo settings correctly and check out the reconstruction GST. If you choose to shoot with wide angle and infrared camera at the same time the GSD shows the IR camera's value.



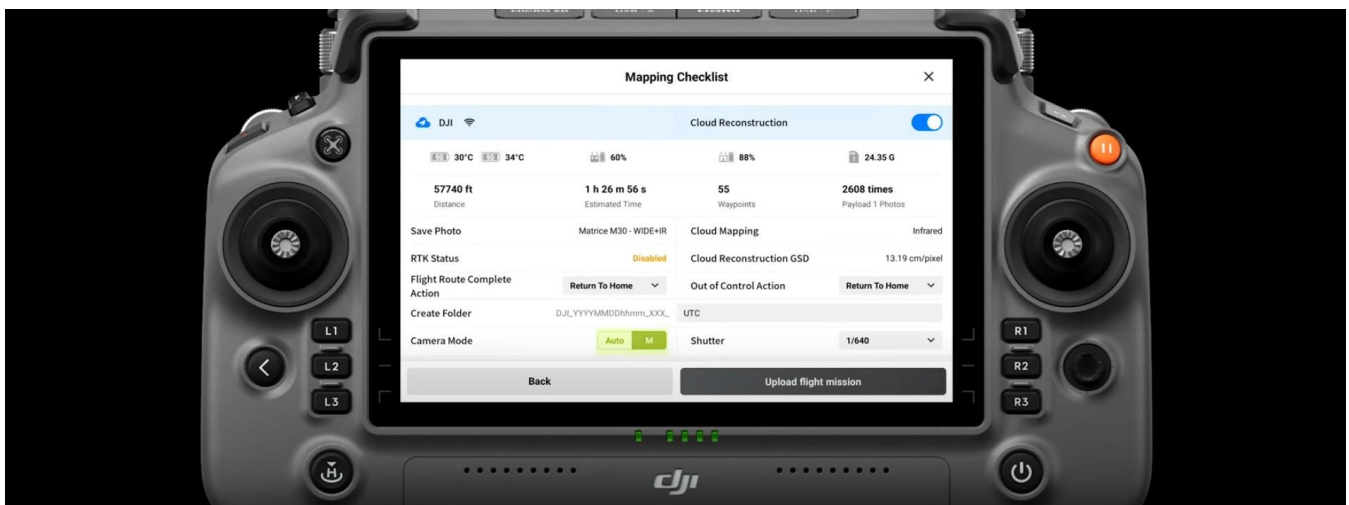
14. Upon completion actions include Exit task / / Return To Home/ Land / Return to start point and hover. The Default option is Return To Home. Out of control action is the action performed after the aircraft is out of control including Hover / Land / Return To Home / Continue.



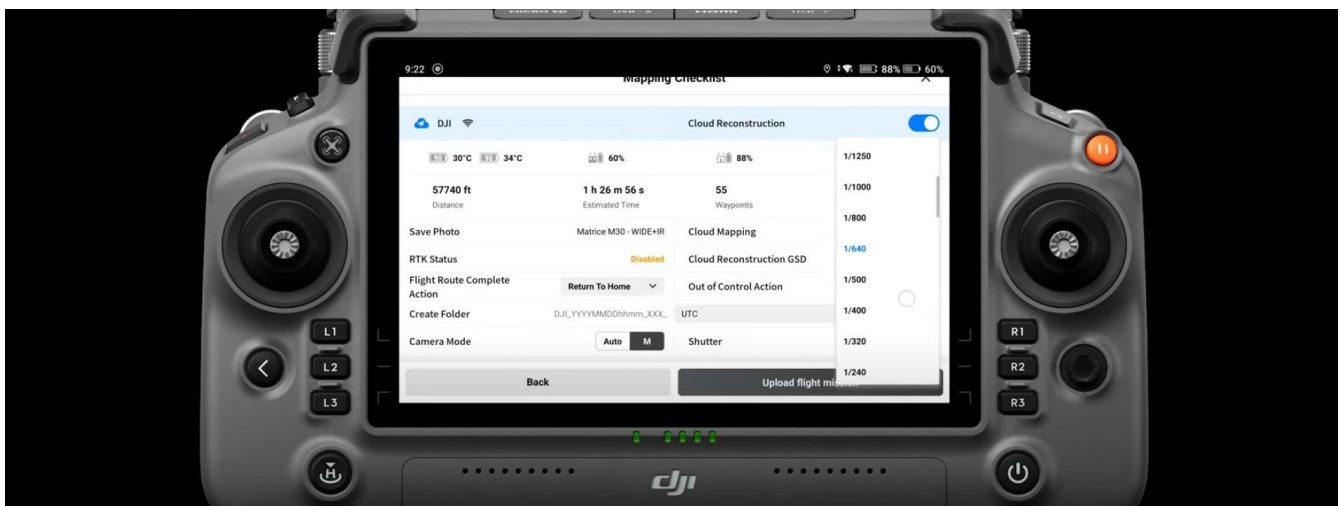


15. The default selection is Continue. Created folder is where the capture photos are stored. The default file name is the task name which can be modified.

Camera mode includes Auto - automatic exposure and M - Menu exposure. It is recommended to use Auto in well-lit scenes and Menu exposure can be used in low light scenes.

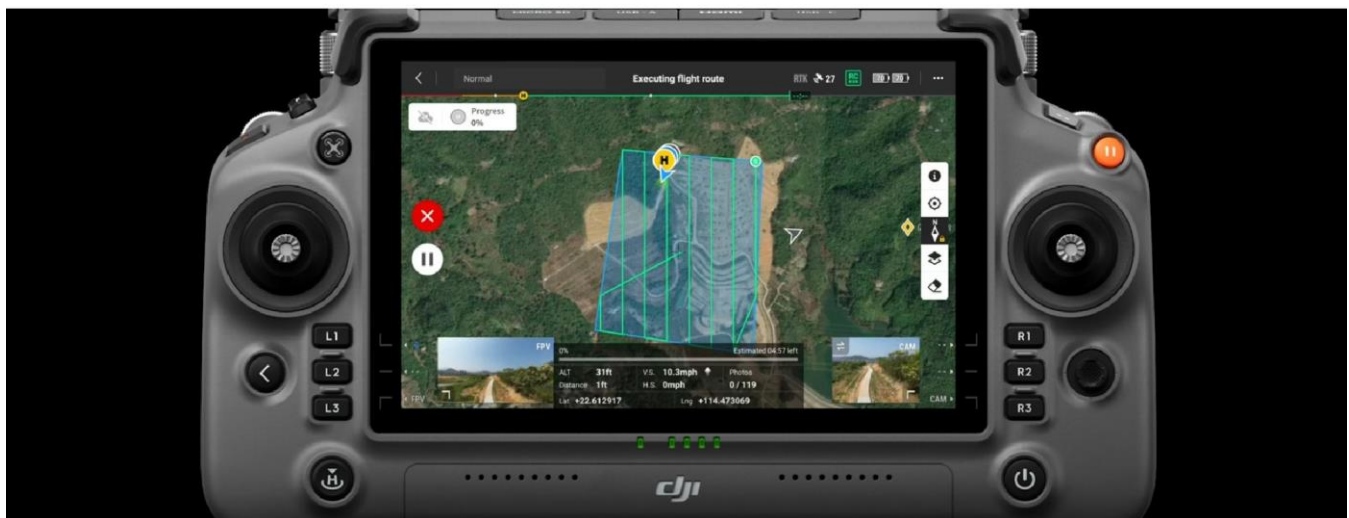


When you choose M you can adjust the shutter speed to ensure the shooting effect.





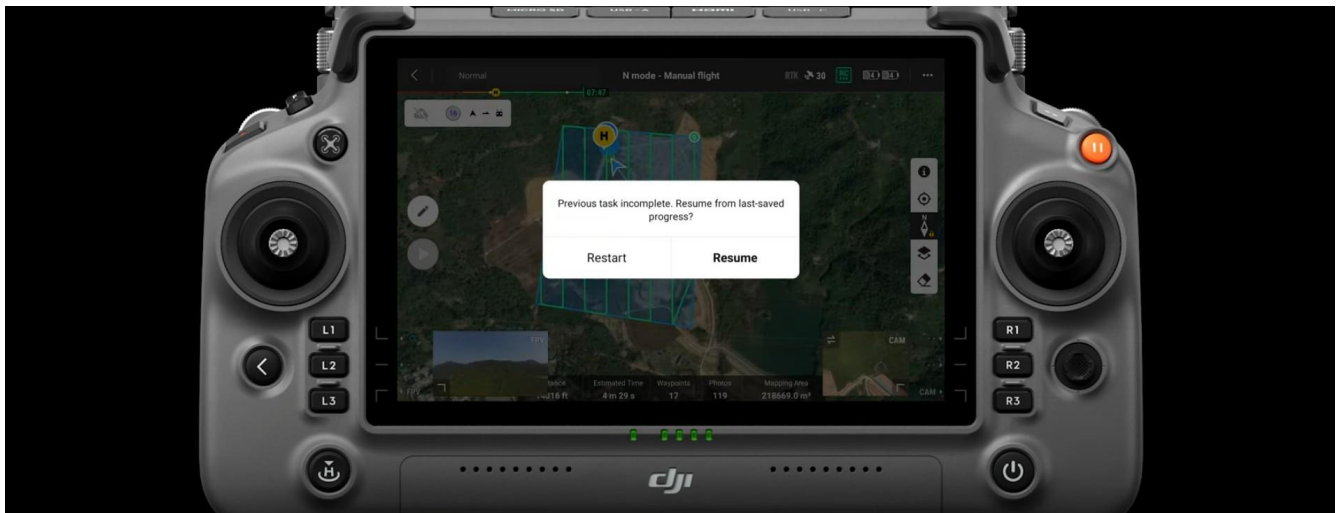
16. After checking all flight route parameters click the upload flight mission button to start the task. During flight execution pay attention to the aircraft's battery level, image exposure and the remaining space of the SD cards.
17. Switch to the FPV screen observe whether there are any obstacles in front of the Aircraft.





18. Monitor the map's construction progress in real time. The real-time mapping results can be viewed on the web page and the app if one sorority falls to complete the mission.

The Aircraft will record the location of the interruption and after the battery is replaced the Aircraft can continue to operate from the point of interruption.



19. After the mission is completed check the status of the Aircraft first, then copy and import the mission data into DJI Tera and you can generate a 2D visible light or infrared orthophotos.