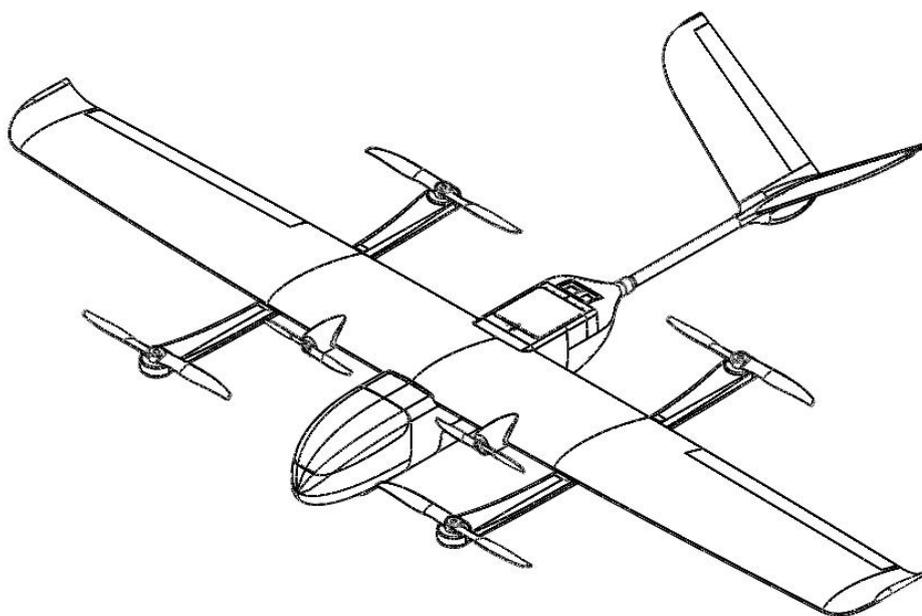
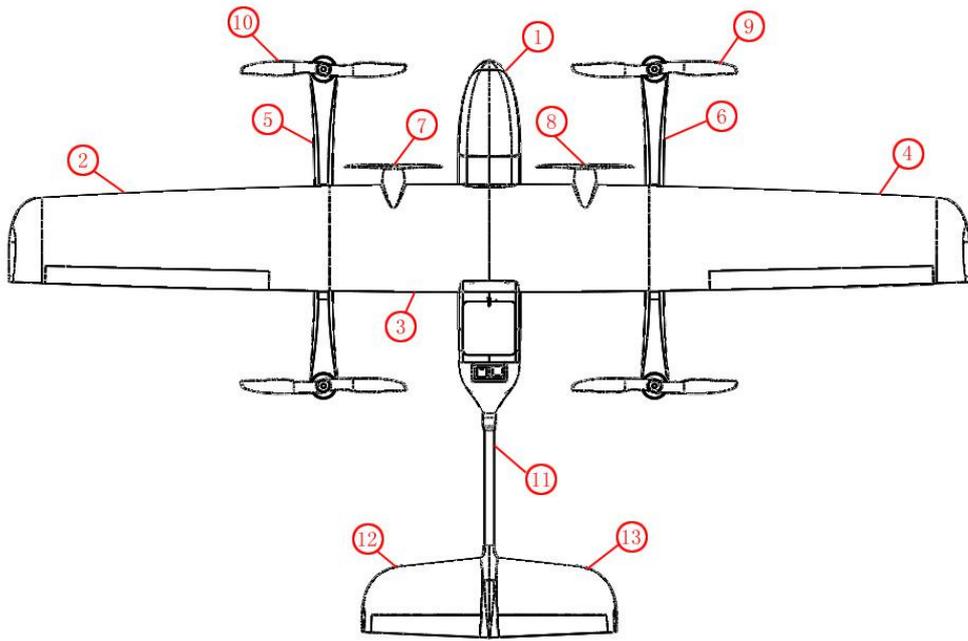


# TTA VTOL SP-09 USER INSTRUCTIONS V1.1



Beijing TT Aviation Technology Co.,Ltd.



**TTA VTOL SP-09 Structure Picture**

Item	Component	Item	Component
1	Fuselage	7	20 Inch Propeller (clockwise)
2	Left Wing	8	20 Inch Propeller (Counterclockwise)
3	Middle Wing	9	13 Inch Propeller (Clockwise)
4	Right Wing	10	13 Inch Propeller (Counter Clockwise)
5	VTOL Left Arm	11	Tail Link
6	VTOL Right Arm	12	Left Tail
13	Right Tail		

**Catalogue**

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  - 1.2 Inspection.....
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## 1. Use Instruction

### 1.1 Safety Instruction

- ◆ The product is not suitable for the ones who are less than eighteen or who do not have full capacity for civil conduct.
- ◆ The product have bigger fuselage size, high speed rotary and strong flight dynamics. At runtime have a certain dangerousness . Not in accordance with the requirement operation and usage will cause to potential danger and hurt.
- ◆ When using this product, please keep away from airport, railroad, high speed road, high buildings ,electric wire and other dangerous environments.
- ◆ When using this product, please keep away from mobile phone base stations, high power transmitting equipment, and other high electromagnetic interference environments.
- ◆ When using this product, please keep away from army and kinds of manned craft flight area.
- ◆ Don't use this product in rain, thunder, sandstorm, fog snow ,high wind ,and low temperature and other bad environments.
- ◆ When flying in more than three kilometers. Environmental factors can lead to flight performance degradation, please care of using it.
- ◆ When operating this product fly in low sky .Please always keep UAV and people & animals in a safe distance of ten meters
- ◆ When using this product in desert area, please keep UAV within the range of operator's eyes
- ◆ Don't hover or fly over the crowd, Don't be delight in scaring others.
- ◆ When it is close to the crowd ,please land this UAV as soon as possible and guide people to keep and avoid potential accident.
- ◆ Don't operate it in the area of children playing.
- ◆ If not in the extreme necessary condition, please do not power off when flying in the

air.

- ◆ You can not fly if you are drinking, tired, drugs, physical discomfort, etc. .
- ◆ Please inspect it before using every time, including but not limited to parts of fastness, organism and propeller of cracks, and abrasion, battery, the effectiveness of light. When error happens, please stop using immediately and replace the corresponding parts.
- ◆ Abnormal working state of the UAV may happen accidentally, don't open the propellers and forcibly fly with wrong.
- ◆ Do not try to prevent the moving parts while working.

## **1.2 Inspection**

- ◆ Before flying, ensure the battery is enough
- ◆ Ensure all the parts are installed firmly, and all the screws are tight as required.
- ◆ Ensure all the wires are correctly linked.
- ◆ Ensure all parts go well. If it is broken or aging, please replace timely.
- ◆ Before flying, carefully check the propellers installation direction, rotation direction, control and others.
- ◆ Ensure all the propellers are fine, no any scratch and tightly installed.
- ◆ Ensure the sprayer is fluent without any clogging and work normally.
- ◆ Pre-flight check-hardware part:
  - ◆ ▲ Is there any blockage in the airspeed tube?
  - ◆ ▲ Is the aileron and elevator mechanical structure reliable?
  - ◆ ▲ Is the connector of the fuselage already firm?
  - ◆ ▲ Are all motors and propellers firmly installed
  - ◆ ▲ Is the center of gravity of the aircraft correct?
- ◆ Pre-flight check-software part
  - ◆ ▲ Is the magnetic compass pointing consistent with the actual pointing? Is the magnetic compass green?
  - ◆ ▲ Is the GPS indication green?
  - ◆ ▲ Is the level indicator correct?

- ◆ ▲ Can the power voltage support the takeoff?
- ◆ ▲ Is the airspeed indication around 0m/s?
- ◆ ▲ Is the relative height indication 0m/s up and down?
- ◆ Pre-flight check-logic part
- ◆ ▲ Do you set the homing hovering point?
- ◆ ▲ Can the remote control normally control all the steering gear mechanisms?
- ◆ ▲ Whether the remote control can use the motor normally
- ◆ ▲ Is the propeller installed correctly?
- ◆ ▲ Is the correction of all the control surfaces correct in attitude mode?
- ◆ ▲ Roller motor position 1-4 is correct
- ◆ ▲ Is the steering of the rotor motor correct?
- ◆ ▲ The landing route is correct, please ensure that the landing route is near the takeoff point.
- ◆ ▲ Is the route from 1 to 9 correct? Please make sure all routes are near the takeoff point.

### **1.3 Environment**

- ◆ While flying, please ensure the drone away from the crowds, dangerous goods, high buildings, high-voltage wires and others. Please fly the drone in a dedicated space.
- ◆ Please ensure the drone fly within the operator's eyesight.
- ◆ The drone working temperature is between 0°C-40°C.
- ◆ Ensure the drone fly within the permit of local law and regulations.
- ◆ To fly the drone safely as required, please fly it within in the height of 300 meters. If it has local flying height limit within 300 meters, please make sure obey the related regulations.

### **1.4 Operation**

- ◆ The flight speed of a fixed-wing aircraft shall not exceed 30 m/s, except in special circumstances.
- ◆ Before remote control calibration、 hardware update, parameter setup, please remove the propellers and avoid the potential moving suddenly.

- ◆ Remove the battery if it does not fly, to avoid flying it when touching the remote control once.
- ◆ Please remove the batteries once landing. Do not move the drone when it is in power.
- ◆ Do not touch the joy stick mistakenly, and prevent start the drone.
- ◆ When it is powered, please stand in the safe distance of above 10 meters.
- ◆ Ensure the propellers completely stop and power off.
- ◆ Please switch it to the manual operation mode when errors happen. When the manual operation mode does not work, please press the emergency bottom. Please keep away from the crowd.
- ◆ When the battery is damaged, please ensure it is stored in the disposal area and avoid spontaneous combustion. In order to protect environment, please don't throw batteries randomly. And consult the maker about the proper disposal method.
- ◆ During the flight, don't fly overload and do not cause any potential dangers.
- ◆ When low battery is warning, please return as soon as possible.
- ◆ Ensure that the remote control and battery is enough, to ensure that firmware has been updated to the latest version.
- ◆ Ensure flying sites outside of the restricted areas and is proper for flight .
- ◆ Please make sure do not fly or operate the drone when you are drunk or with medicine limitation.
- ◆ Be familiar with the remote control operation & each flight mode, and ensure you know how to operate the control condition.
- ◆ User shall know and obey all the law and regulations in flying location.

### **1.5 Compass Calibration Requirements**

- ◆ Compass has to be calibrated before using the first time. If else, it cannot work and will affect flying safety. Calibration tips:
- ◆ Please do not calibrate it in the place close to the high-magnetic field or big metal materials, such as high-voltage, magnet, parking lot, concrete iron building, etc.
- ◆ When calibrating, please do not bring the magnetic materials, such keys and cellphone.

- ♦ If it is calibrated indoor, please do not re-calibrate it outdoor. It prevents that the two magnet differences cause the potential flying data errors.
- ♦ Magnetic field location is different, please make sure re-calibrate when it changes to the place far away from the previous one.

## 2. Product Introduction

TTA VTOL SP-09, Vertical take off and landing make the operate of fixed wing much easier. No environment requirements and don't need complex auxiliary device for taking off and landing makes outdoor work more simple and convenient. Suitable for long distance monitoring with high speed and flexible operation. It can hovering and do accurate monitoring as you want. Supply switching between different courses before landing. User can manage max 9 courses at the same time. GCS can monitoring real-time flight information.

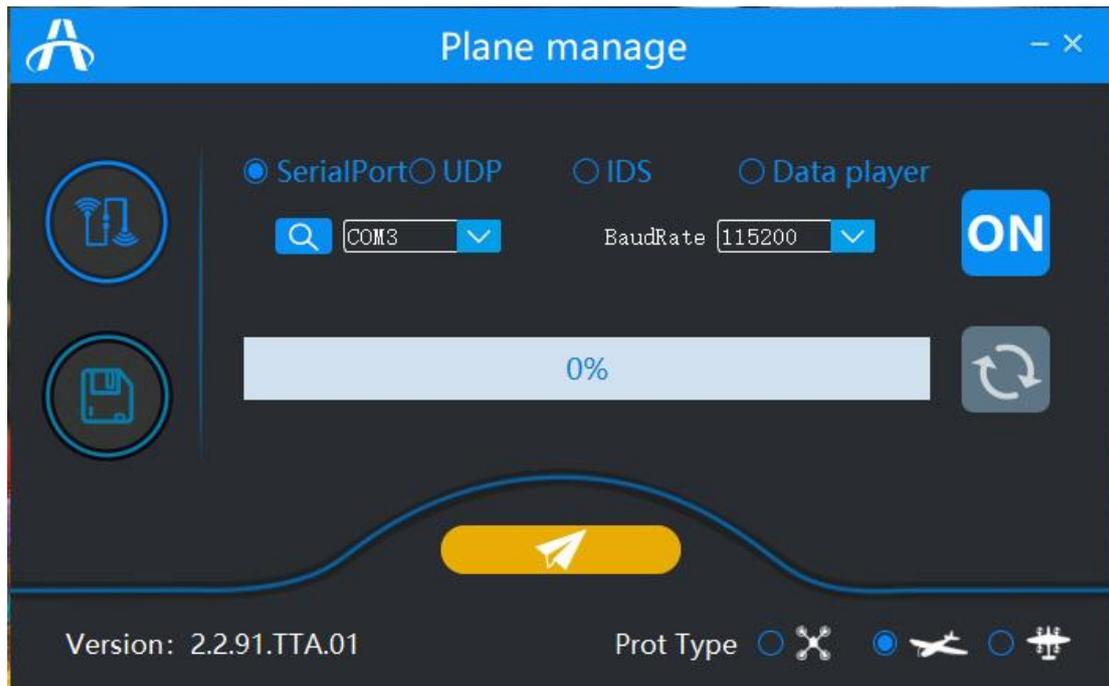
### 2.1 TTA VTOL SP-09 Parameter

Item	Parameters
Flying endurance without payload	1.5 h
Length	1770mm
Wing span	2900mm
Empty weight	3.2kg
Payload	≤2kg
Cruising speed	70-90km/h
Flying mode	Automatic
Take off mode	Vertical take off
Landing mode	Vertical landing
Climbing angle	Less than 15 degree
Frame materials	FRP
RC distance	1km
Control distance	50 km
Suitable flying height	80-1000m
Wind Resistance	10.8m/s
Propeller	13-14 inch
Motor	4x3520

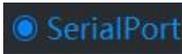
Payload device	QX5.0 Oblique photography camera SONY RX1RII camera Zoom pod and others
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### 3.Aircraft Debugging

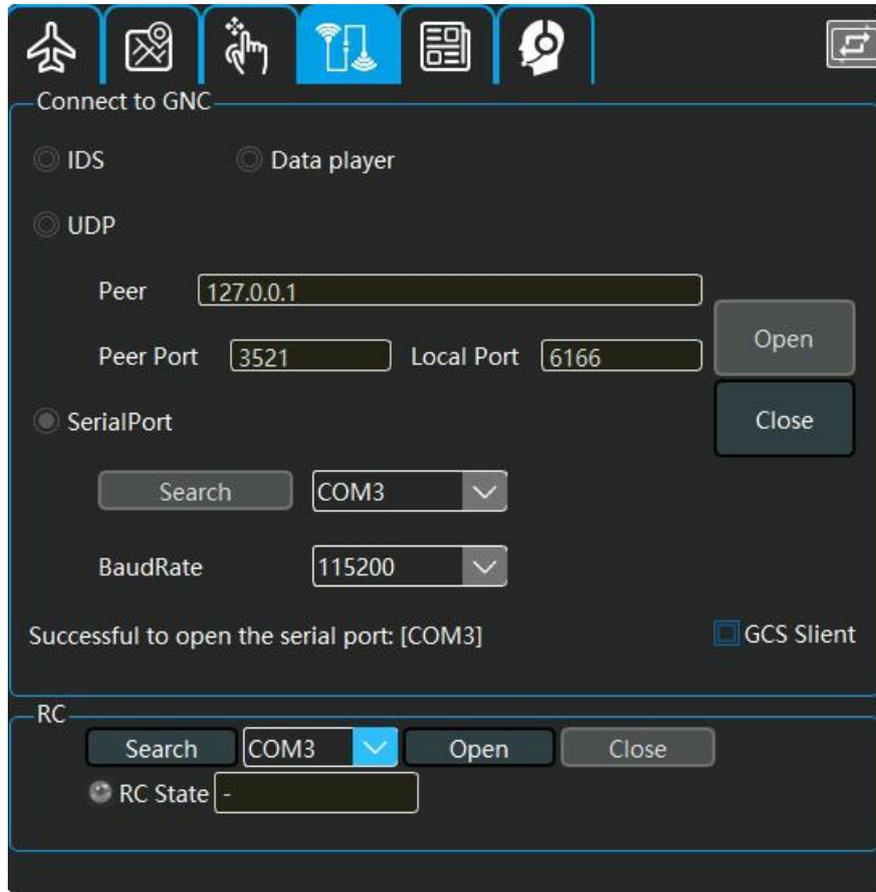
#### 3.1 Configuration Software



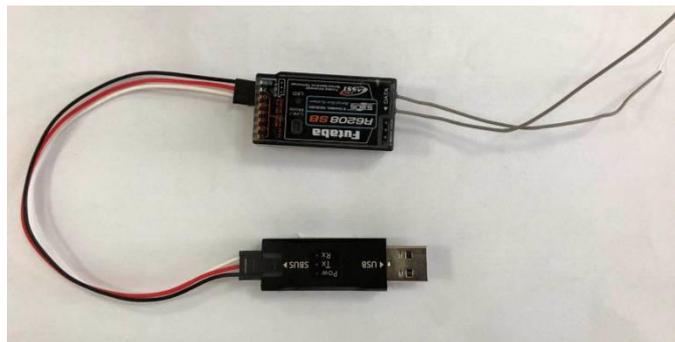
**Ground Station Screen**

- 1) Connect the USB port of the radio to the USB port of the computer before connecting the ground station. All the lights on the radio will light up.
- 2) Open the ground station software on the desktop,  enter the interface, then click,  click  to search the serial port, and then select the  serial port. Because the computer is different, there will be many serial ports, to select the serial port displayed after searching. Select the fixed wing mode  and click  and last click  to enter the ground station.

### 3.2 Radio Receiver Converter

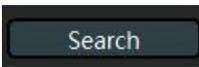


**Ground Station Screen**

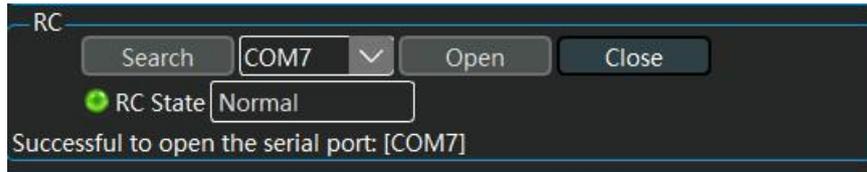


**Radio Receiver Converter**

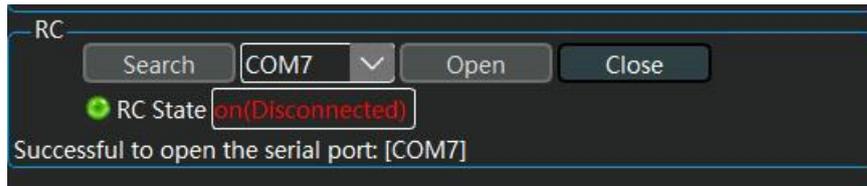
Before connecting the remote control, plug the radio receiver converter into the USB of the computer, set the receiver to the remote control, turn on the ground station, then open 

and then look at the remote control. Click  and select the corresponding serial port. At this time, the remote control icon will become the remote control status 

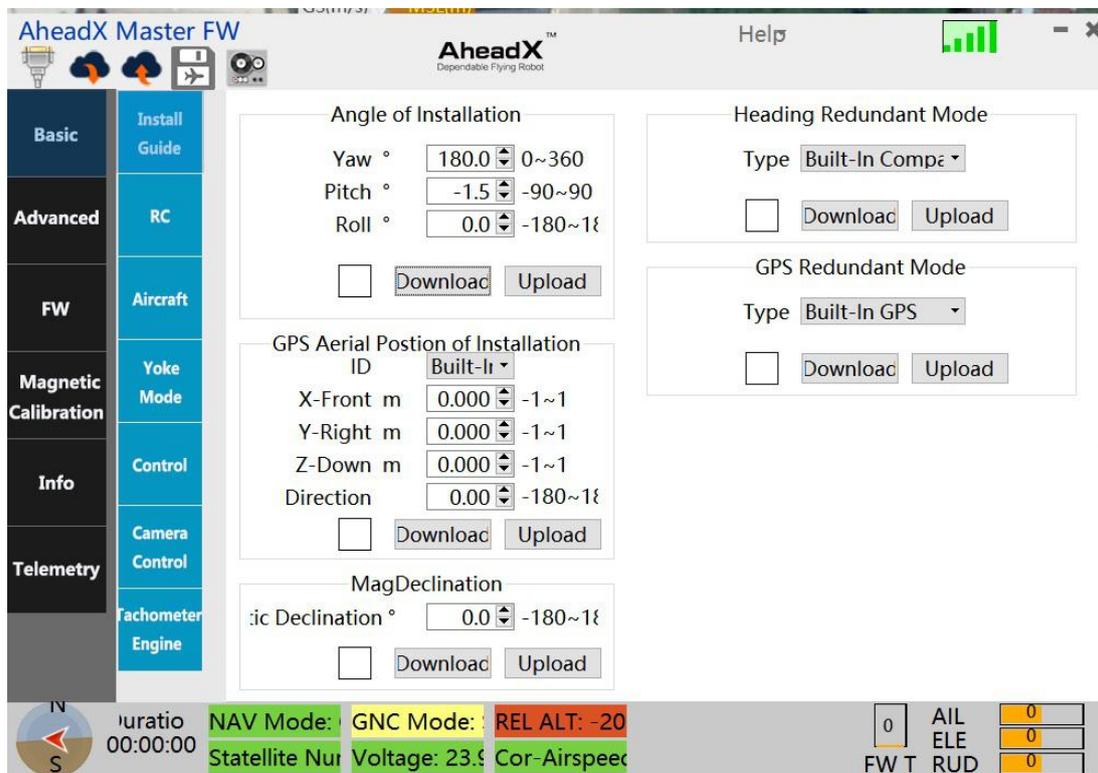
This column will display normal.



If the remote control icon is not displayed, the remote control status bar will display abnormally (lost connection), like this 

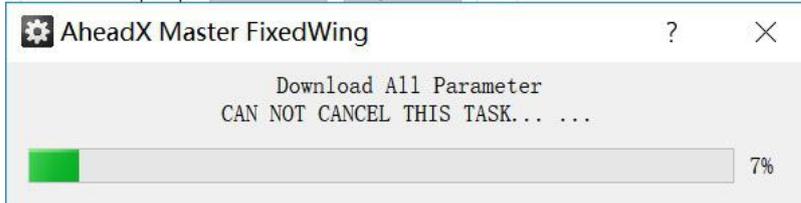


### 3.3 Magnetic Compass Calibration

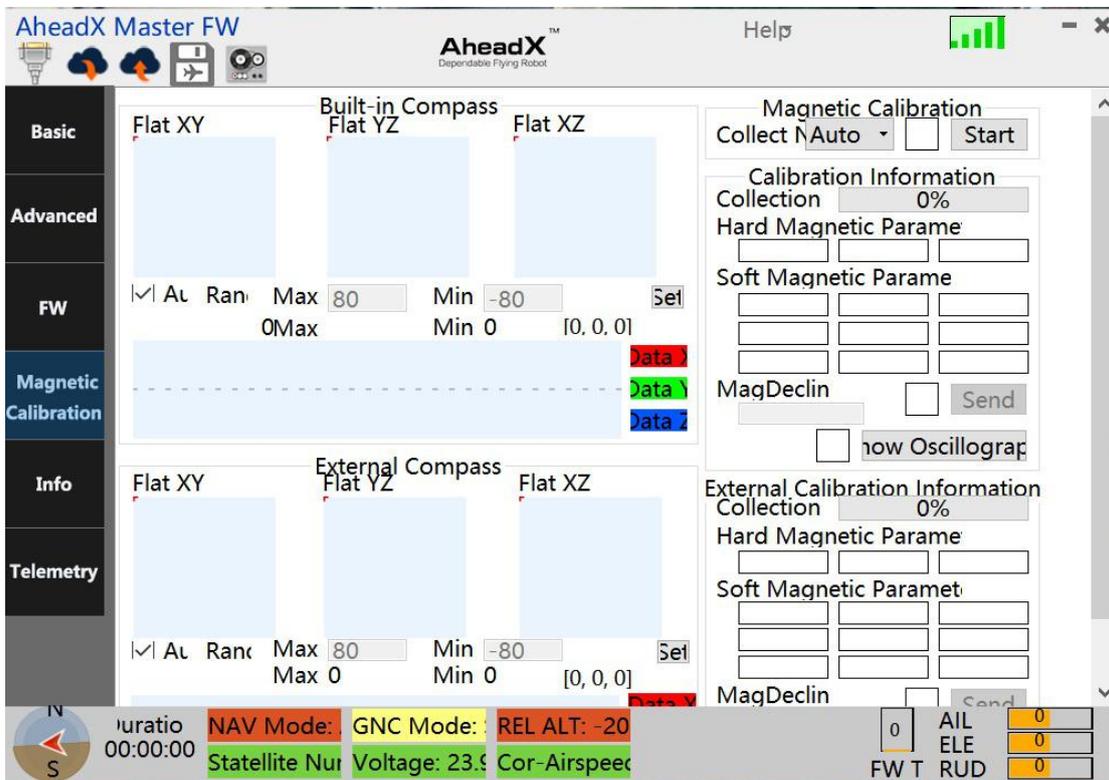


Connect the ground station, open the ground station assistant software to enter the interface. When the interface signal icon  is displayed as connected, you can

proceed to the next step. Click  the batch download data icon and the following progress bar will appear.

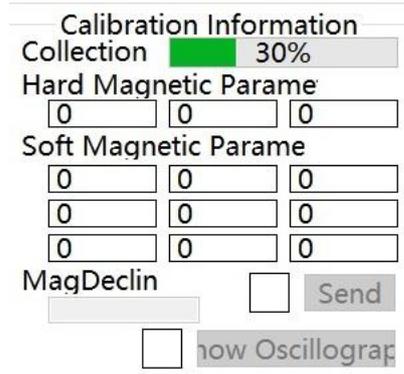


The next progress bar reaches 100% for the next step. Click  to enter the interface.



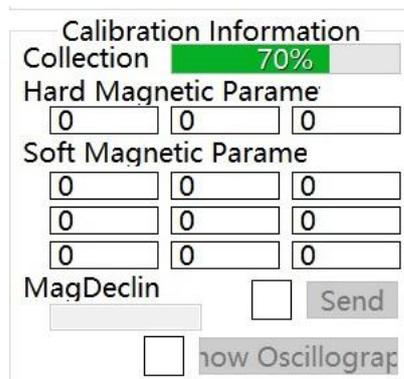
**Magnetic Compass Calibration Screen**

Click **Auto** on the small triangle to enter the interface  and choose **300**  to take the plane from the ground. The plane is horizontal to the ground and then click **Start** to hold the airplane to rotate clockwise. A progress bar will appear. This position needs to be changed from 0% to 30%.



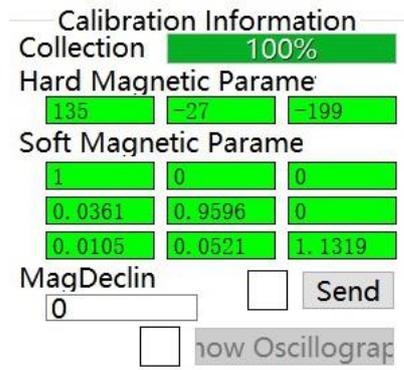
Calibration Information  
 Collection **30%**  
 Hard Magnetic Parame  
 0 0 0  
 Soft Magnetic Parame  
 0 0 0  
 0 0 0  
 0 0 0  
 MagDeclin  Send  
 Show Oscillograp

When the progress bar of the calibration magnetic compass exceeds 30%, the aircraft should be set up and the head should be perpendicular to the ground. Continue to rotate the progress bar in a clockwise direction from 30% to 70%.

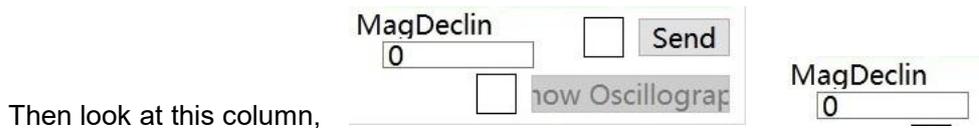


Calibration Information  
 Collection **70%**  
 Hard Magnetic Parame  
 0 0 0  
 Soft Magnetic Parame  
 0 0 0  
 0 0 0  
 0 0 0  
 MagDeclin  Send  
 Show Oscillograp

When the progress bar exceeds 70%, the wing should be set up perpendicular to the ground, and the direction should continue to rotate in a clockwise direction from 70% to 100%. When the progress bar reaches 100% and all the boxes turn green.



Calibration Information  
 Collection **100%**  
 Hard Magnetic Parame  
 135 -27 -199  
 Soft Magnetic Parame  
 1 0 0  
 0.0361 0.9596 0  
 0.0105 0.0521 1.1319  
 MagDeclin  Send  
 0  
 Show Oscillograp



Fill -6 in the magnetic declination column (for example in Beijing, Beijing's magnetic yaw angle is -6) and then click **Send**, the button

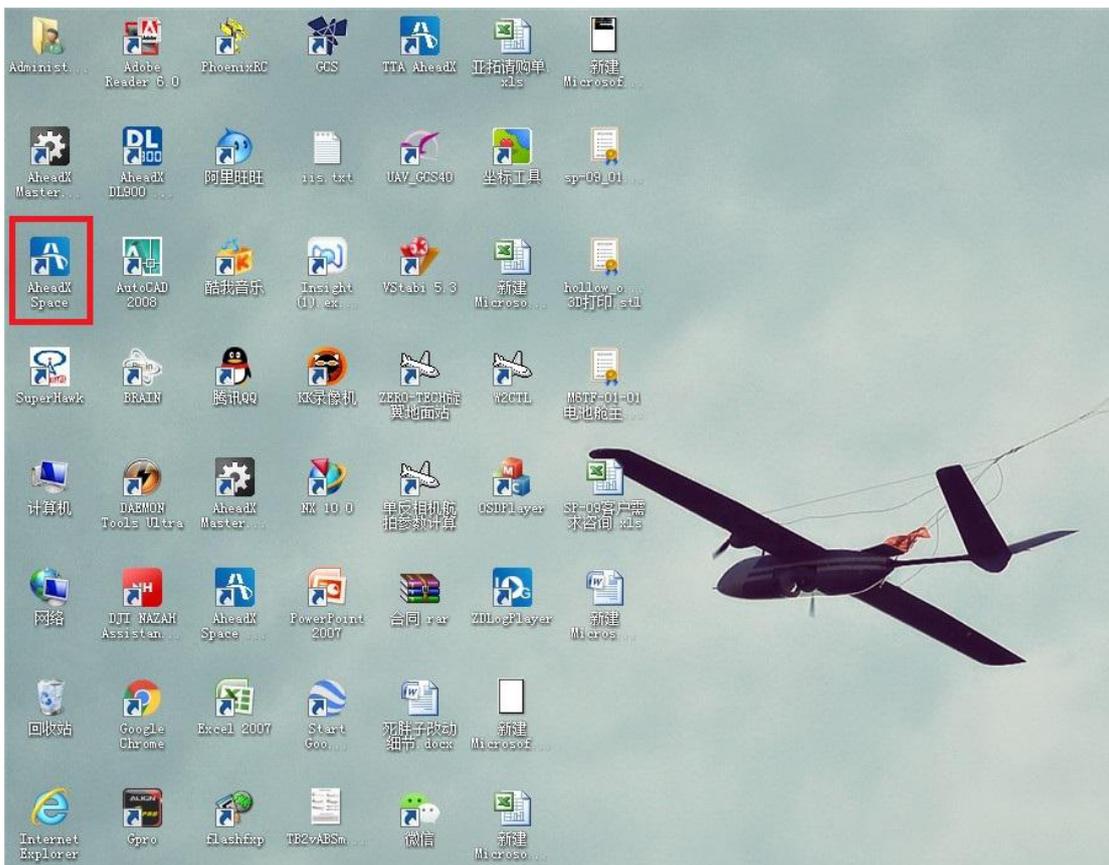
will turn green  and finally click , after the data save button turn green, the aircraft can be powered on.

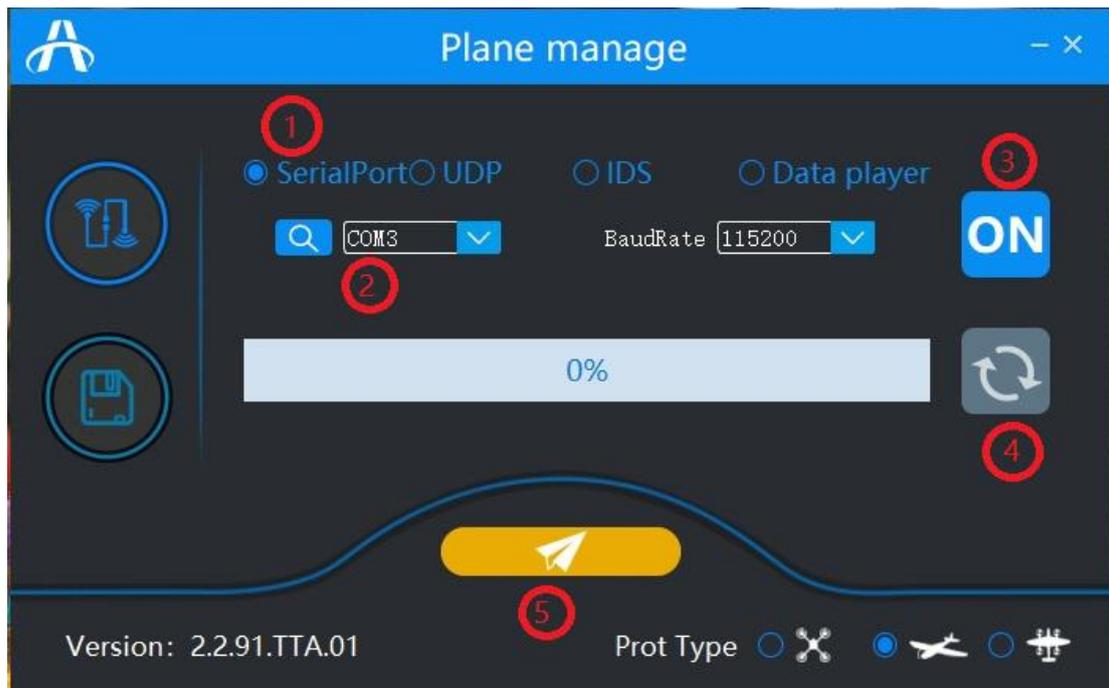
(If there is an external magnetic compass, you need to fill in the two sides of the magnetic yaw method as above)

## 4. The Usage of Ground Station

### ◆ How to Start the Ground Station?

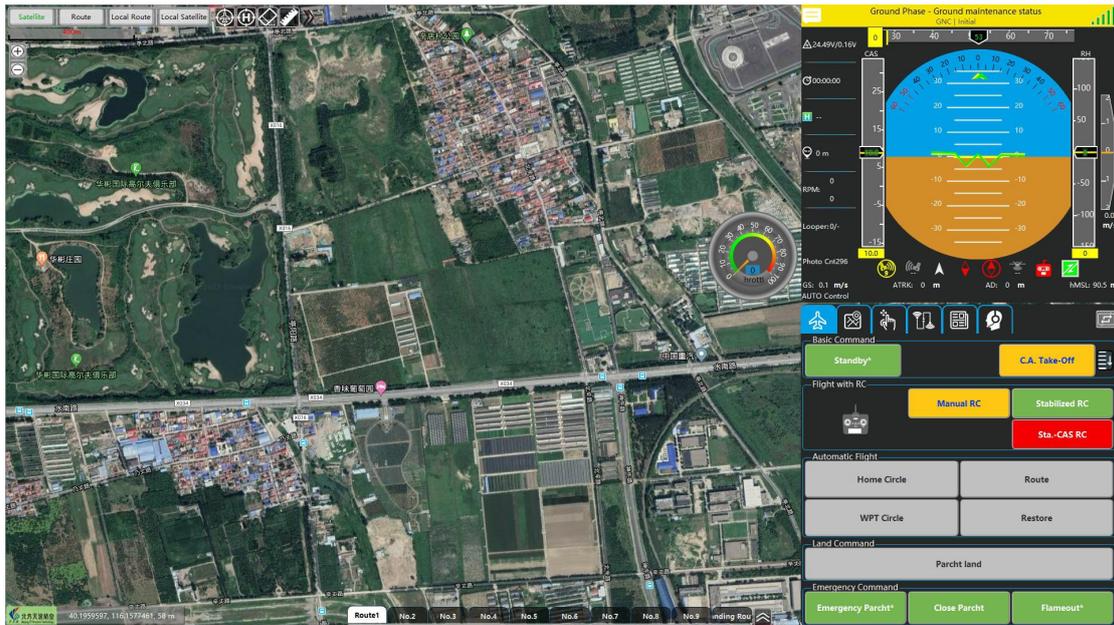
Launch the ground station software from the computer desktop, as shown in the red area icon.





The above picture shows the startup interface of the ground station software. The software needs to make the following choices before the software is opened.

- 1) open the software: use serial port, UDP, IDS or data playback.
- 2) Select the port number where the flight control station is located.
- 3) Click the "ON" button to open the selected port.
- 4) Click the sync button to synchronize the data. The aircraft needs to be powered before synchronization. After synchronization, the software will automatically recognize the type of aircraft, with multiple types of rotors, fixed wings and composite wings.
- 5) Click the small airplane button to launch the software interface, as shown below.



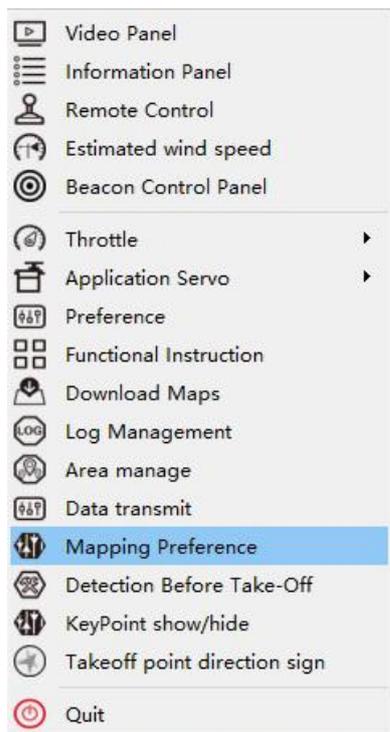
◆How to set camera parameters?

The camera parameter setting here refers to telling the ground station that we use the camera's photo resolution, sensor size and focal length instead of setting the camera itself.

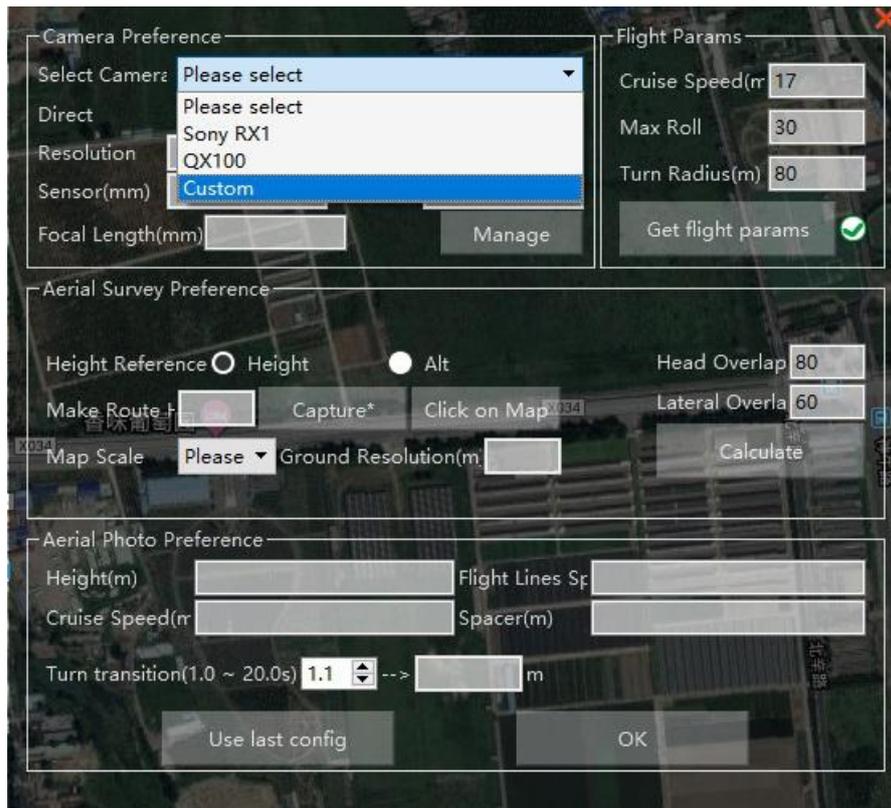
The detailed parameters of the Sony RX1RII and Sony A7R cameras are set at the end of this manual.

1. Right click the mouse in the ground station software, and the following menu appears.

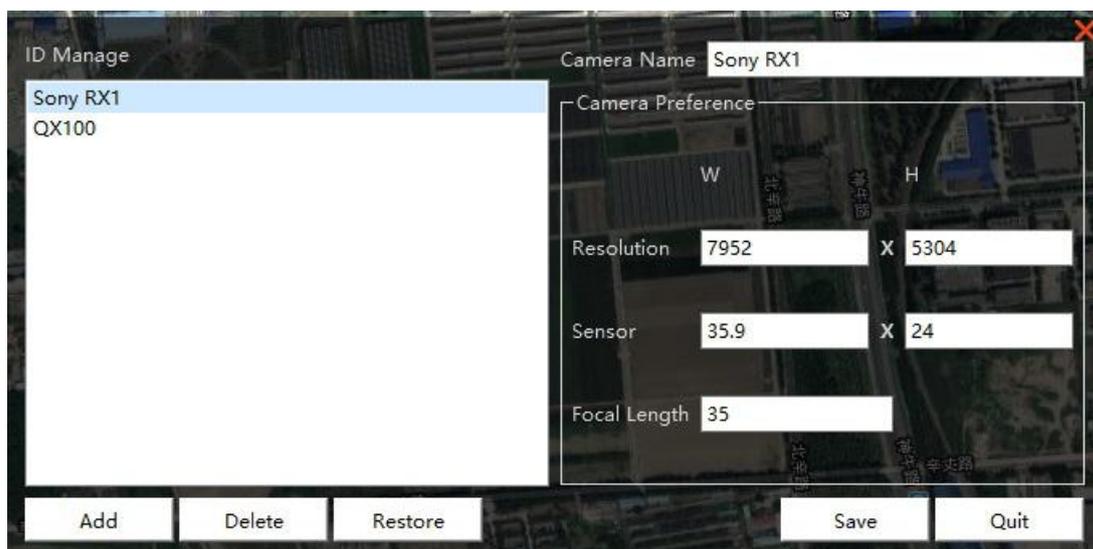
Click “Mapping Preference” in the menu.



2. In the “Select Camera” drop-down list box, select the name of the camera you want to use. If not, click the “Manage” button to create a new camera parameter.

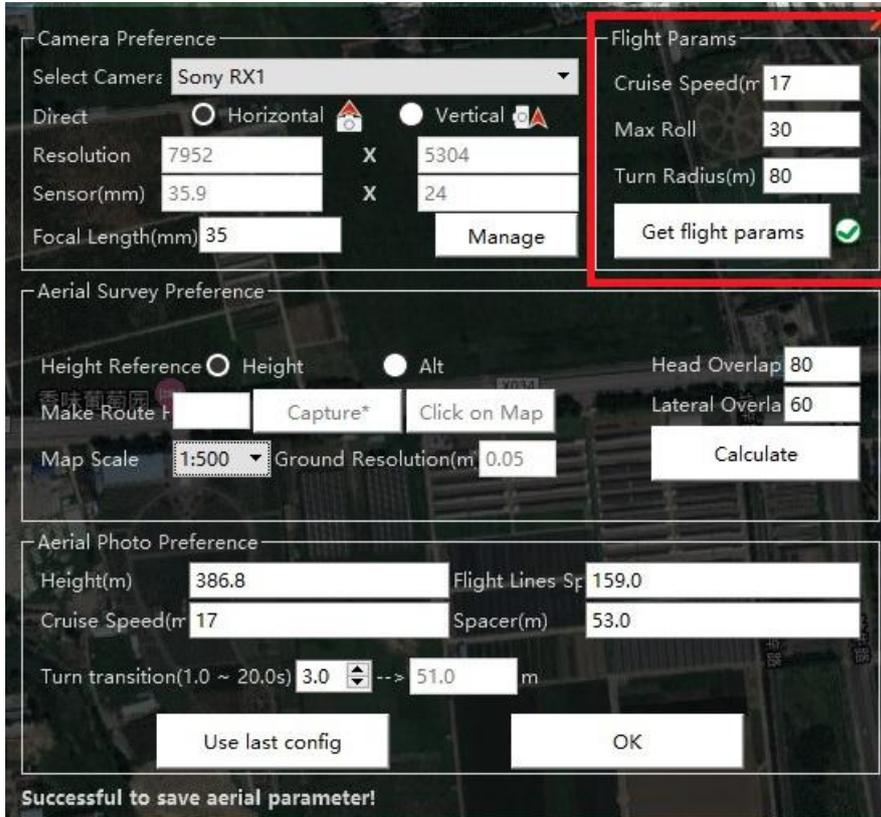


Click the “Manage” button and the “ID Manage” interface will pop up. Here you can “Add” the parameters of the camera you are using, mainly “Camera Name”, “Resolution”, “Sensor” and “Focus Length”. Click the “Save” button when you are done.



◆How to Set the Relevant Parameters Such as Routes?

1 Flight Parameter Settings



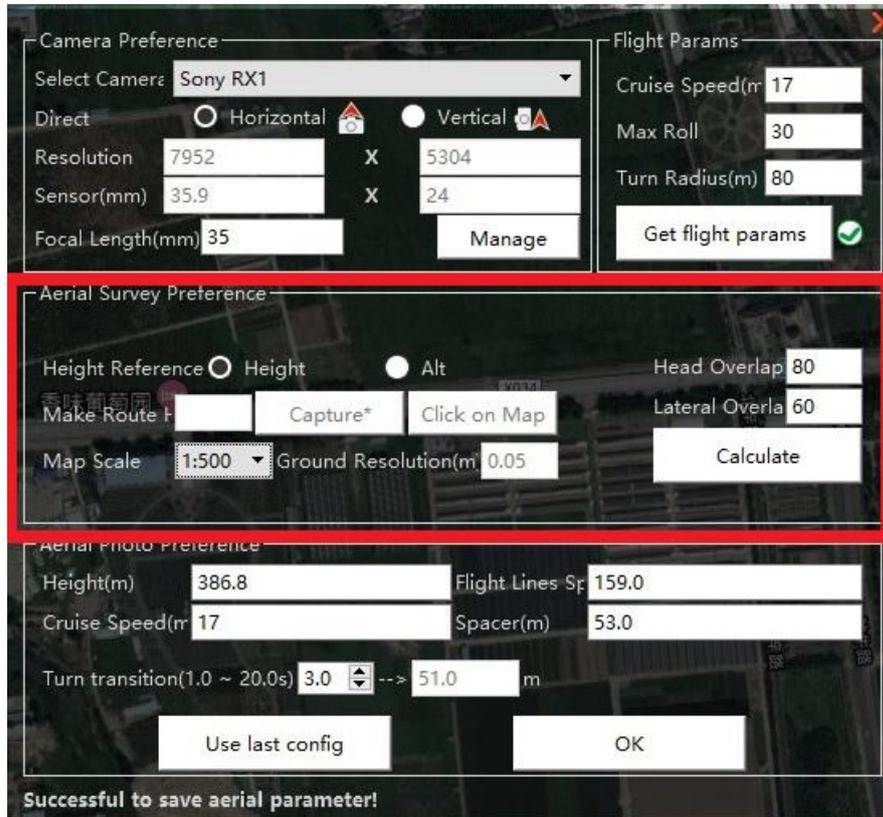
The parameters here are the parameters of the hand-picked fixed-wing wing designed by Tiantu. Of course, you can set it according to the characteristics of your aircraft. In addition, you need to remind that if you are flying in windy weather, you should increase the cruising speed and the maximum rolling angle. And the turning radius. For example, the weather of level 5 wind will adjust the parameters as follows:

Cruising speed: 20m/s

Maximum roll: 35 degrees

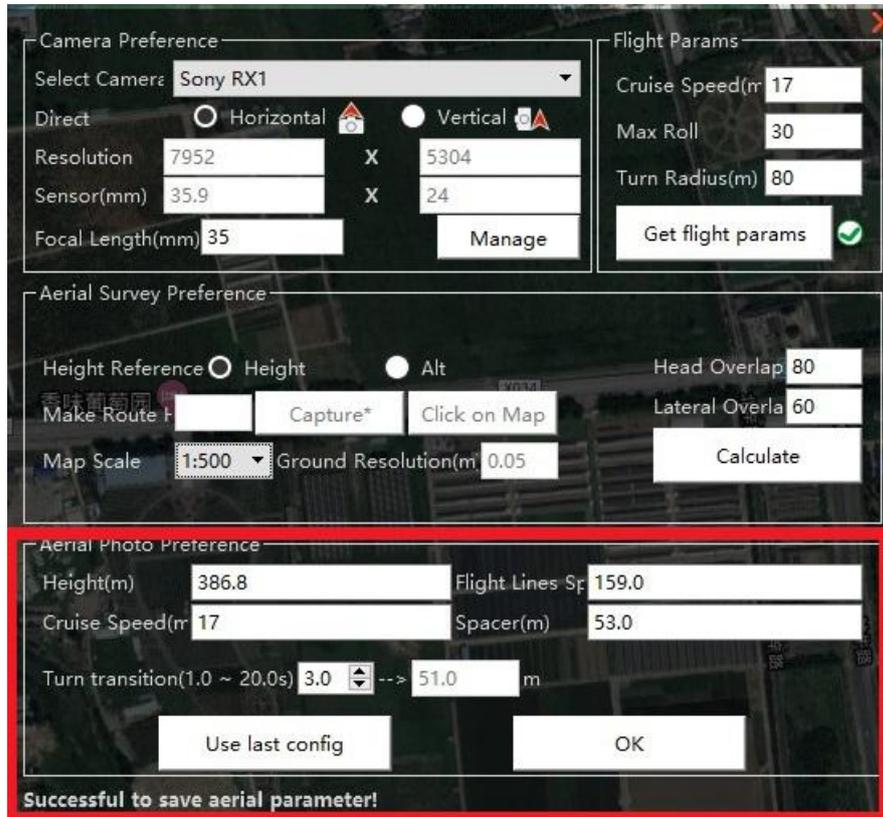
Turning radius: 120m

### 3. Scale and Overlap Rate Settings



Here you need to set the "map scale", "head overlap" and "Lateral overlap", generally the default value. Of course, you can adjust them according to the characteristics of the aircraft and the quality of the drawing. For example, if the aircraft is flying at a faster speed, the heading overlap rate can be adjusted to 70%, so that no discarding occurs during the flight. After setting the parameters, click the "Calculate" button, and the calculated result will be displayed in the "Aerial Calculation" column.

### 3 Route Height,space and Turn Settings



The three parameters "Height", "Flight lines space" and "Spacer" in the above figure are automatically calculated by the above camera parameter setting, drawing scale, heading overlap rate and side overlap rate.

If the height is too low, you can increase the "Picture Scale".

If the flight lines spacing is too small, the "side overlap rate" can be reduced.

If the Spacer is already less than the cruising speed of the aircraft, it means that the camera should take pictures once every 1 second. Such a high frequency camera is difficult to achieve, which is easy to cause photos to be lost. Then you can reduce the "heading overlap rate" appropriately.

The "Turn Transition" column sets the length of the extended portion of the scanning route.

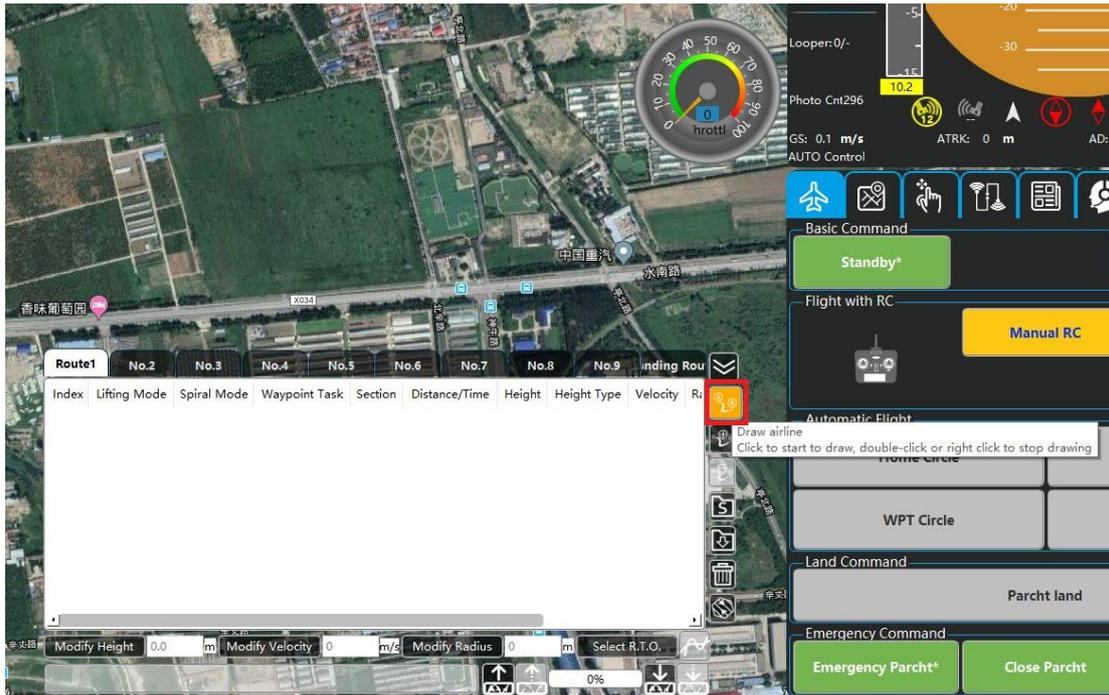
The following is the difference between setting "1" and setting to "5", as shown in the figure below:



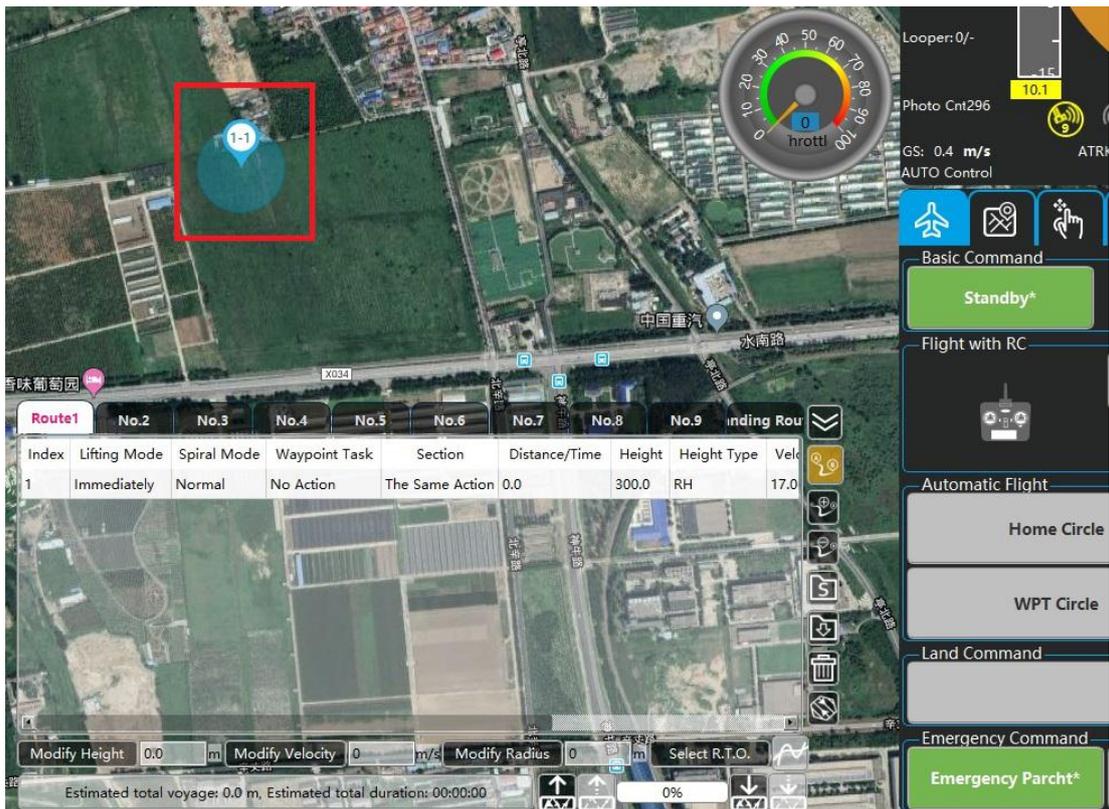
As can be seen from the figure, after setting to "5", the distance from 1 to 2 points is increased. The advantage of this is that if the wind is large, it is more conducive to the aircraft to make a turn, otherwise the aircraft will fly outside the scheduled route. The area is causing photo shooting errors and inaccurate angles. The empirical value indicates that the 5th grade wind suggests setting this value to "7".

◆How to Plan the Route

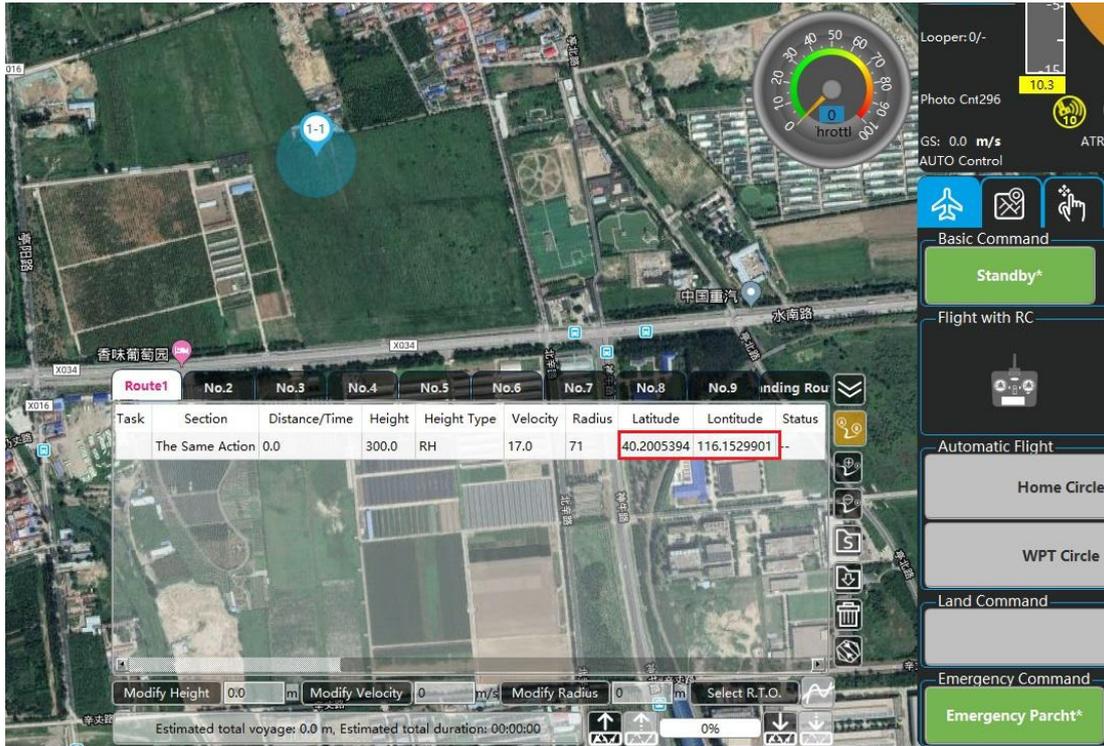
1 Quickly Locate the Survey Area



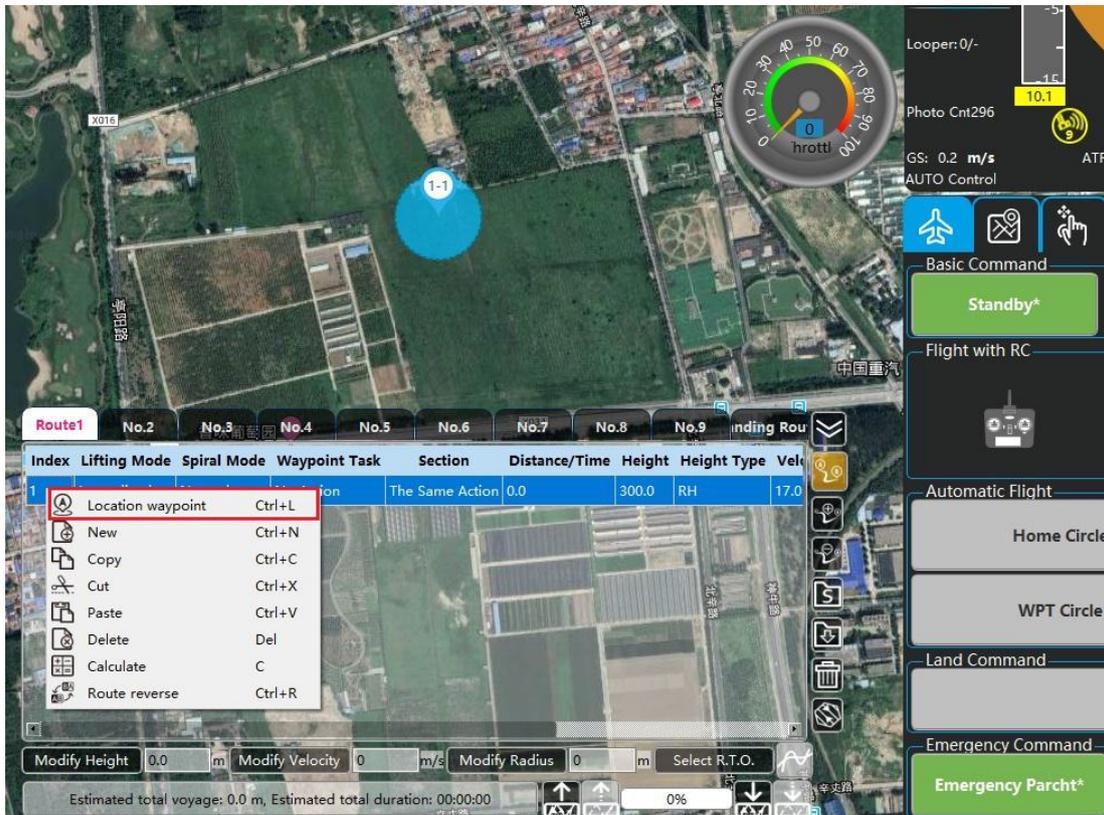
In the image above, click the “Draw Route” icon and click on the map a little.



Then fill in the latitude and longitude of the survey area in the "latitude" and "longitude" columns, as shown below:



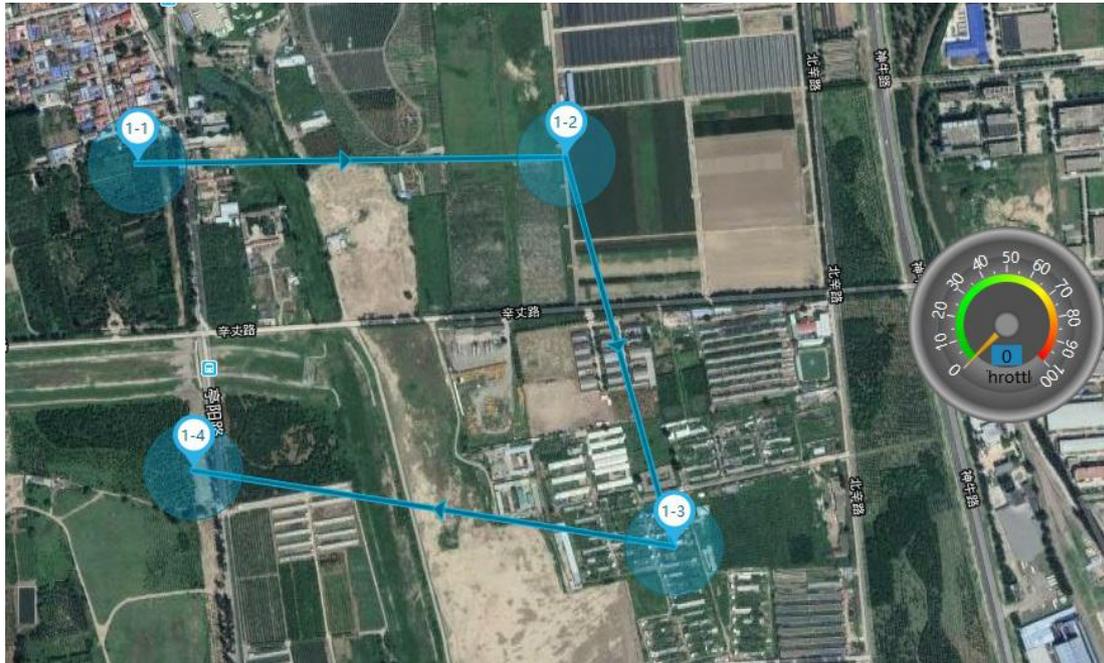
Finally, right click on the line that has just modified the latitude and longitude, and the following menu will appear.



Click "Locate waypoint", then the waypoint location displayed in the map is the location of the survey area.

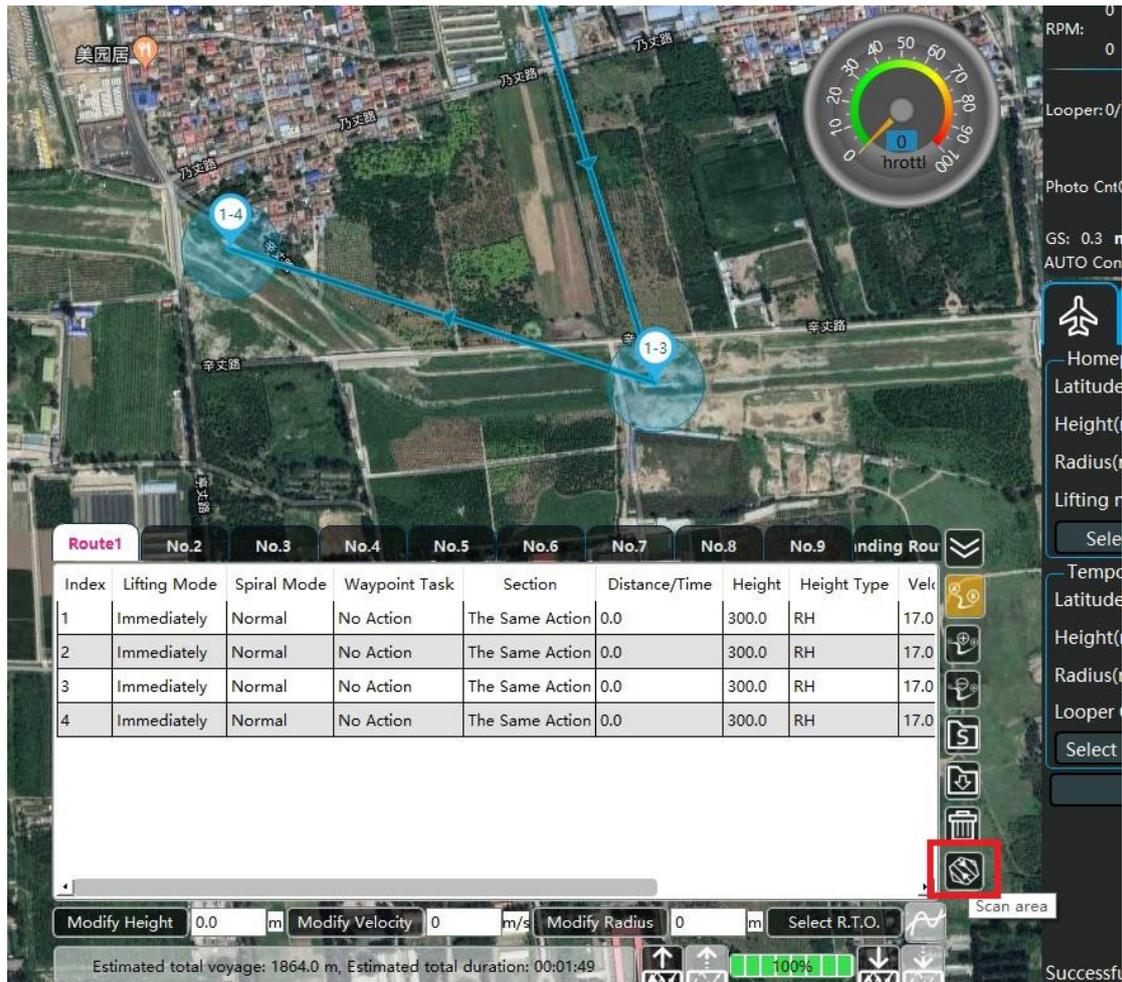
## 2 Planning the Route Boundary of the Survey Area

According to the coordinate value of the boundary of the measurement area given by the customer, the position of each point is selected in the map in turn, as shown in the following figure.



Please pay attention to the route and the position and position relationship of the route 1 and the 2nd route. This will determine that the first route of the aircraft is from 1 o'clock to 2 o'clock, and then selected in turn. A scan route is generated within the area.

After planning the boundary route of the survey area, the next step is to generate the scan route. As shown in the figure below, click the “Scan area” icon.



Then, the planned boundary route of the survey area will disappear, and the scan route will be replaced. The generation of the scan route is closely related to the camera parameters and route parameters we set above. The parameters are different, and the generated scan routes will be very different.



Please note the location and orientation of the first route in the picture. In addition, in principle, we will add a point in front of the 1st waypoint, because the 1st waypoint is definitely at the starting position of the survey area, which is not conducive to the entry of the aircraft, and it is easy to produce sharp corners, so that the aircraft is not easy to cut into the waypoint. 2, will result in photo shooting is not correct, so modify the current route, add a point in front of the 1st waypoint, as shown below:



◆ How to execute the route

After the route planning is completed, you need to upload the route to the flight control to

start the route. Click the "Upload selected Route" icon, as shown below.



After the upload is successful, there will be a "Successful Upload Route 1" revelation, indicating that the route has been successfully uploaded. Generally, we will verify whether the upload is successful. Click the "Clear all waypoints" icon and then click the "Download current route" icon. If it can be downloaded normally, it indicates that the route has been successfully uploaded.

After the route is successfully uploaded, you can take off the aircraft by double-clicking the "shot takeoff" button on the ground station interface. After the aircraft takes off, it will fly directly to the Home point to hover and wait for the command to be issued.



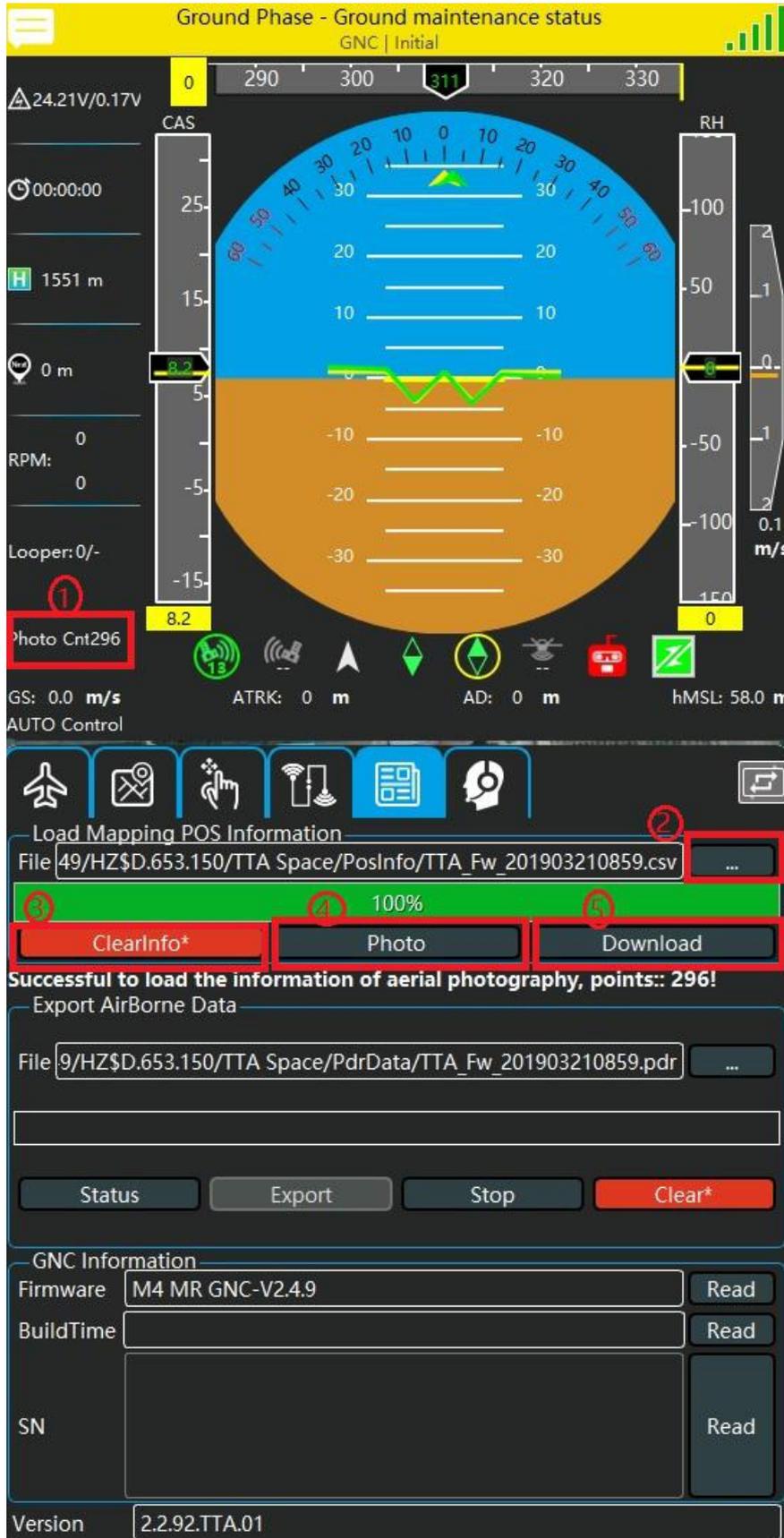
At this time, you can click the “Route Mode” button to select the corresponding route and the waypoint to fly. The aircraft will execute all the points of the current route in turn. As shown in the figure, the aircraft will take photos from the 3rd point. At the 4th point, stop taking pictures; at the 7th point, start to do the same distance photography, stop at the 8th point, and so on, until all the waypoints are flying, the plane will fly to the Home point to make a hovering flight.

◆How to verify the aerial results?

After the flight, we will do 2 things:

First, download the aerial Pos point data information.

Second, check if the data information of the Pos point matches the number of photos in the camera.



As shown in FIG

1 indicates the total number of times the flight control performs the photo taking.

2 Select the directory location where you want to store the Pos data file.

3 Four clicks "Clear Information" before each takeoff means clearing the information of the Pos data of the latest flight control record.

4 Click "Photo" to do a ground check before taking off and manually trigger the camera to take a photo.

5 After the flight is over, click the "Download" button to download the Pos data of the photo to the local computer.

#### Simple flight process

- ◆ Open the ground station software and open the port number where the station is located.
- ◆ Power on the aircraft
- ◆ Set the hovering point
- ◆ Perform the takeoff command on the ground station
- ◆ Executing related routes
- ◆ Executing the landing route

#### Flight safety inspection process

- ◆ Check before takeoff - hardware part
  - Is there any blockage in the airspeed tube?
  - Is the mechanical structure of the aileron and elevator gear reliable?
  - Are the connectors of the fuselage secure?
  - Is the motor and propeller installed securely?
  - Is the center of gravity of the airplane correct?
- ◆ Pre-flight check-software part



- Is the magnetic compass pointing in line with the actual pointing? Is the magnetic compass green?
- Is the GPS indication green?
- Is the level indicator correct?
- Can the power voltage support takeoff?
- Is the airspeed indication near 0m/s?
- Is the relative height indication about 0m?
- ◆ Pre-flight check-logic part
  - Is the homing hover point set?
  - Can the remote control normally control all servo mechanisms?
  - Is the remote control able to control the motor normally?
  - Is the propeller installed correctly?
  - Are all the control surfaces corrected correctly in attitude mode?
  - Is the landing route correct? Please make sure that the landing route is near the takeoff point.
- Is the -1 to 9 route correct? Please make sure that the 1 to 9 route is near the takeoff point.
- ◆ Take off Stage
  - Accurately judge the wind direction and ensure that the aircraft takes off against the wind.

- After take-off, the aircraft will hover at the homing point and wait for instructions.
- If the following occurs during the hovering process, please select the appropriate time to execute the "Emergency Umbrella" command, or take over the manual flight with the remote control.

GPS is missing, yellow or red, as shown on the right.



- GPS completely loses its signal, and the aircraft enters the GPS star protection, as shown below



The magnetic compass indicates red, as shown on the right.



#### ◆ Cruise Stage

- Ensure that the aircraft is hovering at the homing point for a few laps without an abnormality.
- It is recommended to raise the aircraft to the predetermined height before performing the flight.
- After performing any of the operations in the ground station, if the aircraft does not fly as expected, perform the "homing hover" operation immediately.
- After performing any operation in the ground station, it is necessary to confirm the flight height and airspeed of the aircraft again to prevent misoperation, especially when filling in height and speed, the problem of "0" and "0" is small.

#### ◆ Landing Stage

- Please perform the "homing hover" operation before landing.
- After the aircraft is highly stable, select the appropriate timing to execute the "landing" command.

#### 4.7 About the Transition

After the aircraft has been transferred from the previous flight site to the next flight site, it is necessary to re-plan the landing route and the mission route to be performed. The

advantage of this is to prevent the user from misoperation and to perform the task of the previous flight site without knowing it. The route, or the aircraft automatically enters the landing route of the previous flight due to low voltage protection, so it is necessary to ensure that the following items are completed.

- ◆ Calibrate the geomagnetic compass and fill in the geomagnetic declination in the assistant software.
- ◆ Reset the “landing route” in the flight control
- ◆ Reset the task route

## **Disclaimer**

1. To protect the legitimate rights and interests of users, please be sure to read our instruction attached carefully before using product. Be sure to understand your legitimate rights and interests, responsibilities and safety instructions; or it may cause property damage, safety accident and hidden personal safety problem. Beijing TTA reserves the right to update this document. Please be sure to in accordance with the instructions and safety instructions operating this product.
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4. Once you start using this product, deemed as you have read, recognized and accepted the product specification, disclaimer and terms and conditions of all safety instructions. It's user's commitment to their own behavior and therefore is responsible for all the consequences. Users promised to use this product only for legitimate purposes, and agree to these terms and any others policies or guidelines TTA company may develop .
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  - A) through informal agents or improper access to this product units or individuals;
  - B) the unauthorized modification, debugging, and replacement parts products.
  - C) warranty card, serial number, or flight data lost;
  - D) due to personal error caused personal injury and property damage.