

## A Successful RTK UAV Mapping Project with DJI Phantom 4 RTK and SinoGNSS T300 Plus



Mapping Site

### ■ Project Overview

A rural residential area in Shanghai covering 250000m<sup>2</sup> (as shown in Fig. 1) needs to be measured and mapped to obtain a high-accurate map. Featuring large area, time pressured and inadequate staffing, using traditional surveying

methods is challenging to complete the project. Thus, an excellent solution combining of Phantom 4 RTK (hereinafter referred to as P4R) and T300 Plus GNSS receiver is proposed with no image control points, short-time field work and labor-saving.



Fig. 1 Site Environment

## ■ Challenges

- The rural environment is covered with poor 4G network as normally base stations and UAVs transmit correction streams via 4G.
- No image control points will reduce the workload but cause no accuracy validation.
- Project operators are faced up with technical challenges as the new land surveying method is different from the traditional one largely.

## ■ Benefit

- Less Workload: Compared with traditional UAV mapping, RTK drone mapping depends less on control points as it is high-precision, which will reduce the workload in a large extent.
- WIFI Connection: Equipped with WIFI module, T300 Plus can transmit data easily, free from the restriction of Internet.
- Accuracy Validation: Except for being a base station, T300 Plus can also work as a rover to measure the coordinates of check points for accuracy validation.
- Easy to Use: Easy configuration and simple

workflow, no threshold for users.

- PPK Backup: To prevent situations where RTK is not applicable, T300 Plus also provides PPK as a backup plan, which can be performed simultaneously with RTK.

## ■ Project Summary

### ● Date

Field work was completed on 10/26/2020, office work was conducted from 10/26/2020 to 10/27/2020.

### ● Location

Beixin Village, Jiading District, Shanghai, China

### ● Instruments

1 × DJI Phantom 4 RTK  
1 × T300 Plus GNSS Receiver  
5 × checkmarks

### ● Software

Survey Master  
Pix4Dmapper

### ● Procedure

#### ✓ Set up Check Points

5 check points were placed over the mapping area uniformly, which's distribution was shown in Fig. 2. The coordinates were surveyed by SinoGNSS® T300 Plus receiver via Survey Master software in PDA CORS Mode. Survey Master improves the convenience and reliability of this

measuring project as its strong functionality and simplified work flow. With no need of a controller, it can be easily downloaded from Google Play Store and installed on an Android-based smart phone.

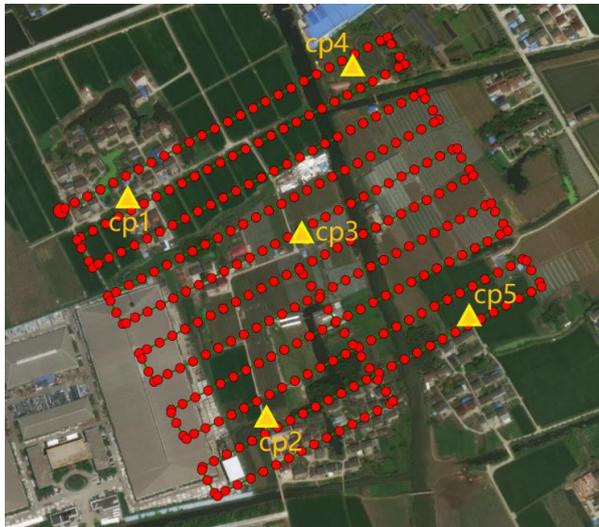


Fig. 2 Check Points Distribution Marked in Yellow

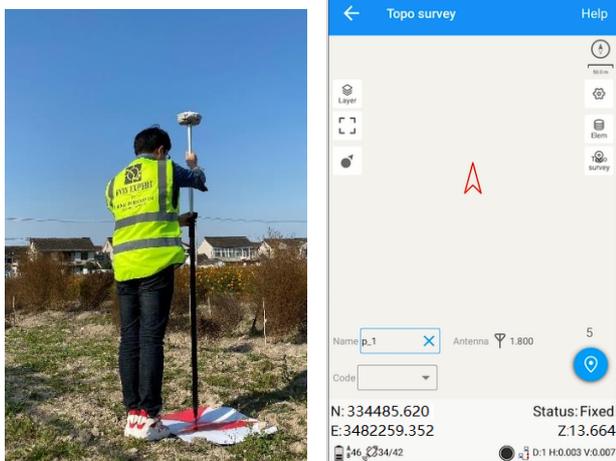


Fig. 3 Check Point Measurement (L) and Survey Master Interface (R)

The check points were only used for accuracy validation without participating in the data processing, causing no influence on the final result.

### ✓ Set up Base Station

On the control point (known point) of mapping area, T300 Plus was set up as base station to transmit correction data to P4R, connected to P4R via WIFI link. Benefit from the web UI of T300 Plus (shown in Fig. 5), it is easy to configure the known point coordinates and related settings on P4R remote controller.



Fig. 4 Base Station

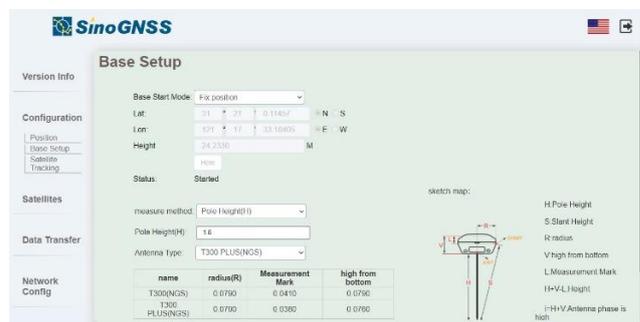


Fig. 5 Web UI of T300 Plus

### ✓ UAV Configuration

The flight route and relevant settings were configured on the remote controller before flying, which are given in Tab 1 and Fig. 6, respectively. It took only 13min for UAV mapping to collect a total of 333 images data in the large site area of 250000m<sup>2</sup>. When shooting each image, the coordinates of the CMOS were surveyed via the RTK module and attached to

each image data.

Tab 1: Flight Parameters

Parameters	Value
Height (m)	100
Speed (m/s)	7.9
Horizontal Overlapping rate (%)	70
Vertical Overlapping rate (%)	80
Photo Ratio	3:2
Gimbal angle (°)	-90
Altitude Optimization	on
Built-in distortion correction	on



Fig. 7 DOM Result



Fig. 6 Flight Route

### ✓ Data Processing

After input of the P4R images into Pix4Dmapper, related processes automatically ran, including initialization, images stitching, distortion correction and etc., and finally the DOM (Digital Orthophoto Map) and DSM (Digital Surface Model) results were generated, as shown in Fig. 7 and Fig. 8. The GSD (average ground sampling distance) is 2.95cm.

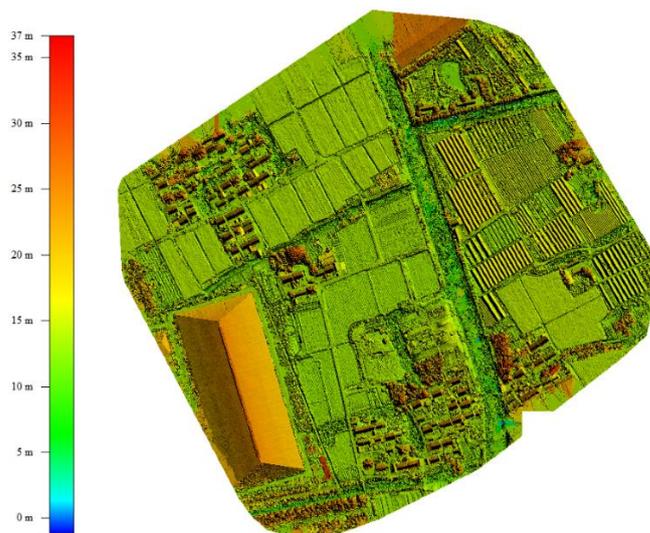


Fig. 8 DSM Result

### ✓ Accuracy Validation

Based on the measured check points, the variances between the DOM coordinates and the measured coordinates were calculated to validate the accuracy. They are within 10cm vertically and 5cm horizontally, as illustrated in Tab 2 below.

Tab 2: Check Points Accuracy

Check Point	Measured Coordinates			DOM Coordinates			Variances		
	N	E	Z	N	E	Z	$\Delta N$	$\Delta E$	$\Delta Z$
cp1	334485.620	3482259.352	13.664	334485.647	3482259.319	13.718	-0.027	0.033	-0.054
cp2	334676.808	3481963.650	13.714	334676.784	3481963.697	13.677	0.024	-0.047	0.037
cp3	334730.794	3482202.946	13.678	334730.763	3482202.985	13.617	0.031	-0.039	0.061
cp4	334804.734	3482437.574	13.770	334804.776	3482437.618	13.683	-0.042	-0.044	0.087
cp5	334956.848	3482092.268	13.780	334956.823	3482092.247	13.814	0.025	0.021	-0.034

## ■ Conclusion

In conclusion, compared with traditional UAV mapping or land surveying, the RTK drone mapping with P4R manifested higher efficiency, simpler workflow and less workload. which can save both time and labor, turning a large proportion of field work into office work. The mapping solution combining a continuous and reliable T300 Plus base station with a commercial UAV rover of Phantom 4 RTK can provide centimeter-level mapping precision to meet most surveying work demands. Thus, it is both high-accuracy and cost-efficient.

As an indispensable part of this mapping solution, T300 Plus receiver played role as a

powerful backup. Supporting WIFI connection enables stable correction streams transmission. Its built-in web UI makes configuration easily. PPK backup plan reduces the absolute reliance on RTK. High-accuracy rover survey realizes accuracy validation of UAV mapping. It can be said as the best-in-class base station choice of drone mapping.

**ComNav Technology Ltd.**  
 Building 2, No.618, Chengliu Middle Rd.  
 Shanghai, 201801, China  
 Tel: +86-21-64056796  
[www.comnavtech.com](http://www.comnavtech.com)