propeller aeropoints

TRANSFORMING SURVEYING WITH THE WORLD'S FIRST SMART GROUND CONTROL POINTS

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PROPELLERAERO.COM/AEROPOINTS

INTRODUCTION

ABSTRACT

AeroPoints are smart ground control points: rugged visual targets with integrated GPS and precision post-processing, designed for use with small drones for fast, highly accurate photogrammetry-based surveying.

Combined with the Propeller online platform, they make it exceptionally simple to capture and deliver accurate geo-referenced drone-based surveys.

This paper outlines the key features of the AeroPoints geo-referencing system as well as the results of several testing phases undertaken by drone pilots and surveying teams designed to validate the real world accuracy of AeroPoints under a variety of conditions and configurations.

WHY USE AEROPOINTS?

Propeller has created the AeroPoints to help survey teams using modern small drones to deliver accurate information.

Photogrammetry-based surveys have well understood benefits and limitations. While 'in-air' RTK systems can improve accuracy, they continue to be expensive and operationally complex. The best results still require ground control.

Aeropoints are a GNSS-enabled ground control point system, capable of recording hours of GNSS data to provide geo-referencing corrections for surveying data with centimeter precision.

This data is uploaded for processing by Propeller's proprietary Post Processed Kinematic (PPK) algorithms.

The usefulness of drone surveying is intrinsically linked to the internal and absolute accuracy of the measured data. Established GNSS surveying technologies such as DGPS and RTK remain expensive in both hardware and implementation. AeroPoints offer a simple and affordable solution to providing accurate surveying data on multiple sites regardless of supporting infrastructure.

As a complete solution, AeroPoints can be paired with the integrated Propeller data platform which offers:
- Full 3D survey and inspection data visualisation
- Best in class 2D and 3D measurements
- Unlimited imagery resolution
- Powerful and fast data processing – verified by a specialist
- No integration needed with drone or camera

AeroPoints are solar powered, easy to use and durable.

GENERAL SPECIFICATIONS

GCPS REVOLUTIONISED

Propeller's cloud software and AeroPoints system together represent a paradigm shift in the way drone surveys are flown, processed and visualised. Data points for surveying purposes are typically considered useful only if a relative internal accuracy of greater than 5cm can be maintained. AeroPoints exceed this degree of accuracy with less setup time and lower cost than current GNSS surveying solutions. The best part? The whole process —recording to data upload— is automated with a single button press.

Table 1 | AeroPoints precision

Specification	Result Difference
Internal[2] accuracy (X,Y,Z) GNSS correction covered area	<2 cm (X,Y,Z)
Absolute accuracy GNSS correction covered area	<2 cm (X,Y) <5 cm (Z)
Internal accuracy (X,Y,Z) Outside GNSS correction network	<2 cm (X,Y,Z)
Absolute accuracy (Z) Outside GNSS correction network	Down to 20 cm (dependent on survey location)
Effective coverage Per set of 12 AeroPoints	150 Ha/1.5 Km^2

2. Where internal accuracy indicates the accuracy of measurements between AeroPoints.

Table 2 | Hardware specification

Description	Measurement
Dimensions (WxLxH)	540x540x35 mm
Weight	1550 g
Power supply	5000mAh $LiFePO_4$ battery with solar charging
Storage	4GB Flash
Wireless connectivity	Wi-Fi (802.11 b/g/n)

Figure 1 | AeroPoints details

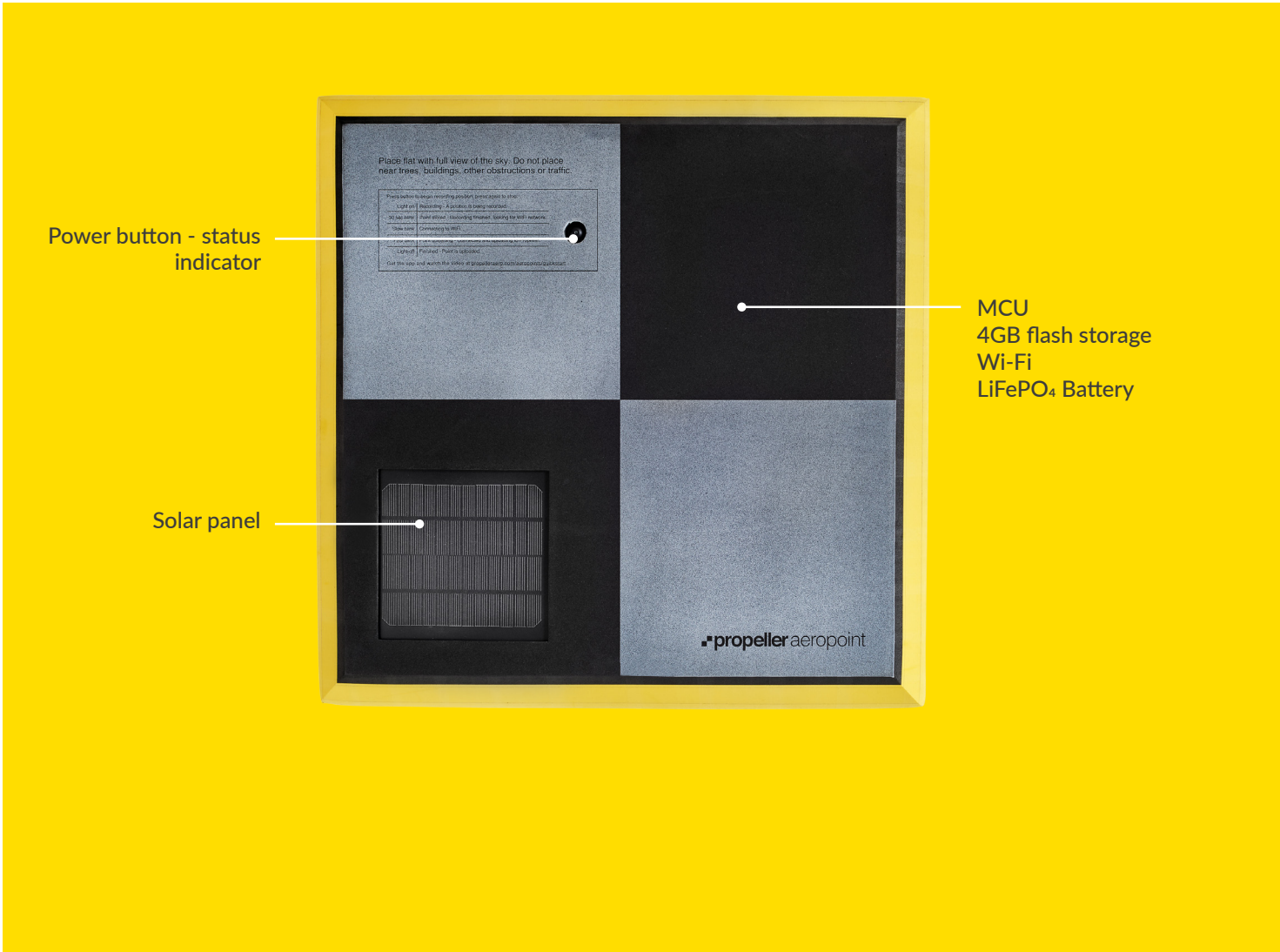


Table 3 | Power consumption profile

Description	Measurement
Recording (GPS on)	70 mA
Uploading data	100 mA
Deep standby	1.2 mA
Powered off	19 uA
Continuous operating time (from full charge without solar)	>40 hours

Table 4 | GNSS fix and data transfer characteristics

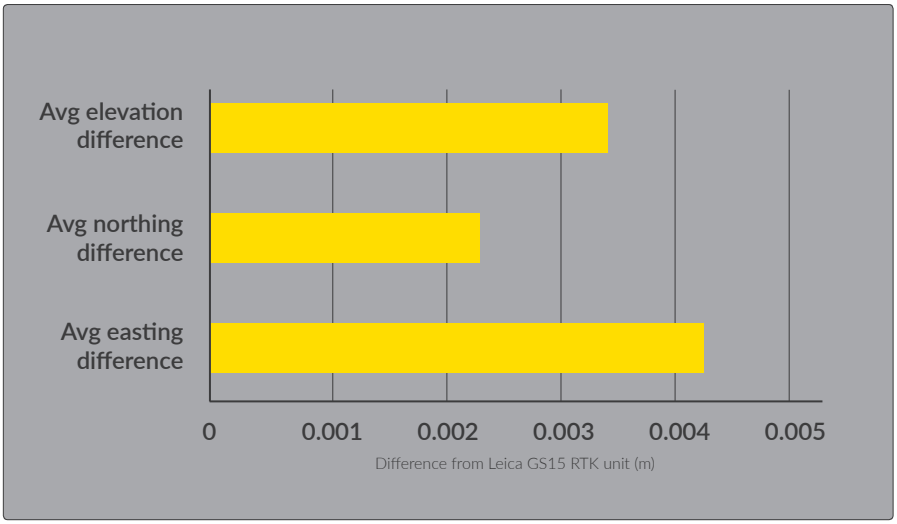
Description	Measurement
Minimum data capture time (within correction network)	30 min
Minimum data capture time (outside correction network)	2 hours
Record data rate	2 MB/hr
Upload data rate	1 MB/min

PRECISION WITHOUT COMPROMISE

AeroPoints offer the same precision as RTK surveys. Tests confirmed AeroPoints consistently produce accurate data with centimetre level precision. The following figures summarise data points gathered using AeroPoints across several rounds of testing during a survey undertaken

on an unused landfill site in Helensburgh, New South Wales. Figures 2 below indicate the measurement variance between the survey data acquired from AeroPoints and measurements achieved by a state-of-the-art Leica GS15 RTK surveying system over three rounds of testing.

Figure 2 | Average static difference in meters, AeroPoints versus Leica GS15 RTK from Helensburgh tests.



Unlike RTK surveys, AeroPoints don't need cellular internet coverage to obtain position corrections.

AeroPoints' ability to record hours of GPS data means operators can record once and upload without fear of losing GPS corrections from an unstable connection. Further, with AeroPoints the accuracy of the derived model is no longer restricted by real time processing restraints. Propeller's Post Processed Kinematic (PPK) algorithm ensures that the data provided for each survey is corrected as accurately as possible utilising information from the entire data stream.

READY WHERE YOU ARE

To compliment the AeroPoints system, a free app is available on iOS and Android to make tracking and uploading AeroPoints easy. Through

the app, an operator can mark the location of each deployed AeroPoint and will get a notification when logging has finished. Once a survey is complete, the app can turn a smartphone into a wireless hotspot, uploading ground control data straight from the site to the platform.

Data submitted to the Propeller platform is automatically processed, verified by a specialist and available online within 24 hours of being uploaded.

POSITIONED FOR SUCCESS

The key to accurate GNSS survey data lies in the quality of control points. With AeroPoints, operators' GCPs can be moved on a whim to best make use of their site's geography and changing conditions. As per any GCP technology best results are achieved with even distribution of AeroPoints at each of the site's corners with remaining points evenly spread throughout the centre of the site.

Figure 3 | Orchard Hills test site with recommended AeroPoints distribution

Many sites can be accurately covered by as few as eight AeroPoints with each additional point improving the quality of operators' survey data.

With the AeroPoints ground control system any drone can deliver survey-grade data.

SOLAR POWER AND DURABILITY

The AeroPoints ground control system is designed to operate for long periods in harsh environmental conditions. The chamfered, low profile design and waterproof enclosure ensures each AeroPoint holds its location even in high winds. Solar charging guarantees each AeroPoint remains charged and operational for the duration of the survey, and the fire-safe battery ensures they can record data for weeks even in heavy cloud.

SPEED AND SIMPLICITY

Each AeroPoint is operated with the press of a single button. Operators can simply drop an AeroPoint at a desired location and press to begin recording. When deployed within range of a GNSS Correction Network, AeroPoints can acquire accurate fixes to GNSS signals in minutes, and two hours when outside of network coverage. Traditional GCP markings for GNSS surveyed sites are often damaged or missing entirely, requiring additional time and cost to be repaired before a survey can commence. Deploying AeroPoints enables operators to get their GCPs right every time, regardless of site infrastructure.

For fast, effortless data transfer, every AeroPoint comes Wi-Fi enabled, ready to automatically upload survey data to a configured access point.

CONCLUSION

AeroPoints represent the next step in GCP-enhanced GNSS surveying. While we recommend using AeroPoints with the Propeller platform, a full report is provided after processing to allow the data to be used in third party solutions. AeroPoints deliver RTK-grade accurate georeferencing without the high cost or complications of traditional GNSS surveying. Centimeter accuracy combined with fast, flexible deployment make AeroPoints a powerful tool for any surveying project.

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