PHOENIX LiDAR SYSTEMS

# GROUND CONTROL RECOMMENDATIONS FOR PHOENIX CLIENTS

11 JANUARY 2018

# INTRODUCTION

Ground control points (GCP) are used as known points that can be related to a ground control reference GNSS station. Without ground control point you will not be able to test the absolute (vertical) accuracy of the project, only rely on the relative line-to-line accuracy.
A high precision GNSS ground station should be used to to create a static point in or near the study area. The GCP locations are tied back to the static ground station, allowing the high accuracies obtained by the long static session to be shared with the rover points.

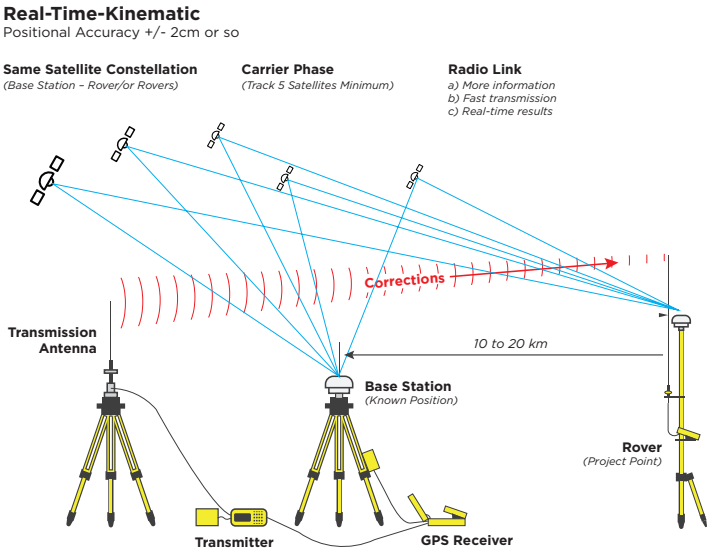
## COLLECTING GCPS

Ground Control Points (GCPs) should be collected using a Real Time Kinematic (RTK) GNSS rover unit that is radio linked back to your static reference station. The relationship between static station and rover and the communication between the two are easily seen in this image:

# GROUND SURVEY AND METHODS

## STATIC REFERENCE STATION

Before starting the LiDAR survey, the static reference station needs to be established and be set to record at a frequency of 1hz. At least two hours of data should be collected by the static station to ensure proper location refinement. The height of instrument (HI) should also be measured at this time. The HI should be measured to the Antenna Reference Point (ARP). This is a crucial measurement when post-processing the data as all measured locations are related back to this point.




## NUMBER AND DISTRIBUTION OF GCPS

There are no recognized standards for the number and distribution of ground control points for small study areas that are typically collected by UAV platforms, but Phoenix recommends about 10 GCPs for every 250 acres (1km) collected. They should be collected homogeneously throughout the study area. Phoenix also recommends that if more than one aerial mission is required for collection of the area of interest, that GCPs are distributed in each mission especially in areas of overlap between missions.

## LAND COVER TYPES

The ideal surface to collect GCPs are on hard ground surfaces (i.e pavement or concrete) to ensure the ground surface points surveyed represent the exact surfaces reflected in the LiDAR point cloud. These points should be collected at least 1 meter away from any sharp terrain changes (i.e. curbs, cliffs, severe slopes) and away from highly reflective surfaces such as paint lines or cars. Phoenix LiDAR Systems recognizes that some project areas are primarily vegetation or a mix of land covers within the project area. For this reason, the distribution of GCPs can vary based on the general proportion of vegetated and non-vegetated area in the project. These points should still be distributed proportionally within the project area and among the various land cover types, with hard surfaces primarily targeted. GCPs collected in vegetation are less reliable than hard surfaces and can often result in decreased reportable accuracies.

## VISIBLE AIR TARGETS

If collecting GCP's for missions involving Imagery collection, using air targets on hard surfaces is ideal. Either utilizing temporary targets that are visible during acquisition or collecting points on hard surface objects (still at ground level) visible from the platform will enable the imagery post-processing to utilize these surveyed points to assist absolute accuracies. If using the latter method, ensure that detailed documentation of the collection and identification of targets is provided to the post-processing team. Without this information, this team will have no idea what object is represented with the GCP.

## DELIVERY OF GCP'S TO POST-PROCESSORS

The GCP's must also be delivered to the post-processing team in the final coordinate system desired for the project. After collection of GCP's, please deliver to Phoenix in the following format:

**Excel .csv file with columns for: ID, Easting, Northing, Elevation**

**All in the final project coordinate system and with header information**

**Please note the coordinate system represented by the points (including units)**