

AirGon Support
11/16/2018
Revision 9.0

Summary

ASPSuite by AirGon, LLC includes all the software needed to import support files, process the Loki observations in Post-Process Kinematic (PPK) mode and update image headers with the refined position information. This document will discuss the workflow starting with checking the data in the field, to the final corrected positions.

Software Installation and Update

You can install or update your ASPSuite software by browsing to the following URL:
<http://airgon.net/asp/aspsuite/publish.htm>.

Simply follow the instructions on this page to install or update to the latest version of the software. Note that Microsoft .NET Framework 4.5.2 (x86 and x64) is required. You may check to see which version of the software you are currently running by browsing to the *About* dialog.

Please note that to install ASPSuite, the following ports **must** be open on your firewall: 5053, and your client specific port specified when you were provided the License String.



Figure 1- About ASPSuite dialog

Licensing

You will receive your license string via email from AirGon Support upon purchasing your license. The email will also include a link to download the ASPSuite application. On the ASPSuite License dialog, simply click *Set License String* and either type or paste the license string and click *OK*. Select your license level from the available licenses and input the number of days (1-30) and click *Check Out License*. Under Current License, the Level and Days Left for the license will be displayed. Licenses can be checked in and back out at any time, you do not have to wait for a license to expire. A **Standard** license allows you to access the Repair Photo Heights and File Manager tools. All other functionality requires an **Advanced** license. The ASP software that comes with the Bring Your Own Drone (BYOD) package is the **Standard** version. This is because the features of ASPSuite **Advanced** are not needed if the user is not utilizing Loki. The version that comes with the Loki PPK kit is the **Advanced** version.

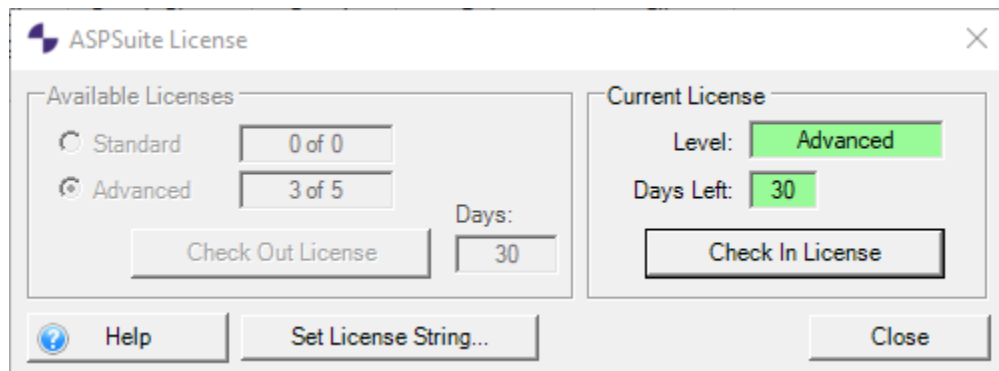


Figure 2- ASPSuite License dialog

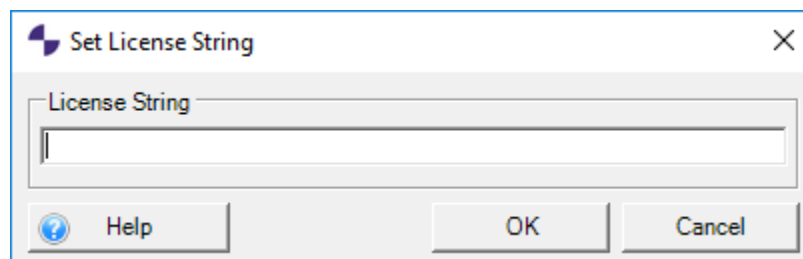


Figure 3- Set License String dialog

Note: You must be connected to the internet to check licenses in and out.

Field Check

A field check is a process used to compare the number of events to the number of images and check their relative position. The event patterns should closely match the flight pattern. The events should be evenly spaced and have no large gaps. Occasionally, one event will be missed. If too many events are missed in a row, it could leave a gap in the data. This scenario would require re-flying the mission. The following sections of this document are organized in a workflow-driven manner so that the user can follow along step by step to complete the processes.

Creating Project/ Adding Flight (Step 1 of 5)

1. The first step in the workflow is to import data from the aircraft in the field, and check the quality. Start by powering on the aircraft. Earlier version of Loki may need to be powered on before connecting with the USB cable. Newer version will not need to be powered on. The hot shoe device is made to connect directly to a DSLR camera, read the camera signal, and record the photo(s) position. Connect a USB cable from your computer to the Loki controller. Your aircraft should have come with a USB cable to download photos. Connect this cable from your computer to the aircraft. When both devices are connected, Open ASPSuite and select *Create Project/ Flight* (Figure 4).
2. Set the *ASP Projects Root Folder* path (Figure 5) to a folder where you want to store the project

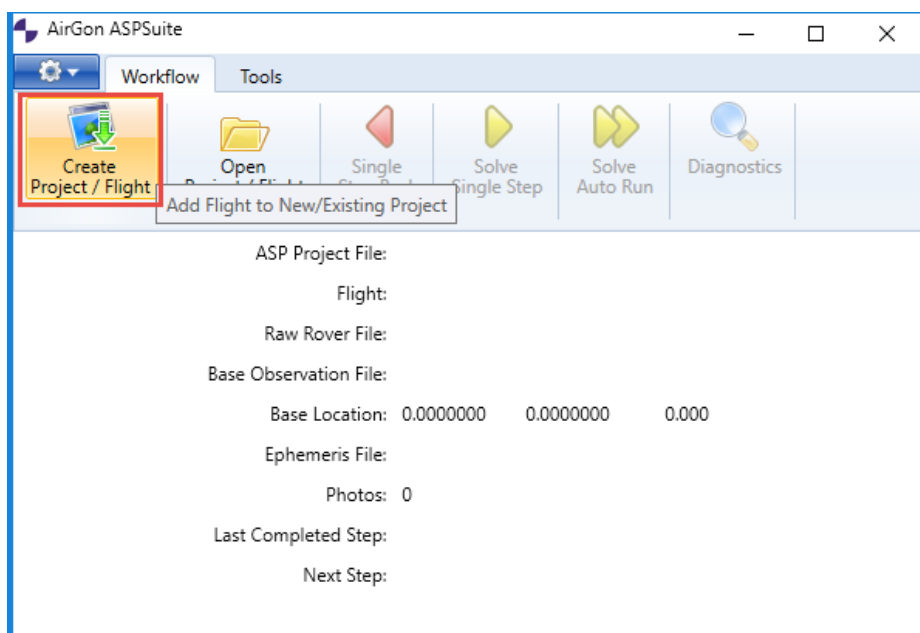


Figure 4- Create Project/ Flight

data. New projects will be written to whichever folder is selected here, and each project will have its own subfolder. If the root folder is changed, then projects will be written to the new path.



Figure 5 - Root Folder

3. Select *Create a New ASP Project* (Figure 6) and give it a name (ex. Date-Site Name)
 - a. Multiple flights can be added to a project by selecting *Add a Flight to an Existing ASP Project* and select the project to which the flight belongs.
 - b. When the drone is powered off, a new SBF file and DAT file are recorded. Therefore, **missions requiring multiple sets of batteries should be divided into separate flights.**

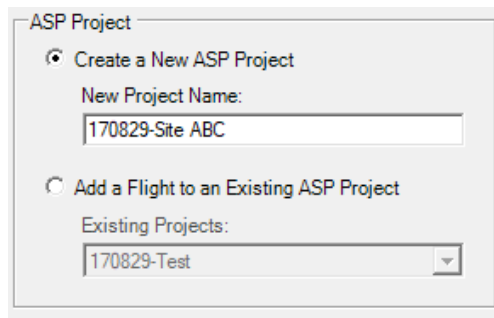


Figure 6 - Create a New ASP Project

4. Give the flight a name and click next when finished. These selected files include the applicable flight data files that the user uploads during the five-step field check process. These may include the Rover (Loki) file, Base Station File, OPUS .txt file, Base Antenna Calibration file, Ephemeris file, DAT file, and drone image files.

Adding Photos and Importing (Step 2 of 5)

5. In the Image Time Zone pull-down, select the time zone from which the images were collected (Figure 7).

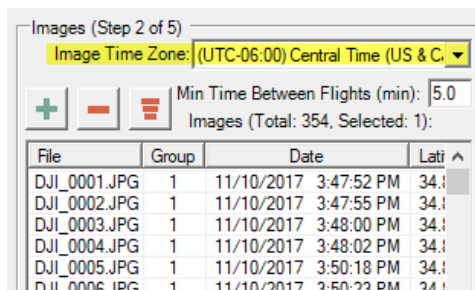


Figure 7 - Image Time Zone

- Select the green plus sign (Figure 8) and navigate to the photos on the aircraft. Select all photos collected during the flight, including the ground photos. If you select photos from more than one flight you will get a notification. Use the group numbers and remove photos from other flights. ASPSuite can only work with one flight at a time.

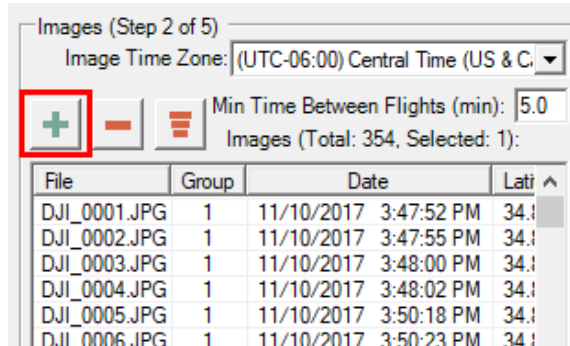


Figure 8 - Add Photos

- The photos should now be visible in the dialog. If a photo is selected, you can preview the photo in the *Preview* window (Figure 10).

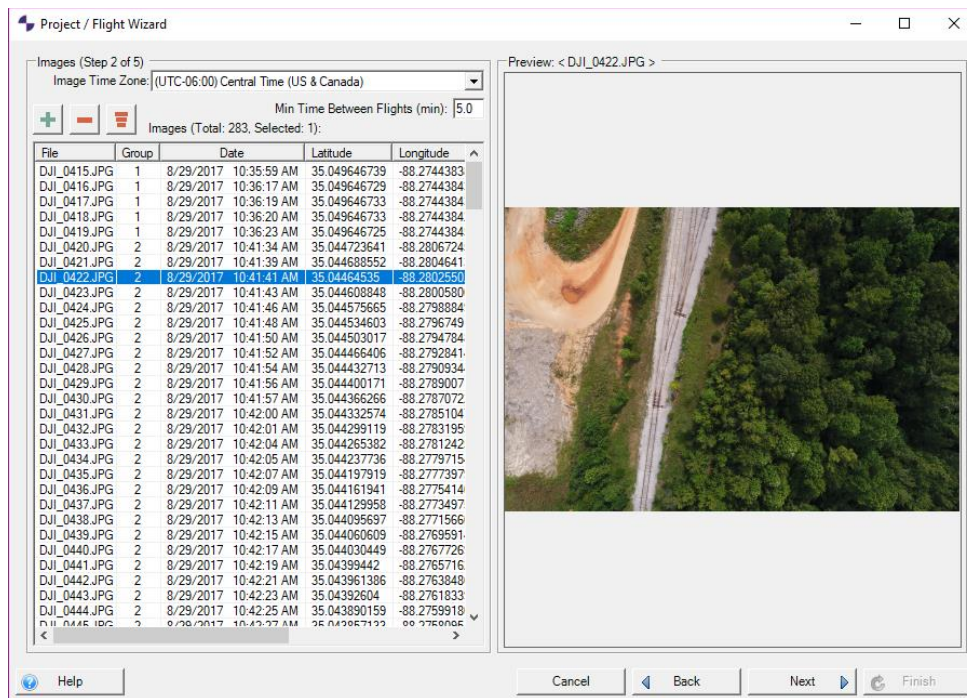


Figure 10 - Photo Preview

- Click finish to import the data from the aircraft and the Loki controller. A blue bar will show the progress (Figure 11).

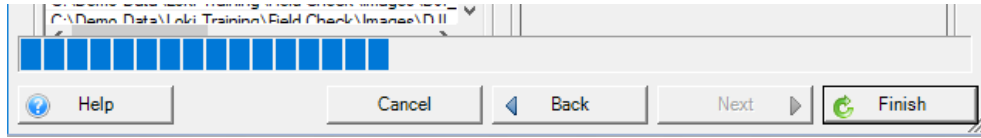


Figure 11 - Import Progress

Loki File and Settings (Step 3 of 5)

- Under the field *Loki Rover File* (Figure 12), navigate to and select the sbf file on the Loki device. If you know which sbf file goes with the flight you are importing, you can browse to the file location and select the file. If you have multiple sbf files from different flights, use the Auto Find option. You will need to navigate to the containing folder, then ASP Suite picks the correct sbf file for your images.

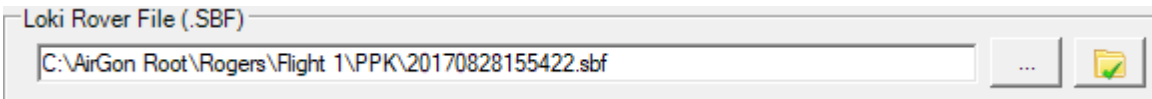


Figure 12 - Select Rover (Loki) File

- Select which method of MEP Interface you are using in the Loki MEP Interface section (Figure 13). If you are using an AirGon provided Inspire 2 Personality cable, select *DJI SD Cable*. If you are using an M200/210 or Phantom 4 Pro Personality cable, select *DJI USB Cable*. If you are using a DSLR camera on a custom drone configuration, select *DSLR Cable*.

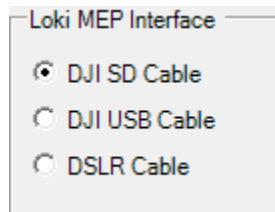


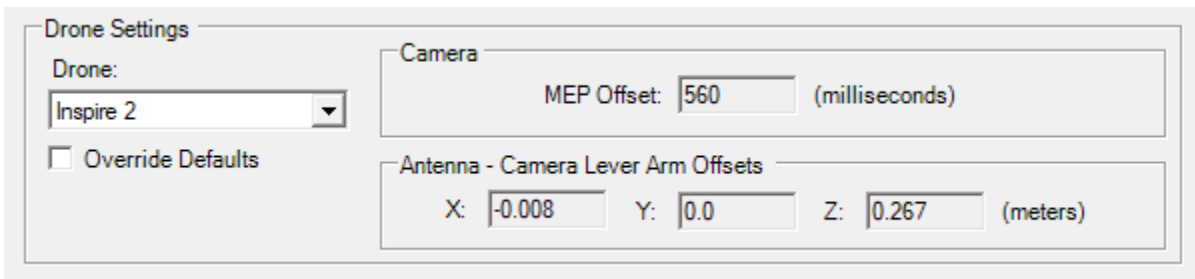
Figure 13 - Loki MEP Interface

- If you selected *DJI USB cable* in step 7, the *DJI Log File (.DAT)* field will enable (Figure 14). You must have a .DAT file to use the DJI USB Cable Interface method. Open DJI Assistant 2 and connect, then browse to the flight .DAT file to continue. You can use the Auto Find option if you have more than one .DAT file from multiple flights, navigate to the containing folder and ASP Suite will select the correct file.



Figure 14 - DJI Log File

12. Selecting the Phantom 4, Inspire 2, or M-200 drone settings will automatically populate the MEP Offset and Antenna/Camera Offset with the appropriate settings for the selected device. If you are using a custom drone or want to modify the default settings of the other options, check Override Defaults to input your own settings. The MEP Offset is the difference in time in which the Loki detects the camera trigger to when the photo is taken. The Antenna-Camera Lever Arm Offset is the distance between the camera sensor's center (Pivot point) and Loki's antenna phase center in meters. This can correct for both horizontal and vertical differences. The reference point begins at phase center of the GPS antenna (3cm above the base of the antenna, not the ground plane). X is positive in the direction of the heading of the aircraft, Y is positive perpendicular and to the right of the heading, Z is positive down to the camera.



The screenshot shows a 'Drone Settings' window. On the left, there is a 'Drone:' dropdown menu with 'Inspire 2' selected and an 'Override Defaults' checkbox. On the right, there are two sections: 'Camera' with a 'MEP Offset' input field containing '560' and '(milliseconds)' text, and 'Antenna - Camera Lever Arm Offsets' with three input fields for 'X' (-0.008), 'Y' (0.0), and 'Z' (0.267) with '(meters)' text.

Figure 15 - Drone Settings

Note: Steps 6-8 are not critical for field checking but are critical for final processing. If these values are not entered now, you will need to go back and edit these fields before you finish processing the data.

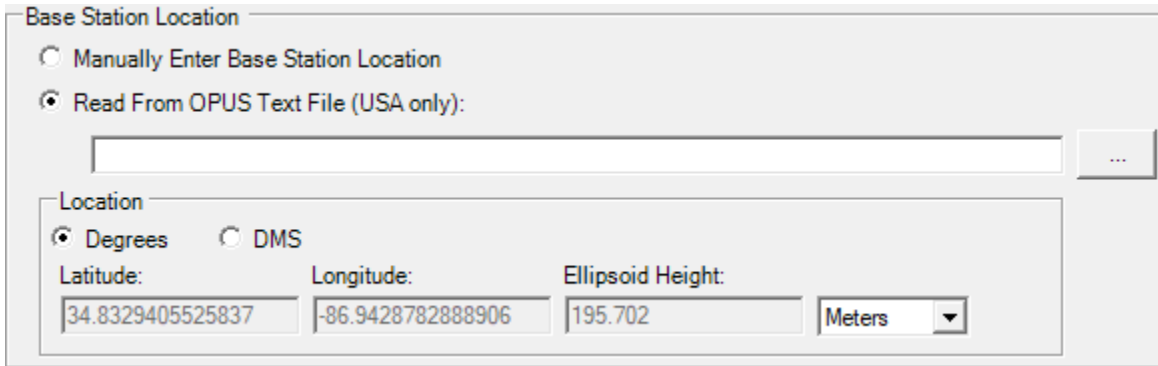
Base Station File and Settings (Step 4 of 5)

13. To check data in the field, both *Base Station File* path and *Read From OPUS Text File* path can be left blank (Figure 17 & Figure 18).



The screenshot shows a 'Base Station File' input field. It consists of a long, empty text box with a small button containing three dots (a browse button) on the right side.

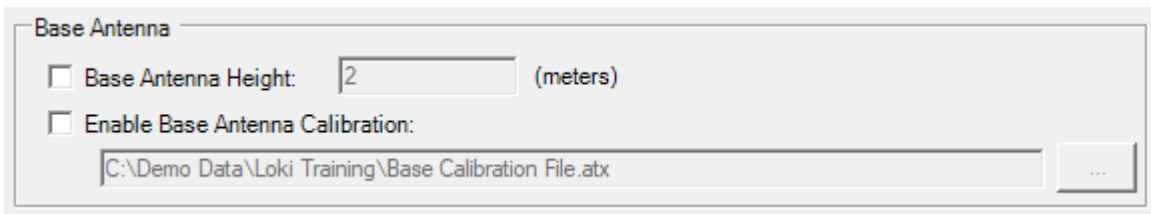
Figure 17 - Base Station File



The screenshot shows the 'Base Station Location' dialog box. It has two radio buttons: 'Manually Enter Base Station Location' (unselected) and 'Read From OPUS Text File (USA only):' (selected). Below the second radio button is a text input field with a browse button (...). The 'Location' section has two radio buttons: 'Degrees' (selected) and 'DMS' (unselected). Below these are three input fields: 'Latitude:' with the value '34.8329405525837', 'Longitude:' with the value '-86.9428782888906', and 'Ellipsoid Height:' with the value '195.702'. To the right of the 'Ellipsoid Height' field is a dropdown menu currently set to 'Meters'.

Figure 18 - Base Station Location

14. Uncheck both boxes in the Base Antenna section (Figure 19) and click next when finished.




The screenshot shows the 'Base Antenna' dialog box. It contains two checkboxes: 'Base Antenna Height:' (unchecked) and 'Enable Base Antenna Calibration:' (unchecked). The 'Base Antenna Height' checkbox is followed by a text input field containing the number '2' and the text '(meters)'. Below the 'Enable Base Antenna Calibration' checkbox is a text input field containing the path 'C:\Demo Data\Loki Training\Base Calibration File.atx' and a browse button (...).

Figure 19 -Base Antenna

Ephemeris File (Step 5 of 5)

15. The *Ephemeris File* (Figure 20) path can be left blank.



The screenshot shows the 'Ephemeris File' dialog box. It features a text input field that is currently empty, followed by a browse button (...). To the right of the browse button is a button labeled 'Auto-Download'.

Figure 20- Ephemeris File

Event Diagnostics

16. When the data import is complete, all of the files will now be in your ASP Project folder. Click the button to *Solve – Auto Run* (Figure 21). Each of the steps are then run automatically one after the other.

- a. The *Solve Single Step* button allows the user to solve one step at a time to get the final solution. The first *Solve* step is to import the source files. This is completed once each of the five Project/Flight Wizard steps are completed and the import process in step 18 is completed.

- b. Next is the file conversion process which converts the raw Rover (.sbf) file.
- c. Third, GNSS trajectory is computed. Sometimes, Global Navigation Satellite Systems (GNSS) can lose signal strength during a flight, which can result in poor positional information. This step helps to smooth out positional data when signal loss occurs. During this step a command window will open (Figure 22). It may take a few seconds before the process starts to run. The window will close automatically once the process has completed.
- d. Fourth, Interpolate Camera Events runs and creates an *Events* file containing all of the GPS events for the flight. It also Auto-Removes redundant or erroneous events that sometimes occur during flight. If the setting *Auto Remove Ground Photos/Events* is checked on the processing tab, ground photos and events will be removed. If this setting is not used, then any redundant events or photos would need to be removed using the [Repair Events File](#) tool. If the number of events and images does not match the *Run Auto-Repair Confirmation* dialog will appear. At this time, you can choose to run *Auto-Repair Events/Photos*. This is an automatic process that compares events to photos and correlates them to give you accurate photo times. After the process runs you will receive a results confirmation dialog giving you the before and after Event and Photo counts. If you accept the results of the process, select Yes. If you do not run *Auto-Repair Events/Photos* now you can run it from the *Repair Events File* dialog. The positional output file from this step will be used to populate the Events list in the [Repair Events File](#) tool.

Note - Any photos eliminated by either the *Auto Remove Ground Photos/Events* or the *Auto-Repair Events/Photos* will be moved to the *Originals* back-up folder.

- e. Lastly, *Solve* will Geotag the images and create a Geotag file. The “Tagging” process involves creating the images.txt file and updating the EXIF tags within the image headers (if *Update Image Headers* box is checked) with the newly computed centimeter accuracy GPS locations. A progress window appears to show the image headers being updated. The EXIF tags updated are: GPSAltitude, GPSLatitude, GPSLongitude, CalibrationFocalLength, CalibrationPPOX, CalibrationPPOY, GPSXYAccuracy, and GPSZAccuracy.
 - i. Note that GPSXYAccuracy and GPSZAccuracy are set in the EXIF tags on a per-image basis based on the PPK solution (both are set to the same value). The values are as follows:
 1. Fixed: 0.02 m
 2. Float: 1.0 m
 3. Navigation (e.g. no solution): 10 m.

ii. These values themselves (not the EXIF tags) are also written as accuracy into the 'XYZImages.txt' file.

f. Note: You can go **back** one step using the *Single Step Back* button.

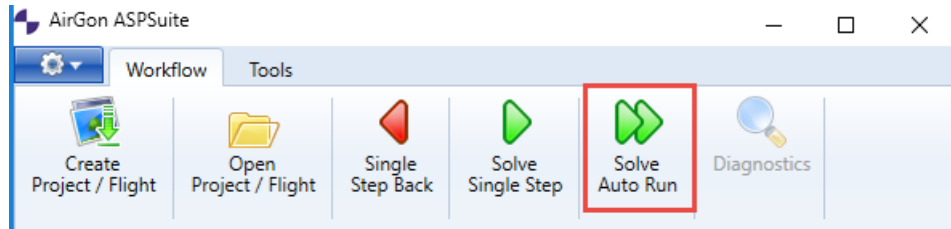


Figure 21 - Auto Run

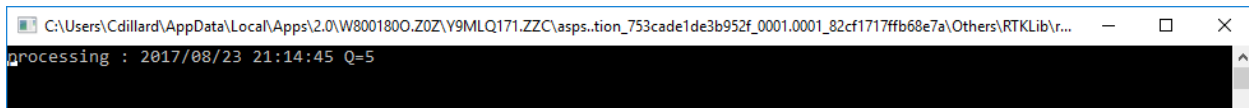


Figure 22 - Processing - Q5 Solution

17. Once complete, click *Diagnostics* (Figure 23) to view the event positions. Observe the events (Figure 24) and check for large gaps. Also, check to make sure the flight lines match those in the flight plan. Getting 100% Q1 events is the correct result (see bottom of diagnostics window), but will not be achieved during the field check. This means that the positions are fixed (2cm or less). Q2 events mean that a “float solution” and will not provide the necessary accuracy needed. Q5 events usually mean that the files are incorrect or missing. Q5 is the expected result during the field check because the base station observation file has not been imported yet. Note that there is a text file called xxxxxxxxxxxx_event.pos in the PPK folder under the Flight folder. The last column in that file shows the Quality (Q) of each GPS event (Figure).

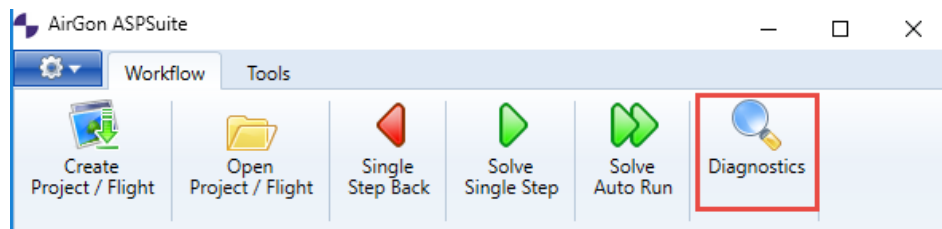


Figure 23 – Diagnostics

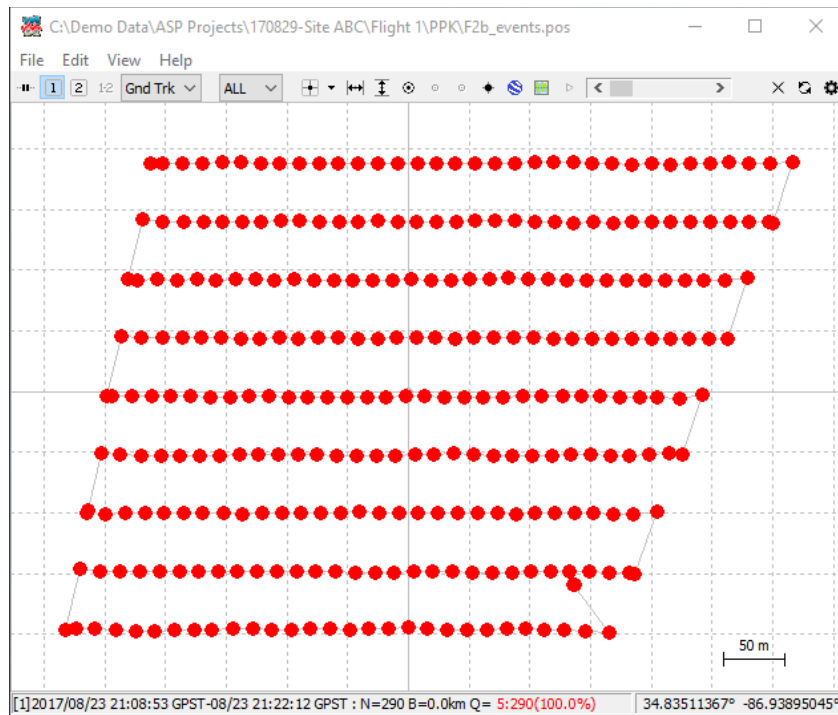


Figure 24 – Events

%	GPST (Delay:0.56)	latitude (deg)	longitude (deg)	height (m)	Q
1976	233463.32744695	34.832664484	-86.944187912	255.891820335	5
1976	233466.846445616	34.832655839	-86.944079537	255.212405689	5
1976	233468.895944883	34.832651289	-86.943954902	255.351963977	5
1976	233471.025443983	34.832645996	-86.943850264	255.179670885	5
1976	233473.035943183	34.83264618	-86.943740606	257.185579517	5
1976	233475.03394245	34.832651664	-86.943632198	256.596395781	5
1976	233477.038441883	34.832653001	-86.943524074	255.92263603	5
1976	233479.033441483	34.832652264	-86.943412834	256.518353961	5

Figure 25 - Event.pos file showing GPS events

Estimate Image Quality

18. The next step is to check image quality using the preferred method of your choice. For example, you could use an application such as PhotoScan or Pix4D. AirGon trains customers using PhotoScan, but there are other possibilities if a customer wishes to use something else. Please consult the application help of your chosen software package for more information.

Final Processing

Opening an Existing Project

To this point in the workflow, we have imported and organized our data by project and subdivided our project into flights. Now we will complete the final steps of the processing workflow.

1. Open ASPSuite and select *Open Project/ Flight* (Figure 26).

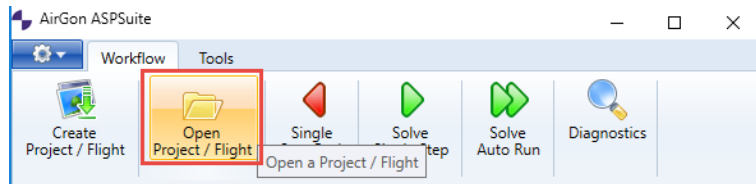


Figure 26 - Open Project Button

2. All projects in the root folder will be visible in the *ASP Project* drop down menu. Select the project and flight you wish to process (Figure 27). Click Ok to open the project.

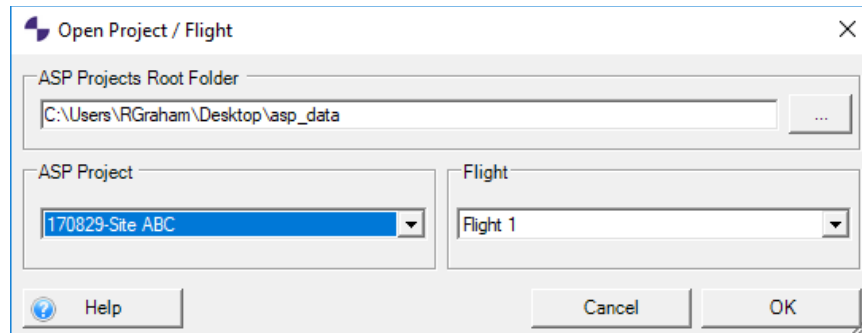


Figure 27 - Project and Flight Selection

Editing Flight

3. Before processing, click the Tools tab (Figure 28) and click *Edit Flight*.

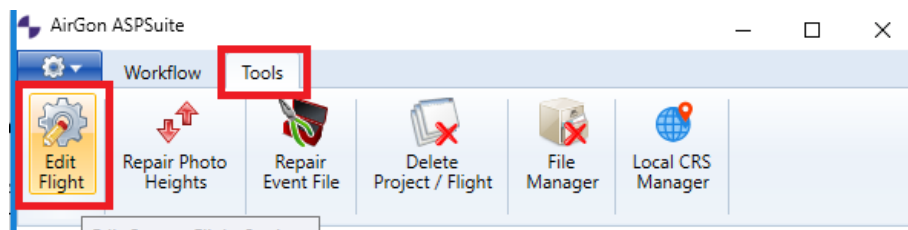
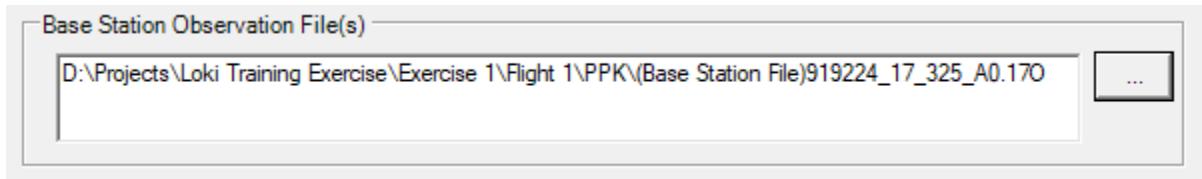


Figure 28 – Edit Flight

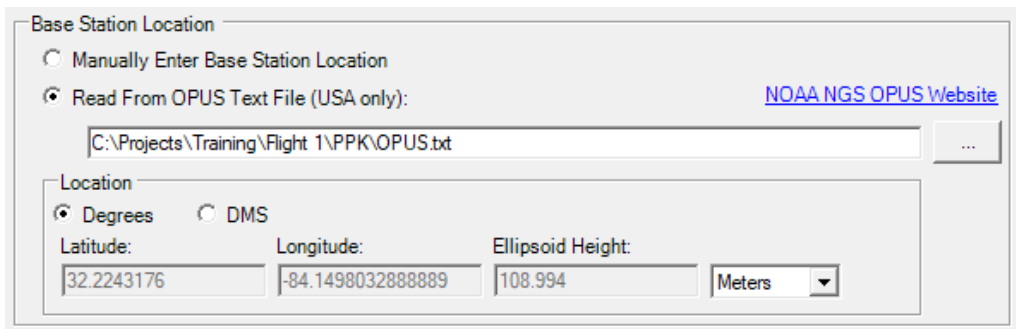
- Click the [Base Station tab](#), then import the base observation file (in Rinex format) into the Base Station Observation field. (Figure 29)



The screenshot shows a text input field titled "Base Station Observation File(s)". The field contains the file path: "D:\Projects\Loki Training Exercise\Exercise 1\Flight 1\PPK\(Base Station File)919224_17_325_A0.170". To the right of the text box is a small button with three dots, used for file selection.

Figure 29 – Base Observation File

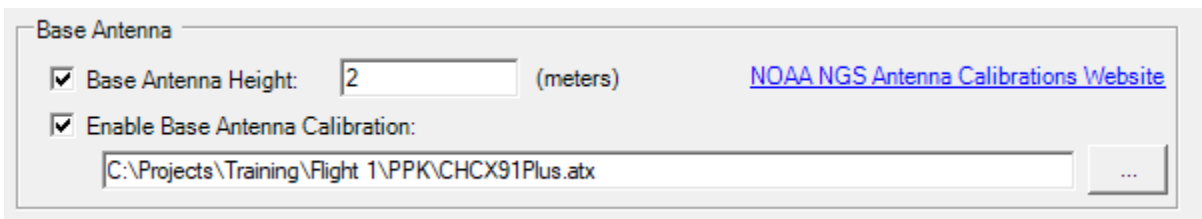
- Manually enter the Base Station location or import the OPUS text file. (Figure 30)



The screenshot shows the "Base Station Location" section. It has two radio buttons: "Manually Enter Base Station Location" (unselected) and "Read From OPUS Text File (USA only):" (selected). To the right of the second option is a link: [NOAA NGS OPUS Website](#). Below this is a text box containing the file path "C:\Projects\Training\Flight 1\PPK\OPUS.txt" and a selection button. Underneath is a "Location" section with two radio buttons: "Degrees" (selected) and "DMS" (unselected). Below these are three input fields: "Latitude:" with the value "32.2243176", "Longitude:" with the value "-84.1498032888889", and "Ellipsoid Height:" with the value "108.994". To the right of these fields is a dropdown menu currently set to "Meters".

Figure 30 – Base Position

- Check the box next to *Antenna Height* and enter the antenna height. Check the box next to *Enable Base Antenna Calibration* and import the base antenna calibration file. (Figure 31)



The screenshot shows the "Base Antenna" section. It has two checked checkboxes: "Base Antenna Height:" and "Enable Base Antenna Calibration:". The "Base Antenna Height:" field contains the value "2" and is followed by "(meters)". To the right is a link: [NOAA NGS Antenna Calibrations Website](#). Below the second checkbox is a text box containing the file path "C:\Projects\Training\Flight 1\PPK\CHCX91Plus.atx" and a selection button.

Figure 31 – Base Antenna Settings

7. Next click the Ephemeris tab (Figure 32). If you wish to process using GLONASS satellites, check the box next to *Use GLONASS Satellites* and then click Auto-Download. If you wish to process using GPS only, uncheck the box and click Auto-Download.

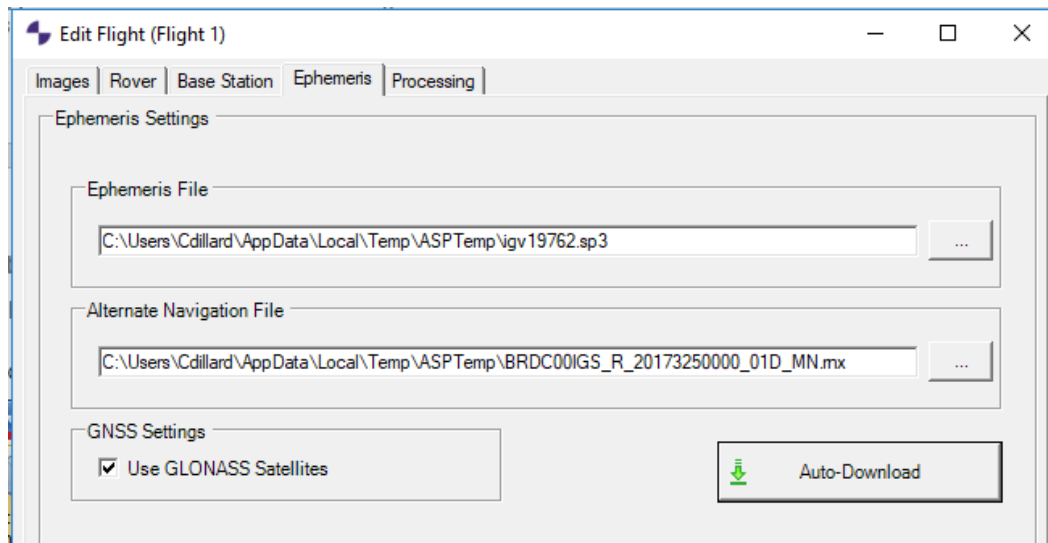


Figure 32 – Ephemeris Tab

8. Next click the Processing tab. Check the box next to Geoid if you wish to process relative to a Geoid. The drop-down menu allows you to select a Geoid model (Figure 33). Select Local Coordinate system if you wish to convert the image positions to a user-defined [local coordinate system](#). If Ellipsoid is checked, the data will be processed using ellipsoid heights (or the height entered as the base coordinate). Using a Geoid allows the user to convert the ellipsoid heights in the images.txt file and the image header GPS coordinates to Geoid heights using the selected Geoid mathematical model in the dropdown box. Typically, GPS units are in WGS84 Ellipsoid, so this box is unchecked by default.
9. The elevation mask can be changed by selecting the drop-down menu (Figure 33). Elevation mask is used to filter satellites low on the horizon, which can cause interference and reduced accuracy. Usually, it is best to start with the elevation mask set at 15, and then raise or lower it if necessary. Getting all Q1 events during the [Event Diagnostics](#) phase is the correct result. This means that there is fixed (2cm or less) accuracy. If there are Q2 or Q5 events, then it may be necessary to check for missing or incorrect files, or adjust the elevation mask and reprocess.

10. *Update Image Headers* (Figure 33), if checked, will write the image positions to the image files (EXIF data). A copy of the original photos will be made and placed in a separate folder named *Originals*. If the box is unchecked, only a text file will be created with the image positions.

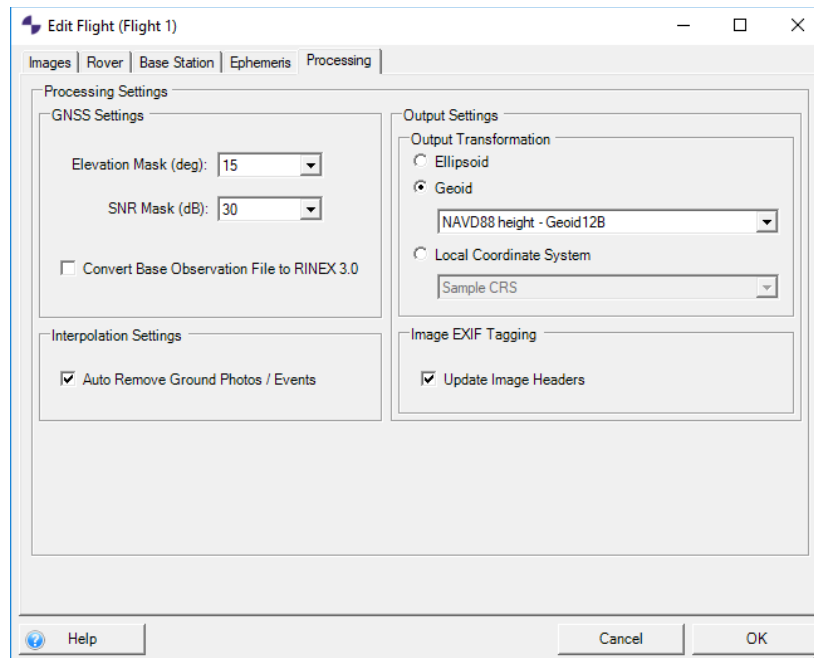


Figure 33 - Update Image Headers

11. Check *Auto Remove Ground Photos/ Events* if you want ASPSuite to automatically remove ground photos and events (Figure 33). If not removed automatically, ground photos and events will need to be removed manually using the event repair tool. **Note:** Any photos eliminated during the *Auto Remove Ground Photos/Events* process will be moved to the *Originals* folder.
12. When all the settings are correct, Click ok.
13. Click the workflow tab and click solve auto-run to begin processing the data.
14. When processing is complete, click the diagnostics button to view the trajectory and events. All event should be Q1 (green).
15. If you have Q2 events (yellow) go back to the processing tab (Tools> edit flight) and raise the elevation mask to 20 and the SNR mask to 35, then reprocess the flight.
16. Check the diagnostics window again for all Q1 events. If necessary, raise the elevation mask again and reprocess.
17. When complete, the images in the flight folder will be tagged with the new position.

Local SRS manager

ASPSuite

ASP Processing with Loki Data

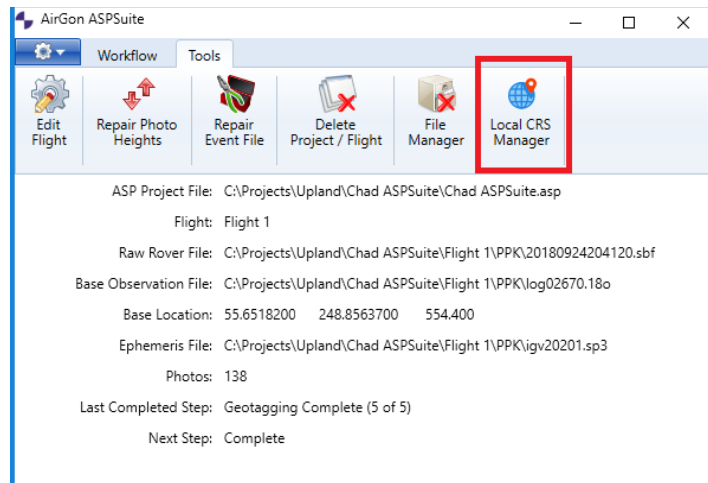


The following steps describe the process for defining a Local coordinate system in ASPSuite's Local SRS Manager.

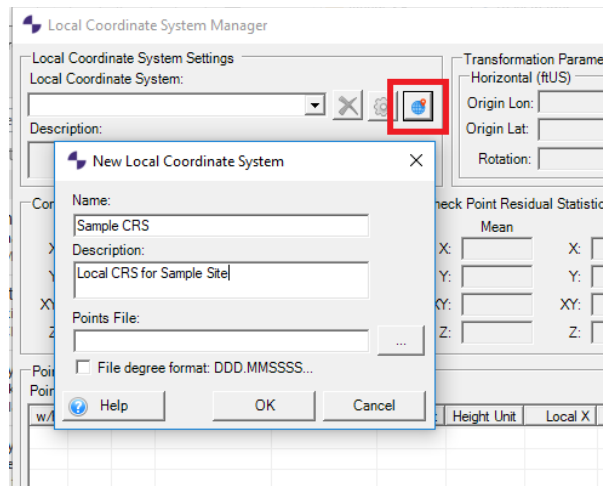
1. The first step is to create a csv (comma separated values) file which will be imported into the Local SRS Manager and parameters are calculated for setting up a local coordinate system transformation, aka a site calibration. The first line (header line) must be exactly as shown in the [SampleLCRS.CSV](#) file.
 - a. The file must contain a longitude, latitude, elevation, and the corresponding Local X,Y, and Z for each point. Do not use thousand separator (comma) when creating CSV file.
 - b. Height unit must be specified for both geographic and local coordinate.
 - i. Units can be one of the following:
 1. ftUS – U.S. Survey Feet
 2. m - Meters
 3. ftIntl – International Feet
 - c. Point type must be specified and can be one of the following:
 - i. FC - Full Control: Uses both horizontal and vertical component to compute the transformation.
 - ii. HC - Horizontal Control: Uses only the horizontal component to compute the transformation
 - iii. VC - Vertical Control: Uses only the vertical component to compute the transformation
 - iv. FK – Full Check
 - v. HK – Horizontal Check
 - vi. VK – Vertical Check

Note: Points identified as “Check” (K) are just test points. Check points are not used in computing the parameters, but only for checking the “goodness of fit” via the residuals.

2. Once the CSV file has been created, open ASPSuite, click the tools tab, then click the “Local CRS Manager” button.



3. Click on the blue globe to access the *New Local Coordinate System* dialog.
 - a. Give the coordinate system a name and description.
 - b. If the latitude and longitude in your CSV file are formatted DDD.MMSSSS, then check the box so the coordinates will be interpreted correctly.
 - c. Click the ellipse button next to *Points File* and navigate to the CSV file created in step 1.
 - d. Click *OK* to import the file and compute the transformation.



4. After importing the file, you should see the transformation parameters in SRS manager.
 - a. If points have been identified as inaccurate, they can be withheld by checking the box next to the point in the "w/h" column. Points withheld will be excluded from the

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transformation calculations. Residual statistics should update, in real time, when points are withheld.

Local Coordinate System Manager

Local Coordinate System Settings

Local Coordinate System:

Sample CRS:

Description:

Local CRS for sample site.

Transformation Parameters

Horizontal (ftUS)

Origin Lon: -112°09'00.67219" Translation X: 632.541

Origin Lat: 40°31'48.01866" Translation Y: 1532.113

Rotation: 31°58'36.4766" Scale: 1.0005032838

Vertical (ftUS)

Vertical Shift: 48.399 Origin X: 0.0

Slope X: -0.000038479 Origin Y: 0.0

Slope Y: 0.000144743

Control Point Residual Statistics (ftUS)

	Mean	Range	RMSE
X:	0.0	0.007	0.002
Y:	0.0	0.01	0.004
XY:	0.004	0.005	0.004
Z:	0.0	0.0	0.0

Check Point Residual Statistics (ftUS)

	Mean	Range	RMSE
X:	0.0	0.0	0.0
Y:	0.0	0.0	0.0
XY:	0.0	0.0	0.0
Z:	0.0	0.0	0.0

Points

Points (Total: 5):

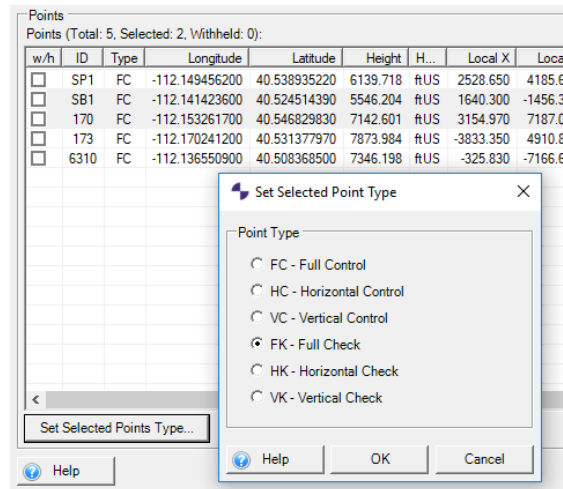
w/h	ID	Type	Longitude	Latitude	Height	H...	Local X	Local Y	Local Z	Local Unit	Computed X	Computed Y	Computed Z	Residual X	Residual Y	Residual XY
<input type="checkbox"/>	SP1	FC	-112.149456200	40.538935220	6139.718	ftUS	2528.650	4185.650	6188.580	ftUS	2528.649	4185.649	6188.580	-0.001	-0.001	0.002
<input type="checkbox"/>	SB1	FC	-112.141423600	40.524514390	5546.204	ftUS	1640.300	-1456.320	5594.220	ftUS	1640.297	-1456.314	5594.220	-0.003	0.006	0.007
<input type="checkbox"/>	170	FC	-112.153261700	40.546829830	7142.601	ftUS	3154.970	7187.010	7191.920	ftUS	3154.971	7187.012	7191.920	0.001	0.002	0.002
<input type="checkbox"/>	173	FC	-112.170241200	40.531377970	7873.984	ftUS	-3833.350	4910.840	7922.670	ftUS	-3833.346	4910.837	7922.670	0.004	-0.003	0.005
<input type="checkbox"/>	6310	FC	-112.136550900	40.508368500	7346.198	ftUS	-325.830	-7166.600	7393.310	ftUS	-325.830	-7166.604	7393.310	0.000	-0.004	0.004

↑ Withhold Points

Set Selected Points Type...

Help OK Cancel Apply

- Point type can be changed by select the points, clicking “Set Selected Points Type”, and checking the new point type.



- Finally, you can use this local system at the end of the ASP flow by selecting “Local Coordinate System” and choosing the site calibration you just created from the drop-down list. A file will be created (In the PPK folder) mapping all the images collected during a flight to local eastings/northings, which can then be processed in PhotoScan, Pix4D, or whatever point cloud generation software you use, as long as it allows you to set a “local coordinate system”.