ASPSuite

ASPSuite User Guide

ASPSuite, Version 2018.1.21.0

AirGon Support
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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.

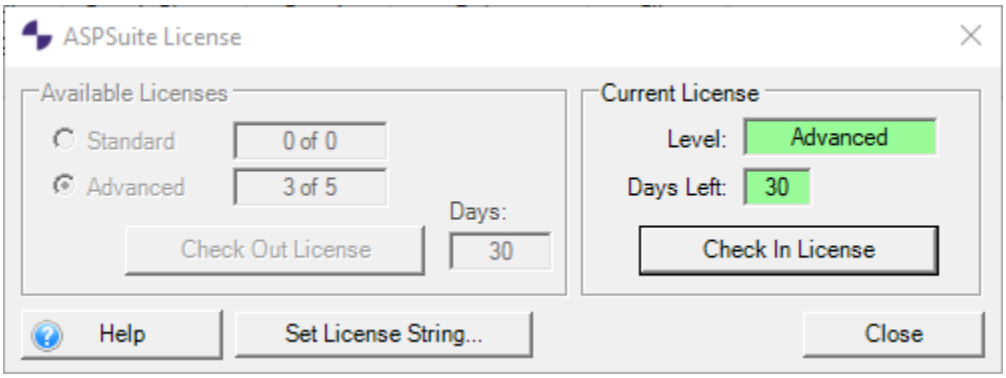

Figure 2- ASPSuite License dialog

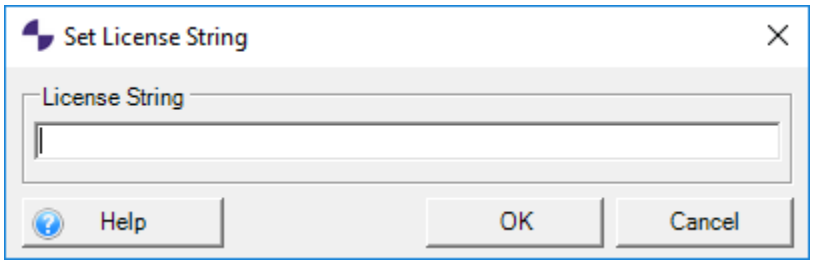

Figure 3- Set License String dialog

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 (and the Loki controller if it doesn't power on automatically). The Loki device will turn on automatically when it is used with a DJI drone. In the case where a "hot shoe" device is utilized, the Loki device will need to be manually powered on by pressing the green button for two seconds. 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).

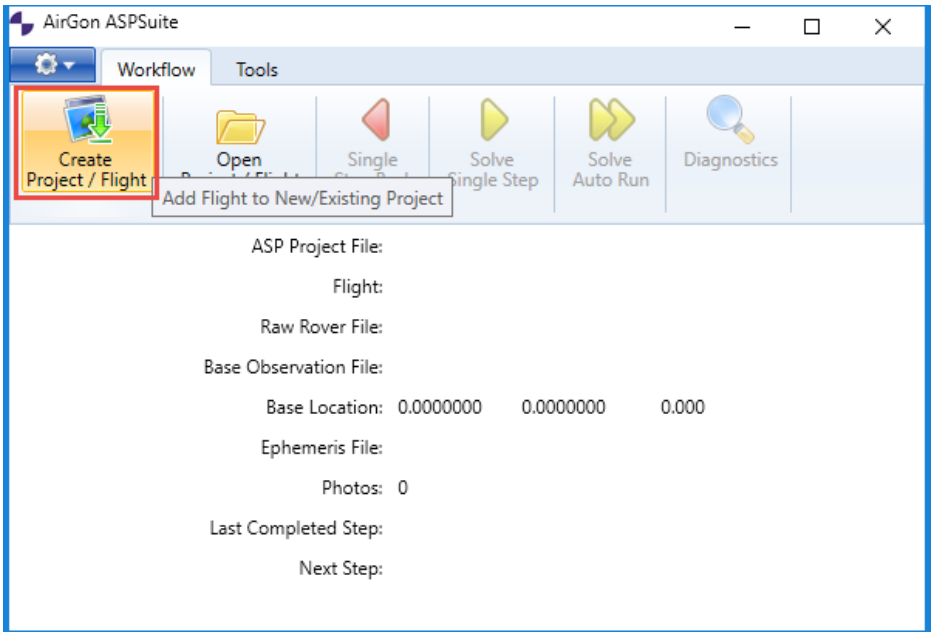

Figure 4- Create Project/ Flight

2. Set the *ASP Projects Root Folder* path (Figure 5) to a folder where you want to store the project 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.

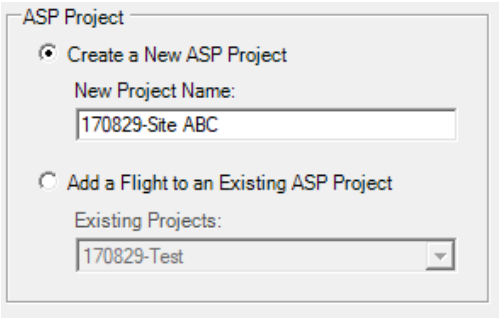

Figure 6 - Create a New ASP Project

4. Give the flight a name and select *Copy Selected Files to Project Folders* (Figure 7) 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.

    a. If the files are already in the desired location, you can select *Leave Selected Files at Current Locations.*

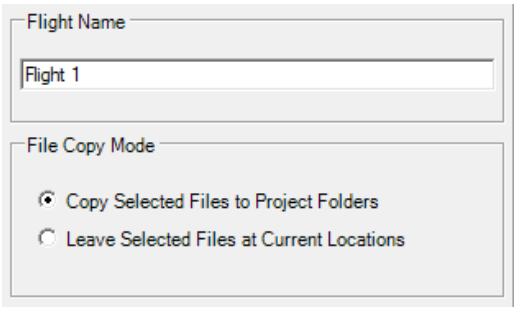

Figure 7 - Copy Selected Files to Project Folders.

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 8).

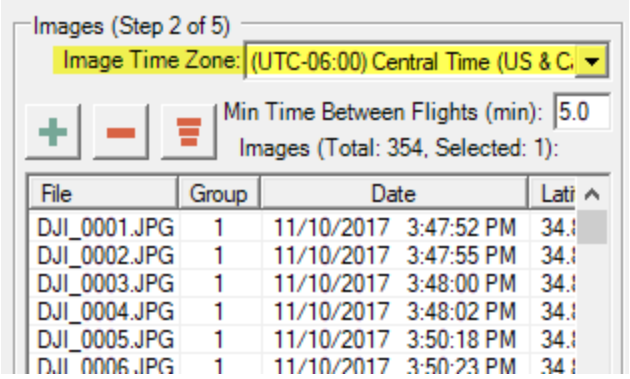

Figure 8 - Image Time Zone

6. Select the green plus sign (Figure 9) 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.

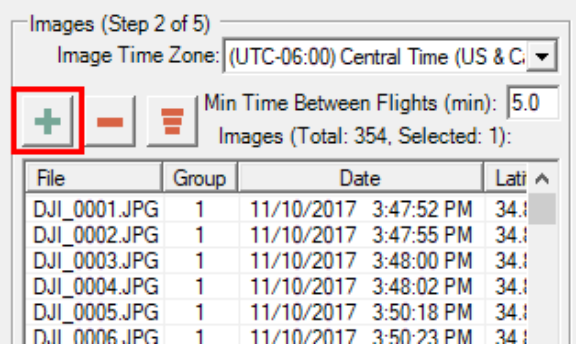

Figure 9 - Add Photos

7. 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).

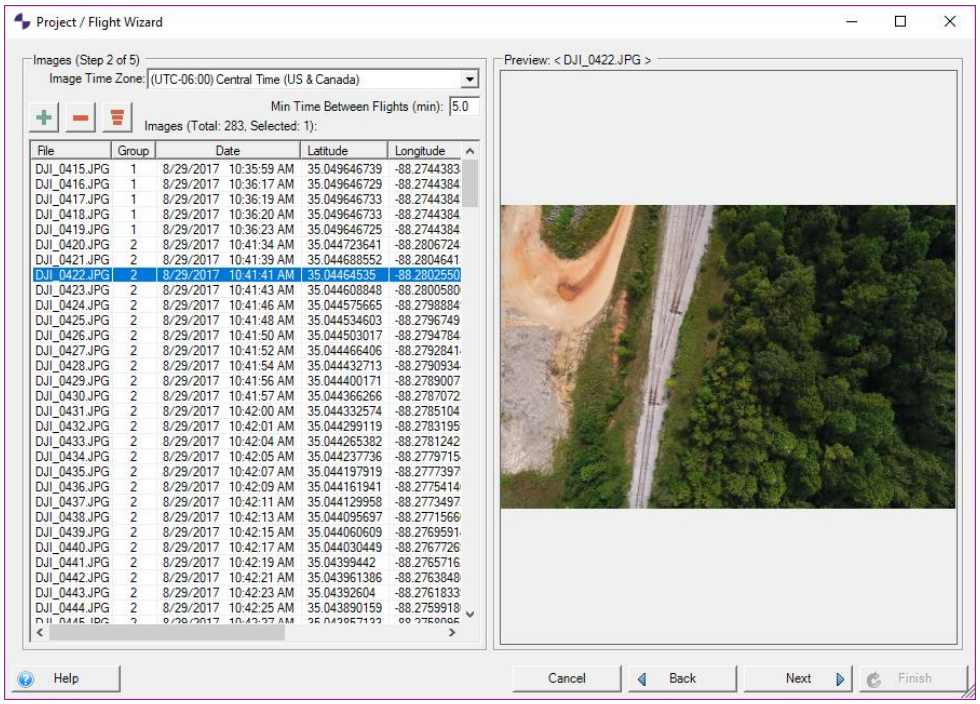

Figure 10 - Photo Preview

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

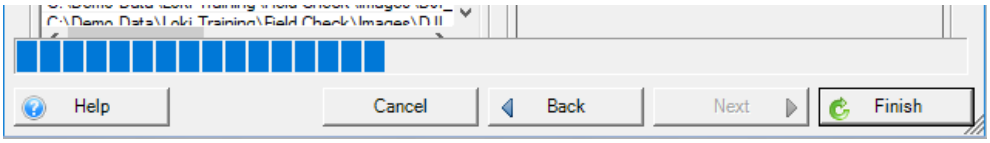

Figure 11 - Import Progress

Loki File and Settings (Step 3 of 5)

9. 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 ASPSuite picks the correct.sbf file for your images.

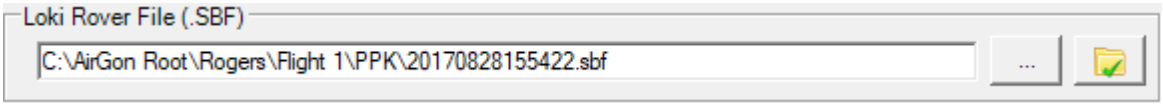

Figure 12 - Select Rover (Loki) File

10. Select which method of MEP Interface you are using in the Loki MEP Interface section (Figure 13). If you are using an AirGon provided USB cable, select *DJI SD Cable*. If you are using a regular USB cable to get the Log files from a DJI Drone, select *DJI USB Cable*. If you are using a DSLR camera on a custom drone configuration, select *DSLR Cable*.

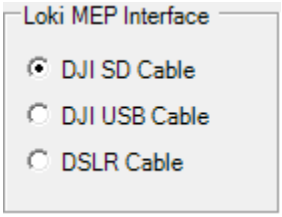

Figure 13 - Loki MEP Interface

11. 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 ASPSuite 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, select Key-In 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.

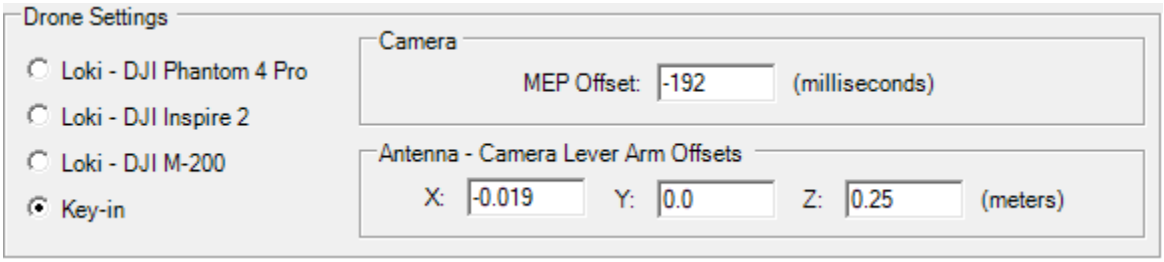

Figure 15 - Drone Settings

13. If you use DroneDeploy's cloud based software, check the boxes and enter the *Camera Calibration* (Figure) values associated with the camera used for this flight. These two settings are for cameras that have been calibrated with AirGon's camera calibration services. If you have had your camera calibrated through AirGon, enter the values you received here. Each setting is unique to every camera, even cameras of the same brand and model will have different settings. Camera calibration settings increase the accuracy of the project. Please contact support@airgon.com for more info.

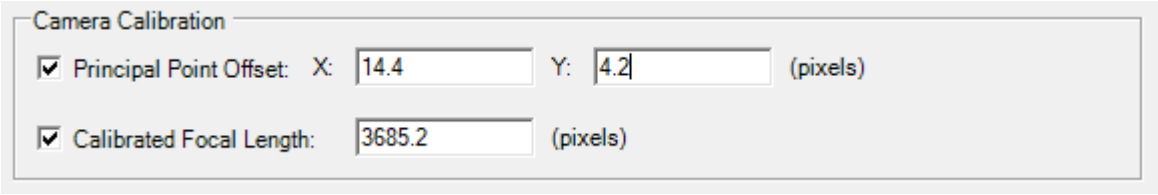

Figure 16 - Camera Calibration

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)

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

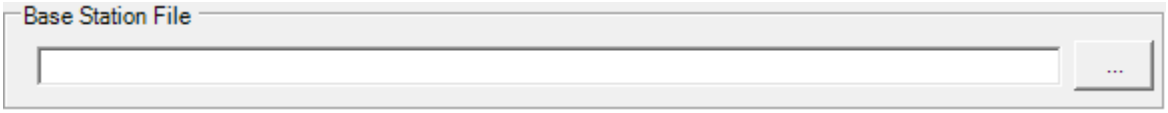

Figure 17 - Base Station File

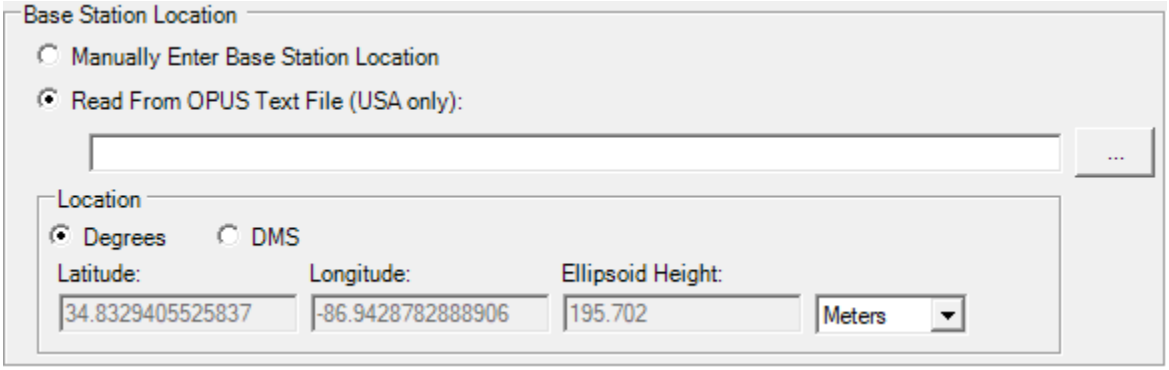

Figure 18 - Base Station Location

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

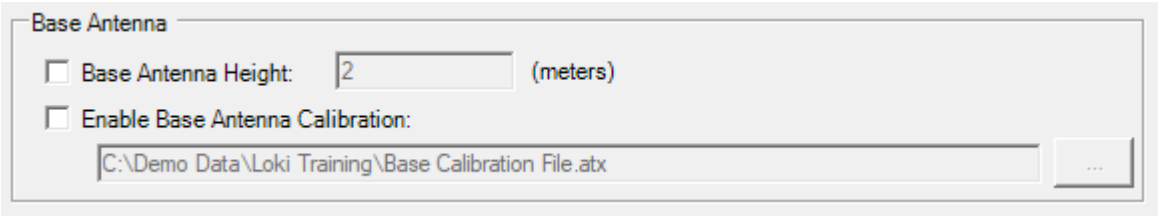

Figure 19 -Base Antenna

Ephemeris File (Step 5 of 5)

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

Figure 20- Ephemeris File

Event Diagnostics

17. 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). 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 lose 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 in the Options dialog. 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 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.

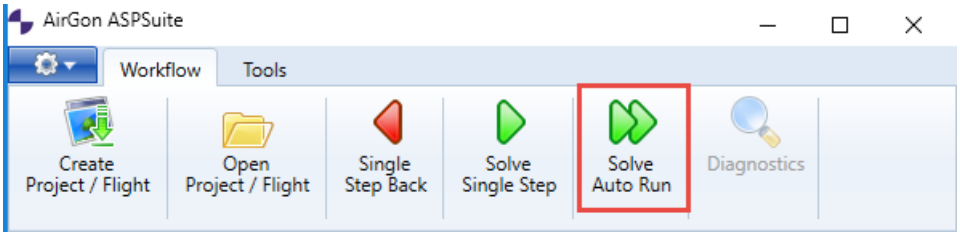

Figure 21 - Auto Run

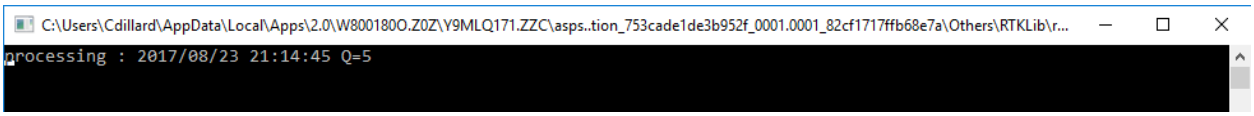

Figure 22 - Processing - Q5 Solution

18. Once complete, click *Diagnostics* (Figure) to view the event positions. Observe the events (Figure) 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). 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 from during the Field Check process. 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).

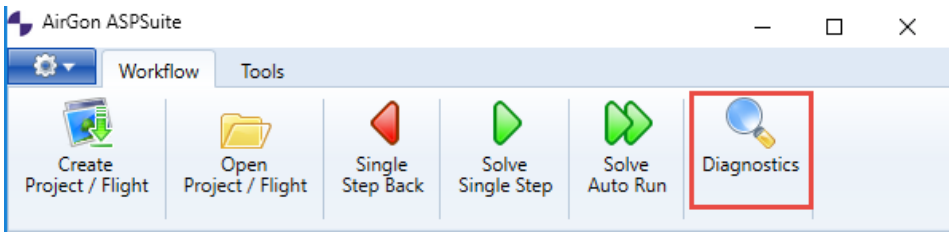

Figure 23 – Diagnostics

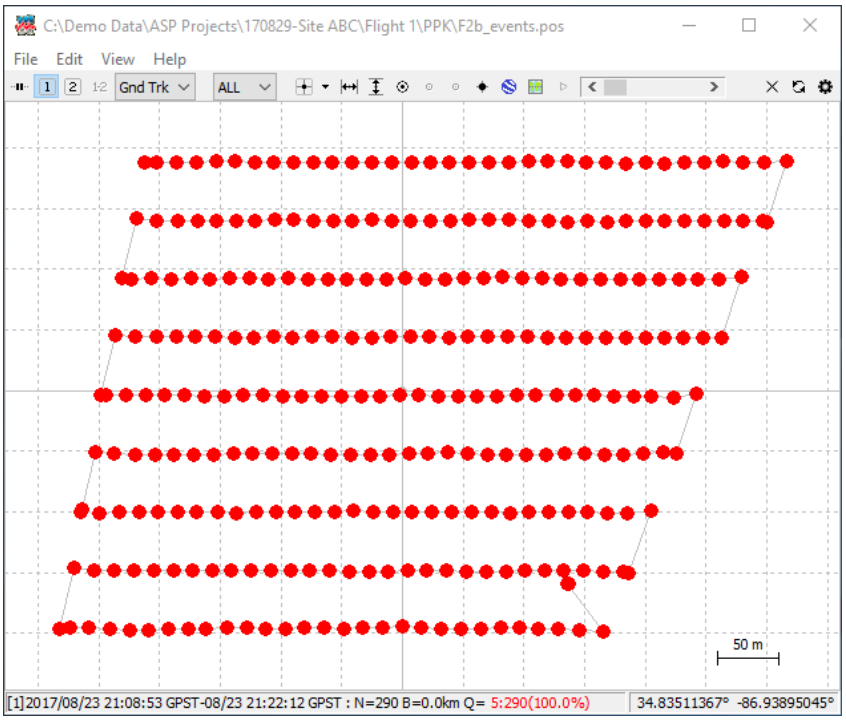

Figure 24 – Events

```
%,GPST(Delay:0.56),latitude(deg),longitude(deg),height(m),Q
1964,152567.593302016,34.688623309,-86.966840186,150.117869182,1
1964,152653.467014316,34.686111941,-86.963150199,229.98687584,1
1964,152657.919524283,34.686238542,-86.963012629,229.822248965,1
1964,152660.240529383,34.686341345,-86.962872581,229.751194925,1
1964,152662.15153405,34.686438748,-86.962751429,229.752382323,1
1964,152664.249538716,34.686547065,-86.962618817,229.632455626,1
```

Figure 25 - Event.pos file showing GPS events

Estimate Image Quality

19. 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).

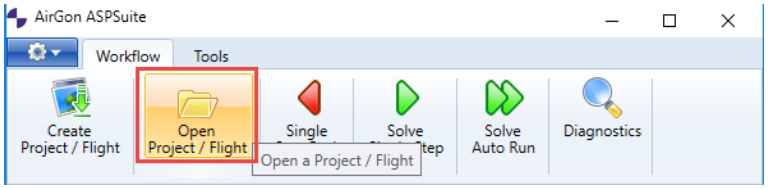

Figure 26 - Open Project Button

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). Click Ok to open the project.

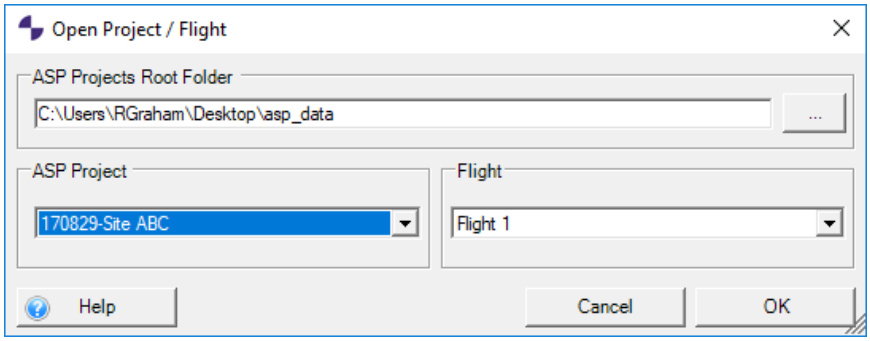

Figure 27 - Project and Flight Selection

Options Dialog

3. Before processing, click the settings tab (Figure) and select *Options*.

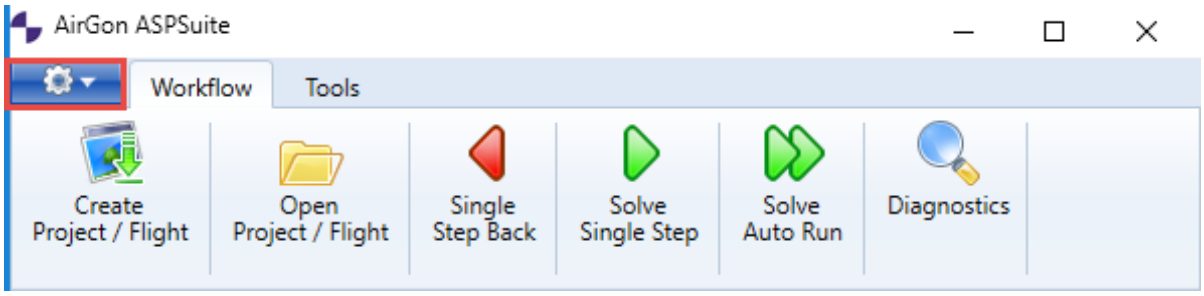

Figure 28 - Settings Tab

4. 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). If the box is unchecked, 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.

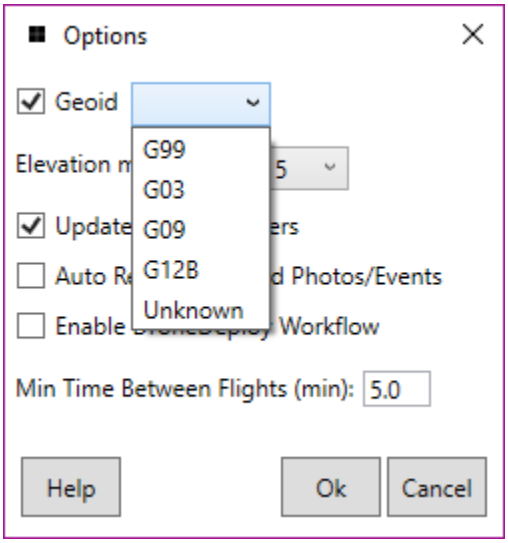

Figure 29 – Geoid

5. The elevation mask can be changed by selecting the drop-down menu (Figure). 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 adjust the elevation mask and reprocess.

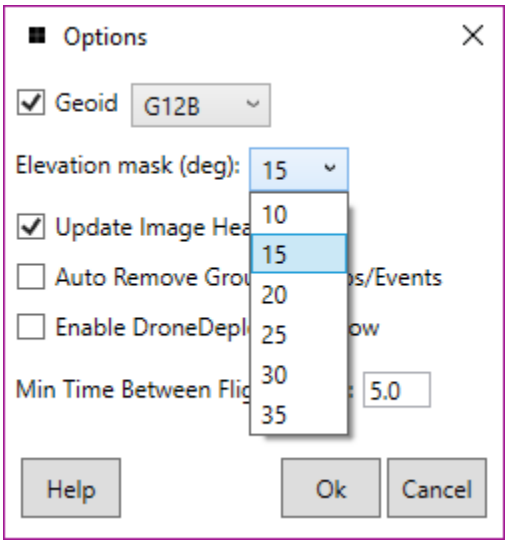

Figure 30 - Elevation Mask

6. *Update Image Headers* (Figure), 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.

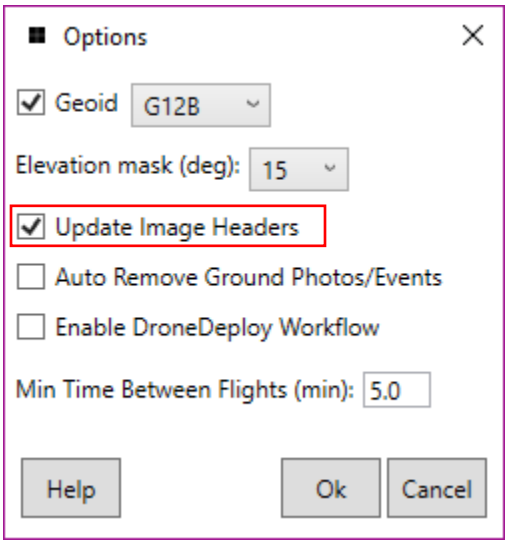

Figure 31 - Update Image Headers

7. Check *Auto Remove Ground Photos/ Events* if you want ASPSuite to automatically remove ground photos and events (Figure). 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.

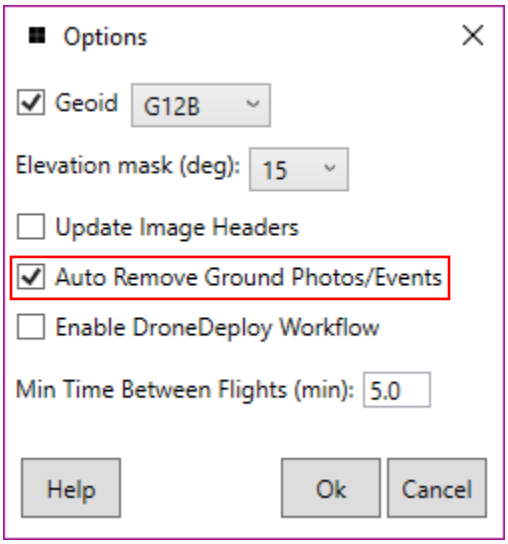

Figure 32 - Auto Remove Ground Photos

8. *Enable DroneDeploy Workflow* will automatically add and remove EXIF fields required in a DroneDeploy workflow (Figure 33). DroneDeploy is a cloud-based service which allows users to upload their georeferenced image data to generate orthophotos and point clouds. **Note:** You must have *Update Image Headers* checked for the DroneDeploy workflow to work.

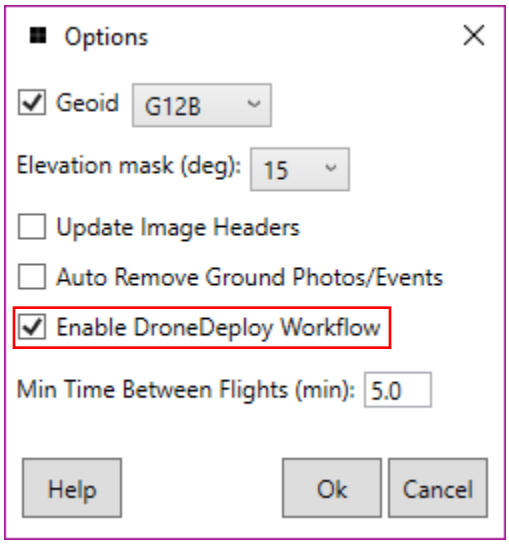

Figure 33- Enable DroneDeploy Workflow

9. ASPSuite will separate photos into “Group” numbers based on the number of minutes that pass between photos (Figure). When more than the specified number of minutes passes between two photos, a new group number will be assigned to the latter group of photos. This is to help identify photos that are part of a different flight. This amount of time is typically set based on how long it takes the user to land the drone and prepare for the next flight. The value is used to

define the 'Group #' column in several of the ASPSuite dialogs. This allows for easier editing and for the user to know which photos belong together as part of the same flight when photos from multiple flights are loaded.

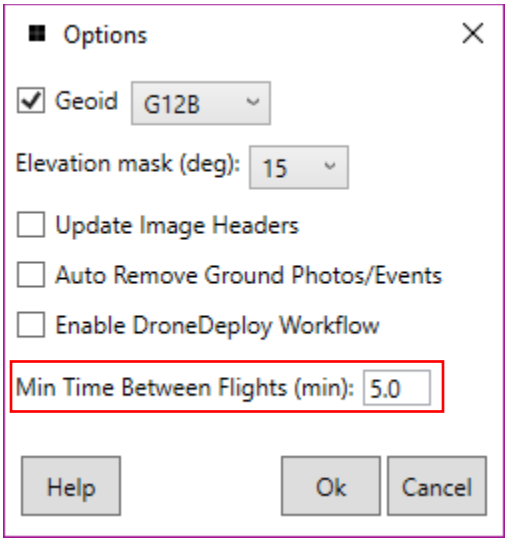

Figure 34 - Min Time between Flights

Flight Tab

10. Select *Tools* tab, then click the *Edit Flight button* (Figure).

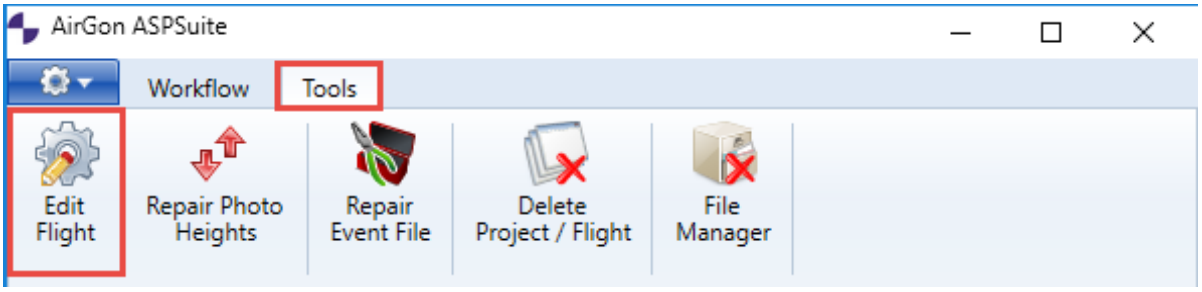

Figure 35 - Tools, Edit Flight

11. On the flight tab, select to *Leave Selected Files at Current Locations* (Figure).

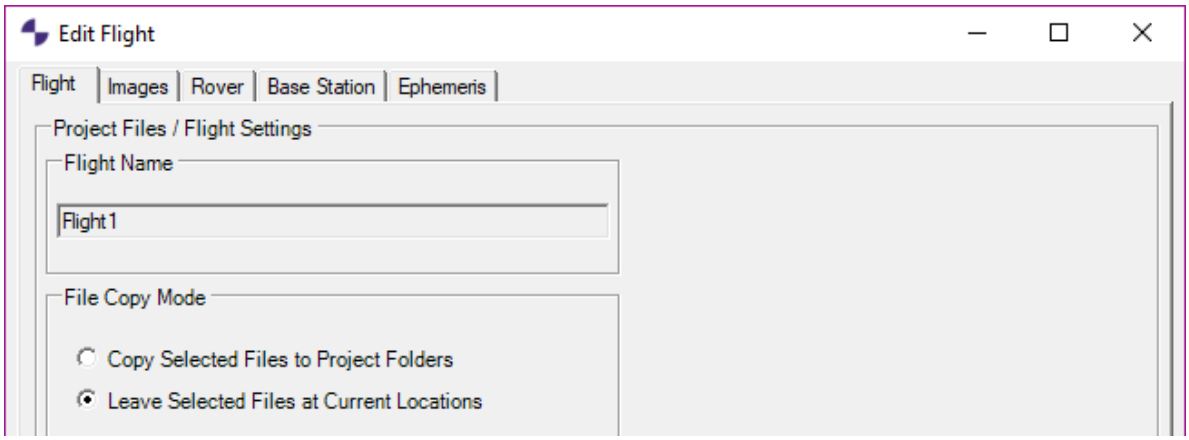

Figure 36 - Flight Tab

Images Tab

12. The images were imported in the field, so you should not have to add them here. You should see the correct image in the *Image Files* window (Figure 37 – Flight Image).

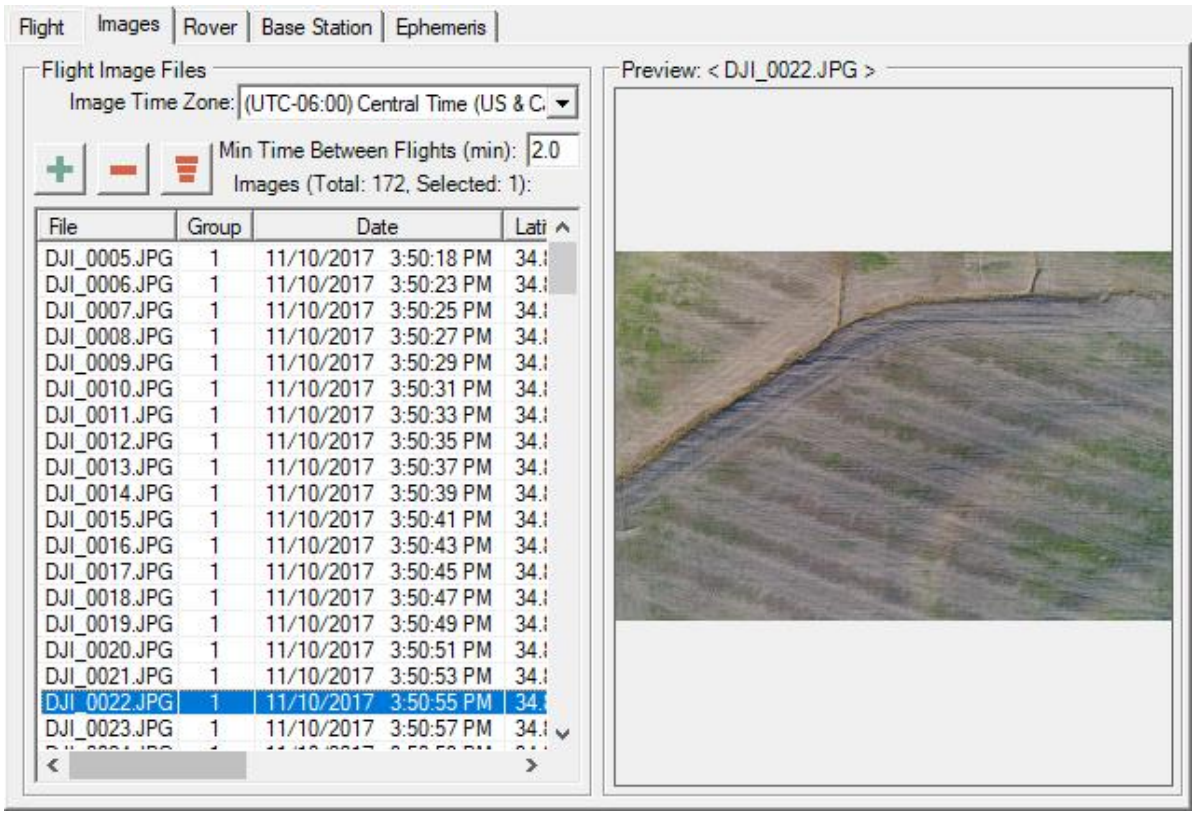

Figure 37 – Flight Image Files with Preview Window

Rover Tab

13. On the Rover tab, make sure all settings are correct (Figure 38). Update any fields that were left blank during the field check. This tab is covered in more detail on page 6 of this document in *Adding Photos and Importing (Step 2 of 5)*
20. In the Image Time Zone pull-down, select the time zone from which the images were collected (Figure 8).

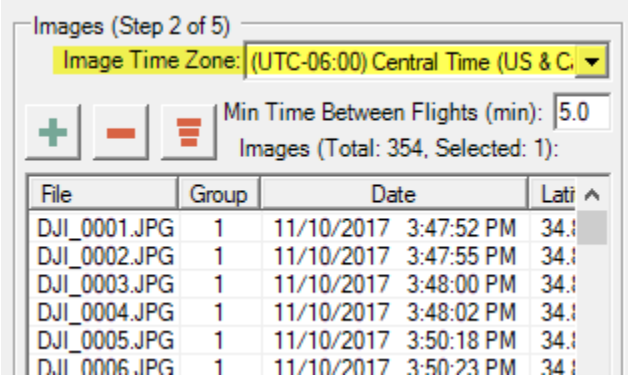

Figure 8 - Image Time Zone

21. Select the green plus sign (Figure 9) 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.

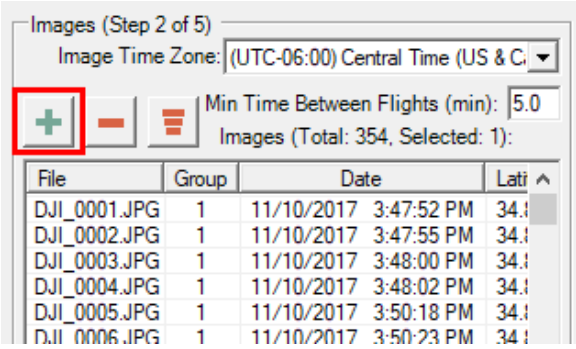

Figure 9 - Add Photos

22. 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).

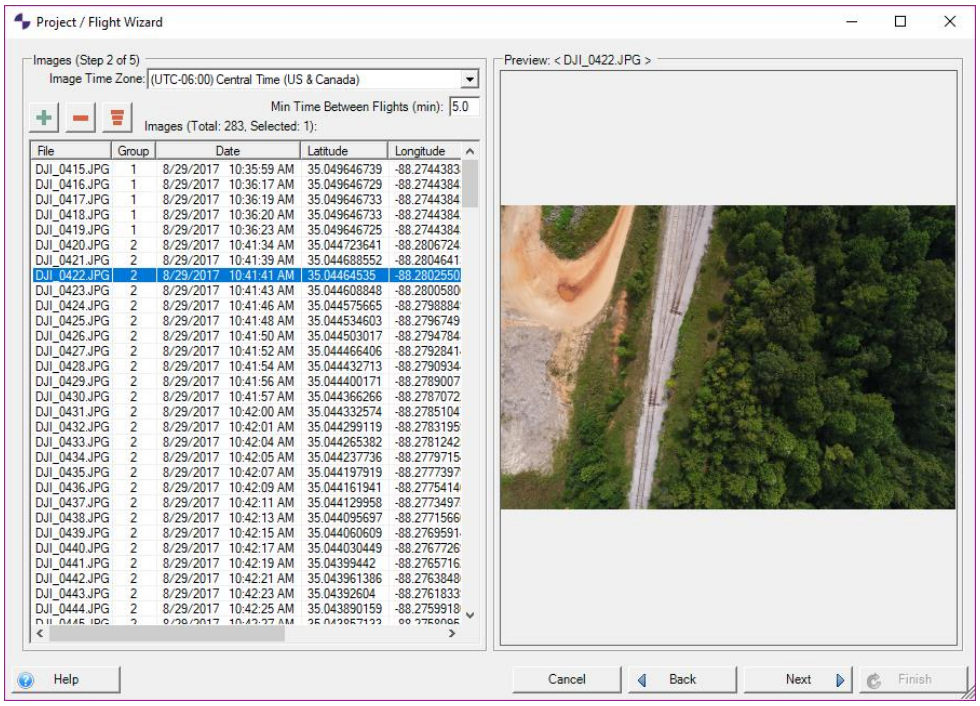

Figure 10 - Photo Preview

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

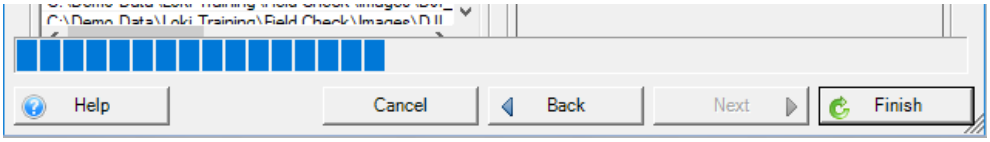

Figure 11 - Import Progress

14. Loki File and Settings (Step 3 of 5).

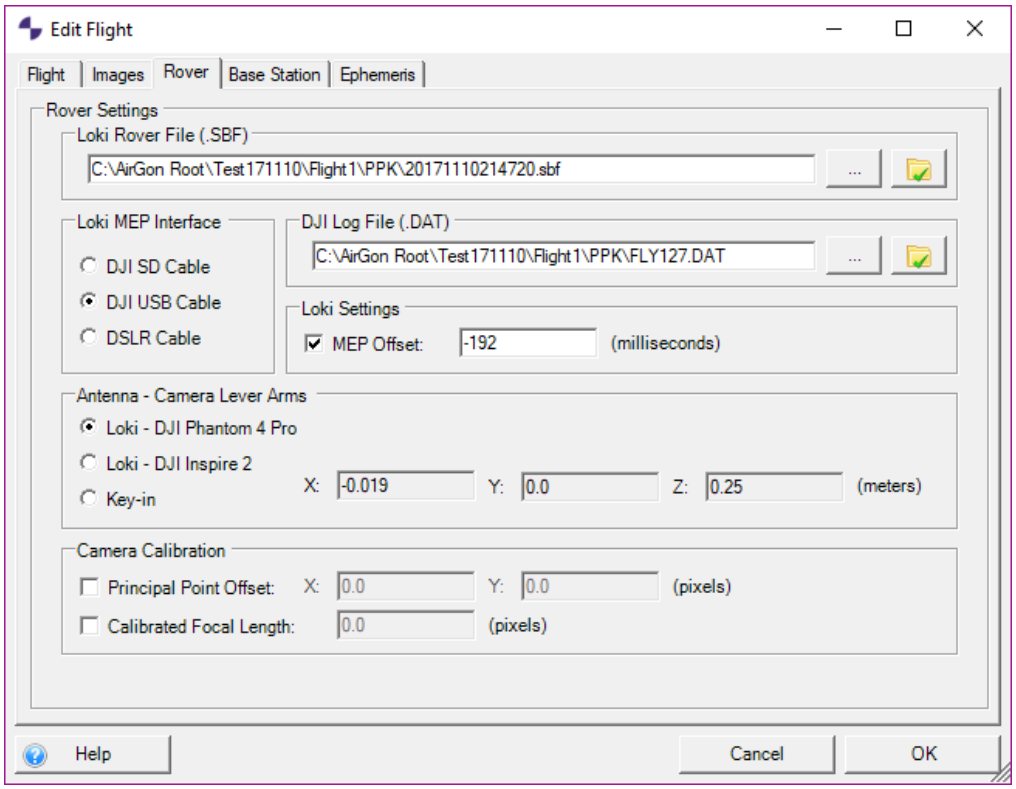

Figure 38 - Rover Tab

Base Station Tab

15. Under *Base Station File*, navigate to the base observation file that was recorded during the flights (Figure).

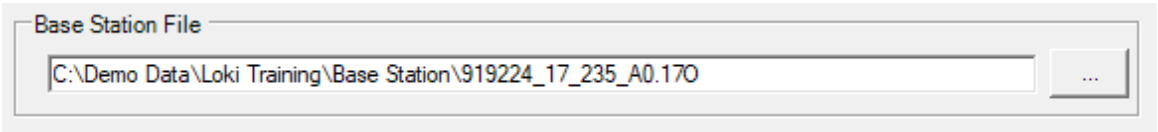

Figure 39 - Base Station File

16. Under *Base Station Location,* manually enter the base position or select *Read From OPUS Text File* and select the text file containing the results from the OPUS email (Figure). If entering manually, locations can be entered in decimal degrees or degrees, minutes, seconds. Ellipsoid height units can be meters, feet, or international feet.

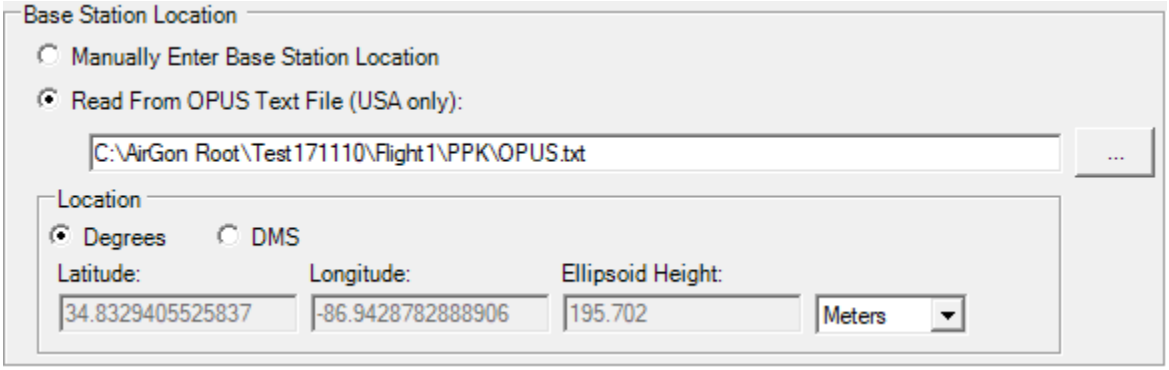

Figure 40 - Base Station Location

17. Under *Base Antenna*, check the box next to *Base Antenna Height* and enter the height of the base station antenna during the observation (Figure 41). Check the box next to *Enable Base Antenna Calibration* and navigate to the calibration file for your base station. A base calibration file can be downloaded from the National Geodetic Survey (NGS) by clicking the Help button in the bottom left corner of the window, and clicking on the NGS link under the Base antenna height section.

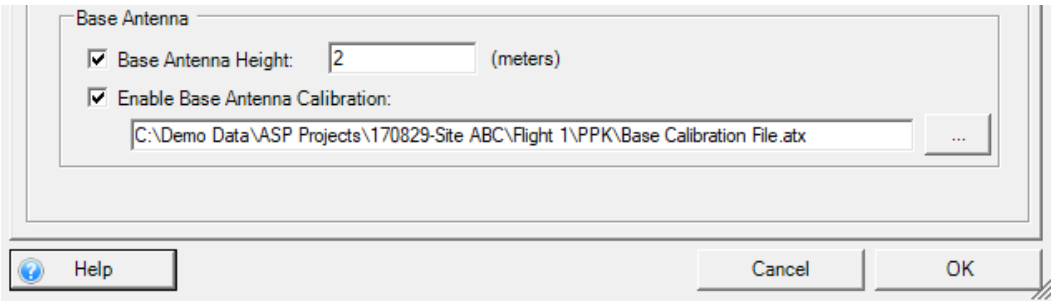

Figure 41 - Base Antenna

Ephemeris Tab

18. Click *Auto-Download* to download ephemeris data (Figure). An Internet connection is needed for the Auto-Download function to work. Alternatively, if you have Ephemeris data on your computer, you can navigate to the file and use it.

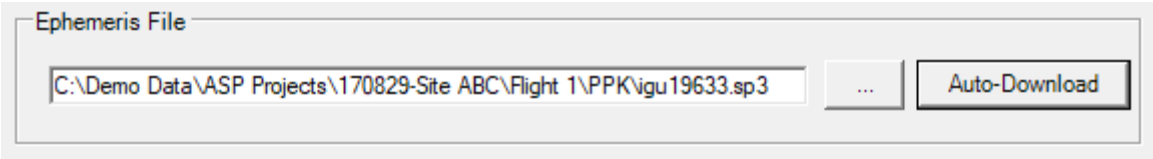

Figure 42 - Ephemeris File

Repair Event File

Sometimes, it may be necessary to look at the Photos and Events together in one dialog, along with their metadata, to determine which Photos and Events should be removed manually. This tool allows the user to make repairs to the event file based on clusters of GPS events that are too close together in time or several photos taken in rapid succession that don't belong in the photo file. Sometimes, there may be more than one event captured per photo which is erroneous. The end goal is that number of photos and GPS events should match. The Repair Event File dialog allows the user to withhold the redundant events and remove those from the event file or remove erroneous photos (Figure 43). Knowing which Photos and Events to withhold is made easier by the "Results" table where it shows the current pairings for events/photos. The Delta Times and Delta Distances between each event and photo are given there.

The Repair Event File dialog will let the user know if the Event Count does not match the Photo Count or vice versa. The user may check Events from the Events section or Photos from the Photos section to mark them for deletion. In the case below, the dialog is letting the user know that the Event Count does not match the Photo Count. The Adjusted Time Offset computes the difference between the average Photo Time and the average Event Time. The refresh button recalculates it if the user removes photos or events from the list.

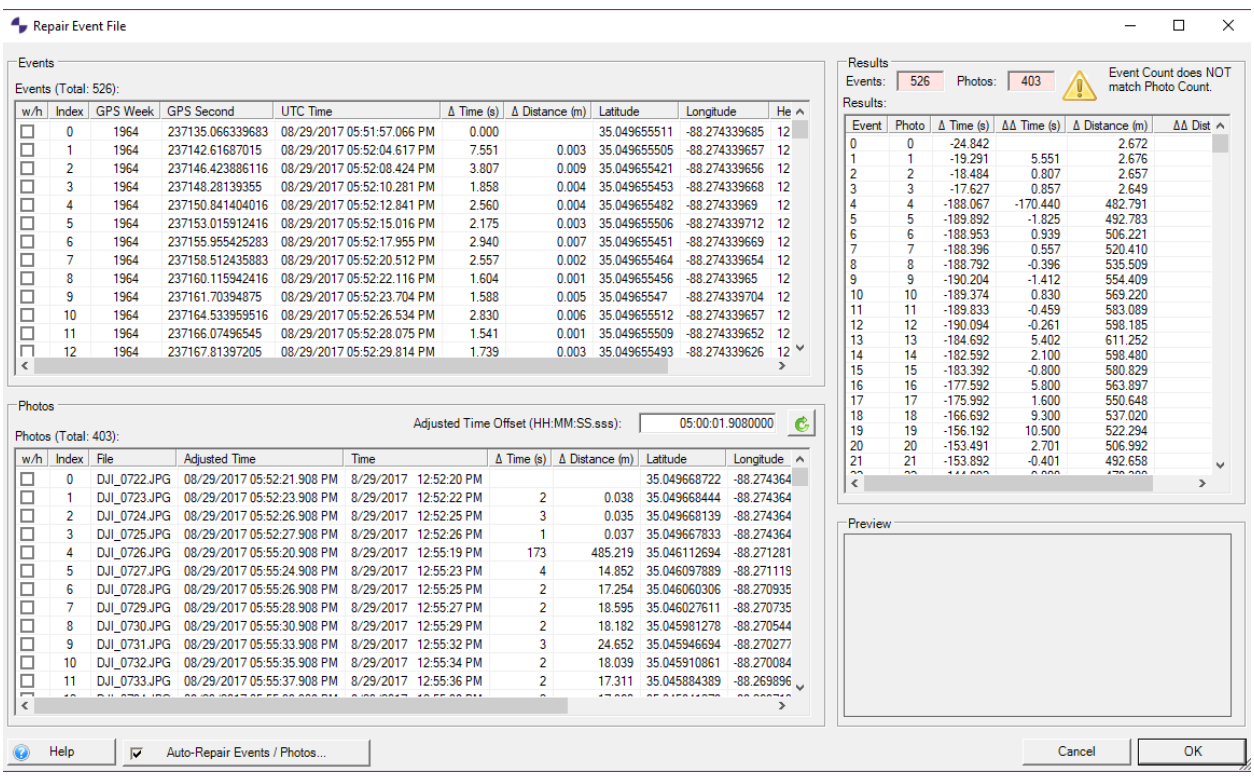

Figure 43 - The Repair Event File dialog

Auto-Repair Events/Photos is an automated process that matches Photo Times and Event Times and automatically checks photos or events for elimination that don't correspond to matching times.

This comparison process can also be done manually. In the case of redundant photos, look at the Photos list and see if there are any redundant photos. That is, make sure there are no photos with a *Δ Time* of zero. If so, these need to be withheld. If there are no photos with a *Δ Time* of zero, then look in the Results tab, *Δ Time* column for a large unexpected jump in the column values. The *ΔΔ Time* is the difference between the *Δ Time* of a row and the previous one. If there are no unexpectedly large jumps in the *Δ Time*, then look at the *Δ Distance*. A value will be flagged in this column if it is more than twice the average *Δ Distance* of the whole list. The *ΔΔ Distance* is the difference between the Δ Distance value of that row and the previous one. When you click a row in the *Results* section, the corresponding event and photo will be highlighted in the *Event* and *Photo* sections, respectively.