GEOCUE
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LP360

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LP360 Drone Users Guide

LP360

TRUEVIEW

microdrones®

Version 2024.1.30.0

CONTENTS

ABOUT MDGROUP

mdGroup is an aerial digital twin maker for industrial applications. It operates its digital twin making business through its portfolio companies Microdrones and GeoCue.

To learn more about mdGroup, visit www.group-md.com

ABOUT GEOCUE

GeoCue is a U.S. based LiDAR data technology company offering software, hardware, training, support and consulting services for high accuracy LiDAR and imaging drone mapping to help civil engineering and surveying professionals achieve successful data collection, processing, and management.

With its TrueView drone LiDAR/Imaging sensors and LP360 point cloud data processing software, GeoCue is the leader in LiDAR mapping processing in North America.

To learn more about GeoCue, visit www.geocue.com

ABOUT MICRODRONES

Microdrones is an unmanned aerial surveying and mapping technology company that delivers industrial-grade survey equipment with a fully integrated geospatial workflow. Transformation of collected data into actionable deliverables and their visualization is made possible through the LP360 Drone data processing software platform.

ABOUT AGISOFT, LLC.

Founded in 2006 as an innovative research company with focus on computer vision technology, through years of intensive R&D work Agisoft LLC has gained expertise in image processing algorithms, with digital photogrammetry techniques setting the direction for development of applied tools. To learn more, visit www.agisoft.com.

ABOUT BAYESMAP SOLUTIONS, LLC.

BayesMap Solutions was founded in September 2014 and registered in California (Alameda County), to provide unique consulting and software development services for the LiDAR industry. Their focus is on data processing, providing efficient and accurate solutions to challenging problems. BayesMap Solutions also help their clients extract a maximum amount of information from large and complex data sets. They are located in Mountain View, CA. To learn more, visit bayesmap.com.

ABOUT SZ DJI TECHNOLOGY CO., LTD.

Creativity is at the heart of every dream. Every idea, every groundbreaking leap that changes our world starts with the vision of talented creators. At DJI, we give these creators the tools they need to bring their ideas to life.

Our platforms empower them to capture images that were once out of reach. Our flying and camera stabilization systems redefine camera placement and motion. Amazing photos and video, treasured personal memories, and high-end professional imagery are captured every day, in every corner of the world using DJI products.

We do this through an unparalleled commitment to R&D, a culture of constant innovation and curiosity, and a focus on transforming complex technology into easy-to-use devices. Building on the ethos of "form follows function," our products combine advanced technology with dynamic designs.

Headquartered in Shenzhen, widely considered China's Silicon Valley, DJI benefits from direct access to the suppliers, raw materials, and young, creative talent pool necessary for sustained success. Drawing on these resources, we have grown from a single small office in 2006 to a global workforce. Our offices can now be found in the United States, Germany, the Netherlands, Japan, South Korea, Beijing, Shanghai, and Hong Kong. As a privately owned and operated company, DJI focuses on our own vision, supporting creative, commercial, and nonprofit applications of our technology. Today, DJI products are redefining industries. Professionals in filmmaking, agriculture, conservation, search and rescue, energy infrastructure, and more trust DJI to bring new perspectives to their work and help them accomplish feats safer, faster, and with greater efficiency than ever before. To learn more, visit www.dji.com.

ABOUT CHC NAVIGATION

Founded in 2003, CHC Navigation (Huace:300627.SZ) creates innovative GNSS navigation and positioning solutions to make customers' work more efficient. CHCNAV products and solutions cover multiple industries such as geospatial, construction, agriculture and marine.

With a presence across the globe, distributors in more than 120 countries and more than 1,700 employees, CHC Navigation is today recognized as one of the fastest growing companies in geomatics technologies. To learn more, visit chcnav.com.

ABOUT WINGTRA AG

Headquartered in Switzerland, Wingtra is the world's leading VTOL drone producer for mapping, survey, and mining industry professionals. Since its market entry in early 2017, Wingtra has partnered with more than 70 of the biggest equipment dealers and has been selling mapping drones globally ever since. To learn more, visit wingtra.com.

ABOUT LP360 DRONE

LP360 is a 64-bit Windows® desktop application used for many years by the LP360 Geospatial community for processing traditional aerial, mobile, and terrestrial tripod laser scanner data. The LP360 Drone community is the focus of this Users Guide containing the LP360 workflows for processing and exploiting TrueView, microdrones®, DJI, Wingtra, and other drone sensor data. Formerly called TrueView EVO, LP360 Drone, is GeoCue's LP360 point cloud exploitation product with the addition of a collection of tools and workflows for processing drone data. LP360 Drone is the software used to post-process your raw flight data to generate a 3D LiDAR point cloud in LAS format, colorize the point cloud, geotag the images collected, and generate an orthomosaic. LP360 also has many tools for assessing and processing point cloud data, such as accuracy assessment, automatic and manual ground classification, and contour/ surface generation. LP360 Drone is available in the following licensing levels:

- **LPViewer** – A free viewer level of LP360 for viewing a point cloud.
- **LP360 Drone Explorer** – A low-cost inspector license equivalent to LP360 Viewer, with Image Explorer enabled for viewing True Pose® photos, and Import Cycle for field QC checks. This is also the license that should be purchased for delivery with LP360 Explorer Packages provided to end users so they can make full use of the TrueView 3DIS point cloud and photos, plus any derivative products you generate for them.
- **LP360 Drone** – Enables PPK processing for systems, such as the DJI P4P RTK, plus TrueView 2DIS and 3DIS. This is the next generation ASPSuite Advanced and is equivalent to LP360 Standard with the addition of the sensor workflow tools and tools for ground classification and volumetric computations. It is limited to product areas of no more than 10 km² of LAS data. Available as an annual subscription or a perpetual license.
- **LP360 Drone+3D Accuracy** – Enables the automatic detection of Accuracy Stars and related target types. Available as an annual subscription or a perpetual license.
- **LP360 Drone+Photo** – Enables local Ortho Mapping. Available as an annual subscription or a perpetual license.
- **LP360 Drone+Photogrammetry with Agisoft** – Enables local Agisoft Ortho Mapping, if you have a Metashape license, and Cloud based Agisoft Ortho Mapping (using LP360 points). Available as an annual subscription or a perpetual license.
- **LP360 Drone+Cloud Photo 3000** – Enables both the local Ortho Mapping, local Agisoft Ortho Mapping processing if you have your own Metashape license, and Cloud based Agisoft Ortho Mapping (includes 3000 photos per month, additional photos may be processed using LP360 points). Available as an annual subscription license.
- **LP360 Drone+Full Photo (formerly Fast Photo)** – Legacy license that enables both the local Ortho Mapping and local Agisoft Ortho Mapping, if you have a Metashape license, and Cloud based Agisoft Ortho Mapping (using LP360 points).
- **LP360 Drone+Strip Align** – Enables Strip Align and Strip Adjustment tools for adjusting for dynamic trajectory errors in the dataset. Available as an annual subscription or a perpetual license.
- **LP360 Drone+Strip Adjustment** – Enables Strip Adjustment for adjusting for dynamic trajectory errors, and Calibration tool for boresight calibration of TrueView or microdrones datasets. Available as a perpetual license.

- **LP360 Drone+Business Intelligence Tools** – Enables specific point cloud tasks designed for extraction of non-ground features, such as rail, power lines, buildings, trees. Available as an annual subscription or a perpetual license.
- **LP360 Drone+Unlimited** – this is the same functionality as LP360 Drone with the size limit removed. Available as an annual subscription or a perpetual license.
- **LP360 Drone+Experimental** – this is the same functionality as LP360 Drone with the addition of features classed as experimental. We may occasionally have features that we call experimental where we have limited access available only to those organizations specifically working with us on those features. Or, at times, a pre-release version being used for training.

ABOUT LP360 ONLINE

LP360 Online replaced **TrueView Reckon**. Both are Amazon Web Services (AWS) hosted platforms that are used for a variety of purposes in TrueView (and other) workflows. It provides services such as (items marked with a $T are extra cost, paid in Points):

- Project data hosting and visualization ($T)
- Data archival ($T)
- Management and automatic delivery of sensor calibration files
- Automatic sensor health check
- Transfer of sensor Cycle data to GeoCue for technical support
- Management of Points for services that are paid via a metering scheme (marked in this list with $T)
- Transaction history of sensor usage
- other related services

LP360 Online is accessed from within LP360 Drone in various workflows. These workflows might require an LP360 Drone user to provide their login credentials. LP360 Online has a web interface for data visualization, processing, and account monitoring.

Every customer is provided an LP360 Online account. Legacy customers may have had a Reckon account that has now been transitioned to an LP360 Online account.

ABOUT LP360 CLOUD

LP360 Cloud is an ever-growing collection of cloud-based tools and resources that will make it easy for you to manage, archive, share and collaborate on geospatial projects.

LP360 has two LP360 Cloud Addon products that are subscription licenses:

- Storing and sharing data → requires an **LP360 Cloud Access** license.
- Power Search, streaming, and cloud data processing → requires an **LP360 Cloud Starter** license.

See the LP360 website for the latest that LP360 Cloud has to offer and activate or renew your subscription today in the LP360 Store.

A CYCLE

All TrueView sensors, and microdrones traditional sensors, write their various data streams to a standard file folder structure called a "Cycle" on the USB drive or internal memory. The term cycle refers to a sensor power cycle because TrueView datasets are started and terminated by the sensor power cycles. It is possible to have multiple collections (flights, in the case of a drone) in a single Cycle, so it is not necessarily correct to think of Cycle as being synonymous with flight, though it is typically.

The folder structure requires four basic components to be a valid Cycle for import into LP360 Drone:

- The folder name must have "Cycle_" at the beginning of the name.
- There must be a sub-folder in the Cycle folder named "System".
- In the System folder there must be a "SystemConfiguration.json" file.
- In the System folder there must be a "CycleParams.json" file.

If the user changes the file structure in a way where these conditions are not met, the cycle will not be valid for import.

```
L:\Cycle_191212_184916
|
+---System
|       CycleParams.json
|       SystemConfiguration.json
```

Example of proper file structure

ACCESSING AND MANAGING LP360 ONLINE FROM A WEB BROWSER

LP360 Online, the replacement for TrueView Reckon, is the infrastructure for LP360 Points and online data storage via LP360 Cloud. LP360 Online allows your account admin to add users who can use your account's LP360 Points and licenses for processing.

1. If you did not create your online account when making your first subscription license purchase then GeoCue will create your account's LP360 Online account, which you can access at the URLs:

   LP360 Store for user, subscription license and LP360 points management:
   https://store.lp360.com/
   LP360 Cloud for data storage, archiving, sharing, and streaming:
   https://cloud.lp360.com/
2. GeoCue will assign someone from your account as the point of contact. This person will be the store administrator of your LP360 Cloud account and may invite additional users who are

allowed to process. The point of contact will receive an email after purchase which contains the invitation to create login credentials.

3. Additional users may be added at any time by your LP360 Store Admin.
4. An invitation email is sent to new user(s) by the LP360 Store.
    a. The user selects the *Setup Account* link in the LP360 Invitation e-mail to confirm the e-mail and create a password.
    b. The password can be reset by the user by accessing one of the LP360 Online URLs and using the "*Forgot Password?"* link on the login page. Note: The password reset will only work if the user has previously confirmed their e-mail address within the specified timeframe in the LP360 Invitation e-mail. Contact support to have your invitation e-mail re-sent.

LICENSING AND INSTALLATION

SYSTEM REQUIREMENTS

Recommended systems for LP360 Drone Processing:

- Windows Version 10, Professional (64-bit) or Windows 11 Professional, or their server equivalents.
- i7 or equivalent CPU. The more cores, the faster the processing.
- 16 GB RAM (32 GB recommended).
- Nvidia Graphics recommended but not required.
- Graphics must support Open GL 4.5.
- Internal Solid State Disk (SSD) with a minimum capacity of 256 GB.
- Secondary storage recommended but not required (e.g., 2 TB spinning disk).
- USB 3.0 Required for data transfer from the TrueView USB Mass Storage (TrueView USB memory stick).
- High speed network access required for TrueView Cloud processing (cloud processing of the trajectory is the only mode supported for rental systems).
- A minimum 1920 x 1080 resolution display recommended. High resolution, 4k displays, require configuring LP360 Drone shortcut properties per Microsoft's recommendations.
- Dual Display is highly recommended for office setups.

INSTALLING LP360 DRONE

When your TrueView system or LP360 Drone is purchased, or a rental or subscription is to begin, your account's point of contact will receive an email from support with instructions for downloading the latest version of LP360 Drone from the LP360 Store, or from the LP360 Installers page on our searchable support knowledge base. For perpetual licenses, a username, password, and link for your LP360 Online account should be provided in the email, along with your perpetual License String. For subscription licenses and licenses provided with a TrueView rental, the first time your organization rents or uses LP360, you will receive an invitation to confirm your e-mail address and create a password to access the LP360 Store to download LP360 and to also use as your license credentials.

PERPETUAL USERS

Download the latest version of LP360 Drone from the LP360 Store or the LP360 Installers page on our searchable support knowledge base and copy to a local drive on your computer. Double-click on the installation file to install LP360 Drone. Once installed, use the steps below to activate LP360 Drone using the License String provided in your licensing email.

*Note: It is necessary to enable outbound communications to TCP ports **5053,** and the **customer specific port** outlined in your licensing email, on any firewalls for the product to communicate with the hosted license server. These ports are normally open by default on most firewalls.*

SUBSCRIPTION USERS AND TRUEVIEW RENTALS

Download the latest version of LP360 Drone from the LP360 Store and save to a local drive on your computer. Double-click on the installation file to install LP360 Drone. Once installed, use the steps below to activate LP360 Drone using a login and password.

PERPETUAL LICENSING FOR LP360 DRONE

1. Open LP360 Drone and select **License Manager** from the Startup dialog, or **File -> License Manager**
    a. If your version of LP360 Drone is currently unlicensed, you will get an error and be prompted to open License Manager when you try to open it.
2. On the Activation tab, under Credentials, select **Perpetual**, then copy and paste the License String, which includes a password, into the License String field.
3. Select "Set" to set the License String. Once successfully set there is no need to set the License String again.
    a. If you encounter an Invalid License String Error message, see the probable resolutions on our searchable support knowledge base.
4. The *Available Licenses* portion of the license manager should now be highlighted. Select the dropdown to select the LP360 Drone license.
5. **Select C*heck out floating license* to use your floating license**. An Internet connection must be maintained while using a floating license.

a. If you need to use the license without internet connectivity, check the box to roam the license, and then check out the license. A license can be roamed for up to 30 days. Other users with access to this license will not be able to use it while the license is roamed.

6. The *Current License* portion of the dialog should now show the license type with a green checkmark (Figure 4) indicating that the license has been activated.

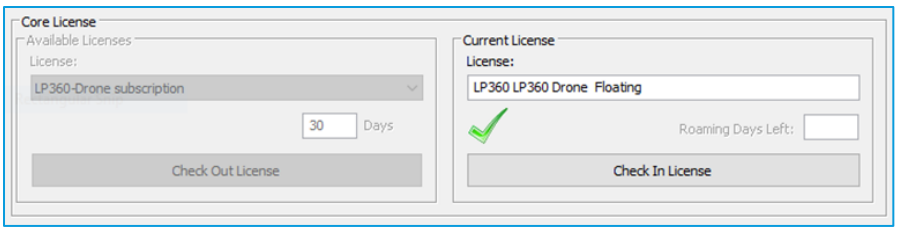


Figure 4 - License Manager

7. The license is now activated, and LP360 Drone can be used for processing.
8. If applicable, select additional addon products from the Available Products list and select "Check Out License" to enable the addon license in addition to the base LP360 Drone license.
9. Select Close to close the LP360 Drone License Manager and open LP360 Drone at the desired license level.
10. You can reopen the LP360 Drone License Manager at any time from within LP360 Drone (File -> License Manager) to change license levels.
11. Repeat this process for all desired machines.

The LP360 Drone license comes standard as a floating license, which means the license can be shared easily within your organization. Just install LP360 Drone on all the machines that need to use the software, then repeat steps 1-6. Only one machine can use the license for one instance of LP360 Drone at a time. The license can be checked in and out as needed if it is not in use by another machine.

Feature Level	***LP360 for ArcGIS***	***LP360***	***LP360 Drone***
Visualization		Viewer (V)	Explorer (X)
PPK processing			Drone (D)
Creating Products	Basic (B)	Basic	
Interactive Edit	Standard (S)	Standard	
Automated Extraction, TrueView 3DIS® Post-Processing (Drone Only)	Advanced (A)	Drone (D)[1], Advanced	BIT addon
Removes 10 km^2 size restriction			Unlimited addon
Experimental			Experimental addon

Table 1 - Licensing Levels of LP360

1 LP360 Drone is limited to point cloud sized less than 10 km². Upgrade to LP360 Advanced to remove this restriction.

2 LP360 Drone is limited to point cloud sizes of less than 10 km². Add an Unlimited addon license to remove this restriction.

SUBSCRIPTION LICENSING FOR LP360 DRONE

1. Open LP360 Drone and select **License Manager** from the Startup dialog, or **File -> License Manager**
    a. If your version of LP360 Drone is currently unlicensed, you will get an error and be prompted to open License Manager when you try to open it.
2. On the Activation tab, under Credentials, select **Subscription**, then enter the same credentials you created when completing your invitation to the LP360 Store to access the licenses for your organization.
3. The *Available Licenses* portion of the license manager should now be highlighted. Select the dropdown to select the LP360 Drone license.
4. **Select *Check out floating license* to use your floating license**. An Internet connection must be maintained while using a floating license.
    a. If you need to use the license without internet connectivity, check the box to roam the license, and then check out the license. A license can be roamed for up to 30 days. Other users with access to this license will not be able to use it while the license is roamed.
5. The *Current License* portion of the dialog should now show the license type with a green checkmark (Figure 4) indicating that the license has been activated.

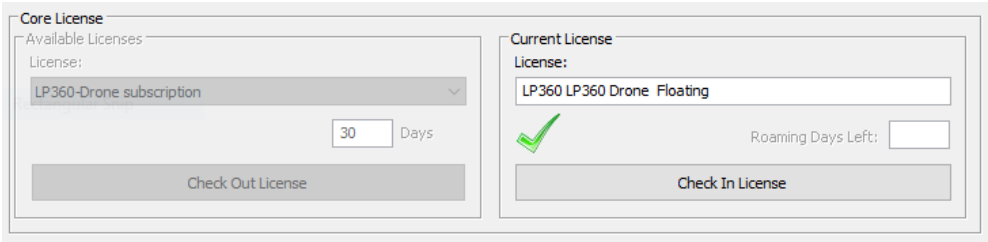


Figure 5 - License Manager

6. The license is now activated, and LP360 Drone can be used for processing.
7. If applicable, select additional addon products from the Available Products list and select "Check Out License" to enable the addon license in addition to the base LP360 Drone license.
8. Select Close to close the LP360 Drone License Manager and open LP360 Drone at the desired license level.
9. You can reopen the LP360 Drone License Manager at any time from within LP360 Drone (File -> License Manager) to change license levels.
10. Repeat this process for all desired machines.

STARTUP DIALOG

Upon launching LP360 Drone, you will be presented with the LP360 Startup dialog containing the frequent starting places.

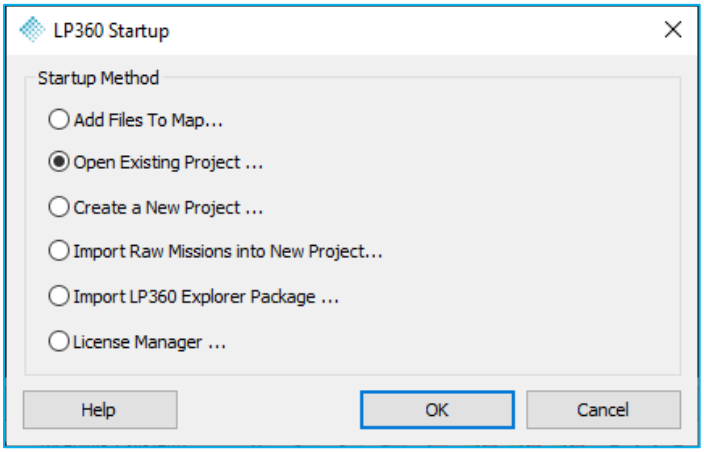


Figure 6 - Startup dialog

- **Add Files to Map –** The typical starting place for geospatial users to start a project by adding LAS, Raster, Feature files, etc. to the session.
- **Open Existing Project** – Launches Project Manager and presents the list of previously opened projects, defaulting to the last opened project.
- **Create a New Project** – Opens the Create Project dialog for when you wish to create a new project from existing LAS/Raster/Feature/True Pose Photo data instead of a Cycle. Not typical for a TrueView workflow as a new project is created when importing the first Cycle into a NEW project.
- **Import Raw Mission into New Project** – Opens the Raw Mission Import Wizard to walk you through creating a new project while importing raw mission (Cycle/Flight) data from a TrueView, microdrones, other supported sensor, or sensor trajectory and LAS from any sensor into LP360.
- **Import LP360 Explorer Package** – Opens the Import Explorer Package dialog to create a new project from an Explorer Package. This is the starting place for the LP360 Explorer license user who has received an Explorer Package from a TrueView sensor owner.
- **License Manager** – Invoke the License Manager dialog to license or change the desired license level. Upon closing the License Manager dialog, returns to the Startup dialog.

Note: Cancelling the Startup dialog will bring you into a blank session of LP360 Drone.

LP360 ONLINE LOGIN IN LP360 DRONE

LP360 Online (formerly TrueView Reckon) is used for a variety of purposes in TrueView workflows. To facilitate, the settings use a universal online login in the upper right of the LP360 Drone main frame (Figure 7). For perpetual licenses, this login is separate from your license credentials, but are the same credentials for subscription users with LP360 Online. Users with LP360 Online licenses are automatically logged into LP360 Online and will not see the Online Account Sign in dialog when selecting on the [Sign In] button. LP360 Online subscription license users do not have a log out option.

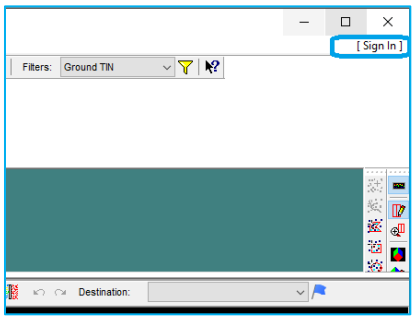


Figure 7 - Unified Online Login

The login string shows information about the login in the following format:

email of logged in user (*Account*) [*Point balance*]

To sign in or change online accounts, the user left clicks on the login bar, opening the *Online Account Sign In* dialog (Figure 8).

> For LP360 Online, the user should be automatically signed when using subscription license credentials.
>
> The TrueView Reckon login has been deprecated, please use your LP360 Online account.

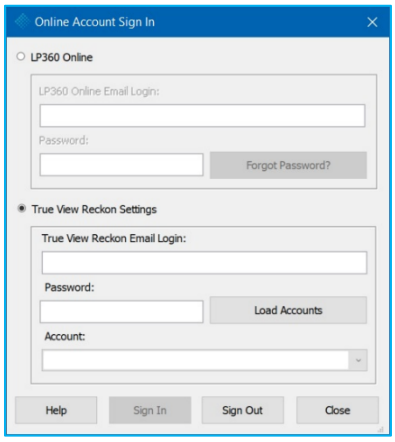


Figure 8 – Online Account Sign In dialog

Note: It is not necessary to sign into your online account if you are not going to do any online related processing, but there are more functions being added to LP360 that utilize LP360 Online as time goes on.

UPDATING TRUEVIEW EVO TO LP360 DRONE

Users already running TrueView EVO will need to uninstall TrueView EVO before installing LP360 Drone.

UPDATING LP360 DRONE

Users already running LP360 Drone v2022.1.48.0 or later may update LP360 Drone by the prompt they will see when starting LP360 Drone, or by selecting Help -> Check for Updates in the LP360 Drone dialog. The latest version of LP360 Drone may also be downloaded from the LP360 Store or from the LP360 Installers page on our searchable support knowledge base and installed over the older version.

Release – The default and recommended selection is to automatically download and install the latest LP360 Drone release.

Experimental – Access to the experimental version is granted based on the organization and uses the LP360 Online login. We may occasionally have products or features that we call experimental where we have a limited version available only to those accounts specifically working with us on those features or products. Or, at times, a pre-release version being used for training and available from the TrueView Training account.

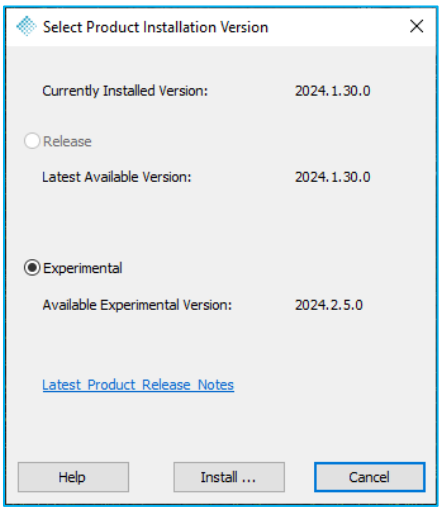


Figure 9 - Check for Updates

POSPAC CLOUD VS LOCAL PROCESSING

LP360 Drone uses a built-in interface that runs the Applanix Corporation POSPac processing solution to provide GNSS and inertial corrections for sensor trajectory processing. POSPac can be run in one of two locations: Cloud or Local. Cloud processing uploads your data to an Applanix server, corrects the data, and downloads the processed results. Local processing runs a locally installed version of POSPac in the background on your machine and does not use LP360 Points but is limited to systems that are the Classic business model, may only run one instance at a time, and requires the user to manage their POSPac installations and licensing.

> Users who operate their sensor as a vehicle mounted mobile scanner will need a POSPac MMS license if the sensor is licensed for local processing. Vehicle mounted mobile scanner configurations using a Traditional/DGaaS hardware type will still use POSPac Cloud.

CLOUD

Cloud processing uploads your flight data to an Applanix server which corrects the GNSS signal and inertial values stored in the T04 or rover RINEX file. The smoothed best estimate trajectory (SBET) is then computed and downloaded back to your local machine. The user is charged LP360 Points based on the number of kinematic minutes for the processed files based on their selected business model. This trajectory is then used to geocode your LiDAR data. Customers with any system where you wish to process the trajectory using SMARTBase or PP-RTX, can only use the cloud processing option. Classic systems also have the option of single base processing using the Cloud. Any use of the POSPacCloud processing must have enough LP360 Points available to cover the cost of processing regardless of the business model for the system. Since LP360 Drone communicates with LP360 Online to manage your account's LP360 Point balance during the *POSPac Processing Wizard* step, you must be logged into your LP360 Online account, except for Traditional and Rental systems when processing using single base.

INSTALLING POSPAC CLOUD

1. POSPacCloud is installed as part of the installation of LP360 as it is used to support several tools. There is nothing to be configured, but POSPacCloud does need to be able to communicate through any firewalls.

FIREWALL REQUIREMENTS FOR POSPAC CLOUD

POSPacCloud needs to be able to communicate with the following domains (different subdomains):

*.pospaccloud.com
*.trimble.com
*.trimblepaas.com

"%Program Files%\Applanix\POSPac Cloud\POSPacCloud.exe" needs to be able to communicate both inbound and outbound through your firewall.

LOCAL

POSPac local processing is a method available only to those who have purchased their TrueView system with a Classic business model and have POSPac UAV or POSPac MMS installed and licensed on their machine. A POSPac UAV network license allowing for only single base processing is included with each TrueView Classic system purchase. Processing any system using SMARTBase or PP-RTX, must use POSPacCloud. TrueView 2DIS and DJI sensors, such as the DJI Phantom 4 RTK, M210 RTK, DJI Zenmuse P1 (M300 RTK), Mavic 3 Enterprise (M3E) RTK use either the built-in post processing kinematic (PPK) engine for local single base processing, or the real-time trajectory solution, so do not require POSPac desktop to be installed.

LP360 Drone will execute a batch process in the background using the local version of POSPac. Use the steps below to configure LP360 Drone for use with a local version of POSPac UAV.

CONFIGURING LP360 DRONE FOR POSPAC UAV OR POSPAC MMS

1. Download POSPac UAV 9.1 from the LP360 Store (Download -> POSPac UAV or POSPac MMS, if applicable).
2. Install POSPac UAV 9.1 on your machine and activate your POSPac UAV license. See Appendix A: POSPac UAV Network License for more information on activating and using your POSPac UAV Network License.
3. Open LP360 Drone and click File -> Project Settings -> TrueView tab.
4. Under *POSPacBatch.exe Location (LOCAL)* (Figure 10), navigate to "*C:\Program Files\Applanix\POSPac UAV* 9.1\" or "*C:\Program Files\Applanix\POSPac MMS* 9.1\" and select *PospacBatch.exe*. Then, select Apply when finished to commit the setting.

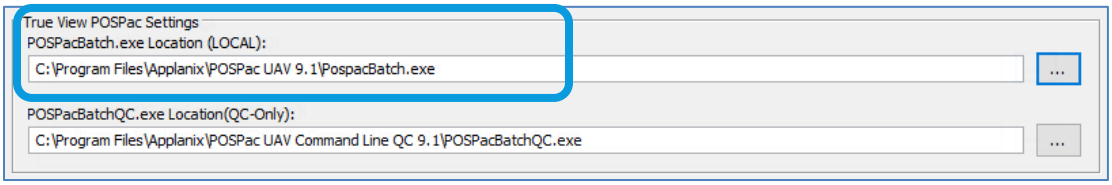


Figure 10 - TrueView POSPac Settings

5. LP360 Drone should now be configured to use local POSPac UAV or MMS desktop. A POSPac UAV license is included with a 3DIS® purchase. A user must have their own POSPac MMS license.

CONFIGURING LP360 DRONE FOR LOCAL POSPAC QC

QC processing of any system can be done using POSPacCloud provided the machine is connected to the internet and requires no additional installation. POSPac QC local processing is a method available for those who wish to be able to run QC processing offline for performing field checks. Offline checks require the installation and configuration of the POSPac UAV Command Line QC utility, which doesn't require a POSPac license on the machine to run.

1. Download POSPac UAV Command Line QC 9.1 from the LP360 Store (Download -> POSPac QC).
2. Install POSPac UAV Command Line QC 9.1 on your machine.
3. Open LP360 Drone and click File -> Project Settings -> TrueView tab.
4. Under *POSPacBatchQC.exe Location (QC-Only)* (Figure 11), navigate to "*C:\Program Files\Applanix\POSPac UAV Command Line QC 9.1*" and select *PospacBatch.exe*. Then, select Apply when finished to commit the setting.

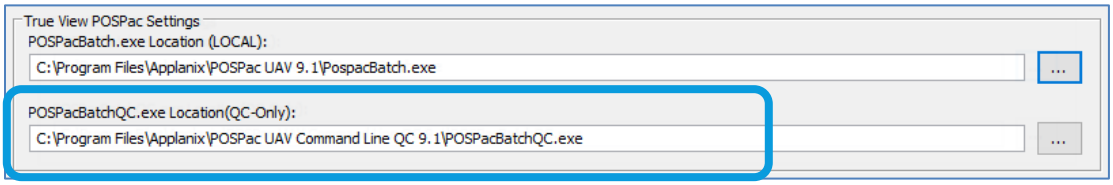


Figure 11 - TrueView POSPac QC Settings

5. LP360 Drone should now be configured to use local POSPac UAV Command Line QC utility to enable local POSPac QC processing.

ADDITIONAL LICENSING REQUIREMENTS FOR LP360 DRONE+STRIP ALIGN

For TrueView 3DIS, microdrones, DJI Zenmuse L1/L2, Wingtra, and "Other" point clouds, strip alignment may be improved by executing an addon license to LP360 Drone, called **Strip Align for LP360 Drone**. Note: Strip Align for LP360 Drone may only be used with drone data processed in LP360.

LP360 Strip Align licensing requires an open HTTPS port (443) to **ls65.rlmcloud.com** [104.245.32.243] to complete the license validation unless an offline activation has been provided.

ADDITIONAL LICENSING REQUIREMENTS FOR LICENSING LP360 DRONE+DESKTOP PHOTO WITH AGISOFT

For TrueView, microdrones, and DJI sensors, the orthomosaic can be generated and the image positions and orientations refined using Agisoft Ortho Mapping, that is an addon license to LP360 Drone, called **Desktop Photo with Agisoft**. Desktop Photo with Agisoft consists of a "Full Photo" (new name for the legacy "Fast Photo" license) or a "Photogrammetry with Agisoft" addon license, plus an Agisoft Ortho Mapping license that must be separately activated. Images may also be processed in the Cloud version for Agisoft Ortho Mapping using points purchased in the LP360 Store and requires no separate Agisoft Ortho Mapping license activation.

The activation uses standard HTTPS protocol (via default system TCP port). Access to **activate.agisoft.com** (52.215.115.17) is required.

True Pose® images may also be processed in other photogrammetric packages, such as PIX4D and Bentley's ContextCapture, using the Export Photo Package tool, but is not tightly integrated like Agisoft Ortho Mapping or Ortho Mapping.

ACTIVATE AGISOFT ORTHO MAPPING LICENSE

To configure your Agisoft Ortho Mapping license:

1. Using Agisoft Ortho Mapping requires no separate installation of Metashape, however, if you are using a GUI version Metashape Pro license then you will need to separately install Metashape Pro v1.7.1, v1.8.x, or v2.0.x and follow the installation and licensing instructions provided by Agisoft with your license delivery and not the following instructions. When using a separately installed GUI version of Metashape Pro, you will need to configure it to be run by LP360 Drone.
2. Once you have installed and licensed LP360 Drone, open LP360 Drone.
3. Cancel off the Startup dialog.
4. Open the **Project Settings** dialog (File -> Project Settings).
5. On the EXP tab, in the Agisoft Ortho Mapping section (Figure 12), select ***Check Activation Status***.

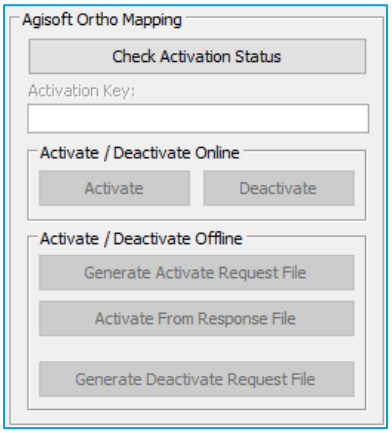


Figure 12 – Agisoft Ortho Mapping License Setting

6. You should see an Activation Status message (Figure 13) indicating, "Metashape is NOT Active". Select *OK*.

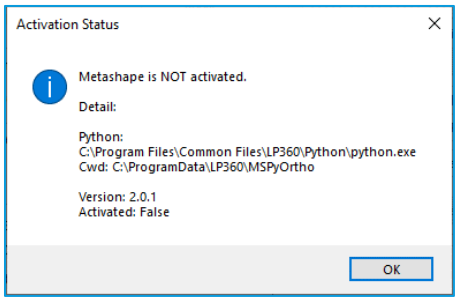


Figure 13 – Agisoft Ortho Mapping Activation Status - NOT Activated

7. Copy/paste your console key, as provided in your initial licensing e-mail, into the **Activation Key** field.

8. Select *Activate* to activate the Agisoft Ortho Mapping license on this machine.
9. You should see an Activation Success message (Figure 14) indicating, "Metashape successfully activated". Select *OK*.

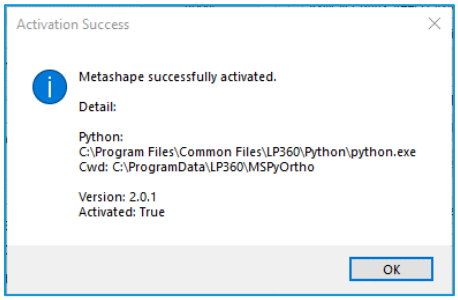


Figure 14 – Agisoft Ortho Mapping Activation Success

10. Select *OK* or *Apply* to close the Project Settings dialog.
11. Check out a "Full Photo" or "Photogrammetry with Agisoft" addon license to the LP360 Drone license.
12. Execute the Agisoft Ortho Mapping tool to generate an orthomosaic and refine the True Pose® photo positions and orientations.

It is necessary to deactivate the Agisoft Ortho Mapping license before re-installing/installing a new OS or changing hardware components. In addition, the license should be deactivated to be transferred to another computer.
If a machine has ever been licensed for Agisoft Ortho Mapping, the metashape.lic file can be found in "%ProgramData%\LP360\MSPyOrtho" or "%CommonProgramFiles%\LP360\MSPy38" and should never be deleted. The licenses are now stored in "%ProgramData%\Agisoft\Licensing\licenses".

DEACTIVATE AGISOFT ORTHO MAPPING LICENSE

To deactivate an Agisoft Ortho Mapping license:

1. Open LP360 Drone. If you previously activated while using elevated permission, then right-click on the LP360 Drone icon in the start menu or task bar and select "Run as Administrator" to grant elevated permissions for deactivating the license.
2. Cancel off the Startup dialog.
3. Open the Project Settings dialog (File -> Project Settings).
4. On the EXP tab, in the Agisoft Ortho Mapping section, select **Check Activation Status**.
5. You should see an Activation Status message (Figure 15) indicating, "Metashape is activated". Select OK.

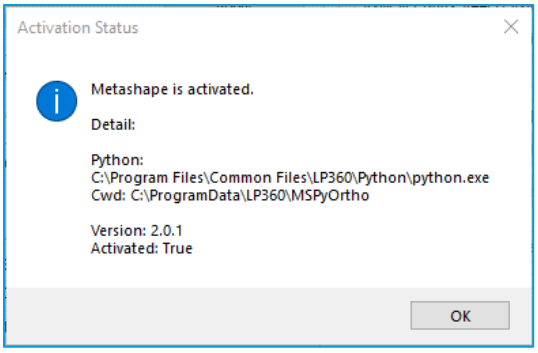


Figure 15 – Agisoft Ortho Mapping Activation Status - Activated

6. Select *Deactivate* to deactivate this Agisoft Ortho Mapping license from this machine.
7. You should see a Deactivation Success message (Figure 16) indicating, "Metashape successfully deactivated". Select *OK*.

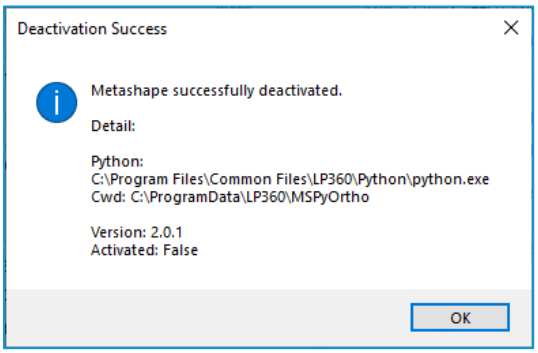


Figure 16 – Agisoft Ortho Mapping Deactivation Success

8. Select *OK* or *Apply* to close the Project Settings dialog. Close and restart LP360 Drone without elevated permissions.

> LP360 Drone will remember your encrypted Agisoft Ortho Mapping license key to make it easier to Activate the license again on the same machine provided it is not activated elsewhere.

OFFLINE ACTIVATE AGISOFT ORTHO MAPPING LICENSE

In some circumstances you may not be able to reach the Agisoft license activation servers to activate/deactivate your license, so you may then need to take the longer route of an offline activation/deactivation of your Agisoft Ortho Mapping license.

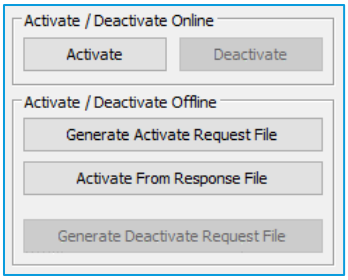


Figure 17 – Agisoft Ortho Mapping Offline Activation/Deactivation

To configure your Agisoft Ortho Mapping license using the offline activation process, not recommended, but required if the machine cannot connect to the Agisoft license servers:

1. Using Agisoft Ortho Mapping requires no separate installation of Metashape, however, if you are using a GUI version Metashape Pro license then you will need to separately install Metashape Pro v1.7.1, v1.8.x, or v2.0.x and follow the installation and licensing instructions provided by Agisoft with your license delivery and not the following instructions. When using a separately installed GUI version of Metashape Pro, you will need to configure it to be run by LP360 Drone.
2. Once you have installed and licensed LP360 Drone, open https://activate.agisoft.com/activate-offline page from a computer with Internet access, input the Agisoft Ortho Mapping license activation key and press Save Activation Parameters button to save the activation parameters file, "metashape-pro.actparam".

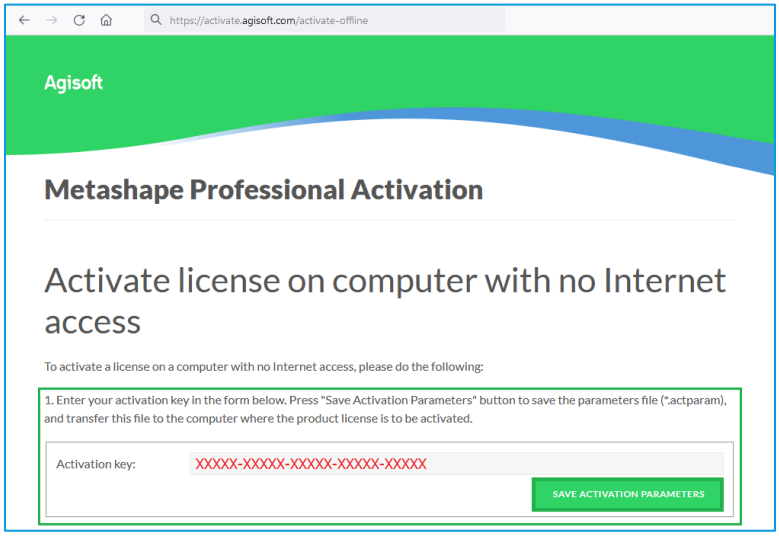


Figure 18 – Section 1 on the Agisoft website for offline activation

3. Transfer the generated activation parameters file to the computer with LP360 Drone where the Agisoft Ortho Mapping license should be activated and proceed to next step.
4. Open LP360 Drone.
5. Cancel off the Startup dialog.
6. Open the **Project Settings** dialog (File -> Project Settings).

7. On the EXP tab, in the Agisoft Ortho Mapping section (Figure 12), select ***Check Activation Status***.
8. You should see an Activation Status message (Figure 19) indicating, "Metashape is NOT Activated". Select *OK*.

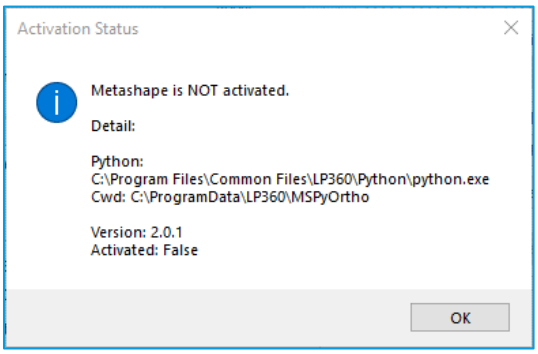


Figure 19 – Agisoft Ortho Mapping Activation Status - NOT Activated

9. This will activate the **Generate Activate Request File** option (Figure 17). Selecting this option will allow you to create an offline activation request file by browsing for the activation parameter file, "metashape-pro.actparam", obtained from the Agisoft offline activation website and save the activation request file, "metashape-pro.actreq". You will see the License Request Generated confirmation dialog (Figure 20).

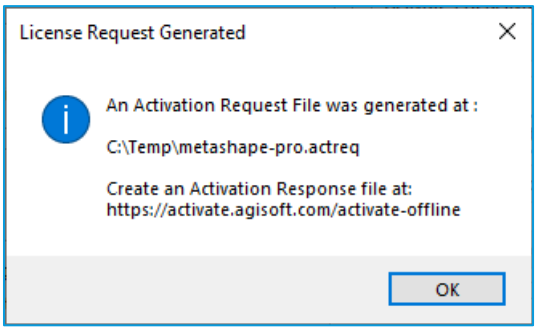


Figure 20 - License Request Generated

10. Transfer the generated activation request file, "metashape-pro.actreq", (created in the previous step) to the computer with Internet access, open https://activate.agisoft.com/activate-offline, beside *Activation request* in section 2, select the request file, "metashape-pro.actreq", and select *Save Activation Response* button to save the response file, "metashape-pro.actresp":

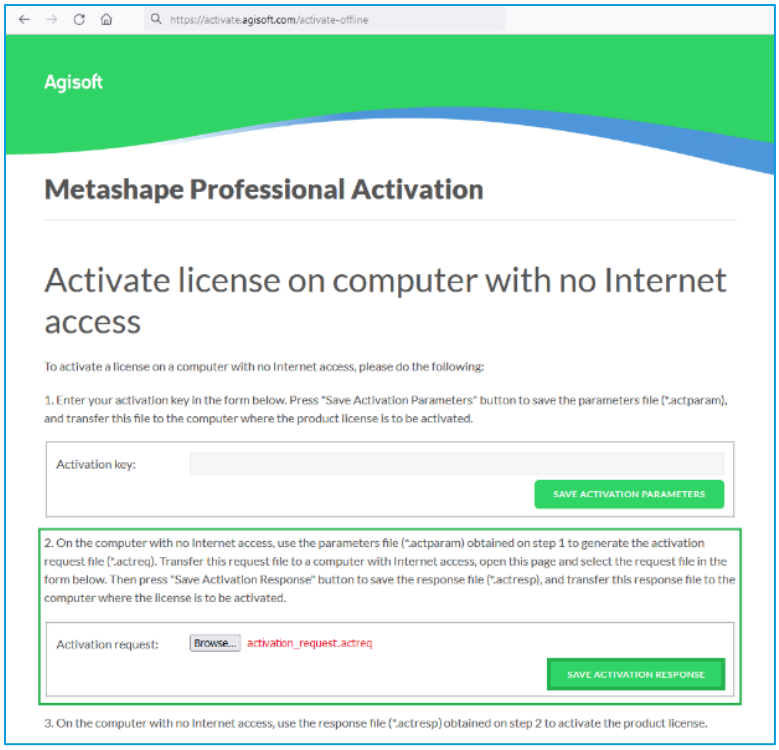


Figure 21 - Section 2 on the Agisoft website for offline activation

11. Transfer the activation response file, "metashape-pro.actresp", to the computer with LP360 Drone where the Agisoft Ortho Mapping license should be activated.
12. Open LP360 Drone.
13. Cancel off the Startup dialog.
14. Open the **Project Settings** dialog (File -> Project Settings).
15. On the EXP tab, in the Agisoft Ortho Mapping section (Figure 12), select ***Check Activation Status***.
16. You should see an Activation Status message (Figure 19) indicating, "Metashape is NOT Activated". Select *OK*.
17. Select ***Activate from Response File*** (Figure 17) and browse for the activation response file, "metashape-pro.actresp" to activate this Agisoft Ortho Mapping license on this machine.
18. You should see the Metashape Offline Activation message (Figure 22) indicating, "Metashape should now be activated". Select *OK*.

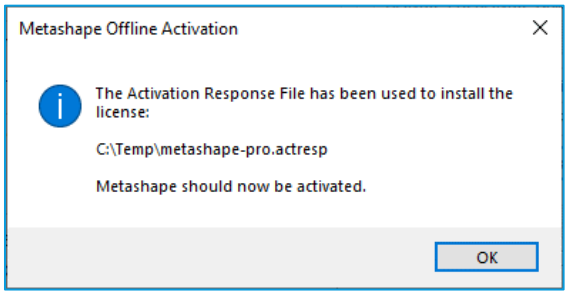


Figure 22 - Offline Agisoft Ortho Mapping Activation Success

19. Select *OK* or *Apply* to close the Project Settings dialog.
20. Check out a "Full Photo" or "Photogrammetry with Agisoft" addon license to the LP360 Drone license.
21. Execute the Agisoft Ortho Mapping tool to generate an orthomosaic and refine the True Pose® photo positions and orientations.

It is necessary to deactivate the Agisoft Ortho Mapping license before re-installing/installing a new OS or changing hardware components. In addition, the license should be deactivated to be transferred to another computer.

OFFLINE DEACTIVATE AGISOFT ORTHO MAPPING LICENSE

To deactivate your Agisoft Ortho Mapping license using the offline activation process, not recommended, but required if the machine cannot connect to the Agisoft license servers:

1. Open LP360 Drone.
2. Cancel off the Startup dialog.
3. Open the Project Settings dialog (File -> Project Settings).
4. On the EXP tab, in the Agisoft Ortho Mapping section, select **Check Activation Status**.
5. You should see an Activation Status message (Figure 23) indicating, "Metashape is activated". Select OK.

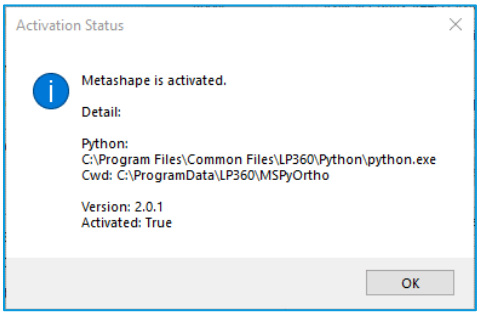


Figure 23 – Agisoft Ortho Mapping Activation Status - Activated

This will activate the **Generate Deactivate Request File** option (Figure 17). Selecting this option will allow you to select a folder in which to create the offline deactivate license request file(s), "deactivate*.actreq". You will get a confirmation dialog with the number of licenses that have been deactivated and the location where to find the deactivation request file(s).

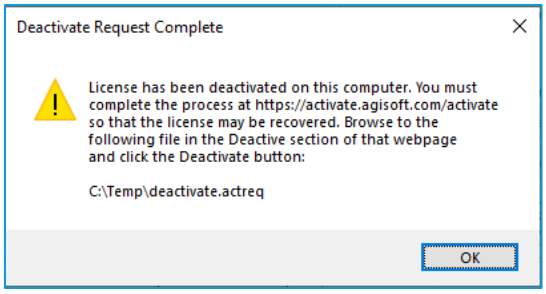


Figure 24 - Deactivation Request Complete Confirmation

Important! Once you have generated a deactivate license request file you must complete the deactivate step on the website to be able to activate your license key on a new machine.

6. Transfer the generated deactivation request file(s), "deactivate*.actreq", from the previous step, to the computer with Internet access, open https://activate.agisoft.com/activate-offline, select this request file in the corresponding "Deactivate license on computer with no Internet access" section and select the *Deactivate* button to complete the license deactivation process. You will see an offline license deactivation confirmation page.

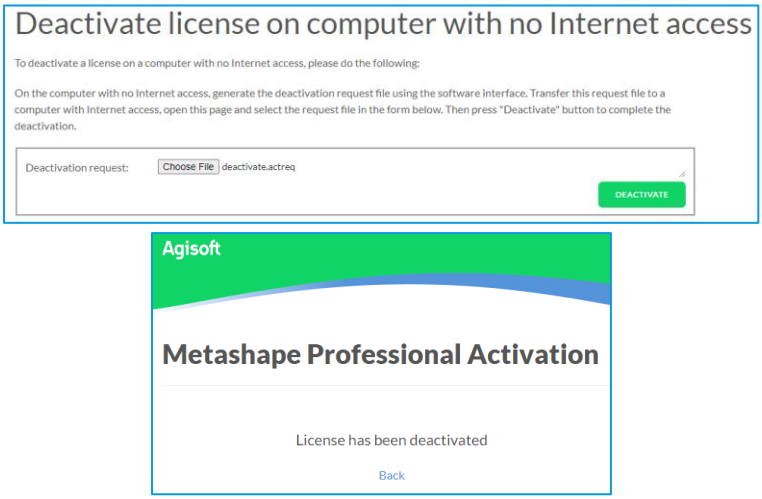


Figure 25 – (Top) Deactivate section on the Agisoft website to deactivate licenses offline. (Bottom) Offline license deactivation confirmation.

7. Close LP360 Drone.

CREATING A NEW DRONE PROJECT

The following steps will guide you through each step of the workflow, importing data to create a drone project, generate a LiDAR point cloud, tagging photos, or generating an orthomosaic. Importing a Cycle is the first step, post flight, of the Sensor workflow. A Cycle can be imported into LP360 Drone to form a new project or, if a project already exists, to add a Cycle to that project.

1. Open LP360 Drone and check out your license if necessary. See the Licensing LP360 Drone section in this document.
2. Insert the USB drive, which contains your Cycles/Flights (raw flight data), into your computer.

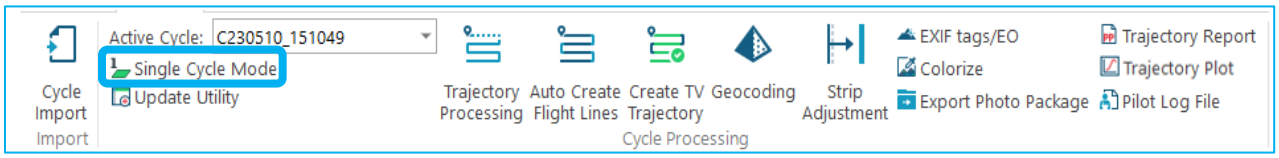


Figure 26 - Enabling Single Cycle Mode will only display layers relevant to Active Cycle

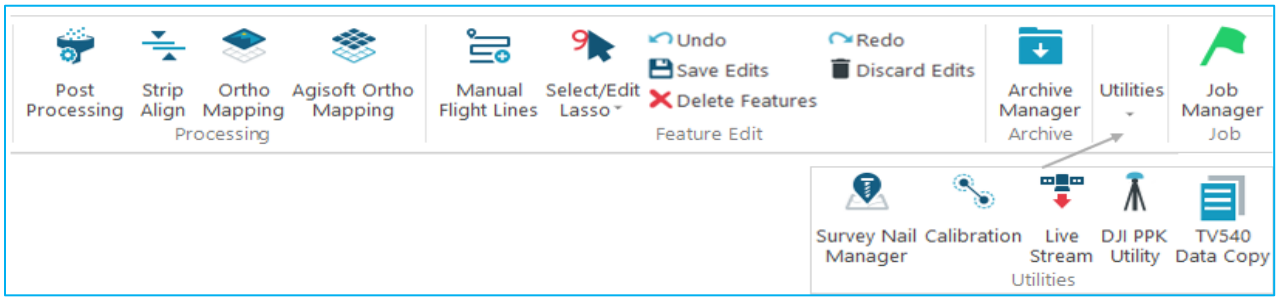


Figure 27 – TrueView Workflow and Utilities on the Sensor tab

3. Select **Cycle Import** on the **Sensor** tab (Figure 27) to open the *Raw Mission Import Wizard*. If the wizard is run outside of an existing LP360 project, then it will create a new project. If you run the wizard from within an existing project, the occurrences of "NEW" in Figure 29 are replaced with "CURRENT".

Note: If the *Cycle Import* button is greyed out, then you do not have a valid LP360 Drone Explorer or higher level LP360 Drone (recommended) license checked out. See the Licensing LP360 Drone section in this document.

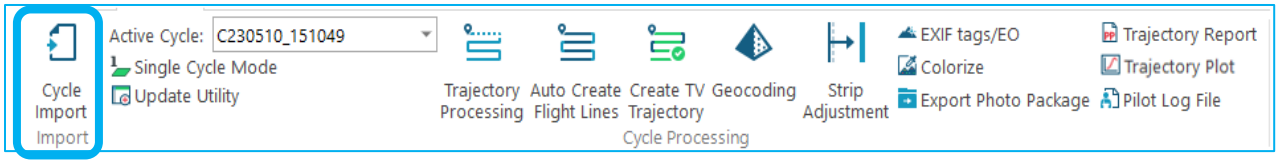


Figure 28 – Import Cycle

If any of your Cycles utilized a "Companion" camera, you must manually copy the photos into the Cycle prior to importing the Cycle into LP360. Then, refer to the Companion Camera(s) EO File Generation section for more information on the workflow.

RAW MISSION IMPORT WIZARD

Selecting **Cycle Import** on the Sensor tab brings up the first page of the Raw Mission Import wizard (Figure 29).

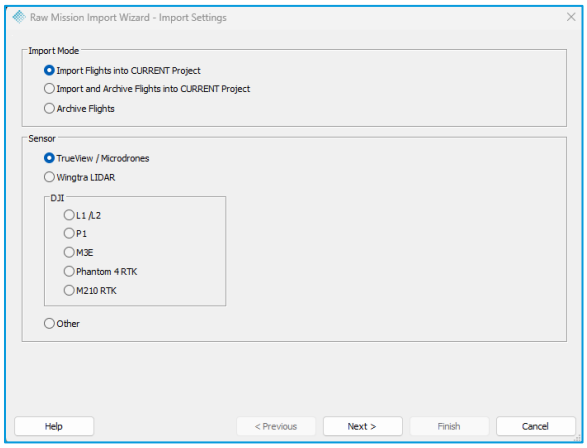


Figure 29 - First page of Import Cycle Wizard for a NEW Project

IMPORT MODE

The import mode options allow you to import a Cycle from a disk-based file (typically the USB memory stick from the TrueView or "Other" named sensor), and/or from a TrueView Archive.

- **Import Flights into NEW/CURRENT Project** (Not Recommended!) – this option imports a Cycle into an existing or new project. We recommend against this because you will not have a backup of the Cycle in the native "Cycle Format."
- **Import and Archive Flights into NEW/CURRENT Project** – this option adds the Cycle to an Archive and creates/adds to an LP360 project (**Recommended** – See Best Practice).
- **Archive Flights** – this option imports a Cycle from a USB/File and adds it to an Archive. This option does not run the same checks on the data as the previous step would do. We recommend against using this option because you will not have performed any checks on the data being put into the archive.

SENSOR

LP360 Drone has the capability to import data from TrueView sensors, as well as systems such as the DJI Zenmuse L1 or L2, Wingtra LiDAR, DJI Phantom 4 RTK, M210 RTK, DJI Zenmuse P1 (M300 RTK), and DJI Mavic 3 Enterprise (M3E) for both real-time kinematic (RTK) and post processing kinematic (PPK) workflows, and image processing to an orthomosaic and generated point cloud. Additional sensors may be added upon request. Other supports any point cloud with a sensor trajectory file.

Select the "**Import Flights into NEW/CURRENT Project**" radio button and the desired **Sensor** type from the Raw Mission Import Wizard (Figure 29). Then, press the **Next >** button at the bottom of the dialog to take you to the specific Input Folder Page, as described below.

- TrueView / Microdrones
- Wingtra LIDAR
- DJI
    - L1/L2
    - P1
    - M3E
    - Phantom 4 Pro RTK
    - M210 RTK
- Other

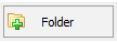
After selecting the import mode and the desired sensor, press the **Next >** button at the bottom of the dialog to take you to the applicable input Cycle, flights, or missions page as described in the following subsections.

> ***Best Practice***
>
> Import and archive the Cycle/Flight to an Archive. Add all files that you want bundled with the Archive. When the archived Cycle/Flight is complete, LP360 will import from the Archive to update or create a project.
>
> Note: Archiving is currently only available for TrueView and microdrones sensors.

INPUT TRUEVIEW CYCLES/FLIGHTS

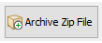
The next step of the import process as depicted in Figure 33 is to add Cycle/Flight folders or archived Cycles/Flights to the Input Flights page and fill in the optional fields as desired.

Add a TrueView Cycle/Flight from:

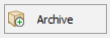


Folder – Add one or more TrueView Cycle/Flight by selecting the Cycle folder(s) found on the USB. Select option and browse to the desired Cycle folder(s).

> For high-density scanner Cycles, such as the TV680 or TV720, the laser data is on a secondary media retrieved from the laser scanner. When loading these Cycles, LP360 prompts the user to specify the path to the laser data (rxp files). After the path to the laser data is selected, the files will be copied to the correct location in the raw Cycle data for importing into the project and creating the archived Cycle.



Archive Zip File – If you or a pilot in the field has previously archived TrueView Cycles/Flights to an LP360 Cloud Cycle-Archive and shared that archived Cycle for download, use this button to add archived Cycles to the queue for import into the project without them needing to reside in a configured TrueView Archive.



Archive – If you or a pilot in the field has previously archived TrueView Cycles/Flights to an Archive use this button to add archived Cycles to the queue for import into the project.

IMPORTING FROM AN ARCHIVE

Choosing to add Cycles from an Archive will bring up a dialog that lists your current Archives as shown in Figure 30. **Available Archives** are listed in the top panel of the dialog (an Archive is simply a directory reachable by a Universal Naming Convention (UNC) path where you store Cycles). TrueView Archives must be added in the TrueView Archive Manager prior to running the Raw Mission Import Wizard. Use the *Compute Size* button to see how much disk space is currently being used by that archive.

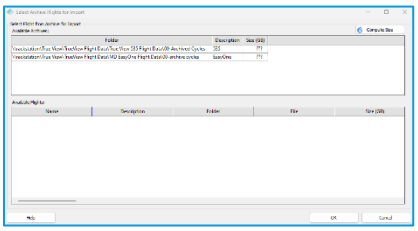


Figure 30 - Archive and Cycle Selection Page

Selecting one of the Archives by left-clicking a row in the Available Archives section will show a list in the lower pane of the Cycles stored in that Archive (Figure 31).

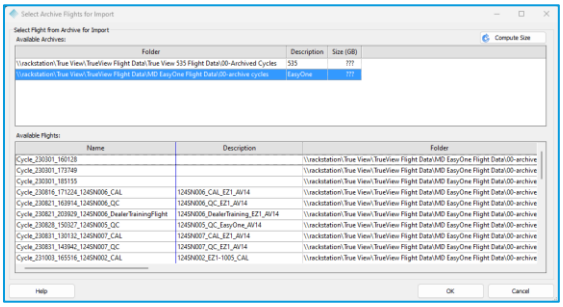


Figure 31 - Selecting an Archive shows the available Cycles

Select the Cycle(s) in the lower pane of Figure 31 and press **OK**. You will receive a confirmation dialog (Figure 32). Press **OK** to proceed with adding the archived Cycles to the flights to be imported queue. The Cycle is in a compressed format and will be decompressed into a temporary file for import into the Project. This may take a bit of time so be patient.

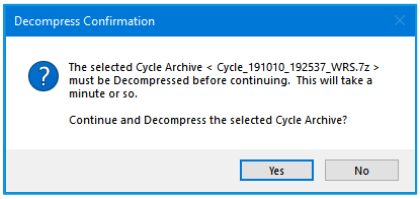


Figure 32 - Import from Archive confirmation dialog

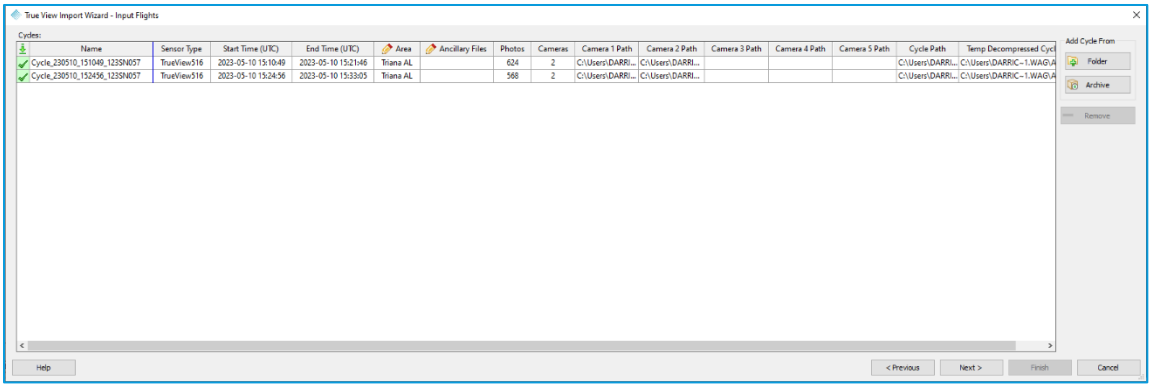


Figure 33 – Input TrueView Flights page

Note: Columns with a pencil indicate user editable fields. Multi select and right-click to set the same value for all selected rows. Right-click on a populated field to use that as the default value for the selected rows.

- **Cycle/Flight Name -** Any alphanumeric string. The default is the name given to the Cycle by the TrueView Sensor. It is generally a good idea to keep this name since it is the same name used in the Cycle directory structure.
- **Sensor Type –** The TrueView sensor model.
- **Area (Site) name** – This is an optional label that can be added when you are segregating a Project (e.g., "Peabody Mine 77") into multiple areas such as "Pit Area" and "Stockpile Yard."
- **Ancillary Files** – This section of the dialog allows you to add any files you would like that are relevant to this project. For example, you could add a Check Point file, pdf description files, project reports and so forth. Note that these ancillary files will be associated with the Cycle, not the Project (that is, added to the Cycle file structure). If you are simultaneously archiving this project, these ancillary files will be included in the compressed archive.

  The first time you add Ancillary files to a project, an Ancillary Files folder is created within the Cycle folder structure and within your LP360 project. Copies of these files are then placed in these folders.

  > ***Best Practice***
  >
  > Add your checkpoint file to the Ancillary files section of this dialog. This will package the checkpoints for future use with this Cycle. Make sure to include the Coordinate Reference System of the Check Points if they are not the same as the Project.
  >
  > If you have used a positioning service such as OPUS to establish the base station location, add the OPUS report to the ancillary files as well.

- **Archive Description** – An optional description that can be viewed when viewing the archived Cycle in the TrueView Archive Manager. Only visible when one of the import options that archives is selected.
- **Photos** – The number of photos found in the Cycle/Flight.

- **Cameras** – The number of cameras for this Cycle/Flight.
- **Camera Paths** – If the images were added to the Cycle folder during wind-down (or alternatively manually added prior to running this wizard), their paths will already be populated in the dialog after having selected the Cycle. If the images have not been previously added to the Cycle folder, browse for the folders containing the Starboard and Port Images by double-clicking in the applicable image path column. Note that it is not necessary to know which camera is port or starboard; LP360 Drone will sort this out. Other times the camera paths are not auto detected usually indicate potential issues with the folder structure, content, or CycleParams file that need to be resolved before importing the Cycle/Flight. Contact support@geocue.com for assistance.
- **Temp Decompressed Cycle Path** – populated only if the Cycle/Flight was added from an Archive.

After selecting the input flights, press the **Next >** button at the bottom of the dialog to take you to the Base Observation Files page.

INPUT WINGTRA LIDAR

LP360 Drone has the capability to import data from the Wingtra LiDAR. For a Wingtra LiDAR, the raw data must first be processed through the Wingtra LiDAR Application. The resulting LAS and trajectory files (TXT or SBET) from can then be imported into LP360 Drone for post-processing which allows for modifications to the already geocoded data.

To import into LP360, manually select the LAS files and Trajectory Files (Figure 34) produced by the Wingtra LiDAR Application. If present in the selected files or known due to the file formats, the Coordinate Reference System (CRS) information will auto populate the dropdowns (Figure 34) on the **Raw Mission Import Wizard – Wingtra** page for the selected LAS File(s) and sensor Trajectory File(s). The sensor trajectory files (.TXT or SBET.OUT) will always be in a geographic coordinate system and therefore may not match the CRS of the LAS file exactly, depending on whether the LAS files are in a projected or geographic coordinate system. There does not have to be a correlation of one LAS per sensor trajectory file, there could also be one LAS for many SBETs, one LAS to one SBET, or many LAS to one SBET, so long as there is coverage in time for the sensor trajectory file(s) for every point in the LAS file(s). The only currently supported sensor trajectory ASCII text format (.TXT) is a tab delimited text file with nine columns in the order of: Week, GPSTime, UTCTime, Longitude, Latitude, H-Ell, Heading, Pitch, and Roll, where H-Ell are ellipsoidal heights.

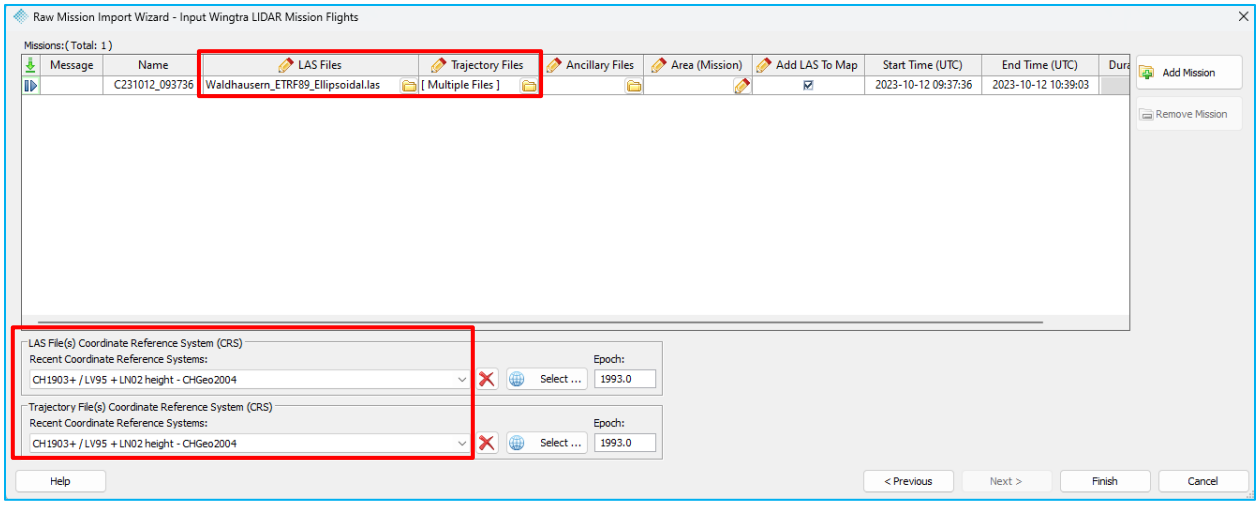


Figure 34 - Import Wizard - Input Wingtra Page

Add Mission – Select to add one or more missions to be imported into LP360 Drone.

Remove Mission– Select row(s) from the grid to enable this button to remove one or more flights that you no longer wish to import.

Once a mission has been added, the grid will display a summary of the desired files for each flight.

Note: Columns with a pencil indicate user editable fields. Multi select and right-click to set the same value for all selected rows. Right-click on a populated field to use that as the default value for the selected rows.

> **Area (Mission) name** – This is an optional label that can be added when you are segregating a Project (e.g., "Peabody Mine 77") into multiple areas such as "Pit Area" and "Stockpile Yard."
>
> **Ancillary Files** – This section of the dialog allows you to add any files you would like that are relevant to this project. For example, you could add a Check Point file, pdf description files, project reports and so forth. Note that these ancillary files will be associated with the Cycle, not the Project (that is, added to the Cycle file structure). If you are simultaneously archiving this project, these ancillary files will be included in the compressed archive.
>
> The first time you add Ancillary files to a project, an Ancillary Files folder is created within the Cycle folder structure and within your LP360 project. Copies of these files are then placed in these folders.

Then, press the **Next >** button at the bottom of the dialog to take you to the Setting Output TrueView Project page when importing to a NEW project. Select **Finish** to begin importing the queued flights. Upon successful completion of the Wingtra LIDAR import queue, proceed with examining the imported files.

INPUT DJI ZENMUSE L1/L2

For a DJI Zenmuse L1/L2, the data expected from the system for processing in LP360 Drone is a combination of the raw flight folder(s) from the sensor and some of the DJI Terra processed folders.

Previously individual flights with an L1/L2 project would need to be processed as individual missions in Terra, now all flights for a single project can be processed in one Terra mission, then the mission folder can be imported into LP360.

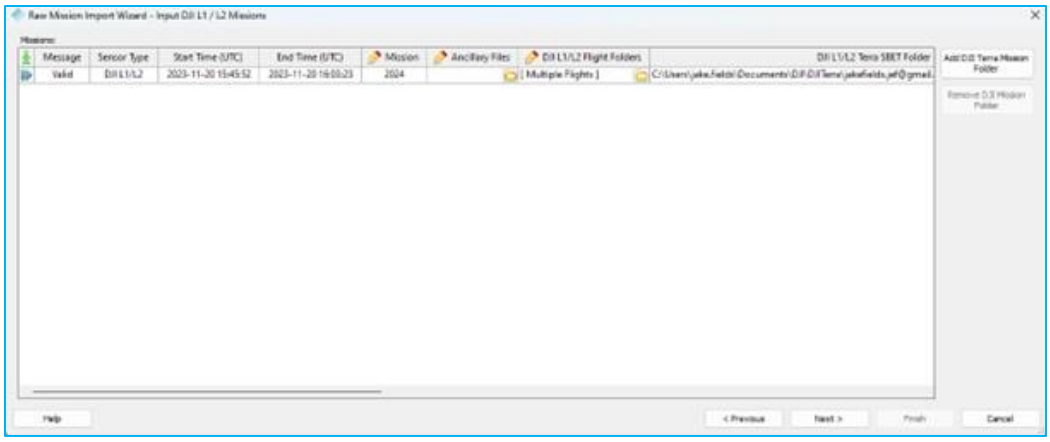


Figure 35 - Import Wizard - Input DJI L1/L2 Folder Page

Add DJI Terra Mission Folder – Select to add one or more folders that were processed in DJI Terra and must contain the lidars subfolder containing one or more sbet.out and smrmsg.out files, and lidar\terra_las subfolder containing LAS files.

Remove DJI Mission Folder – Select row(s) from the grid to enable this button to remove one or more missions that you no longer wish to import.

Once a mission folder has been added the grid will display a summary of the detected files for each flight.

Note: Columns with a pencil indicate user editable fields. Multi select and right-click to set the same value for all selected rows. Right-click on a populated field to use that as the default value for the selected rows.

> **Mission name** – This is an optional label that can be added when you are segregating a Project (e.g., "Peabody Mine 77") into multiple areas such as "Pit Area" and "Stockpile Yard." It is automatically named the same as your DJI Terra mission folder.
>
> **Ancillary Files** – This section of the dialog allows you to add any files you would like that are relevant to this project. For example, you could add a Check Point file, pdf description files, project reports and so forth. Note that these ancillary files will be associated with the Cycle, not the Project (that is, added to the Cycle file structure). If you are simultaneously archiving this project, these ancillary files will be included in the compressed archive.

The first time you add Ancillary files to a project, an Ancillary Files folder is created within the Cycle folder structure and within your LP360 project. Copies of these files are then placed in these folders.

> ***Best Practice***
>
> Add your checkpoint file to the Ancillary files section of this dialog. This will package the checkpoints for future use with this Cycle. Make sure to include the Coordinate Reference System of the Check Points if they are not the same as the Project.
>
> If you have used a positioning service such as OPUS to establish the base station location, add the OPUS report to the ancillary files as well.

DJI L1/L2 Flight Folders – These folders come straight off the sensor from acquisition and must contain the acquired photos (.JPG) and usually contains the .IMU, .CLC, .CLI, .LDR, .RTK, .RTL, .RTS files from the flight. If DJI Terra was processed on the same machine doing the import into LP360, then the DJI Mission file will typically include the correct folders, otherwise, LP360 will prompt you to browse for the raw flight folders that correspond with the missions being imported. The sub dialog will display the number of photos for each raw flight folder.

DJI L1/L2 Terra Processed Folders - These are outputs from the DJI Terra processing. There will be many files, but a few are key for continuing the processing in LP360 Drone:

DJI L1/L2 Terra SBET Folder - Typically the 'lidars' folder found beneath the DJI Terra processed output folder and containing one or more sbet.out and smrmsg.out files.

DJI L1/L2 Terra LAS Folder - Typically the "lidars\terra_las" folder found beneath the DJI Terra processed output folder, containing the LAS file(s). Hover over this field to display the tooltip with the CRS of the DJI LAS file to ensure the project CRS is selected to match.

DJI L1/L2 Terra Report Folder - (Optional) Typically the "lidars\report" folder found beneath the DJI Terra processed output folder, containing the html or md report files.

Add to Map – (Not recommended) Select to add the DJI Terra generated LAS as a LAS Layer in the project. Note: the LAS data, as created within DJI Terra, is in the v1.2 LAS format and is one continuous stream of data. Adding this data may cause confusion later in the workflow.

Then, press the **Next >** button at the bottom of the dialog to take you to the Setting Output TrueView Project page when importing to a NEW project, or for DJI L1/L2 flights only, the Input DJI L1/L2 Fights page with an enabled **Finish** button, when importing to the CURRENT project. Select **Finish** to begin importing the queued flights. Upon successful completion of the DJI L1/L2 import queue, proceed with examining the imported files.

INPUT DJI PHANTOM 4 PRO RTK / DJI P1 / M210 RTK / M3E

If you are unfamiliar, for a P4P-RTK, the data expected from the system for processing in LP360 Drone is explained in the [Phantom 4 RTK: Downloading Data for PPK Processing in LP360 Drone - GeoCue Group] post on our searchable support knowledge base.

Data from the M210 RTK cameras, X4s or X7, and DJI Zenmuse P1 (M300 RTK) are similar to the P4RTK but may utilize the PPKRAW.bin and LP360 Drone will generate the OBS file during import of the flight, or may directly use the OBS file if it was generated by the system firmware.

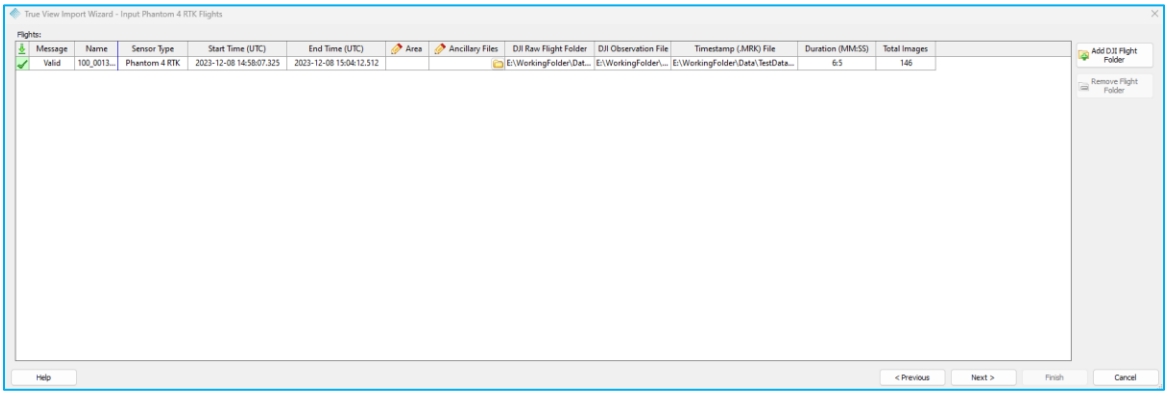


Figure 36 - Import Wizard - Input P4P-RTK Flights Page

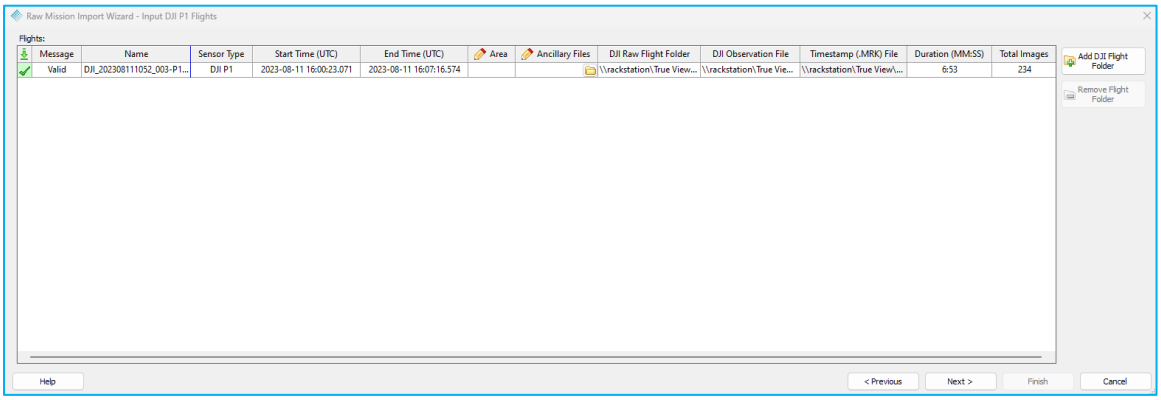


Figure 37 - Import Wizard - Input DJI P1 Folder Page

Add DJI Flight Folder – Select to add one or more folders that come straight off the sensor from acquisition and must contain the acquired photos (.JPG), observation file (.OBS/.BIN) and timestamp (.MRK) files from the flight.

Remove Flight Folder – Select row(s) from the grid to enable this button to remove one or more flights that you no longer wish to import.

Once a flight folder has been added the grid will display a summary of the detected files for each flight. Note: Columns with a pencil indicate user editable fields. Multi select and right-click to set the same

value for all selected rows. Right-click on a populated field to use that as the default value for the selected rows.

DJI Observation File – Raw GNSS observation file found in the flight folder.

Timestamp (.MRK) File – The timestamp file found in the flight folder.

Area (Site) name – This is an optional label that can be added when you are segregating a Project (e.g., "Peabody Mine 77") into multiple areas such as "Pit Area" and "Stockpile Yard."

Ancillary Files – This section of the dialog allows you to add any files you would like that are relevant to this project. For example, you could add a Check Point file, pdf description files, project reports and so forth. Note that these ancillary files will be associated with the Cycle, not the Project (that is, added to the Cycle file structure). If you are simultaneously archiving this project, these ancillary files will be included in the compressed archive.

The first time you add Ancillary files to a project, an Ancillary Files folder is created within the Cycle folder structure and within your LP360 project. Copies of these files are then placed in these folders.

> ***Best Practice***
>
> Add your checkpoint file to the Ancillary files section of this dialog. This will package the checkpoints for future use with this Cycle. Make sure to include the Coordinate Reference System of the Check Points if they are not the same as the Project.
>
> If you have used a positioning service such as OPUS to establish the base station location, add the OPUS report to the ancillary files as well.

Then, press the **Next >** button at the bottom of the dialog to take you to the Base Observation Files page.

INPUT OTHER

The Other sensor type in the Raw Mission Import Wizard allows for the import of point clouds from other sensors that are not specifically listed in the Raw Mission Import Wizard. For Other sensors, the raw data must first be processed through the manufacturer's software to produce LAS files of the point cloud and the sensor trajectory solution in one of the supported formats. The resulting LAS and trajectory files (.posT, TXT, or SBET) can then be imported into LP360 Drone for post-processing which allows for modifications to the already geocoded data.

To import into LP360, manually select the LAS files and Trajectory Files (Figure 38) produced by the sensor manufacturer's software. If present in the selected files or known due to the file formats, the Coordinate Reference System (CRS) information will auto populate the dropdowns (Figure 38) on the **Raw Mission Import Wizard – Input Other Mission Flight** page for the selected LAS File(s) and sensor Trajectory File(s). The sensor trajectory files (.posT and SBET.OUT) will always be in a geographic coordinate system and therefore may not match the CRS of the LAS file exactly, depending on whether

the LAS files are in a projected or geographic coordinate system. An ASCII text file (.TXT) may either be projected or geographic. There does not have to be a correlation of one LAS per sensor trajectory file, there could also be one LAS for many SBETs, one LAS to one SBET, or many LAS to one SBET, so long as there is coverage in time for the sensor trajectory file(s) for every point in the LAS file(s). The only currently supported sensor trajectory ASCII text format (.TXT) is a tab delimited text file with nine columns in the order of: Week, GPSTime, UTCTime, Longitude, Latitude, H-Ell, Heading, Pitch, and Roll, where H-Ell are ellipsoidal heights.

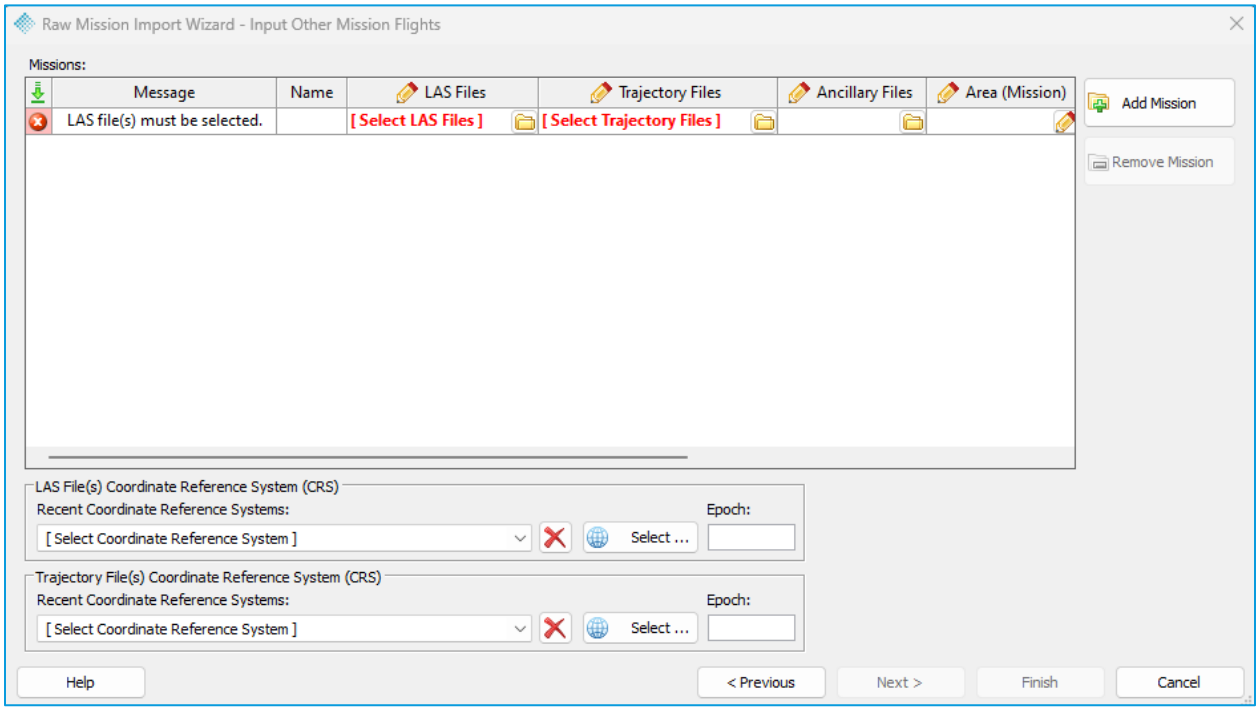


Figure 38 – Import Wizard - Input Other Sensor Dialog

Add Mission – Select to add one or more missions to be imported into LP360 Drone.

Remove Mission– Select row(s) from the grid to enable this button to remove one or more flights that you no longer wish to import.

Once a mission has been added, the grid will display a summary of the desired files for each flight.

Note: Columns with a pencil indicate user editable fields. Multi select and right-click to set the same value for all selected rows. Right-click on a populated field to use that as the default value for the selected rows.

Area (Mission) name – This is an optional label that can be added when you are segregating a Project (e.g., "Peabody Mine 77") into multiple areas such as "Pit Area" and "Stockpile Yard."

Ancillary Files – This section of the dialog allows you to add any files you would like that are relevant to this project. For example, you could add a Check Point file, pdf description files, project reports and so forth. Note that these ancillary files will be associated with the Cycle, not

the Project (that is, added to the Cycle file structure). If you are simultaneously archiving this project, these ancillary files will be included in the compressed archive.

The first time you add Ancillary files to a project, an Ancillary Files folder is created within the Cycle folder structure and within your LP360 project. Copies of these files are then placed in these folders.

Then, press the **Next >** button at the bottom of the dialog to take you to the Setting Output TrueView Project page when importing to a NEW project. Select **Finish** to begin importing the queued flights. Upon successful completion of the Other Sensor import queue, proceed with examining the imported files.

ADDING BASE STATION OBSERVATION FILES

The next page of the dialog allows for the optional input of Base Station Observation files. Note: If you are not using a Single Base strategy (RTK, smartBase or PP-RTX) or wish to add the base observation files later during trajectory processing, you can skip this page.

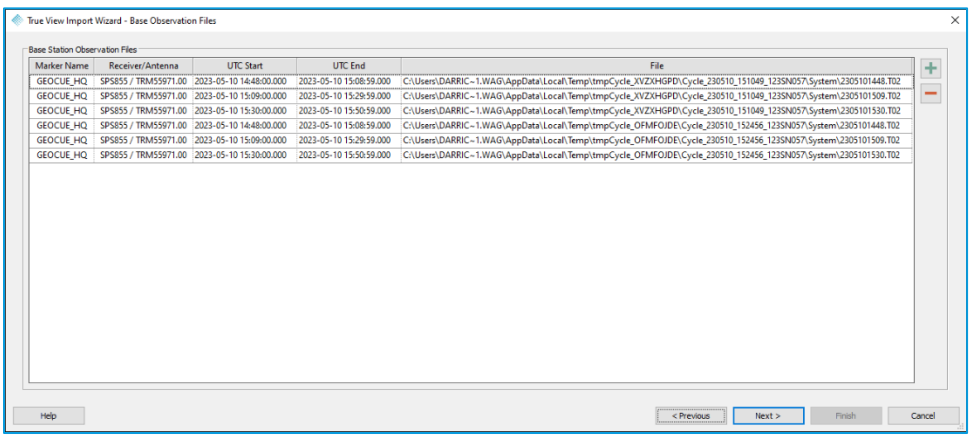


Figure 39 - Base Observation Files Page

If using a single base strategy and have previously added the Observation files to the Cycle\System folder, these files will appear in the dialog. If you have not previously loaded this file (or files), press the green "+" key to add the required files. If you inadvertently add a file that is not part of the Cycle/Flights being imported, select it in the file list and press the red "-" button to remove it from consideration. Note the file will not be deleted from the source; it will simply be removed from this list. LP360 will auto correlate the base observation files with the applicable flights and remove the rest before presenting the Flight/Base Positioning page.

Note: RINEX observations, v2.10 to 3.05, are supported. Version 3.05 is recommended. Trimble T02 files are supported for POSPac processing workflows and the DJI PPK Utility.

> ***Best Practice***
>
> Put your base station RINEX files to the Cycle\System folder on the USB so it will be automatically detected by the Import Cycle Wizard.

Base Antenna Calibration File

During GNSS processing the antenna type must be known for the processing software to apply the proper antenna phase center (APC) to antenna reference point (ARP) offsets. LP360 Drone will automatically read the antenna model, if present, from the base RINEX file and display it black in the dialog if the antenna is a known type for which it has the antennae calibration. If the antenna model is unknown or not stipulated in the RINEX file, or no antenna calibration exists for the specified model then the antenna model will display in red (Figure 40). Hovering over the antenna model will provide a tooltip with the explanation, "Warning: NGS calibration for antenna model (Unknown) not found. Verify the correct antenna model is listed in the base observation file. If you have a newer model antenna it may need to be added to our database, contact 'support@geocue.com'. Proceeding with processing as is will result in no APC to ARP offsets applied, which is not normally desired, however, is acceptable in some circumstances."

Proceeding without a recognized antenna model will prompt for a confirmation when processing the trajectory solution. An example of when it may be okay to proceed with an unknown antenna model or missing antenna calibration would be if the reference mark was processed to the antenna phase center (APC) instead of an antenna reference point (ARP).

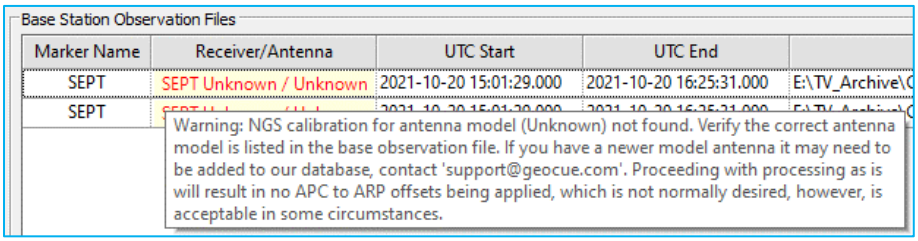


Figure 40 - NGS Antenna Calibration Not Found

Then, press the **Next >** button at the bottom of the dialog to take you to the LP360 Drone Project Page when importing to a NEW project, or the Flight/Base Positioning Page, when importing to the CURRENT project.

SETTING TRUEVIEW PROJECT, COORDINATE REFERENCE SYSTEM AND EPOCH

If creating a new TrueView Project during the import (i.e., you are not running this wizard from within an existing TrueView Project), you will be presented the dialog of Figure 41. Browse to the top-level folder where you would like the TrueView Project folder to be created. There is a **Default Projects Root Folder** setting on the File -> Project Settings -> Project tab if you would always like your projects

created in the same location (recommended). Under the "TrueView Output Project Name", type in the name of your new project. You will receive an error message if a Project of that name already exists in the selected project folder. If this occurs, choose a different project name (or location).

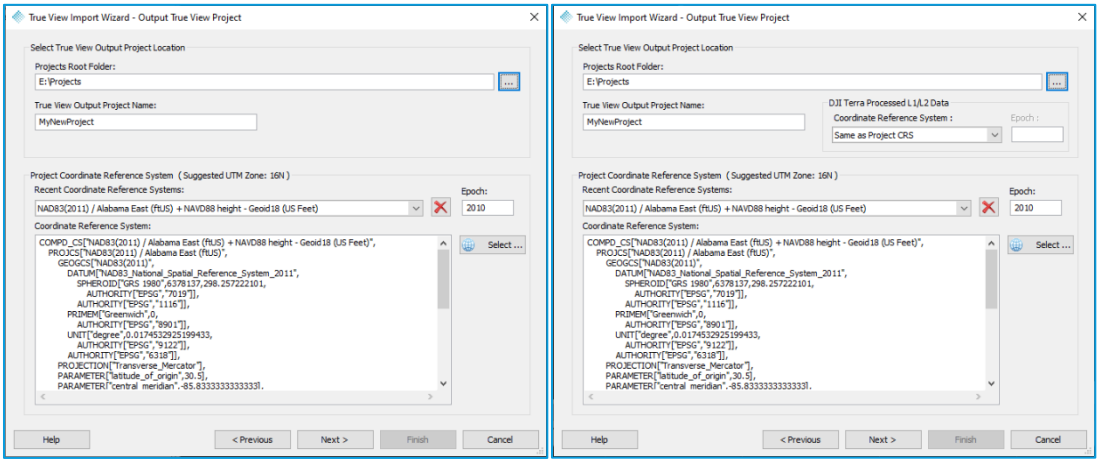
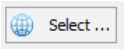


Figure 41 – Output TrueView Project Information (Left: 3DIS, Right: DJI L1/L2)

If running the Wizard from within an existing TrueView Project, the Cycle being imported will be added to this project (which, of course, is already named), hence the import Wizard will skip this step.

In the lower section of the dialog, set the Coordinate Reference System (CRS) that will be used for the project by selecting from the Recent Coordinate Reference System list or by selecting the  to open the Select Project Coordinate Reference System dialog (Figure 42). Remove an item from the Most Recent Used list by selecting the item to delete and pressing the ✕ tool. The suggested UTM zone is provided to assist users processing to UTM, but unsure of in which zone the data resides.

Note: If you are adding a Cycle/Flight to an existing project, this section of the dialog will show the current project CRS but will not allow you to change it (you can change a project CRS via other LP360 tools).

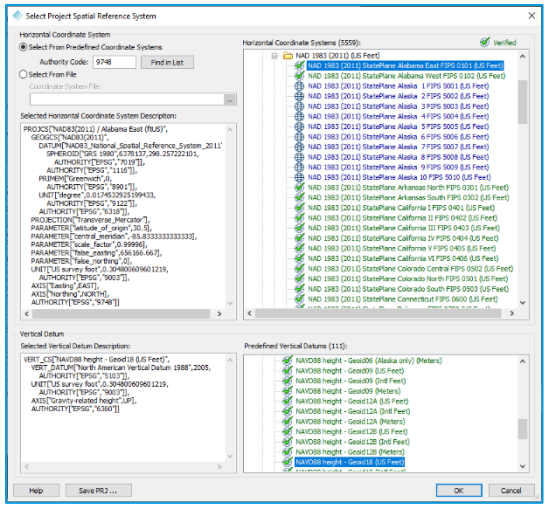


Figure 42 - Select Project Coordinate Reference System

The project epoch is set when the project CRS is selected if one is known for the datum of the selected project CRS. It can be verified (File -> Project Settings -> Project -> Project Epoch) and modified after Import Cycle has completed. Use the decimal year of the **Cycle Date** for coordinate reference systems using variable ellipsoid and variable epoch, such as the WGS84 datum, otherwise select enter the applicable epoch for the datum of your coordinate reference system. For example, NAD83(2011) has a fixed ellipsoid and variable epoch date of 2010.0. Typically, the epoch date for your project datum should be selected by default.

DJI Terra Processed L1/L2 Data – This section appears for projects being created by importing a DJI L1/L2 Cycle to allow the user to specify how the DJI Terra processing was performed.

L1/L2 Coordinate Reference System (CRS) – LP360 needs to know the CRS that was selected when processing in DJI Terra and provides one of two options:

Same as Project CRS – If you're happy with the way DJI Terra is positioning the data in your desired CRS, then select this option and select the matching CRS for your project, both horizontal and vertical, as you selected for processing in DJI Terra.

ITRF2014 (EPSG:9000), ellipsoidal heights – Coordinate systems vary greatly in how one program or another implements them. To best support the wide variety of CRS around the world, we recommend that users select EPSG:9000 with ellipsoidal heights for processing in DJI Terra, then allow LP360's CRS handler to handle the datum and epoch transformations and reprojection to the user's desired project CRS.

The L1/L2 epoch needs to be set when EPSG:9000 is selected for the L1/L2 CRS. The epoch must correspond with the epoch of the position used for the base station when using PPK or of the RTK correction network.

For example, if you used OPUS and the ITRF coordinate, then use the decimal year of the **Cycle Date** or mean Cycle Dates if all were flown in a fairly short

period of time. If you used an ETRS89 coordinate, then the epoch is 1989.0, or if you used NAD83(2011) it would be 2010.0, or if you used GDA2020, then epoch 2020.0, or if your base coordinate is GDA94, then epoch 1994.0.

When you have finished, press the **Next >** button to be taken to the Output Archive Folder page if one of the import options that archives was selected, or the Flight/Base Positioning page otherwise. If the import data is DJI L1/L2, press the **Next >** button to be taken to the Input DJI L1/L2 Fights page with an enabled **Finish** button which can be used to begin the import of the queued flights.

SETTING THE ARCHIVE LOCATION

If you chose one of the import options that archives, the next page of the dialog is used to select the Archive location where you would like to store a compressed copy of this Cycle. To select the Archive where you would like a compressed copy of this Cycle stored, select a row in the Available Archives list (Figure 43). TrueView Archives must be added in the TrueView Archive Manager prior to running the Import Wizard or you will not have any archives from which to choose. Use the *Compute Size* button to see how much disk space is currently being used by each archive.

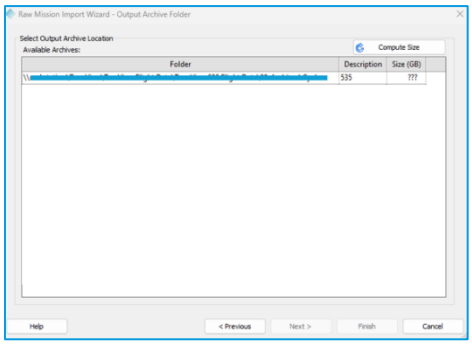


Figure 43 - Selecting an Archive

After selecting the Archive, the **Next >** button at the bottom of the dialog will enable and take you to the Flight / Base Positioning page.

SETTING THE FLIGHT/BASE POSITIONING

The Flight / Base Positioning page of the multi-Cycle Import Wizard will display a grid of the flights queued to be imported and the base observation files that have been autocorrelated with them. Review the information and set the reference mark to be used later with the post processing wizard, if applicable for your workflow. This can also be skipped at this stage and set later during the post processing wizard.

Note: Columns with a pencil indicate user editable fields. Multi select and right-click to set the same value for all selected rows. Right-click on a populated field to use that as the default value for the selected rows. See Set base station reference mark for multiple Cycles for an example.

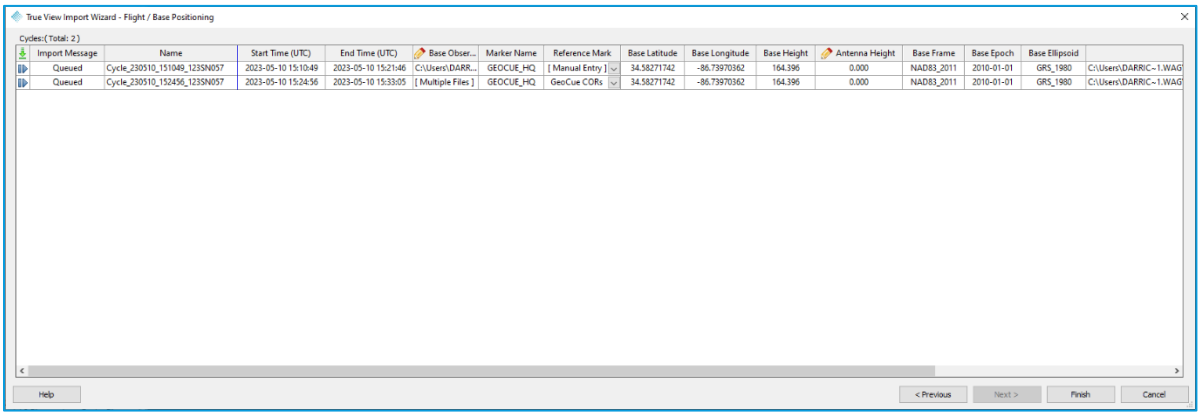


Figure 44 – Flight / Base Positioning

Import Message – Will provide information on the status of the Cycle/Flight import. The column to its left will indicate the import status with an icon for queued, processing, complete or error once the import processing has begun.

REFERENCE MARK/BASE STATION LOCATION

This column allows you to set the reference mark/survey nail for the Base Station location during import or skip this assignment and set it later during the post process wizard. Select the name of an existing survey nail from the list or select **[Survey Nail]** to open the Survey Nail Manager and add a new Survey Nail. Once selected from the list or from the Survey Nail Manager, the Base Station Location/Frame/Epoch/Ellipsoid information will appear in the applicable columns of the dialog for the applicable row. The dropdown list is sorted by distance from the average position found in the base station RINEX file.

> A red Survey Nail in this column indicates the distance from the Survey Nail to the approximate location found in the base observation file is greater than 10 meters, and you should verify the information as displayed in the Location is correct. Over 50m will typically fail when processing the sensor trajectory. Values in between are okay if you have verified the survey nail location to be correct.

Base Antenna Height

The base antenna height will be populated automatically if present and can be ready from the base observation file. Make sure to review and modify if necessary to set the applicable base station antenna height or skip at this time and set it later during the post process wizard. The antenna height is the height in meters from the monument to the antenna reference point (ARP). Phase center offsets should not be added to the antenna height unless the base antenna model was not written to the header and recognized on the *Base Station Observation Files* page.

The **Finish** button at the bottom of the dialog will enable. Press this to begin the import process for the queue Cycles/Flights. The first column and the message column will indicate the import status with an icon for queued, processing, complete or error once the import processing has begun. Upon successful completion of the import queue, proceed with examining the imported files.

EXAMINING IMPORTED FILES

After the import is complete, the flight files will be displayed in the map view of LP360 Drone. A WMS layer will be displayed behind the data so the user can see approximately where flight path occurred (Figure 45). The white box on the left side of Figure 45 is the Table of Contents (TOC), the map area on the right is referred to as the Map View. Each layer in the TOC is named after the Cycle date and time, with a name appended to the end that represents the type of information contained in the layer and prepended by the Area Name (Area_Name_Cycle_Flight). A layer can be selected by left clicking on the desired layer until it is highlighted. Once selected, right-click the layer and select Feature Analyst to open the Feature Analyst dialog (Figure 46) to review the attributes of features on the layer.

Figure 45 – TOC and Map View

a) **Photos Layer** – This layer contains information about each photo and photos can be viewed in Feature Analyst. The icons in the Map View represent the location each photo was taken, using the navigation grade solution (real-time) of the TrueView Position and Orientation System (POS). If your sensor has multiple cameras, you will see an icon for each photo from each camera. Thus, if you zoom in on the display, you will usually see photo icons close together. This occurs because TrueView sensors with multiple cameras usually fire the cameras at approximately the same time. You can quickly *inspect* information about any *feature* in LP360 by selecting the Info tool (the "I" icon on the main toolbar), left clicking the item you wish to inspect and viewing the attribute data in the Info pane of the TOC. This is illustrated for a photo in Figure 47.

b) **Trajectory Points Layer** – TrueView and microdrones sensors collect a location point every second based on the real-time navigation position information from the Position and Orientation System. You can select a Trajectory Point with the info tool to show metadata such as location and height in the info pane of the TOC. These points can be used to Manually Create Flight Lines.

c) **Log Points Layer** – TrueView and microdrones Sensors collect information about the status of operations throughout the flight. This log file is a simple text file stored within the Cycle directory. You can examine the entire log by right clicking the LogPoints layer in the table of contents and selecting Feature Analyst. Like all data in Feature Analyst,

you can drive the log to a specific entry by selecting a point in the Map View. Each entry within this file has a time tag. During import of a Cycle, the log file is correlated with the Trajectory Points data and spatially displayed as a layer in the TOC. The log file can provide valuable insight into sensor operations (voltages, temperatures) as well as diagnostics when something goes wrong. This layer will not be created for DJI and Other systems. The Log Points layer is turned off by default for performance reasons as they typically have a very large number of features on them.

d) **Trajectory Line Layer** – Shows the real-time trajectory from the beginning to the end of the Cycle.

e) **WMS Layer** – A WMS backdrop layer, such as Google Hybrid or Bing Aerial with Labels, allows the user to check the flight for coverage and rough location.

f) Layer toggle On/Off – Each layer can be toggled on/off and viewed independently by toggling the checkbox next to the layer.

g) Layer in Map – Each layer is plotted on the map view as shown in (Figure 45) in the order they are listed, from top to bottom, in the TOC.

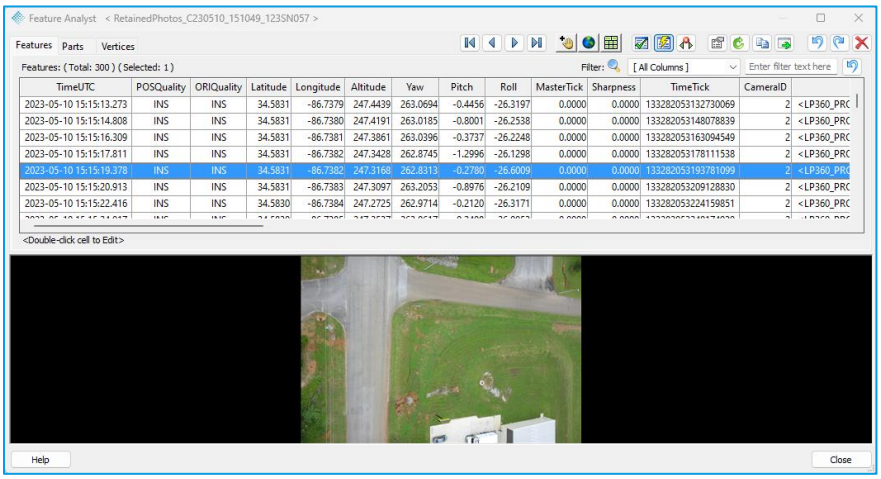


Figure 46 – Feature Analyst

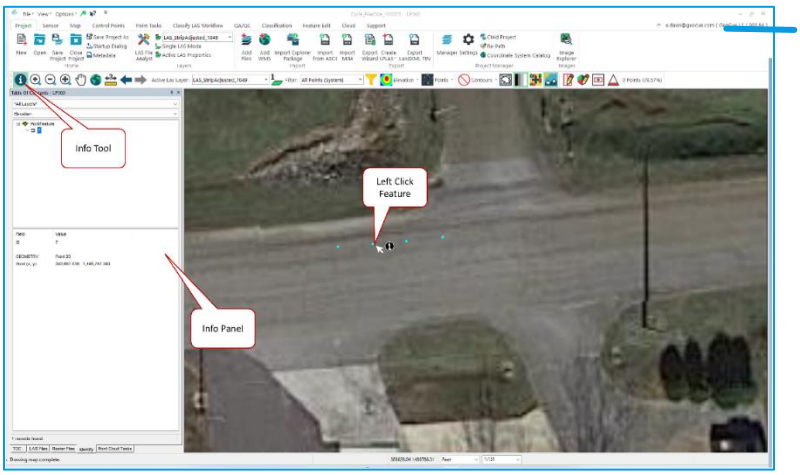


Figure 47 - Inspecting a Feature

Repeat the TrueView Import Wizard to add more flights to the same project. After the data has been imported and the files have been examined, follow the applicable workflow for your data type(s):

- TrueView 3DIS® Processing Workflow
- Wingtra LiDAR and Other Workflow
- DJI Zenmuse L1/L2 Processing Workflow
- TrueView 2DIS and DJI-RTK Processing Workflow

SINGLE CYCLE MODE

Enabling **Single Cycle Mode** (Figure 26) will display layers relevant to the Active Cycle making for efficient review of the layers for each imported Cycle/Mission. The Single Cycle Mode is a shortcut configuration for the standard Use mode in Project Manager where, layers are live and you can modify the display by changing the layers listed in the Table of Contents. Members of the active Cycle display group are configured automatically during Cycle Import but may be modified by using the Groups -> Build mode (Figure 48) on the Groups/Layers tab of Project Manager. The build mode allows one to set up new groups, edit existing groups, and delete groups you no longer need. You can also automatically create groups based on unique cycle or temporal data. Use the Refresh button to update the Table of Contents to see any changes you have made. In build mode, select the group to modify on the left, then layers can be configured as **V**isible, **M**ember, **B**ase, and/or **I**mage**E**xplorer.

Visible – The layer is enabled in the TOC and visible in the map view when the view group is selected when in the Use mode.

Member – The layer is part of the selected group and displayed on the TOC when the view group is selected when in the Use mode.

Base – Denotes the layer is a base layer, such as a WMS layer.

Image **E**xplorer – Denotes the layer is suitable for use by Image Explorer. LP360 disables the photo layer when it creates the Retained Photos layer to remove the photos in turns and takeoff and landing from being displayed in Image Explorer.

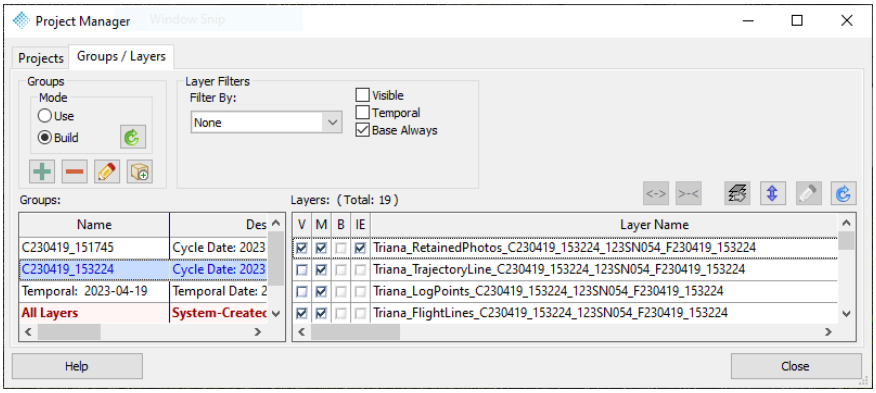


Figure 48 - Build Mode in the Groups/Layers tab of Project Manager

PILOT LOGS

LP360 has the capability to view the Pilot Log from imported TrueView Cycles. These logs can be created by the pilot in the field using the TrueView Web UI. The Pilot Log is stored in the System folder of the raw Cycle. As the pilot log is a text file, it can also be created manually after importing the Cycle into LP360. The file must have "PilotLog" in the name and stored in the Project\Area\Cycle\System folder for it to be recognized by LP360.

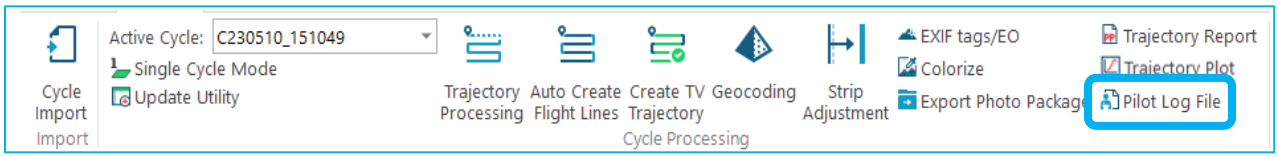


Figure 49 - Pilot Log View Tool

TRUEVIEW 3DIS® PROCESSING WORKFLOW

This section provides a step-by-step guide to processing TrueView 3D Imaging System (3DIS®) data from the point of project creation to a colorized point cloud, exporting a photo package for downstream processing, or generating an orthomosaic. For dual purpose 3DIS, considerations for mobile Cycles are generally noted in textboxes where applicable.

For the new TrueView 540 by CHCNAV LiDAR payload, there is no USB, so the Cycle data must be copied from the payload to your local drive using the TV540 Data Copy tool found in the Utilities group on the Sensor tab of the ribbon.

To import TrueView and supported microdrones Cycle data from the USB mounted in the system during acquisition into a new or current project, open the Raw Mission Import Wizard and select *TrueView/Microdrones* as the sensor.

TV540 DATA COPY

For the new TrueView 540 by CHCNAV LiDAR payload, there is no USB, so the Cycle data must be copied from the payload to your local drive using the **TV540 Data Copy** tool found in the Utilities group on the Sensor tab of the ribbon. The **TV540 Data Copy** tool is used to retrieve data as well as format the sensor storage. To download data, the sensor must be connected to a workstation using the provided USB-C to USB-A cable.

1. Connect the sensor to a workstation using the USB-C to USB-A cable.
2. Open LP360 with elevated permissions by using right-click and "Run as Administrator".

   Note: This is a current requirement to run the DataCopy tool . All other functions may be run with LP360 launch normally. We are working to remove this impediment as soon as possible.
3. Go to the Sensor → Utilities → TV540 Data Copy .
4. Follow the steps and save the Cycles in a local HD.
5. Organize the Cycles (flights) in a single folder.
6. Add the base station file (RINEX format) and the coordinates of the base station in WGS84/ITRF2014 Latitude, Longitude and Ellipsoidal height.
5. Now the data is ready to be delivered to GeoCue using the **Upload to Support** tool found on the Support tab in LP360.
   3. Open LP360.
   4. Support → Upload to support → Select the folder containing all the Cycles for a project area and upload it.
   5. Wait for the upload to finish (you will receive an email notification).
   6. Send an email to "support@geocue.com", include in the email if photogrammetry is needed (orthomosaic), and if required, please specify the Coordinate Reference System (CRS) for the LAS and orthomosaic.

Then, the trajectory processing and initial point cloud generation from the raw data is performed by GeoCue as a pre-processing step before beginning the workflow in LP360 Drone until LP360 v2024.2 is available for users. **Coming soon!**

TRAJECTORY PROCESSING WIZARD

After the data has been imported and the files have been examined, the next step is to correct and fuse the GNSS and inertial data by running the tightly integrated Applanix POSPacCloud (Cloud), or POSPac UAV (local). The sensor Trajectory Processing tool will launch the applicable processing wizard, to walk you through the inputs needed to create the sensor trajectory, a single text file with the corrected position and orientation of the entire flight, along with a QC Report.

1. On the Sensor tab (Figure 50), make active the Cycle/Flight combination to be processed.

> Enabling **Single Cycle Mode** (Figure 26) displays layers relevant to the Active Cycle making for efficient viewing of the layers for the Active Cycle.

2. Open the **POSPac Processing Wizard** dialog by selecting the sensor **Trajectory Processing** button on the Sensor tab (Figure 50).

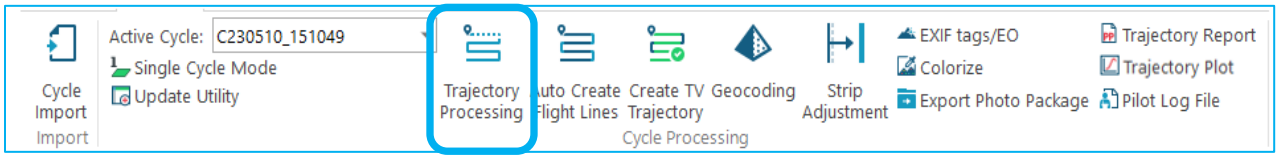


Figure 50 – POSPac Processing Wizard

PROCESSING SETTINGS SELECTION

3. The **POSPac Processing Wizard** dialog (Figure 51) should now be opened to the first page, which is where the user will select the file to be processed, and how it will be processed. The first time you open this page for a Cycle it may take a moment as LP360 Drone analyses the raw position file. The bullets below explain the settings for the **POSPac Processing Wizard** dialog (Figure 51).

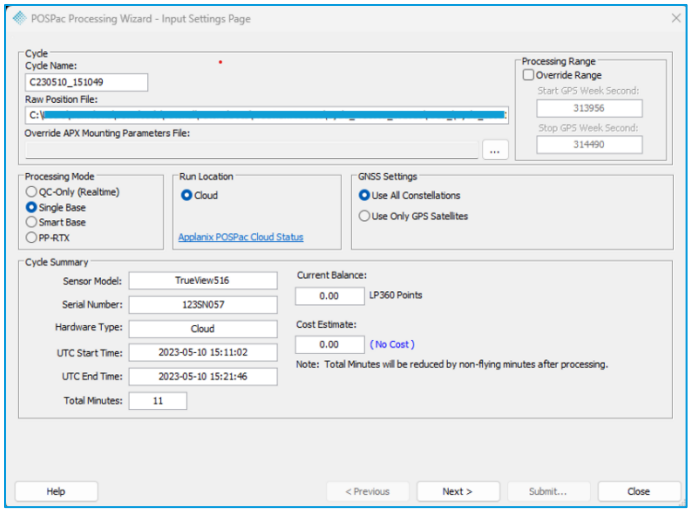


Figure 51 – Input Settings Page

a) **Cycle Name** – The Active Cycle for which to process the trajectory.
b) **Raw Position File** – This shows the path to the T04 file contained in the cycle that was selected in step A. Each cycle will have a different T04 file.
c) **Override APX Mounting Parameters File** – The default antenna offsets (lever arms) and orientation for the APX are loaded into the APX firmware during manufacturing. These can also be manually changed in the field via a process where one logs into the APX via Wi-Fi as described in the hardware users guide for your TrueView model. This field on the POSPac processing wizard allows a user to browse to a JSON file that defines one or both of these 3-tuples to override the APX values when processing.

The format of the JSON file is:

```
{
"IMUMountingAngles": {
"Override": "false",
"RefToIMUMountingAnglX": "0.0",
"RefToIMUMountingAnglY": "0.0",
"RefToIMUMountingAnglZ": "0.0"
},
"LeverArm": {
"Override": "false",
"PriGNSSLeverX": "0.0",
"PriGNSSLeverY": "0.0",
"PriGNSSLeverZ": "0.0"
 },
"VehicleToRef": {
"Override": "false",
"VehicleToRefAnglX": "0.0",
"VehicleToRefAnglY": "0.0",
"VehicleToRefAnglZ": "0.0"
 }
}
```

NOTE – This should only be used when there is a configuration error with the APX. For TrueView 620, 640, 660, 680 or 720 use "RefToRemoteIMUMountingAngl*" instead of "RefToIMUMountingAngl*". Set the override to "true" for the desired section(s).

d) **Processing Range - Override Range –** Enable Override Range to manually set the start/end processing times in GPS week seconds instead of using those which were automatically determined from the kinematic motion of the sensor trajectory. Override Range is useful when there are data gaps around the time of takeoff. Generate a real-time POSPac QC report to see the full trajectory information and determine alternate start and end times.

e) **POSPac Processing Mode** – Choose the processing method to be used to correct your GNSS and inertial data.
   i. QC Only (Realtime) – A no charge means to generate a QC Report PDF and realtime sensor trajectory for the rover for infield QC checks of your data.
   ii. Single Base ($) – Uses the RINEX file recorded from a single base station. No cost for Traditional or rental business models.
   iii. Smart Base ($$) – Uses the SmartBase network from Applanix.
   iv. PP-RTX ($$$) – Uses the PP-RTX solution from Applanix. This is the least accurate option and should be used only if single base and SmartBase cannot be used.

f) **POSPac Run Location** – Select to process Local or Cloud by selecting the applicable radio button next to the option. If the POSPac Processing Mode is set to SmartBase or PP-RTX, then Cloud is the only option that can be used.

g) **GNSS Settings** – Normally set to process using all available constellations but can be toggled to process using GPS only if one of the other constellations is causing noise in the solution.

h) **Cycle Summary** – Contains information about the sensor and the Cycle start/end time. The TrueView account balance will be displayed, if enabled, along with the estimated cost to process this cycle using the selected method. "Duplicate Task" will be shown if the process has already been run successfully on this data before using the same method and indicates no additional points will be charged. "No Cost" will be shown if the process is included in your business model, no points will be charged.

An online account login is only applicable if the POSPac Run location is set to Cloud since LP360 Drone communicates with LP360 Online to manage your account's Point balance. During the *sensor Trajectory Processing* step, you must be logged into your online account to process using POSPac with the run location, Cloud.

4. Select Next to move to the next page of the dialog. If using single base as the processing mode, the next page will be the base station input page (Figure 52). If using Smart base or PP-RTX, the next page will be the Trajectory Output Settings.

BASE STATION SETTINGS

5. The **Base Station Input** page only appears when processing using the single base option. The bullets below correspond to Figure 52.

Base Station Observation File(s) – This field should be populated automatically if the base station RINEX file(s) was imported during the TrueView multi-Cycle Import wizard step. If not, it can be imported here by selecting + to the right of the grid. If the Antenna type was written to the RINEX header, it will automatically be recognized and displayed in this box. **If not present, the RINEX file should be edited to include the information and added anew.**

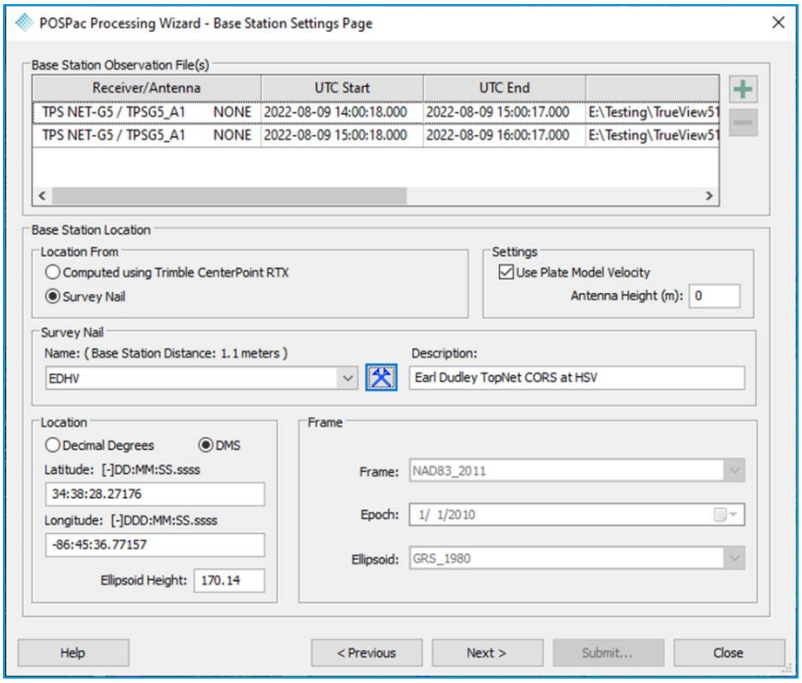


Figure 52 – Base Station Settings

a) **Base Antenna Calibration File** – During GNSS processing, whether local in LP360 Drone for 2DIS, in POSPac desktop, or using POSPacCloud, the antenna type must be known for the software to apply the proper antenna phase center (APC) to antenna reference point (ARP) offsets. LP360 Drone will automatically read the antenna model, if present, from the base RINEX file and display it black in the dialog if the antenna is a known type for which it has the antennae calibration. If the antenna model is unknown or not stipulated in the RINEX file, or no antenna calibration exists for the specified model then the antenna model will display in red (Figure 53). Hovering over the antenna model will provide a tooltip with the explanation, "Warning: NGS calibration for antenna model (Unknown) not found. Verify the correct antenna model is listed in the base observation file. If you have a newer model antenna it may need to be added to our database, contact 'support@geocue.com'. Proceeding with processing as is will result in no APC to ARP offsets applied, which is not normally desired, however, is acceptable in some circumstances."

Proceeding without a recognized antenna model will prompt for a confirmation when processing the trajectory solution. An example of when it may be okay to proceed with an unknown antenna model or missing antenna calibration would be if the reference mark was processed to the antenna phase center (APC) instead of the antenna reference point (ARP).

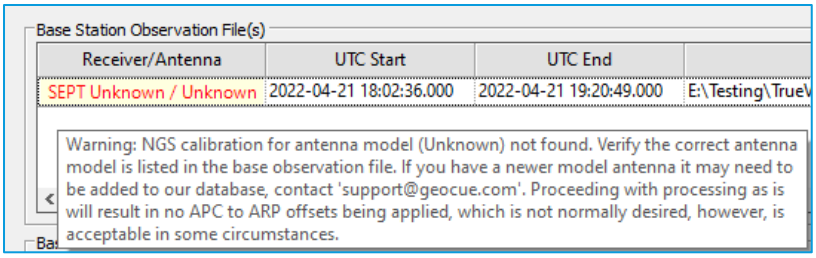


Figure 53 - NGS Antenna Calibration Not Found

b) **Base Station Location**

i. **Location from –** The base station location may be preset if the base station was setup over a known survey nail / reference mark or can be computed during POSPac processing using Trimble CenterPoint RTX.

1. **Trimble CenterPoint RTX –** Selecting this option will disable the location and frame portions of the dialog as those will be determined using the Trimble CenterPoint RTX post-processing service. Trimble RTX© is a global GNSS technology that provides centimeter-level positioning, worldwide, at any time. The CenterPoint RTX post-processing service supports dual frequency GNSS receivers. Antennas must be on the Supported Antennas list. The post-processing service will not process unsupported antennas. See also: **Supported Antennas**

   Base Station Observation files must meet the following requirements:

   - Data formats accepted include Trimble proprietary data formats (e.g., DAT, T01, T02, T04, Quark) and the standard RINEX 2 and RINEX 3 data formats.
   - For optimal processing results, it is recommended to provide **at least 60 minutes** of observations.
   - Data files cannot exceed 24 hours in length.
   - Data files must be static only.
   - Data files must contain dual frequency pseudorange and carrier phase observations (L1 and L2).
   - Data must have been collected after 14 May 2011.

2. **Survey Nail/Reference Mark –** If properly selected during the Cycle Import Wizard this information will already be set. Otherwise, select the name of an existing survey nail from the list or select the nail icon to open the Survey Nail Manager, and add a new Survey Nail. Note: The dropdown list is sorted by distance from the average position found in the base station RINEX file.

A message appears on the page to indicate the distance from the Survey Nail to the approximate location found in the base observation file header. If this distance is greater than 10 meters, the message shows in red, and you should verify the information as displayed in the Location is correct. Over 50m will typically fail when processing the sensor trajectory. Values in between are okay if you have verified the survey nail location to be correct.

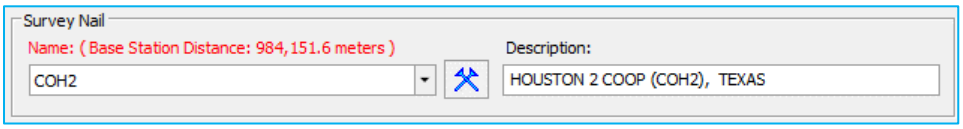


Figure 54 - Base Station Location Warning

c) **Settings: Antenna Height** - Enter the base antenna height from the measured mark to the Antenna Reference Point (ARP). Phase center offsets should not be added to the antenna height unless the base antenna model was not written to the header and recognized in *Base Station Observation* section (Figure 53).

d) **Location** – Once a survey nail is selected from the list or from the Survey Nail Manager, the Base Station Location information will appear in the dialog.

e) **Frame** – Once selected from the list or from the Survey Nail Manager, the Base Station Frame, epoch, and ellipsoid will appear in the dialog.

   i. **Settings: Use Plate Model Velocity –** Plate Model Velocity calculations can be omitted by unchecking the box, if desired. If selected, POSPac uses the ITRF2008 plate velocity model for user provided single base and PP-RTX processing, or HTDP for stations from the Applanix database - only used in LP360 Drone for smartBase processing. When used, a 14-parameter model is used to go between the user defined frame and ITRF00, in which POSPac does all the trajectory processing. **Use plate model velocity to transform between epochs**.

f) Select **Next >** to move to the Processing Confirmation page.

PROCESSING CONFIRMATION

6. The **Processing Confirmation** page contains information about the sensor and processing times. The bullets below correspond to Figure 55.
   a) **Review Current Settings** – Contains information about the hardware, software, and cost estimates.
   b) **Results** – After trajectory processing is completed successfully, contains information about the results of the processing, including the actual cost, if applicable.

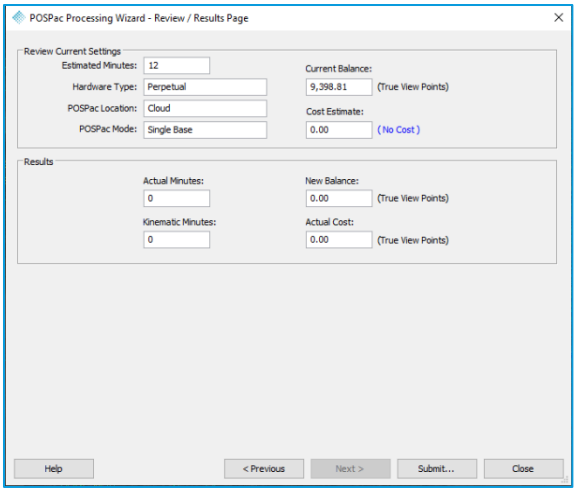


Figure 55 – Processing Confirmation

7. Select *Submit* when ready to submit the data for processing.
8. If during the validation for submittal check, the antenna model is unknown or was not stipulated in the RINEX file, or no antenna calibration exists for the specified model, the user will be prompted to acknowledge the missing antenna calibration before continuing with the task submission to ensure she desires to proceed with this information missing.

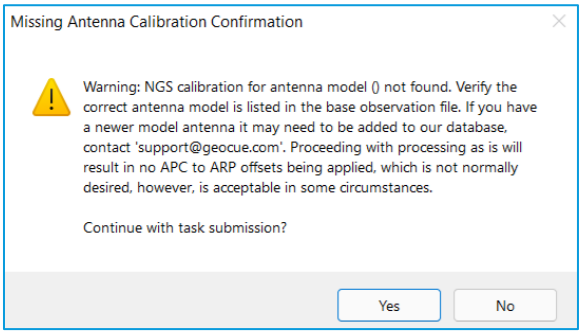


Figure 56 - Missing Antenna Calibration Confirmation

9. You will then be prompted with a message asking you to confirm the submission. Click Ok.

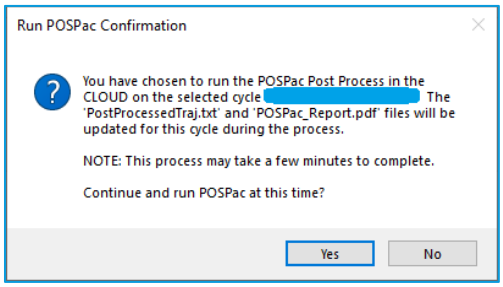


Figure 57 - Run POSPac Confirmation

10. A successfully submitted job notification will appear confirming the job submission (Figure 58).

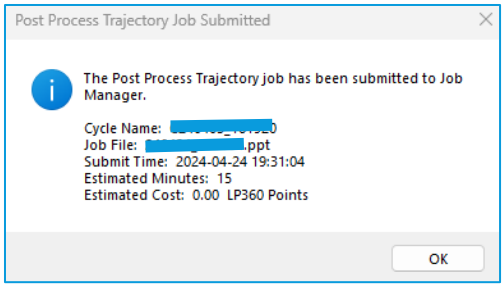


Figure 58 - Post Process Trajectory Job Submitted

11. The Post Process Trajectory (PPT) job progress may be monitored using Job Manager.
12. Upon completion of the PPT job by the Job Manager:
    a) Job Manager will indicate completion by the green checkmark flashing on the Job Manager icon
    b) The job will need to be post-processed to view the resulting POSPac report and/or log file.
13. If desired, or for troubleshooting, in Job Manager, select the applicable PPT job, then select View Log to review the PPT processing log for POSPac Troubleshooting.
14. In Job Manager, select the applicable PPT job, then select Open Project to open the applicable project for the job, if not currently open.
15. Then, select Post-Process to review the POSPac Report.
16. When desired, in Job Manager, select the applicable PPT job, then select Delete Job to clean up the temporary files generated while processing the job.

POSPAC REPORT REVIEW

1. When prompted to view the POSPac report, select *Yes* to view the report, or *No* to move to the next step. You may reopen the POSPac report at any time by selecting on the Sensor tab. There are several plots that one should review to ensure a viable trajectory solution before moving on to additional processing steps:
    - **Rover Data Summary**
        - Start/End time meets expectations.
        - Start of fine alignment is within a minute or two of takeoff.
    - **Rover Data QC**
        - **Primary Observables & Satellite Data**
            - **GPS/GLONASS L2 Satellite Lock/Elevation**
                - Review this plot to ensure ephemeris information is available for all satellites for the entire length of the Cycle.
                - Review this plot to ensure there are not many Cycle slips or data gaps throughout the Cycle.
            - **GPS L2 SNR**
                - Review this plot for gaps or less than four satellites above 30.

- **GLONASS L2 SNR**
    - Review this plot for gaps or less than four satellites above 30.
- **Smoothed Trajectory Information**
    - **Top View**
        - Review the top down path of the trajectory solution and compare to the flight plan and the Cycle position feature files created during the TrueView Cycle Import.
    - **Altitude**
        - Review the profile path of the trajectory solution and compare to expectations.
- **Base Station Information**
    - Ensure the base antenna manufacturer and model is properly read from the RINEX file. Fix in the RINEX file if it says Unknown.
    - Verify the correct antenna height was used.
    - Verify the correct base station coordinate was used.
    - The Frame, Epoch and Ellipsoid should match that of the survey nail. For instance, a point from an OPUS solution should be Frame: NAD83_2011, Epoch: 2010, Ellipsoid: GRS_1980
- **GNSS QC**
    - **GNSS QC Statistics**
        - Look for a 100% fixed solution, minimum four satellites (preferably many more) and a maximum PDOP less than 3.
    - **Forward/Reverse Separation**
        - Ideal 1-2cm in Easting/Northing and less than 5cm in down for single base processing.
    - **PDOP**
        - Ideally well less than three across the board
- **GNSS-Inertial Processor Configuration**
    - Verify the correct GNSS lever arm and mounting angles were used for your 3DIS® and drone configuration.
- **Smoothed Performance Metrics**
    - **Position Error RMS (m)**
        - Ideal 1-2cm in Easting/Northing and less than 5cm in down for single base processing.
- **Forward Processed Solution Status**
    - **Processing Mode**
        - Should be zero (Fixed NL) across the board. May have some portion at the very beginning/end that loses lock for forward and/or reverse.
    - **Baseline Length**
        - Shows the 3D distance between the base station and the TrueView throughout the Cycle. Ensure it falls within expectation. Review the Base Station Location used for processing if it does not.
- **Export Summary**

- Output Units (Coordinate) should be in the units of your project.
- Height option, Grid, Zone, Datum, Ellipsoid and Target Epoch must match that of your LP360 Drone project CRS.

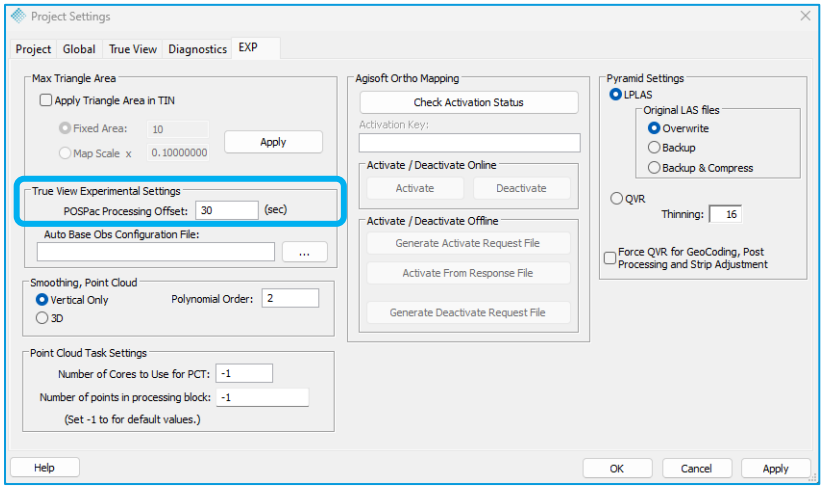


Figure 59 - POSPac Processing Offset

2. The results of this process will be corrected position and orientation, which will be saved in an SBET file located in the POS folder under the LP360 project and Cycle folder.

POSPAC TROUBLESHOOTING

When POSPac is not successful in producing the trajectory, a user may encounter a few generic error messages indicating the failure.

TRUEVIEW ERROR: UPLOAD_FAILED

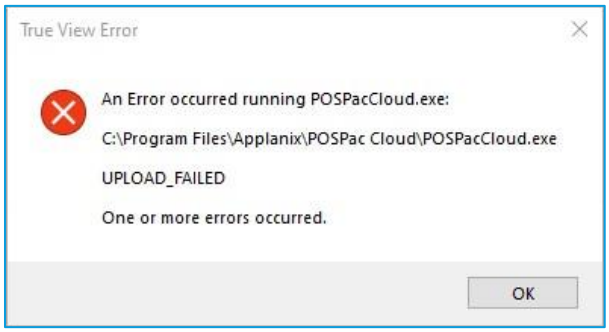


Figure 60 - TrueView Error: Upload_Failed

POSPacCloud.exe is experiencing problems packaging and uploading the POS data to the POSPacCloud. Verify your internet connection is stable and try again. Otherwise, see the probable resolutions on our searchable support knowledge base.

TRUEVIEW ERROR: EXECUTION_FAILED

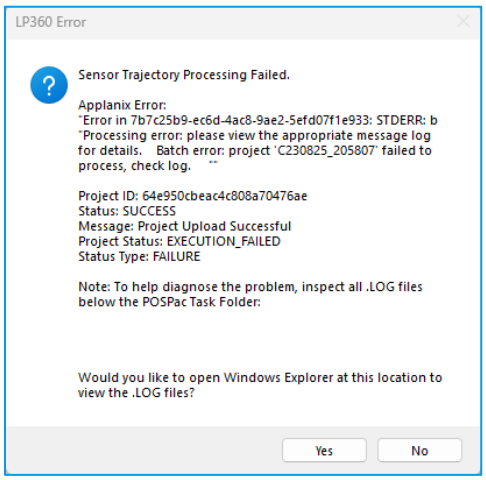


Figure 61 – LP360 Error: Execution_Failed

This generic error message occurs whenever POSPacCloud fails to produce a smoothed GNSS-Inertial solution. Open the \Project\Area\Cycle\POS\POSPac_YYMMDD_HHMMSS\YYMMDD_HHMMSS.log file corresponding to the attempted execution in POSPacCloud and review the contents for the messages in the reason section. Selecting "Yes" on the error dialog will open the \Project\Area\Cycle\POS\POSPac_YYMMDD_HHMMSS\CYYMMDD_HHMMSS folder corresponding to the attempted execution in POSPacCloud so you may review the log files for additional information. Refer to the probable resolutions on our searchable support knowledge base.

TRUEVIEW ERROR: AN UNEXPECTED ERROR OCCURRED RUNNING POSPACBATCH.EXE

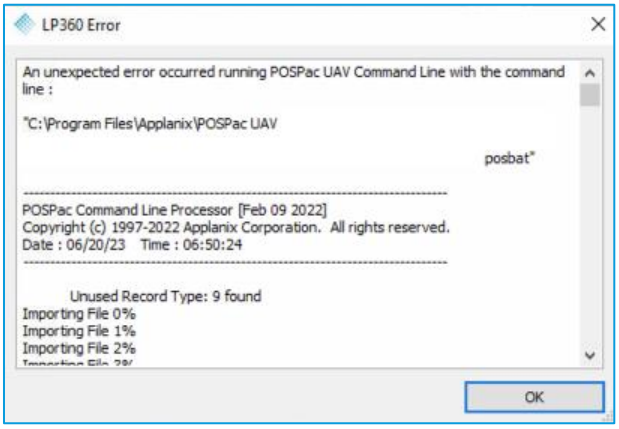


Figure 62 – LP360 Error: An Unexpected Error Occurred Running POSPac UAV

This generic error message occurs whenever POSPac UAV (local) fails to produce a smoothed GNSS-Inertial solution. The error message contains the overall processing log. The top reasons for this error are:

- No license available, open the Applanix Software License Utility and verify the machine being used to process can see the licenses being served by the Applanix license server machine on your network.
- If this is the first time running POSPac on the machine, open the POSPac UAV desktop application and ensure it opens without error to ensure the installation occurred without any issues.
- Incorrect base station location, datum, or epoch.
- Project path length exceeds 200 characters, this error will be reported in the posbat file towards the end.
- A user still has the POSPac Processing Offset (**File -> Project Settings -> EXP -> True View Experimental Settings**) set to a large number (Default = 30s). The large offset number was necessary for v8.4-8.5 but is no longer needed with v8.6 or later.
- A user has installed POSPac v9.0 hotfix or later but is running a deprecated version of LP360 Drone/True View EVO.
- A user has installed POSPac v9.1 but has not yet upgraded their POSPac licenses to v9.1.
- A user has installed POSPac MMS instead of the POSPac UAV for which their licenses are valid. Verify the POSPaBatch.exe Location (LOCAL) is pointing to the POSpacBatch.exe in a "POSPac UAV 9.1" folder and not a "POSPac MMS 9.1" folder.

Open the \Project\Area\Cycle\POS\POSPac_YYMMDD_HHMMSS\YYMMDD_HHMMSS.log file and review at which stage the processing failed. Refer to the probable resolutions on our searchable support knowledge base.

CREATING FLIGHT LINES AND TRUEVIEW TRAJECTORIES

The steps to this point have allowed us to create a single file with the corrected sensor trajectory for the entire Cycle. Sections of each flight in the Cycle are not useful to us, such as the IMU heading alignment maneuver and flight line transitions, so we clip these sections out by defining which portions of the flight to keep. Usually only the data collected along the flight lines are retained, so we will use the ***Auto Create Flight Lines*** tool (Figure 63) and the ***Create Flight Lines from Selected Trajectory Points*** (Figure 64) from the Sensor tab for the next step. Flight lines are created using the time in the trajectory points layer, then a new layer is created named "*Area*_YYMMDD_HHMMSS_Flight lines". The steps below describe how to create flight lines automatically and manually. The best approach is to create flight lines automatically, then add or delete flight lines manually to get the exact flight lines we want.

For legacy microdrones payloads, the flight lines are automatically generated during import based on the mdCockPit flight plan. These flight lines are not editable.

For mobile datasets, the **Auto Create Flight Lines** tool will likely be inadequate for creating usable flight lines. It is currently advised to create these manually to clip to the desired data.

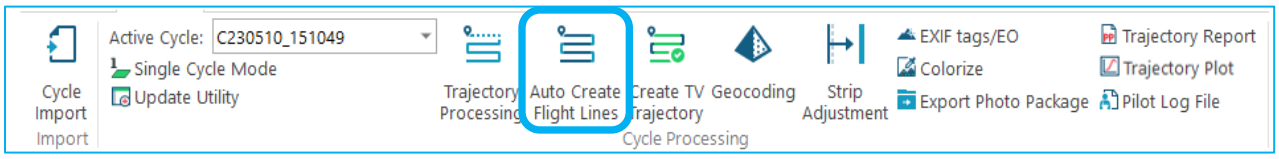


Figure 63 – Auto Create Flight Lines

Figure 64 - Create Flight Lines from Selected Trajectory Points

AUTO CREATE FLIGHT LINES

1. If not already done, make active the Cycle/Flight combination to be processed.

> Enabling **Single Cycle Mode** (Figure 26) displays layers relevant to the Active Cycle making for efficient viewing of the layers for the Active Cycle.

2. Select the **Auto-Create Flight Lines** tool on the Sensor tab (Figure 63) to open the Auto Create Flight Lines dialog (Figure 65).
   a) **Flight Line Layer** - The name of the layer that will be created and requires no input from the user.
   b) **Min. Length** – No linear set of points shorter than this value will be considered for the calculation of a flight line. This number should usually be set to the shortest flight line length. Use the **Measure** tool on the main LP360 toolbar to measure the shortest desired flight line.
   c) **Turn Radius** – The radius, in map units, to allow at turns. The smaller the number, the closer the flight lines will be cut to the turns. The greater the radius, the larger the gap.
   d) **Max Deviation** – The deviation parameter that tells the software when to break a line segment into two. The smaller this number, the more linear the flight lines but the more flight lines that will be created. The larger this value, the more "bend" will be allowed in a relatively straight segment without splitting. Hence, increase this value significantly if you have curved flight lines.

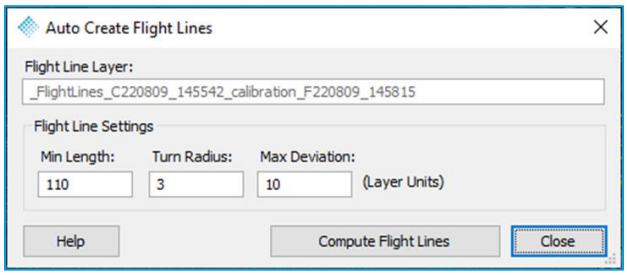


Figure 65 – Auto Create Flight Lines

3. Once you have entered the desired parameters, select *Compute Flight Lines.*
4. The flight line layer should be created, and the flight lines displayed in blue in the map view.
   a) Results can be changed by changing the parameters and selecting *Compute Flight Lines* again. The existing lines will be replaced with the results from the new settings.
5. Flight lines can be deleted if necessary, by selecting the layer with the *Select/ Edit Features* button on the left end of the Feature Edit tab (Figure 66) and clicking the red "X" on the right end of the Feature Edit tab (Figure 66).
   a) Select the ***Select/ Edit Features*** tool on the LP360 Feature Edit tab (Figure 66).
   b) Select the flight line you wish to delete, and the line will be highlighted (Figure 67).

i. If multiple feature layers are selected, you will be prompted to choose a layer. Choose the flight line layer.
ii. Hold control while selecting to select multiple flight lines. Or drag to select multiple flight lines.

c) Select the **Delete Selected Features** button on the LP360 Feature Edit tab (Figure 66) and the selected feature(s) will be deleted.

d) Delete all unnecessary flight lines. **Undo** and **Redo** may be used if you accidentally remove the wrong flight line.

e) Select the **Save Feature Edits** icon on the LP360 Feature Edit tab (Figure 66) to save the edits.

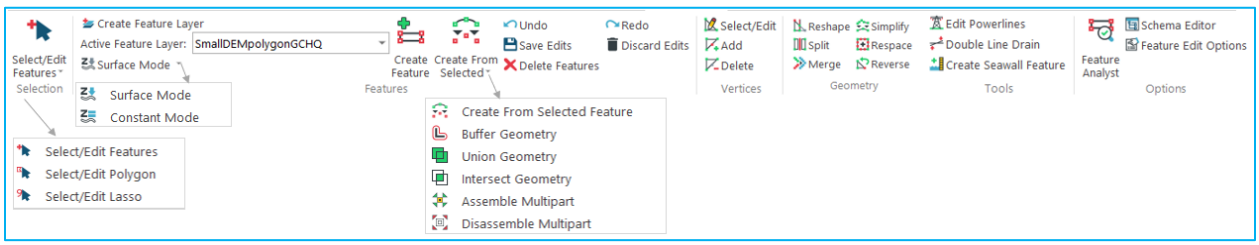


Figure 66 - LP360 Feature Edit Tab

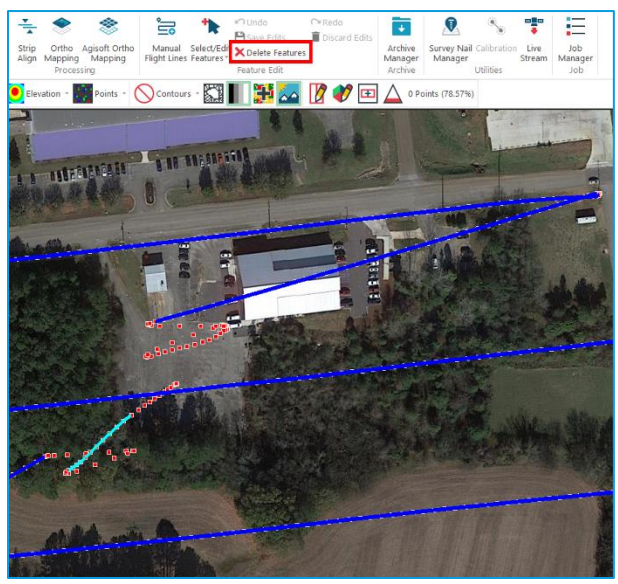


Figure 67 – Editing Flight Lines

MANUALLY CREATE FLIGHT LINES

1. Flight lines can be added manually by selecting trajectory points (red points) at the beginning and end of each line.

   a) Select the ***Select/ Edit Features*** tool on the LP360 Feature Edit tab (Figure 66).

b) Select a trajectory point at the beginning of the desired flight line. The point will be highlighted when selected.
c) Hold control, then select a trajectory point at the end of the flight line. Both trajectory points should now be highlighted (Figure 68).

Figure 68 – Manually Creating Flight Lines

d) Select ***Create Flight Lines from Selected Trajectory Points*** on the Sensor tab (Figure 64) and a new flight line should be created.
e) Select the **Save Feature Edits** icon on the LP360 Feature Edit tab (Figure 66) to save the edits.

Note: If you select Trajectory Point patterns that do not form the required base for creating a flight line, you will receive an error message that explains the issue (Figure 69).

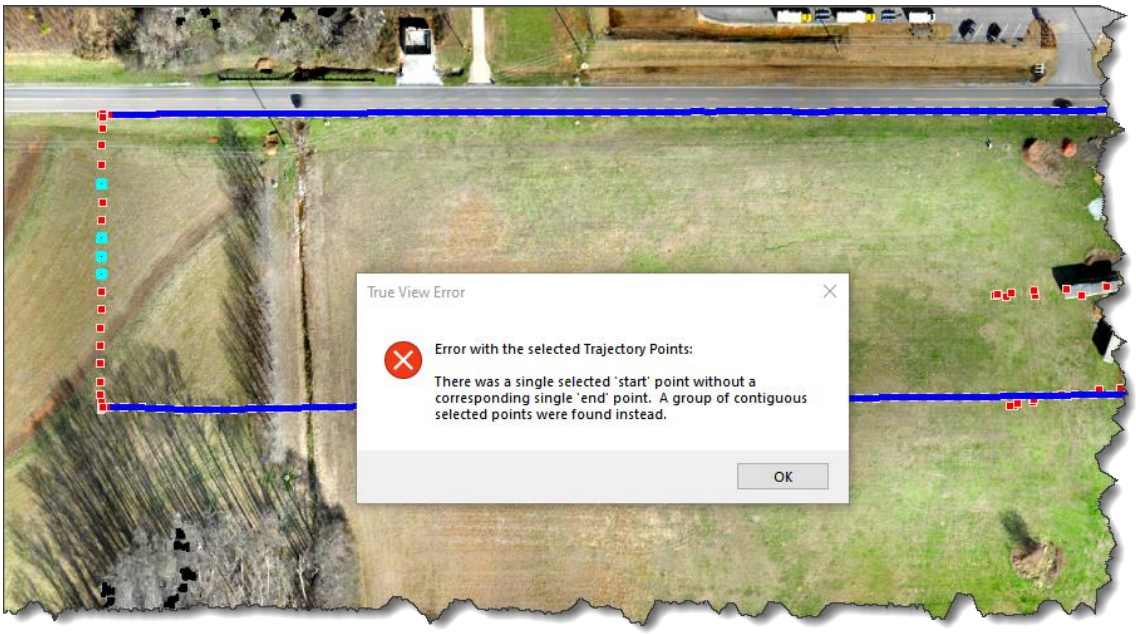


Figure 69 - A pattern of Trajectory Points not compatible with forming a flight line

CREATE TRUEVIEW TRAJECTORIES

1. If not already done, make active the Cycle/Flight combination to be processed.
2. Once flight lines have been created, and the edits saved, select ***Create TV Trajectories*** from the Sensor tab (Figure 70). The purpose of this step is to use the flight line layer to create a reduced trajectory file from the PostProcessedTraj.txt file for each flight line. Optionally and recommended, you may also update the image EXIF tags at the same time.

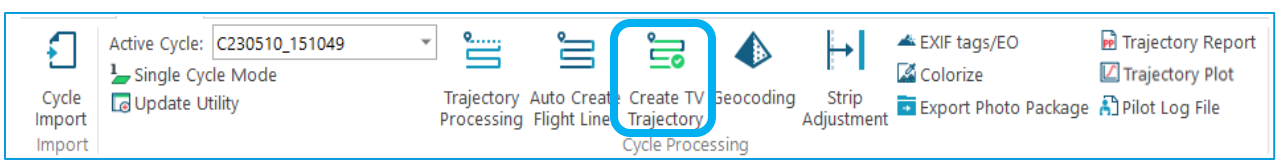


Figure 70 - Create TrueView Trajectories

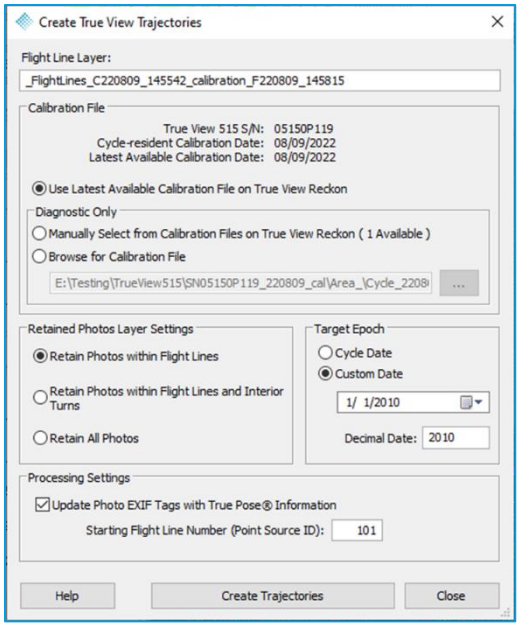


Figure 71 - Create TrueView Trajectories dialog

3. These fields of this dialog are usually auto populated if the post process trajectory solution was successful.
    a) **Flight Line Layer** - Select the flight line layer from which to generate TrueView trajectories if multiple Cycles are being processed.
    b) **Post Processed Trajectory File** – The trajectory file generated by POSPac. A post processed trajectory file may also be imported here if have one from a previous processing session with the same data.
    c) **Calibration file** – The TrueView sensor calibration is critical to get accurate LiDAR and imagery data for all supported system types. Select the option for the calibration file you wish to use:
        i. **Use Latest Available Calibration File on TrueView Reckon** (Recommended) – The latest calibration file for each sensor is stored on TrueView Reckon, the sensor management backend. When this option is selected, LP360 Drone will use the latest calibration file found on TrueView Reckon to process the data. This is the recommended option as some smarts exist on Reckon and in LP360 Drone to help ensure the correct calibration file for the system and Cycle. **If your system does not have a calibration file on Reckon, please contact support@geocue.com for assistance.**
        ii. **Diagnostic Only:** Users should never normally use either of these options, except for: DJI Zenmuse L1/L2 processing, where it should not be modified from the default; Imagery only sensors, such as the P4RTK or P1, where the user does not have a camera calibration on Reckon and is therefore following a more arduous workflow involving measuring control rather than a more automated Ortho Mapping processing with only check points for validation (Image Explorer will also not be usable without a camera calibration).

Otherwise, if the "Latest Calibration" option above is greyed out, please contact support@geocue.com for further assistance. for further assistance.

1. **Use Cycle-resident Calibration File** – If this option is selected, the calibration file in the system folder of Cycle being processed will be used to process the data. This may not be the latest calibration file if updates to your calibration have been made and those updates were not copied to the USB prior to acquisition.
2. **Manually Select Calibration File** – This choice will invoke a dialog that allows you to select a file from all available calibration files for this sensor from Reckon. If you select this choice, the Calibration File Picker dialog (Figure 72) will be displayed when you press the Create Trajectories button at the bottom of the Create TrueView Trajectories dialog. You can pick the calibration file you desire using the dropdown picker.

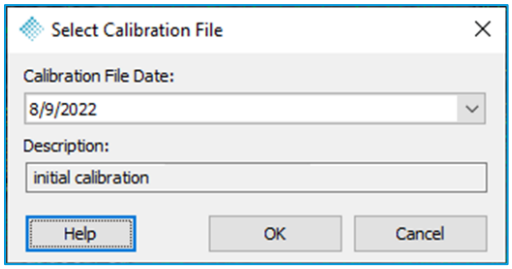


Figure 72 - Calibration File Picker

d) **Retained Photos Layer Settings** – Allows the user to specify the photos to be kept for geotagging and export to photogrammetric software packages using Export Photo Package or for processing in Agisoft Ortho Mapping, or for processing in Ortho Mapping. The notion of "Retained Photos" creates a layer of the retained photos on a new layer called "RetainedPhotos."

   i. ***Retain Photos within Flight Lines*** – This option retains only the photos that occur between the start and end of each flight line (flight lines were defined in the prior Create Flight Lines step). This option eliminates photos in turns. (Recommended). Selecting the option to "Retain Photos within Flight Lines." creates a new layer in the Table of Contents (TOC) called "RetainedPhotos". The resultant layer is shown in Figure 73. Note that only photos that are between the beginning and end of each flight line are retained.

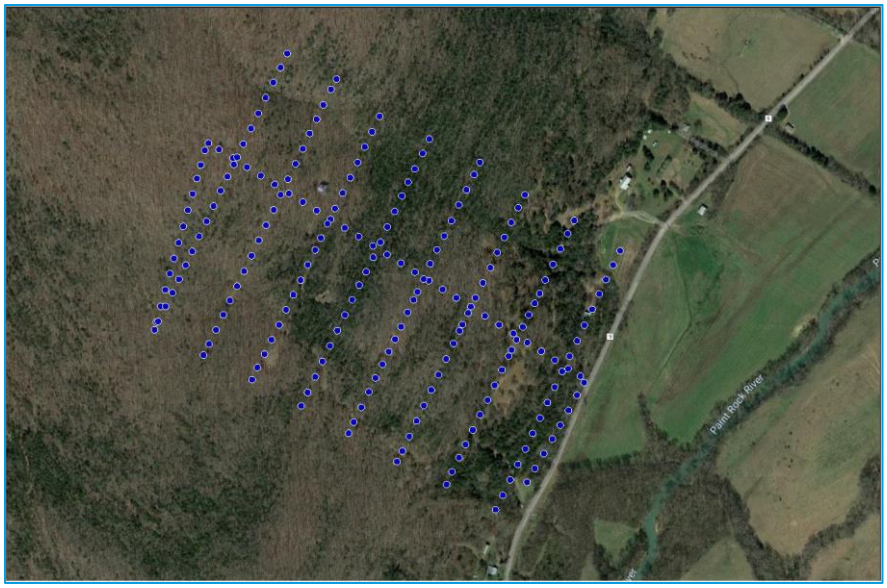


Figure 73 - Retain Photos only within Flight Lines

ii. ***Retain Photos within Flights Lines and Interior Turns*** – This option retains all photos from the start of the first flight line (*start* as defined by GPS time) and the end of the last flight line. Thus, all ferry line photos are retained.

iii. ***Retain All Photos*** – All project photos are retained. In Figure 74, all photos retained.

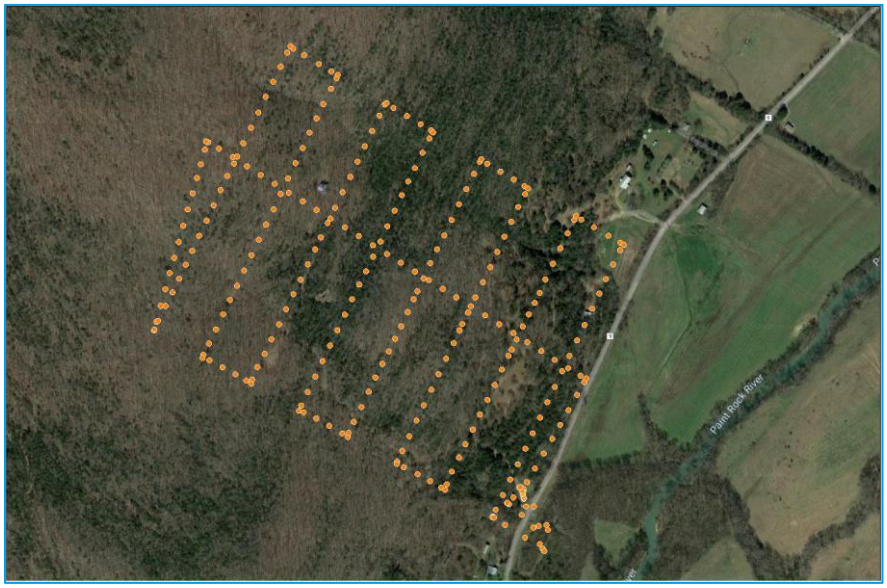


Figure 74 - All Project Camera Photos

e) **Target Epoch –** Select **Cycle Date** for coordinate reference systems using the WGS84 datum, otherwise select **Custom Date** and enter the applicable epoch for the datum of your coordinate reference system. For example, NAD83(2011) has an epoch date of 2010.0. Typically, the epoch date for your project datum should be selected by default. You will be prompted after selecting OK if the project epoch differs from the value entered on this dialog. The project epoch is set when the project CRS is selected but can be modified in File -> Project Settings -> Project -> Project Epoch.

f) **Processing Settings**

i. **Update Photo EXIF Tags with True Pose® Information** – Performs the operations of the Update EXIF Tags for Photogrammetric Software tool. Recommended to have this checked to avoid needing to separately run the Update EXIF Tags for Photogrammetric Software tool.

ii. **Starting Flight Line Number (Point Source ID)** – When there are multiple Cycles or flights in a project it is important to assign unique point source IDs, or flight line numbers to each line. Selecting a unique starting ID allows the user to determine the best values between 1 and 65535 to use for each line. For multi-Cycle projects it is suggested to use a nomenclature, such as CCCFF, where CCC is the Cycles flown for the project, 1-645, and FF is the flight line per Cycle, 1-99, to keep the point source IDs unique within the project.

4. Select ***Create TV Trajectories*** to create TrueView trajectories for the selected Flight Line layer. Once trajectories for a flight line are created the flight line will change from blue to magenta. Close the dialog when finished.

You can delete additional photos on the RetainedPhotos layer using the Feature Edit *delete* tool. Only photos associated with this layer will be geocoded and exported as an export package, which greatly eases the setup of downstream tools.

Note also that the RetainedPhotos layer behaves as a normal Photos layer. This means that the image view panes appear if you open this layer in Feature Analyst.

If you cannot remember if you have run the Create TV Trajectories step, there is no harm in running it multiple times. The FlightLines layer symbology turns magenta when this step has been run. If you want to confirm creation of the flight line trajectories, you can inspect the Flight Line *attributes* using the LP360 Feature Analyst tool. Right-click the Flight Line layer in the TOC and then left-click "Feature Analyst …" (see Figure 75).

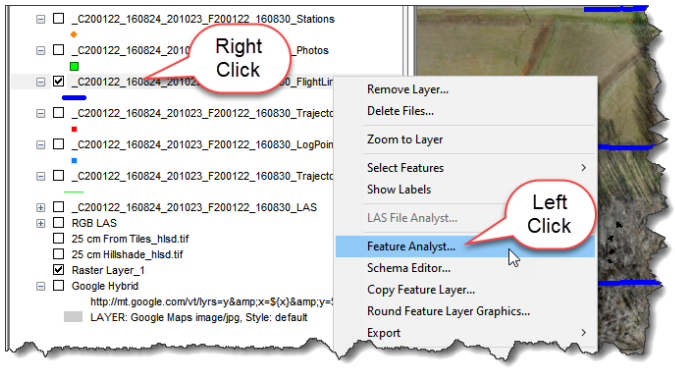


Figure 75 - Opening Feature Analyst on the Flight Line layer

Observe the "TVTrajFIle" column in the Feature table of Feature Analyst (Figure 76). If this column is blank, flight line trajectories have not yet been created.

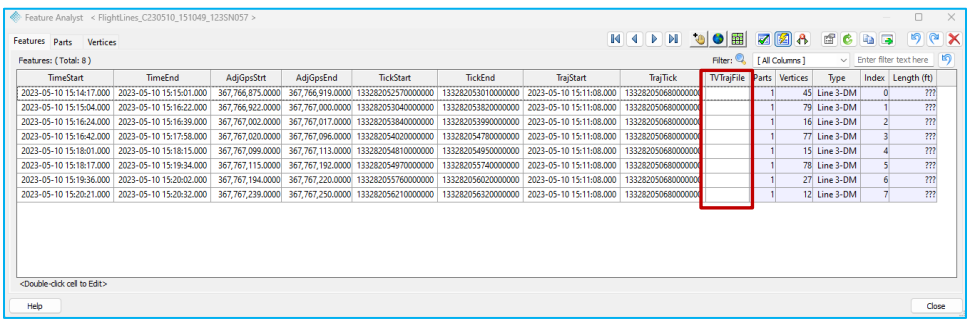


Figure 76 - TrueView Flight Lines prior to assigning Trajectories

Figure 77 shows the feature table after creation of the TrueView Flight Line trajectories. Note a file location is now populated in the TVTrajFile attribute column.

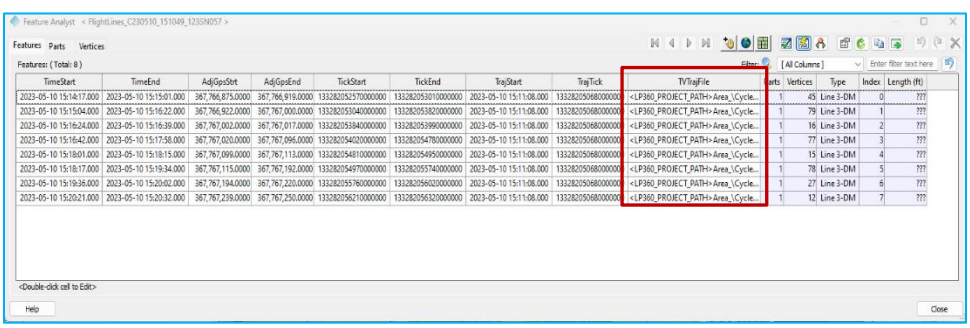


Figure 77 - TrueView Flight Lines after assigning Trajectories

Note: The Flight Line Trajectory files created in LP360 Drone for 3D Imaging Sensors (3DIS®) are in the Terrasolid trajectory format. These trajectories can be directly used in products such as TerraScan, TerraMatch and TerraPhoto.

GEOCODE LIDAR

The Geocode LiDAR step is where the raw data in the laser file is geocoded, creating a spatially accurate 3D point cloud. The steps below explain the functions of the Geocode LiDAR dialog. TrueView trajectories must have been generated before the Geocode LiDAR tool will be active.

1. If not already done, make active the Cycle/Flight combination to be processed.
2. Select the **Geocode LiDAR** button on the Sensor tab (Figure 78) to open the Geocode LiDAR dialog (Figure 79).

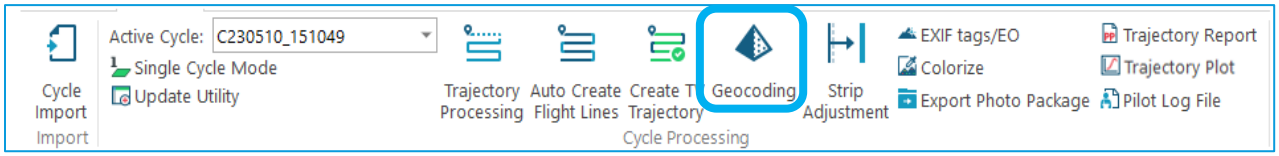


Figure 78 – Geocode LiDAR

3. The Geocode LiDAR dialog (Figure 79) is where the user will select the calibration file, and LiDAR clipping settings. A 3D point cloud, LAS files, will be generated after completing this step.
   a) **Flight Line Layer** – The layer that will be used to geocode and set by the active Cycle/Flight.

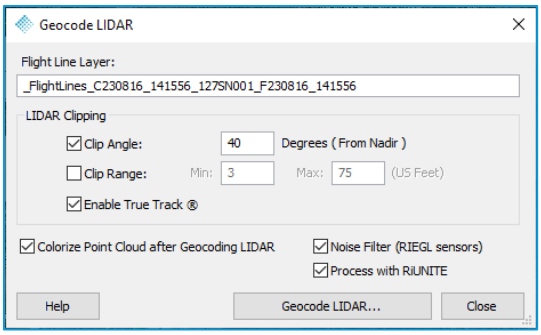


Figure 79 - Geocode LiDAR dialog

   b) **LiDAR Clipping:**
      i. **Clip Angle** – Enter the processing angle in degrees. This number represents the half angle off Nadir of the scanner. If 40 is entered, LiDAR data will be geocoded if it falls between +40° and -40° creating a total field of view (FOV) of 80°.
      ii. **Clip Range** – Enter the minimum and maximum range to be geocoded. No points with a range less than and/or greater than these values, respectively, will be geocoded. Useful when no Clip Angle is used to pick up features beside the system.
      iii. **Enable True Track®** – True Track® is our term for software-enabled roll compensation of the sensor. The roll attitude of the sensor (due to roll of the

drone carrying the sensor) is constantly reset to the nadir position and clipping (if set) applied at this point. The effect is flight lines with straight rather than wavy edges.

You should always enable True Track. For a given clipping angle, it will produce more accurate as well as better aligned data. Figure 80 shows a LiDAR swath clipped to 20° but with True Track disabled. Notice the waviness in the sides of the track.

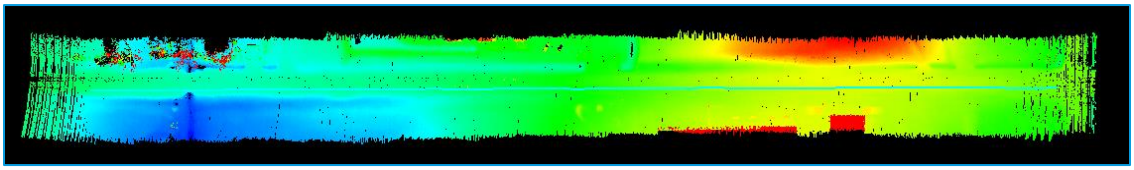


Figure 80: LiDAR Strip without True Track

Figure 81 shows the same swath, again clipped to 20°, with True Track enabled. Notice how the edges of the swath are now relatively straight.

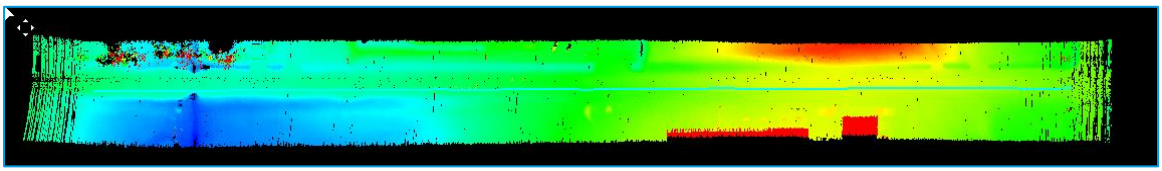


Figure 81: LiDAR Strip with True Track enabled

c) **Colorize Point Cloud after Geocoding** – At the completion of geocoding the LiDAR data, automatically kick-off the Colorize Point Cloud step of the TrueView Workflow in the Sensor tab (Figure 55) to use the photos to colorize each point in the point cloud for this Cycle/Flight. Selecting the option here allows one to skip running the Colorize Point Cloud step.

Support for colorizing mobile datasets in LP360 using ray tracing is currently in development. If you need to colorize the mobile point clouds this needs to be performed with Rigel RiProcess or using LP360's Color by Image Point Cloud Task (PCT) using an orthomosaic.

d) **Noise Filter (Riegl sensors only)** – Enabled by default when processing Riegl laser scanner data, this option will help automatically filter noise points from being geocoded. A user would not normally disable this option but may wish to do so when the density of the point cloud is more important than the accuracy of the points.

e) **Process with RiUNITE (TV680/TV720 Riegl sensors only)** – Available only when processing TV680 or TV720 Riegl laser scanner data and requires an applicable scanner specific Riegl license installed on the machine. The option supports MTA zones during

geocoding, adding a significant amount of extra processing time, so a user would normally disable this option when the Cycle was flown lower than the first transition zone but may wish to enable when close due to slant ranges. Failing to use this option when needed may result in an abnormal amount of noise in the dataset.

4. **Geocode LiDAR** – LiDAR data will be geocoded when this button is selected, creating the LAS layer for the selected Cycle.

POST PROCESSING TOOL

The Post Processing tool can be used for all sensor types imported in LP360. The purpose of this tool is to prepare the datasets for post processing tools. The main need is to use the flight line layer to create a trajectory file for each flight line from the sensor trajectory file(s) and cut the LAS data into files corresponding to those flight lines, plus, apply any additional user desired filtering while performing this operation. This tool is helpful when processing large datasets as one can geocode everything, and later cut and filter as desired without needing to geocode again.

1. On the Sensor tab (Figure 50), make active the Cycle/Flight combination to be processed.
2. Open the **Post Processing** dialog by selecting the sensor **Post Processing** button on the Sensor tab (Figure 82) to open the Post Processing dialog (Figure 83).

Figure 82 - Post Processing tool on the Sensor Ribbon

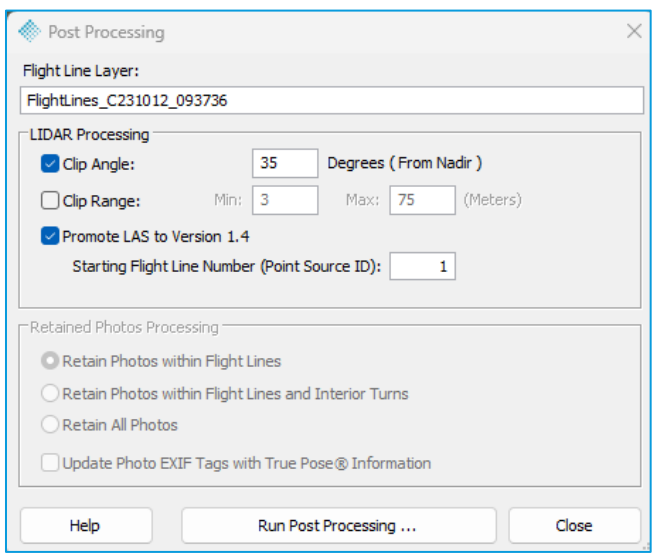


Figure 83 - Post-Processing Dialog

a) **LiDAR Processing:**
   i. **Clip Angle** – Enter the processing angle in degrees. This number represents the half angle off Nadir of the scanner. If 40 is entered, LiDAR data will be geocoded if it falls between +40° and -40° creating a total field of view (FOV) of 80°.

ii. **Clip Range** – Enter the minimum and maximum range to be geocoded. No points with a range less than and/or greater than these values, respectively, will be geocoded. Useful when no Clip Angle is used to pick up features beside the system.

iii. **Promote LAS to Version 1**.4 – Default is checked. This ensures the output LAS file format will be 1.4.

iv. **Starting Flight Line Number (Point Source ID)** – When there are multiple Cycles or flights in a project it is important to assign unique point source IDs, or flight line numbers to each line. Selecting a unique starting ID allows the user to determine the best values between 1 and 65535 to use for each line. For multi-Cycle projects it is suggested to use a nomenclature, such as CCCFF, where CCC is the Cycles flown for the project, 1-645, and FF is the flight line per Cycle, 1-99, to keep the point source IDs unique within the project.

b) **Retained Photos Layer Settings** – This section will only become available when a photo layer is detected. Allows the user to specify the photos to be kept for geotagging and export to photogrammetric software packages using Export Photo Package or for processing in Agisoft Ortho Mapping, or for processing in Ortho Mapping. The notion of "Retained Photos" creates a layer of the retained photos on a new layer called "RetainedPhotos."

i. ***Retain Photos within Flight Lines*** – This option retains only the photos that occur between the start and end of each flight line (flight lines were defined in the prior Create Flight Lines step). This option eliminates photos in turns. (Recommended). Selecting the option to "Retain Photos within Flight Lines." creates a new layer in the Table of Contents (TOC) called "RetainedPhotos". The resultant layer is shown in Figure 84. Note that only photos that are between the beginning and end of each flight line are retained.

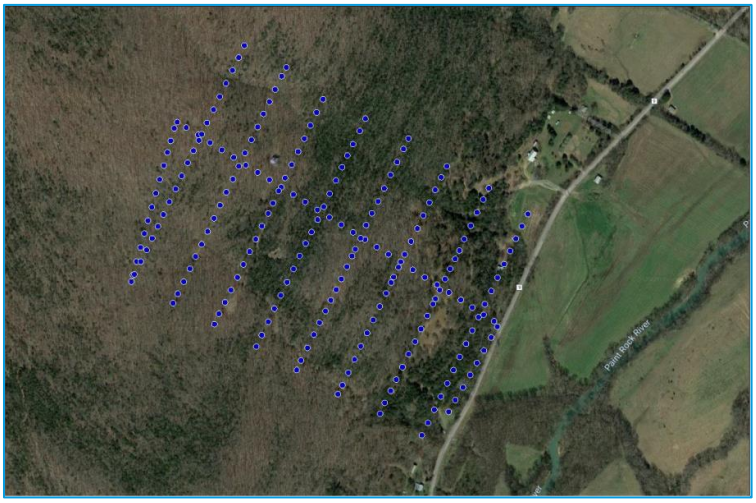


Figure 84 - Retain Photos only within Flight Lines

ii. ***Retain Photos within Flights Lines and Interior Turns*** – This option retains all photos from the start of the first flight line (*start* as defined by GPS time) and the end of the last flight line. Thus, all ferry line photos are retained.

iii. ***Retain All Photos*** – All project photos are retained. In Figure 85Figure 74, all photos retained.

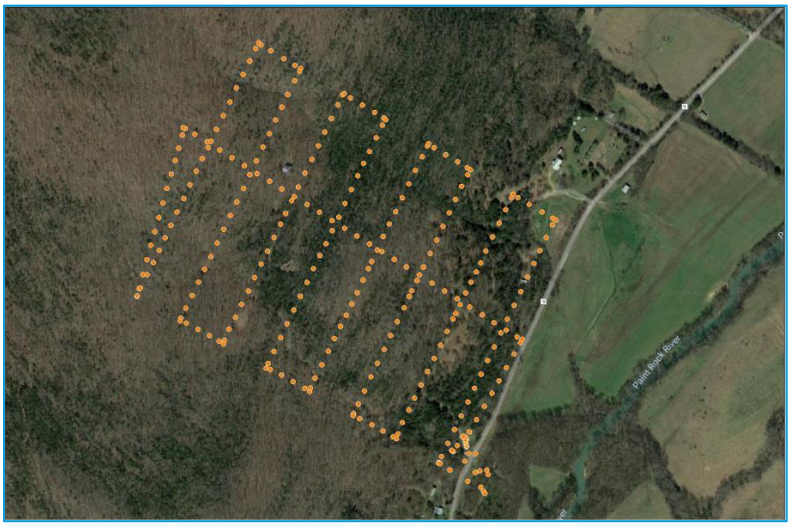


Figure 85 - All Project Camera Photos

4. A Confirmation page will appear to confirm the execution of the tool (Figure 86).

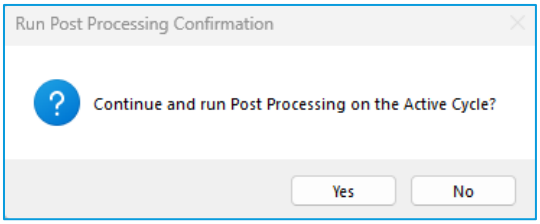


Figure 86 - Post Processing Confirmation Page

STRIP ADJUSTMENT

For a TrueView 3DIS and microdrones payloads, strip alignment may be improved by executing an addon license to LP360 Drone, called **Strip Adjustment**. Refer to the method and context behind Strip Adjustment. For boresite calibration, use the Boresite Calibration utility found on the Sensor tab.

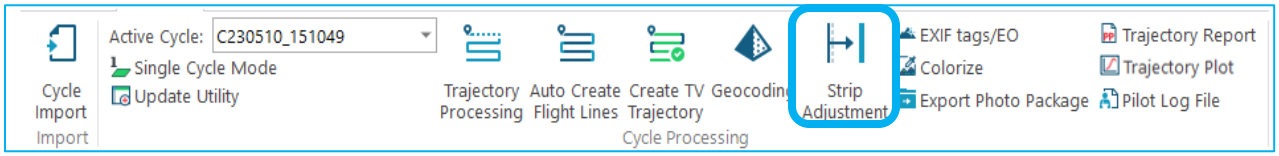


Figure 87 - Strip Adjustment on the Sensor tab

Strip Adjustment requires a "Strip Adjustment" or a "Strip Align" addon license be checked out in addition to the LP360 Drone license. Note: LP360 Drone+Strip Adjustment may only be used with TrueView 3DIS® or microdrones data.

A good way to assess the need for using LP360 Strip Adjustment on your dataset is to inspect the data using profiles to review the interline fit and generate dz image(s) using the LP360 Export Wizard.

1. The active Cycle on the Sensor tab is not used by this utility, so it does not matter what is selected.
2. Select **Strip Adjustment** on the Sensor tab (Figure 87) to open the Strip Adjustment dialog (Figure 88). **Note:** To enable this tool requires a "Strip Adjustment" or a "Strip Align" addon license be checked out in addition to the "LP360 Drone" license.

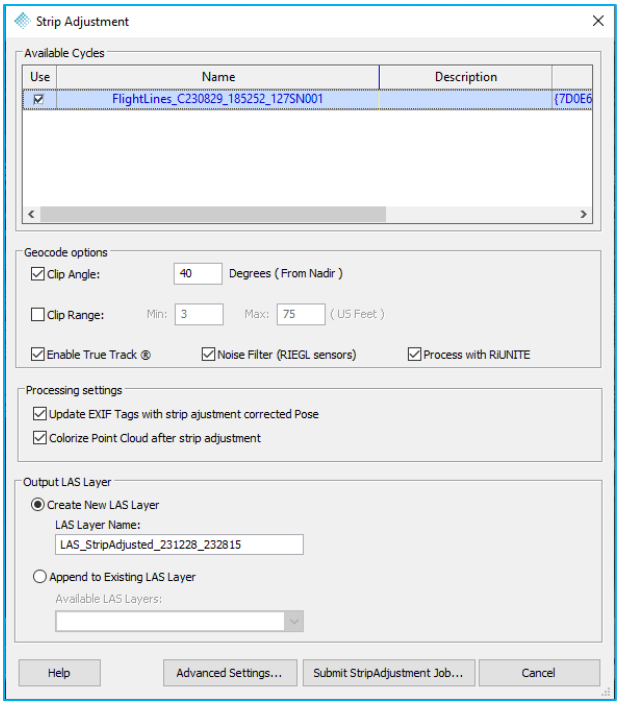


Figure 88 - Strip Adjustment dialog

a) **Input Settings**
   i. **Available Cycles** – Lists all Cycles in the currently open project.
   ii. **Use** – Select the checkbox in the "Use" column beside a Cycle to determine corrections for that Cycle. The Cycle must have a processed sensor trajectory in the typical file structure when following the TrueView workflow.

b) **Geocode Options**
   i. The Geocode LiDAR options are listed here as the Strip Alignment process will geocode a new point cloud from the raw data using a corrected sensor trajectory. Use the same options you would for Geocode LiDAR.

c) **Processing Settings**
   i. **Update EXIF tags with strip adjustment corrected Pose** – As the Strip Adjustment computes a corrected sensor trajectory, the same corrections apply to the photos so update the image EXIF tags at this time to refine the True Pose information on the photos. Recommended enabled.
   ii. **Colorize Point Cloud after strip adjustment** – As the Strip Alignment process will geocode a new point cloud from the raw data using a corrected sensor trajectory it will need to be colorized at this time if colorization is desired. At the completion of geocoding the LiDAR data, automatically kick-off the Colorize Point Cloud step of the Sensor tab to use the photos to colorize each point in the point cloud for the selected Cycles/Flights. Selecting the option here allows one to skip running the Colorize Point Cloud step. Recommended enabled.

d) **Output Settings**

i. **LAS Layer Name** – Type in a unique name for the destination layer on which to generate the corrected LAS files from the "Use" layers. This is the typical first or only run option. Default name is "LAS_StripAdjusted_YYMMDD_hhmmss, where the date/time stamp is when the Strip Adjustment tool was invoked.

ii. **Append to Existing LAS Layer** – Select from the Available LAS Layer the previously created layer name on which to append the additional Cycle(s). Not typical.

e) **Submit StripAdjustment Job** – Submits the Strip Adjustment processing to the Job Manager queue for processing.

3. A successfully submitted job notification will appear confirming the job submission (Figure 104).

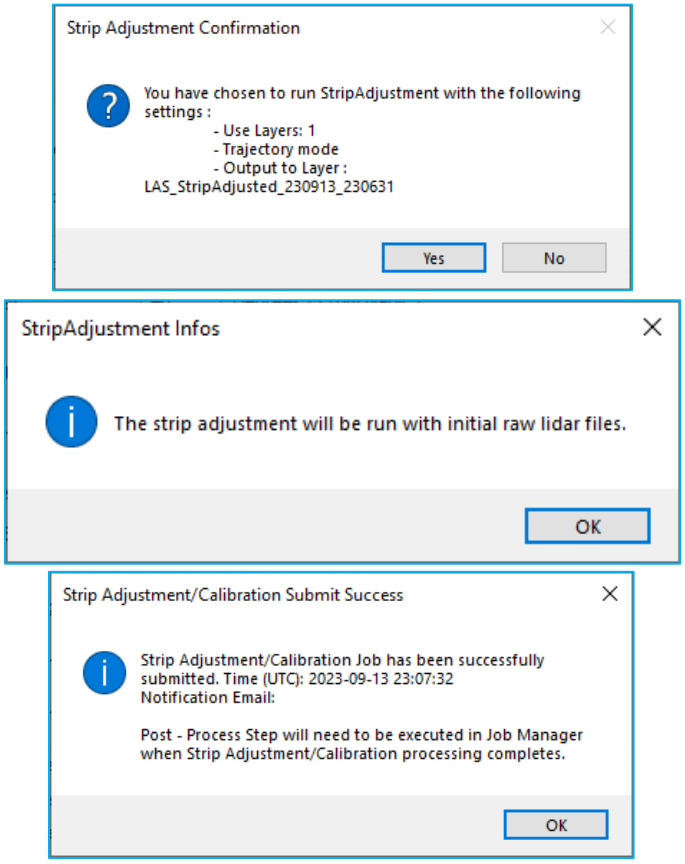


Figure 89 - Strip Adjustment Job Submission Confirmations

4. An empty e-mail will be sent when the processing begins to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings).
5. The Strip Adjustment job progress may be monitored using Job Manager.
6. Upon completion of the Strip Adjustment job by the Job Manager:

a) Job Manager will indicate completion by the green checkmark flashing on the Job Manager icon
b) An empty completion e-mail notification will be sent to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings)
c) The job will need to be post-processed to add the resulting LAS layer and/or LAS files to the open project.

7. In Job Manager, select the applicable Strip Adjustment job, then select View Log to review the Strip Adjustment processing log.
   a) Review the STDERR section for any reported errors.
8. In Job Manager, select the applicable Strip Adjustment job, then select Open Project to open the applicable project for the job, if not currently open.
9. Then, select Post-Process to add the new LAS Layer and/or LAS file(s) to the currently open project based on the settings at the time the job was submitted.
10. Review the adjusted LAS data vs the original to determine suitability of the correction. Cut profiles and generate a dz image for comparison to those done before the adjustment.
11. When desired, in Job Manager, select the applicable Strip Adjustment job, then select Delete Job to clean up the temporary files generated while processing the job.

STRIP ADJUSTMENT ADVANCED SETTINGS

The most commonly configurable Strip Adjustment settings are configured on the Strip Adjustment Advanced Settings dialog (Figure 90). The defaults are the recommended settings, though users may wish to modify for some datasets.

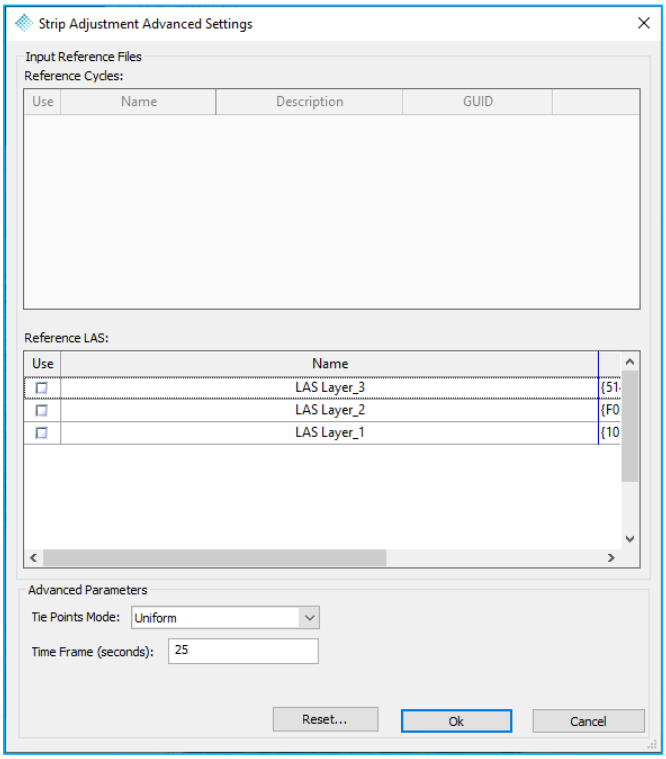


Figure 90 - Strip Adjustment Advanced Settings

- **Input Reference Files**
  - **Reference Cycles** – This list is populated with the Cycles in the project that were not selected in the Input Settings. Select the checkbox in the "Use" column beside a Cycle to hold that Cycle fixed and use as reference for the "Use" layers of the Input Settings -> Available Cycles list. The Cycle must have a processed sensor trajectory in the typical file structure when following the TrueView workflow.
  - **Reference LAS** – Select the checkbox in the "Use" column beside a LAS layer to hold that layer fixed and use as reference for the "Use" layers of the Input Settings -> Available Cycles list. Trajectories are neither required, nor used for reference LAS layers.
- **Advanced Parameters**

  This is dedicated to advanced users, so non-advanced users should not modify this section. Changing these settings will change how Strip Adjustment results are generated and may also affect the processing time.

- **Tie Points Mode** – To estimate the trajectory correction, only a portion of data is considered. The considered portion is constituted of points, which we refer to as Tie points. Tie points should be representative enough of the sensor trajectory errors. This is realized by subsampling the data. There are two implemented subsampling methods. This parameter enables to define the one used:
    - **Uniform: Recommended mode.** Tie points are uniformly distributed through the terrain. This option should be used for non-flat terrains. It is also recommended for high dynamic trajectory errors.
    - **Normal:** Tie points are equally distributed on each inch of the terrain with a different orientation. This option should be used for terrains with a predominant direction where the variation of the orientation is relatively small. It is also recommended for low dynamic trajectory errors.
- **Time Frame (seconds)** – defines the frequency of the estimated temporal correction of the trajectory. The smaller the value, the higher the frequency of the correction. The higher the frequency of correction, the more time consuming is the processing.

Minimum value	High dynamic error	Low dynamic error	Maximum value
5 secs	15 secs	25 secs (default)	N/A - depends on the flight line length

Table 2 - Time Frame Recommendations

- **Reset** – Resets the Strip Adjustment advanced settings back to their default values.

COLORIZE POINT CLOUD

Colorize Point Cloud on the Sensor tab (Figure 91) uses the photos to colorize each point in the point cloud. The colorization of the point cloud will depend on the quality of the photos. If colorization is critical to the project, it is recommended to check the photo quality in the field prior to leaving the site. This step may be skipped if already run by selecting the **Colorize Point Cloud after Geocoding** checkbox on the Geocode LiDAR dialog.

1. If not already done, make active the Cycle/Flight combination to be processed.
2. Select ***Colorize Point Cloud*** on the Sensor tab (Figure 91) and the colorize point cloud dialog (Figure 92) will open.

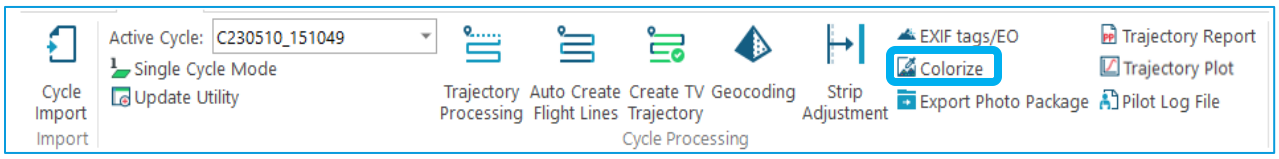


Figure 91 – Colorize Point Cloud

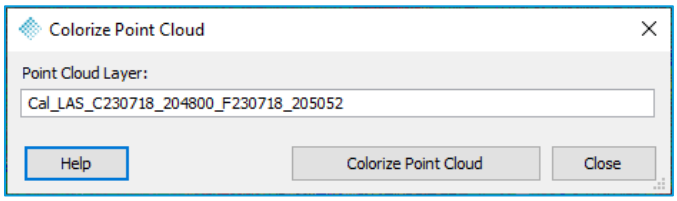


Figure 92 – Colorize Point Cloud dialog

3. The photo layer that will be used to colorize the point cloud is auto selected for the active Cycle/Flight.
4. Select *Colorize Point Cloud* on the dialog and the point cloud for the active Cycle/Flight will be colorized. The display mode is changed to **Display by RGB Values** .
5. Close when finished.

Colorizing the point cloud is a more time-consuming process than Geocoding. Processing status will be displayed in the lower left section of the LP360 main window frame and swaths will be loaded in the Map View, with Display by Color enabled, as they complete processing. An example of a colorized point cloud from a TrueView 516 3DIS® is shown in Figure 93. An example of a colorized point cloud from a TrueView 615 3DIS® is shown in Figure 94.

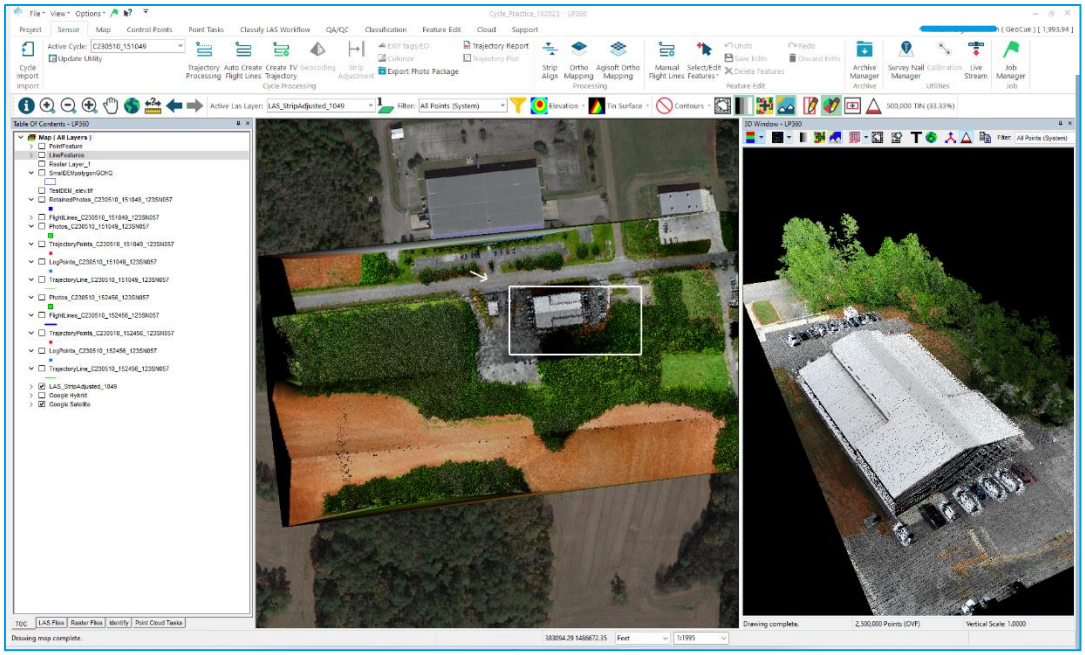


Figure 93: A colorized TrueView 516 Point Cloud

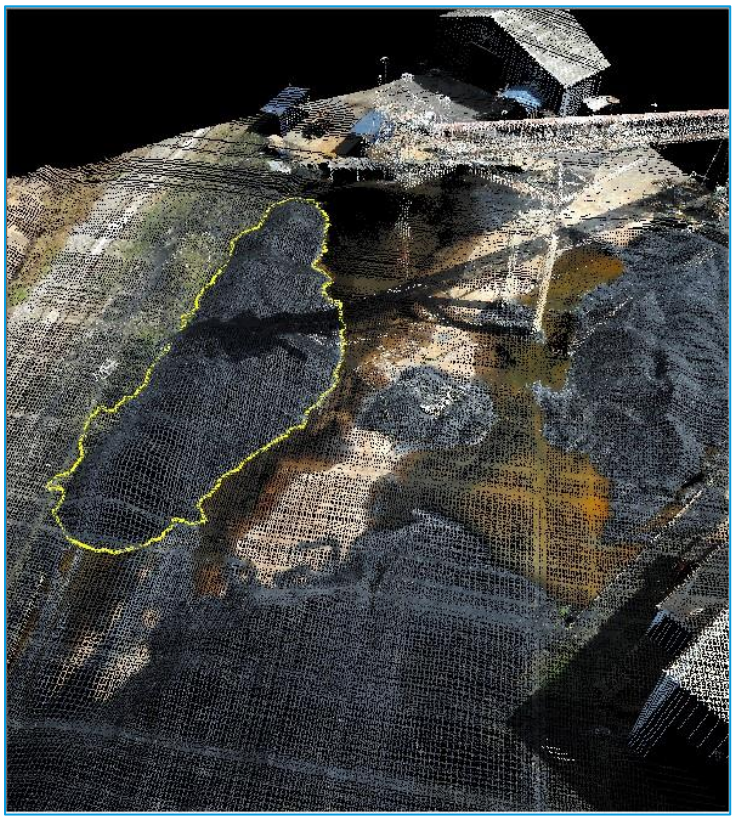


Figure 94 - A colorized TrueView 615 Point Cloud

UPDATE EXIF TAGS FOR PHOTOGRAMMETRIC SOFTWARE

Update EXIF Tags on the Sensor tab (Figure 95) will geotag each photo with the corrected position and accuracy value. Photos that were taken outside of the corrected trajectory file, such as photos on the ground before takeoff, will be removed. **This utility must be run to use the images in Metashape, Pix4D and other photogrammetric packages with similar workflows.** This step may be skipped if already run by selecting the **Update Photo EXIF Tags with True Pose® Information** checkbox on the Create TrueView Trajectories dialog. When completed, the Export Photo Package tool will be enabled.

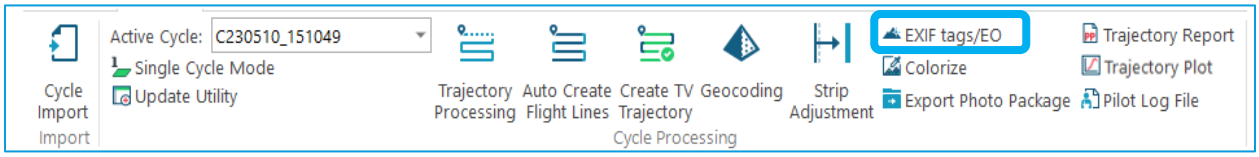


Figure 95 – Update EXIF Tags

1. If not already done, make active the Cycle/Flight combination to be processed.
2. Select ***Update EXIF Tags*** on the Sensor tab (Figure 95) to open the Update EXIF tags dialog (Figure 96).

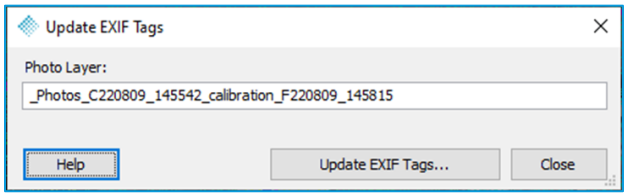


Figure 96 - Update EXIF Tags dialog

3. The photo layer that will be used to update the EXIF tags is selected based on the active Cycle/Flight combination on the Sensor tab.
4. Select *Update EXIF Tags* to tag the images.
5. A confirmation dialog (Figure 97) will appear showing the number of images that will be removed. This is a result of those images being outside of the corrected trajectory time frame and normal for the tagging process. Select *yes* to continue.

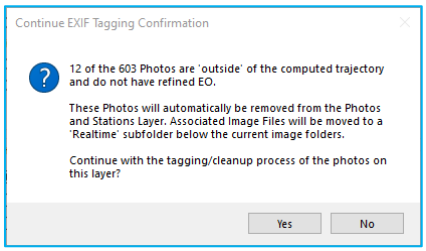


Figure 97 - EXIF Tagging Confirmation

6. When the process is complete, select OK on the confirmation dialog.

7. The images from both cameras are now tagged. Proceed to the Export Photo Package tool to export the photos on the Retained layer and associated camera calibration files for downstream processing in photogrammetric processing software.
8. To review the updated EXIF information in LP360 Drone:
    A) Select and right-click on the Photo or Stations layer in the Table of Contents (TOC) and select Feature Analyst.
    B) Select a photo or station from the Features list in Feature Analyst.
    C) Right-click on the desired image displayed in the lower section of Feature Analyst and select EXIF Information from the menu.

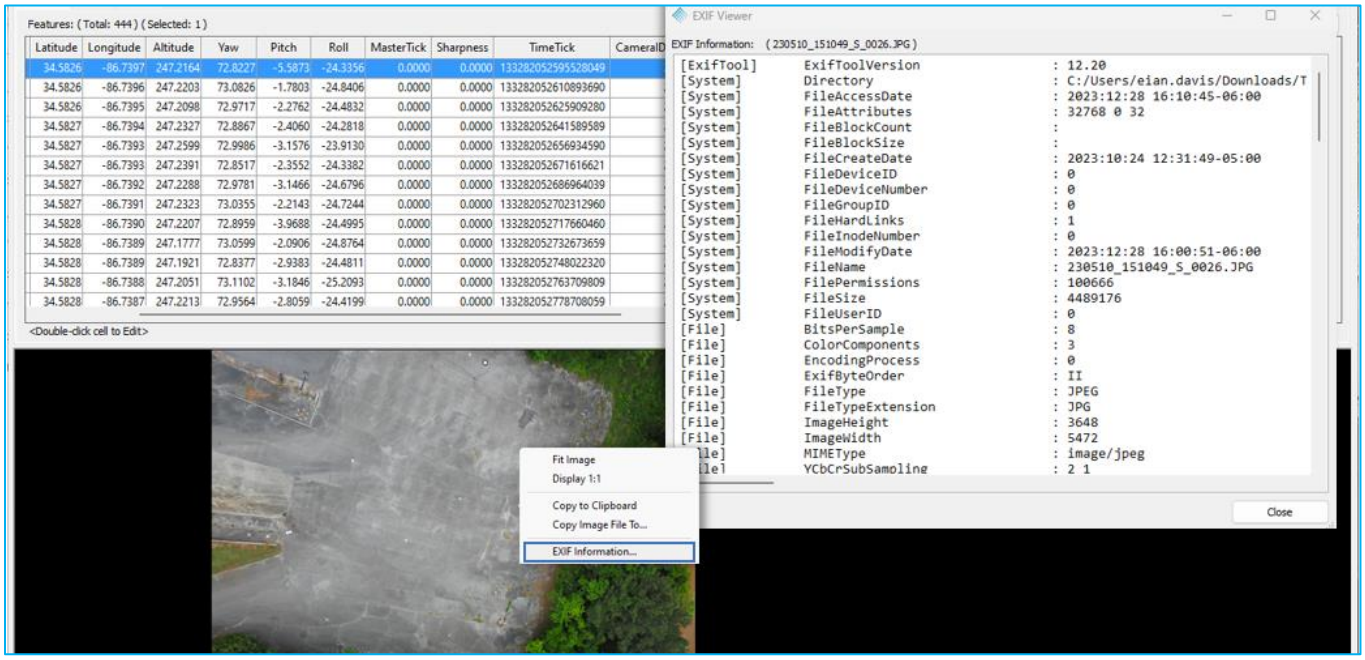


Figure 98 - Image EXIF Viewer

9. For troubleshooting purposes, the following information is left in this user guide but is superfluous when using the Export Photo Package tool.
    a) Tagged images, suitable for **Metashape**, are in the project folder, in the Port and Starboard folders (Figure 99) (Project\Area_\Cycle_YYMMDD_HHMMSS\Flight_YYMMDD_HHMMSS\)

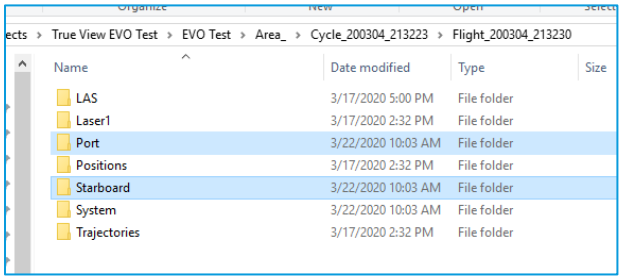


Figure 99 – Example Location of Tagged Images

b) Two CSV files with the image positions are created in the System folder in the same location (Project\Area_\Cycle_YYMMDD_HHMMSS\Flight_ YYMMDD_HHMMSS\System)
   i. The CSV file named "Image_geo_eo.csv" (Figure 100) contains the image positions in geographic coordinates, height in meters. The orientation angles are yaw, pitch and roll in degrees.
   ii. The CSV file named "Image_proj_eo.csv" (Figure 100) contains the image positions in projected coordinates, height in project units. The orientation angles are yaw, pitch and roll in degrees.
   iii. The CSV file named "image_geo_opk.csv" contains the image position file in geographic coordinates, height in meters, with the orientation angles represented as omega, phi, kappa in degrees. **This file is configured to be used in Pix4D**.

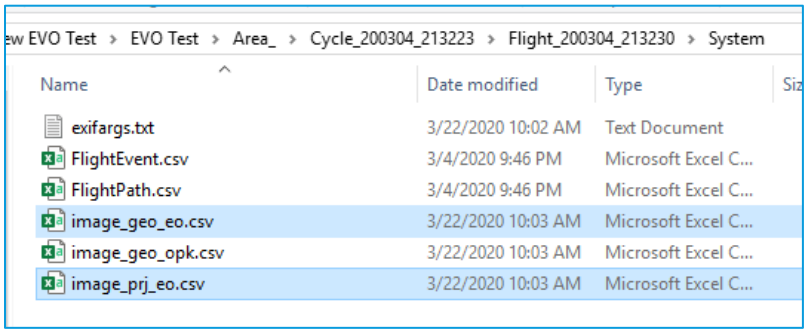


Figure 100 – Example Location of Image Position Files

c) Camera calibration files are also created for each camera in Project\Area_\Cycle_YYMMDD_HHMMSS\Flight_ YYMMDD_HHMMSS\System folder (Figure 101).
   i. The xml files named *Port.xml* and *Starboard.xml* can be **directly imported into Metashape**.
   ii. The text files named *PortP4D.txt* and *StarboardP4D.txt* **can be used in Pix4D**.

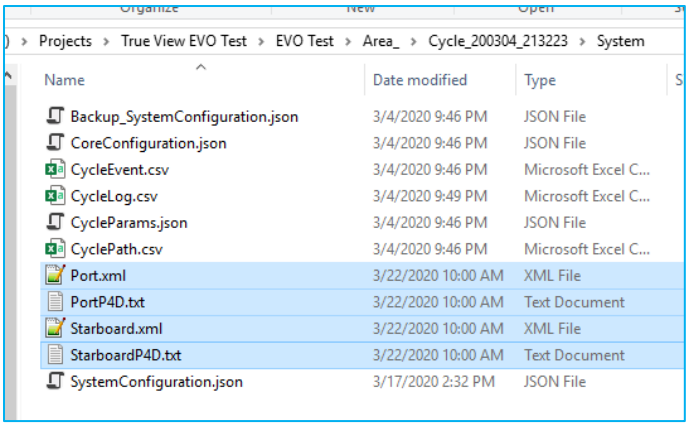


Figure 101 – Example Location of Camera Calibration Files

LP360 STRIP ALIGN (FKA STRIPALIGN FOR EVO(SAFE))

For a TrueView 3DIS, microdrones, and DJI Zenmuse L1/L2, strip alignment may be improved by executing an addon license to LP360 Drone, called **Strip Align** .

Figure 102 - Strip Align on the Sensor tab

LP360 Strip Align requires a "Strip Align" addon license be checked out in addition to the LP360 Drone license. Note: LP360 Drone+Strip Align may only be used with TrueView 3DIS®, microdrones, or DJI Zenmuse L1/L2 data.

A good way to assess the need for using LP360 Strip Align on your dataset is to inspect the data using profiles to review the interline fit and generate dz image(s) using the LP360 Export Wizard.

1. The active Cycle on the Sensor tab is not used by this utility, so it does not matter what is selected.
2. Select ***Strip Align*** on the Sensor tab (Figure 102) to open the Strip Align dialog (Figure 103). **Note:** To enable this tool requires a Strip Align addon license to be checked out in addition to the LP360 Drone license.

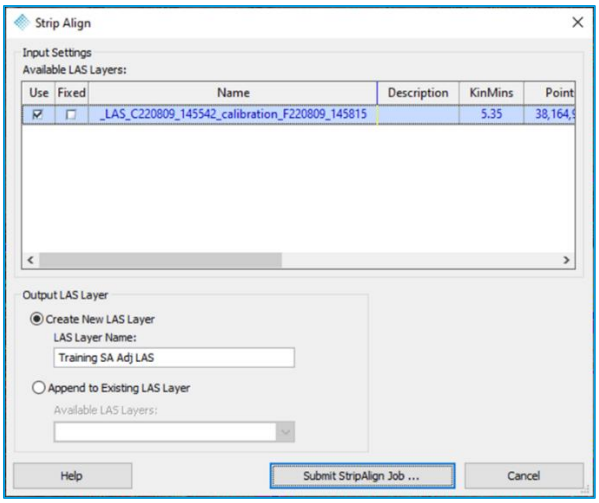


Figure 103 – Strip Align dialog

Note: There are no "tuning" parameters for LP360 Strip Align; it is fully automated.

a) **Input Settings**
   i. **Available LAS Layers** – Will list all LAS layers in the currently open project.
   ii. **Use** – Select the checkbox in the "Use" column beside a LAS layer to determine corrections for that layer. The layer must have trajectories located in the same folder as the LAS, or in a Trajectories folder at the same level as the LAS data as is the typical file structure when following the TrueView workflow.
   iii. **Fixed** – Select the checkbox in the "Fixed" column beside a LAS layer to hold that layer fixed and use as reference for the "Use" layers. Trajectories are neither required, nor used for fixed layers.
   iv. There are no "tuning" parameters for Strip Align, it is fully automated.

b) **Output Settings**
   i. **LAS Layer Name** – Type in a unique name for the destination layer on which to generate the corrected LAS files from the "Use" layers. This is the typical first or only run option.
   ii. **Append to Existing LAS Layer** – Select from the Available LAS Layer the previously created layer name on which to append the additional Cycle(s).

c) **Submit StripAlign Job** – Submits the Strip Align processing to the Job Manager queue for processing.

3. A successfully submitted job notification will appear confirming the job submission (Figure 104).

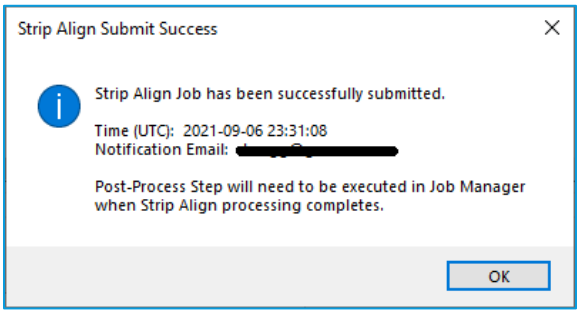


Figure 104 - Strip Align Job Submission Confirmation

4. An empty e-mail will be sent when the processing begins to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings).
5. The Strip Align job progress may be monitored using Job Manager.
6. Upon completion of the Strip Align job by the Job Manager:
   a) Job Manager will indicate completion by the green checkmark flashing on the Job Manager icon
   b) An empty completion e-mail notification will be sent to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings)
   c) The job will need to be post-processed to add the resulting LAS layer and/or LAS files to the open project.

7. In Job Manager, select the applicable Strip Align job, then select View Log to review the Strip Align processing log.
    a) Review the STDOUT section for "XYZ-displacements RMS" statistics before the correction and "Residual RMS" after the correction.
    b) Review the STDERR section for any reported errors aside from the expected benign warnings.

```
STDERR:
=======
WARNING: Uncertainty vector image: z multiplied by 10
WARNING: no mount file specified, using BODY/IMU rot=0 and Bore=0
```

8. In Job Manager, select the applicable Strip Align job, then select Open Project to open the applicable project for the job, if not currently open.
9. Then, select Post-Process to add the new LAS Layer and/or LAS file(s) to the currently open project based on the settings at the time the job was submitted.
10. Review the adjusted LAS data vs the original to determine suitability of the correction. Cut profiles and generate a dz image for comparison to those done before the adjustment.
11. When desired, in Job Manager, select the applicable Strip Align job, then select Delete Job to clean up the temporary files generated while processing the job.

ORTHO MAPPING

For TrueView, microdrones, and DJI image sensors, the orthomosaic can be generated and the image positions and orientations refined using **Ortho Mapping** , that is included in an addon license to LP360 Drone, called **Photo**. A "Photo3000" or legacy "Full Photo" addon license may also enable this tool.

Figure 105 – Ortho Mapping on the Sensor tab

Ortho Mapping from Images (Photo Layers) requires a very recent version of your graphics driver that supports CuDA 12.0. Typically, that means manually downloading and installing a driver from the manufacturer that has been released since December 2022.

1. The active Cycle/Flight combination on the Sensor tab is not used by this utility, so it does not matter what is selected.
2. Select ***Ortho Mapping*** on the Sensor tab (Figure 105) to open the Ortho Mapping dialog (Figure 106). **Note:** To enable this tool requires a "Photo", or "Photo3000", or legacy "Full Photo" addon license be checked out in addition to the LP360 Drone license.

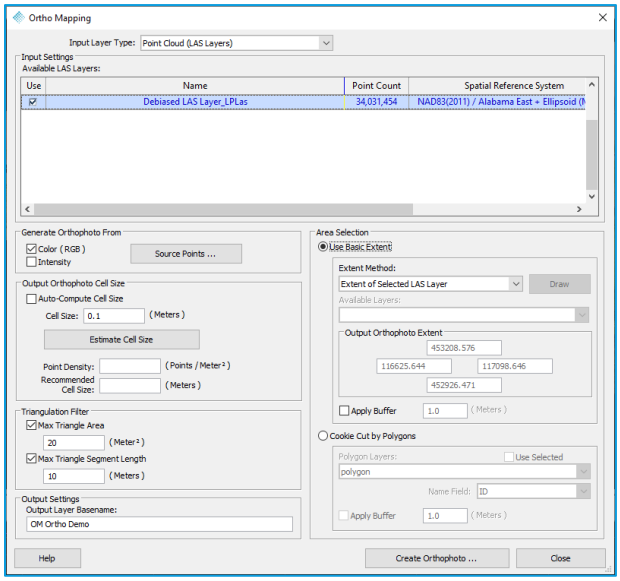


Figure 106 – Ortho Mapping dialog with Input Layer Type: Point Cloud (LAS Layers)

a) Input Layer Type:

The two modes available for the Ortho Mapping tool are predicated on the selection of the Input Layer Type.

i. **Point Cloud (LAS Layers)** – **Recommended for with TrueView 3DIS and microdrones**, since the heavy lifting has already been done by the point cloud colorization, the user may select to use the colorized point cloud LAS Layer from which to quickly generate an orthomosaic in a fraction of the time it would take to use the photos. Select the desired colorized point cloud LAS layer(s) from which to generate the orthophoto.

ii. **Images (Photo Layers)** – For TrueView, microdrones, and DJI image sensors, the orthomosaic can be generated from the photos, and the image positions and orientations refined by selecting the images on the Photo layer(s) as the input.

INPUT LAYER TYPE: POINT CLOUD (LAS LAYERS)

3. With the input layer type selected to be **Point Cloud** the Ortho Mapping dialog looks like Figure 106.
   a) **Input Settings**
      i. **Available LAS Layers** – Select the checkbox in the "Use" column beside all desired colorized LAS layers that you wish to use as source points for the orthomosaic generation. This would typically include LAS layers for every Cycle in the project that covers the desired area.
   b) **Generate Orthophoto From**
      i. **Color (RGB)** - This option will generate an RGB orthophoto using the RGB attributes from the selected Source Points.
      ii. **Intensity** – This option will generate a greyscale orthophoto using the intensity attributes from the selected Source Points.
      iii. **Source Points** – Selecting will open Live View to allow filtering the points to be used from the input LAS Layers based on the available criteria.
   c) **Output Orthophoto Cell Size** – Specify the ground sample distance (GSD) of the orthophoto to be generated in the project map units.
      i. **Auto-Compute Cell Size** – **Not Recommended** – will disable the other options in this group box and compute the cell size to use during processing.
      ii. **Cell Size** – Key in your desired cell size.
         1. **Estimate Cell Size** – when pressed, will sample the input LAS layers to populate the *Point Density* and *Recommended Cell Size* and populate the *Cell Size* with that same recommended value. It is recommended to manually modify the value in the *Cell Size* to increase it slightly and make it a round number. For example, if the *Recommended Cell Size* is 0.082 meters, then modify the *Cell Size* field to be 0.1 meters.
   d) **Triangulation Filter** – The selected attributes from the input LAS Layers will be triangulated and then sampled to produce the orthophoto. Use these settings to filter triangles based on their attributes to minimize the inclusion of long triangles that may span areas of void data to help clean up your orthophoto.
      i. **Max Triangle Area**
      ii. **Max Triangle Length**

e) **Output Settings** – Specify the *Output Layer Basename* for the orthophoto(s) to be generated on.

f) **Area Selection** – Define the extents for the orthophoto.

   i. **Use Basic Extent**

      1. **Extent Method**

         a. **Extent of Selected LAS Layer(s)**

         b. Custom Extent – manually enter the *Output Orthophoto Extents*.

         c. Current Map Extent – uses the current map view extents to define the *Output Orthophoto Extents*.

         d. Layer Extent – Enables the layer selection dropdown to select which layers extents to use to define the *Output Orthophoto Extent.*

         e. Draw Window in Map – Select Draw then draw a rectangle in the map view to define the *Output Orthophoto Extent*.

      2. Output Orthophoto Extent – changes with the Extent Method selected to describe the rectangular bounding box in map coordinates.

      3. Apply Buffer – enable and enter the buffer value to increase the size of the triangulated surface to some buffered distance around the *Output Orthophoto Extent.*

   ii. **Cookie Cut by Polygons**

      1. **Polygon Layers** – select the layer from which to use the polygon features to generate one orthophoto for each polygon.

         a. **Use Selected** – enable to only generate a single orthophoto for the polygon which has been selected from the selected polygon layer.

      2. **Name Field** – choose which field to use to uniquely name the generated orthophoto files for each polygon.

      3. **Apply Buffer** – enable and enter the buffer value to increase the size of the triangulated surface to some buffered distance around each *polygon.*

g) **Create Orthophoto** – Executes the Export Wizard to generate the orthophoto(s). s the process is relatively quick, a progress bar appears during processing and there is no job submitted to the Job Manager.

INPUT LAYER TYPE: IMAGES (PHOTO LAYERS)

3. After selecting the input layer type to be **Images** the Ortho Mapping dialog will change to look like Figure 107.

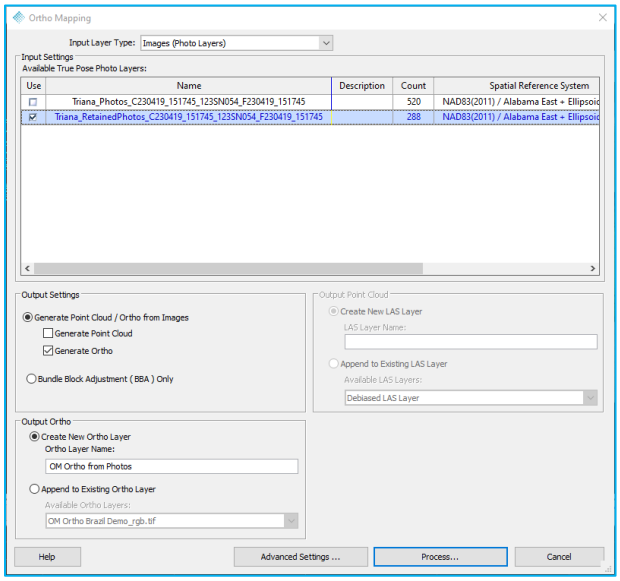


Figure 107 – Ortho Mapping dialog with Input Layer Type: Images (Photo Layers)

a. **Input Settings**
   i. **Available True Pose® Photo Layers** – Select the checkbox in the "Use" column beside all desired True Pose® layers that you wish to use as source photos for the orthomosaic generation. This would typically include all RetainedPhotos layers for every Cycle in the project that covers the desired area. A True Pose® image means their full metadata, including camera calibration, is stored in special GeoCue tags within each photo's EXIF tags.

b. **Output Settings**
   i. **Generate Point Cloud / Ortho from Images** - This option will generate a Dense Image Matching (DIM) point cloud.
      1. **Generate Point Cloud (LAS)** - generate and retain the Dense Image Matching (DIM) point cloud to add to the project during the post-process step.
      2. **Generate Ortho** - generate and retain the orthomosaic to add to the project during the post-process step.
   ii. **Bundle Block Adjustment (BBA) Only** – Useful for troubleshooting, or to improve the True Pose® information for use with Image Explorer when not generating an orthomosaic.

c. **Output Point Cloud** – Only use this option for 2DIS (image only systems).
   i. **Create New LAS Layer - LAS Layer Name** – Type in a unique name for the destination layer on which to generate the DIM LAS files from the Ortho Mapping run.

ii. **Append to Existing LAS Layer** – Select from the Available LAS Layer the previously created layer name on which to append the additional DIM LAS files.

d. **Output Ortho**

i. **Create New Ortho Layer** – **Ortho Layer Name** – Type in a unique name for the destination layer on which to generate the orthomosaic raster resulting from this Ortho Mapping run.

ii. **Append to Existing Ortho Layer** – Select from the Available Ortho Layers a previously created layer name on which to add the orthomosaic raster resulting from this Ortho Mapping run.

e. **Advanced Settings** – Opens the Ortho Mapping Advanced Settings dialog (Figure 109Figure 113)

f. **Process** – Submits the Ortho Mapping processing to the Job Manager queue for processing.

4. A successfully submitted job notification will appear confirming the job submission (Figure 112).

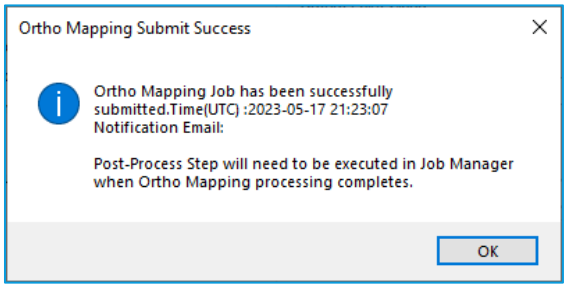


Figure 108 – Ortho Mapping job submission confirmation

5. An e-mail will be sent when the processing begins to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings).
6. The Ortho Mapping job progress may be monitored using Job Manager.
7. Upon completion of the Ortho Mapping job by the Job Manager:
   a. Job Manager will indicate completion by the green checkmark flashing on the Job Manager icon
   b. A completion e-mail notification will be sent to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings)
   c. The job will need to be post-processed to add the resulting Orthomosaic layer and/or raster, as well as the optional LAS layer and/or LAS files to the open project.
8. If desired, or for troubleshooting, in Job Manager, select the applicable Ortho Mapping job, then select View Log to review the Ortho Mapping processing log.
9. In Job Manager, select the applicable Ortho Mapping job, then select Open Project to open the applicable project for the job, if not currently open.
10. Then, select Post-Process to add the new Ortho Layer and/or raster file, and for 2DIS the new LAS Layer and/or LAS file(s) to the currently open project based on the settings at the time the job was submitted.

11. Review the generated Orthomosaic and for 2DIS, LAS data.
12. When desired, in Job Manager, select the applicable Ortho Mapping job, then select Delete Job to clean up the temporary files generated while processing the job.
13. **Optional:** Use the **Reproject Raster PCT** providing it your deliverable project boundary, or boundaries if you would like to tile the ortho, as input geometry, leave the reproject unchecked so as not to reproject the raster, and it will quickly create you a clipped orthomosaic. This PCT is also useful for converting the Ortho Mapping generated orthomosaic from the default BigTIFF format to a regular TIFF for using the raster in Autodesk's Civil3D, which cannot read BigTIFFs. Unless, of course, your orthomosaic is around 4GB or larger, thus requiring to be a BigTIFF, unless you use the **Reproject Raster PCT** to cut the orthomosaic into an index of your own or one created using the **Grid Generator PCT**.

ORTHO MAPPING ADVANCED SETTINGS

The most commonly configurable Ortho Mapping settings are configured on the Ortho Mapping Advanced Settings dialog (Figure 109). The defaults are the recommended settings, though users may wish to modify for their personal preferences.

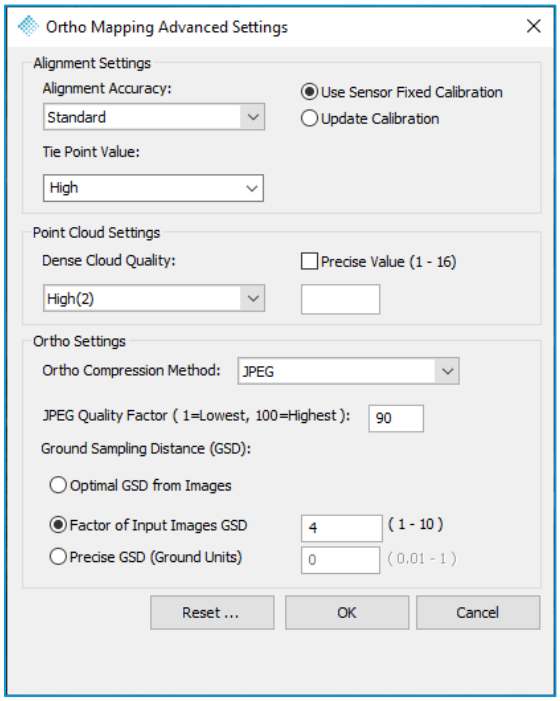


Figure 109 - Ortho Mapping Advanced Settings dialog

- **Alignment Settings**
  - **Alignment Accuracy** – Selects the input photo resolution that will be used in the Bundle Block Adjustment (BBA) step. The higher the resolution, the more accurate the BBA, but at the expense of increased processing time. Select from:

Highest	2:1	
High	1:1	**High is recommended.**
Medium	1:2	
Low	1:4	
Lowest	1:8	

  - **Camera Calibration –** This radio button choice allows you to use *a prior* camera calibration or Update Calibration to calibrate the camera as part of the BBA process. For pre-calibrated sensors (usually the case with GeoCue workflows, but not the case for DJI L1/L2), select **Use Sensor Fixed Calibration** to use the camera calibrations for your system that are stored on Reckon. You should always use this option. ***Note:*** You cannot perform "GCP-Free" geopositioning if you do not have a pre-calibrated camera.
- **Point Cloud Settings**
  - **Dense Cloud Quality** – This sets the resolution of the input photos during the dense cloud formation part of the processing. As with BBA, a higher setting provides higher quality but at the expense of increased processing time. Each level is approximately four times the processing time of the level below it. Select from:
    - Ultra High 1:1
    - High 1:2 **High is recommended for CUDA cores.**
    - Medium 1:4 **Medium is recommended when no CUDA cores.**
    - Low 1:8
    - Lowest 1:16
    - Precise Value (1-16)
- **Ortho Settings**
  - **Ortho Compression Method** – Select from No compression, JPEG, or LZW. **JPEG recommended.**
  - **JPG Quality** – If a JPEG compression method is used, specify the desired quality, with 1 being the lowest and 100, the highest. **Recommended to use 90** for a good quality to compression ratio.
  - **Optimal GSD from Images** – Allow Ortho Mapping to determine the optimal ground sample distance for the orthomosaic from the input photos. i.e., Full resolution. **Not Recommended!**
  - **Factor of Input Images GSD** – Allows the tool to automatically determine the *Optimal GSD from Images*, then multiply it by the factor to set the desired Precise GSD. **For optimal results, recommended to generate the orthomosaic a factor of four times the optimal GSD from Images.**
  - **Precise GSD (Ground Units)** – The user may deselect the *Optimal GSD from Images* option and enter a desired GSD in the project units.

AGISOFT ORTHO MAPPING (FKA METASHAPE FOR EVO(MFE))

For TrueView and DJI image sensors, the orthomosaic can be generated and the image positions and orientations refined using Agisoft Ortho Mapping , that is included in an addon license to LP360 Drone, called **Photo with Agisoft**. Images may also be processed in the Cloud version for Ortho Mapping using LP360 points purchased in the LP360 Store.

The Agisoft Ortho Mapping license is a separate key from the LP360 Drone+Photo with Agisoft licenses. See Licensing LP360 Drone+Desktop Photo with Agisoft for more information on activating/deactivating your Agisoft Ortho Mapping license. **It is not necessary to install Metashape Pro to use this tool**, however, Agisoft Ortho Mapping may also drive the GUI version of Metashape Pro (v1.7.1 through 2.0.x) if you have such licenses or desire to purchase a node-locked or floating license.

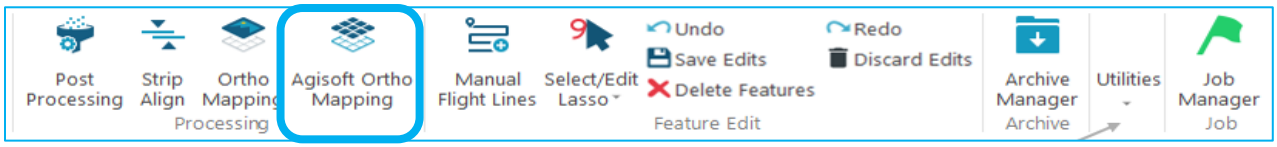


Figure 110 – Agisoft Ortho Mapping on the Sensor tab

When using a 3DIS, it is recommended that you run a ground classification on your dataset and additionally classify any building roofs or bridge decks to achieve optimal and efficient results when running Agisoft Ortho Mapping to generate your orthomosaic.

1. The active Cycle/Flight combination on the Sensor tab is not used by this utility, so it does not matter what is selected.
2. Select ***Agisoft Ortho Mapping*** on the Sensor tab (Figure 110) to open the Agisoft Ortho Mapping dialog (Figure 111). **Note:** To enable this tool requires a "Full Photo", "Photo with Agisoft", or "Photo3000" addon license be checked out in addition to the LP360 Drone license.

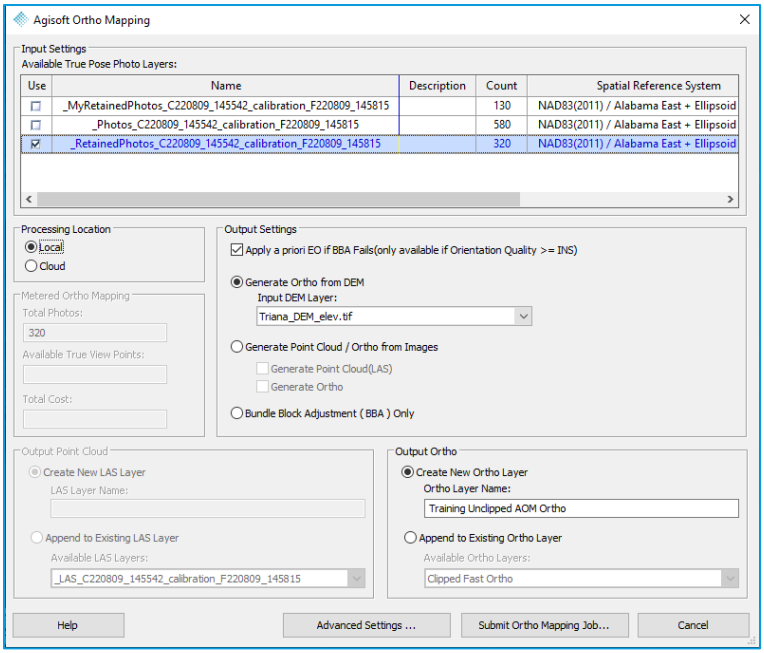


Figure 111 – Agisoft Ortho Mapping dialog

a) **Input Settings**
   i. **Available True Pose® Photo Layers** – Select the checkbox in the "Use" column beside all desired True Pose® layers that you wish to use as source photos for the orthomosaic generation. This would typically include all RetainedPhotos layers for every Cycle in the project that covers the desired area. A True Pose® image means their full metadata, including camera calibration, is stored in special GeoCue tags within each photo's EXIF tags.

b) **Processing Location** – Select to process Local or Cloud by selecting the applicable radio button next to the option.

c) **Metered Ortho Mapping** – When Cloud is selected, this section will detail the number of photos, available LP360 Points, and the total cost for generating the orthomosaic using Ortho Mapping Cloud.

d) **Output Settings**
   i. **Apply a priori EO if BBA Fails (Only available if Orientation Quality >= INS)** – (**Recommended for 3DIS®**) Always defaulted on for True Pose® photo layers from a TrueView 3DIS®. This option is not available for DJI and other sensors. When selected, two Metashape projects are generated as LP360 Drone identifies those images for which Metashape failed to align, for instance, those in vegetation, and updates the alignments for those in the new project. This second project is then used to generate the orthomosaic so that the holes one would normally have from a standard Metashape processing are minimized, if not eliminated.

   i. **Generate Ortho from DEM** (**Highly recommended for 3DIS®**)
      1. **Input DEM Layer**

a. Remove any high and low noise from the dataset. Often best accomplished using the *Clip Range* option in Geocode LiDAR, *Low/Isolated* PCT, and/or a *Basic Filter* PCT that uses elevation clipping. See Noise Removal Options for more details.
b. Run a ground classification (*Adaptive TIN Ground* PCT) against the dataset using appropriate settings for a good, generalized ground surface. It is not important to have a perfect surface as there is some leeway in the orthomosaic process, however, if you have features such as retaining walls then you may need breaklines to properly hold those types of features.
c. *Optional* - Manually cleanup the gross blunders in the ground surface (Class 2) using the manual classification tools found on the Classification tab and Profile toolbar, and/or the *Ground Cleanup Filter* PCT.
d. *Optional* - Manually classify building roofs to class 6, and bridge decks to class 17 to create a better looking orthomosaic.
e. *Optional* – To create the cleanest edge lines along buildings and bridges, polygonate the building and bridge deck classes, then set those to the ground and upper surface elevations by following these steps to create two polygon sets, one set being the buffered footprints and one set the headprints:
    i. Use the Point Group Tracing and Squaring PCT with appropriate parameters for your dataset to polygonate the desired non-ground features, normally roofs and bridge decks, but could be other features desired for a "True Ortho". To run this PCT with high density TrueView data you will first need to thin the dataset to roughly 8 points/m^2 using the Classify by Statistics PCT.
    ii. Use the Conflate PCT to pure drape a copy of each non-ground feature to the ground class to create the footprints. This holds the edge clean to the existing ground surface.
    iii. Use the Conflate PCT to conflate to the closest elevation of the building or bridge deck points found therein, a copy of each footprint polygon to create the headprints.
    iv. We need to buffer the footprint polygons slightly, say 2.5cm, using the Buffer Geometry tool found on the Feature Edit tab, since in a TIN you cannot have two points at the same planimetric location with differing elevations.

v. Use the Classify by Feature PCT to mark any ground points found within the buffered footprint polygons so as not to use them in your resulting DEM.
vi. If you perform these steps to generate a set of buffered footprint polygons (buffered and ground conflated polygons) and headprint (closest elevation conflated) polygons for your desired non-ground features, then skip the *Classify by Statistics* PCT in the next step since you will not have conflicting surfaces over the same cell. Furthermore, use Breakline Enforcement, using the polygons generated by the preceding steps to help hold the edge of your features, when in the export DEM step.

f. Export a DEM using the Export Wizard to quickly create a DEM from the LiDAR data and generate the orthomosaic much faster than Metashape generating a DEM from the images.
   i. **Run Classify by Statistics PCT** – For best results, it is recommended to perform some initial classification as described above before exporting a DEM. Run the Classify by Statistics PCT with the following recommended settings to help in areas where there are two surfaces in the same location, such as when the roof overhangs and the LiDAR sees the ground beneath:
      1. Feature Geometry – Tool Geometry
      2. Units – Set to project units.
      3. Input LAS Layer – Active LAS Layer
      4. Source Points - Classes 2, 6, and 17. Flags ignored.
      5. Cell Size – 0.05m - Gently rolling terrain doesn't need as high a resolution DEM as an area with sharper features.
      6. Samples – Max
      7. Destination Class – Flags Only – Synthetic – Set
      8. Quartile Classification – Leave blank.
      9. Generate Cell Output Shape file – Leave unchecked.
      10. Run by project.
   ii. Recommended **Export LiDAR Data** DEM settings:
      1. Source Points:
         a. If the Classify by Statistics in the previous section was performed, use Synthetic Flag Set

b. If the optional non-ground polygons were created and the Classify by Statistics PCT skipped, then use classes 2, 6, and 17 ignoring the synthetic flag.
c. or use all points for a quick ortho.

2. Export Type - Surface
3. Surface Method - Triangulation
4. Pixel size: 0.05m to 0.25m. Gently rolling terrain does not need as high a resolution DEM as an area with sharper features.
5. Surface Attribute to export – Elevation
6. Export Format – GeoTIFF
7. Raster Information – Pixel Size: 0.05 to 0.25m. Gently rolling terrain doesn't need as high a resolution DEM as an area with sharper features.

ii. **Generate Point Cloud / Ortho from Images** - Typically only use this option for 2DIS (image only systems). This option will take much longer and will generate a Dense Image Matching (DIM) point cloud.

1. **Generate Point Cloud (LAS)** - generate and retain the Dense Image Matching (DIM) point cloud to add to the project during the post-process step.
2. **Generate Ortho** - generate and retain the orthomosaic to add to the project during the post-process step.

iii. **Bundle Block Adjustment (BBA) Only** – Useful for troubleshooting, or to improve the True Pose® information for use with Image Explorer when not generating an orthomosaic.

e) **Output Point Cloud** – Only use this option for 2DIS (image only systems).

i. **Create New LAS Layer - LAS Layer Name** – Type in a unique name for the destination layer on which to generate the DIM LAS files from the Ortho Mapping run.
ii. **Append to Existing LAS Layer** – Select from the Available LAS Layer the previously created layer name on which to append the additional DIM LAS files.

f) Output Ortho

i. **Create New Ortho Layer** – **Ortho Layer Name** – Type in a unique name for the destination layer on which to generate the orthomosaic raster resulting from this Ortho Mapping run.
ii. **Append to Existing Ortho Layer** – Select from the Available Ortho Layers a previously created layer name on which to add the orthomosaic raster resulting from this Ortho Mapping run.

g) **Advanced Settings** – Opens the Agisoft Ortho Mapping Advanced Settings dialog (Figure 113)

h) **Submit Ortho Mapping Job** – Submits the Agisoft Ortho Mapping processing to the Job Manager queue for processing.

3. A successfully submitted job notification will appear confirming the job submission (Figure 112).

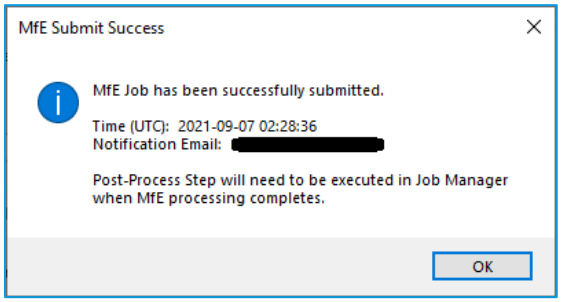


Figure 112 – Agisoft Ortho Mapping job submission confirmation

4. An e-mail will be sent when the processing begins to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings).
5. The Agisoft Ortho Mapping job progress may be monitored using Job Manager.
6. Upon completion of the Agisoft Ortho Mapping job by the Job Manager:
   a) Job Manager will indicate completion by the green checkmark flashing on the Job Manager icon
   b) A completion e-mail notification will be sent to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings)
   c) The job will need to be post-processed to add the resulting Orthomosaic layer and/or raster, as well as the optional LAS layer and/or LAS files to the open project. Plus, update the EXIFs on each photo to the bundle block adjusted values.
7. In Job Manager, select the applicable Agisoft Ortho Mapping job, then select View Report to review the Agisoft Ortho Mapping processing report. Review for position and orientation average corrections to be within tolerances for your system's POS.
8. If desired, or for troubleshooting, in Job Manager, select the applicable Agisoft Ortho Mapping job, then select View Log to review the Agisoft Ortho Mapping processing log.
9. In Job Manager, select the applicable Agisoft Ortho Mapping job, then select Open Project to open the applicable project for the job, if not currently open.
10. Then, select Post-Process to add the new Ortho Layer and/or raster file, and for 2DIS the new LAS Layer and/or LAS file(s) to the currently open project based on the settings at the time the job was submitted. Plus, update the EXIFs on each photo to the bundle block adjusted values.
    a) If the run location selected was Cloud, you will be asked to browse for the 7z file you downloaded from the link in the job completion e-mail.
11. Review the generated Orthomosaic and for 2DIS, LAS data.
12. When desired, in Job Manager, select the applicable Agisoft Ortho Mapping job, then select Delete Job to clean up the temporary files generated while processing the job.

13. **Optional:** Use the **Reproject Raster PCT** providing it your deliverable project boundary, or boundaries if you would like to tile the ortho, as input geometry, leave the reproject unchecked so as not to reproject the raster, and it will quickly create you a clipped orthomosaic. This PCT is also useful for converting the Ortho Mapping generated orthomosaic from the default BigTIFF format to a regular TIFF for using the raster in Autodesk's Civil3D, which cannot read BigTIFFs. Unless, of course, your orthomosaic is around 4GB or larger, thus requiring to be a BigTIFF, unless you use the **Reproject Raster PCT** to cut the orthomosaic into an index of your own or one created using the **Grid Generator PCT**.

AGISOFT ORTHO MAPPING ADVANCED SETTINGS

The most commonly configurable Agisoft Ortho Mapping settings are configured on the Agisoft Ortho Mapping Advanced Settings dialog (Figure 113). The defaults are the recommended settings, though users may wish to modify for their personal preferences.

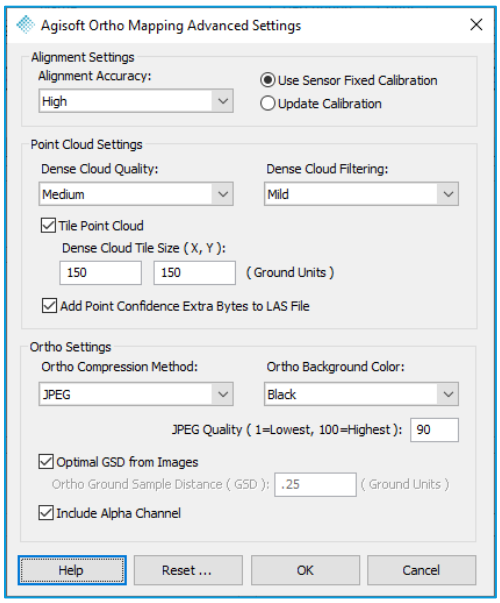


Figure 113 - Agisoft Ortho Mapping Advanced Settings dialog

- **Alignment Settings**
  - **Alignment Accuracy** – Selects the input photo resolution that will be used in the Bundle Block Adjustment (BBA) step. The higher the resolution, the more accurate the BBA, but at the expense of increased processing time. Select from:

Highest	2:1	
High	1:1	**High is recommended.**
Medium	1:2	
Low	1:4	
Lowest	1:8	

- **Camera Calibration –** This radio button choice allows you to use *a prior* camera calibration or Update Calibration to calibrate the camera as part of the BBA process. For pre-calibrated sensors (usually the case with GeoCue workflows, but not the case for DJI L1/L2), select **Use Sensor Fixed Calibration** to use the camera calibrations for your system that are stored on Reckon. You should always use this option. ***Note:*** You cannot perform "GCP-Free" geopositioning if you do not have a pre-calibrated camera.

- **Point Cloud Settings**
  - **Dense Cloud Quality** – This sets the resolution of the input photos during the dense cloud formation part of the processing. As with BBA, a higher setting provides higher quality but at the expense of increased processing time. Each level is approximately four times the processing time of the level below it. Select from:
    - Ultra High 1:1
    - High 1:2
    - Medium 1:4 **Medium is recommended.**
    - Low 1:8
    - Lowest 1:16.
  - **Dense Cloud Filtering** – Adjusts the aggressiveness of the smoothing filter applied after the point cloud formation. Select from:
    - Disabled
    - Mild **Mild is recommended.**
    - Moderate
    - Aggressive
  - **Tile Point Cloud using Dense Cloud Tile Size** – This setting will form the resultant point cloud into a set of tiled LAS files. LP360 prefers smaller file sizes, so it is better to tile when generating a point cloud, such that each LAS is less than 256MB.
  - **Add Point Confidence Extra Bytes to LAS File** – The Agisoft confidence, or reliability extra byte, can be an additional attribute useful when determining the suitability of a DIM point for ground classification. The value represents the number of depth maps used for the given point generation. The noisy areas of the dense cloud will have lower confidence and you can use the extra byte filter options in the Source Points/Live View dialog to exclude the noisy points from point cloud processing or views.

- **Ortho Settings**
  - **Ortho Compression Method** – Select from No compression, JPEG, LZW, Packbits, or Deflate. **JPEG recommended.**
  - **JPG Quality** – If a JPEG compression method is used, specify the desired quality, with 1 being the lowest and 100, the highest. **Recommended to use 90** for a good quality to compression ratio.
  - **Ortho Background Color** – Select a black or white background color for the void pixels in the image.
  - **Optimal GSD from Images** – Allow Metashape to determine the optimal ground sample distance for the orthomosaic from the input photos. i.e., Full resolution.
  - **Ortho Ground Sample Distance (GSD)** – The user may deselect the *Optimal GSD from Images* option and enter a desired GSD in the project units.

- **Include Alpha Channel –** The alpha channel is a special channel on the image that handles transparency. Typically included, but users of older CAD programs, such as MicroStation v8i, need to uncheck this option if the program cannot handle images with an alpha channel included.

Agisoft Ortho Mapping also uses a settings file, MSConfig.yml to set some less commonly configurable settings for the resulting orthomosaic that are not displayed on this dialog. The defaults are the recommended settings for best practice. To modify these, you can do so directly in the MSConfig file. Select the appropriate one depending on whether you wish the settings change to affect a single execution of Agisoft Ortho Mapping, a single LP360 project, or any project run on the machine.

For a single Agisoft Ortho Mapping job:

The MSConfig file used for an Agisoft Ortho Mapping job is found in <project folder>/Jobs/<yymmdd_hhmmss>_MFE. It is based on the union of the Agisoft Ortho Mapping Advanced Settings dialog configured for a job and the MSConfig file found in the project folder.

For a single project:

The MSConfig file found in the project folder is created from the MSConfig found in %PROGRAMDATA%/LP360/MSPyOrtho, the first time Agisoft Ortho Mapping is run on a project.

For all projects on a machine:

The MSConfig found in %PROGRAMDATA%/LP360/MSPyOrtho is copied from the %COMMONPROGRAMFILES%/LP360/MSPy38 folder the first time Agisoft Ortho Mapping is run on a machine.

Example settings only found in MSConfig.yml:

BuildOrthomosaic: **refine_seamlines** – default is False. Recommended: True. Use smart algorithm to identify photo seamlines where they will least distort.

BuildOrthomosaic: **ghosting_filter** – Default is False. True enables the Metashape ghosting filter, which is useful to improve the texture if the quality of the dataset is not very good (for example, there can be moving objects, patches of reflected light, unwanted objects in the foreground, etc.). Useful when generating the DEM from the photos, but it increases processing time.

BuildOrthomosaic: **calibrate_colors** – useful to even the brightness and white balance of the images over the data set. Please note that for large data sets the Calibrate colors procedure can turn out to be quite time consuming.

> **cal_colors_whte_balance** – ignored if calibrate_colors is False. Additional option to be switched on if white balance should be evened as well.
>
> **cal_colors_use_tie_points** – if false, uses DEM if available, else Model. If false, uses DEM if available, else uses the Model. Defines what data should be taken as the basis for overlapping areas estimation. It is preferable to select the source data type according to the surface on which you plan to project the orthomosaic.

EXECUTING AGISOFT ORTHO MAPPING ON ANOTHER MACHINE

The recommended workflow should you wish to process your Cycles to a colorized point cloud on one machine, but generate your orthomosaic on a different machine, is to process all Cycles for your project on machine A. Then,

1. Export an Explorer Package from machine A containing all the desired RetainedPhotos layers and a single DEM layer (for 3DIS®) to be used for generating the orthomosaic.
2. Copy the Explorer Package to machine B.
3. On machine B, open the Explorer Package to create a new project.
4. Run **Agisoft Ortho Mapping** on machine B to generate your orthomosaic, and the optional point cloud (for 2DIS).
5. Post Process the Agisoft Ortho Mapping run to add the orthomosaic, and optional point cloud (for 2DIS) to the project on machine B.
6. On machine A, import the following from their folder locations on machine B into your existing project:
    1. **Orthomosaic** – UNC path as specified in the Agisoft Ortho Mapping completion e-mail.
    2. The updated **True Pose® photos** from the RetainedPhotos layer(s) – Right-click on the layer in the project on machine B, select Open Location in Explorer to determine the path to photos. They are in subfolders of the parent folder to the feature file. Recall only the retained photos were copied to machine B so you can import all photos found here.
    3. *optional* **point cloud (for 2DIS)** – UNC path as specified in the Agisoft Ortho Mapping completion e-mail.
7. Use the new True Pose® photos layer as the drive for Image Explorer by deselecting any other layers IE column in project manager and only enabling the new layer.

CONFIGURING LP360 DRONE TO RUN METASHAPE PRO

The recommended method of running **Agisoft Ortho Mapping** is to use the integrated version installed with LP360 Drone, however, LP360 Drone may also drive the GUI version of Metashape Pro if you have such licenses. To configure a user installed version of Metashape Pro (v1.7.1 to v2.0.x) to be run by the Agisoft Ortho Mapping:

1. Install the necessary components by running the "InstallPyYAML.bat" batch file found in "%CommonProgramFiles%\LP360\MSPy38" (Metashape v1.7.x to v2.0.x).
    a) Open an elevated command prompt by right-clicking on the Command Prompt in the Start menu and selecting "Run as Administrator".
    b) Change directory to the appropriate MSPy folder, using "cd %CommonProgramFiles%\\LP360\MSPy38" (Metashape v1.7.x to v2.0.x).
    c) Execute the batch file by typing "InstallPyYAML.bat", <Enter>
    d) You may see a notification about a newer pip version being available but can ignore this message ().

COMPANION CAMERA(S) EO FILE GENERATION

1. If utilizing one or more companion cameras, the images must be added to the cycle folder prior to starting the import process. For each companion camera and dataset, retrieve the photos from the flight and place them into the raw TrueView Cycle folder under *Cycle_\Flight_\Camera11\, Cycle_\Flight_\Camera12\, and Cycle_\Flight_\Camera13\ for companion camera one, two and three, respectively.*
2. Import the TrueView Cycle into LP360 using the normal workflow.
3. After the Create TV Trajectories step is complete make a copy of the EO file from the LP360 project path to a new location and open this file in a spreadsheet application for editing *Project\Area_\Cycle_\Flight_\System\Companion_EO.csv*

   Note: the Project\Area_\Cycle_\Flight_\System\Companion_Timing.csv contains information about the event in UTC that may be useful for helping to align the correct photo to the correct event.

4. In the Companion_EO.csv note the first column for image name does not match the companion camera image names and will need to be updated. These events are tagged with the camera#_, i.e. 11_P, 12_N, and 13_S, when there is more than one companion camera. Also, note the sequential numbering of the photos does not start at one. Every image preceding the first image number will be disregarded as those images are not part of the trajectory solution and have no positional data. The first image number minus one will be the number of images from the image file list that need to be disregarded. Also, note the total number of rows in the file minus one (subtracting the column header) for your total EO file image count.
5. To correct the image file names, locate the folder of the companion camera images. Open a command prompt in that location by right-clicking an empty area and selecting Open in Terminal. Type the command below to generate a file list.
   dir /B > companion_images.txt
   Another method is to create a batch file. Save the above command to a text file named companion_image_list.bat, this file can be placed in the image folder and executed by double-clicking.
6. Open the companion_images.txt file, select the image names by excluding the number of photos to be disregarded from step 2, and ending with the last image of the file list. The total count of images file names should also match the total number EO file image count determined in step 2. Copy this selection.
7. Go back to the Companion_EO.csv file in Excel and paste the file list selection from the companion_images.txt into the %image column to replace with the proper image file names.
8. The EO file is now ready to load into photogrammetry software much like an exported Photo Package would be for the built-in cameras.

BORESITE CALIBRATION

For a TrueView 3DIS and microdrones payloads, boresite calibration may be improved by executing an addon license to LP360 Drone, called **Strip Alignment**. **Calibration** can be used to estimate constant parameters, the boresite angles, but would not be suited to remove inconsistencies in the point cloud generated by dynamic sensor trajectory errors. Please refer to the method and context behind Strip Adjustment and the Strip Adjustment tool for correcting dynamic sensor trajectory errors.

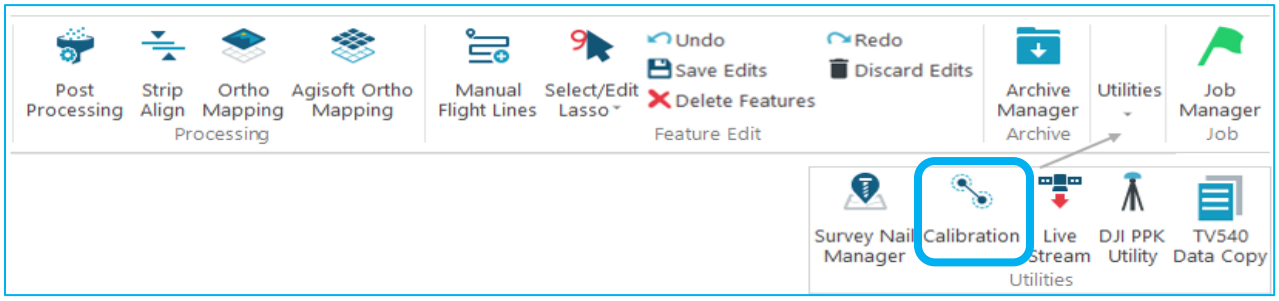


Figure 120 - Calibration on the Sensor tab

Calibration requires a "Strip Adjustment" addon license be checked out in addition to the LP360 Drone license. Note: LP360 Drone+Strip Adjustment may only be used with TrueView 3DIS® or microdrones data.

A good way to assess the need for using LP360 Calibration on your dataset is to inspect the data using profiles to review the interline fit and generate dz image(s) using the LP360 Export Wizard.

1. The active Cycle/Flight combination on the Sensor tab is not used by this utility, so it does not matter what is selected.
2. Select **Calibration** on the Sensor tab (Figure 120) to open the Boresite Calibration dialog (Figure 121). **Note:** To enable this tool requires a "Strip Adjustment" addon license be checked out in addition to the "LP360 Drone" license.

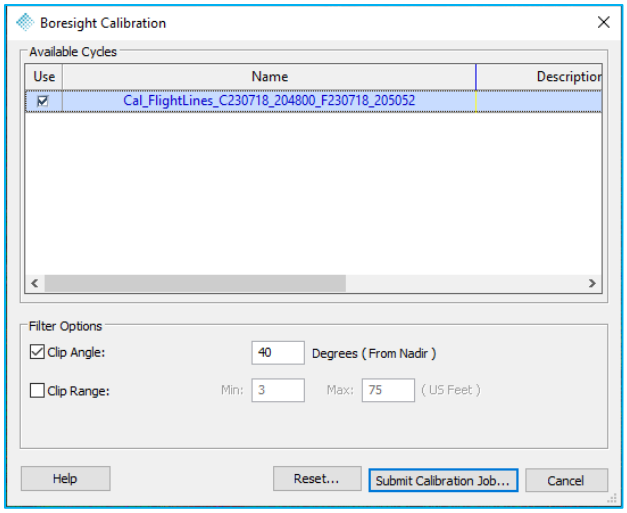


Figure 121 – Boresite Calibration dialog

a) **Input Settings**
   i. **Available Cycles** – Lists all Cycles in the currently open project.
   ii. **Use** – Select the checkbox in the "Use" column beside a Cycle to determine corrections for that Cycle. The Cycle must have a processed sensor trajectory in the typical file structure when following the TrueView workflow.

b) **Filter Options**
   i. The Geocode LiDAR options are listed here as the Boresite Calibration process will geocode a new point cloud from the raw data. Typically, use the same options you would for Geocode LiDAR. Note: The Boresite Calibration does not generate a point cloud as a result.

c) **Submit Calibration Job** – Submits the calibration processing to the Job Manager queue for processing.

3. A successfully submitted job notification will appear confirming the job submission (Figure 104).

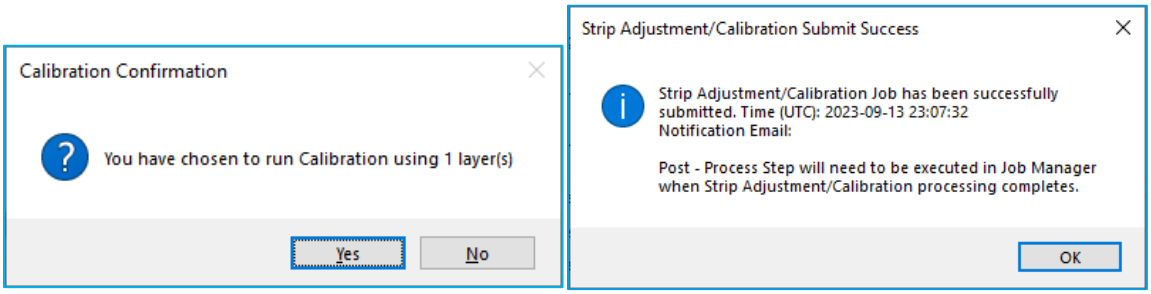


Figure 122 – Boresite Calibration Job Submission Confirmation

4. An empty e-mail will be sent when the processing begins to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings).
5. The calibration job progress may be monitored using Job Manager.

6. Upon completion of the calibration job by the Job Manager:
    a) Job Manager will indicate completion by the green checkmark flashing on the Job Manager icon
    b) An empty completion e-mail notification will be sent to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings)
    c) The job will not need to be post-processed.
7. In Job Manager, select the applicable calibration job, then select View Log to review the calibration processing log.
    a) Review the STDERR section for any reported errors.
8. In Job Manager, select the applicable calibration job, then select File Explorer to open the applicable job folder to review the results.
9. If the user wishes to implement these results and view how they would affect the point cloud, press Post-Process Post-Process.
    a) The new System Configuration file created from this calibration process will then be moved from the job folder and will replace the System Configuration file in the Project\Area\Cycle\System folder. The original System Configuration file located in the Project\Area\Cycle\System folder will be renamed as SystemConfigurationBackUpBeforeStripCalibration.json.
    b) If the Geocode LiDAR step is rerun, the updated System Configuration file will be used when creating the new LAS files.
10. If desired, provide GeoCue Support with the updated SystemConfiguration json file to have it posted to Reckon for availability when running Create TV Trajectories while processing subsequent Cycles from this payload.

When desired, in Job Manager, select the applicable calibration job, then select Delete Job to clean up the temporary files generated while processing the job.

DJI ZENMUSE L1/L2 WORKFLOW

This section provides a step-by-step guide to processing LiDAR and imagery from the DJI Zenmuse L1 or L2 (M300 RTK), from the point of project creation to an orthomosaic and generated point cloud. Included are common steps for geotagging images, exporting a photo package for downstream processing, or generating the orthomosaic.

CONFIGURE AND LICENSE DJI TERRA

To configure the license for DJI Terra, please follow this quick guide.

1. Download and install the latest version of DJI Terra from https://www.dji.com/downloads/softwares/dji-terra
2. After installing DJI Terra, open DJI Terra and login to bind it with your devices. Note: Your login account should be the one you use to activate DJI Terra.
    1. If you do not yet have a DJI account, register for an account at https://account.dji.com/register?actionType=login&appId=dji_official_aws&backUrl=https%3A%2F%2Fwww.dji.com%2F&psign=0ac960d27851d087ac3b3f6ef611025c&pnonce=2938792794146867&locale=en_US
3. In DJI Terra, select the user icon in the upper right corner, then select activated licenses.
4. It will take you to https://license.dji.com/ where you can activate your license using your activation code and logging into your DJI account.

DJI PPK UTILITY

The DJI PPK Utility is designed to streamline the arduous process and multiple steps users might otherwise need to follow to prepare their raw mission folders for Post-Processing Kinematic (PPK) in DJI Terra. Automatic association of base station file(s) with each raw flight folder, conversion of T02 files, concatenating multiple observations, when necessary, easy assignment of the survey nail/reference mark, etc., make for quick data preparation before performing PPK processing in DJI Terra.

Note: Most users process their L1/L2 data using RTK, where they maintained connection with the D-RTK2 base station or VRS to the DJI system for the duration of each flight. This utility is only necessary if there was an issue with RTK or a user desire to process with PPK specifically.

1. Open the **DJI PPK Utility** located in the Utilities group on the Sensor tab of the LP360 ribbon (Figure 123) to open the DJI PPK Utility dialog (Figure 124).

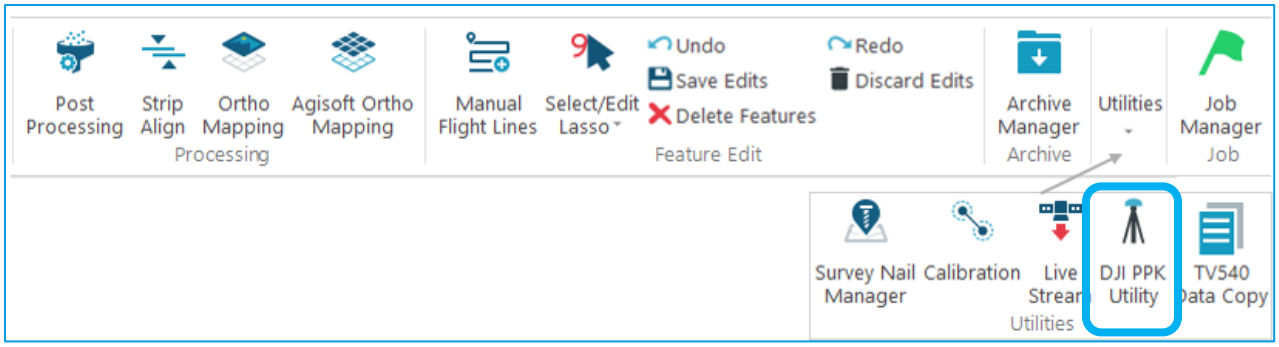


Figure 123 - DJI PPK Utility Tool on the Sensor ribbon

2. In the upper portion of the dialog, add your Raw Flight Folders by selecting the green "+" and browsing for the folders as found on the USB after acquisition.
3. In the lower portion of the dialogue, select your Base Station Observation files by selecting the green plus and browsing for the RINEX or T02 files.
    a) Base observation files overlapping in time with each flight in the upper section will be listed in their "Base Observation Files" column. All observations must be from the same location. Edit to remove, if necessary.
4. For each flight listed, select a reference mark. The dropdown menu will show available reference marks from your Survey Nail Manager, or to create a new one, or enter a manual position.
5. Then, select "Update Raw Flight Folder(s)" to allow the DJI PPK Utility to make the necessary modifications to prepare your raw flight datasets with the base station observation files for PPK processing by DJI Terra.
6. Then, proceed to perform the applicable pre-processing in DJI Terra.

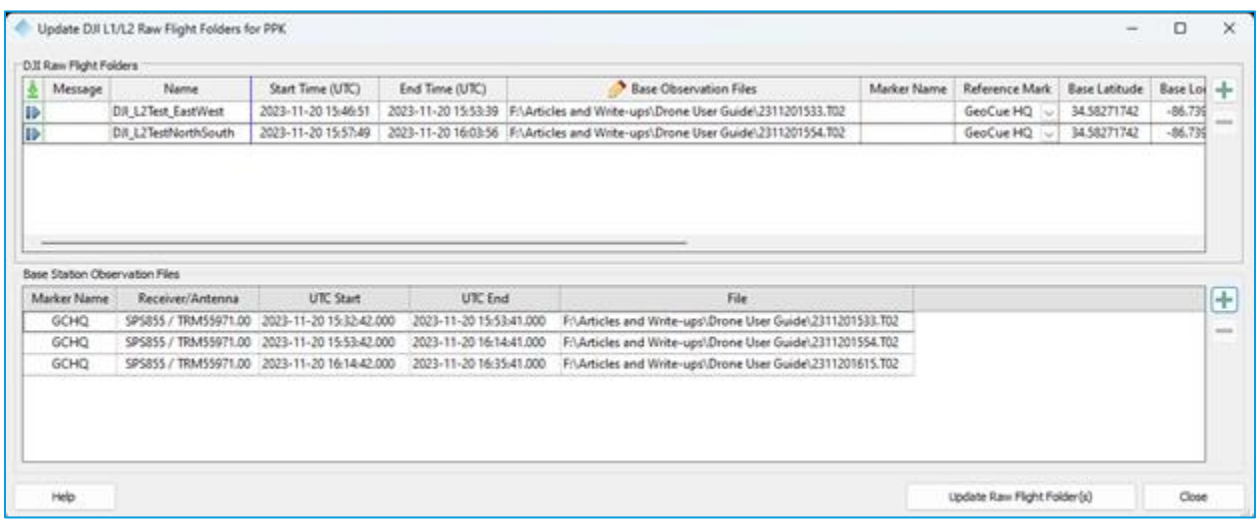


Figure 124 - DJI PPK Utility Dialog

PRE-PROCESSING IN DJI TERRA

For the DJI Zenmuse L1/L2, trajectory processing and initial point cloud generation from the raw data is performed in DJI Terra as a pre-processing step before beginning the workflow in LP360 Drone. If processing using PPK, then use the DJI PPK Utility to easily prepare your data for processing in DJI Terra. LP360 Drone is used to reproject the data to various coordinate reference systems not supported by DJI Terra, clean up the LiDAR data and fully tag the images as True Pose® photos, plus utilize the extensive capabilities of LP360 Drone for classification, vectorization, and derivative product generation.

For more information on pre-processing in DJI Terra, please refer to the DJI Terra User Manual.

IMPORT DJI ZENMUSE L1/L2 FLIGHT

To import DJI Zenmuse L1/L2 mission data into a new or current project, open the Raw Mission Import Wizard and select *DJI L1/L2*.

When importing DJI L1/L2 flights into a project, the coordinate reference system (CRS), both the horizontal and vertical components, of the project must match what was used to process the data in DJI Terra or be in ITRF2014 (EPSG:9000), ellipsoidal heights. On the Input DJI L1/L2 Flights page of the multi-Cycle import wizard, hover over the Terra LAS File to see the tooltip and confirm the CRS.

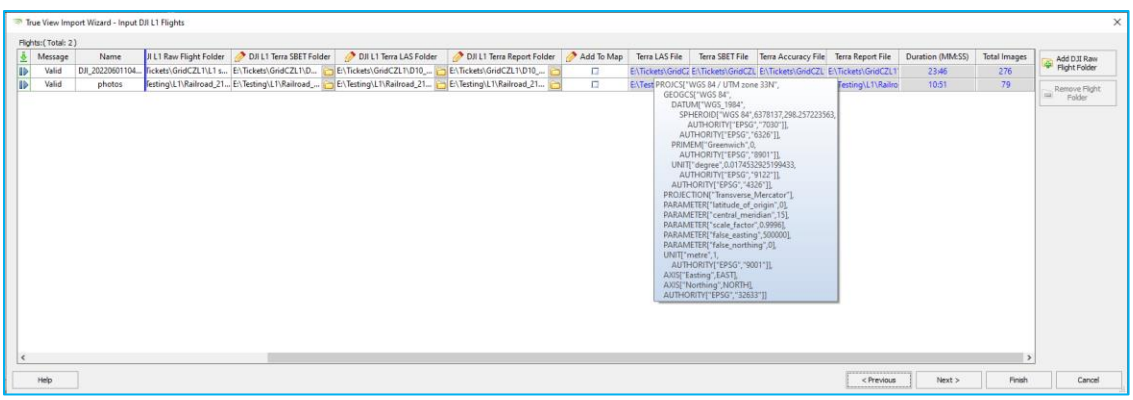


Figure 125 - CRS Tooltip for DJI Terra LAS file in multi-Cycle Import wizard

As of LP360 v2023.2.21.0, processing updates the RTK tagged image positions for the L1 /L2 workflow using the project geoid, if applicable. As of LP360 v2024.1, if you do PPK processing in DJI Terra using a new coordinate not entered in the D-RTK2 base at the time of acquisition, or using a third party base, or used the DJI PPK Utility to prepare your dataset for PPK processing in this manner, then the photo positions will be updated during the L1/L2 PPK workflow. This removes the restriction that had previously existed forcing one to always process in DJI Terra to an ellipsoidal vertical coordinate system.

A confirmation dialogue will appear after selecting the project CRS if LP360 Drone is not certain that the CRS of the data and the CRS of the project match, to give the user the opportunity to go back and modify the project CRS or confirm the differences are acceptable, before completing the import. It is very important to review the information in this message and confirm it is correct. This dialog is always displayed when the data is in ellipsoidal elevations because in this circumstance, DJI Terra does not write a vertical CRS in the LAS file header.

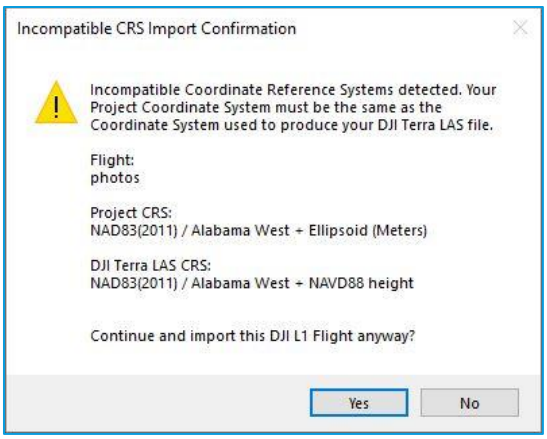


Figure 126 - Incompatible CRS Import Confirmation

After the data has been imported and the files have been examined, the next steps are:

1. Create TV Trajectories
2. Geocode LiDAR to upconvert the DJI Terra generated LAS v1.2 files to the latest LAS v1.4 format and perform other useful operations on the pre-processed LAS files, such as splitting the data by flight line.
3. Optionally, run Strip Align for LP360
4. Optionally, run Ortho Mapping or Agisoft Ortho Mapping, using the Update Calibration option.
5. Utilize the extensive capabilities of LP360 for debias, QAQC, classification, vectorization, and derivative product generation.

CREATING FLIGHT LINES AND TRUEVIEW TRAJECTORIES

The steps to this point have allowed us to create a single file with the corrected sensor trajectory for the entire Cycle. Sections of each flight in the Cycle are not useful to us, such as the IMU heading alignment maneuver and flight line transitions, so we clip these sections out by defining which portions of the flight to keep. Usually only the data collected along the flight lines are retained, so we will use the ***Auto Create Flight Lines*** tool (Figure 63) and the ***Create Flight Lines from Selected Trajectory Points*** (Figure 64) from the Sensor tab for the next step. Flight lines are created using the time in the trajectory points layer, then a new layer is created named "*Area*_YYMMDD_HHMMSS_Flight lines". The steps below describe how to create flight lines automatically and manually. The best approach is to create flight lines automatically, then add or delete flight lines manually to get the exact flight lines we want.

For legacy microdrones payloads, the flight lines are automatically generated during import based on the mdCockPit flight plan. These flight lines are not editable.

For mobile datasets, the **Auto Create Flight Lines** tool will likely be inadequate for creating usable flight lines. It is currently advised to create these manually to clip to the desired data.

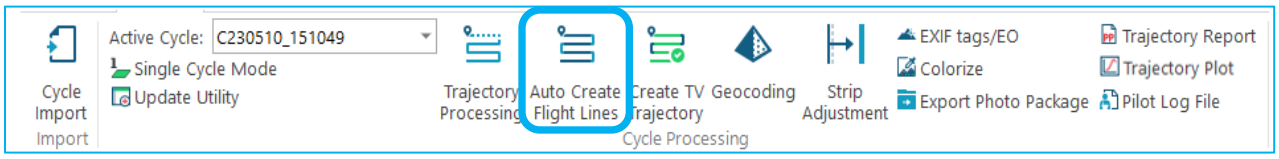


Figure 127 – Auto Create Flight Lines

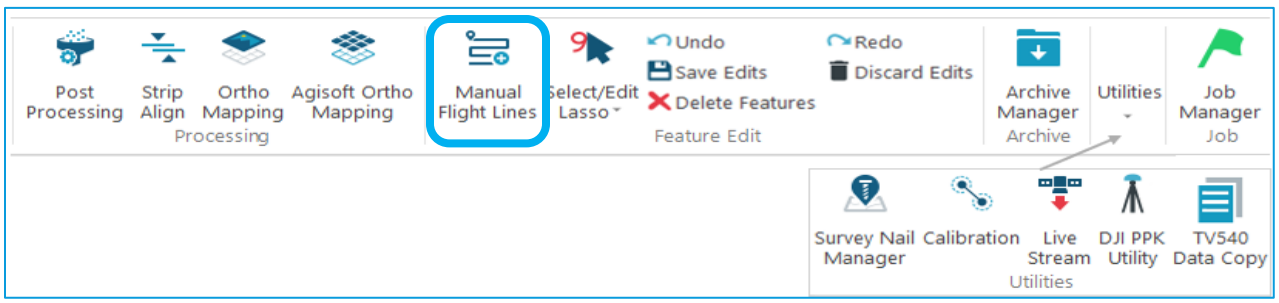


Figure 128 - Create Flight Lines from Selected Trajectory Points

AUTO CREATE FLIGHT LINES

6. If not already done, make active the Cycle/Flight combination to be processed.

7. Select the **Auto-Create Flight Lines** tool on the Sensor tab (Figure 63) to open the Auto Create Flight Lines dialog (Figure 65).
    a) **Flight Line Layer** - The name of the layer that will be created and requires no input from the user.
    b) **Min. Length** – No linear set of points shorter than this value will be considered for the calculation of a flight line. This number should usually be set to the shortest flight line length. Use the **Measure** tool on the main LP360 toolbar to measure the shortest desired flight line.
    c) **Turn Radius** – The radius, in map units, to allow at turns. The smaller the number, the closer the flight lines will be cut to the turns. The greater the radius, the larger the gap.
    d) **Max Deviation** – The deviation parameter that tells the software when to break a line segment into two. The smaller this number, the more linear the flight lines but the more flight lines that will be created. The larger this value, the more "bend" will be allowed in a relatively straight segment without splitting. Hence, increase this value significantly if you have curved flight lines.

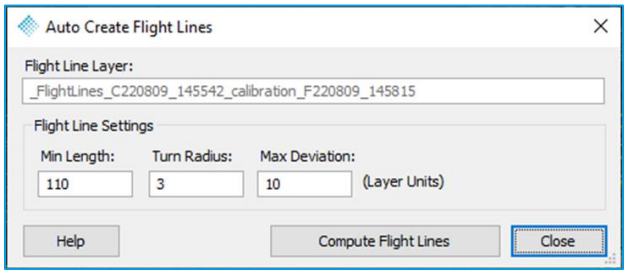


Figure 129 – Auto Create Flight Lines

8. Once you have entered the desired parameters, select *Compute Flight Lines.*
9. The flight line layer should be created, and the flight lines displayed in blue in the map view.
    a) Results can be changed by changing the parameters and selecting *Compute Flight Lines* again. The existing lines will be replaced with the results from the new settings.
10. Flight lines can be deleted if necessary, by selecting the layer with the *Select/ Edit Features* button on the left end of the Feature Edit tab (Figure 66) and clicking the red "X" on the right end of the Feature Edit tab (Figure 66).
    a) Select the ***Select/ Edit Features*** tool on the LP360 Feature Edit tab (Figure 66).
    b) Select the flight line you wish to delete, and the line will be highlighted (Figure 67).
        i. If multiple feature layers are selected, you will be prompted to choose a layer. Choose the flight line layer.
        ii. Hold control while selecting to select multiple flight lines. Or drag to select multiple flight lines.
    c) Select the **Delete Selected Features** button on the LP360 Feature Edit tab (Figure 66) and the selected feature(s) will be deleted.
    d) Delete all unnecessary flight lines. **Undo** and **Redo** may be used if you accidentally remove the wrong flight line.

e) Select the **Save Feature Edits** icon on the LP360 Feature Edit tab (Figure 66) to save the edits.

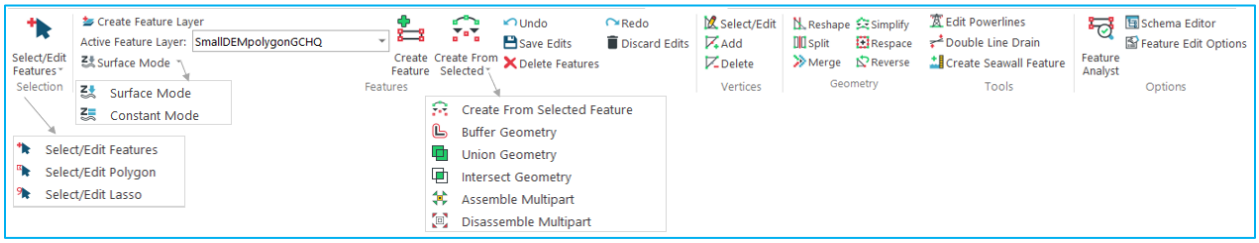


Figure 130 - LP360 Feature Edit Tab

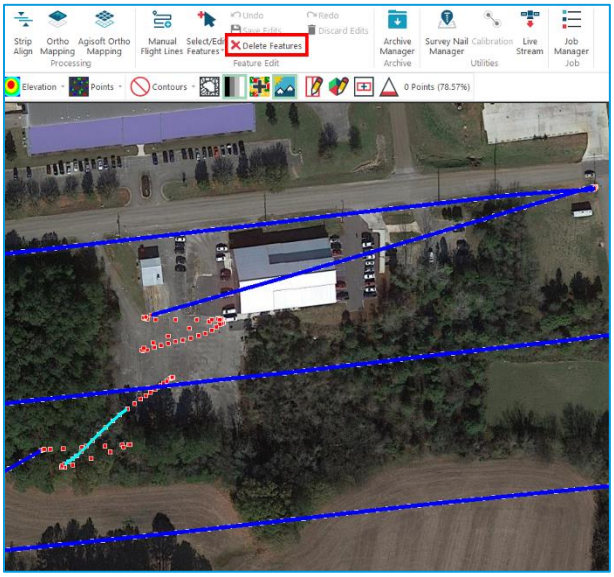


Figure 131 – Editing Flight Lines

MANUALLY CREATE FLIGHT LINES

2. Flight lines can be added manually by selecting trajectory points (red points) at the beginning and end of each line.

   a) Select the ***Select/ Edit Features*** tool on the LP360 Feature Edit tab (Figure 66).

   b) Select a trajectory point at the beginning of the desired flight line. The point will be highlighted when selected.

   c) Hold control, then select a trajectory point at the end of the flight line. Both trajectory points should now be highlighted (Figure 68).

Figure 132 – Manually Creating Flight Lines

d) Select ***Create Flight Lines from Selected Trajectory Points*** on the Sensor tab (Figure 64) and a new flight line should be created.

e) Select the **Save Feature Edits** icon on the LP360 Feature Edit tab (Figure 66) to save the edits.

Note: If you select Trajectory Point patterns that do not form the required base for creating a flight line, you will receive an error message that explains the issue (Figure 69).

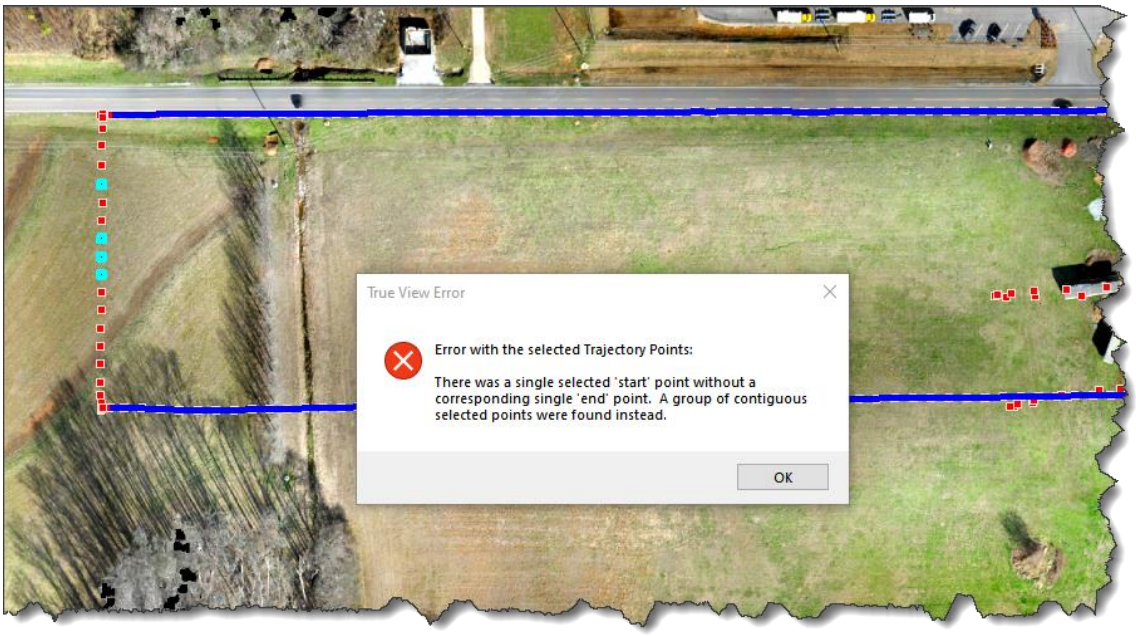


Figure 133 - A pattern of Trajectory Points not compatible with forming a flight line

CREATE TRUEVIEW TRAJECTORIES

5. If not already done, make active the Cycle/Flight combination to be processed.
6. Once flight lines have been created, and the edits saved, select ***Create TV Trajectories*** from the Sensor tab (Figure 70). The purpose of this step is to use the flight line layer to create a reduced trajectory file from the PostProcessedTraj.txt file for each flight line. Optionally and recommended, you may also update the image EXIF tags at the same time.

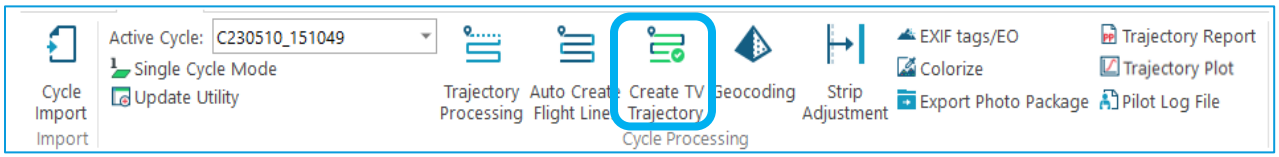


Figure 134 - Create TrueView Trajectories

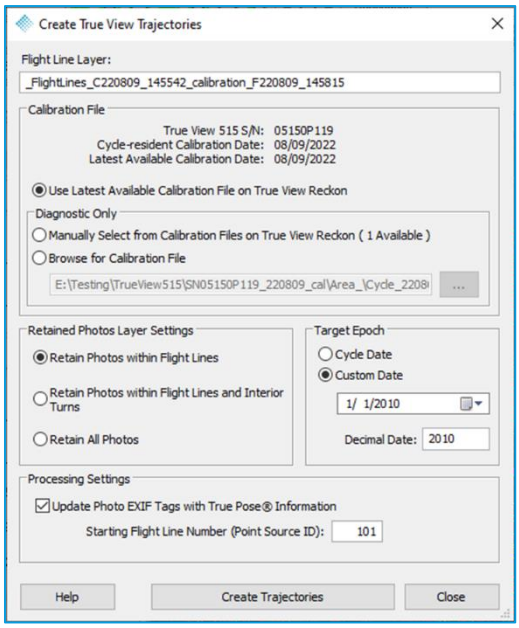


Figure 135 - Create TrueView Trajectories dialog

7. These fields of this dialog are usually auto populated if the post process trajectory solution was successful.
    a) **Flight Line Layer** - Select the flight line layer from which to generate TrueView trajectories if multiple Cycles are being processed.
    b) **Post Processed Trajectory File** – The trajectory file generated by POSPac. A post processed trajectory file may also be imported here if have one from a previous processing session with the same data.
    c) **Calibration file** – The TrueView sensor calibration is critical to get accurate LiDAR and imagery data for all supported system types. Select the option for the calibration file you wish to use:

i. **Use Latest Available Calibration File on TrueView Reckon** (Recommended) – The latest calibration file for each sensor is stored on TrueView Reckon. When this option is selected, LP360 Drone will use the latest calibration file found on TrueView Reckon to process the data. This is the recommended option as some smarts exist on Reckon and in LP360 Drone to help ensure the correct calibration file for the system and Cycle. **If your system does not have a calibration file on Reckon, please contact support@geocue.com for assistance.**

ii. **Diagnostic Only:** Users should never normally use either of these options, except for: DJI Zenmuse L1/L2 processing, where it should not be modified from the default; Imagery only guest sensors, such as the P4RTK or P1, where the user does not have a camera calibration on Reckon and is therefore following a more arduous workflow involving measuring control rather than a more automated Ortho Mapping processing with only check points for validation (Image Explorer will also not be usable without a camera calibration). Otherwise, if the "Latest Calibration" option above is greyed out, please contact support@geocue.com for further assistance. for further assistance.

1. **Use Cycle-resident Calibration File** – If this option is selected, the calibration file in the system folder of Cycle being processed will be used to process the data. This may not be the latest calibration file if updates to your calibration have been made and those updates were not copied to the USB prior to acquisition.
2. **Manually Select Calibration File** – This choice will invoke a dialog that allows you to select a file from all available calibration files for this sensor from Reckon. If you select this choice, the Calibration File Picker dialog (Figure 72) will be displayed when you press the Create Trajectories button at the bottom of the Create TrueView Trajectories dialog. You can pick the calibration file you desire using the dropdown picker.

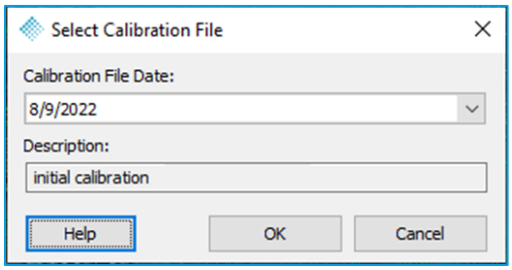


Figure 136 - Calibration File Picker

d) **Retained Photos Layer Settings** – Allows the user to specify the photos to be kept for geotagging and export to photogrammetric software packages using Export Photo Package or for processing in Agisoft Ortho Mapping, or for processing in Ortho

Mapping . The notion of "Retained Photos" creates a layer of the retained photos on a new layer called "RetainedPhotos."

i. ***Retain Photos within Flight Lines*** – This option retains only the photos that occur between the start and end of each flight line (flight lines were defined in the prior Create Flight Lines step). This option eliminates photos in turns. (Recommended). Selecting the option to "Retain Photos within Flight Lines." creates a new layer in the Table of Contents (TOC) called "RetainedPhotos". The resultant layer is shown in Figure 73. Note that only photos that are between the beginning and end of each flight line are retained.

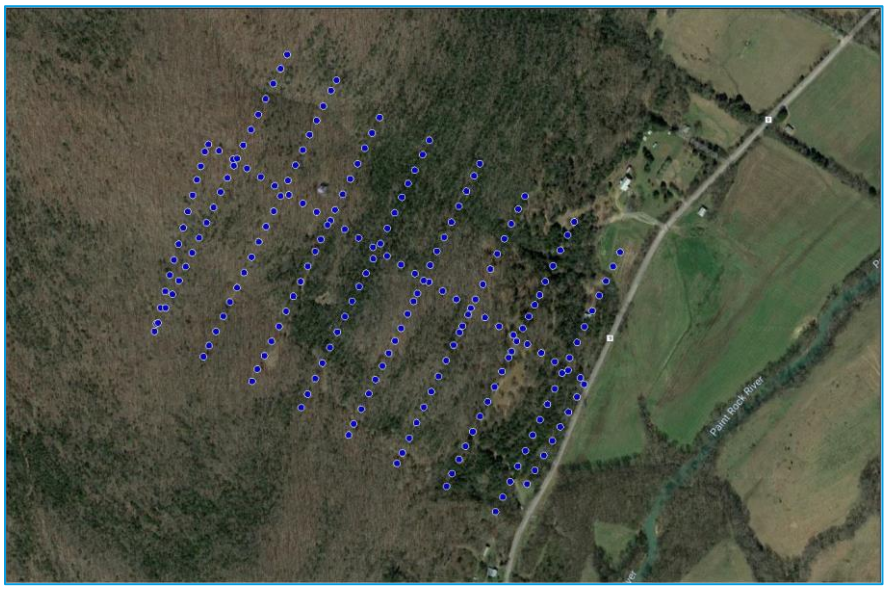


Figure 137 - Retain Photos only within Flight Lines

ii. ***Retain Photos within Flights Lines and Interior Turns*** – This option retains all photos from the start of the first flight line (*start* as defined by GPS time) and the end of the last flight line. Thus, all ferry line photos are retained.

iii. ***Retain All Photos*** – All project photos are retained. In Figure 74, all photos retained.

Figure 138 - All Project Camera Photos

e) **Target Epoch –** Select **Cycle Date** for coordinate reference systems using the WGS84 datum, otherwise select **Custom Date** and enter the applicable epoch for the datum of your coordinate reference system. For example, NAD83(2011) has an epoch date of 2010.0. Typically, the epoch date for your project datum should be selected by default. You will be prompted after selecting OK if the project epoch differs from the value entered on this dialog. The project epoch is set when the project CRS is selected but can be modified in File -> Project Settings -> Project -> Project Epoch.

f) **Processing Settings**

   i. **Update Photo EXIF Tags with True Pose® Information** – Performs the operations of the Update EXIF Tags for Photogrammetric Software tool. Recommended to have this checked to avoid needing to separately run the Update EXIF Tags for Photogrammetric Software tool.

   ii. **Starting Flight Line Number (Point Source ID)** – When there are multiple Cycles or flights in a project it is important to assign unique point source ids, or flight line numbers to each line. Selecting a unique starting ID allows the user to determine the best values between 1 and 65535 to use for each line. For multi-Cycle projects it is suggested to use a nomenclature, such as CCCFF, where CCC is the Cycles flown for the project, 1-645, and FF is the flight line per Cycle, 1-99, to keep the point source IDs unique within the project.

8. Select ***Create TV Trajectories*** to create TrueView trajectories for the selected Flight Line layer. Once trajectories for a flight line are created the flight line will change from blue to magenta. Close the dialog when finished.

You can delete additional photos on the RetainedPhotos layer using the Feature Edit *delete* tool. Only photos associated with this layer will be geocoded and exported as an export package, which greatly eases the setup of downstream tools.

Note also that the RetainedPhotos layer behaves as a normal Photos layer. This means that the image view panes appear if you open this layer in Feature Analyst.

If you cannot remember if you have run the Create TV Trajectories step, there is no harm in running it multiple times. The FlightLines layer symbology turns magenta when this step has been run. If you want to confirm creation of the flight line trajectories, you can inspect the Flight Line *attributes* using the LP360 Feature Analyst tool. Right-click the Flight Line layer in the TOC and then left-click "Feature Analyst …" (see Figure 75).

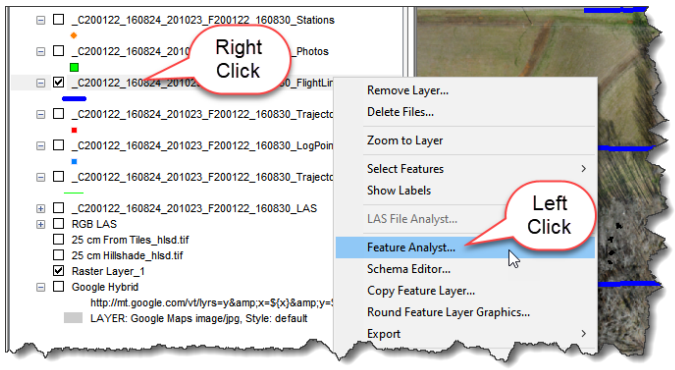


Figure 139 - Opening Feature Analyst on the Flight Line layer

Observe the "TVTrajFIle" column in the Feature table of Feature Analyst (Figure 76). If this column is blank, flight line trajectories have not yet been created.

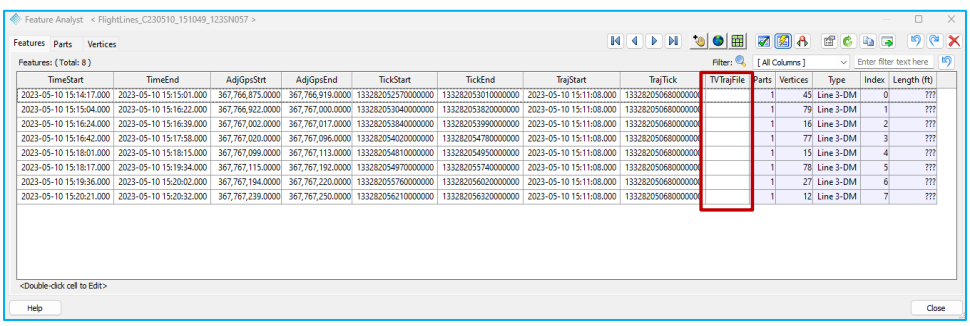


Figure 140 - TrueView Flight Lines prior to assigning Trajectories

Figure 77 shows the feature table after creation of the TrueView Flight Line trajectories. Note a file location is now populated in the TVTrajFile attribute column.

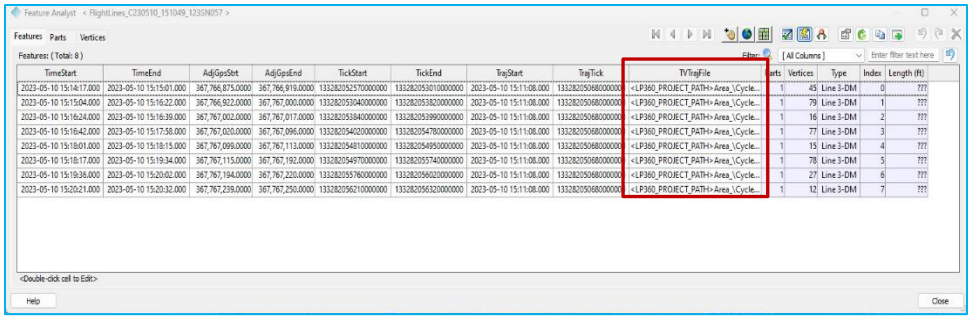


Figure 141 - TrueView Flight Lines after assigning Trajectories

Note: The Flight Line Trajectory files created in LP360 Drone for 3D Imaging Sensors (3DIS®) are in the Terrasolid trajectory format. These trajectories can be directly used in products such as TerraScan, TerraMatch and TerraPhoto.

GEOCODE LIDAR FOR L1/L2

The Geocode LiDAR step is where the pre-processed DJI Zenmuse L1/L2 LAS files produced by DJI Terra are used by LP360 Drone to:

- Upgrade the LAS from the DJI Terra format of LAS v1.2 to the latest LAS v1.4 format.
- Cut the LAS into the previously defined flight lines by file.
- Add flight line numbers (Point Source ID) to the points in the LAS files to allow for display by flight line, swath-to-swath analysis, and processing by Strip Align for LP360.

The steps below explain the functions of the Geocode LiDAR dialog. TrueView trajectories must have been generated before the Geocode LiDAR tool will be active.

1. If not already done, make active the Cycle/Flight combination to be processed.
2. Select the **Geocode LiDAR** button on the Sensor tab (Figure 78) to open the Geocode LiDAR dialog (Figure 79).

Figure 142 – Geocode LiDAR

3. The Geocode LiDAR dialog (Figure 79) is where the user will select the calibration file, and LiDAR clipping settings. A 3D point cloud, LAS files, will be generated after completing this step.
   a) **Flight Line Layer** – The layer that will be used to geocode and set by the active Cycle/Flight.

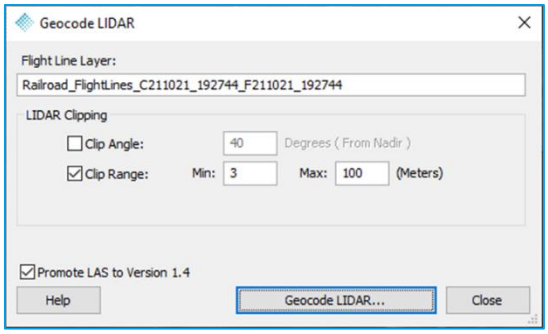


Figure 143 – Geocode L1/L2 LiDAR dialog

   b) **LiDAR Clipping:**
      i. **Clip Angle** – Enter the processing angle in degrees. This number represents the half angle off Nadir of the scanner. If 40 is entered, LiDAR data will be geocoded if it falls between +40° and -40° creating a total field of view (FOV) of

80°. Due to the narrow FOV of the L1/L2 we recommend keeping all data, so default this option as unchecked.

ii. **Clip Range** – Enter the minimum and maximum range to be geocoded. No points with a range less than and/or greater than these values, respectively, will be geocoded. Useful when no Clip Angle is used to pick up features beside the system.

4. **Promote LAS to Version 1.4** – Recommended to update the LAS file format to the current version of the industry standard.
5. **Geocode LiDAR** – LiDAR data will be geocoded when this button is clicked, creating the LAS layer for the selected Cycle.

UPDATE EXIF TAGS FOR PHOTOGRAMMETRIC SOFTWARE

Update EXIF Tags on the Sensor tab (Figure 95) will geotag each photo with the corrected position and accuracy value. Photos that were taken outside of the corrected trajectory file, such as photos on the ground before takeoff, will be removed. **This utility must be run to use the images in Metashape, Pix4D and other photogrammetric packages with similar workflows.** This step may be skipped if already run by selecting the **Update Photo EXIF Tags with True Pose® Information** checkbox on the Create TrueView Trajectories dialog. When completed, the Export Photo Package tool will be enabled.

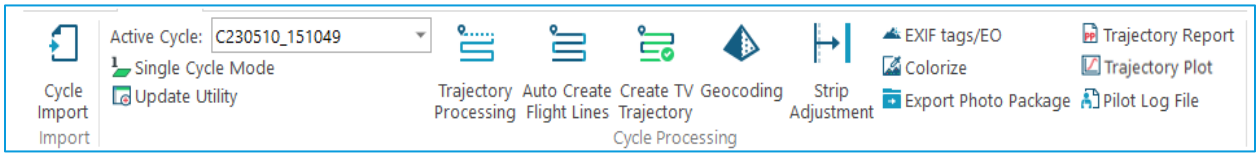


Figure 95 – Update EXIF Tags

10. If not already done, make active the Cycle/Flight combination to be processed.
11. Select ***Update EXIF Tags*** on the Sensor tab (Figure 95) to open the Update EXIF tags dialog (Figure 96).

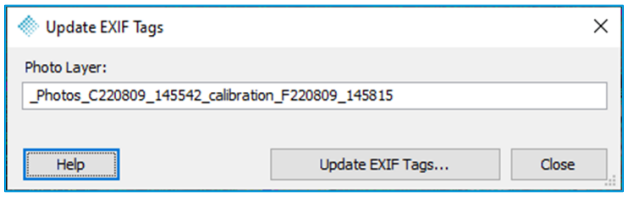


Figure 96 - Update EXIF Tags dialog

12. The photo layer that will be used to update the EXIF tags is selected based on the active Cycle/Flight combination on the Sensor tab.
13. Select *Update EXIF Tags* to tag the images.
14. A confirmation dialog (Figure 97) will appear showing the number of images that will be removed. This is a result of those images being outside of the corrected trajectory time frame and normal for the tagging process. Select *yes* to continue.

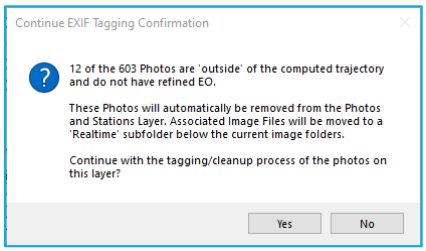


Figure 97 - EXIF Tagging Confirmation

15. When the process is complete, select OK on the confirmation dialog.

16. The images from both cameras are now tagged. Proceed to the Export Photo Package tool to export the photos on the Retained layer and associated camera calibration files for downstream processing in photogrammetric processing software.
17. To review the updated EXIF information in LP360 Drone:
    A) Select and right-click on the Photo or Stations layer in the Table of Contents (TOC) and select Feature Analyst.
    B) Select a photo or station from the Features list in Feature Analyst.
    C) Right-click on the desired image displayed in the lower section of Feature Analyst and select EXIF Information from the menu.

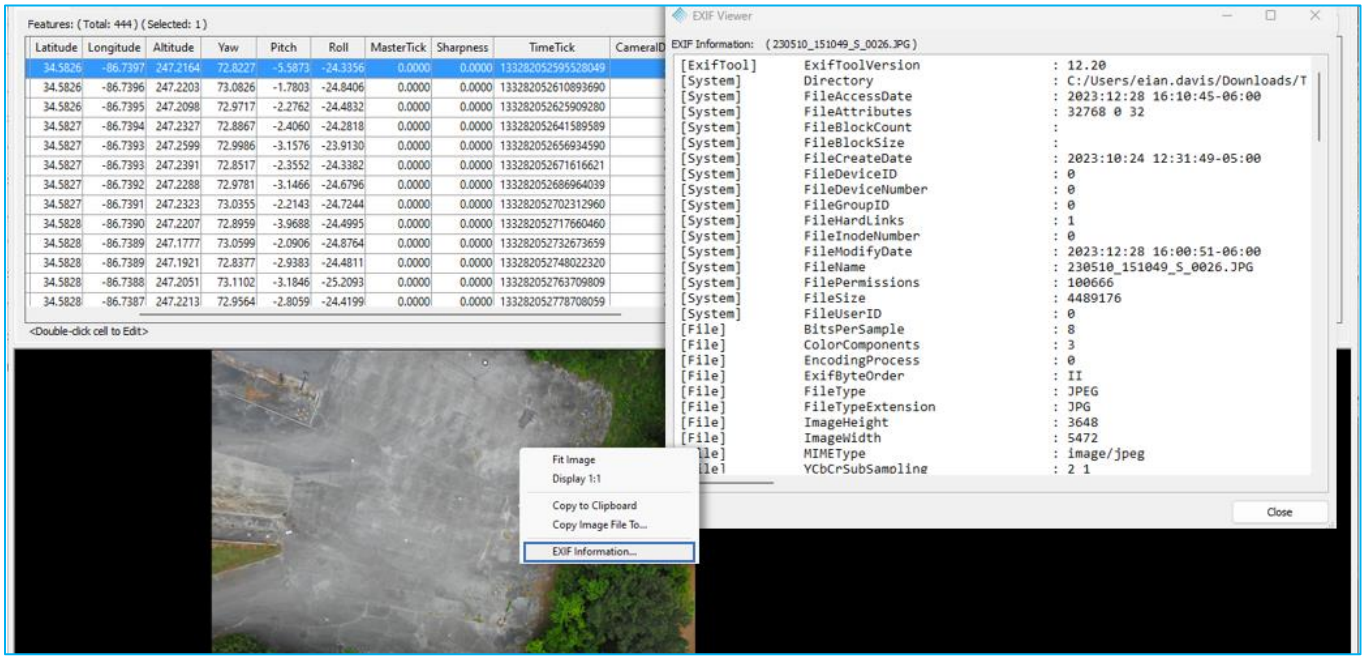


Figure 98 - Image EXIF Viewer

18. For troubleshooting purposes, the following information is left in this user guide but is superfluous when using the Export Photo Package tool.
    a) Tagged images, suitable for **Metashape**, are in the project folder, in the Port and Starboard folders (Figure 99) (Project\Area_\Cycle_YYMMDD_HHMMSS\Flight_YYMMDD_HHMMSS\)

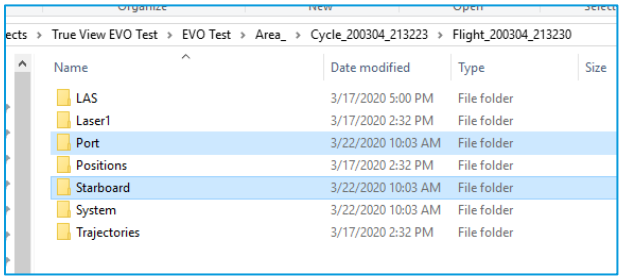


Figure 99 – Example Location of Tagged Images

b) Two CSV files with the image positions are created in the System folder in the same location (Project\Area_\Cycle_YYMMDD_HHMMSS\Flight_ YYMMDD_HHMMSS\System)
   i. The CSV file named "Image_geo_eo.csv" (Figure 100) contains the image positions in geographic coordinates, height in meters. The orientation angles are yaw, pitch and roll in degrees.
   ii. The CSV file named "Image_proj_eo.csv" (Figure 100) contains the image positions in projected coordinates, height in project units. The orientation angles are yaw, pitch and roll in degrees.
   iii. The CSV file named "image_geo_opk.csv" contains the image position file in geographic coordinates, height in meters, with the orientation angles represented as omega, phi, kappa in degrees. **This file is configured to be used in Pix4D**.

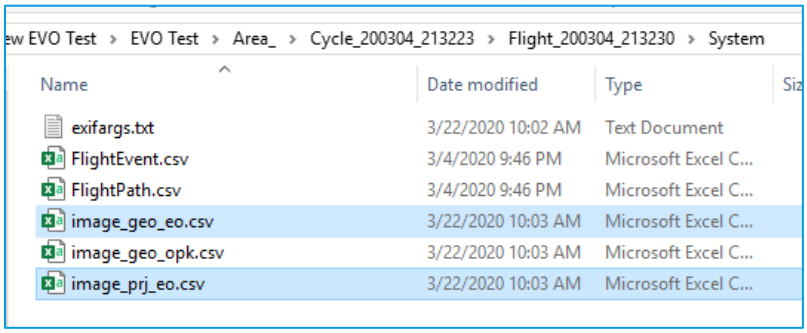


Figure 100 – Example Location of Image Position Files

c) Camera calibration files are also created for each camera in Project\Area_\Cycle_YYMMDD_HHMMSS\Flight_ YYMMDD_HHMMSS\System folder (Figure 101).
   i. The xml files named *Port.xml* and *Starboard.xml* can be **directly imported into Metashape**.
   ii. The text files named *PortP4D.txt* and *StarboardP4D.txt* **can be used in Pix4D**.

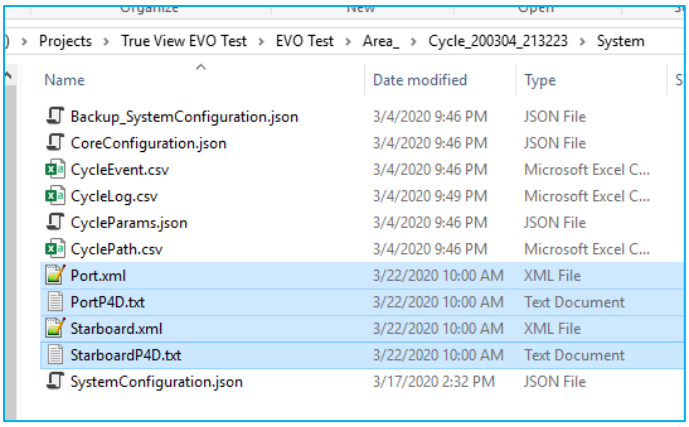


Figure 101 – Example Location of Camera Calibration Files

LP360 STRIP ALIGN (FKA STRIPALIGN FOR EVO(SAFE))

For a TrueView 3DIS, microdrones, and DJI Zenmuse L1/L2, strip alignment may be improved by executing an addon license to LP360 Drone, called **Strip Align** .

Figure 102 - Strip Align on the Sensor tab

LP360 Strip Align requires a "Strip Align" addon license be checked out in addition to the LP360 Drone license. Note: LP360 Drone+Strip Align may only be used with TrueView 3DIS®, microdrones, or DJI Zenmuse L1/L2 data.

12. The active Cycle on the Sensor tab is not used by this utility, so it does not matter what is selected.
13. Select ***Strip Align*** on the Sensor tab (Figure 102) to open the Strip Align dialog (Figure 103). **Note:** To enable this tool requires a Strip Align addon license to be checked out in addition to the LP360 Drone license.

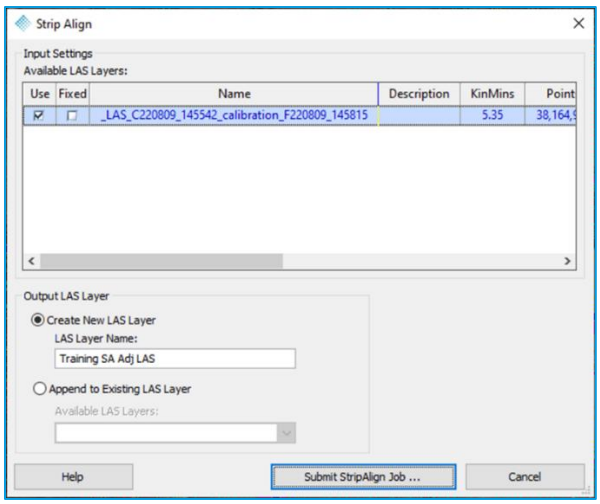


Figure 103 – Strip Align dialog

a) **Input Settings**
   i. **Available LAS Layers** – Will list all LAS layers in the currently open project.
   ii. **Use** – Select the checkbox in the "Use" column beside a LAS layer to determine corrections for that layer. The layer must have trajectories located in the same folder as the LAS, or in a Trajectories folder at the same level as the LAS data as is the typical file structure when following the TrueView workflow.
   iii. **Fixed** – Select the checkbox in the "Fixed" column beside a LAS layer to hold that layer fixed and use as reference for the "Use" layers. Trajectories are neither required, nor used for fixed layers.

iv. There are no "tuning" parameters for Strip Align, it is fully automated.

b) **Output Settings**

i. **LAS Layer Name** – Type in a unique name for the destination layer on which to generate the corrected LAS files from the "Use" layers. This is the typical first or only run option.

ii. **Append to Existing LAS Layer** – Select from the Available LAS Layer the previously created layer name on which to append the additional Cycle(s).

c) **Submit StripAlign Job** – Submits the Strip Align processing to the Job Manager queue for processing.

14. A successfully submitted job notification will appear confirming the job submission (Figure 104).

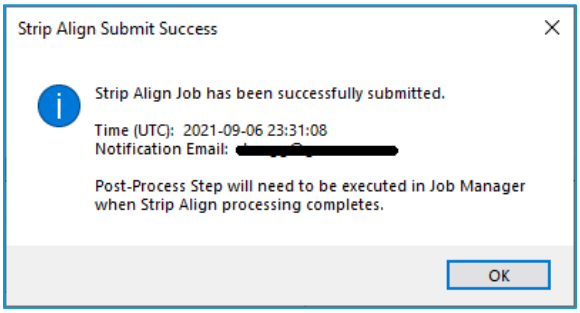


Figure 104 - Strip Align Job Submission Confirmation

15. An empty e-mail will be sent when the processing begins to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings).
16. The Strip Align job progress may be monitored using Job Manager .
17. Upon completion of the Strip Align job by the Job Manager :
    a) Job Manager will indicate completion by the green checkmark flashing on the Job Manager icon
    b) An empty completion e-mail notification will be sent to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings)
    c) The job will need to be post-processed to add the resulting LAS layer and/or LAS files to the open project.
18. In Job Manager , select the applicable Strip Align job, then select View Log to review the Strip Align processing log.
    a) Review the STDOUT section for "XYZ-displacements RMS" statistics before the correction and "Residual RMS" after the correction.
    b) Review the STDERR section for any reported errors aside from the expected benign warnings.
19. In Job Manager , select the applicable Strip Align job, then select Open Project to open the applicable project for the job, if not currently open.

20. Then, select Post-Process to add the new LAS Layer and/or LAS file(s) to the currently open project based on the settings at the time the job was submitted.
21. Review the adjusted LAS data vs the original to determine suitability of the correction. Cut profiles and generate a dz image for comparison to those done before the adjustment.
22. When desired, in Job Manager, select the applicable Strip Align job, then select Delete Job to clean up the temporary files generated while processing the job.

ORTHO MAPPING

For TrueView, microdrones, and DJI image sensors, the orthomosaic can be generated and the image positions and orientations refined using **Ortho Mapping** , that is included in an addon license to LP360 Drone, called **Photo**. A "Photo3000" or legacy "Full Photo" addon license may also enable this tool.

Figure 105 – Ortho Mapping on the Sensor tab

4. The active Cycle/Flight combination on the Sensor tab is not used by this utility, so it does not matter what is selected.
5. Select ***Ortho Mapping*** on the Sensor tab (Figure 105) to open the Ortho Mapping dialog (Figure 106). **Note:** To enable this tool requires a "Photo", or "Photo3000", or legacy "Full Photo" addon license be checked out in addition to the LP360 Drone license.

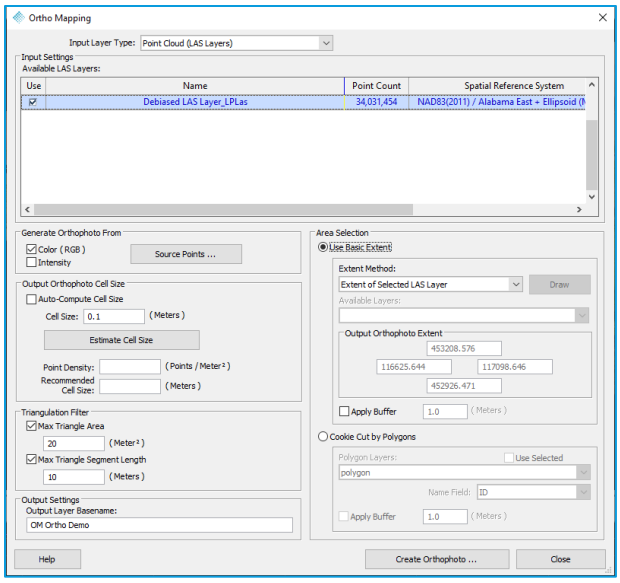


Figure 106 – Ortho Mapping dialog with Input Layer Type: Point Cloud (LAS Layers)

a) Input Layer Type:

The two modes available for the Ortho Mapping tool are predicated on the selection of the Input Layer Type.

i. **Point Cloud (LAS Layers) – Recommended for with TrueView 3DIS and microdrones,** since the heavy lifting has already been done by the point cloud colorization, the user may select to use the colorized point cloud LAS Layer from which to quickly generate an orthomosaic in a fraction of the time it would

take to use the photos. Select the desired colorized point cloud LAS layer(s) from which to generate the orthophoto.

ii. **Images (Photo Layers)** – For TrueView, microdrones, and DJI image sensors, the orthomosaic can be generated from the photos, and the image positions and orientations refined by selecting the images on the Photo layer(s) as the input.

INPUT LAYER TYPE: POINT CLOUD (LAS LAYERS)

6. With the input layer type selected to be **Point Cloud** the Ortho Mapping dialog looks like Figure 106.
   a) **Input Settings**
      i. **Available LAS Layers** – Select the checkbox in the "Use" column beside all desired colorized LAS layers that you wish to use as source points for the orthomosaic generation. This would typically include LAS layers for every Cycle in the project that covers the desired area.
   b) **Generate Orthophoto From**
      i. **Color (RGB)** - This option will generate an RGB orthophoto using the RGB attributes from the selected Source Points.
      ii. **Intensity** – This option will generate a greyscale orthophoto using the intensity attributes from the selected Source Points.
      iii. **Source Points** – Selecting will open Live View to allow filtering the points to be used from the input LAS Layers based on the available criteria.
   c) **Output Orthophoto Cell Size** – Specify the ground sample distance (GSD) of the orthophoto to be generated in the project map units.
      i. **Auto-Compute Cell Size** – **Not Recommended** – will disable the other options in this group box and compute the cell size to use during processing.
      ii. **Cell Size** – Key in your desired cell size.
         1. **Estimate Cell Size** – when pressed, will sample the input LAS layers to populate the *Point Density* and *Recommended Cell Size* and populate the *Cell Size* with that same recommended value. It is recommended to manually modify the value in the *Cell Size* to increase it slightly and make it a round number. For example, if the *Recommended Cell Size* is 0.082 meters, then modify the *Cell Size* field to be 0.1 meters.
   d) **Triangulation Filter** – The selected attributes from the input LAS Layers will be triangulated and then sampled to produce the orthophoto. Use these settings to filter triangles based on their attributes to minimize the inclusion of long triangles that may span areas of void data to help clean up your orthophoto.
      i. **Max Triangle Area**
      ii. **Max Triangle Length**
   e) **Output Settings** – Specify the *Output Layer Basename* for the orthophoto(s) to be generated on.
   f) **Area Selection** – Define the extents for the orthophoto.
      i. **Use Basic Extent**

1. **Extent Method**
    a. **Extent of Selected LAS Layer(s)**
    b. **Custom Extent** – manually enter the *Output Orthophoto Extents*.
    c. **Current Map Extent** – uses the current map view extents to define the *Output Orthophoto Extents*.
    d. **Layer Extent** – Enables the layer selection dropdown to select which layers extents to use to define the *Output Orthophoto Extent.*
    e. **Draw Window in Map** – Select Draw then draw a rectangle in the map view to define the *Output Orthophoto Extent*.
2. **Output Orthophoto Extent** – changes with the Extent Method selected to describe the rectangular bounding box in map coordinates.
3. **Apply Buffer** – enable and enter the buffer value to increase the size of the triangulated surface to some buffered distance around the *Output Orthophoto Extent.*

ii. **Cookie Cut by Polygons**
1. **Polygon Layers** – select the layer from which to use the polygon features to generate one orthophoto for each polygon.
    a. **Use Selected** – enable to only generate a single orthophoto for the polygon which has been selected from the selected polygon layer.
2. **Name Field** – choose which field to use to uniquely name the generated orthophoto files for each polygon.
3. **Apply Buffer** – enable and enter the buffer value to increase the size of the triangulated surface to some buffered distance around each *polygon.*

g) **Create Orthophoto** – Executes the Export Wizard to generate the orthophoto(s). s the process is relatively quick, a progress bar appears during processing and there is no job submitted to the Job Manager.

INPUT LAYER TYPE: IMAGES (PHOTO LAYERS)

14. After selecting the input layer type to be **Images** the Ortho Mapping dialog will change to look like Figure 107.

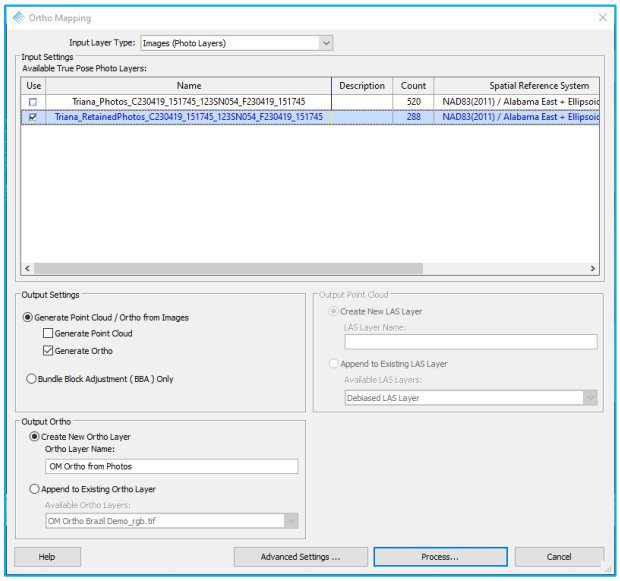


Figure 107 – Ortho Mapping dialog with Input Layer Type: Images (Photo Layers)

a. **Input Settings**
   i. **Available True Pose® Photo Layers** – Select the checkbox in the "Use" column beside all desired True Pose® layers that you wish to use as source photos for the orthomosaic generation. This would typically include all RetainedPhotos layers for every Cycle in the project that covers the desired area. A True Pose® image means their full metadata, including camera calibration, is stored in special GeoCue tags within each photo's EXIF tags.

b. **Output Settings**
   i. **Generate Point Cloud / Ortho from Images** - This option will generate a Dense Image Matching (DIM) point cloud.
      1. **Generate Point Cloud (LAS)** - generate and retain the Dense Image Matching (DIM) point cloud to add to the project during the post-process step.
      2. **Generate Ortho** - generate and retain the orthomosaic to add to the project during the post-process step.
   ii. **Bundle Block Adjustment (BBA) Only** – Useful for troubleshooting, or to improve the True Pose® information for use with Image Explorer when not generating an orthomosaic.

c. **Output Point Cloud** – Only use this option for 2DIS (image only systems).
   i. **Create New LAS Layer - LAS Layer Name** – Type in a unique name for the destination layer on which to generate the DIM LAS files from the Ortho Mapping run.

ii. **Append to Existing LAS Layer** – Select from the Available LAS Layer the previously created layer name on which to append the additional DIM LAS files.

d. **Output Ortho**

i. **Create New Ortho Layer** – **Ortho Layer Name** – Type in a unique name for the destination layer on which to generate the orthomosaic raster resulting from this Ortho Mapping run.

ii. **Append to Existing Ortho Layer** – Select from the Available Ortho Layers a previously created layer name on which to add the orthomosaic raster resulting from this Ortho Mapping run.

e. **Advanced Settings** – Opens the Ortho Mapping Advanced Settings dialog (Figure 109Figure 113)

f. **Process** – Submits the Ortho Mapping processing to the Job Manager queue for processing.

15. A successfully submitted job notification will appear confirming the job submission (Figure 112).

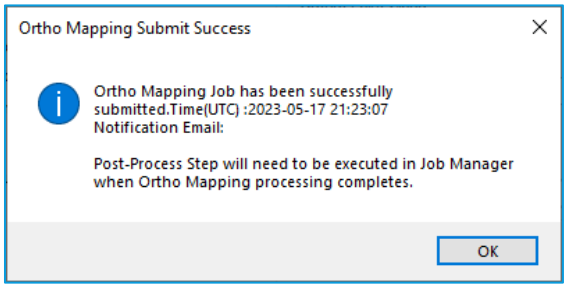


Figure 108 – Ortho Mapping job submission confirmation

16. An e-mail will be sent when the processing begins to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings).
17. The Ortho Mapping job progress may be monitored using Job Manager .
18. Upon completion of the Ortho Mapping job by the Job Manager :
    a. Job Manager will indicate completion by the green checkmark flashing on the Job Manager icon
    b. A completion e-mail notification will be sent to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings)
    c. The job will need to be post-processed to add the resulting Orthomosaic layer and/or raster, as well as the optional LAS layer and/or LAS files to the open project.
19. If desired, or for troubleshooting, in Job Manager , select the applicable Ortho Mapping job, then select View Log to review the Ortho Mapping processing log.
20. In Job Manager , select the applicable Ortho Mapping job, then select Open Project to open the applicable project for the job, if not currently open.
21. Then, select Post-Process to add the new Ortho Layer and/or raster file, and for 2DIS the new LAS Layer and/or LAS file(s) to the currently open project based on the settings at the time the job was submitted.

22. Review the generated Orthomosaic and for 2DIS, LAS data.
23. When desired, in Job Manager, select the applicable Ortho Mapping job, then select Delete Job to clean up the temporary files generated while processing the job.
24. **Optional:** Use the **Reproject Raster PCT** providing it your deliverable project boundary, or boundaries if you would like to tile the ortho, as input geometry, leave the reproject unchecked so as not to reproject the raster, and it will quickly create you a clipped orthomosaic. This PCT is also useful for converting the Ortho Mapping generated orthomosaic from the default BigTIFF format to a regular TIFF for using the raster in Autodesk's Civil3D, which cannot read BigTIFFs. Unless, of course, your orthomosaic is around 4GB or larger, thus requiring to be a BigTIFF, unless you use the **Reproject Raster PCT** to cut the orthomosaic into an index of your own or one created using the **Grid Generator PCT**.

ORTHO MAPPING ADVANCED SETTINGS

The most commonly configurable Ortho Mapping settings are configured on the Ortho Mapping Advanced Settings dialog (Figure 109). The defaults are the recommended settings, though users may wish to modify for their personal preferences.

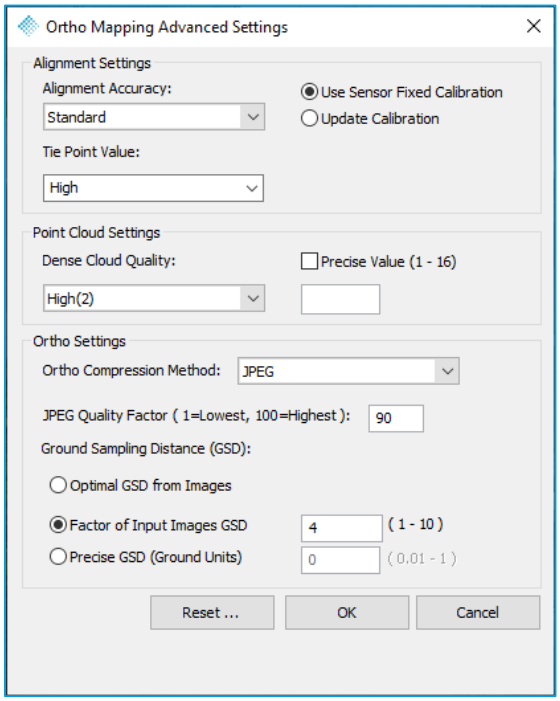


Figure 109 - Ortho Mapping Advanced Settings dialog

- **Alignment Settings**
  - **Alignment Accuracy** – Selects the input photo resolution that will be used in the Bundle Block Adjustment (BBA) step. The higher the resolution, the more accurate the BBA, but at the expense of increased processing time. Select from:

Highest	2:1	
High	1:1	**High is recommended.**
Medium	1:2	
Low	1:4	
Lowest	1:8	

  - **Camera Calibration –** This radio button choice allows you to use *a prior* camera calibration or Update Calibration to calibrate the camera as part of the BBA process. For pre-calibrated sensors (usually the case with GeoCue workflows, but not the case for DJI L1/L2), select **Use Sensor Fixed Calibration** to use the camera calibrations for your system that are stored on Reckon. You should always use this option. ***Note:*** You cannot perform "GCP-Free" geopositioning if you do not have a pre-calibrated camera.
- **Point Cloud Settings**
  - **Dense Cloud Quality** – This sets the resolution of the input photos during the dense cloud formation part of the processing. As with BBA, a higher setting provides higher quality but at the expense of increased processing time. Each level is approximately four times the processing time of the level below it. Select from:
    - Ultra High 1:1
    - High 1:2 **High is recommended for CUDA cores.**
    - Medium 1:4 **Medium is recommended when no CUDA cores.**
    - Low 1:8
    - Lowest 1:16
    - Precise Value (1-16)
- **Ortho Settings**
  - **Ortho Compression Method** – Select from No compression, JPEG, or LZW. **JPEG recommended.**
  - **JPG Quality** – If a JPEG compression method is used, specify the desired quality, with 1 being the lowest and 100, the highest. **Recommended to use 90** for a good quality to compression ratio.
  - **Optimal GSD from Images** – Allow Ortho Mapping to determine the optimal ground sample distance for the orthomosaic from the input photos. i.e., Full resolution. **Not Recommended!**
  - **Factor of Input Images GSD** – Allows the tool to automatically determine the *Optimal GSD from Images*, then multiply it by the factor to set the desired Precise GSD. **For optimal results, recommended to generate the orthomosaic a factor of four times the optimal GSD from Images.**
  - **Precise GSD (Ground Units)** – The user may deselect the *Optimal GSD from Images* option and enter a desired GSD in the project units.

AGISOFT ORTHO MAPPING (FKA METASHAPE FOR EVO(MFE))

For TrueView and DJI image sensors, the orthomosaic can be generated and the image positions and orientations refined using Agisoft Ortho Mapping , that is included in an addon license to LP360 Drone, called **Photo with Agisoft**. Images may also be processed in the Cloud version for Ortho Mapping using LP360 points purchased in the LP360 Store.

The Agisoft Ortho Mapping license is a separate key from the LP360 Drone+Photo with Agisoft licenses. See Licensing LP360 Drone+Desktop Photo with Agisoft for more information on activating/deactivating your Agisoft Ortho Mapping license. **It is not necessary to install Metashape Pro to use this tool**, however, Agisoft Ortho Mapping may also drive the GUI version of Metashape Pro (v1.7.1 through 2.0.x) if you have such licenses or desire to purchase a node-locked or floating license.

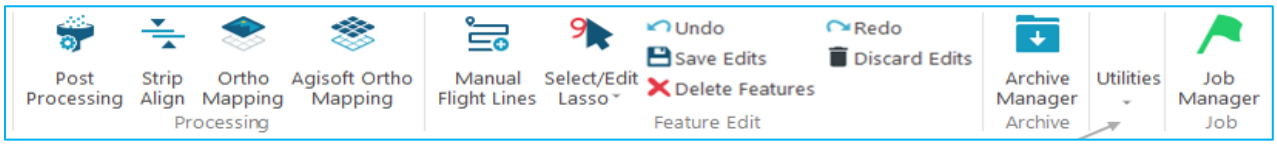


Figure 110 – Agisoft Ortho Mapping on the Sensor tab

14. The active Cycle/Flight combination on the Sensor tab is not used by this utility, so it does not matter what is selected.
15. Select ***Agisoft Ortho Mapping*** on the Sensor tab (Figure 110) to open the Agisoft Ortho Mapping dialog (Figure 111). **Note:** To enable this tool requires a "Full Photo", "Photo with Agisoft", or "Photo3000" addon license be checked out in addition to the LP360 Drone license.

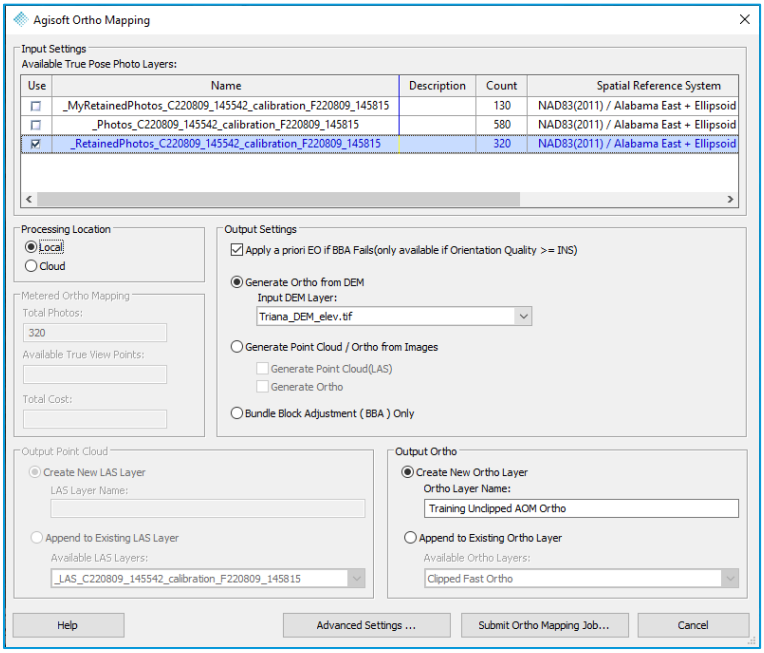


Figure 111 – Agisoft Ortho Mapping dialog

a) **Input Settings**
   i. **Available True Pose® Photo Layers** – Select the checkbox in the "Use" column beside all desired True Pose® layers that you wish to use as source photos for the orthomosaic generation. This would typically include all RetainedPhotos layers for every Cycle in the project that covers the desired area. A True Pose® image means their full metadata, including camera calibration, is stored in special GeoCue tags within each photo's EXIF tags.

b) **Processing Location** – Select to process Local or Cloud by selecting the applicable radio button next to the option.

c) **Metered Ortho Mapping** – When Cloud is selected, this section will detail the number of photos, available LP360 Points, and the total cost for generating the orthomosaic using Ortho Mapping Cloud.

d) **Output Settings**
   i. **Apply a priori EO if BBA Fails (Only available if Orientation Quality >= INS)** – (**Recommended for 3DIS®**) Always defaulted on for True Pose® photo layers from a TrueView 3DIS®. This option is not available for DJI and other sensors. When selected, two Metashape projects are generated as LP360 Drone identifies those images for which Metashape failed to align, for instance, those in vegetation, and updates the alignments for those in the new project. This second project is then used to generate the orthomosaic so that the holes one would normally have from a standard Metashape processing are minimized, if not eliminated.

   i. **Generate Ortho from DEM** (**Highly recommended for 3DIS®**)
      1. **Input DEM Layer**
         a. Remove any high and low noise from the dataset. Often best accomplished using the *Clip Range* option in Geocode LiDAR, *Low/Isolated* PCT, and/or a *Basic Filter* PCT that uses elevation clipping. See Noise Removal Options for more details.
         b. Run a ground classification (*Adaptive TIN Ground* PCT) against the dataset using appropriate settings for a good, generalized ground surface. It is not important to have a perfect surface as there is some leeway in the orthomosaic process, however, if you have features such as retaining walls then you may need breaklines to properly hold those types of features.
         c. *Optional* - Manually cleanup the gross blunders in the ground surface (Class 2) using the manual classification tools found on the Classification tab and Profile toolbar, and/or the *Ground Cleanup Filter* PCT.
         d. *Optional* - Manually classify building roofs to class 6, and bridge decks to class 17 to create a better looking orthomosaic.
         e. *Optional* – To create the cleanest edge lines along buildings and bridges, polygonate the building and bridge deck classes, then set those to the ground and upper surface elevations by

following these steps to create two polygon sets, one set being the buffered footprints and one set the headprints:

i. Use the Point Group Tracing and Squaring PCT with appropriate parameters for your dataset to polygonate the desired non-ground features, normally roofs and bridge decks, but could be other features desired for a "True Ortho". To run this PCT with high density TrueView data you will first need to thin the dataset to roughly 8 points/m^2 using the Classify by Statistics PCT.
ii. Use the Conflate PCT to pure drape a copy of each non-ground feature to the ground class to create the footprints. This holds the edge clean to the existing ground surface.
iii. Use the Conflate PCT to conflate to the closest elevation of the building or bridge deck points found therein, a copy of each footprint polygon to create the headprints.
iv. We need to buffer the footprint polygons slightly, say 2.5cm, using the Buffer Geometry tool found on the Feature Edit tab, since in a TIN you cannot have two points at the same planimetric location with differing elevations.
v. Use the Classify by Feature PCT to mark any ground points found within the buffered footprint polygons so as not to use them in your resulting DEM.
vi. If you perform these steps to generate a set of buffered footprint polygons (buffered and ground conflated polygons) and headprint (closest elevation conflated) polygons for your desired non-ground features, then skip the *Classify by Statistics* PCT in the next step since you will not have conflicting surfaces over the same cell. Furthermore, use Breakline Enforcement, using the polygons generated by the preceding steps to help hold the edge of your features, when in the export DEM step.

f. Export a DEM using the Export Wizard to quickly create a DEM from the LiDAR data and generate the orthomosaic much faster than Metashape generating a DEM from the images.

i. **Run Classify by Statistics PCT** – For best results, it is recommended to perform some initial classification as described above before exporting a DEM. Run the Classify by Statistics PCT with the following recommended settings to help in areas where there are

two surfaces in the same location, such as when the roof overhangs and the LiDAR sees the ground beneath:

1. Feature Geometry – Tool Geometry
2. Units – Set to project units.
3. Input LAS Layer – Active LAS Layer
4. Source Points - Classes 2, 6, and 17. Flags ignored.
5. Cell Size – 0.05m - Gently rolling terrain doesn't need as high a resolution DEM as an area with sharper features.
6. Samples – Max
7. Destination Class – Flags Only – Synthetic – Set
8. Quartile Classification – Leave blank.
9. Generate Cell Output Shape file – Leave unchecked.
10. Run by project.

ii. Recommended **Export LiDAR Data** DEM settings:

1. Source Points:
   a. If the Classify by Statistics in the previous section was performed, use Synthetic Flag Set
   b. If the optional non-ground polygons were created and the Classify by Statistics PCT skipped, then use classes 2, 6, and 17 ignoring the synthetic flag.
   c. or use all points for a quick ortho.
2. Export Type - Surface
3. Surface Method - Triangulation
4. Pixel size: 0.05m to 0.25m. Gently rolling terrain does not need as high a resolution DEM as an area with sharper features.
5. Surface Attribute to export – Elevation
6. Export Format – GeoTIFF
7. Raster Information – Pixel Size: 0.05 to 0.25m. Gently rolling terrain doesn't need as high a resolution DEM as an area with sharper features.

ii. **Generate Point Cloud / Ortho from Images** - Typically only use this option for 2DIS (image only systems). This option will take much longer and will generate a Dense Image Matching (DIM) point cloud.

1. **Generate Point Cloud (LAS)** - generate and retain the Dense Image Matching (DIM) point cloud to add to the project during the post-process step.
2. **Generate Ortho** - generate and retain the orthomosaic to add to the project during the post-process step.

iii. **Bundle Block Adjustment (BBA) Only** – Useful for troubleshooting, or to improve the True Pose® information for use with Image Explorer when not generating an orthomosaic.

e) **Output Point Cloud** – Only use this option for 2DIS (image only systems).

i. **Create New LAS Layer - LAS Layer Name** – Type in a unique name for the destination layer on which to generate the DIM LAS files from the Ortho Mapping run.

ii. **Append to Existing LAS Layer** – Select from the Available LAS Layer the previously created layer name on which to append the additional DIM LAS files.

f) Output Ortho

i. **Create New Ortho Layer** – **Ortho Layer Name** – Type in a unique name for the destination layer on which to generate the orthomosaic raster resulting from this Ortho Mapping run.

ii. **Append to Existing Ortho Layer** – Select from the Available Ortho Layers a previously created layer name on which to add the orthomosaic raster resulting from this Ortho Mapping run.

g) **Advanced Settings** – Opens the Agisoft Ortho Mapping Advanced Settings dialog (Figure 113)

h) **Submit Ortho Mapping Job** – Submits the Agisoft Ortho Mapping processing to the Job Manager queue for processing.

16. A successfully submitted job notification will appear confirming the job submission (Figure 112).

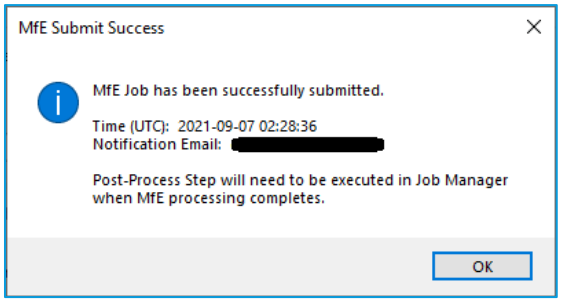


Figure 112 – Agisoft Ortho Mapping job submission confirmation

17. An e-mail will be sent when the processing begins to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings).
18. The Agisoft Ortho Mapping job progress may be monitored using Job Manager .
19. Upon completion of the Agisoft Ortho Mapping job by the Job Manager :
    a) Job Manager will indicate completion by the green checkmark flashing on the Job Manager icon

b) A completion e-mail notification will be sent to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings)
c) The job will need to be post-processed to add the resulting Orthomosaic layer and/or raster, as well as the optional LAS layer and/or LAS files to the open project. Plus, update the EXIFs on each photo to the bundle block adjusted values.

20. In Job Manager, select the applicable Agisoft Ortho Mapping job, then select View Report to review the Agisoft Ortho Mapping processing report. Review for position and orientation average corrections to be within tolerances for your system's POS.
21. If desired, or for troubleshooting, in Job Manager, select the applicable Agisoft Ortho Mapping job, then select View Log to review the Agisoft Ortho Mapping processing log.
22. In Job Manager, select the applicable Agisoft Ortho Mapping job, then select Open Project to open the applicable project for the job, if not currently open.
23. Then, select Post-Process to add the new Ortho Layer and/or raster file, and for 2DIS the new LAS Layer and/or LAS file(s) to the currently open project based on the settings at the time the job was submitted. Plus, update the EXIFs on each photo to the bundle block adjusted values.
    a) If the run location selected was Cloud, you will be asked to browse for the 7z file you downloaded from the link in the job completion e-mail.
24. Review the generated Orthomosaic and for 2DIS, LAS data.
25. When desired, in Job Manager, select the applicable Agisoft Ortho Mapping job, then select Delete Job to clean up the temporary files generated while processing the job.
26. **Optional:** Use the **Reproject Raster PCT** providing it your deliverable project boundary, or boundaries if you would like to tile the ortho, as input geometry, leave the reproject unchecked so as not to reproject the raster, and it will quickly create you a clipped orthomosaic. This PCT is also useful for converting the Ortho Mapping generated orthomosaic from the default BigTIFF format to a regular TIFF for using the raster in Autodesk's Civil3D, which cannot read BigTIFFs. Unless, of course, your orthomosaic is around 4GB or larger, thus requiring to be a BigTIFF, unless you use the **Reproject Raster PCT** to cut the orthomosaic into an index of your own or one created using the **Grid Generator PCT**.

AGISOFT ORTHO MAPPING ADVANCED SETTINGS

The most commonly configurable Agisoft Ortho Mapping settings are configured on the Agisoft Ortho Mapping Advanced Settings dialog (Figure 113). The defaults are the recommended settings, though users may wish to modify for their personal preferences.

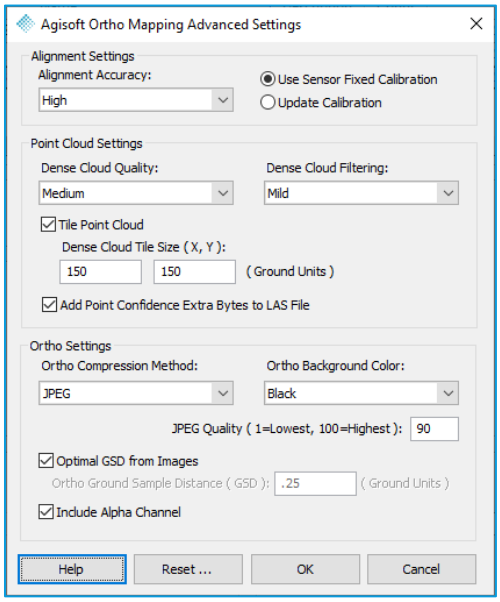


Figure 113 - Agisoft Ortho Mapping Advanced Settings dialog

- **Alignment Settings**
  - **Alignment Accuracy** – Selects the input photo resolution that will be used in the Bundle Block Adjustment (BBA) step. The higher the resolution, the more accurate the BBA, but at the expense of increased processing time. Select from:

Highest	2:1	
High	1:1	**High is recommended.**
Medium	1:2	
Low	1:4	
Lowest	1:8	

  - **Camera Calibration –** This radio button choice allows you to use *a prior* camera calibration or Update Calibration to calibrate the camera as part of the BBA process. For pre-calibrated sensors (usually the case with GeoCue workflows, but not the case for DJI L1/L2), select **Use Sensor Fixed Calibration** to use the camera calibrations for your system that are stored on Reckon. You should always use this option. ***Note:*** You cannot perform "GCP-Free" geopositioning if you do not have a pre-calibrated camera.
- **Point Cloud Settings**
  - **Dense Cloud Quality** – This sets the resolution of the input photos during the dense cloud formation part of the processing. As with BBA, a higher setting provides higher

quality but at the expense of increased processing time. Each level is approximately four times the processing time of the level below it. Select from:

- Ultra High 1:1
- High 1:2
- Medium 1:4 **Medium is recommended.**
- Low 1:8
- Lowest 1:16.

- **Dense Cloud Filtering** – Adjusts the aggressiveness of the smoothing filter applied after the point cloud formation. Select from:
  - Disabled
  - Mild **Mild is recommended.**
  - Moderate
  - Aggressive
- **Tile Point Cloud using Dense Cloud Tile Size** – This setting will form the resultant point cloud into a set of tiled LAS files. LP360 prefers smaller file sizes, so it is better to tile when generating a point cloud, such that each LAS is less than 256MB.
- **Add Point Confidence Extra Bytes to LAS File** – The Agisoft confidence, or reliability extra byte, can be an additional attribute useful when determining the suitability of a DIM point for ground classification. The value represents the number of depth maps used for the given point generation. The noisy areas of the dense cloud will have lower confidence and you can use the extra byte filter options in the Source Points/Live View dialog to exclude the noisy points from point cloud processing or views.

- **Ortho Settings**
  - **Ortho Compression Method** – Select from No compression, JPEG, LZW, Packbits, or Deflate. **JPEG recommended.**
  - **JPG Quality** – If a JPEG compression method is used, specify the desired quality, with 1 being the lowest and 100, the highest. **Recommended to use 90** for a good quality to compression ratio.
  - **Ortho Background Color** – Select a black or white background color for the void pixels in the image.
  - **Optimal GSD from Images** – Allow Metashape to determine the optimal ground sample distance for the orthomosaic from the input photos. i.e., Full resolution.
  - **Ortho Ground Sample Distance (GSD)** – The user may deselect the *Optimal GSD from Images* option and enter a desired GSD in the project units.
  - **Include Alpha Channel –** The alpha channel is a special channel on the image that handles transparency. Typically included, but users of older CAD programs, such as MicroStation v8i, need to uncheck this option if the program cannot handle images with an alpha channel included.

EXECUTING AGISOFT ORTHO MAPPING ON ANOTHER MACHINE

The recommended workflow should you wish to process your Cycles to a colorized point cloud on one machine, but generate your orthomosaic on a different machine, is to process all Cycles for your project on machine A. Then,

8. Export an Explorer Package from machine A containing all the desired RetainedPhotos layers and a single DEM layer (for 3DIS®) to be used for generating the orthomosaic.
9. Copy the Explorer Package to machine B.
10. On machine B, open the Explorer Package to create a new project.
11. Run **Agisoft Ortho Mapping** on machine B to generate your orthomosaic, and the optional point cloud (for 2DIS).
12. Post Process the Agisoft Ortho Mapping run to add the orthomosaic, and optional point cloud (for 2DIS) to the project on machine B.
13. On machine A, import the following from their folder locations on machine B into your existing project:
    1. **Orthomosaic** – UNC path as specified in the Agisoft Ortho Mapping completion e-mail.
    2. The updated **True Pose® photos** from the RetainedPhotos layer(s) – Right-click on the layer in the project on machine B, select Open Location in Explorer to determine the path to photos. They are in subfolders of the parent folder to the feature file. Recall only the retained photos were copied to machine B so you can import all photos found here.
    3. *optional* **point cloud (for 2DIS)** – UNC path as specified in the Agisoft Ortho Mapping completion e-mail.
14. Use the new True Pose® photos layer as the drive for Image Explorer by deselecting any other layers IE column in project manager and only enabling the new layer.

CONFIGURING LP360 DRONE TO RUN METASHAPE PRO

The recommended method of running **Agisoft Ortho Mapping** is to use the integrated version installed with LP360 Drone, however, LP360 Drone may also drive the GUI version of Metashape Pro if you have such licenses. To configure a user installed version of Metashape Pro (v1.7.1 to v2.0.x) to be run by the Agisoft Ortho Mapping:

2. Install the necessary components by running the "InstallPyYAML.bat" batch file found in "%CommonProgramFiles%\LP360\MSPy38" (Metashape v1.7.x to v2.0.x).
    a) Open an elevated command prompt by right-clicking on the Command Prompt in the Start menu and selecting "Run as Administrator".
    b) Change directory to the appropriate MSPy folder, using "cd %CommonProgramFiles%\ \LP360\MSPy38" (Metashape v1.7.x to v2.0.x).
    c) Execute the batch file by typing "InstallPyYAML.bat", <Enter>
    d) You may see a notification about a newer pip version being available but can ignore this message ().

TRUEVIEW 2DIS AND DJI-RTK CAMERA ONLY SENSOR WORKFLOW

This section provides a step-by-step guide to processing imagery only TrueView 2DIS, DJI Phantom 4 RTK, M210 RTK, DJI Zenmuse P1 (M300 RTK), and Mavic 3 Enterprise (M3E) RTK from the point of project creation to an orthomosaic and generated point cloud, using either the post processing kinematic (PPK) engine or the real-time trajectory solution. Included are common steps for geotagging images, exporting a photo package for downstream processing, or generating the orthomosaic.

To import TrueView 2DIS and supported DJI-RTK camera only sensor Cycle data from the USB mounted in the system during acquisition into a new or current project, open the Raw Mission Import Wizard and select *TrueView/Microdrones* as the sensor or the applicable supported DJI camera payload.

POST PROCESS TRAJECTORY WIZARD

After the data has been imported and the files have been examined, the next step is to correct the GNSS data by running the tightly integrated post processing kinematic (PPK) engine. This step is named Post Process Trajectory Wizard and will create a single text file with the corrected position information for the entire flight, along with QC plots.

When following the **real-time kinematic (RTK)** workflow for a DJI-RTK image sensor, skip this step and go directly to Creating Flight Lines and TrueView Trajectories.

1. On the Sensor tab (Figure 144), make active the Cycle/Flight combination to be processed.

   Enabling **Single Cycle Mode** (Figure 26) displays layers relevant to the Active Cycle making for efficient viewing of the layers for the Active Cycle.

2. Open the **Post Processing Trajectory Wizard** dialog by selecting the sensor **Trajectory Processing** button on the Sensor tab (Figure 144).

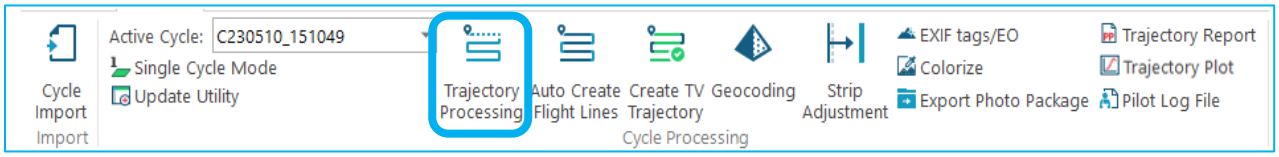


Figure 144 – Post Processing Trajectory Wizard

PROCESSING SETTINGS SELECTION

3. The **Post Processing Trajectory Wizard** dialog (Figure 145) should now be opened to the first page, which is where the user will select the file to be processed, and how it will be processed. The first time you open this page for a Cycle it may take a moment as LP360 Drone analyses the

raw observation file. The bullets below explain the settings for the **Post Processing Trajectory Wizard** dialog (Figure 145). Note: The title bar on this dialog will change to reflect the model of sensor being processed, "Phantom 4 RTK Post Processing Wizard" or "TrueView 250 Post Processing Wizard", or "POSPac Processing Wizard" for all models when processing using smartBase or PP-RTX using Applanix POSPacCloud.

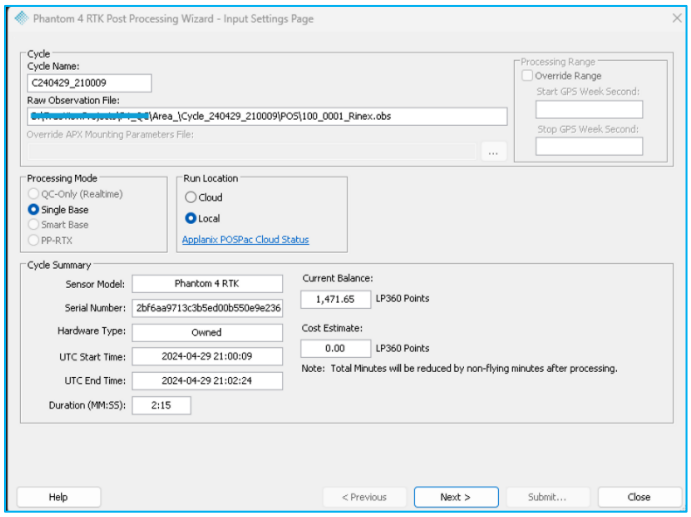


Figure 145 - Input Settings Page

a) **Cycle Name** – The Active Cycle for which to process the trajectory.
b) **Raw Observation File** – This shows the path to the obs file contained in the cycle that was selected in step A. Each cycle will have a different obs file.
c) **Override APX Mounting Parameters File** – Not applicable to the 2DIS workflow.
d) **Processing Mode** – Choose the processing method to be used to correct the GNSS data.
    i. QC-Only (Realtime)
    ii. Single Base ($) – Uses the RINEX file recorded from a single base station and always sets the run location to local.
    iii. Smart Base ($$) – Uses the SmartBase network from Applanix.
    iv. PP-RTX ($$$) – Uses the PP-RTX solution from Applanix. This is the least accurate option and should be used only if single base and SmartBase cannot be used.
e) **Run Location** – Select to process Local or Cloud by selecting the applicable radio button next to the option. If the Processing Mode is set to Single Base, then Local is the only option that can be used. If the Processing Mode is set to SmartBase or PP-RTX, then Cloud is the only option that can be used, and a user must be logged into an online account.
f) **GNSS Settings** – Only applicable if the Run Location is set to Cloud. Normally set to process using all available constellations but can be toggled to process using GPS only if one of the other constellations is causing noise in the solution. It is always set to use GPS only when processing DJI-RTK sensors using PP-RTX.

g) **Cycle Summary** – Contains information about the sensor and the Cycle start/end time. The account balance will be displayed, if enabled, along with the estimated cost to process this Cycle using the selected method. "Duplicate Task" will be shown if the process has already been run successfully on this data before using the same method, and indicates no additional points will be charged.

> An online account login is only applicable if the POSPac Run location is set to Cloud since LP360 Drone communicates with LP360 Online to manage your account's Point balance. During the *POSPac Processing Wizard* step, you must be logged into your online account to process using POSPac Cloud.

4. Select Next to move to the next page of the dialog. If using single base as the processing mode, the next page will be the Base Station Settings page (Figure 146). If using Smart base or PP-RTX, the next page will be the Processing Confirmation page.

BASE STATION SETTINGS

5. The **Base Station Input** page only appears when processing using the single base option. The bullets below correspond to Figure 146.

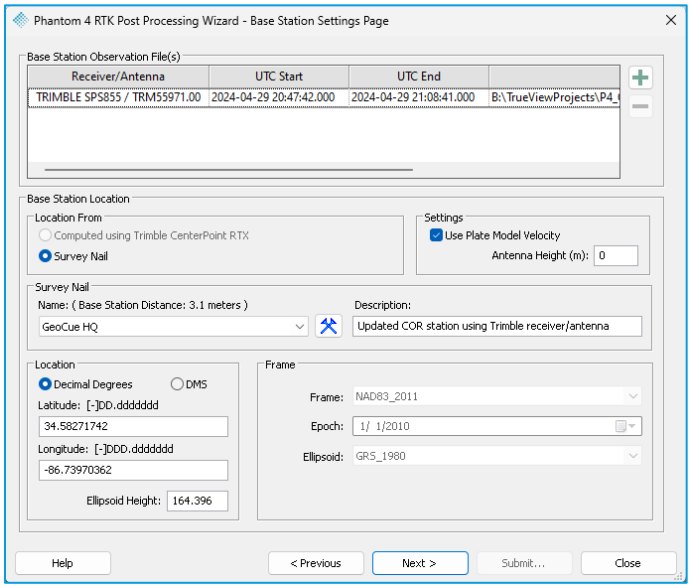


Figure 146 – Base Station Settings

Base Station Observation File(s) – This field should be populated automatically if the base station RINEX file(s) was imported during the Raw Mission Import wizard step. If not, it can be imported here by selecting ➕ to the right of the grid. If the Antenna type was written to the RINEX header, it will automatically be recognized and displayed in this box. **If not present, the RINEX file should be edited to include the information and added anew.**

a) **Base Antenna Calibration File** - During GNSS processing, whether local in LP360 Drone for 2DIS, in POSPac desktop, or using POSPacCloud, the antenna type must be known for the software to apply the proper antenna phase center (APC) to antenna reference point (ARP) offsets. LP360 Drone will automatically read the antenna model, if present, from the base RINEX file and display it black in the dialog if the antenna is a known type for which it has the antennae calibration. If the antenna model is unknown or not stipulated in the RINEX file, or no antenna calibration exists for the specified model then the antenna model will display in red (Figure 147). Hovering over the antenna model will provide a tooltip with the explanation, "Warning: NGS calibration for antenna model (Unknown) not found. Verify the correct antenna model is listed in the base observation file. If you have a newer model antenna it may need to be added to our database, contact 'support@geocue.com'. Proceeding with processing as is will result in no APC to ARP offsets applied, which is not normally desired, however, is acceptable in some circumstances."

Proceeding without a recognized antenna model will prompt for a confirmation when processing the trajectory solution. An example of when it may be okay to proceed with an unknown antenna model or missing antenna calibration would be if the reference mark was processed to the antenna phase center (APC) instead of the antenna reference point (ARP).

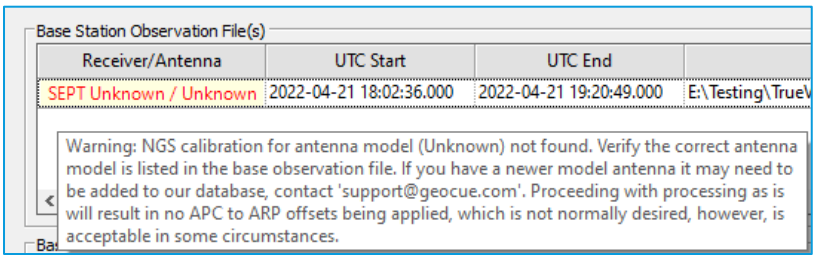


Figure 147 - NGS Antenna Calibration Not Found

b) **Base Station Location**

i. **Location from –** The base station location may be preset if the base station was set up over a known survey nail / reference mark or can be computed during POSPac processing using Trimble CenterPoint RTX.

1. **Trimble CenterPoint RTX –** Selecting this option will disable the location and frame portions of the dialog as those will be determined using the Trimble CenterPoint RTX post-processing service. Trimble RTX© is a global GNSS technology that provides centimeter-level positioning, worldwide, at any time. The CenterPoint RTX post-processing service supports dual frequency GNSS receivers. Antennas must be on the Supported Antennas list. The post-processing service will not process unsupported antennas. See also: **Supported Antennas**

Base Station Observation files must meet the following requirements:

- Data formats accepted include Trimble proprietary data formats (e.g., DAT, T01, T02, T04, Quark) and the standard RINEX 2 and RINEX 3 data formats.
- For optimal processing results, it is recommended to provide **at least 60 minutes** of observations.
- Data files cannot exceed 24 hours in length.
- Data files must be static only.
- Data files must contain dual frequency pseudorange and carrier phase observations (L1 and L2).
- Data must have been collected after 14 May 2011.

2. **Survey Nail / Reference Mark –** If properly selected during the Cycle Import Wizard this information will already be set. Otherwise, select the name of an existing survey nail from the list or select the nail icon to open the Survey Nail Manager, and add a new Survey Nail. Note: The dropdown list is sorted by distance from the average position found in the base station RINEX file.

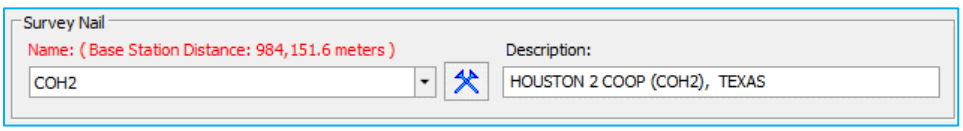


Figure 148 - Base Station Location Warning

A message appears on the page to indicate the distance from the Survey Nail to the approximate location found in the base observation file. If this distance is greater than 10 meters, the message shows in red, and you should verify the information as displayed in the Location is correct.

b) **Settings: Antenna Height** - Enter the base antenna height from the measured mark to the Antenna Reference Point (ARP). Phase center offsets should not be added to the antenna height unless the base antenna model was not written to the header and recognized in *Base Station Observation* section (item A).

c) **Location** – Once selected from the list or from the Survey Nail Manager, the Base Station Location information will appear in the dialog.

d) **Frame** – Once selected from the list or from the Survey Nail Manager, the Base Station Frame, epoch and ellipsoid will appear in the dialog.
   i. **Settings: Use Plate Model Velocity** – Not used in 2DIS trajectory processing. The frame of your base station coordinate dictates the frame of your resulting trajectory solution. Meaning if your base coordinate is NAD83(2011) epoch 2010.0, or if your base coordinate GDA2020 epoch 2020.0, or if your base coordinate is GDA94 epoch 1994.0, then your resulting trajectory solution matches that base datum frame as the data will be pulled from IGS(WGS84) to your base frame during processing.

e) Select Next to move to the Ephemeris Settings.

Note: It may take a moment while the ephemeris files are downloaded before the Ephemeris Settings page of the Wizard displays. Press ESC to cancel the auto-download if you wish to process in broadcast mode or have issues downloading the ephemeris files.

EPHEMERIS SETTINGS

6. The **Ephemeris Settings** page is used to configure the download of ephemeris or alternative navigation files, as well as configure the GNSS processing settings. LP360 Drone will attempt to download the necessary ephemeris files when transitioning to this page of the wizard, or when the GNSS Settings are changed. The bullets below correspond to Figure 149.
   a) Ephemeris Mode:
      i. Post-Processed (Downloaded from Internet) – Downloads the available mixed or GPS only ephemeris, and daily broadcast navigation file from the internet.
      ii. **Broadcast (Use Alternate Navigation File (i.e., *.24N), downloaded from the Base Station (No internet connection required)** – Uses the base station broadcast navigation file. No internet connection required.

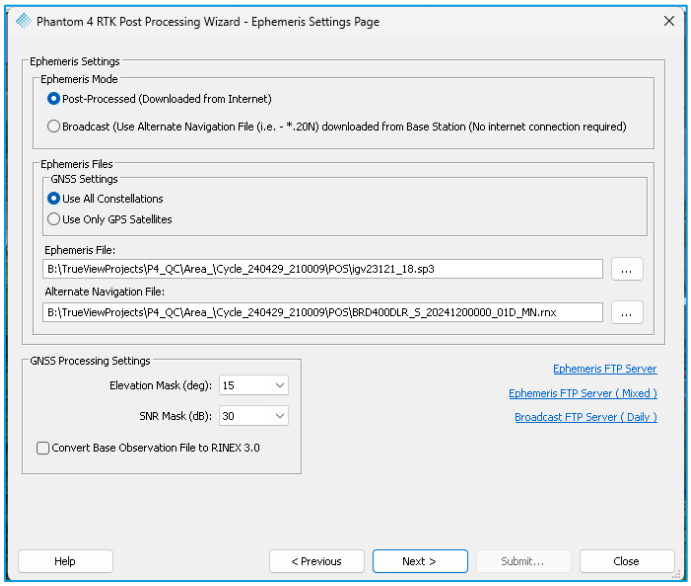


Figure 149 - Ephemeris Settings

b) **Ephemeris Files**

i. Select to process using **All Constellations** (default) or to process using **GPS only.** You may elect to use GPS only if you are having issues processing a successful solution as one of the other constellations may be causing issues. Toggling this selection will trigger Auto-Download to download the corresponding ephemeris files.

ii. Displays and allows for browsing to the ephemeris (.sp3) and/or the alternative navigation file (*.23N, *_GN.rnx for GPS Only, or *.23P, *_MN.rnx for All constellations).

iii. Alternatively, manually download ephemeris files from the listed FTP links:

1. Ephemeris FTP Server
2. Ephemeris FTP Server (Mixed)
3. Broadcast FTP Server (Daily)

iv. A less accurate alternative, but possibly suitable for your needs, process using the **Broadcast Mode** and provide the *.23N or *_GN.rnx (GPS Only) or *.23P or *_MN.rnx (All constellations) file from your base station.

The auto-download of the ephemerides is done via a connection to gdc.cddis.eosdis.nasa.gov (198.118.242.43) on port 21 using FTP-SSL. Your organization may only have a limited port range open and available for use by the auto-download function causing the auto-download to fail. You can use the TrueView settings tab in File->Project Settings to limit the port range used by the FTP-SSL secondary data channel to auto-download ephemeris using only TCP ports within the specified range instead of the default, which is to use any port in the 1023-65535 range.

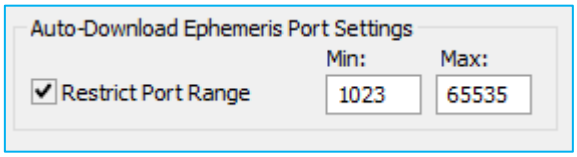


Figure 150 - Project Settings - TrueView - Auto-Download Ephemeris Port Settings

c) **GNSS Processing Settings**

i. **Elevation Mask (deg)** and **SNR Mask (dB)** - The elevation mask and/or SNR mask can be changed by selecting the drop-down menu. The 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, as necessary. Getting all Q1 is the correct result. This means that there is fixed (2cm or less) accuracy. If there are Q2 or Q5 sections of the trajectory solution, then it may be necessary to check for missing/incorrect files or adjust the elevation mask and reprocess. For more information regarding GNSS quality levels, see GNSS Quality Levels Explained.

d) **Convert Base Observation File to RINEX 3.0** – This option can be used to convert your base station to the preferred RINEX 3.0 format. We do not have a good handle on when that is necessary. We have found it to be a viable solution in one instance if you cannot

get a fixed solution (Q1) and are only achieving a float solution (Q2), yet everything looks like it should be achieving a fixed solution. However, we have also seen the opposite, where it was necessary to process without doing this conversion of the base station to get a fixed solution. We do not have a definitive answer yet as to when one or the other should be used.

PROCESSING CONFIRMATION

7. The **Processing Confirmation** page contains information about the sensor and processing times. The bullets below correspond to Figure 151.
    a) **Review Current Settings** – Contains information about the hardware, software, and cost estimates.
    b) **Results** – After trajectory processing is completed successfully, contains information about the results of the processing, including the actual cost, if applicable.

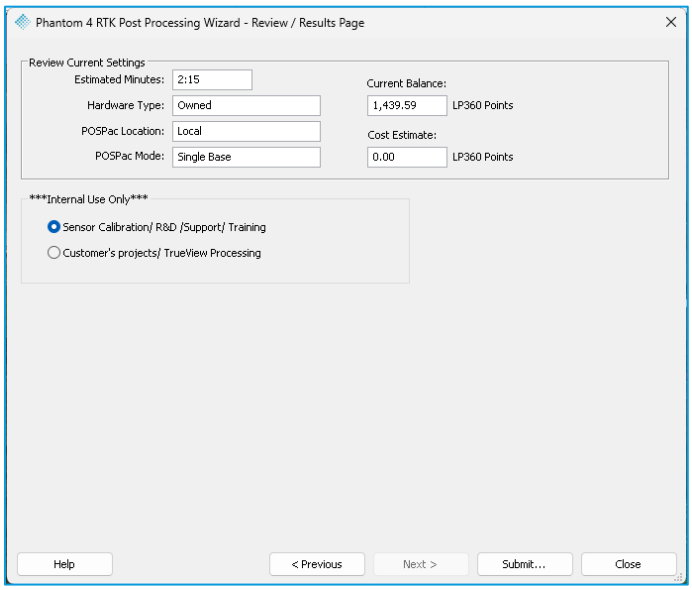


Figure 151 – Processing Confirmation

8. Select *Submit* when ready to submit the data for processing.
9. If during the validation for submittal check, the antenna model is unknown or was not stipulated in the RINEX file, or no antenna calibration exists for the specified model, the user will be prompted to acknowledge the missing antenna calibration before continuing with the task submission to ensure she desires to proceed with this information missing.

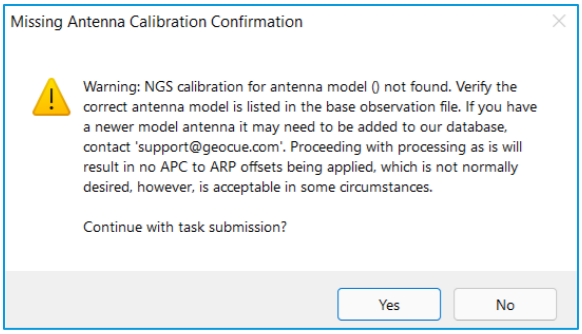


Figure 152 - Missing Antenna Calibration Confirmation

10. You will be prompted with a message asking you to confirm your submission. Click Ok.

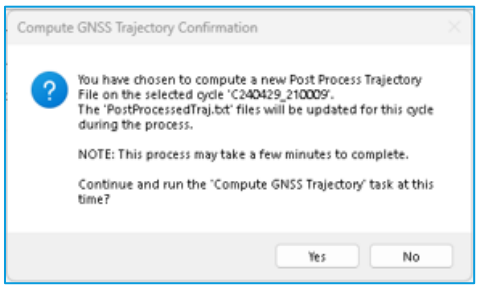


Figure 153 - Compute GNSS Trajectory Confirmation

11. A successfully submitted job notification will appear confirming the job submission (Figure 154Figure 58).

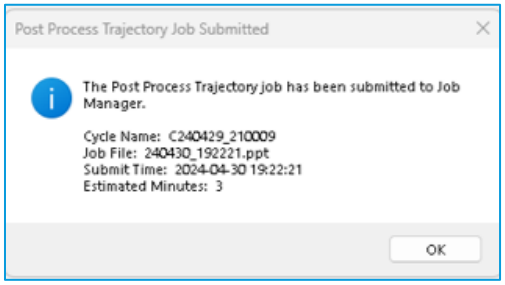


Figure 154 - Post Processing Trajectory Job Submitted

12. The Post Process Trajectory (PPT) job progress may be monitored using Job Manager.
13. Upon completion of the PPT job by the Job Manager:
    a) Job Manager will indicate completion by the green checkmark flashing on the Job Manager icon
    b) The job will need to be post-processed to view the resulting Trajectory Plot and/or log file.
14. If desired, or for troubleshooting, in Job Manager, select the applicable PPT job, then select View Log to review the PPT processing log for POS File Troubleshooting.

15. In Job Manager, select the applicable PPT job, then select Open Project to open the applicable project for the job, if not currently open.
16. Then, select Post-Process to review the Trajectory Plot.
17. When desired, in Job Manager, select the applicable PPT job, then select Delete Job to clean up the temporary files generated while processing the job.

TRAJECTORY PLOT REVIEW

1. Once complete, you will be prompted to view the ***Trajectory Plot***. Select *Yes* to view the plot, or *No* to move to the next step. You may reopen the ***Trajectory Plot*** at any time by selecting on the Sensor tab. You desire a Q1 solution for the complete plot. Observe the plot (Figure 155) and check for large gaps. Also, check to make sure the flight lines match those of the flight plan.
    a) Getting ~100% Q1 (green) is the correct result (see bottom of diagnostics window). This means that the positions are fixed (2cm or less).
    b) Q2 events mean that a "float solution" and will not provide the necessary accuracy needed. If you have Q2 positions (yellow), raise the Elevation Mask to 20 and the SNR mask to 35, then reprocess the flight.
    c) Q5 events usually mean that files are incorrect or missing. For example, the base observation file does not overlap the rover, or will not suitably combine with the rover.
    d) For more information regarding GNSS quality levels, see GNSS Quality Levels Explained.

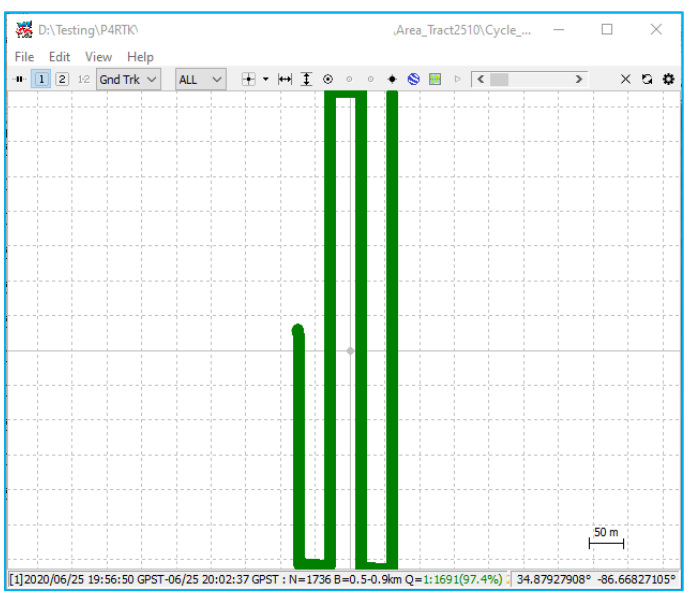


Figure 155 - Quality 1 solution for entire plot

POS FILE TROUBLESHOOTING

When a POS file is not successfully produced the user will see an error message (Figure 156) indicating the failure and typically corresponds with achieving all quality zero positions. See Quality Levels Explained for probable resolutions when achieving No Solution, Q0.

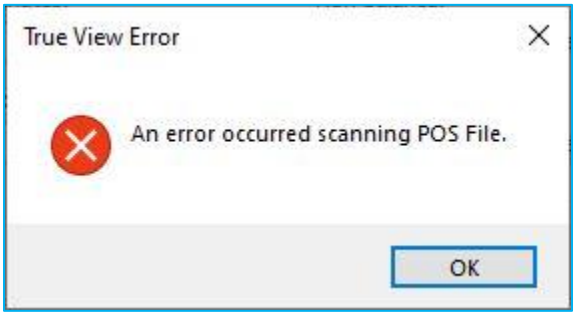


Figure 156 - Processing resulted in an empty POS file

CREATING FLIGHT LINES AND TRUEVIEW TRAJECTORIES

The steps to this point have allowed us to create a single file with the corrected sensor trajectory for the entire Cycle. Sections of each flight in the Cycle are not useful to us, such as the IMU heading alignment maneuver and flight line transitions, so we clip these sections out by defining which portions of the flight to keep. Usually only the data collected along the flight lines are retained, so we will use the ***Auto Create Flight Lines*** tool (Figure 63) and the ***Create Flight Lines from Selected Trajectory Points*** (Figure 64) from the Sensor tab for the next step. Flight lines are created using the time in the trajectory points layer, then a new layer is created named "*Area*_YYMMDD_HHMMSS_Flight lines". The steps below describe how to create flight lines automatically and manually. The best approach is to create flight lines automatically, then add or delete flight lines manually to get the exact flight lines we want.

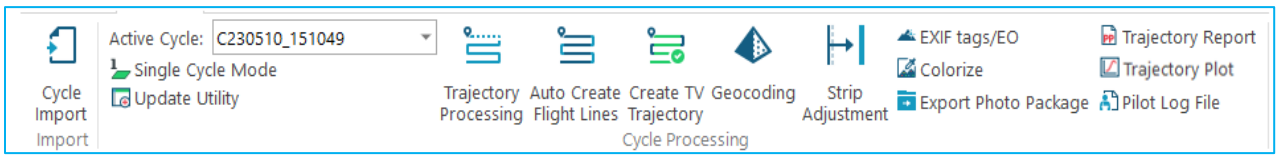


Figure 63 – Auto Create Flight Lines

Figure 64 - Create Flight Lines from Selected Trajectory Points

AUTO CREATE FLIGHT LINES

11. If not already done, make active the Cycle/Flight combination to be processed.

12. Select the **Auto-Create Flight Lines** tool on the Sensor tab (Figure 63) to open the Auto Create Flight Lines dialog (Figure 65).
    a) **Flight Line Layer** - The name of the layer that will be created and requires no input from the user.
    b) **Min. Length** – No linear set of points shorter than this value will be considered for the calculation of a flight line. This number should usually be set to the shortest flight line length. Use the **Measure** tool on the main LP360 toolbar to measure the shortest desired flight line.
    c) **Turn Radius** – The radius, in map units, to allow at turns. The smaller the number, the closer the flight lines will be cut to the turns. The greater the radius, the larger the gap.

d) **Max Deviation** – The deviation parameter that tells the software when to break a line segment into two. The smaller this number, the more linear the flight lines but the more flight lines that will be created. The larger this value, the more "bend" will be allowed in a relatively straight segment without splitting. Hence, increase this value significantly if you have curved flight lines.

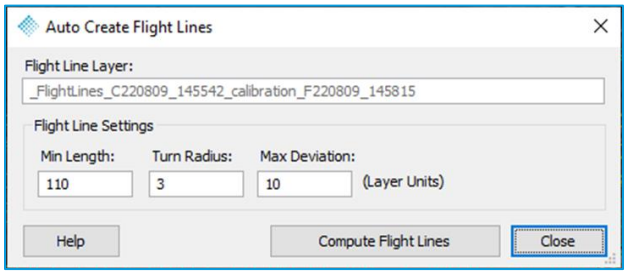
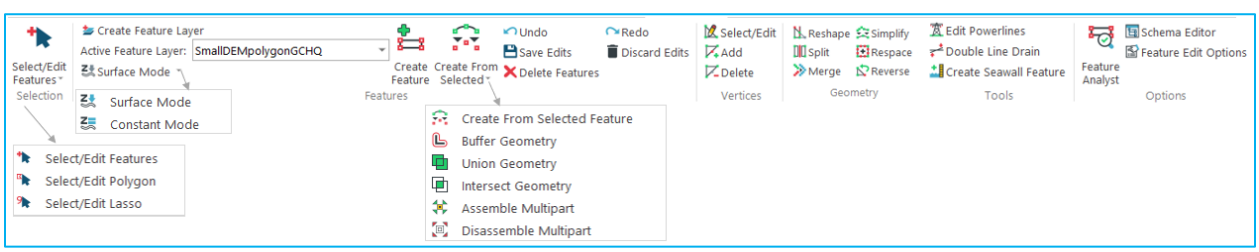


Figure 65 – Auto Create Flight Lines

13. Once you have entered the desired parameters, select *Compute Flight Lines.*
14. The flight line layer should be created, and the flight lines displayed in blue in the map view.
    a) Results can be changed by changing the parameters and selecting *Compute Flight Lines* again. The existing lines will be replaced with the results from the new settings.
15. Flight lines can be deleted if necessary, by selecting the layer with the *Select/ Edit Features* button on the left end of the Feature Edit tab (Figure 66) and clicking the red "X" on the right end of the Feature Edit tab (Figure 66).
    a) Select the ***Select/ Edit Features*** tool on the LP360 Feature Edit tab (Figure 66).
    b) Select the flight line you wish to delete, and the line will be highlighted (Figure 67).
        i. If multiple feature layers are selected, you will be prompted to choose a layer. Choose the flight line layer.
        ii. Hold control while selecting to select multiple flight lines. Or drag to select multiple flight lines.
    c) Select the **Delete Selected Features** button on the LP360 Feature Edit tab (Figure 66) and the selected feature(s) will be deleted.
    d) Delete all unnecessary flight lines. **Undo** and **Redo** may be used if you accidentally remove the wrong flight line.
    e) Select the **Save Feature Edits** icon on the LP360 Feature Edit tab (Figure 66) to save the edits.



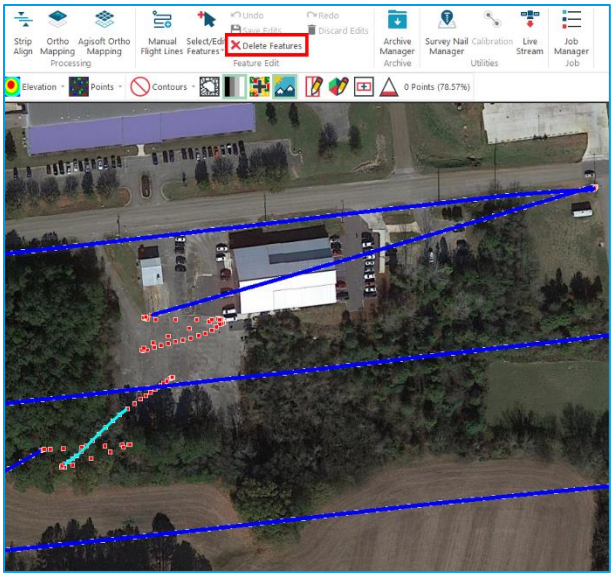


Figure 67 – Editing Flight Lines

MANUALLY CREATE FLIGHT LINES

3. Flight lines can be added manually by selecting trajectory points (red points) at the beginning and end of each line.
    a) Select the ***Select/ Edit Features*** tool on the LP360 Feature Edit tab (Figure 66).
    b) Select a trajectory point at the beginning of the desired flight line. The point will be highlighted when selected.
    c) Hold control, then select a trajectory point at the end of the flight line. Both trajectory points should now be highlighted (Figure 68).

Figure 68 – Manually Creating Flight Lines

d) Select ***Create Flight Lines from Selected Trajectory Points*** on the Sensor tab (Figure 64) and a new flight line should be created.

e) Select the **Save Feature Edits** icon on the LP360 Feature Edit tab (Figure 66) to save the edits.

Note: If you select Trajectory Point patterns that do not form the required base for creating a flight line, you will receive an error message that explains the issue (Figure 69).

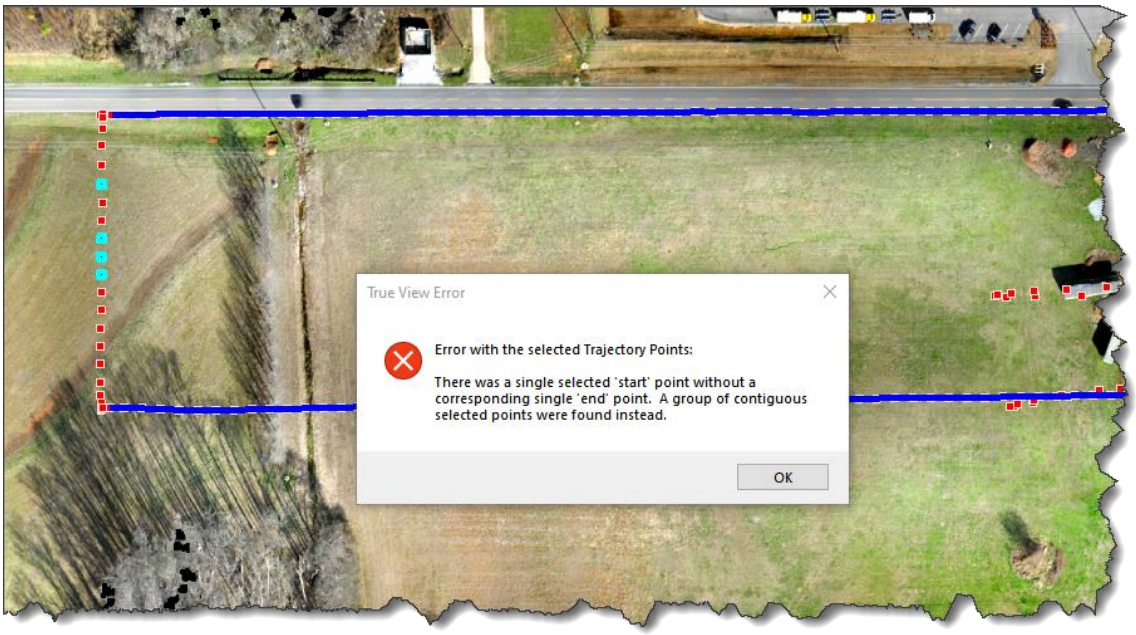


Figure 69 - A pattern of Trajectory Points not compatible with forming a flight line

CREATE TRUEVIEW TRAJECTORIES

9. If not already done, make active the Cycle/Flight combination to be processed.
10. Once flight lines have been created, and the edits saved, select ***Create TV Trajectories*** from the Sensor tab (Figure 70). The purpose of this step is to use the flight line layer to create a reduced trajectory file from the PostProcessedTraj.txt file for each flight line. Optionally and recommended, you may also update the image EXIF tags at the same time.

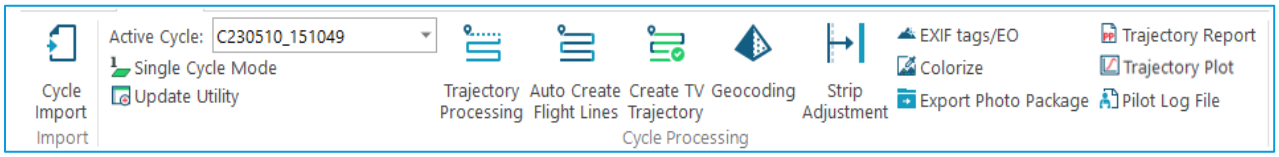


Figure 70 - Create TrueView Trajectories

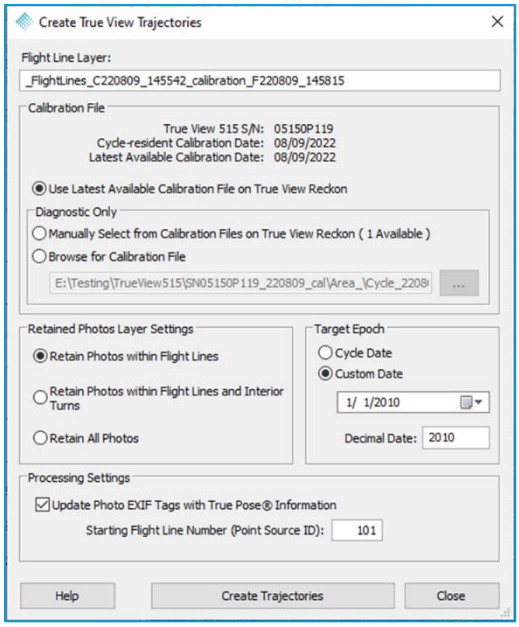


Figure 71 - Create TrueView Trajectories dialog

11. These fields of this dialog are usually auto populated if the post process trajectory solution was successful.
    a) **Flight Line Layer** - Select the flight line layer from which to generate TrueView trajectories if multiple Cycles are being processed.
    b) **Post Processed Trajectory File** – The trajectory file generated by POSPac. A post processed trajectory file may also be imported here if have one from a previous processing session with the same data.
    c) **Calibration file** – The TrueView sensor calibration is critical to get accurate LiDAR and imagery data for all supported system types. Select the option for the calibration file you wish to use:
        i. **Use Latest Available Calibration File on TrueView Reckon** (Recommended) – The latest calibration file for each sensor is stored on TrueView Reckon, the sensor management backend. When this option is selected, LP360 Drone will use the latest calibration file found on TrueView Reckon to process the data. This is the recommended option as some smarts exist on Reckon and in LP360 Drone to help ensure the correct calibration file for the system and Cycle. **If your system does not have a calibration file on Reckon, please contact support@geocue.com for assistance.**
        ii. **Diagnostic Only:** Users should never normally use either of these options, except for: DJI Zenmuse L1/L2 processing, where it should not be modified from the default; Imagery only sensors, such as the P4RTK or P1, where the user does not have a camera calibration on Reckon and is therefore following a more arduous workflow involving measuring control rather than a more automated Ortho Mapping processing with only check points for validation (Image Explorer will also not be usable without a camera calibration).

Otherwise, if the "Latest Calibration" option above is greyed out, please contact **support@geocue.com** for further assistance. for further assistance.

1. **Use Cycle-resident Calibration File** – If this option is selected, the calibration file in the system folder of Cycle being processed will be used to process the data. This may not be the latest calibration file if updates to your calibration have been made and those updates were not copied to the USB prior to acquisition.
2. **Manually Select Calibration File** – This choice will invoke a dialog that allows you to select a file from all available calibration files for this sensor from Reckon. If you select this choice, the Calibration File Picker dialog (Figure 72) will be displayed when you press the Create Trajectories button at the bottom of the Create TrueView Trajectories dialog. You can pick the calibration file you desire using the dropdown picker.

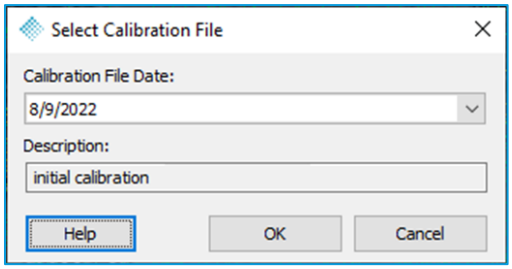


Figure 72 - Calibration File Picker

d) **Retained Photos Layer Settings** – Allows the user to specify the photos to be kept for geotagging and export to photogrammetric software packages using Export Photo Package or for processing in Agisoft Ortho Mapping , or for processing in Ortho Mapping . The notion of "Retained Photos" creates a layer of the retained photos on a new layer called "RetainedPhotos."

   i. ***Retain Photos within Flight Lines*** – This option retains only the photos that occur between the start and end of each flight line (flight lines were defined in the prior Create Flight Lines step). This option eliminates photos in turns. (Recommended). Selecting the option to "Retain Photos within Flight Lines." creates a new layer in the Table of Contents (TOC) called "RetainedPhotos". The resultant layer is shown in Figure 73. Note that only photos that are between the beginning and end of each flight line are retained.

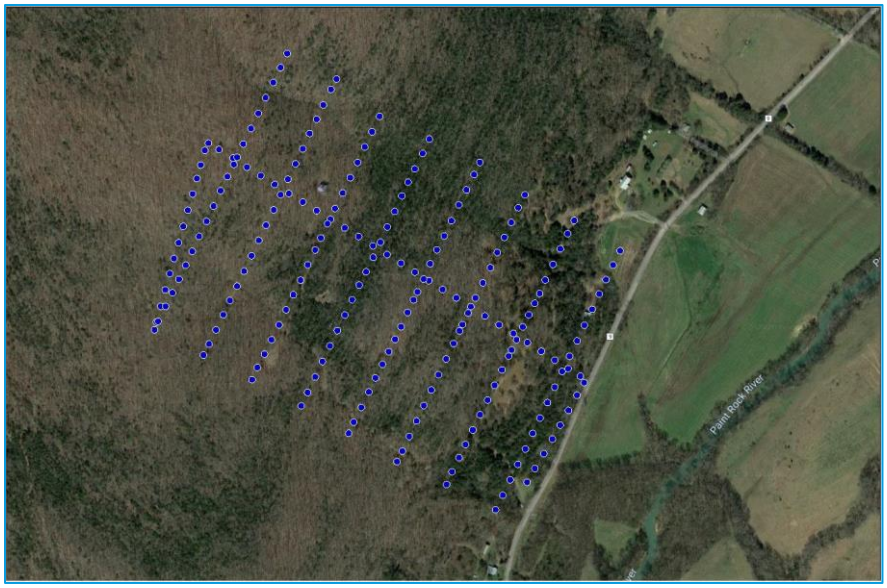


Figure 73 - Retain Photos only within Flight Lines

ii. ***Retain Photos within Flights Lines and Interior Turns*** – This option retains all photos from the start of the first flight line (*start* as defined by GPS time) and the end of the last flight line. Thus, all ferry line photos are retained.

iii. ***Retain All Photos*** – All project photos are retained. In Figure 74, all photos retained.

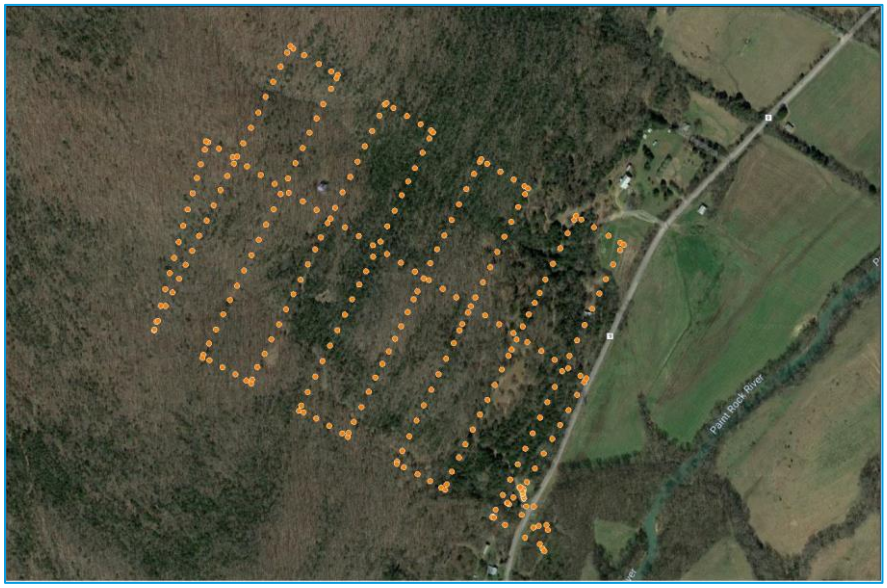


Figure 74 - All Project Camera Photos

e) **Target Epoch –** Select **Cycle Date** for coordinate reference systems using the WGS84 datum, otherwise select **Custom Date** and enter the applicable epoch for the datum of your coordinate reference system. For example, NAD83(2011) has an epoch date of 2010.0. Typically, the epoch date for your project datum should be selected by default. You will be prompted after selecting OK if the project epoch differs from the value entered on this dialog. The project epoch is set when the project CRS is selected but can be modified in File -> Project Settings -> Project -> Project Epoch.

f) **Processing Settings**

   i. **Update Photo EXIF Tags with True Pose® Information** – Performs the operations of the Update EXIF Tags for Photogrammetric Software tool. Recommended to have this checked to avoid needing to separately run the Update EXIF Tags for Photogrammetric Software tool.

   ii. **Starting Flight Line Number (Point Source ID)** – When there are multiple Cycles or flights in a project it is important to assign unique point source IDs, or flight line numbers to each line. Selecting a unique starting ID allows the user to determine the best values between 1 and 65535 to use for each line. For multi-Cycle projects it is suggested to use a nomenclature, such as CCCFF, where CCC is the Cycles flown for the project, 1-645, and FF is the flight line per Cycle, 1-99, to keep the point source IDs unique within the project.

12. Select ***Create TV Trajectories*** to create TrueView trajectories for the selected Flight Line layer. Once trajectories for a flight line are created the flight line will change from blue to magenta. Close the dialog when finished.

You can delete additional photos on the RetainedPhotos layer using the Feature Edit *delete* tool. Only photos associated with this layer will be geocoded and exported as an export package, which greatly eases the setup of downstream tools.

Note also that the RetainedPhotos layer behaves as a normal Photos layer. This means that the image view panes appear if you open this layer in Feature Analyst.

If you cannot remember if you have run the Create TV Trajectories step, there is no harm in running it multiple times. The FlightLines layer symbology turns magenta when this step has been run. If you want to confirm creation of the flight line trajectories, you can inspect the Flight Line *attributes* using the LP360 Feature Analyst tool. Right-click the Flight Line layer in the TOC and then left-click "Feature Analyst …" (see Figure 75).

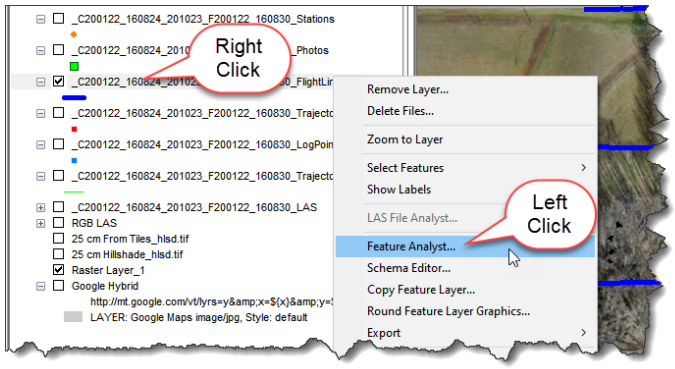


Figure 75 - Opening Feature Analyst on the Flight Line layer

Observe the "TVTrajFIle" column in the Feature table of Feature Analyst (Figure 76). If this column is blank, flight line trajectories have not yet been created.

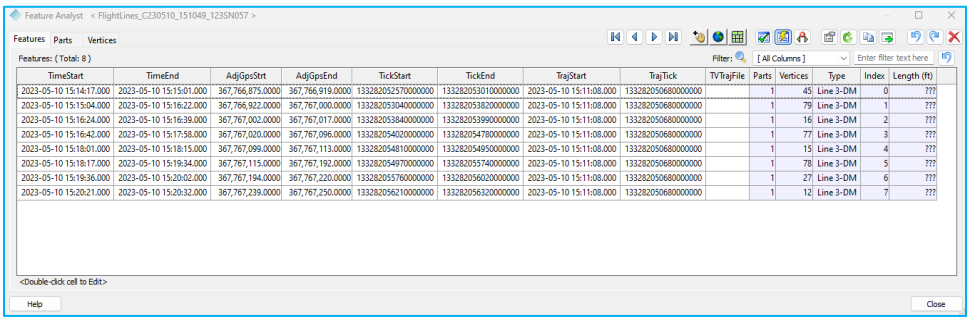


Figure 76 - TrueView Flight Lines prior to assigning Trajectories

Figure 77 shows the feature table after creation of the TrueView Flight Line trajectories. Note a file location is now populated in the TVTrajFile attribute column.

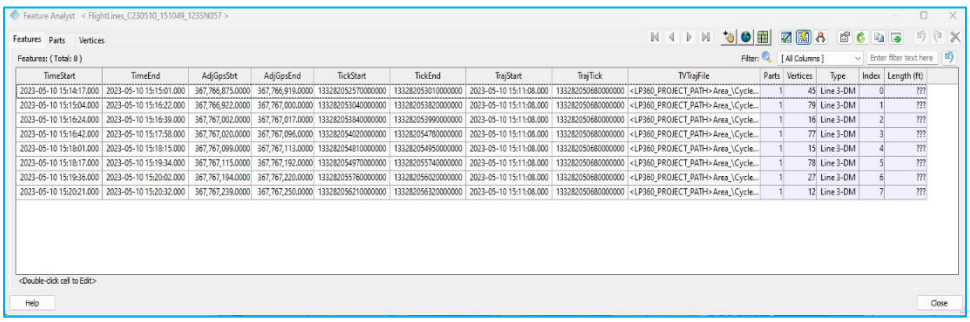


Figure 77 - TrueView Flight Lines after assigning Trajectories

Note: The Flight Line Trajectory files created in LP360 Drone for 3D Imaging Sensors (3DIS®) are in the Terrasolid trajectory format. These trajectories can be directly used in products such as TerraScan, TerraMatch and TerraPhoto.

UPDATE EXIF TAGS FOR PHOTOGRAMMETRIC SOFTWARE

Update EXIF Tags on the Sensor tab (Figure 95) will geotag each photo with the corrected position and accuracy value. Photos that were taken outside of the corrected trajectory file, such as photos on the ground before takeoff, will be removed. **This utility must be run to use the images in Metashape, Pix4D and other photogrammetric packages with similar workflows.** This step may be skipped if already run by selecting the **Update Photo EXIF Tags with True Pose® Information** checkbox on the Create TrueView Trajectories dialog. When completed, the Export Photo Package tool will be enabled.

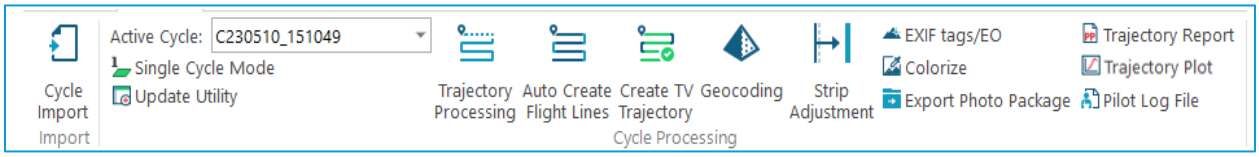


Figure 95 – Update EXIF Tags

19. If not already done, make active the Cycle/Flight combination to be processed.
20. Select ***Update EXIF Tags*** on the Sensor tab (Figure 95) to open the Update EXIF tags dialog (Figure 96).

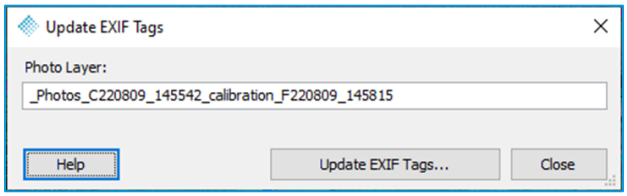


Figure 96 - Update EXIF Tags dialog

21. The photo layer that will be used to update the EXIF tags is selected based on the active Cycle/Flight combination on the Sensor tab.
22. Select *Update EXIF Tags* to tag the images.
23. A confirmation dialog (Figure 97) will appear showing the number of images that will be removed. This is a result of those images being outside of the corrected trajectory time frame and normal for the tagging process. Select *yes* to continue.

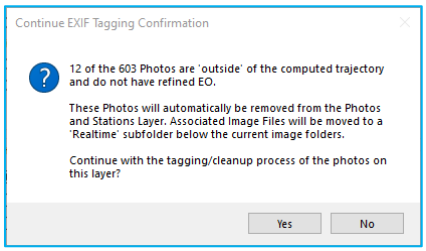


Figure 97 - EXIF Tagging Confirmation

24. When the process is complete, select OK on the confirmation dialog.

25. The images from both cameras are now tagged. Proceed to the Export Photo Package tool to export the photos on the Retained layer and associated camera calibration files for downstream processing in photogrammetric processing software.
26. To review the updated EXIF information in LP360 Drone:
    A) Select and right-click on the Photo or Stations layer in the Table of Contents (TOC) and select Feature Analyst.
    B) Select a photo or station from the Features list in Feature Analyst.
    C) Right-click on the desired image displayed in the lower section of Feature Analyst and select EXIF Information from the menu.

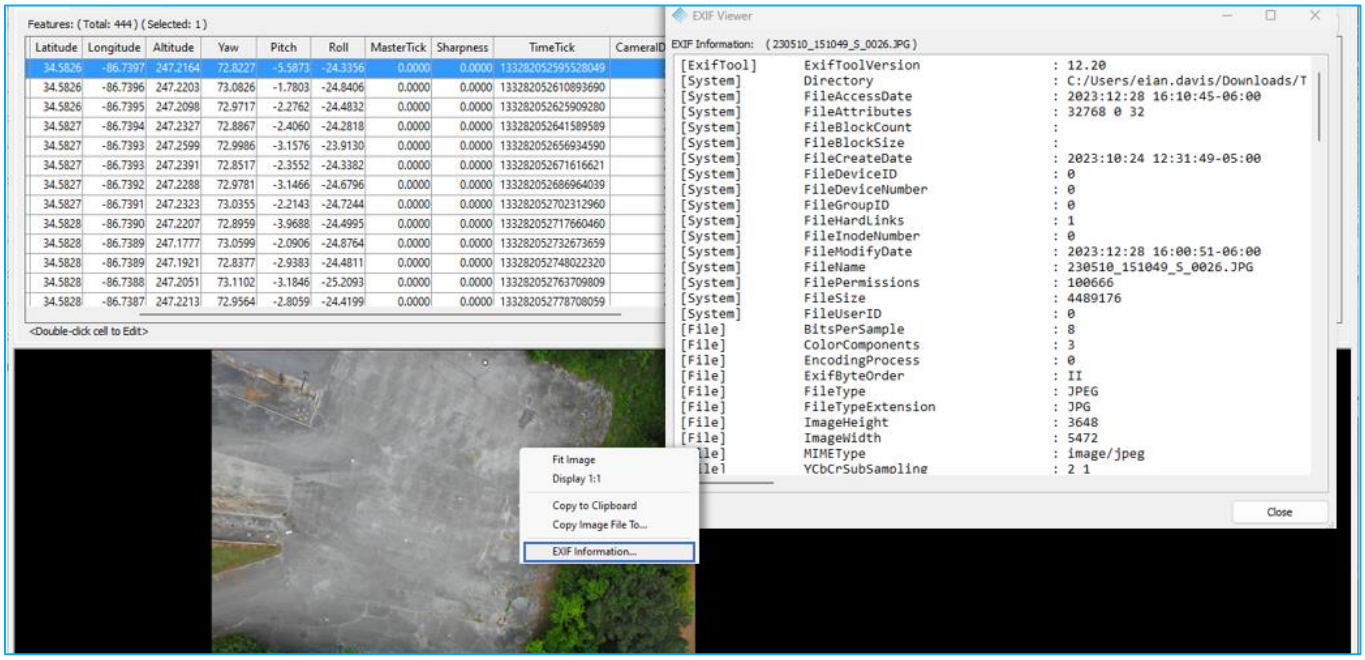


Figure 98 - Image EXIF Viewer

27. For troubleshooting purposes, the following information is left in this user guide but is superfluous when using the Export Photo Package tool.
    a) Tagged images, suitable for **Metashape**, are in the project folder, in the Port and Starboard folders (Figure 99) (Project\Area_\Cycle_YYMMDD_HHMMSS\Flight_YYMMDD_HHMMSS\)

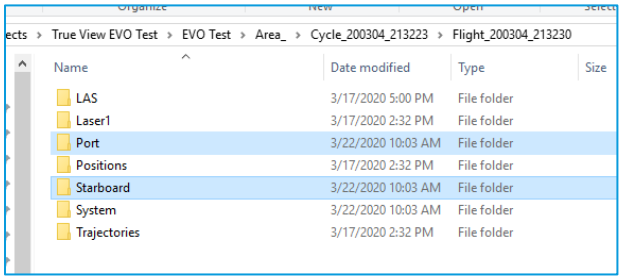


Figure 99 – Example Location of Tagged Images

b) Two CSV files with the image positions are created in the System folder in the same location (Project\Area_\Cycle_YYMMDD_HHMMSS\Flight_ YYMMDD_HHMMSS\System)
   i. The CSV file named "Image_geo_eo.csv" (Figure 100) contains the image positions in geographic coordinates, height in meters. The orientation angles are yaw, pitch and roll in degrees.
   ii. The CSV file named "Image_proj_eo.csv" (Figure 100) contains the image positions in projected coordinates, height in project units. The orientation angles are yaw, pitch and roll in degrees.
   iii. The CSV file named "image_geo_opk.csv" contains the image position file in geographic coordinates, height in meters, with the orientation angles represented as omega, phi, kappa in degrees. **This file is configured to be used in Pix4D**.

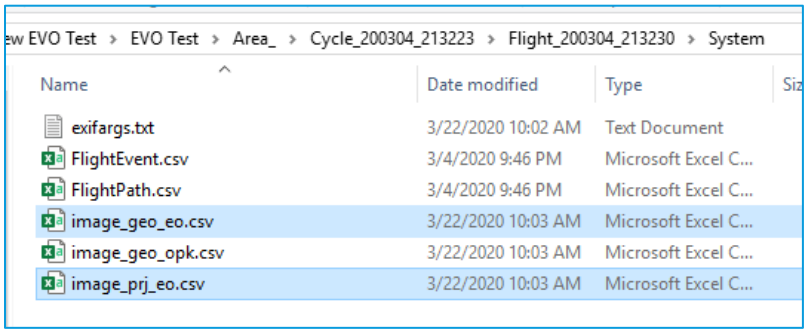


Figure 100 – Example Location of Image Position Files

c) Camera calibration files are also created for each camera in Project\Area_\Cycle_YYMMDD_HHMMSS\Flight_ YYMMDD_HHMMSS\System folder (Figure 101).
   i. The xml files named *Port.xml* and *Starboard.xml* can be **directly imported into Metashape**.
   ii. The text files named *PortP4D.txt* and *StarboardP4D.txt* **can be used in Pix4D**.

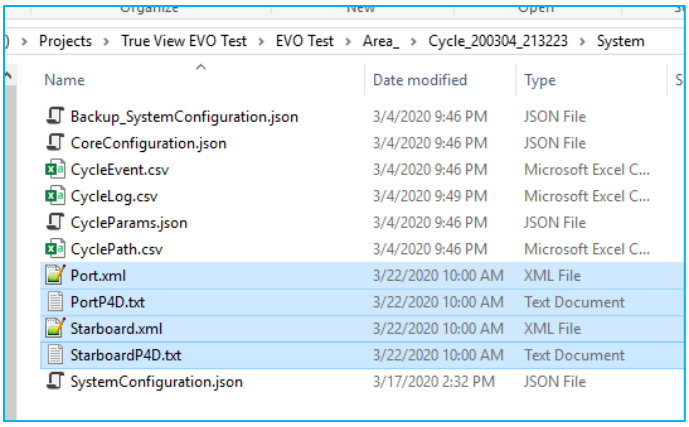


Figure 101 – Example Location of Camera Calibration Files

ORTHO MAPPING

For TrueView, microdrones, and DJI image sensors, the orthomosaic can be generated and the image positions and orientations refined using **Ortho Mapping** , that is included in an addon license to LP360 Drone, called **Photo**. A "Photo3000" or legacy "Full Photo" addon license may also enable this tool.

Figure 105 – Ortho Mapping on the Sensor tab

7. The active Cycle/Flight combination on the Sensor tab is not used by this utility, so it does not matter what is selected.
8. Select ***Ortho Mapping*** on the Sensor tab (Figure 105) to open the Ortho Mapping dialog (Figure 106). **Note:** To enable this tool requires a "Photo", or "Photo3000", or legacy "Full Photo" addon license be checked out in addition to the LP360 Drone license.

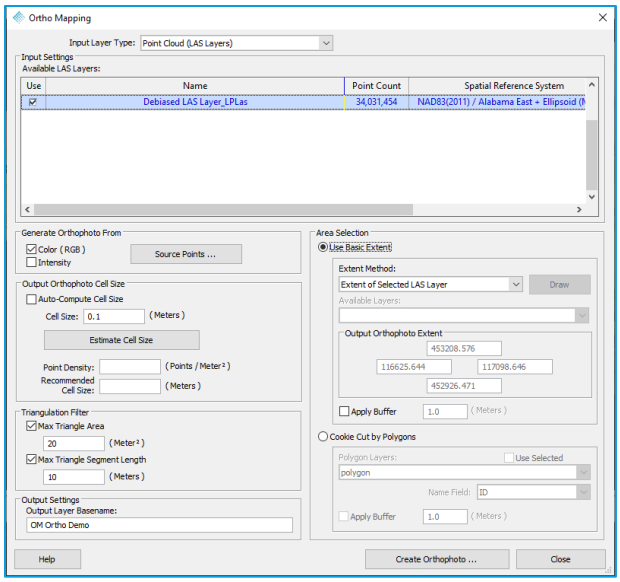


Figure 106 – Ortho Mapping dialog with Input Layer Type: Point Cloud (LAS Layers)

a) Input Layer Type:

The two modes available for the Ortho Mapping tool are predicated on the selection of the Input Layer Type.

i. **Point Cloud (LAS Layers) – Recommended for with TrueView 3DIS and microdrones,** since the heavy lifting has already been done by the point cloud colorization, the user may select to use the colorized point cloud LAS Layer from which to quickly generate an orthomosaic in a fraction of the time it would

take to use the photos. Select the desired colorized point cloud LAS layer(s) from which to generate the orthophoto.

ii. **Images (Photo Layers)** – For TrueView, microdrones, and DJI image sensors, the orthomosaic can be generated from the photos, and the image positions and orientations refined by selecting the images on the Photo layer(s) as the input.

INPUT LAYER TYPE: POINT CLOUD (LAS LAYERS)

9. With the input layer type selected to be **Point Cloud** the Ortho Mapping dialog looks like Figure 106.
   a) **Input Settings**
      i. **Available LAS Layers** – Select the checkbox in the "Use" column beside all desired colorized LAS layers that you wish to use as source points for the orthomosaic generation. This would typically include LAS layers for every Cycle in the project that covers the desired area.
   b) Generate Orthophoto From
      i. **Color (RGB)** - This option will generate an RGB orthophoto using the RGB attributes from the selected Source Points.
      ii. **Intensity** – This option will generate a greyscale orthophoto using the intensity attributes from the selected Source Points.
      iii. **Source Points** – Selecting will open Live View to allow filtering the points to be used from the input LAS Layers based on the available criteria.
   c) **Output Orthophoto Cell Size** – Specify the ground sample distance (GSD) of the orthophoto to be generated in the project map units.
      i. **Auto-Compute Cell Size** – **Not Recommended** – will disable the other options in this group box and compute the cell size to use during processing.
      ii. **Cell Size** – Key in your desired cell size.
         1. **Estimate Cell Size** – when pressed, will sample the input LAS layers to populate the *Point Density* and *Recommended Cell Size* and populate the *Cell Size* with that same recommended value. It is recommended to manually modify the value in the *Cell Size* to increase it slightly and make it a round number. For example, if the *Recommended Cell Size* is 0.082 meters, then modify the *Cell Size* field to be 0.1 meters.
   d) Triangulation Filter – The selected attributes from the input LAS Layers will be triangulated and then sampled to produce the orthophoto. Use these settings to filter triangles based on their attributes to minimize the inclusion of long triangles that may span areas of void data to help clean up your orthophoto.
      i. **Max Triangle Area**
      ii. **Max Triangle Length**
   e) **Output Settings** – Specify the *Output Layer Basename* for the orthophoto(s) to be generated on.
   f) **Area Selection** – Define the extents for the orthophoto.
      i. **Use Basic Extent**

1. **Extent Method**
    a. **Extent of Selected LAS Layer(s)**
    b. **Custom Extent** – manually enter the *Output Orthophoto Extents*.
    c. **Current Map Extent** – uses the current map view extents to define the *Output Orthophoto Extents*.
    d. **Layer Extent** – Enables the layer selection dropdown to select which layers extents to use to define the *Output Orthophoto Extent.*
    e. **Draw Window in Map** – Select Draw then draw a rectangle in the map view to define the *Output Orthophoto Extent*.
2. **Output Orthophoto Extent** – changes with the Extent Method selected to describe the rectangular bounding box in map coordinates.
3. **Apply Buffer** – enable and enter the buffer value to increase the size of the triangulated surface to some buffered distance around the *Output Orthophoto Extent.*

ii. **Cookie Cut by Polygons**
1. **Polygon Layers** – select the layer from which to use the polygon features to generate one orthophoto for each polygon.
    a. **Use Selected** – enable to only generate a single orthophoto for the polygon which has been selected from the selected polygon layer.
2. **Name Field** – choose which field to use to uniquely name the generated orthophoto files for each polygon.
3. **Apply Buffer** – enable and enter the buffer value to increase the size of the triangulated surface to some buffered distance around each *polygon.*

g) **Create Orthophoto** – Executes the Export Wizard to generate the orthophoto(s). s the process is relatively quick, a progress bar appears during processing and there is no job submitted to the Job Manager.

INPUT LAYER TYPE: IMAGES (PHOTO LAYERS)

25. After selecting the input layer type to be **Images** the Ortho Mapping dialog will change to look like Figure 107.

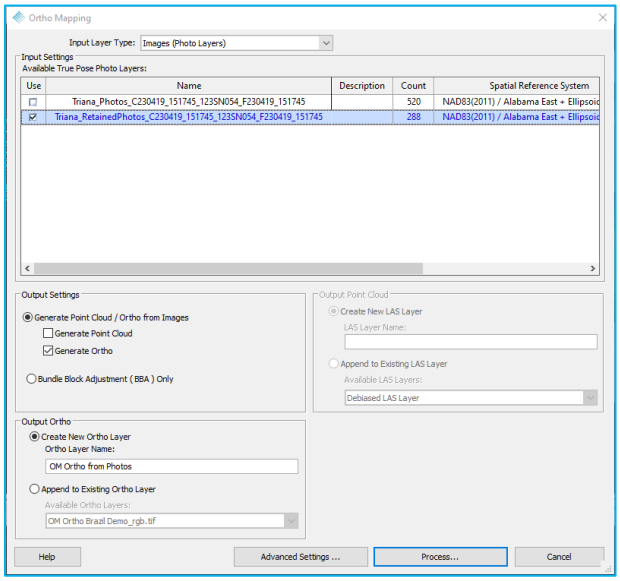


Figure 107 – Ortho Mapping dialog with Input Layer Type: Images (Photo Layers)

a. **Input Settings**
   i. **Available True Pose® Photo Layers** – Select the checkbox in the "Use" column beside all desired True Pose® layers that you wish to use as source photos for the orthomosaic generation. This would typically include all RetainedPhotos layers for every Cycle in the project that covers the desired area. A True Pose® image means their full metadata, including camera calibration, is stored in special GeoCue tags within each photo's EXIF tags.

b. **Output Settings**
   i. **Generate Point Cloud / Ortho from Images** - This option will generate a Dense Image Matching (DIM) point cloud.
      1. **Generate Point Cloud (LAS)** - generate and retain the Dense Image Matching (DIM) point cloud to add to the project during the post-process step.
      2. **Generate Ortho** - generate and retain the orthomosaic to add to the project during the post-process step.
   ii. **Bundle Block Adjustment (BBA) Only** – Useful for troubleshooting, or to improve the True Pose® information for use with Image Explorer when not generating an orthomosaic.

c. **Output Point Cloud** – Only use this option for 2DIS (image only systems).
   i. **Create New LAS Layer - LAS Layer Name** – Type in a unique name for the destination layer on which to generate the DIM LAS files from the Ortho Mapping run.

ii. **Append to Existing LAS Layer** – Select from the Available LAS Layer the previously created layer name on which to append the additional DIM LAS files.

d. **Output Ortho**

i. **Create New Ortho Layer** – **Ortho Layer Name** – Type in a unique name for the destination layer on which to generate the orthomosaic raster resulting from this Ortho Mapping run.

ii. **Append to Existing Ortho Layer** – Select from the Available Ortho Layers a previously created layer name on which to add the orthomosaic raster resulting from this Ortho Mapping run.

e. **Advanced Settings** – Opens the Ortho Mapping Advanced Settings dialog (Figure 109Figure 113)

f. **Process** – Submits the Ortho Mapping processing to the Job Manager queue for processing.

26. A successfully submitted job notification will appear confirming the job submission (Figure 112).

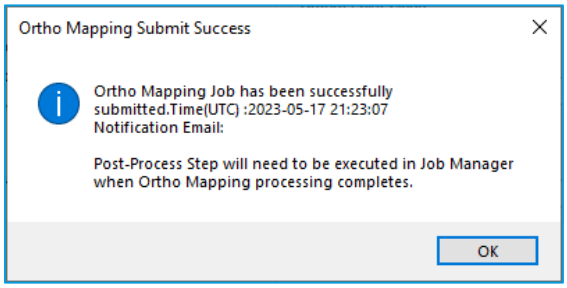


Figure 108 – Ortho Mapping job submission confirmation

27. An e-mail will be sent when the processing begins to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings).
28. The Ortho Mapping job progress may be monitored using Job Manager .
29. Upon completion of the Ortho Mapping job by the Job Manager :
    a. Job Manager will indicate completion by the green checkmark flashing on the Job Manager icon
    b. A completion e-mail notification will be sent to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings)
    c. The job will need to be post-processed to add the resulting Orthomosaic layer and/or raster, as well as the optional LAS layer and/or LAS files to the open project.
30. If desired, or for troubleshooting, in Job Manager , select the applicable Ortho Mapping job, then select View Log to review the Ortho Mapping processing log.
31. In Job Manager , select the applicable Ortho Mapping job, then select Open Project to open the applicable project for the job, if not currently open.
32. Then, select Post-Process to add the new Ortho Layer and/or raster file, and for 2DIS the new LAS Layer and/or LAS file(s) to the currently open project based on the settings at the time the job was submitted.

33. Review the generated Orthomosaic and for 2DIS, LAS data.
34. When desired, in Job Manager, select the applicable Ortho Mapping job, then select Delete Job to clean up the temporary files generated while processing the job.
35. **Optional:** Use the **Reproject Raster PCT** providing it your deliverable project boundary, or boundaries if you would like to tile the ortho, as input geometry, leave the reproject unchecked so as not to reproject the raster, and it will quickly create you a clipped orthomosaic. This PCT is also useful for converting the Ortho Mapping generated orthomosaic from the default BigTIFF format to a regular TIFF for using the raster in Autodesk's Civil3D, which cannot read BigTIFFs. Unless, of course, your orthomosaic is around 4GB or larger, thus requiring to be a BigTIFF, unless you use the **Reproject Raster PCT** to cut the orthomosaic into an index of your own or one created using the **Grid Generator PCT**.

ORTHO MAPPING ADVANCED SETTINGS

The most commonly configurable Ortho Mapping settings are configured on the Ortho Mapping Advanced Settings dialog (Figure 109). The defaults are the recommended settings, though users may wish to modify for their personal preferences.

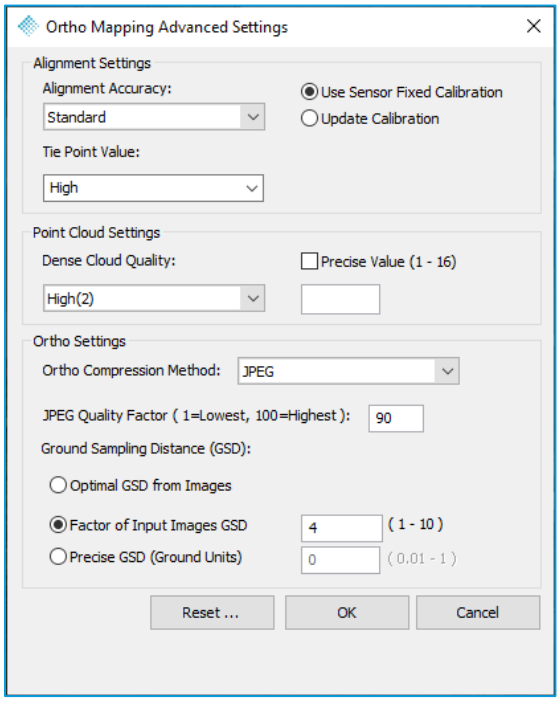


Figure 109 - Ortho Mapping Advanced Settings dialog

- **Alignment Settings**
  - **Alignment Accuracy** – Selects the input photo resolution that will be used in the Bundle Block Adjustment (BBA) step. The higher the resolution, the more accurate the BBA, but at the expense of increased processing time. Select from:

Highest	2:1	
High	1:1	**High is recommended.**
Medium	1:2	
Low	1:4	
Lowest	1:8	

  - **Camera Calibration –** This radio button choice allows you to use *a prior* camera calibration or Update Calibration to calibrate the camera as part of the BBA process. For pre-calibrated sensors (usually the case with GeoCue workflows, but not the case for DJI L1/L2), select **Use Sensor Fixed Calibration** to use the camera calibrations for your system that are stored on Reckon. You should always use this option. ***Note:*** You cannot perform "GCP-Free" geopositioning if you do not have a pre-calibrated camera.
- **Point Cloud Settings**
  - **Dense Cloud Quality** – This sets the resolution of the input photos during the dense cloud formation part of the processing. As with BBA, a higher setting provides higher quality but at the expense of increased processing time. Each level is approximately four times the processing time of the level below it. Select from:
    - Ultra High 1:1
    - High 1:2 **High is recommended for CUDA cores.**
    - Medium 1:4 **Medium is recommended when no CUDA cores.**
    - Low 1:8
    - Lowest 1:16
    - Precise Value (1-16)
- **Ortho Settings**
  - **Ortho Compression Method** – Select from No compression, JPEG, or LZW. **JPEG recommended.**
  - **JPG Quality** – If a JPEG compression method is used, specify the desired quality, with 1 being the lowest and 100, the highest. **Recommended to use 90** for a good quality to compression ratio.
  - **Optimal GSD from Images** – Allow Ortho Mapping to determine the optimal ground sample distance for the orthomosaic from the input photos. i.e., Full resolution. **Not Recommended!**
  - **Factor of Input Images GSD** – Allows the tool to automatically determine the *Optimal GSD from Images*, then multiply it by the factor to set the desired Precise GSD. **For optimal results, recommended to generate the orthomosaic a factor of four times the optimal GSD from Images.**
  - **Precise GSD (Ground Units)** – The user may deselect the *Optimal GSD from Images* option and enter a desired GSD in the project units.

AGISOFT ORTHO MAPPING (FKA METASHAPE FOR EVO(MFE))

For TrueView and DJI image sensors, the orthomosaic can be generated and the image positions and orientations refined using Agisoft Ortho Mapping , that is included in an addon license to LP360 Drone, called **Photo with Agisoft**. Images may also be processed in the Cloud version for Ortho Mapping using LP360 points purchased in the LP360 Store.

The Agisoft Ortho Mapping license is a separate key from the LP360 Drone+Photo with Agisoft licenses. See Licensing LP360 Drone+Desktop Photo with Agisoft for more information on activating/deactivating your Agisoft Ortho Mapping license. **It is not necessary to install Metashape Pro to use this tool,** however, Agisoft Ortho Mapping may also drive the GUI version of Metashape Pro (v1.7.1 through 2.0.x) if you have such licenses or desire to purchase a node-locked or floating license.

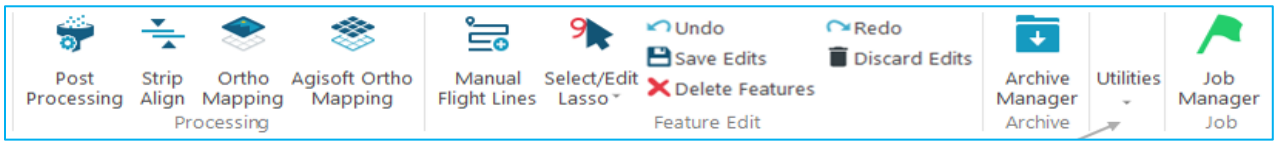


Figure 110 – Agisoft Ortho Mapping on the Sensor tab

27. The active Cycle/Flight combination on the Sensor tab is not used by this utility, so it does not matter what is selected.
28. Select ***Agisoft Ortho Mapping*** on the Sensor tab (Figure 110) to open the Agisoft Ortho Mapping dialog (Figure 111). **Note:** To enable this tool requires a "Full Photo", "Photo with Agisoft", or "Photo3000" addon license be checked out in addition to the LP360 Drone license.

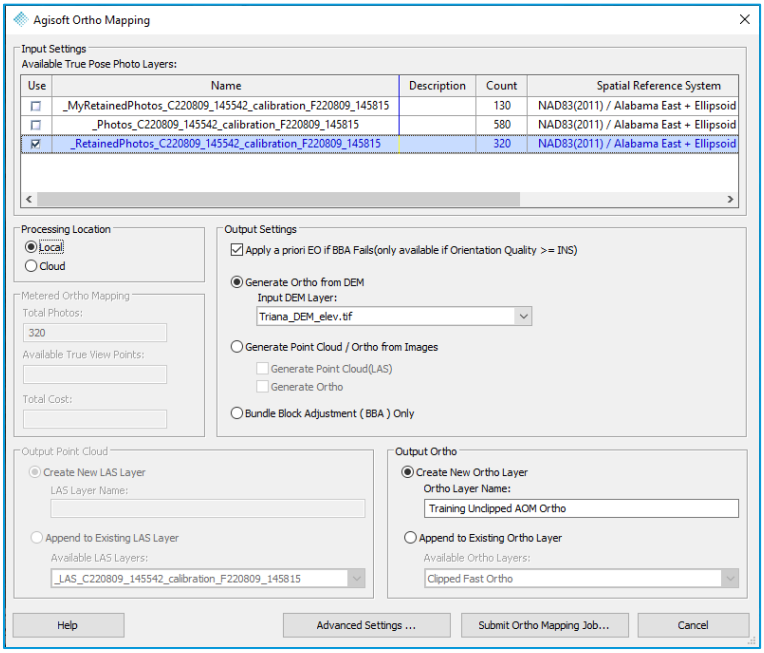


Figure 111 – Agisoft Ortho Mapping dialog

a) **Input Settings**
   i. **Available True Pose® Photo Layers** – Select the checkbox in the "Use" column beside all desired True Pose® layers that you wish to use as source photos for the orthomosaic generation. This would typically include all RetainedPhotos layers for every Cycle in the project that covers the desired area. A True Pose® image means their full metadata, including camera calibration, is stored in special GeoCue tags within each photo's EXIF tags.

b) **Processing Location** – Select to process Local or Cloud by selecting the applicable radio button next to the option.

c) **Metered Ortho Mapping** – When Cloud is selected, this section will detail the number of photos, available LP360 Points, and the total cost for generating the orthomosaic using Ortho Mapping Cloud.

d) **Output Settings**
   ii. **Apply a priori EO if BBA Fails (Only available if Orientation Quality >= INS)** – (**Recommended for 3DIS®**) Always defaulted on for True Pose® photo layers from a TrueView 3DIS®. This option is not available for DJI and other sensors. When selected, two Metashape projects are generated as LP360 Drone identifies those images for which Metashape failed to align, for instance, those in vegetation, and updates the alignments for those in the new project. This second project is then used to generate the orthomosaic so that the holes one would normally have from a standard Metashape processing are minimized, if not eliminated.

   i. **Generate Ortho from DEM** (**Highly recommended for 3DIS®**)
      1. **Input DEM Layer**
         a. Remove any high and low noise from the dataset. Often best accomplished using the *Clip Range* option in Geocode LiDAR, *Low/Isolated* PCT, and/or a *Basic Filter* PCT that uses elevation clipping. See Noise Removal Options for more details.
         b. Run a ground classification (*Adaptive TIN Ground* PCT) against the dataset using appropriate settings for a good, generalized ground surface. It is not important to have a perfect surface as there is some leeway in the orthomosaic process, however, if you have features such as retaining walls then you may need breaklines to properly hold those types of features.
         c. *Optional* - Manually cleanup the gross blunders in the ground surface (Class 2) using the manual classification tools found on the Classification tab and Profile toolbar, and/or the *Ground Cleanup Filter* PCT.
         d. *Optional* - Manually classify building roofs to class 6, and bridge decks to class 17 to create a better looking orthomosaic.
         e. *Optional* – To create the cleanest edge lines along buildings and bridges, polygonate the building and bridge deck classes, then set those to the ground and upper surface elevations by

following these steps to create two polygon sets, one set being the buffered footprints and one set the headprints:

i. Use the Point Group Tracing and Squaring PCT with appropriate parameters for your dataset to polygonate the desired non-ground features, normally roofs and bridge decks, but could be other features desired for a "True Ortho". To run this PCT with high density TrueView data you will first need to thin the dataset to roughly 8 points/m^2 using the Classify by Statistics PCT.
ii. Use the Conflate PCT to pure drape a copy of each non-ground feature to the ground class to create the footprints. This holds the edge clean to the existing ground surface.
iii. Use the Conflate PCT to conflate to the closest elevation of the building or bridge deck points found therein, a copy of each footprint polygon to create the headprints.
iv. We need to buffer the footprint polygons slightly, say 2.5cm, using the Buffer Geometry tool found on the Feature Edit tab, since in a TIN you cannot have two points at the same planimetric location with differing elevations.
v. Use the Classify by Feature PCT to mark any ground points found within the buffered footprint polygons so as not to use them in your resulting DEM.
vi. If you perform these steps to generate a set of buffered footprint polygons (buffered and ground conflated polygons) and headprint (closest elevation conflated) polygons for your desired non-ground features, then skip the *Classify by Statistics* PCT in the next step since you will not have conflicting surfaces over the same cell. Furthermore, use Breakline Enforcement, using the polygons generated by the preceding steps to help hold the edge of your features, when in the export DEM step.

f. Export a DEM using the Export Wizard to quickly create a DEM from the LiDAR data and generate the orthomosaic much faster than Metashape generating a DEM from the images.

i. **Run Classify by Statistics PCT** – For best results, it is recommended to perform some initial classification as described above before exporting a DEM. Run the Classify by Statistics PCT with the following recommended settings to help in areas where there are

two surfaces in the same location, such as when the roof overhangs and the LiDAR sees the ground beneath:

1. Feature Geometry – Tool Geometry
2. Units – Set to project units.
3. Input LAS Layer – Active LAS Layer
4. Source Points - Classes 2, 6, and 17. Flags ignored.
5. Cell Size – 0.05m - Gently rolling terrain doesn't need as high a resolution DEM as an area with sharper features.
6. Samples – Max
7. Destination Class – Flags Only – Synthetic – Set
8. Quartile Classification – Leave blank.
9. Generate Cell Output Shape file – Leave unchecked.
10. Run by project.

ii. Recommended **Export LiDAR Data** DEM settings:

1. Source Points:
   a. If the Classify by Statistics in the previous section was performed, use Synthetic Flag Set
   b. If the optional non-ground polygons were created and the Classify by Statistics PCT skipped, then use classes 2, 6, and 17 ignoring the synthetic flag.
   c. or use all points for a quick ortho.
2. Export Type - Surface
3. Surface Method - Triangulation
4. Pixel size: 0.05m to 0.25m. Gently rolling terrain does not need as high a resolution DEM as an area with sharper features.
5. Surface Attribute to export – Elevation
6. Export Format – GeoTIFF
7. Raster Information – Pixel Size: 0.05 to 0.25m. Gently rolling terrain doesn't need as high a resolution DEM as an area with sharper features.

ii. **Generate Point Cloud / Ortho from Images** - Typically only use this option for 2DIS (image only systems). This option will take much longer and will generate a Dense Image Matching (DIM) point cloud.

1. **Generate Point Cloud (LAS)** - generate and retain the Dense Image Matching (DIM) point cloud to add to the project during the post-process step.
2. **Generate Ortho** - generate and retain the orthomosaic to add to the project during the post-process step.

iii. **Bundle Block Adjustment (BBA) Only** – Useful for troubleshooting, or to improve the True Pose® information for use with Image Explorer when not generating an orthomosaic.

e) **Output Point Cloud** – Only use this option for 2DIS (image only systems).

i. **Create New LAS Layer - LAS Layer Name** – Type in a unique name for the destination layer on which to generate the DIM LAS files from the Ortho Mapping run.

ii. **Append to Existing LAS Layer** – Select from the Available LAS Layer the previously created layer name on which to append the additional DIM LAS files.

f) Output Ortho

i. **Create New Ortho Layer** – **Ortho Layer Name** – Type in a unique name for the destination layer on which to generate the orthomosaic raster resulting from this Ortho Mapping run.

ii. **Append to Existing Ortho Layer** – Select from the Available Ortho Layers a previously created layer name on which to add the orthomosaic raster resulting from this Ortho Mapping run.

g) **Advanced Settings** – Opens the Agisoft Ortho Mapping Advanced Settings dialog (Figure 113)

h) **Submit Ortho Mapping Job** – Submits the Agisoft Ortho Mapping processing to the Job Manager queue for processing.

29. A successfully submitted job notification will appear confirming the job submission (Figure 112).

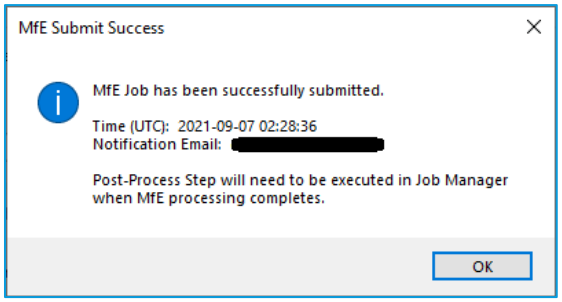


Figure 112 – Agisoft Ortho Mapping job submission confirmation

30. An e-mail will be sent when the processing begins to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings).
31. The Agisoft Ortho Mapping job progress may be monitored using Job Manager .
32. Upon completion of the Agisoft Ortho Mapping job by the Job Manager :
    a) Job Manager will indicate completion by the green checkmark flashing on the Job Manager icon

b) A completion e-mail notification will be sent to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings)
c) The job will need to be post-processed to add the resulting Orthomosaic layer and/or raster, as well as the optional LAS layer and/or LAS files to the open project. Plus, update the EXIFs on each photo to the bundle block adjusted values.

33. In Job Manager, select the applicable Agisoft Ortho Mapping job, then select View Report to review the Agisoft Ortho Mapping processing report. Review for position and orientation average corrections to be within tolerances for your system's POS.
34. If desired, or for troubleshooting, in Job Manager, select the applicable Agisoft Ortho Mapping job, then select View Log to review the Agisoft Ortho Mapping processing log.
35. In Job Manager, select the applicable Agisoft Ortho Mapping job, then select Open Project to open the applicable project for the job, if not currently open.
36. Then, select Post-Process to add the new Ortho Layer and/or raster file, and for 2DIS the new LAS Layer and/or LAS file(s) to the currently open project based on the settings at the time the job was submitted. Plus, update the EXIFs on each photo to the bundle block adjusted values.
    a) If the run location selected was Cloud, you will be asked to browse for the 7z file you downloaded from the link in the job completion e-mail.
37. Review the generated Orthomosaic and for 2DIS, LAS data.
38. When desired, in Job Manager, select the applicable Agisoft Ortho Mapping job, then select Delete Job to clean up the temporary files generated while processing the job.
39. **Optional:** Use the **Reproject Raster PCT** providing it your deliverable project boundary, or boundaries if you would like to tile the ortho, as input geometry, leave the reproject unchecked so as not to reproject the raster, and it will quickly create you a clipped orthomosaic. This PCT is also useful for converting the Ortho Mapping generated orthomosaic from the default BigTIFF format to a regular TIFF for using the raster in Autodesk's Civil3D, which cannot read BigTIFFs. Unless, of course, your orthomosaic is around 4GB or larger, thus requiring to be a BigTIFF, unless you use the **Reproject Raster PCT** to cut the orthomosaic into an index of your own or one created using the **Grid Generator PCT**.

AGISOFT ORTHO MAPPING ADVANCED SETTINGS

The most commonly configurable Agisoft Ortho Mapping settings are configured on the Agisoft Ortho Mapping Advanced Settings dialog (Figure 113). The defaults are the recommended settings, though users may wish to modify for their personal preferences.

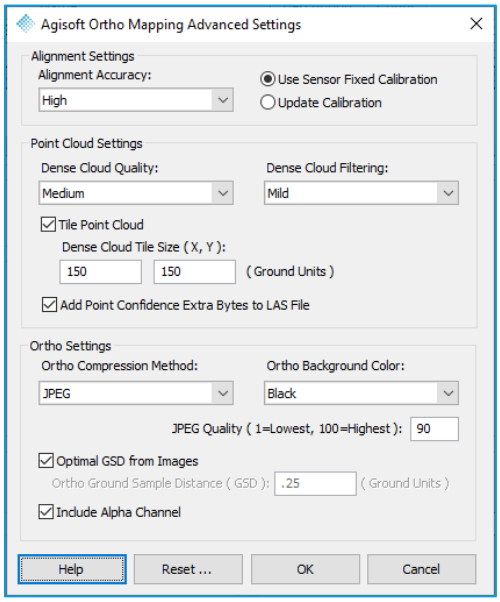


Figure 113 - Agisoft Ortho Mapping Advanced Settings dialog

- **Alignment Settings**
  - **Alignment Accuracy** – Selects the input photo resolution that will be used in the Bundle Block Adjustment (BBA) step. The higher the resolution, the more accurate the BBA, but at the expense of increased processing time. Select from:

Highest	2:1	
High	1:1	**High is recommended.**
Medium	1:2	
Low	1:4	
Lowest	1:8	

  - **Camera Calibration –** This radio button choice allows you to use *a prior* camera calibration or Update Calibration to calibrate the camera as part of the BBA process. For pre-calibrated sensors (usually the case with GeoCue workflows, but not the case for DJI L1/L2), select **Use Sensor Fixed Calibration** to use the camera calibrations for your system that are stored on Reckon. You should always use this option. ***Note:*** You cannot perform "GCP-Free" geopositioning if you do not have a pre-calibrated camera.
- **Point Cloud Settings**
  - **Dense Cloud Quality** – This sets the resolution of the input photos during the dense cloud formation part of the processing. As with BBA, a higher setting provides higher

quality but at the expense of increased processing time. Each level is approximately four times the processing time of the level below it. Select from:

- Ultra High 1:1
- High 1:2
- Medium 1:4 **Medium is recommended.**
- Low 1:8
- Lowest 1:16.

- **Dense Cloud Filtering** – Adjusts the aggressiveness of the smoothing filter applied after the point cloud formation. Select from:
  - Disabled
  - Mild **Mild is recommended.**
  - Moderate
  - Aggressive
- **Tile Point Cloud using Dense Cloud Tile Size** – This setting will form the resultant point cloud into a set of tiled LAS files. LP360 prefers smaller file sizes, so it is better to tile when generating a point cloud, such that each LAS is less than 256MB.
- **Add Point Confidence Extra Bytes to LAS File** – The Agisoft confidence, or reliability extra byte, can be an additional attribute useful when determining the suitability of a DIM point for ground classification. The value represents the number of depth maps used for the given point generation. The noisy areas of the dense cloud will have lower confidence and you can use the extra byte filter options in the Source Points/Live View dialog to exclude the noisy points from point cloud processing or views.

- **Ortho Settings**
  - **Ortho Compression Method** – Select from No compression, JPEG, LZW, Packbits, or Deflate. **JPEG recommended.**
  - **JPG Quality** – If a JPEG compression method is used, specify the desired quality, with 1 being the lowest and 100, the highest. **Recommended to use 90** for a good quality to compression ratio.
  - **Ortho Background Color** – Select a black or white background color for the void pixels in the image.
  - **Optimal GSD from Images** – Allow Metashape to determine the optimal ground sample distance for the orthomosaic from the input photos. i.e., Full resolution.
  - **Ortho Ground Sample Distance (GSD)** – The user may deselect the *Optimal GSD from Images* option and enter a desired GSD in the project units.
  - **Include Alpha Channel –** The alpha channel is a special channel on the image that handles transparency. Typically included, but users of older CAD programs, such as MicroStation v8i, need to uncheck this option if the program cannot handle images with an alpha channel included.

EXECUTING AGISOFT ORTHO MAPPING ON ANOTHER MACHINE

The recommended workflow should you wish to process your Cycles to a colorized point cloud on one machine, but generate your orthomosaic on a different machine, is to process all Cycles for your project on machine A. Then,

15. Export an Explorer Package from machine A containing all the desired RetainedPhotos layers and a single DEM layer (for 3DIS®) to be used for generating the orthomosaic.
16. Copy the Explorer Package to machine B.
17. On machine B, open the Explorer Package to create a new project.
18. Run **Agisoft Ortho Mapping** on machine B to generate your orthomosaic, and the optional point cloud (for 2DIS).
19. Post Process the Agisoft Ortho Mapping run to add the orthomosaic, and optional point cloud (for 2DIS) to the project on machine B.
20. On machine A, import the following from their folder locations on machine B into your existing project:
    1. **Orthomosaic** – UNC path as specified in the Agisoft Ortho Mapping completion e-mail.
    2. The updated **True Pose® photos** from the RetainedPhotos layer(s) – Right-click on the layer in the project on machine B, select Open Location in Explorer to determine the path to photos. They are in subfolders of the parent folder to the feature file. Recall only the retained photos were copied to machine B so you can import all photos found here.
    3. *optional* **point cloud (for 2DIS)** – UNC path as specified in the Agisoft Ortho Mapping completion e-mail.
21. Use the new True Pose® photos layer as the drive for Image Explorer by deselecting any other layers IE column in project manager and only enabling the new layer.

CONFIGURING LP360 DRONE TO RUN METASHAPE PRO

The recommended method of running **Agisoft Ortho Mapping** is to use the integrated version installed with LP360 Drone, however, LP360 Drone may also drive the GUI version of Metashape Pro if you have such licenses. To configure a user installed version of Metashape Pro (v1.7.1 to v2.0.x) to be run by the Agisoft Ortho Mapping:

3. Install the necessary components by running the "InstallPyYAML.bat" batch file found in "%CommonProgramFiles%\LP360\MSPy38" (Metashape v1.7.x to v2.0.x).
    a) Open an elevated command prompt by right-clicking on the Command Prompt in the Start menu and selecting "Run as Administrator".
    b) Change directory to the appropriate MSPy folder, using "cd %CommonProgramFiles%\ \LP360\MSPy38" (Metashape v1.7.x to v2.0.x).
    c) Execute the batch file by typing "InstallPyYAML.bat", <Enter>
    d) You may see a notification about a newer pip version being available but can ignore this message ().

WINGTRA LIDAR AND OTHER WORKFLOW

This section provides a step-by-step guide to processing LiDAR and sensor trajectory from the Wingtra LiDAR and "other" sensors where the sensor trajectory processing and geocoding/point cloud generation is done in the manufacturer's software before importing into LP360. This workflow covers from the point of project creation, prepping the data for post-processing, and included common steps for downstream processing such as Strip Align.

PRE-PROCESSING

For the Wingtra LiDAR, trajectory processing and initial point cloud generation from the raw data is performed in Wingtra LiDAR Application as a pre-processing step before beginning the workflow in LP360 Drone. Similarly, "other" sensors will need to have the trajectory processing and initial point cloud generation from the raw data performed in their manufacturer's software.

LP360 Drone is used to reproject the data to various coordinate reference systems not supported by Wingtra Lidar and clean up the LiDAR data, plus utilize the extensive capabilities of LP360 Drone for strip alignment, classification, vectorization, and derivative product generation.

IMPORT WINGTRA OR "OTHER" MISSION

To import Wingtra LiDAR or "other" mission data into a new or current project, open the Raw Mission Import Wizard and select Wingtra or "Other", as applicable.

When importing Wingtra LiDAR or other missions into a project, the LAS file(s) coordinate reference system (CRS) and Trajectory File(s) CRS, including the datum and epoch, must be known.

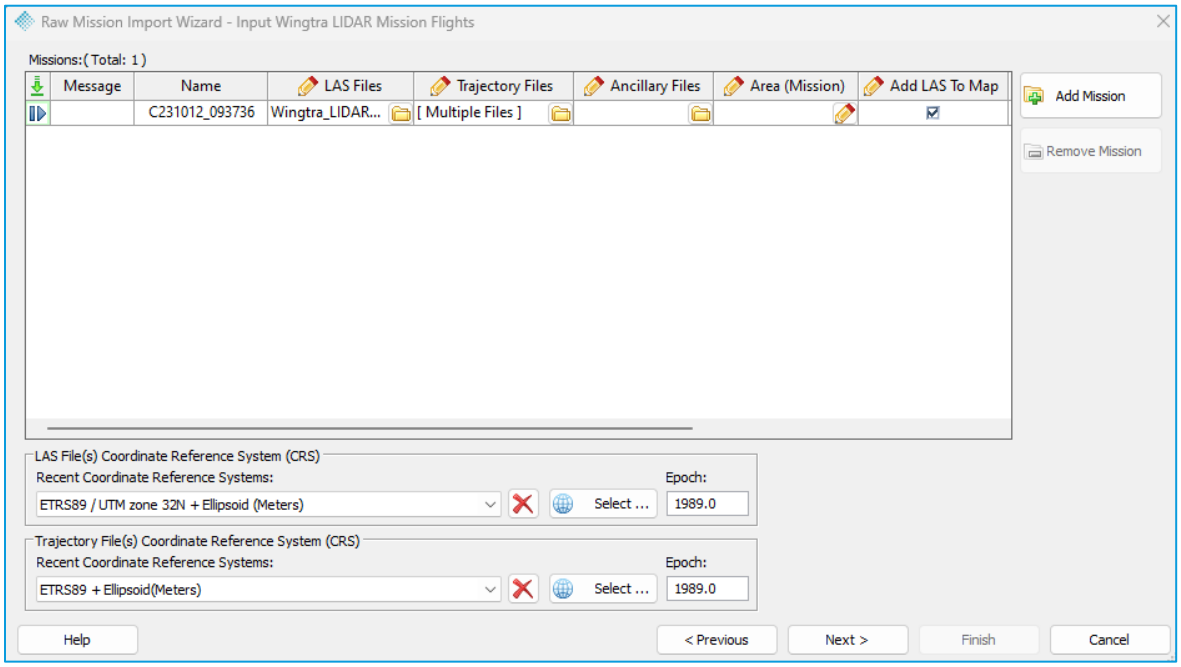


Figure 157 - Input Wingtra Mission Flights dialog

A confirmation dialogue will appear after selecting the project CRS if LP360 Drone is not certain that the CRS of the data and the CRS of the project match, to give the user the opportunity to go back and modify the project CRS or confirm the differences are acceptable, before completing the import (Figure 158). It is very important to review the information in this message and confirm it is correct. If the LAS CRS and Project CRS are not compatible, the LAS file will not be added to the map as LP360 does not perform on-the-fly reprojections in the map display.

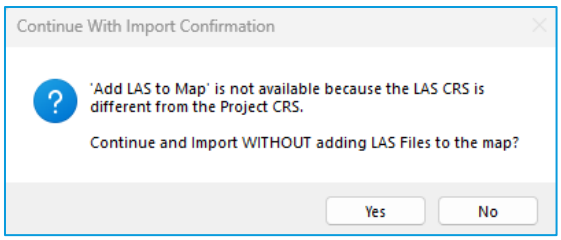


Figure 158 - Continue with Import Confirmation

After the data has been imported and the files have been examined, the next steps are:

6. Create Flight Lines
7. Post Processing to generate a v1.4 LAS file with the correct CRS and perform other useful operations on the pre-processed LAS files, such as splitting the data by flight line.
8. Optionally, run Strip Align for LP360
9. Utilize the extensive capabilities of LP360 for debias, QAQC, classification, vectorization, and derivative product generation.

CREATING FLIGHT LINES AND TRUEVIEW TRAJECTORIES

The steps to this point have allowed us to create a single file with the corrected sensor trajectory for the entire Cycle. Sections of each flight in the Cycle are not useful to us, such as the IMU heading alignment maneuver and flight line transitions, so we clip these sections out by defining which portions of the flight to keep. Usually only the data collected along the flight lines are retained, so we will use the ***Auto Create Flight Lines*** tool (Figure 63) and the ***Create Flight Lines from Selected Trajectory Points*** (Figure 64) from the Sensor tab for the next step. Flight lines are created using the time in the trajectory points layer, then a new layer is created named "*Area*_YYMMDD_HHMMSS_Flight lines". The steps below describe how to create flight lines automatically and manually. The best approach is to create flight lines automatically, then add or delete flight lines manually to get the exact flight lines we want.

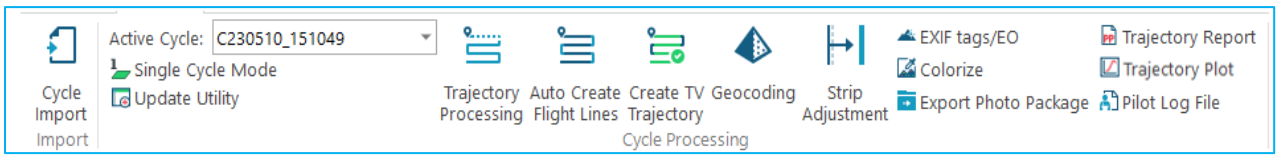


Figure 63 – Auto Create Flight Lines

Figure 64 - Create Flight Lines from Selected Trajectory Points

AUTO CREATE FLIGHT LINES

16. If not already done, make active the Cycle/Flight combination to be processed.

17. Select the **Auto-Create Flight Lines** tool on the Sensor tab (Figure 63) to open the Auto Create Flight Lines dialog (Figure 65).
    a) **Flight Line Layer** - The name of the layer that will be created and requires no input from the user.
    b) **Min. Length** – No linear set of points shorter than this value will be considered for the calculation of a flight line. This number should usually be set to the shortest flight line length. Use the **Measure** tool on the main LP360 toolbar to measure the shortest desired flight line.
    c) **Turn Radius** – The radius, in map units, to allow at turns. The smaller the number, the closer the flight lines will be cut to the turns. The greater the radius, the larger the gap.

d) **Max Deviation** – The deviation parameter that tells the software when to break a line segment into two. The smaller this number, the more linear the flight lines but the more flight lines that will be created. The larger this value, the more "bend" will be allowed in a relatively straight segment without splitting. Hence, increase this value significantly if you have curved flight lines.

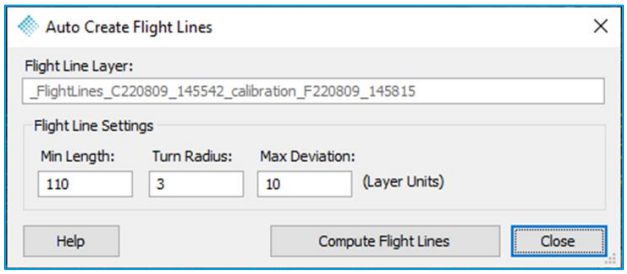
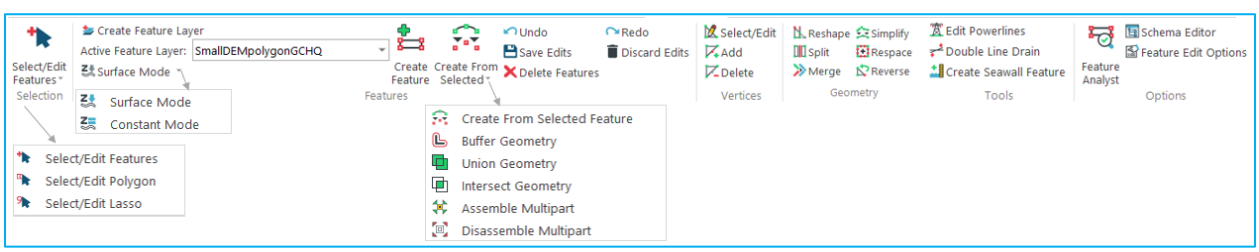


Figure 65 – Auto Create Flight Lines

18. Once you have entered the desired parameters, select *Compute Flight Lines.*
19. The flight line layer should be created, and the flight lines displayed in blue in the map view.
    a) Results can be changed by changing the parameters and selecting *Compute Flight Lines* again. The existing lines will be replaced with the results from the new settings.
20. Flight lines can be deleted if necessary, by selecting the layer with the *Select/ Edit Features* button on the left end of the Feature Edit tab (Figure 66) and clicking the red "X" on the right end of the Feature Edit tab (Figure 66).
    a) Select the ***Select/ Edit Features*** tool on the LP360 Feature Edit tab (Figure 66).
    b) Select the flight line you wish to delete, and the line will be highlighted (Figure 67).
        i. If multiple feature layers are selected, you will be prompted to choose a layer. Choose the flight line layer.
        ii. Hold control while selecting to select multiple flight lines. Or drag to select multiple flight lines.
    c) Select the **Delete Selected Features** button on the LP360 Feature Edit tab (Figure 66) and the selected feature(s) will be deleted.
    d) Delete all unnecessary flight lines. **Undo** and **Redo** may be used if you accidentally remove the wrong flight line.
    e) Select the **Save Feature Edits** icon on the LP360 Feature Edit tab (Figure 66) to save the edits.



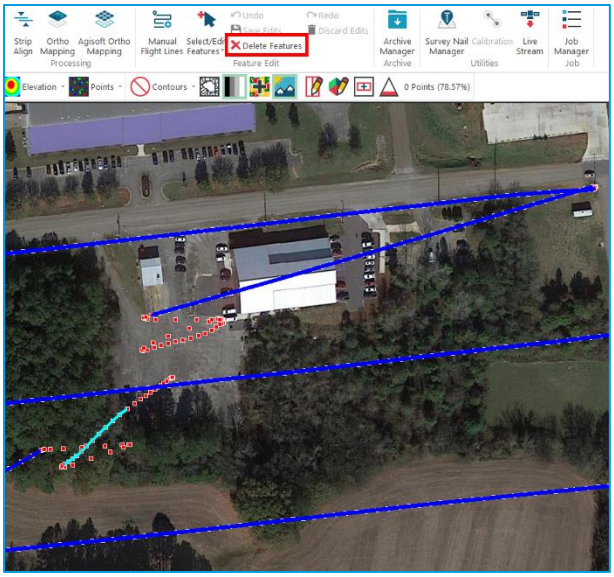


Figure 67 – Editing Flight Lines

MANUALLY CREATE FLIGHT LINES

4. Flight lines can be added manually by selecting trajectory points (red points) at the beginning and end of each line.
    a) Select the ***Select/ Edit Features*** tool on the LP360 Feature Edit tab (Figure 66).
    b) Select a trajectory point at the beginning of the desired flight line. The point will be highlighted when selected.
    c) Hold control, then select a trajectory point at the end of the flight line. Both trajectory points should now be highlighted (Figure 68).

Figure 68 – Manually Creating Flight Lines

d) Select ***Create Flight Lines from Selected Trajectory Points*** on the Sensor tab (Figure 64) and a new flight line should be created.

e) Select the **Save Feature Edits** icon on the LP360 Feature Edit tab (Figure 66) to save the edits.

Note: If you select Trajectory Point patterns that do not form the required base for creating a flight line, you will receive an error message that explains the issue (Figure 69).

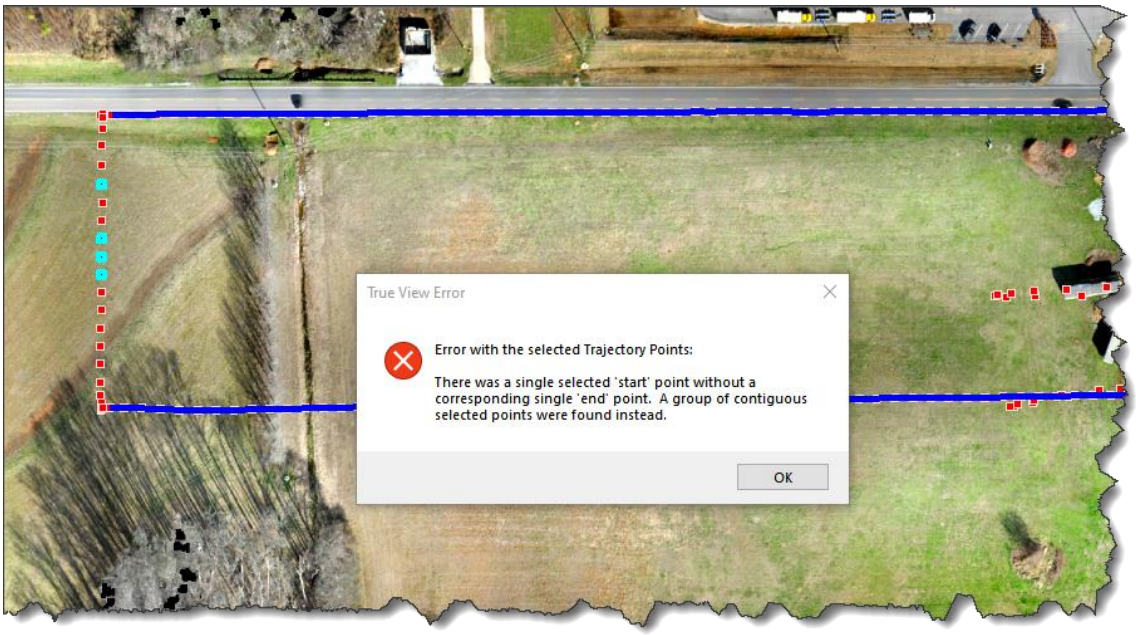


Figure 69 - A pattern of Trajectory Points not compatible with forming a flight line

POST PROCESSING TOOL

The Post Processing tool can be used for all sensor types imported in LP360. The purpose of this tool is to prepare the datasets for post processing tools. The main need is to use the flight line layer to create a trajectory file for each flight line from the sensor trajectory file(s) and cut the LAS data into files corresponding to those flight lines, plus, apply any additional user desired filtering while performing this operation. This tool is helpful when processing large datasets as one can geocode everything, and later cut and filter as desired without needing to geocode again.

3. On the Sensor tab (Figure 50), make active the Cycle/Flight combination to be processed.
4. Open the **Post Processing** dialog by selecting the sensor **Post Processing** button on the Sensor tab (Figure 82) to open the Post Processing dialog (Figure 83).

Figure 82 - Post Processing tool on the Sensor Ribbon

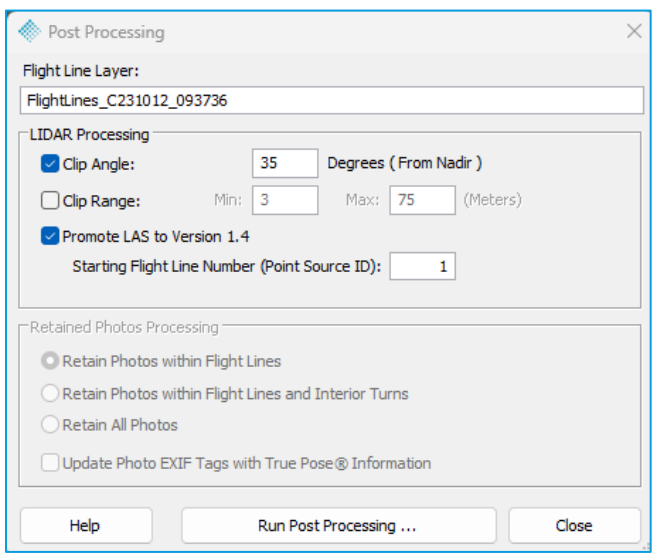


Figure 83 - Post-Processing Dialog

c) **LiDAR Processing:**

i. **Clip Angle** – Enter the processing angle in degrees. This number represents the half angle off Nadir of the scanner. If 40 is entered, LiDAR data will be geocoded if it falls between +40° and -40° creating a total field of view (FOV) of 80°.

ii. **Clip Range** – Enter the minimum and maximum range to be geocoded. No points with a range less than and/or greater than these values, respectively, will be geocoded. Useful when no Clip Angle is used to pick up features beside the system.

iii. **Promote LAS to Version 1**.4 – Default is checked. This ensures the output LAS file format will be 1.4.

iv. **Starting Flight Line Number (Point Source ID)** – When there are multiple Cycles or flights in a project it is important to assign unique point source IDs, or flight line numbers to each line. Selecting a unique starting ID allows the user to determine the best values between 1 and 65535 to use for each line. For multi-Cycle projects it is suggested to use a nomenclature, such as CCCFF, where CCC is the Cycles flown for the project, 1-645, and FF is the flight line per Cycle, 1-99, to keep the point source IDs unique within the project.

d) **Retained Photos Layer Settings** – This section will only become available when a photo layer is detected. Allows the user to specify the photos to be kept for geotagging and export to photogrammetric software packages using Export Photo Package or for processing in Agisoft Ortho Mapping, or for processing in Ortho Mapping. The notion of "Retained Photos" creates a layer of the retained photos on a new layer called "RetainedPhotos."

i. ***Retain Photos within Flight Lines*** – This option retains only the photos that occur between the start and end of each flight line (flight lines were defined in the prior Create Flight Lines step). This option eliminates photos in turns. (Recommended). Selecting the option to "Retain Photos within Flight Lines." creates a new layer in the Table of Contents (TOC) called "RetainedPhotos". The resultant layer is shown in Figure 84. Note that only photos that are between the beginning and end of each flight line are retained.

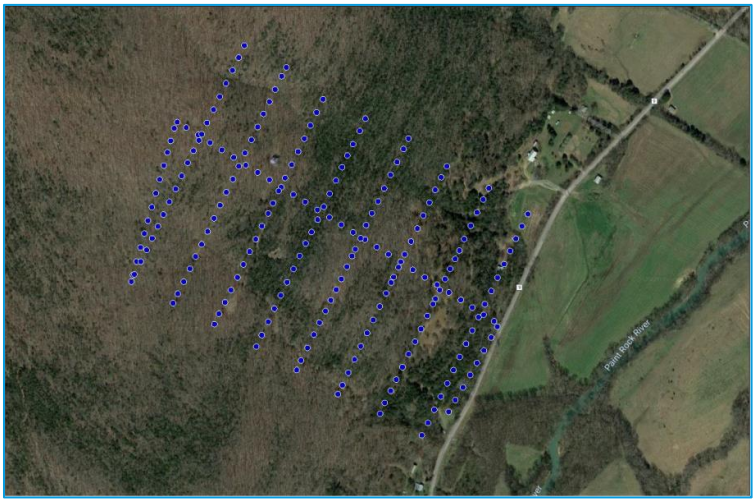


Figure 84 - Retain Photos only within Flight Lines

ii. ***Retain Photos within Flights Lines and Interior Turns*** – This option retains all photos from the start of the first flight line (*start* as defined by GPS time) and the end of the last flight line. Thus, all ferry line photos are retained.

iii. ***Retain All Photos*** – All project photos are retained. In Figure 85Figure 74, all photos retained.

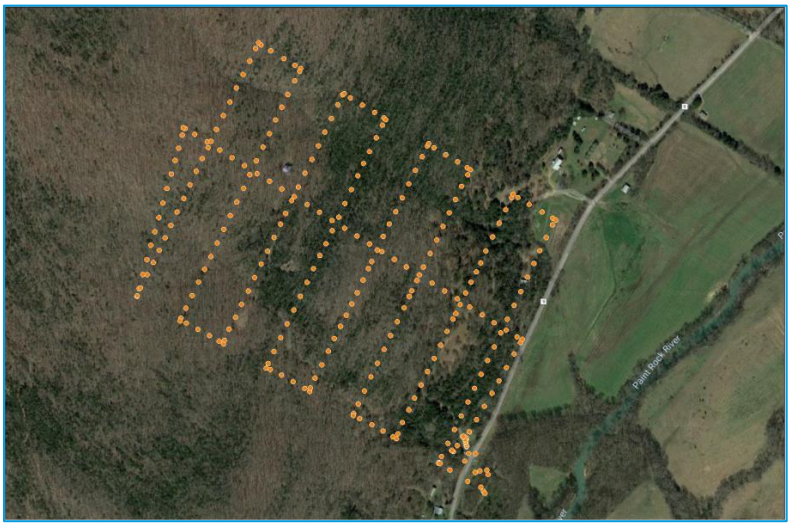


Figure 85 - All Project Camera Photos

4. A Confirmation page will appear to confirm the execution of the tool (Figure 86).

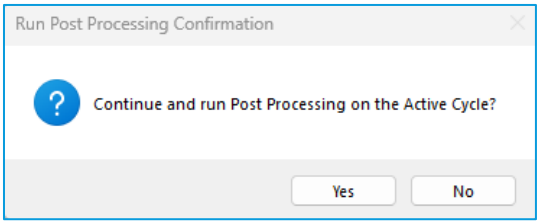


Figure 86 - Post Processing Confirmation Page

LP360 STRIP ALIGN (FKA STRIPALIGN FOR EVO(SAFE))

For a TrueView 3DIS, microdrones, and DJI Zenmuse L1/L2, strip alignment may be improved by executing an addon license to LP360 Drone, called **Strip Align** .

Figure 102 - Strip Align on the Sensor tab

LP360 Strip Align requires a "Strip Align" addon license be checked out in addition to the LP360 Drone license. Note: LP360 Drone+Strip Align may only be used with TrueView 3DIS®, microdrones, or DJI Zenmuse L1/L2 data.

23. The active Cycle on the Sensor tab is not used by this utility, so it does not matter what is selected.
24. Select ***Strip Align*** on the Sensor tab (Figure 102) to open the Strip Align dialog (Figure 103). **Note:** To enable this tool requires a Strip Align addon license to be checked out in addition to the LP360 Drone license.

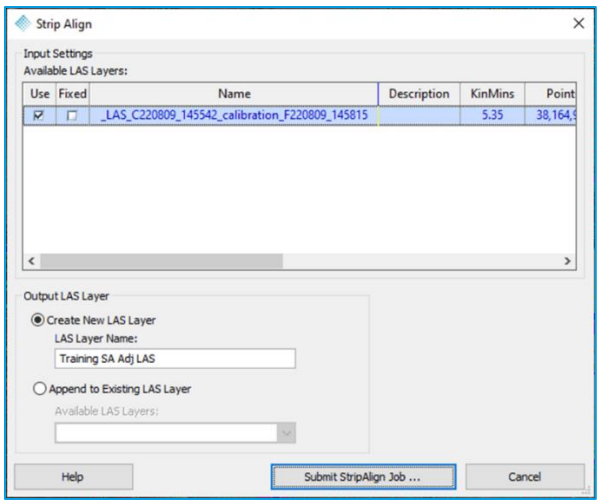


Figure 103 – Strip Align dialog

a) **Input Settings**
   i. **Available LAS Layers** – Will list all LAS layers in the currently open project.
   ii. **Use** – Select the checkbox in the "Use" column beside a LAS layer to determine corrections for that layer. The layer must have trajectories located in the same folder as the LAS, or in a Trajectories folder at the same level as the LAS data as is the typical file structure when following the TrueView workflow.
   iii. **Fixed** – Select the checkbox in the "Fixed" column beside a LAS layer to hold that layer fixed and use as reference for the "Use" layers. Trajectories are neither required, nor used for fixed layers.

iv. There are no "tuning" parameters for Strip Align, it is fully automated.

b) Output Settings

i. **LAS Layer Name** – Type in a unique name for the destination layer on which to generate the corrected LAS files from the "Use" layers. This is the typical first or only run option.

ii. **Append to Existing LAS Layer** – Select from the Available LAS Layer the previously created layer name on which to append the additional Cycle(s).

c) **Submit StripAlign Job** – Submits the Strip Align processing to the Job Manager queue for processing.

25. A successfully submitted job notification will appear confirming the job submission (Figure 104).

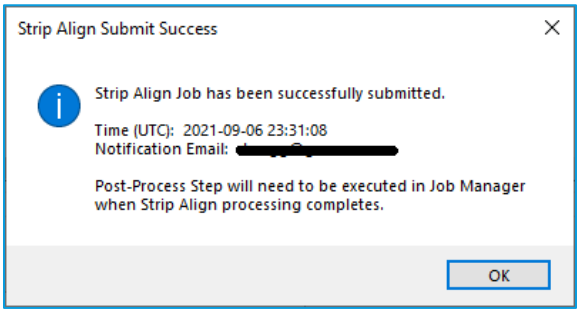


Figure 104 - Strip Align Job Submission Confirmation

26. An empty e-mail will be sent when the processing begins to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings).
27. The Strip Align job progress may be monitored using Job Manager .
28. Upon completion of the Strip Align job by the Job Manager :
    a) Job Manager will indicate completion by the green checkmark flashing on the Job Manager icon
    b) An empty completion e-mail notification will be sent to the e-mail configured in the *LP360 E-mail Notification Settings* (File -> Project Settings -> Global -> LP360 E-mail Notification Settings)
    c) The job will need to be post-processed to add the resulting LAS layer and/or LAS files to the open project.
29. In Job Manager , select the applicable Strip Align job, then select View Log to review the Strip Align processing log.
    a) Review the STDOUT section for "XYZ-displacements RMS" statistics before the correction and "Residual RMS" after the correction.
    b) Review the STDERR section for any reported errors aside from the expected benign warnings.
30. In Job Manager , select the applicable Strip Align job, then select Open Project to open the applicable project for the job, if not currently open.

31. Then, select Post-Process to add the new LAS Layer and/or LAS file(s) to the currently open project based on the settings at the time the job was submitted.
32. Review the adjusted LAS data vs the original to determine suitability of the correction. Cut profiles and generate a dz image for comparison to those done before the adjustment.
33. When desired, in Job Manager, select the applicable Strip Align job, then select Delete Job to clean up the temporary files generated while processing the job.

TRUEVIEW ARCHIVE MANAGER

The TrueView Archive Manager is used to specify the local network or machine location for LP360 Drone to Archive a Cycle. An archived Cycle is a compressed file packaging all the components of a Cycle, optionally including the base station data and any additional ancillary files the user desires. The compressed Archive can be stored in one or more local or network file locations the user has added as Archive repositories.

In addition to local Archives, you can transfer an Archived Cycle from a local Archive to your LP360 Cloud Cycle-Archive for easy, economical and long term offsite storage of your Archived Cycles.

The TrueView Archive Manager dialog (Figure 160) can be accessed at any time from the Sensor tab (Figure 159).

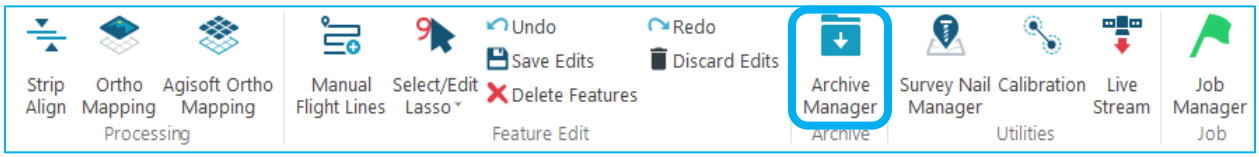


Figure 159 - TrueView Archive Manager

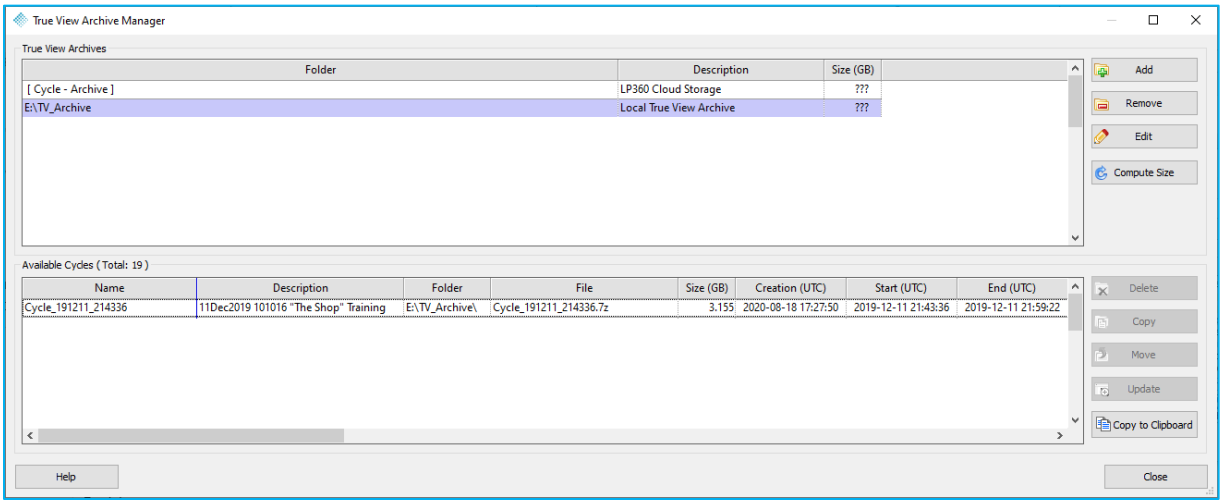


Figure 160 - TrueView Archive Manager Dialog

TrueView Archives – The list of available Archive locations.

Add/Remove/Edit – Used for managing the list of TrueView Archives.

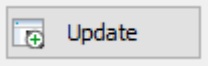
Compute Size – Used to compute how much disk space is currently being used by that archive.

Log into your online account using the LP360 Online Login to automatically add your LP360 Cloud *[Cycle-Archive]* to the list of available TrueView Archives for LP360 Online, respectively. Your Online Archive allows you to efficiently store archived Cycles in your LP360 Cloud account,

as well as enables you to be able to submit Cycles to support for assistance and troubleshooting.

Available Cycles – Selecting a TrueView Archive will populate the list of available Cycles found on the selected TrueView Archive.

Delete/Copy/Move – Are enabled when an available Cycle is selected from the Available Cycles list and are used to manage the selected Cycle in the TrueView Archive. Copy/Move available Cycles from this Archive to your account LP360 Cloud Cycle-Archive or another local Archive location, if configured.

Update 

– Opens the TrueView Update Utility for the selected Archive of the selected Cycle from the Available Cycles.

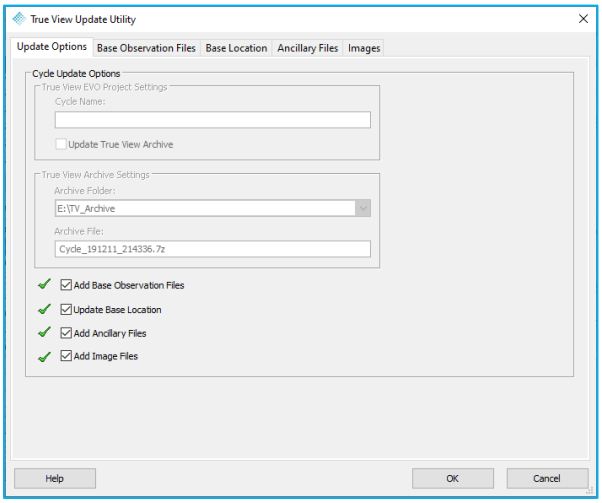


Figure 161 - Archive Cycle Update Utility

Update Options – Selecting the desired update function adds the applicable tab to the Update Utility. A green checkmark beside the option indicates the existence of that information in the Archived Cycle.

Update/Add Base Observation Files – To update/add base observation files to the Archived Cycle, add the desired files on the Base Observation Files tab.

Update/Add Base Location – To update/add the base location for the Archived Cycle, on the Base Location tab select from the available list of Survey Nails or add/modify a survey nail location using the Survey Nail Manager .

Update/Add Ancillary Files – To update/add ancillary files of a user's desire to the Archived Cycle, add the desired files on the Ancillary Files tab.

Update/Add Image Files – To update/add Images to the Archived Cycle, select the respective Camera 1 and Camera 2 Image Folders on the Images tab.

SURVEY NAIL MANAGER

The management of *a priori* survey base station locations (so-called "survey nail" or "reference mark") is done using the Survey Nail Manager found on the Sensor tab (Figure 162) and is used throughout LP360 Drone where access to these data are needed.

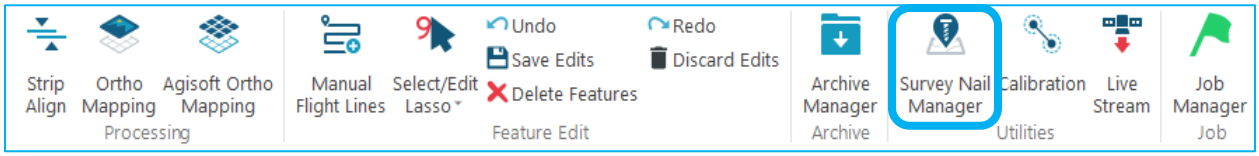


Figure 162 - Survey Nail Manager

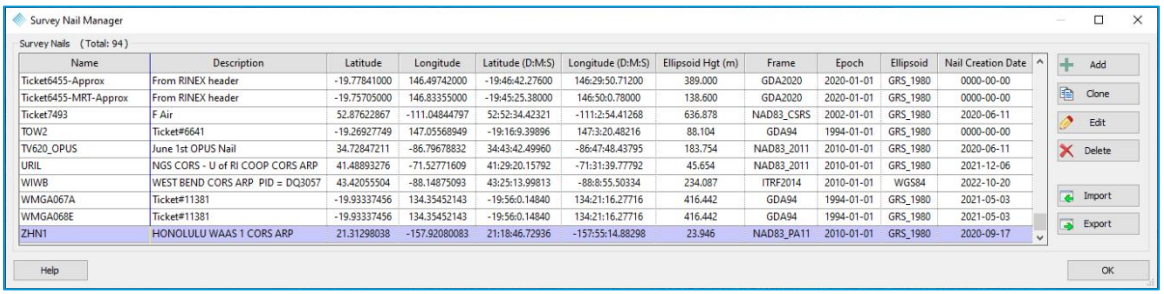
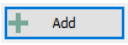


Figure 163 - Survey Nail Manager Dialog

Selecting *Add* 

will invoke the Add Survey Nail dialog (Figure 164)

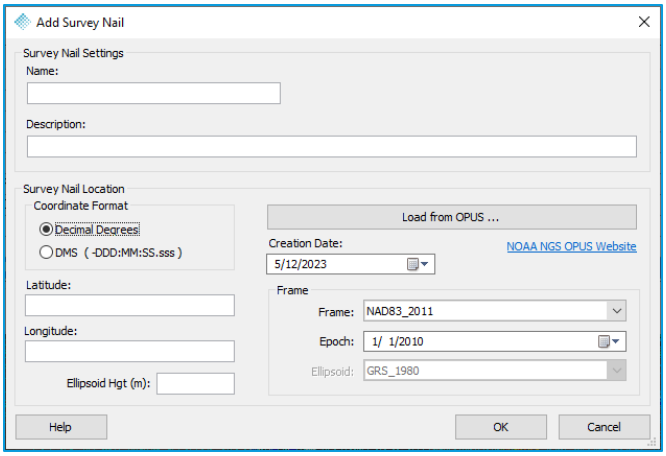


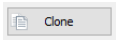
Figure 164 - Add Survey Nail dialog

e) **Name –** Enter a unique name for the new Survey Nail
f) **Description –** Optionally add a description for the new Survey Nail
g) **Survey Nail Location** – Enter the Latitude and Longitude in decimal degrees or degrees minutes seconds (DMS) as per the selected *Coordinate Format*, and Ellipsoid height in meters. Be sure to separate the Degrees, minutes, and seconds, with a colon (DD:MM:SS.sssss).

i. If an OPUS solution is being used, save the OPUS results in a simple text file, and import it into LP360 using the *Load from OPUS* button. The Latitude, Longitude, and ellipsoid elevation will be automatically read from the text file and populated in the applicable fields.

h) **Creation Date** – Enter the date when the nail was established.

i) **Frame** – Choose the correct reference frame and epoch for the base station coordinate. The ellipsoid for the selected frame will be shown for reference. POSPac uses this information to perform any datum and epoch transformations necessary for processing. For 2DIS local base processing, this is reference information to understand the reference frame for the resulting sensor trajectory.

Selecting *Clone* 

will invoked the Clone Survey Nail dialog (Figure 165) with an exact copy of the selected nail in the Survey Nail Manager dialog (Figure 163). Edits may then be made as desired. Note it is necessary to change the name to a unique name before saving the cloned nail.

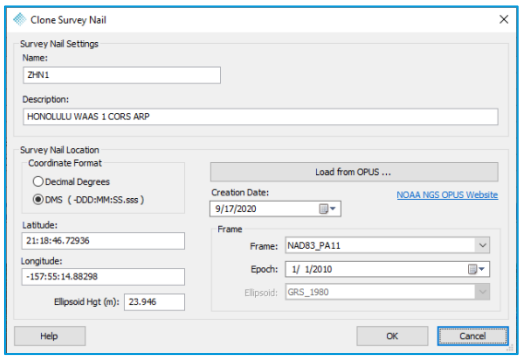
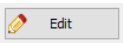


Figure 165 - Clone Survey Nail dialog

Selecting *Edit* 

will invoke the Edit Survey Nail dialog (Figure 166) for the selected nail in the Survey Nail Manager dialog (Figure 163) to make modifications as desired.

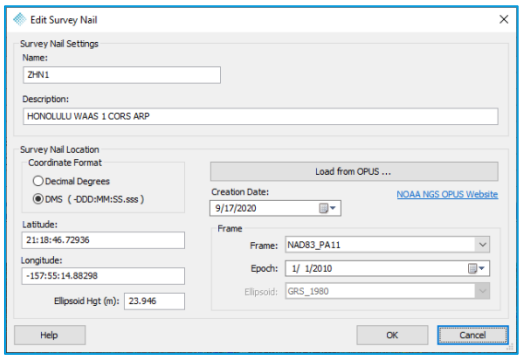


Figure 166 - Edit Survey Nail dialog

Delete, *Import*, *Export* tools are also available for managing the saved survey nail locations and moving them around between processing machines.

JOB MANAGER

The LP360 Job Manager , located on the LP360 Quick Access toolbar and in the Sensor tab, is a convenient way to queue and manage background task processing. Typically, only one job may execute at any given time, but a user may queue many jobs of the same or differing types from within a project or across multiple projects. The processing of the queue occurs in order of submittal time on the machine on which the queue is created.

SUBMITTING JOBS TO THE JOB MANAGER

A growing list of tools, such as Post Process Trajectory, Strip Adjustment, Boresite Calibration, Ortho Mapping, Strip Align for LP360, and Agisoft Ortho Mapping that can submit jobs to the Job Manager will generally do so using a button labelled, "Submit … job".

MONITORING THE JOB MANAGER

Jobs in the Job Manager queue may be monitored by opening the Job Manager dialog (Figure 167). Note: The Job Manager is modeless and may be left open or closed without affecting the queue. The Job Manager icon will flash with a green checkmark when one or more jobs has completed regardless of the currently open project in the session.

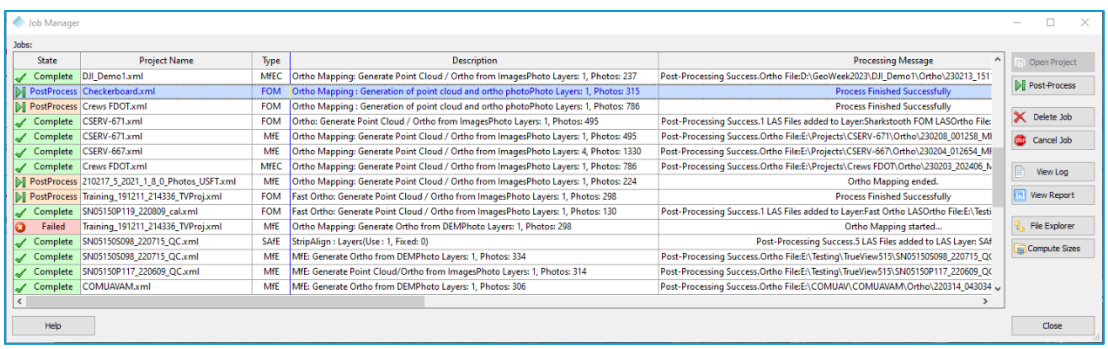


Figure 167 - Job Manager dialog

Open Project – Closes the current project in the session, prompting to save the project, and opens the project associated with the selected job in the grid.

Post-Process – If the status of a job is Post-Process, selecting the job, then the Post-Process icon will execute the post-process step to perform the operation shown in the Post-Processing Steps column. For instance, with a "Strip Align for LP360" job the Post-Process will create a new LAS Layer and/or add LAS files to the specified layer in the project.

Delete Job – Deletes the temporary files associated with the selected job and removes the job from the Job Manager.

Cancel Job – If possible, will cancel the selected job at the next possible opportunity after being selected.

View Log – Where applicable, opens the default viewer with the log for the selected job.

View Report – Where applicable, opens the default viewer with the report that was generated by the job.

File Explorer – Opens in File Explorer the folder location for the selected job.

Compute Sizes – Computes the current size on disk of the temporary files associated will all jobs in Job Manager.

Locking your machine or closing LP360 Drone will not affect the processing queue in Job Manager, however, logging out of your machine will have the unintended consequence of closing the background processes, including those in the Job Manager.

Job Manager creates a directory called "Jobs" directly under the folder in which your project xml file is stored (the "Project Folder"). Each submitted Job will have a unique folder under the Jobs folder. You can quickly access this folder by selecting the desired row in Job Manager and pressing the File Explorer button. Data within a Jobs directory is only used until the Job finishes. However, these folders are kept until you explicitly delete them using the Delete Job command. This allows you do still view reports, logs and so forth at some future time. Job files can consume a lot of space. The amount of space being taken up by a Job is listed in the Size column of the Job row in Job Manager.

EXPORT PHOTO PACKAGE

The ***Export Photo Package*** on the Sensor tab (Figure 168) will allow the user to export the photos on the retained layer and associated camera calibration files. This tool facilitates the downstream import of images into photogrammetric processing software. **Note: Images must have had the Update EXIF Tags for Photogrammetric Software utility run on them before being able to run the Export Photo Package utility for a Cycle/Flight combination. Export Photo Package is not used when using Agisoft Ortho Mapping or Ortho Mapping, only when processing in other photogrammetric software packages that are not tightly integrated with LP360.**

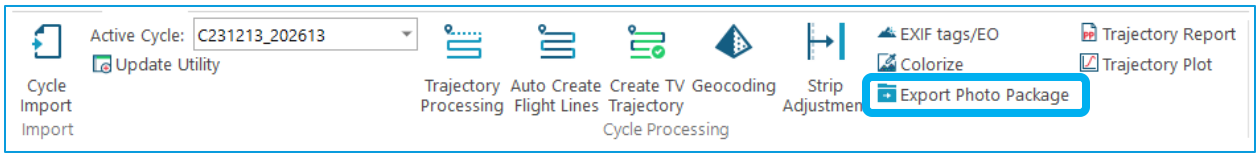


Figure 168 - Export Photo Package

1. If not already done, on the Sensor tab make active the Cycle/Flight combination to be processed.
2. Select ***Export Photo Package*** on the Sensor tab (Figure 168) to open the Update EXIF tags dialog (Figure 169).

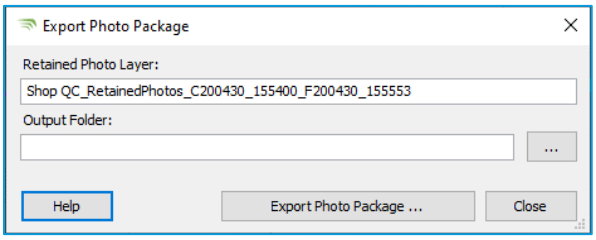


Figure 169 - Export Photo Package dialog

3. The Retained Photos Layer is selected based on the active Cycle/Flight on the Sensor tab.
4. Select the desired output folder to write the geotagged images and associated camera calibration files.
5. Select *Export Photo Package* to write the geotagged images and associated camera calibration files into the selected folder.
6. A progress bar will inform you of the export progress.
7. A confirmation dialog will appear showing the number of images and calibration files written to the output folder. Select *OK* to continue.
8. Repeat for each Cycle/Flight combination in the project, being sure to select the same output folder for each so there is one photo package per project.

   The exported photo package contains:

   a) Images are sorted into folders by camera serial number and named with a Cycle_Flight_ImageNumberCameraPosition nomenclature.

b) Camera calibration files are also placed in each camera folder.
   i. The xml files named *Port_cameraserial#.xml*, *Starboard_cameraserial#.xml*, or *Nadir_cameraserial#.xml* can be **directly imported into Agisoft Metashape**.
   ii. The text files named *Port_cameraserial#_P4D.txt*, *Starboard_cameraserial#_P4D.txt*, or *Nadir_cameraserial#_P4D.txt* **can be used in Pix4D**.
   iii. For other photogrammetric packages you may need to convert these camera calibration values to something applicable to the respective package. For example, Converting Focal Length from Pixels to Millimeters to use in Bentley Context Capture.

c) While **Metashape** and **PIX4D** (v4.6.4) read the updated EXIF tags, some photogrammetric packages require the information be read from a file:
   i. The CSV file named "Cycle_Flight_image_geo_opk.csv" contains the image position file in geographic coordinates, height in meters, with the orientation angles represented as omega, phi, kappa in degrees for each Cycle/Flight combination that was exported.
   ii. The CSV file named "merged_image_geo_opk.csv" is a merged file of all the Cycle/Flight combinations that have been exported into the same Exported Photo Package folder. **This file is configured to be used in Pix4D**.

d) **Default.prj** – Contains the coordinate reference system information from the project.

e) A DEM folder is generated for use with 3DIS® processing.

EXPLORER PACKAGE

EXPORT/PUBLISH EXPLORER PACKAGE

Export Explorer package is a tool found in Project Manager (PM) , located on the Project tab. This package will create an archive of the layers selected in Project Manager.

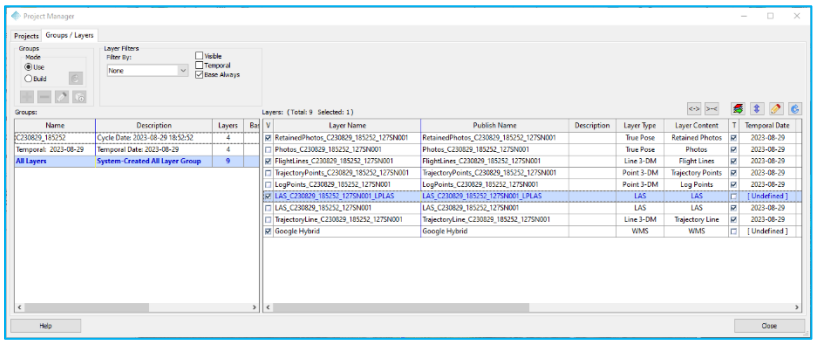


Figure 170 - Project Manager - Groups/Layers

1. Set the published name for layers as desire.

   Project Manager has a "Publish Name" column that lets you set a name that will be used as the new layer name when the package is imported to create a new LP360 Explorer package. This was added to allow you to turn Cycle layer names into something more readable. There is a handy tool that will automatically create short names for you. Just select the layers for which you want short (*publish*) names and press the "Set Published name …" . If you do not like the auto name, you can edit the fields of the row; *select* the row and press Edit (the pencil tool at the right of the dialog) or just double-click the row.

   NOTE – Publish names of rows to be exported must be unique since these will become the layer names in the recreated project.

2. Select one or more rows to select the layers that are to be included in the exported package. Use the usual Windows Explorer multi-select keyboard commands.
3. Press the Export/Publish Explorer Package tool to open the Export/Publish Explorer Package dialog (**Error! Reference source not found.**).
4. Check the box beside **Export Explorer Package** to create an Explorer Package that you can share with a colleague or client.
   a) Set a destination path, filename for the package. The file extension is "evx".
5. **Reckon has been deprecated, DO NOT** check the box beside **Publish Explorer Package to Reckon**. **For publishing data to** [LP360 Cloud] **use the** [LP360 Cloud Uploader] .
6. Select "Export/Publish Explorer Package". Confirm. The dialog will provide status as the compression takes place. This can take quite some time for a large project.

a) If **Export Explorer Package** was selected, the data associated with the selected layer(s) will be packaged into a compressed archive with an extension of "evx". This package can be imported by LP360 with a viewer license or higher by using the Open LP360 Explorer Package tool .

OPEN AN LP360 EXPLORER PACKAGE

To open or import an Explorer Package (a compressed "evx" package) created by the Export/Publish Explorer Package tool in Project Manager , use File -> Open -> Explorer Package (Figure 171), in any LP360, v2021.1.12, or later, or on the Project tab of the ribbon, to open the **Import Explorer Package** dialog (Figure 172). Or simply select "*Import LP360 Explorer Package…*" from the Startup dialog when you first open LP360 Drone.

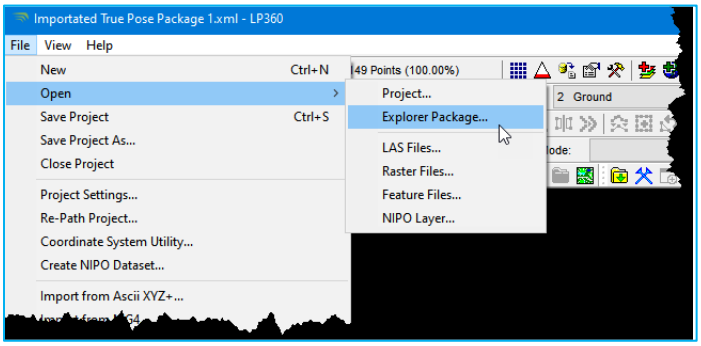


Figure 171 - Open Explorer Package

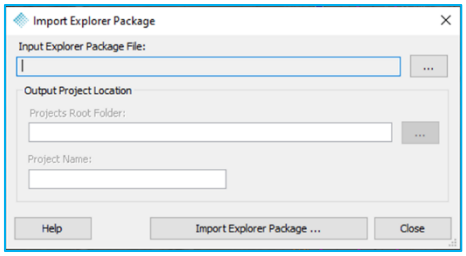


Figure 172 - Import Explorer Package dialog

On the Input line, browse to the Explorer Package (the "evx" archive). Under Output Project Location, The Projects Root Folder will default to the location set in Project Settings, if set, in either case you can browse to the location for the top level of the LP360 project that will be created. The Project Name will default to the name of the Explorer Package, and can be modified at this time, if desired. After filling out these fields, press Import Explorer Package. The package is imported, and an LP360 project is created. This can take some time since the archive has to be decompressed and all file locations redirected.

When the decompression and import is complete you will have a new LP360 project containing the layers from the package.

Note – You cannot use this import to add layers to an existing project. If you are in an LP360 project when you perform an import, you will be asked if you wish to Save the current project. After the save (if you elect this option), a new project will be created containing the imported layers.

If you examine the directory structure (Figure 173) of the newly created project, you will see that it has been reorganized into what we might call a canonical LP360 project structure. There is a parent folder for the project with a set of top-level subfolders for each *data type* that LP360 is capable of managing:

- LAS
- Raster
- Photo (True Pose® photos)
- Feature

Under each of these is a folder for each layer of that type as well as folders containing the files that are associated with the layer.

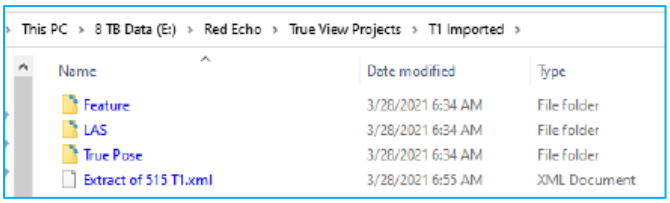


Figure 173 - Directory structure of imported package

Thus, one nice use of this Export tool is to collect up scattered projects. For example, if you have a project that accesses data from several other LP360 projects the export will collect up all the elements you need and deposit them into an organized, hierarchical project.

MULTI-CYCLE PROCESSING TIPS

For a lot of project areas, it is necessary fly multiple Cycles to cover the project area. Follow these tips to help process efficiently.

- Import all Cycles that cover the project area into the same LP360 project.
- Use Project Manager to build Cycle and Temporal layer groups.
    - Open **Project Manager** .
    - Change Groups mode to Build.
    - Use to automatically create layer Groups for each unique Cycle and Temporal date included in the project.
- Use the Cycle layer groups to help move from Cycle to Cycle to process in a methodical manner through to colorized point clouds for 3DIS®, and updated EXIF tags for all systems.
    - Open **Project Manager** .
    - With Groups mode set to Use, select the desired Cycle Group from the available Groups in the left pane. The layer group shown in the TOC will change as you select a different group in Project Manager. When only one Cycle is in a layer Group, the Cycle selector on the Sensor tab automatically changes to match. You may leave Project Manager open to make it easier to change between groups, or close and re-open as needed.

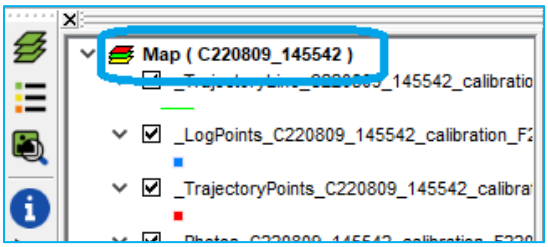


Figure 174 - Selected Layer Group being displayed in the TOC

- It is typically best to QC the individual Cycle LAS layers before merging as it is easiest to correct or make elevation adjustments when the Cycles are separated. If using Strip Adjustment or Strip Align for LP360, you probably do not need to make any elevation adjustments to the individual Cycles but should still perform the QC.
    - You can do some manual comparisons of the Cycles to each other by toggling the active LAS layer while reviewing the profile and 3D View to compare.
    - Run a control report of each Cycle LAS layer to your check points to see if there are any issues such as a large offset in one of the Cycles due to mistakes in the trajectory processing.
    - A quick review of the attributes and coverage of each LAS layer for any issues.
    - Use the **Affine Transform LAS PCT** to adjust any significant elevation offsets of lines or Cycles to better match when they are merged.

For dual purpose 3DIS, if your project requires merging aerial and mobile cycles, each method must have corrective post-processing steps performed prior to merging. This is necessary because both collection methods will produce different GNSS biases. A typical workflow would be to run Strip Adjustment or Strip Align on all cycles together per each collection method, then apply adjustments such as debiasing or Accuracy Star adjustments, then merge.

- For 3DIS®, when using Strip Adjustment, process all Cycle/Flight LAS layers into a single combined Strip Adjusted LAS layer by selecting all Cycle/Flight LAS layers when processing in Strip Adjustment.
    - If processing new flight(s) to add to already Strip Adjusted Cycles, set the already Strip Adjusted data as reference files (LAS or Cycles) and write the new results to a new LAS layer. This allows for scaling the workflow to larger projects where your system resources may not allow for processing all Cycles in a single run, or for times where you may be processing data blocks as they're acquired and adding more over time.
- For 3DIS® or DJI L1/L2, when using Strip Align for LP360, process all Cycle/Flight LAS layers into a single combined Strip Align Adjusted LAS layer by selecting all Cycle/Flight LAS layers when processing in Strip Align for LP360.
    - If processing new flight(s) to add to already Strip Align adjusted Cycles, set the already Strip Align adjusted data as fixed and write the new results to a new LAS layer. This allows for scaling the workflow to larger projects where your system resources may not allow for processing all Cycles in a single run, or for times where you may be processing data blocks as they're acquired and adding more over time.
- When not using Strip Adjustment or Strip Align for LP360, in the TOC, select the desired LAS Layers to be merged or copied, and use the right-click -> **Merge LAS Layers** command (Figure 175) or **Copy LAS Layers** command to open the Merge LAS Layers dialog (Figure 176) or Copy LAS Layers dialog in order to merge or copy the individual Cycle/Flight LAS layers into a single combined LAS layer before smoothing or ground classification.

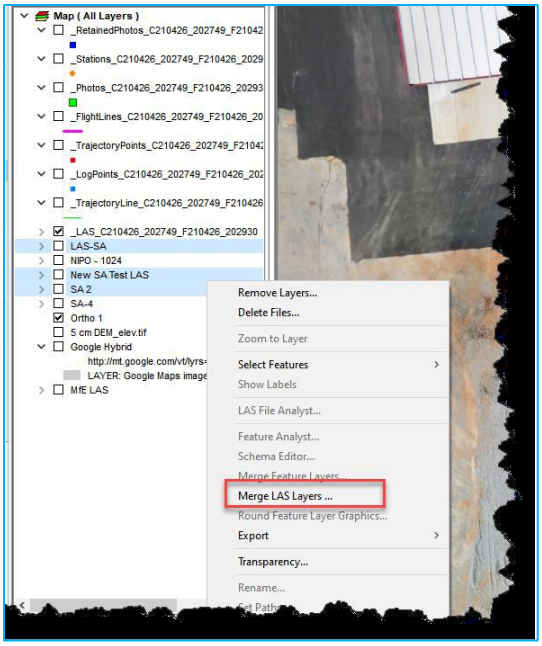


Figure 175 - Merge LAS Layers RCM Command

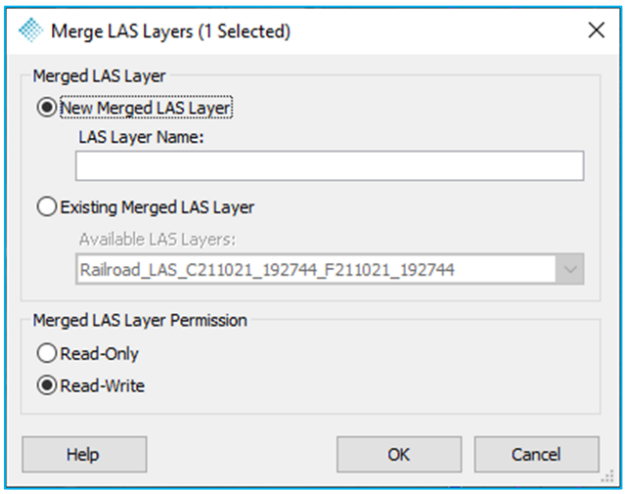


Figure 176 - Merge LAS Layers options dialog

- For more selective processing you might select individual LAS file(s) in the LAS Files tab and use the right-click -> **Move Selected File(s) to Layer** command (Figure 177) to open the Move LAS Files to Layer options dialog (Figure 178). This command allows you to move one or more LAS files from one LAS Layer to another. You can also create a new destination LAS Layer with this command.

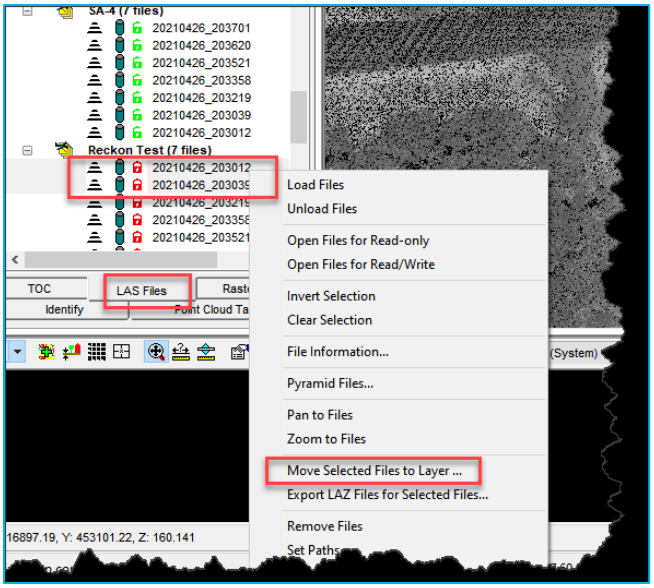


Figure 177 - Invoking the Move Selected File(s) to Layer Command

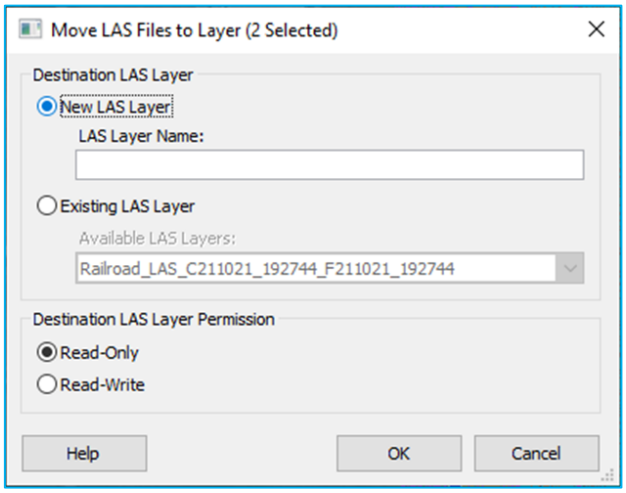


Figure 178 - Move Selected Files to Layer command dialog

- For 3DIS® or DJI L1/L2, if running the Smoothing Point Cloud PCT after Strip Adjustment or Strip Align for LP360 or after merging/copying LAS Layers, select the Output Structure as "Tiled Files" to create suitable sized LAS files for downstream processing in LP360 such as ground classification, etc., when using QVR pyramids. This is not necessary when using LPLAS.
- For 3DIS® or DJI L1/L2, if not running the Smoothing Point Cloud PCT, then after merging/copying LAS Layers, use the Merge Point Cloud PCT to create suitable sized LAS files for downstream processing in LP360 such as ground classification, etc. Files should be no larger than 256MB on disk for optimal performance when using QVR pyramids. This is not necessary when using LPLAS.
- If you wish to subset RetainedPhotos layer(s), select the desired layer(s) in the TOC and use the right-click **Merge Feature Layers** and/or **Copy Feature Layer** command, as applicable, to create an editable copy that is easy to delete and re-create if needed. When running Agisoft

Ortho Mapping or Ortho Mapping tools for multiple Cycle/Flight RetainedPhotos layers, it is not necessary to merge or copy them first, just select the desired layers in the Agisoft Ortho Mapping or Ortho Mapping dialogs.

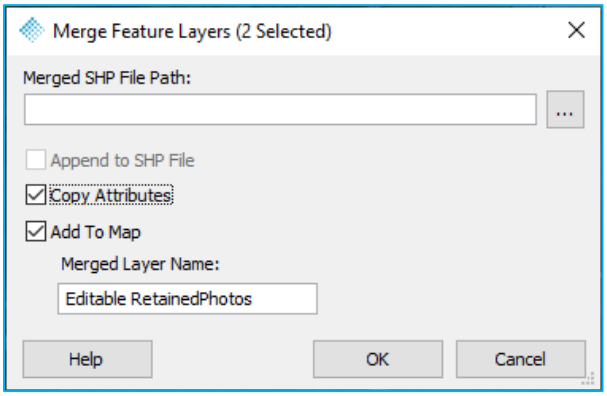


Figure 179 - Merge Feature Layers command dialog

- If not running the fully integrated Agisoft Ortho Mapping or Ortho Mapping tools, create a single photo package for all Cycle/Flight RetainedPhotos layers by always selecting the same output folder for the Export Photo Package tool as you toggle between each applicable Cycle/Flight combination.
    - If your project area is very large and has a lot of photos, then you may need to section it into overlapping sub areas depending on the capabilities of your photogrammetric software and the capabilities of your hardware.
- After running Agisoft Ortho Mapping or Ortho Mapping tools or manually processing the photo package in another photogrammetric package:
    - Add the orthomosaic raster to your project. For Agisoft Ortho Mapping or Ortho Mapping, this is done as part of the post-processing step in Job Manager, along with updating the image EXIF tags with the bundle block adjustment positions and angles to improve the image drives.
    - Use the **Reproject Raster PCT** to create a new raster clipped to the project deliverable boundary by selecting the polygon layer as the Tool Geometry and the orthomosaic as the Input Raster Layer. Deselect the Convert CRS to maintain the current CRS on the orthomosaic.

Running the Reproject Raster on small rasters can create the output as a regular TIFF that can be added to Autodesk's Civil3D, an example of a program which cannot read the BigTIFF file format typically generated by Metashape and other photogrammetric processing packages. Rasters resulting in a file >~4GB cannot be written in the TIFF format so be sure to select the Create BigTIFF File option when running the Reproject Raster PCT, or use an index, which can be generated using the **Grid Generator PCT**, to cut a single large raster into smaller rasters to fit the TIFF format.

APPENDIX A: POSPAC UAV NETWORK LICENSE

Depending upon the purchased business model, a purchased system may come with a set of Applanix Network POSPac UAV licenses (POSEO, MMS_GNSS-Inertial_QC, and UAV GNSS-Inertial) or POSPac MMS licenses for post processing the sensor trajectory solution from within LP360 Drone. POSPac provides a user with the capability to use a software license within a shared network environment running a license management service included with the POSPac installation. Hence, is best to activate this license on a machine which can act as the License Server on your network. Other computers on the same network will automatically borrow the license when needed and return it when done. If needed, you may also borrow the licenses from the server to a laptop to take to the field for processing while disconnected from the license server.

Let's say you activated your license on Computer A.

- The license now resides on Computer A
- The license **CANNOT** be activated again on any other computer
- Each license can **ONLY** be activated on a single computer
- Trying to activate the same license will yield a *"All activations have been exhausted for this entitlement"* like shown here

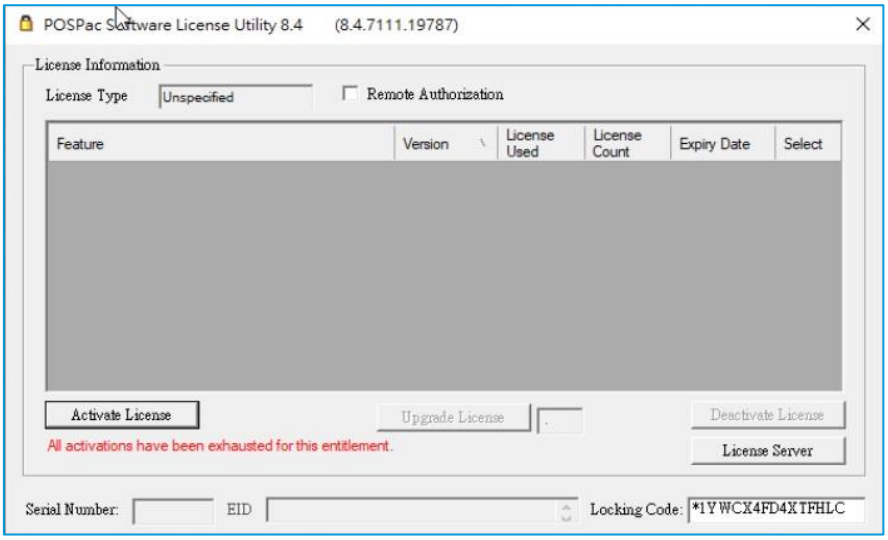


Figure 180 - POSPac Software License Utility

Now, any computers that are on the same network as Computer A will be able to **USE** the license residing on Computer A. No configuration is usually necessary but see the Firewall Settings to Communicate with the License Server below if the Applanix Software License Utility on the other computers do not automatically see the licenses on the License Server after activation.

- The license still **resides** on Computer A
- Other computers **on the same network** as Computer A will automatically borrow the license when needed

There are some steps to ensure this feature is working properly.

ACTIVATE THE LICENSE SERVER

When you have selected the machine to act as your Applanix License Server, install POSPac UAV if you wish to use it to also process data on the same machine. Otherwise, install only the Applanix **Software License Utility**, also available from the POSPac folder on our FTP site.

POSPac supports online activation of software licenses. Activation can be accomplished entirely by the user, provided they have internet access and an Applanix-provided Entitlement ID (EID).

POSPac provides a utility for managing software licenses. The Software License Utility can be run from the POSPac Help menu or the Windows Start Menu under the All Programs -> Applanix -> SoftwareLicenseUtility menu.

1. Open the Applanix Software License Utility (SLU)
2. Select Activate License (internet access is required)

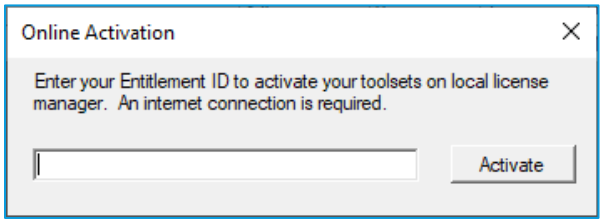


Figure 181 - Online Activation

3. In the dialog, enter the POSPac Entitlement ID provided with your TrueView licensing information.
4. If necessary, configure the Firewall Settings to Communicate with the License Server.

TO USE THE LICENSE WHILE ON THE SAME NETWORK AS THE LICENSE SERVER

1. The computers on the network will have to point the **License Server (in the Software License Utility (SLU))** towards Computer A. We will name this computer, Computer B, for clarity-sake.

   First, find the host name of Computer A (you can run ipconfig /all in the Command Prompt). Then go into the **License Server** inside the SLU on Computer B and add the host name of Computer A. It will look something like this. **Make sure to save after adding the name.**

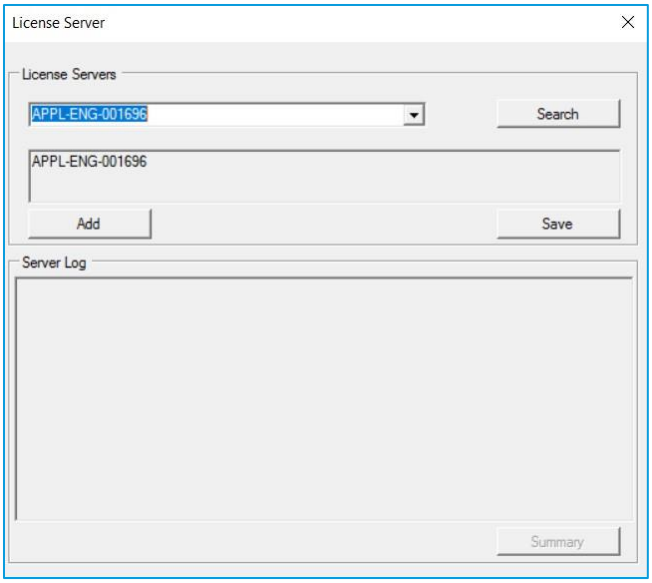


Figure 182 - License Servers

2. Now, if you look at the SLU on Computer B, you should see the licenses that are on Computer A. Note that it says on the bottom *"Found license manager running on APPL-ENG001696"*. This should now be the host name of Computer A if done correctly.

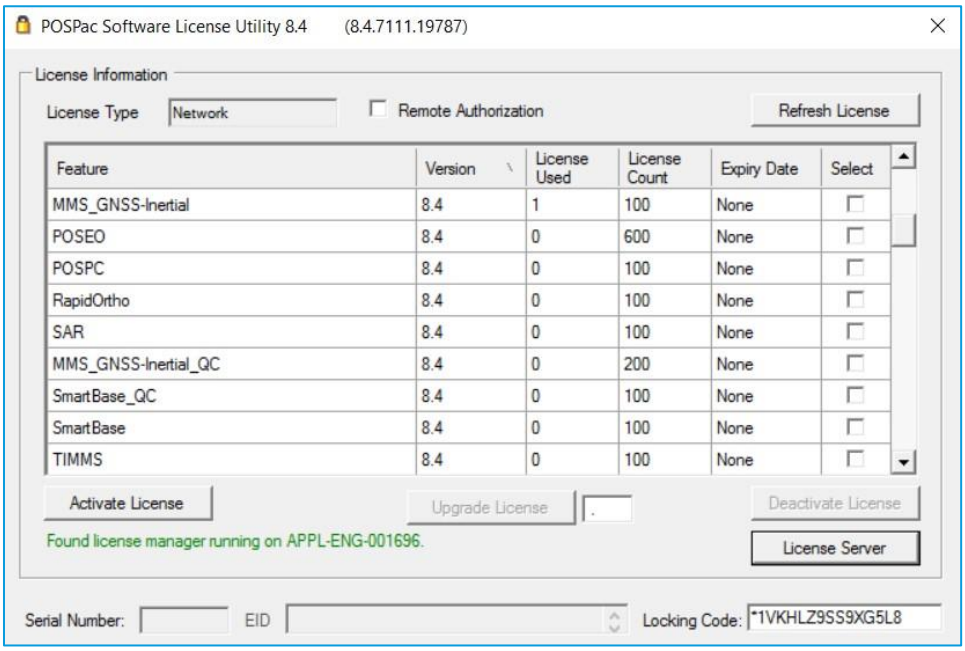
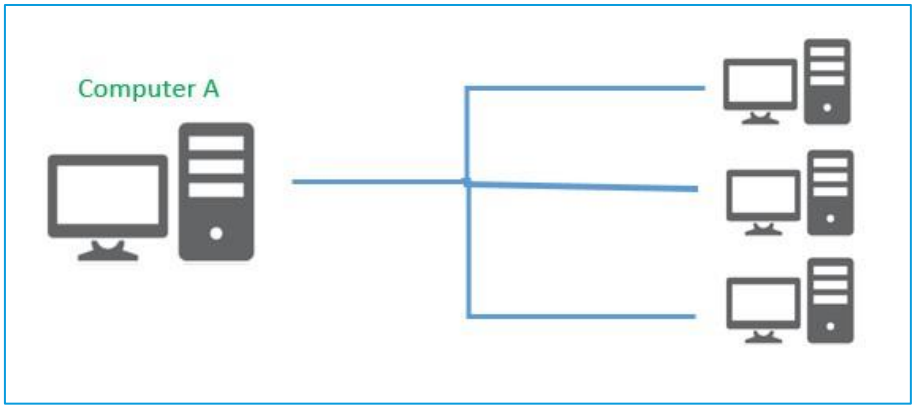


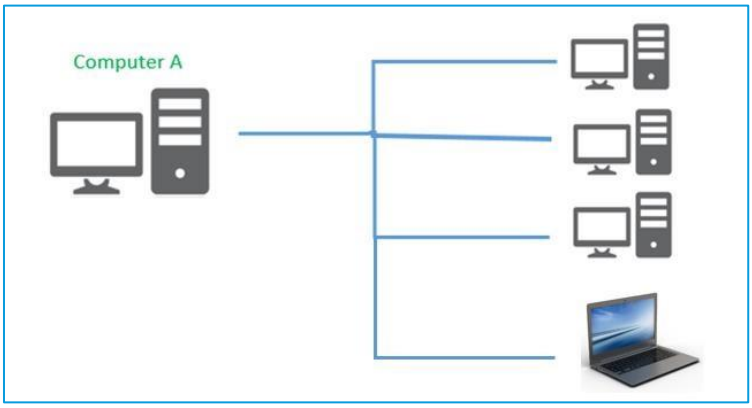
Figure 183 - SLU - Licensed

3. The above procedures are for computers on the **same local network**



TO BORROW A LICENSE FROM THE LICENSE SERVER

1. Now, say you have a laptop on the network, and you wish to take this laptop out in the field but still want to use POSPac for processing. In this case, you can check-out the license (you are essentially borrowing the license from Computer A)



2. Open the SLU on the laptop. You can then **Select** the licenses you want to borrow, set the **Commute days**, then select **Check Out Selected**.

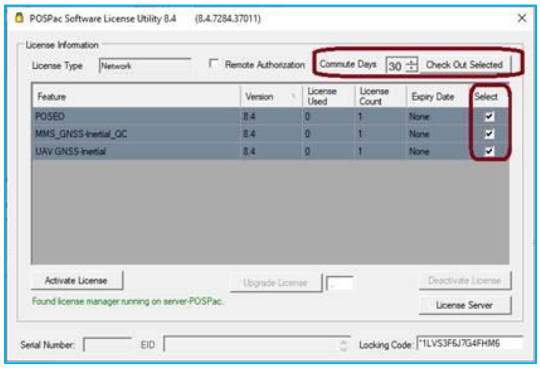


Figure 184 - Commute Licenses

3. Once you do this, the license on Computer A will temporarily move to the laptop for the set number of days. **Note** that when you do this, Computer A will act as if there are no licenses on it and therefore the computers on the network will not be able to see and use the licenses.

Once the set number of days has passed, the license will automatically be recalled to Computer A

4. You can remove the laptop from the network and still be able to use the license
5. You can also return the license back to Computer A whenever the laptop is on the same network again.

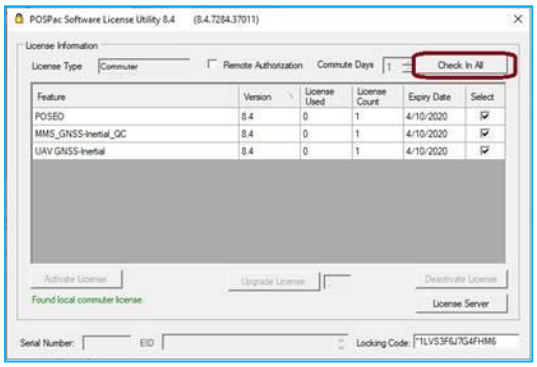


Figure 185 - Check in Commuted License

FIREWALL SETTINGS TO COMMUNICATE WITH THE LICENSE SERVER

If either your License Server or workstation have a firewall in place, then exceptions will need to be made to allow for the license communication through the firewall. Make the exceptions on all machines with firewalls in place.

In the Windows Defender Firewall Advanced settings add the following inbound rules:

- Allow the program "C:\Program Files (x86)\Applanix\SoftwareLicenseUtility\Applanix.SoftwareLicenseUtility.exe"
- Allow TCP port 5093
- Allow UDP port 5093

In the Windows Defender Firewall Advanced settings add the following Outbound rules:

- Allow the program "C:\Program Files (x86)\Applanix\SoftwareLicenseUtility\Applanix.SoftwareLicenseUtility.exe"
- Allow TCP port 5093
- Allow UDP port 5093

FIREWALL SETTINGS TO COMMUNICATE FOR EPHEMERIDES

If your workstation has a firewall in place, then exceptions will need to be made to allow for the download of the ephemerides through the firewall to communicate with the services list in the %ProgramFiles%\Applanix\ POSPac UAV x.x\ EphemDataServices.ini file.

ANTIVIRUS EXCEPTIONS FOR APPLANIX POSPAC

When running Applanix POSPac some antivirus software may interfere with processing and cause processing exceptions or slow license check in, or processing times. It is recommended to provide exceptions for programs located in the following folders:

POSPacCloud should always be installed with LP360 Drone, so include exceptions for:

- C:\Program Files\Applanix
- C:\Program Files\Common Files\Applanix
- C:\Users\%user%\AppData\Roaming\POSPacCloud

If POSPac UAV Desktop or POSPac MMS Desktop is installed for owned systems, also include exceptions for:

- C:\Program Files\Applanix
- C:\Program Files\Common Files\Applanix
- C:\Program Files (x86)\Applanix
- C:\Program Files (x86)\SafeNet Sentinel

CONFIGURING THE APPLANIX SOFTWARE LICENSE UTILITY FOR VPN

In some instances, you may wish to use the license while remote, but can connect to the License Server via a VPN connection. First, ensure both the License Server and your computer have configured applicable Firewall Settings to Communicate with the License Server.

1. Connect to your office network via VPN.
2. Open the Applanix SLU on your computer.
3. If it doesn't find any License Server, select **License Server.**
4. Type the name of your License Server in the top bar.
5. Select Add.
6. Select Save.
7. Close the License Server dialog.
8. Close the SLU dialog.
9. Open the SLU and now it should find the license manager running on the License Server.

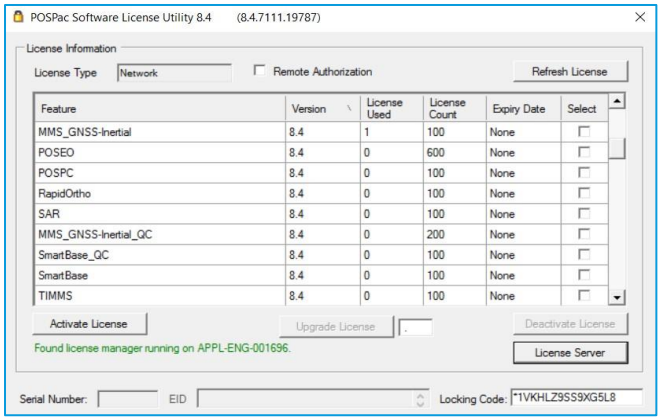


Figure 186 – SLU – Licensed from Server

From that point forward, you should only have to connect to the VPN. Then, execute the post processed trajectory processing from within LP360 Drone and the license will borrow akin to being on the network.

APPLANIX SOFTWARE LICENSE UTILITY TROUBLESHOOTING

NO INTERNET CONNECTION AVAILABLE. ACTIVATING A LICENSE REQUIRES AN INTERNET CONNECTION.

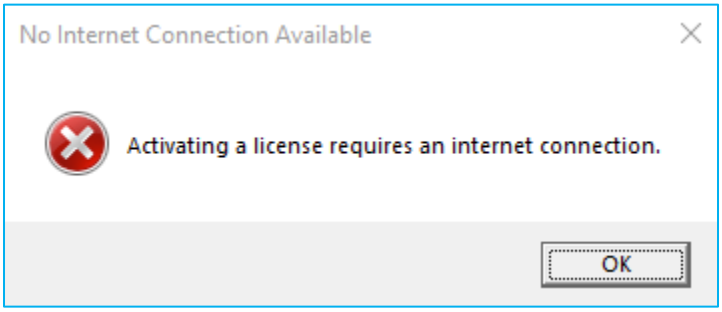


Figure 187 - No Internet Connection Available

The Applanix license activation and deactivation uses HTTP/HTTPs protocol to communicate with their license server web portal at **licensing.applanix.com** (24.137.193.172) using HTTP Port 8080 and 31350, as well as **applanix.prod.sentinelcloud.com** (34.149.188.209) using SSL Port 443.

On bootup, the Software License Utility attempts to connect to ftp.applanix.com (24.137.193.171). You will need to ensure that the Software License Utility and Sentinel RMS License Manager are not being blocked by any firewalls.

SUPPORT

Our searchable support knowledge base contains information on workflows, tips, hints, and probable resolutions to error messages or commonly encountered situations.

https://support.geocue.com/

Normal support business hours are **Monday - Friday, 8 AM — 5 PM** USA Central Time.

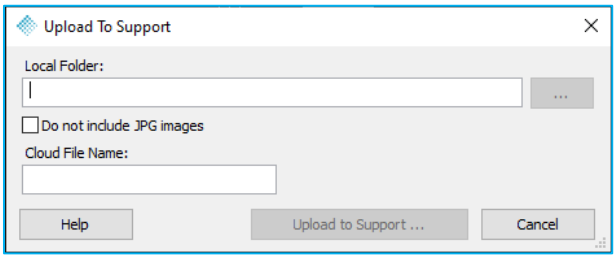
If a support request is sent during business hours a representative will typically get back to you within 4 hours. If received after hours, a response will be sent the following day. To speed response time please include the following information in your request:

- Contact information - please include e-mail address and phone number
- Account name
- TrueView Model and Serial Number
- TrueView Cycle log

If your request includes problems pertaining to a specific error message, please include a screenshot of the error message.

TrueView Cycles may be easily transferred to support by first moving/copying them to your LP360 Cloud Cycle-Archive (see TrueView Archive Manager). Then, log into your LP360 Cloud account, select the Cycle-Archive folder, locate the desired archived Cycle(s) and select share with everyone to generate a link that you can share with us in your support ticket.

For all other data types, use the **Upload to Support** tool found on the Support tab in LP360 to browse for a folder and have LP360 compress the contents of the selected folder and any subfolders, with an option to exclude JPG images when not needed for the support ticket, and upload the compressed folder to the Support folder of your LP360 Cloud account. Then, log into your LP360 Cloud account, locate Support folder, then the desired layer(s) and select share with everyone to generate a link that you can share with us in your support ticket.



For LP360 Drone and TrueView hardware support contact:

support@geocue.com