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HIGH-END PHOTOGRAMMETRY SOFTWARE

PREPARING PROJECTS FOR PROCESSING IN CORRELATOR3D™

1 Overview

Correlator3D (C3D) has been developed to process imagery coming from any platform, including drones and aircraft. One of the key factors to successfully process a photogrammetry project is to correctly set up the project and to ensure the input data is complete.

This guide will describe the process of creating a project in Correlator3D, validating input data and cleaning up any unnecessary images to optimize output quality and minimize processing time.

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2 Project setup

When importing EXIF data, Correlator3D should correctly interpret the exterior orientation (EO) from the images. However, if an EO file is imported instead, users should understand how the EO parameters were defined. Typically, the header of the file being imported will provide information about these. If they were generated from an RTK or PPK post processing solution, users should also know if the elevations reported account for a geoid offset so they can apply it in project setup.

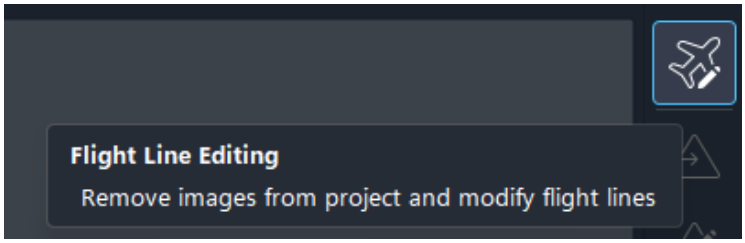
Correlator3D should also automatically detect all camera parameters from the images. In rare cases, such as when using new cameras, Correlator3D may not recognize some parameters such as the focal length or pixel size. In such cases, users should have this information available.

Users should be aware of the output projection required. Also, any data imported such as a boundary file or ground control points (GCPs) need to be in the same projection as the project.

Not understanding any of the parameters above may position the input data in the wrong location spatially, leading to repeating project setup or requiring additional editing of output data.

3 Initial cleanup

Before processing in Correlator3D, users should first ensure that they have complete coverage and remove unnecessary images that are outside the project boundary. Using the flight line editing tools, disabling images does not erase them. It just prevents the software from them being processed by the software.



To do so, users should follow these steps:

1. After completing the project setup import, the project boundary file should be displayed by selecting the following from the C3D menu: File>Add to Project>Add Vectors>Add Features. The boundary file will appear in the main window with the images loaded into the project.

2. To remove images outside the project boundary, users can open C3D's aerial triangulation (AT) module. A pop-up window will suggest an initial tie point extraction, which can be dismissed.

3. Once inside the AT module, the flight line editing tools will appear in the sub menu as the uppermost icon on the right side of the screen. From there, users can select and remove images outside the project boundary in the following ways:

   → Individually, by selecting them and remove them from the project

   → By flight line, by selecting an image in the flight line then selecting the corresponding flight in in the project directory and removing the whole line

   → Graphically, by using the box select tool

If multiple missions were incorporated into the project, users should also use these same tools to remove images that overlap between missions.

Changes can be saved by closing the flight line editing tools and exiting the AT module.

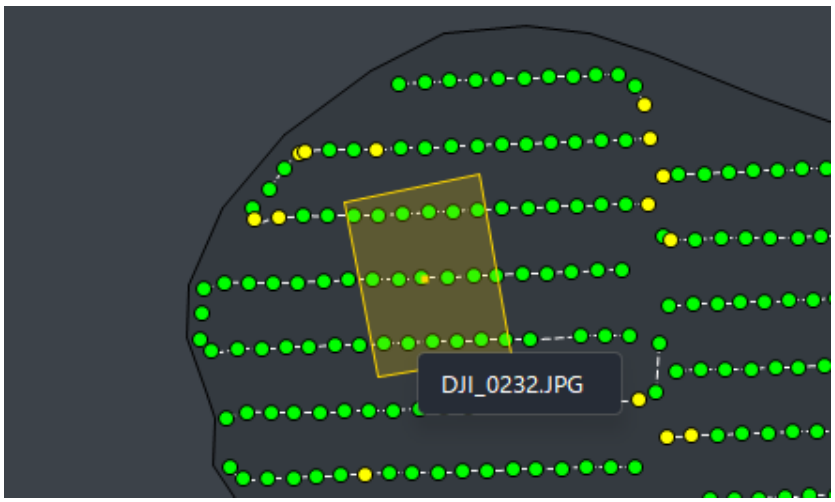
4 Adjusting image overlap/sidelap

Users should then adjust the overlap/sidelap of the project to optimize results and processing times. C3D allows for a visual inspection within the main project window. Here are the steps:

1. Create a coarse DEM: users should open the AT module and run the AT steps through the bundle adjustment, and coarse DEM extraction. This will display the image footprints underneath the initial image positions as the cursor is moved over them.

   In general, 60% forward overlap and 30% sidelap are all that is needed for mapping. If a higher degree of overlap was acquired, disabling these extra images should be considered.

2. Disabling forward overlapping images: if a project was flown at 80% forward overlap, disabling every other image in the flight line should be considered. This will leave the user with 60% forward overlap. To do this, open the flight line editing tools and either:



   → Select every other image in the directory tree and disable them from the project.

   → Graphically select every other image and disable them from the project.

3. Disabling overlapping flight lines (sidelap): if a project was flown at 80% sidelap, disabling every two adjacent flight lines should be considered. This will leave the user with 40% sidelap. To do this, open the flight line editing tools and select each flight line(s) to be removed in the directory tree and disable them from the project.

Close the Flight Line editing tools, saving the changes that were made and exit the AT module.

Users should understand that every image imported to a project adds time in processing and increases file size. These extra images can generate from 10 to 40% of bloat in a project. It is thus strongly recommended to eliminate wasteful images.

5 Importing GCPs

Once all unnecessary images are disabled from the project and an initial bundle adjustment has been performed, users should add and measure ground control points (GCPs). To ensure the accuracy of a project, users should have a good distribution of GCPs within the project boundary. This includes projects that were flown with RTK or PPK enabled drones. In such cases, the GCPs can be imported as check points and compared against the post processed solution. If there are issues, they will become apparent after the first iteration of AT and the RTK/PPK solution should be abandoned: users should then rely on measured control points only to create a good AT solution.

Users should follow these steps to import GCPs to their project:

1. Open the AT module and select the Add GCP's icon on the sub menu to the right of the display. A window will appear asking the user for an import file. Select the appropriate file.

2. Users should then set the appropriate delimiter so that the file imported appears to be sorted into columns.

3. Users must then match the imported columns with the correct header values and then save the information.

If imported correctly, the GCPs will appear on screen within the project boundary. If they do not appear within the project boundary, then most likely the XY columns were reversed on import or the project coordinate system was not entered correctly during project setup.

The project coordinate system should always match the coordinate system of the GCPs.

At this point, users should designate a portion of the GCPs as check points. This is done by selecting a point in the project directory under GCPs and reassigning it as a check point. C3D will not use these in the AT solution, but rather use their measurements to independently validate the overall solution.

6 Measuring GCPs

Once imported into the project, users should then measure the GCP positions in the images by following these steps:

1. Select a GCP in the project directory and measure the center of the control point in all images. If a GCP appears to be on the edge of an image, skip measuring the GCP in that image.

2. Repeat this step for all GCPs (both used as control and as check points) and run the bundle adjustment.

7 Reviewing the AT report

The AT report reveals the quality of the AT process, allowing users to determine if additional iterations are needed or if it is sufficient to continue processing the project. The first thing to look for is the image tie point quality assessment in the project summary on the first page of the report. It will rate the tie point quality either excellent, good or poor. This is based on the average projection error, standard deviation, and the average number of tie points per image.

IMAGE TIE POINTS

Quality assessment	EXCELLENT	
Average projection error	0.33	pixels
Standard deviation	0.29	pixels
Average number of tie points per image	96.4	

If the assessment is poor, users should consider re-running the AT process using different parameters such as the full AT unconstrained mode, allowing the software to correct the input parameters further. If the assessment is excellent or good, then users can move on to reviewing the GCP measurements.

If the measurement of the GCPs do not meet the accuracy requirement of the project, users should perform the following:

→ If the vertical error is not consistent, disable the GCP with the vertical value farthest out of the norm rerun the bundle adjustment. If the results improve, it is likely a poorly surveyed point and can be discarded.

→ If the vertical error is consistent across all GCPs, then there is likely an issue error in the RTK/PPK post processing, or the lack of a GEOID offset. Return to project setup, add the inverse of the consistent error into the altitude offset when importing the images and follow the processing steps once again.

When the quality report meets the accuracy requirement of the project, close the AT module and continue the processing steps to create the deliverables desired.

8 Step-by-step processing in C3D

Correlator3D offers many processing options, giving the user complete control in the way output data is generated. It is recommended that users work through the steps manually (e.g. DSM generation, DTM extraction, orthorectification, mosaic creation) using the visual interface to understand and be able to adjust results along the way. C3D's user interface is set up so that the user can follow the traditional steps in photogrammetry by completing each module from left to right above the main project window. At any step in the process, if there is an issue or the results do not meet the desired requirements, users can re-run that step before continuing on.