

Processing Trimble UX5 HP Aerial Survey Data

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About this tutorial

In this tutorial, you will process survey data collected by a Trimble UX5 HP unmanned aircraft system (UAS) using Survey Office and Trimble UASMaster. In addition to a high-resolution camera, the Trimble UX5 HP includes an on-board Trimble GNSS receiver with PPK technology that minimizes or eliminates the need for ground control points (GCPs), greatly streamlining the data collection and station adjustment processes. UASMaster, which is installed by default with SO, is a powerful software program for processing, georeferencing, geo-imaging, geo-capturing, and geo-modeling UAS data, resulting in the highest quality aerial photogrammetry deliverables possible.

You will start by creating a new SO project using the *Trimble UX5 HP Solution Template*, which includes project settings configured specifically to support the processing and viewing of UX5 HP aerial survey data. After setting up the project, you will select an appropriate coordinate system and import flight and GNSS data, reference station data, and ground control data. Next, you will process a precise trajectory from the continuous GNSS data and then download the data to UASMaster for processing and the creation of deliverables. Finally, you will import UASMaster deliverables back into the SO project.

Notes:

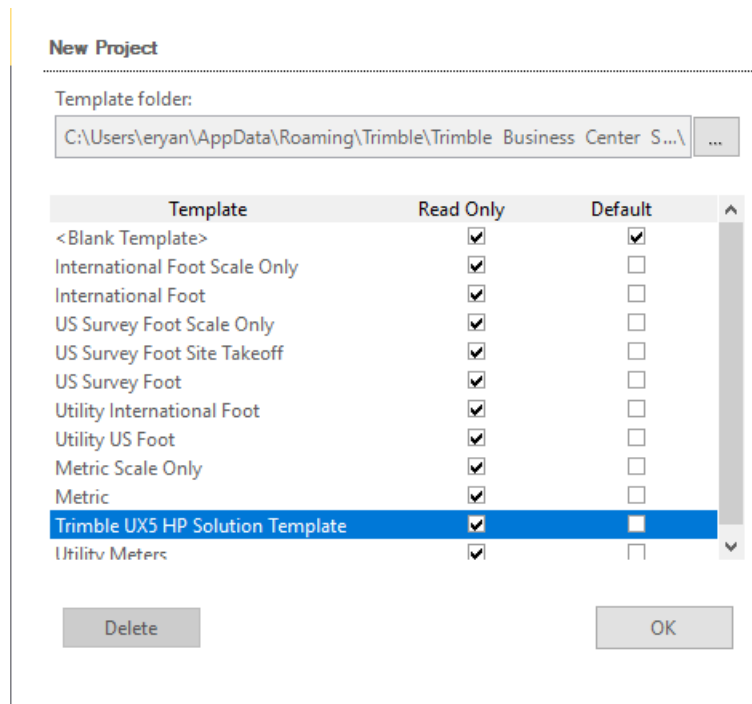
- This tutorial is intended to demonstrate the overall workflow for processing UX5 HP data in SO, sending the data to UASMaster (where you perform minimal processing), and sending the processed data back into SO. It is not intended to explain how to use UASMaster to perform comprehensive processing tasks, which would be beyond the scope of this tutorial. See the UASMaster documentation for complete instructions on using all of the features in this powerful software package.
- The Trimble UASMaster application is installed automatically when you install Survey Office version 3.80 or later. Your SO license provides access to all UASMaster features.
- Depending on your computer, processing in UASMaster for this tutorial could last up to 15 - 20 minutes and may affect performance during that time if you are working with other applications.
- If you need additional help at any time you are using the software, press **F1** to display the online help.

Step 1. Create the project in SO

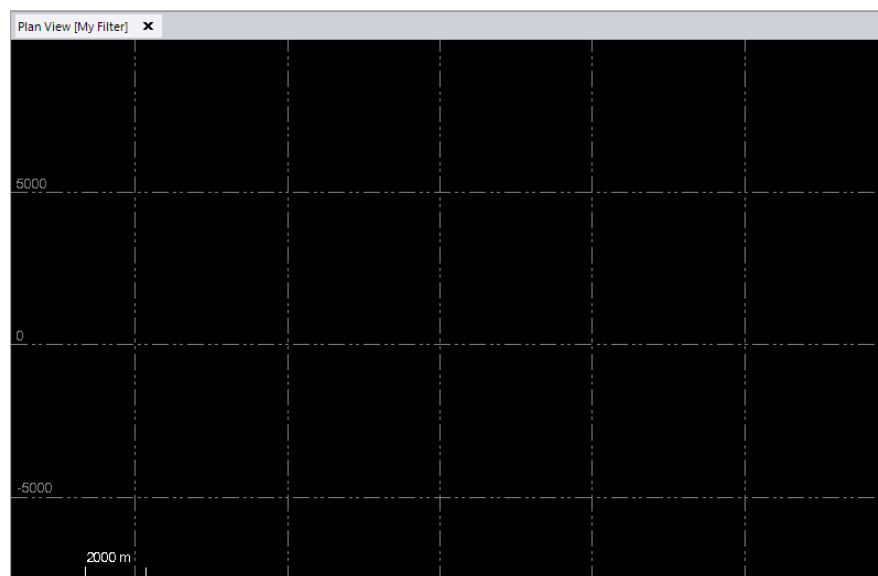
For this tutorial, you will create a new project using a predefined custom project template whose project settings are configured specifically to support the processing and viewing of UX5 HP aerial survey data.

Note: The downloaded *ProcessingUX5HPAerialSurveyData* folder contains this PDF file, a *Data* folder from which you will import data into the SO project, and a *UX5 HP Tutorial - UASMaster* folder in which UASMaster project files will be stored when they are created later in the tutorial.

1. Select **File > New**.
2. In the **New Project** window, select the *Trimble UX5 HP Solution Template* option and click **OK**.



The **Plane View** tab displays for the new project. Since no data has yet been imported, it is blank.

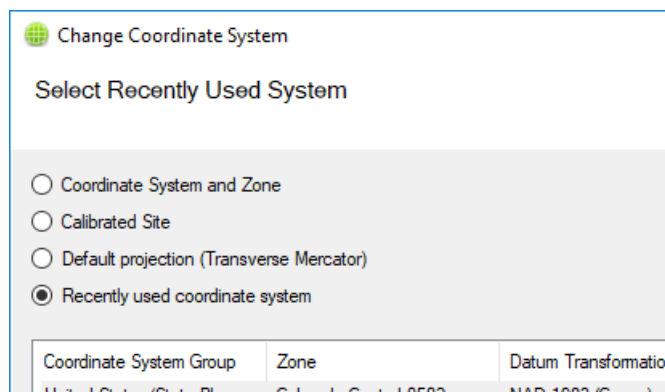


Note: By default, the *Trimble UX5 HP Solution Template* is configured to display distances in meters. Optionally, you can change the unit of measurement by selecting **Project Settings** in the **Quick Access** toolbar (located at the top of the **Survey Office** window) and then selecting **Units > Distance** in the left navigation pane.

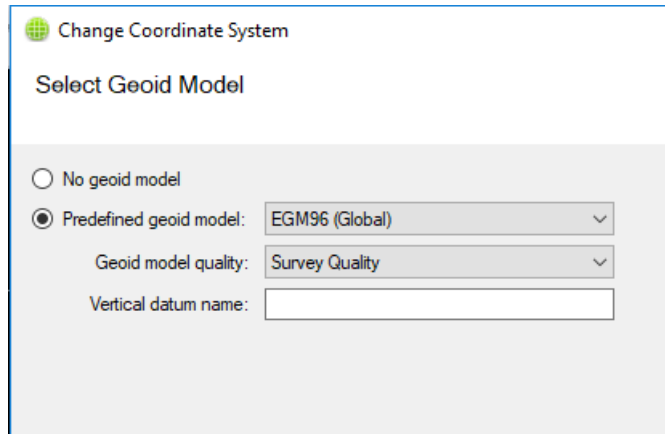
3. To save the new project, do the following:
 - a. Select **File > Save As**.
 - b. In the **Save As** dialog, save the project file in the `..\ProcessingUX5HPAerialSurveyData` folder with the name *UX5 HP Tutorial*
 - c. Click **Save**.

You are now ready to select the appropriate coordinate system for the ground control data you will be importing. This is the coordinate system for which deliverables will be generated.

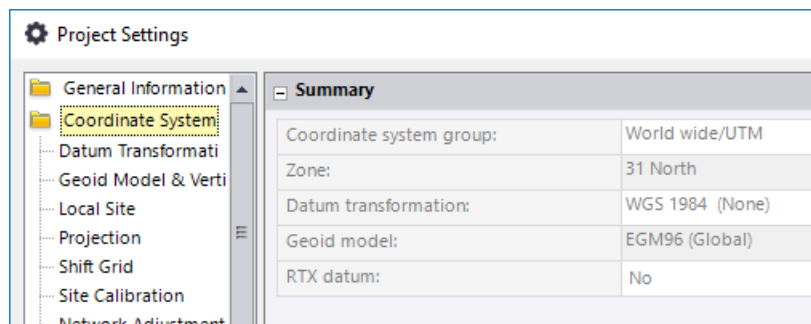
4. In the **SO** ribbon, select **Photogrammetry > Setup > Change Coordinate System** to display the **Change Coordinate System** dialog.



5. In the **Change Coordinate System** dialog, do the following:
 - a. Select the **Coordinate System and Zone** option.
 - b. Select the **Coordinate System Group** *World wide/UTM* and select the **Zone** *31 North*. Then click **Next**.
 - c. Select the **Horizontal Datum** *WGS 1984 (None)*. Then click **Next**.
 - d. Select the **Predefined geoid model** *EGM96 (Global)* and select the **Geoid model quality** *Survey Quality*. Then click **Finish**.



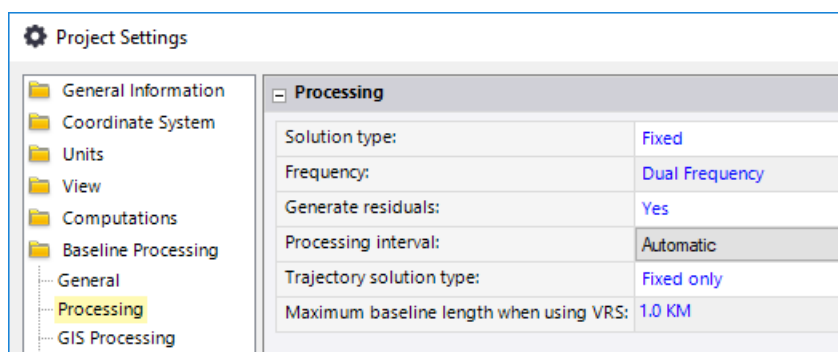
- In the **Quick Access** toolbar (located at the top of the **Survey Office** window), select **Project Settings**. Then select **Coordinate System** in the left navigation pane to verify the selected coordinate system.



With the **Project Settings** dialog open, you can also verify the **Baseline Processing** and **Referenced Image** settings, which were automatically configured based on the selected *Trimble UX5 HP Solution Template*.

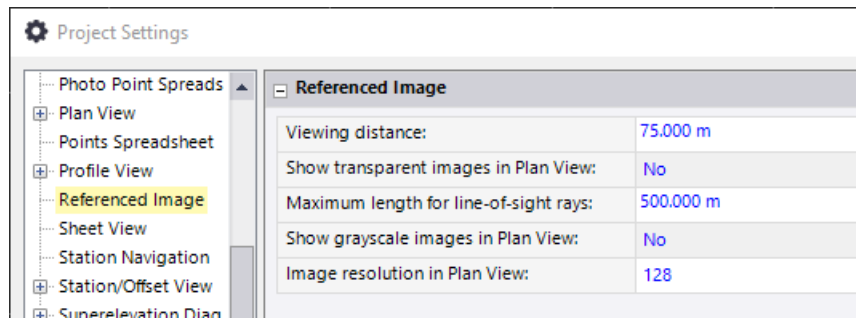
- Select **Baseline Processing > Processing** in the left navigation pane.

As you can see, the **Frequency** is *Dual Frequency* and the **Trajectory solution type** is *Fixed only*. These are default project settings for the *Trimble UX5 HP Solution Template*. In non-UX5 HP project templates, these settings default to *Multiple Frequencies* and *Fixed and float* respectively. Do not make any changes.



- Select **View > Referenced Image** in the left navigation pane.

Note that the **Viewing distance** is *75.00 m*. This distance determines how much the images overlap when viewed in the **Plan View**. In non-UX5 HP templates, this setting is *15.00 m*. Again, do not make any changes.



9. Click **Cancel** to close the **Project Settings** dialog.

Your project is correctly configured and you are ready to import data.

Step 2. Import the data into SO

In this step, you will import the following files into the project:

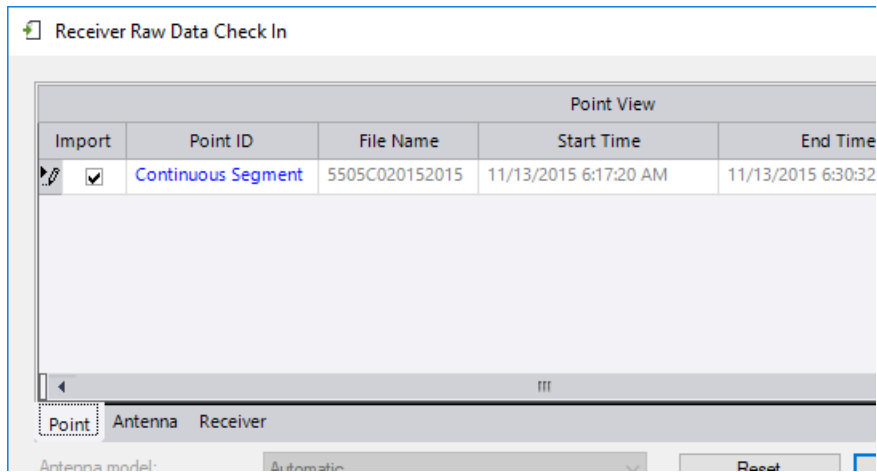
- A JXL (.jxl) file containing aerial photo station data, which, when imported, causes associated high-resolution images to also be imported
- A T04 (.t04) raw data file (automatically imported with the JXL file) containing continuous data with event markers captured with the on-board GNSS receiver (This data will be used to create a trajectory in the project.)
- A T02 (.t02) raw data file containing a reference station coordinate that will be used to process trajectory coordinates
- A CSV (.csv) file containing ground control point (GCP) coordinates with *Control* quality

Note: To perform a trajectory-enabled photo station adjustment as described in this tutorial, the base station coordinate must be *Control Quality*.

To import each of these files, you will use the drag-and-drop method rather than using the **Import** command pane since it is faster and you will not need to specify any import settings.

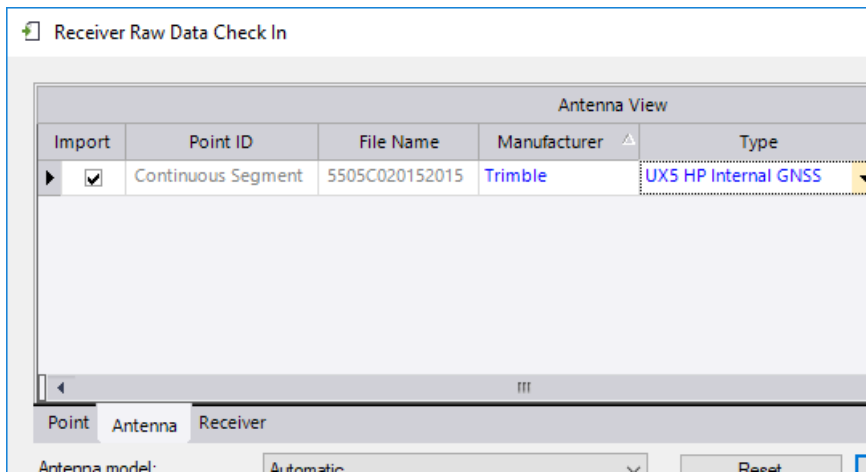
1. Open the `..\ProcessingUX5HPAerialSurveyData\Data` folder and drag-and-drop the `UX5HPFarmingProject_Flight2.jxl` file onto the **Plan View** tab.

Importing the JXL file automatically imports flight metadata, images, and, in the case of the Trimble UX5 HP, onboard GNSS raw data contained in a T04 file. Because of the GNSS data included in the import, the **Receiver Raw Data Check In** dialog displays.

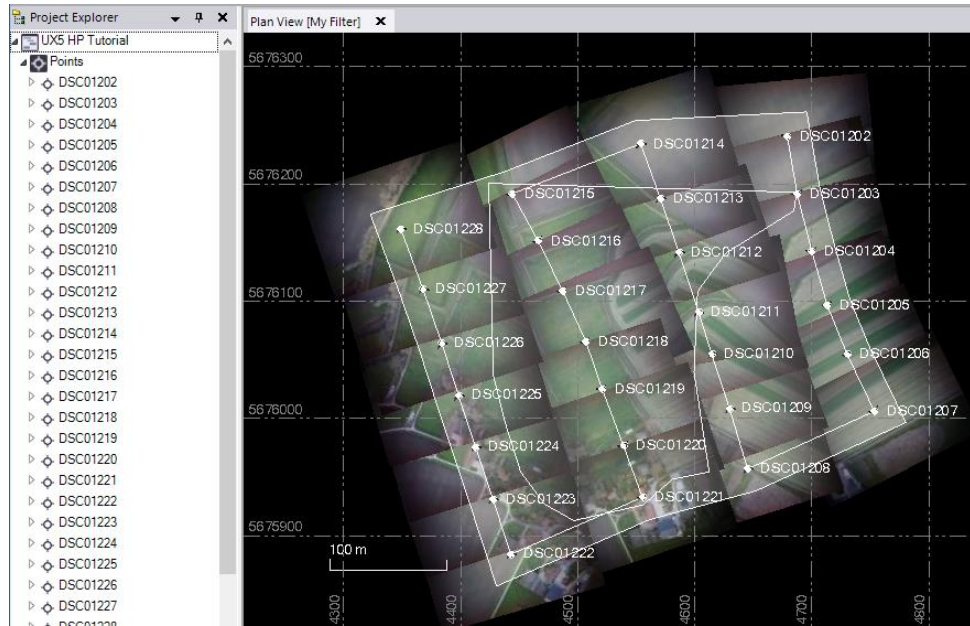


The **Point** tab in the dialog summarizes the properties of the contained trajectory, including its duration. Other tabs are used to summarize antenna and receiver configuration data. You will need to make a change on the **Antenna** tab.

2. On the **Antenna** tab in the **Receiver Raw Data Check In** dialog, select *Trimble* for the **Manufacturer** and *UX5 HP Internal GNSS* for the **Type**. Then click **OK**.



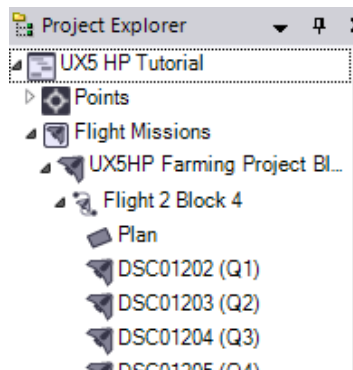
The aerial photo station points and captured images are displayed in the **Project Explorer** and **Plan View**.



Note the heavy vignetting in the images due to the wide-angle lens used. You will correct this later in UASMaster.

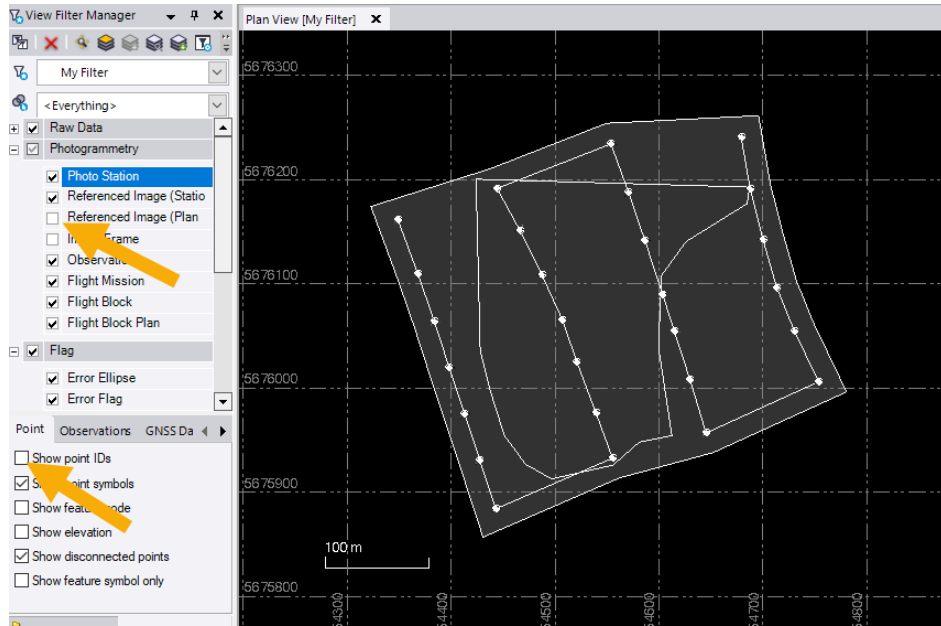
When using a project template other than the *Trimble UX5 HP Solution Template*, the image thumbnails may be shown smaller and non-overlapping (projected closer to the camera than to the ground) due to the setting in the **Project Settings > View > Referenced Image > Viewing Distance** field, as discussed earlier in this tutorial.

Nodes representing the imported flight mission, flight block, flight block plan, and individual aerial photo stations are displayed nested beneath the **Flight Missions** node in the **Project Explorer**.



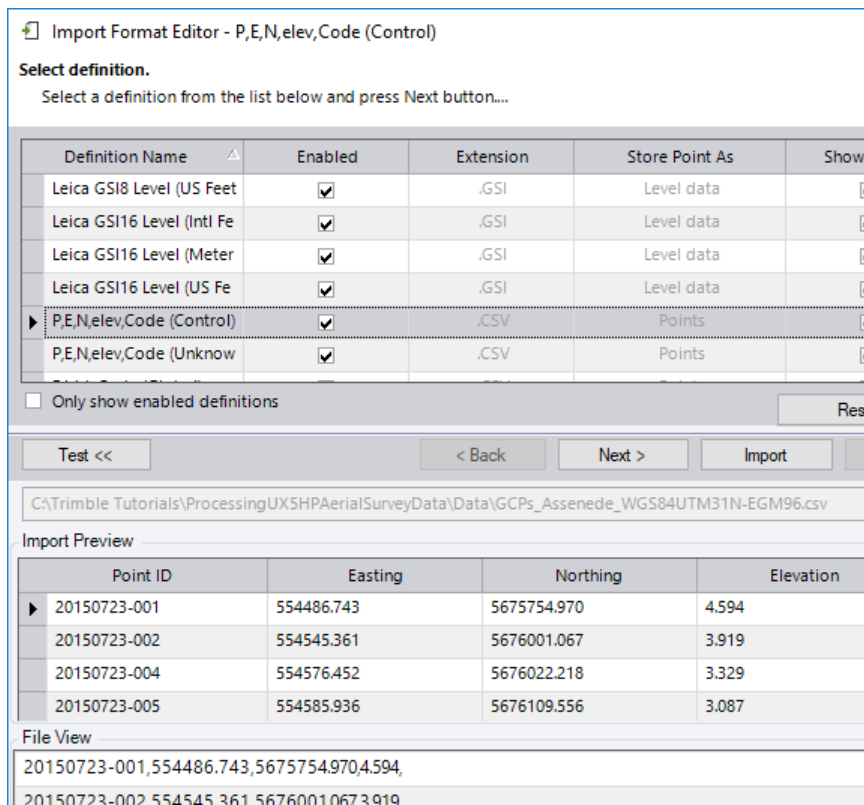
Next, you will use the **View Filter Manager** to "clean up" the view a bit since there is no need to view the photo images or point IDs at this time.

3. In the **SO** ribbon, select **Home > View > View Filter Manager** and do the following in the **View Filter Manager** pane:
 - a. In the **Photogrammetry** list, uncheck **Referenced Image (Plan View)**.
 - b. On the **Point** tab at the bottom of the pane, uncheck **Show point IDs**.




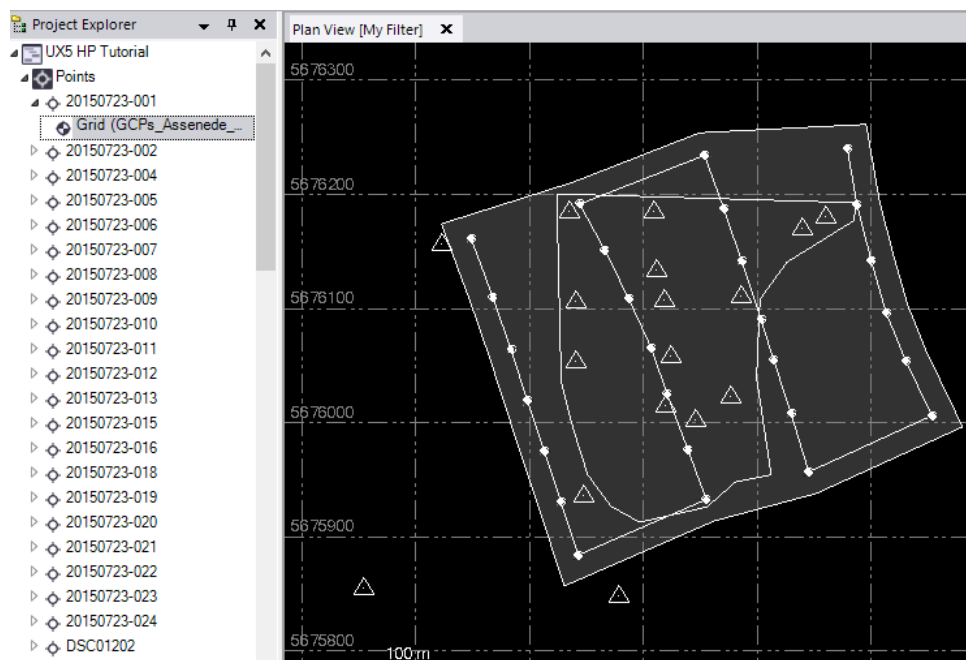
You are now ready to import GCPs contained in a CSV file into the project. Note that the coordinates contained in the CSV file must be in the same coordinate system selected for the project.

4. Open the `..\ProcessingUX5HPAerialSurveyData\Data` folder and drag-and-drop the `GCPs_Assenede_WGS84UTM31N-EGM96.csv` file onto the **Plan View** tab.
5. In the **Import Format Editor** window, verify that the **P,E,N,elev,Code (Control)** definition is selected and that the fields displayed in **File View** match the fields displayed in **Import Preview** correctly, ensuring data will map correctly into the project.



6. Click the **Import** button.

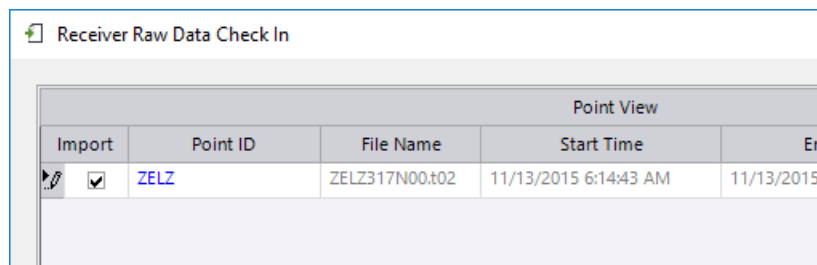
The imported GCPs are represented by dot-in-triangle icons () in the **Plan View**. This type of icon indicates that the point has *Control Quality*. Each GCP is also represented by a **Points** node and a nested coordinate node in the **Project Explorer**.



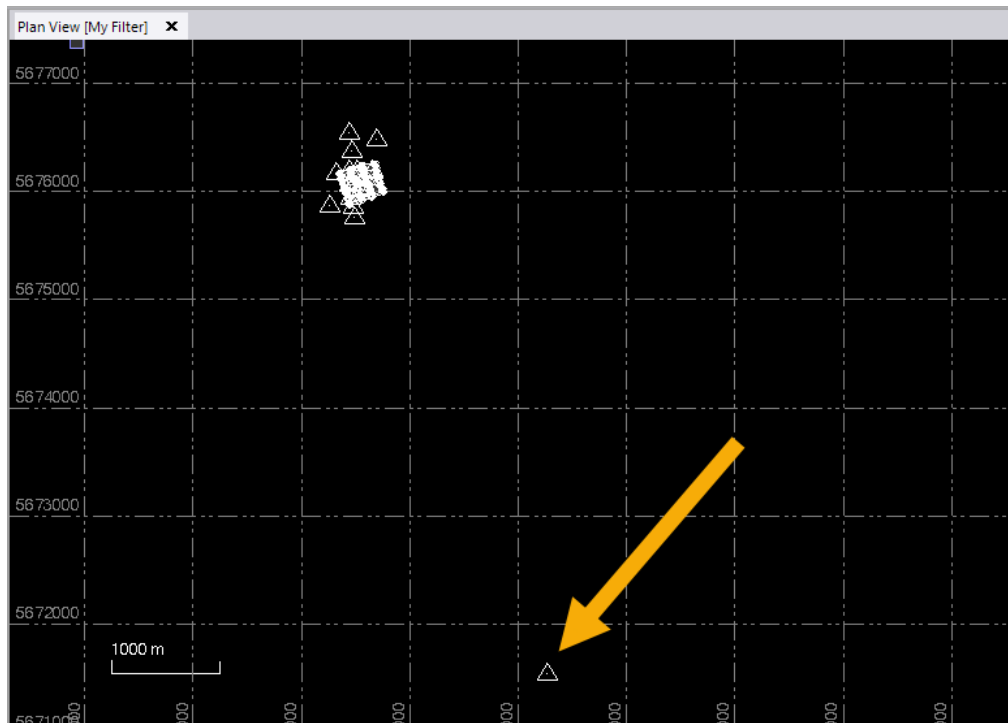
Note: If the field crew had measured GCPs in the field using a Trimble RTK GNSS rover (such as the Trimble R10) and a Trimble field controller (such as the Trimble TSC-3), you could also import the GCP data by connecting the field controller to the computer via a USB connection. Then, using the **Devices** command pane, you could import the job file containing the GCP measurements directly into the project, avoiding the need to first export the measurements into a CSV file.


If this was a UX5 project, it would be ready for processing now and you could proceed by selecting the **Send to UASMaster** command. However, since this is a UX5 HP project, you must first import raw GNSS base station data contained in a T01, T02, or RINEX file and process the precise trajectory in the project.



7. Open the `..\ProcessingUX5HPAerialSurveyData\Data` folder and drag-and-drop the `ZELZ317N00.t02` file onto the **Plan View** tab.
8. In the **Receiver Raw Data Check In** dialog, review the information (no changes are necessary) and click **OK**.



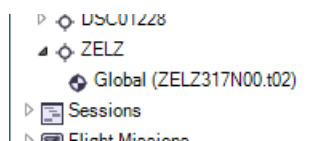
The **Plan View** zooms out automatically to fit the project extent and show the new base station. As you can see, the base data file is from a CORS approximately 5 km to the southeast of the project.



It is important that the base station display the same icon as the imported GCPs () , indicating the point has *Control Quality*. If this is not the case (the icon is a circle instead), either of the following may apply:

- The position of the base station is not yet precisely known and still needs to be post-processed against other reference stations. In this case, you could go ahead and import more reference data files and post-process the base station location, after which its quality setting would be automatically updated to *Control Quality* and the icon would change to .
- You are confident the coordinate is precisely known, but the imported file type (for example, RINEX) does not support such an indication. In this case, you can expand the **Points** node in the **Project Explorer**, expand the base point, and double-click the *Global* node to display its properties in the **Properties** pane. There, you can click the point symbols next to the **Latitude**, **Longitude**, and **Height** coordinates, and manually change them to *Control Quality*, which in turn causes its icon to change to .

The new base station is represented by a new **Point** node with a nested coordinate node in the **Project Explorer**.



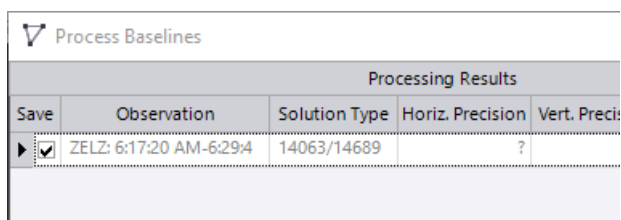
Now that all of the data has been imported into the project, you are ready to process the flight trajectory.

Step 3. Process the trajectory in SO

In this step, you will use the Baseline Processor in Survey Office to process the flight trajectory based on the GNSS data collected on board the UX5 HP.

1. In the **SO** ribbon, select **Survey > GNSS > Process Baselines**.

The **Process Baselines** dialog displays and shows the progress of the processing. When processing is complete, the results are displayed.



The screenshot shows the 'Process Baselines' dialog box. It has a title bar with a checkmark icon and the text 'Process Baselines'. Below the title bar is a table with the following structure:

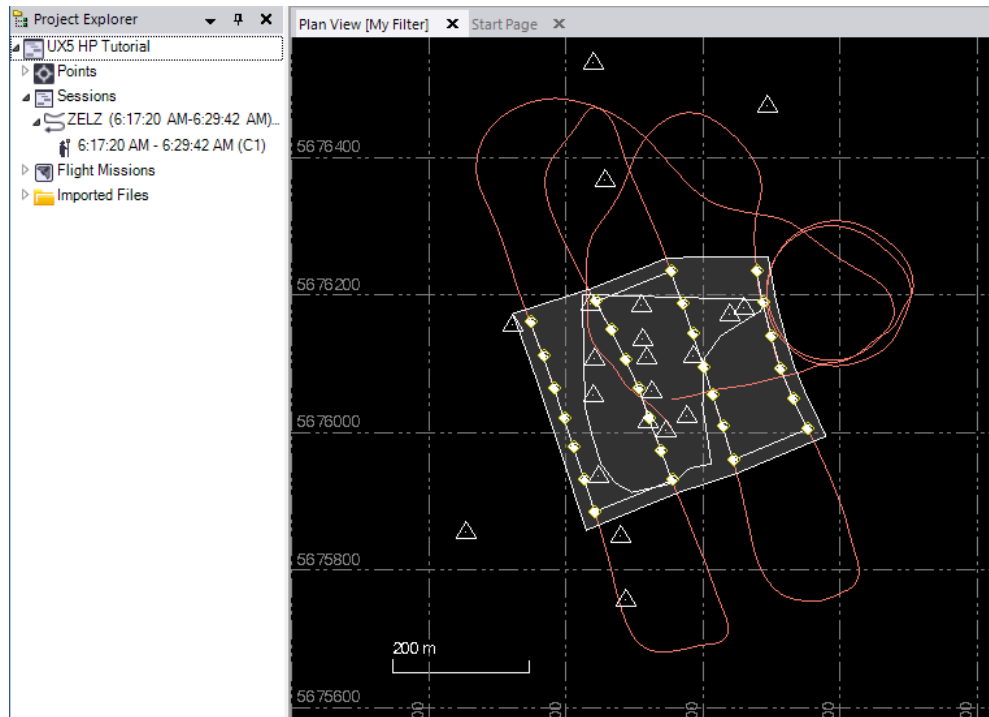
Processing Results				
Save	Observation	Solution Type	Horiz. Precision	Vert. Preci:
<input checked="" type="checkbox"/>	ZELZ: 6:17:20 AM-6:29:4	14063/14689		?

The **Solution** field shows how many epochs were processed out of the total available. In this case, over 95% of the epochs were processed successfully. These are strong processing results worthy of saving in the project. Note that because the processing results will be stored as a single trajectory in the project, no values are displayed in the precision fields, as would be the case if you were processing individual baselines.

Note: The **Process Baselines** command is available only if the duration of the base and aircraft raw data files overlap.

2. In the **Process Baseline** dialog, click the **Save** button.

A red line displays in the **Plan View** showing the aircraft's precise trajectory from take-off to landing, including all turns and maneuvers. (The line shows some straight segments in turns due to GNSS signal loss). Additionally, a yellow circle displays around each of the photo station points, indicating that a precise, fixed coordinate solution was calculated. New **Sessions** nodes are displayed in the **Project Explorer**.



Note: When an unusually low number of epochs are calculated, low-quality GNSS data is typically the cause. In this case, the red precise trajectory line may end or start abruptly somewhere in the middle of the expected flight lines, or some photo station points may not be surrounded by a yellow circle after baseline processing. As long as a vast majority of photo station points has a yellow circle and the photo station points missing a circle are randomly and sparsely distributed across the project, there should be no substantial impact on the processing. Otherwise, you can delete the trajectory by clicking **Survey > GNSS > Clear Processing Results** and re-process using only GCPs as would be customary with a UX5 data set. If no GCPs are available, the mission should be re-flown.

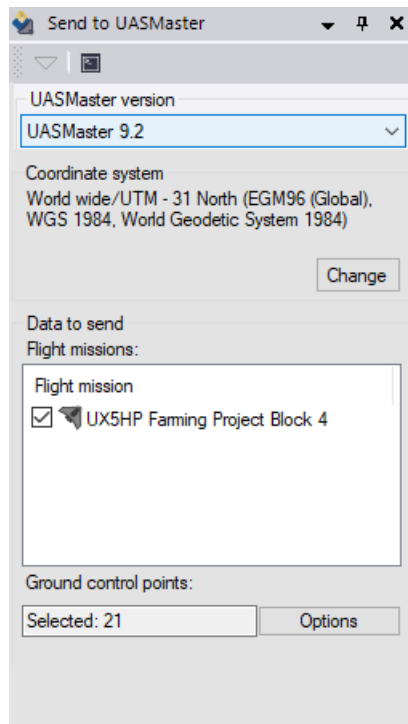
You are now ready to send your project to UASMaster for additional processing and the creation of deliverables.

Step 4. Send the project data to UASMaster

Although you could adjust aerial photo stations and create deliverables directly in Survey Office, for this tutorial you will use Trimble UASMaster, a powerful software program for processing, georeferencing, geo-imaging, geo-capturing, and geo-modeling UAS data, resulting in the highest quality aerial photogrammetry deliverables possible.

1. Select **File > Save** to save the project before sending data to UASMaster.
2. In the **SO** ribbon, select **Photogrammetry > Adjust > Send to UASMaster**.
3. In the **Send to UASMaster** command pane, verify that the latest version of UASMaster and the correct coordinate system are selected.

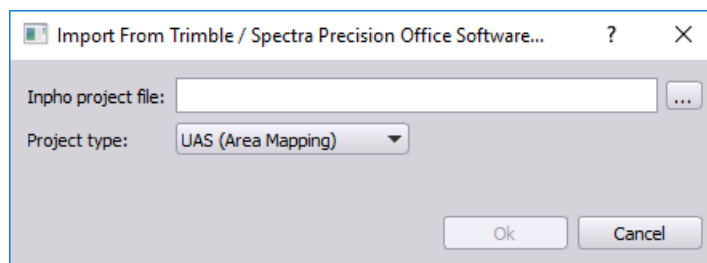
4. Check the *UX5HP Farming Project Block 4* check box in the **Flight missions** list.
5. Click in the **Ground Control points** field and then, holding down the **Shift** key, select points *20150723-001* through *20150723-024* in the **Project Explorer**.



Note that you can select control points as well as independent check points to send to UASMaster (more about this later).

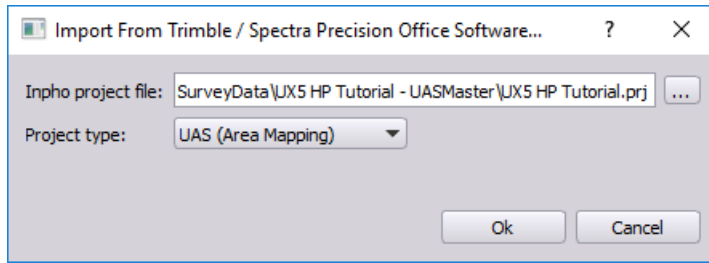
6. Click **OK**.

The **Import From** dialog displays, allowing you to specify a name and location for the new UASMaster project that will contain the downloaded SO data.



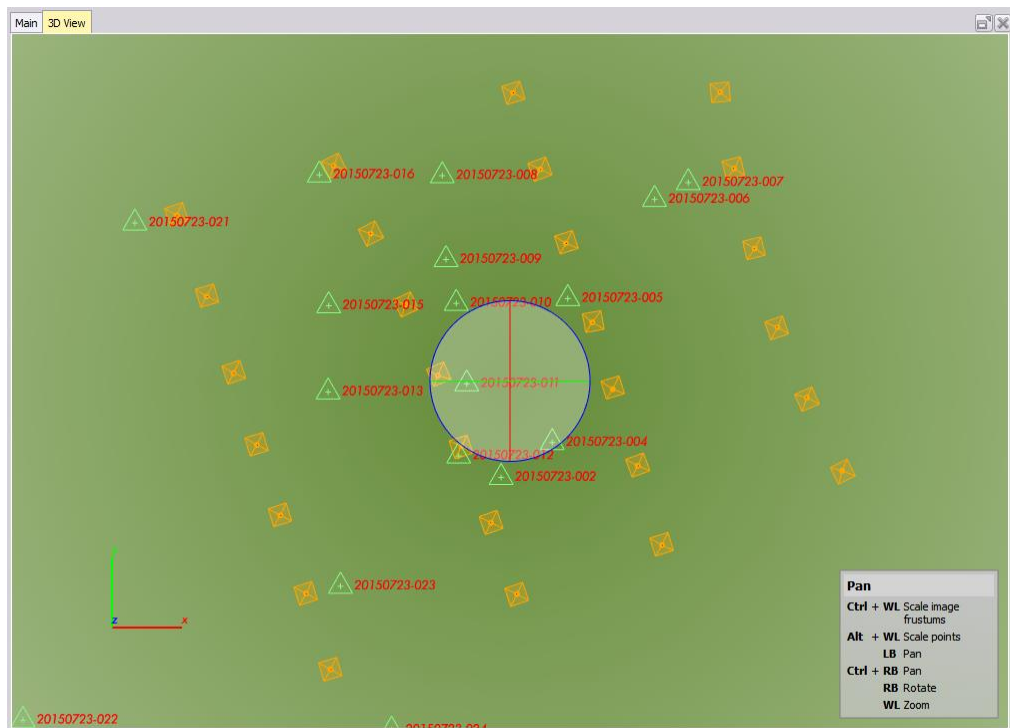
7. In the **Import From** dialog, click the **Browse** button (...) located to the right of the **Inpho project file** field.
8. In the **Save As** dialog, select the folder *..\ProcessingUX5HPAerialSurveyData\UX5 HP Tutorial - UASMaster*, enter the project **File name** *UX5 HP Tutorial*, and click **Save**.

The new file name and path display in the **Inpho project file** field in the **Import From** dialog. Do not change the **Project type: UAS (Area Mapping)** option.



9. In the **Import From** dialog, click **OK**.

The **UAS ApplicationsMaster** window opens showing the downloaded aerial photo station points on the **3D View** tab. All applicable SO project data, including the coordinate system and geoid definitions, GCPs, and images linked to their precise coordinates, is now loaded in UASMaster.



Next, you will process the data and create deliverables.

Step 5. Process the data in UASMaster

Before processing the data and creating deliverables in UASMaster, you will configure check points and correct for image vignetting.

1. In the **UAS ApplicationsMaster** window, click **Project > Edit**.

The **UAS Project Editor** window displays, allowing you to review and edit project information, including the camera sensor configuration, image files, point types and standard deviations, ortho images, and administrative, corrections, and units settings.

Project	Value
Elements	
Cameras/Sensors	1
Photos	
Frame Type	27
Orthos	0
GNSS/IMU - Approx.EO	27
Points	21
Groupings	
Strips	0
Settings	

Note: Strips (flight lines) information is not actually imported from SO but instead is automatically generated upon import into UASMaster based on the exterior orientation information of the images. The number of **Strips** listed in the **UAS Project Editor**, and the start and end points of the strips as displayed in blue in the **UAS ApplicationsMaster Main** view, can vary from the expected flight lines as displayed in SO, and can be safely ignored when different than expected. The **Strips** definition is a legacy function in UASMaster necessary for the adjustment algorithms, but the exact configuration is not important.

You will now take a closer look at the configuration of the GCPs.

- In the **UAS Project Editor**, double-click **Points** to display the **Points** dialog.

Points							
ID	Act	Type	Coord. System	East X	North Y	Height Z	StdC
20150723-001	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554486.743	5675754.970	4.594	Stan
20150723-002	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554545.361	5676001.067	3.919	Stan
20150723-004	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554576.452	5676022.218	3.329	Stan
20150723-005	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554585.936	5676109.556	3.087	Stan
20150723-006	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554638.783	5676169.659	2.950	Stan
20150723-007	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554659.295	5676179.837	2.973	Stan
20150723-008	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554509.489	5676184.028	3.225	Stan

The displayed coordinates should match the coordinates contained in the *GCPs_Assenede_WGS84UTM31N-EGM96.csv* file.

Note that the X/Y and Z standard deviation class is displayed for each point. The deviation class defines the a priori standard deviations for planimetric and height components. Deviation classes allow for the grouping together of points with the same accuracy level. See the UASMaster documentation for more information.

SO does not make a distinction between actual GCPs to be used during processing and independent check points to be used to calculate the accuracy after processing, either at the time of importing the points into SO or at the time of downloading them to UASMaster. As a result, they are all listed with a **Type** of *HV* in the UASMaster **Points** dialog. *HV* stands for *Horizontal and Vertical* control, meaning the points would all be used as GCPs in the camera calibration once they have been measured in the photos, preventing global shifts of the photogrammetry results relative to ground control. This might be acceptable for a UX5 project (although even in that case you would probably want to use some of the points as control and the other points as check); however, since this is a UX5 HP project, not as many GCPs are required. Since all of these points are of high-quality, you might typically select approximately five of them in the project to use for control. Per best practices, you would select GCPs that are evenly distributed throughout the project area. You would then select to use the remaining points as check points.

Note: This tutorial project includes a single flight mission with a single flight block. If the project had included a second "crossing" flight block flown in an overlapping diagonal pattern over the same area as the first flight block, you could achieve a high-accuracy adjustment without the use of any GCPs. However, the downloadable tutorial package would have doubled in size, resulting in a much longer download time. So although you can process and adjust a single block without GCPs and often achieve mapping quality results, for this tutorial you would typically want to include multiple GCPs in the adjustment to ensure the highest accuracy.

To expedite processing for this tutorial you will select only one GCP, even though accuracy will not be optimal. The rest of the points will be used for check.

3. Click in the **Points** list and press the **Ctrl + A** keys to select all of the points. Then press and hold the **Ctrl** key and click the point *20150723-011* to deselect it.

ID	Act	Type	Coord. System	East X	North Y	Height Z	StdD
20150723-001	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554486.743	5675754.970	4.594	Stan
20150723-002	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554545.361	5676001.067	3.919	Stan
20150723-004	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554576.452	5676022.218	3.329	Stan
20150723-005	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554585.936	5676109.556	3.087	Stan
20150723-006	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554638.783	5676169.659	2.950	Stan
20150723-007	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554659.295	5676179.837	2.973	Stan
20150723-008	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554509.489	5676184.028	3.225	Stan
20150723-009	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554511.787	5676133.195	3.148	Stan
20150723-010	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554517.972	5676106.617	3.141	Stan
20150723-011	<input type="checkbox"/>	HV	WGS 1984 / 31 North	554524.385	5676057.811	3.482	Stan
20150723-012	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554519.513	5676014.049	3.946	Stan
20150723-013	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554439.997	5676052.886	3.067	Stan
20150723-015	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554440.220	5676105.175	2.749	Stan

This is the only point you want to use for a GCP. You will change the other imported points to check points.

- Click the **Edit** button.
- In the **Point Properties** dialog, check the **Type** check box and select *CHV (Check Horizontal Vertical)*. Then click **OK**.

Point Properties

Identification: *****

Type: CHV

Description: Undefined

Activation: Active

Coordinates: East X: ***** North Y: ***** Height Z: *****

Coordinate system: WGS 1984 / 31 North

Deviations X,Y: Standard

Deviations Z: Standard

OK Cancel

In the **Points** dialog you can see the distinction between the two point types.

ID	Act	Type	Coord. System	East X	North Y	Height Z	StdDe
20150723-001	<input checked="" type="checkbox"/>	CHV	WGS 1984 / 31 North	554486.743	5675754.970	4.594	Stanc
20150723-002	<input checked="" type="checkbox"/>	CHV	WGS 1984 / 31 North	554545.361	5676001.067	3.919	Stanc
20150723-004	<input checked="" type="checkbox"/>	CHV	WGS 1984 / 31 North	554576.452	5676022.218	3.329	Stanc
20150723-005	<input checked="" type="checkbox"/>	CHV	WGS 1984 / 31 North	554585.936	5676109.556	3.087	Stanc
20150723-006	<input checked="" type="checkbox"/>	CHV	WGS 1984 / 31 North	554638.783	5676169.659	2.950	Stanc
20150723-007	<input checked="" type="checkbox"/>	CHV	WGS 1984 / 31 North	554659.295	5676179.837	2.973	Stanc
20150723-008	<input checked="" type="checkbox"/>	CHV	WGS 1984 / 31 North	554509.489	5676184.028	3.225	Stanc
20150723-009	<input checked="" type="checkbox"/>	CHV	WGS 1984 / 31 North	554511.787	5676133.195	3.148	Stanc
20150723-010	<input checked="" type="checkbox"/>	CHV	WGS 1984 / 31 North	554517.972	5676106.617	3.141	Stanc
20150723-011	<input checked="" type="checkbox"/>	HV	WGS 1984 / 31 North	554524.385	5676057.811	3.482	Stanc
20150723-012	<input checked="" type="checkbox"/>	CHV	WGS 1984 / 31 North	554519.513	5676014.049	3.946	Stanc
20150723-013	<input checked="" type="checkbox"/>	CHV	WGS 1984 / 31 North	554439.997	5676052.886	3.067	Stanc
20150723-015	<input checked="" type="checkbox"/>	CHV	WGS 1984 / 31 North	554440.230	5676105.175	2.748	Stanc

- In the **Points** dialog, click **OK**.

Optionally, you can review other project information and make edits as necessary in the **UAS Project Editor**. For this project, no additional changes are necessary. See the UASMaster documentation for additional instructions.

- Close the **UAS Project Editor** window. When prompted, click **Yes** to save the project.

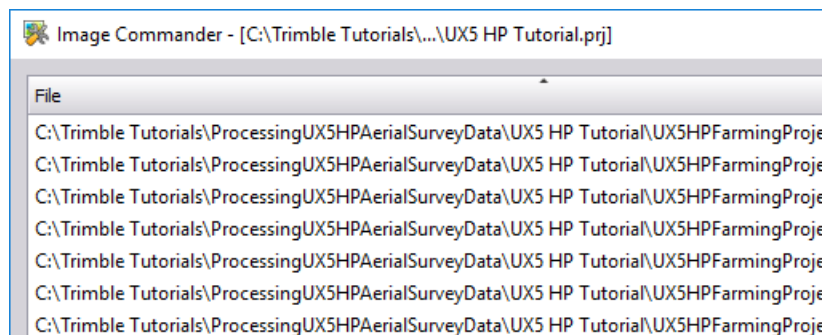
On the **Main** tab in the **UAS ApplicationsMaster** window, you can see that only the symbol for the retained GCP (*HV*) is still displayed in green. The check point (*CHV*) symbols are displayed in blue.



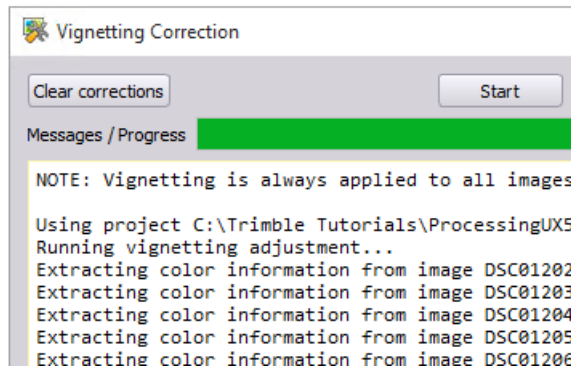
Next, you will fix the severe photo vignetting (dark corners) that was visible in SO. The influence of vignetting on the final products depends on the effective overlap. In this project, the unusually low overlap (below 80%) results in dark areas corresponding to image footprints in the orthomosaic. Applying vignetting correction before processing is also helpful when measuring GCPs and check points, especially when they are located in the otherwise very dark outer corners of the images. The correction increases the ray intersection angles of the point measurements in the images, which, in turn, increases the vertical accuracy of the photogrammetric processing.

Note: Vignetting correction can be performed when a JXL file is being exported in Trimble Access Aerial Imaging. However, for this project that was not done, so you will perform the correction in UASMaster.

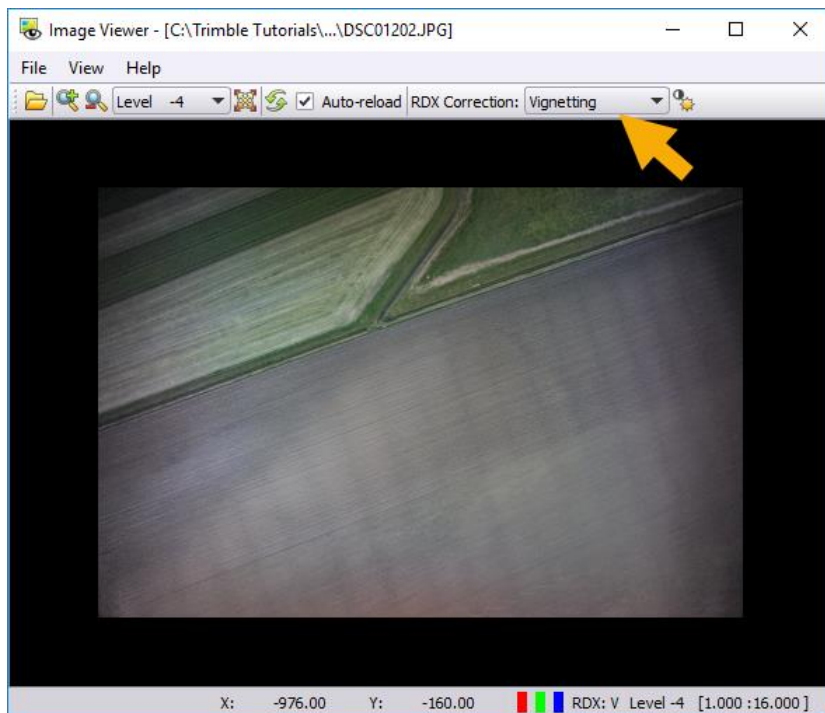
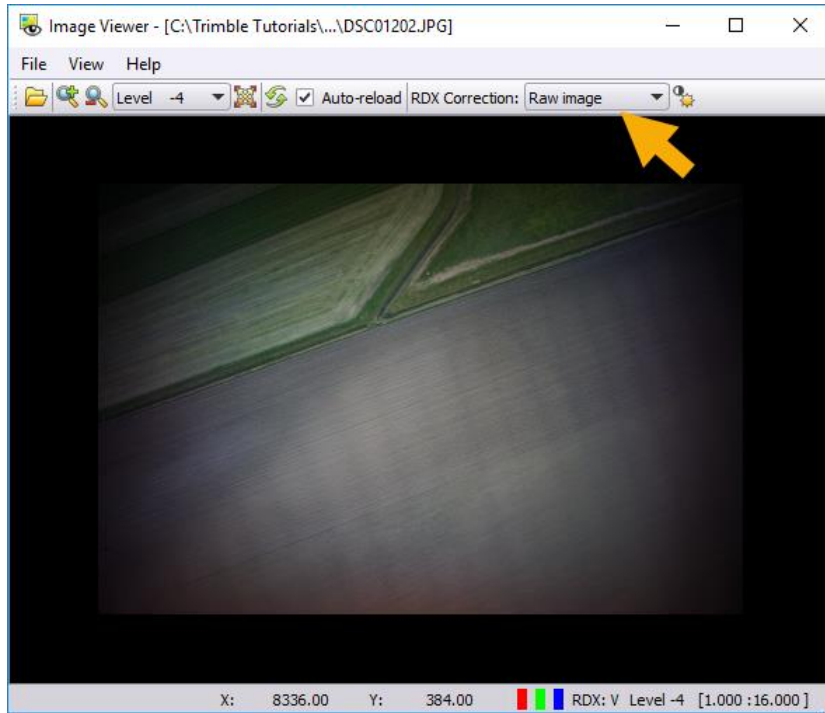
8. To correct photo images for vignetting, do the following:
 - a. In the **UAS ApplicationsMaster** window, select **Tools > Image Commander**.



- b. In the **Image Commander** window, click the **Vignetting** button.
There is no need to first select images in the list. The **Vignetting Correction** command applies to all of images in the project.
- c. In the **Vignetting Correction** window, click the **Start** button.
The progress of the process is displayed.



- d. After processing is done, click the **Close** button to close the **Vignetting Correction** window.
- e. In the **Image Commander** window, click the **Close** button.
You can now view the results of the correction.
- f. In the **UAS ApplicationsMaster** window, select **Tools > Image Viewer**.
- g. In the **Image Viewer** window, select **File > Open** and open the folder `..\ProcessingUX5HPAerialSurveyData\UX5 HP Tutorial\UX5HPFarmingProject_Flight2.jxl`
- h. Double-click to open any of the JPG image files in the folder.
The *UX5 HP Tutorial* project folder was automatically created when you saved your *UX5 HP Tutorial* project in SO.
- i. In the **RDX Correction** drop-down list, toggle between the **Raw image** and **Vignetting** options.



- j. When you are done, close the **Image Viewer** window.

Note: The vignetting correction algorithms used in Trimble Access Aerial Imaging and UASMaster are not the same and will produce different results. Each method has its drawbacks and advantages. The UASMaster vignetting correction is faster and does not alter the images themselves. Instead it creates an RDX (Radiometric metadata) file from the JPG file for on-the-fly corrections. However, it does not always remove the vignetting entirely (although it does not include the risk of over-correcting either) and it does not correct for color shifts. The vignetting correction in UASMaster can be applied to imagery from every sensor/lens combination. The vignetting correction in Aerial Imaging can be applied only to imagery from the Trimble UX5 HP.

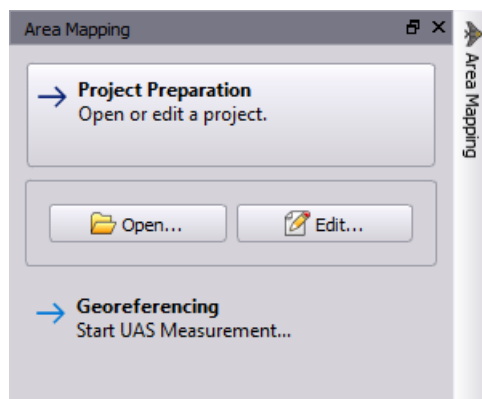
The project is now ready for processing. You could use the **Georeferencing** command, which allows you to proceed step-by-step through the calibration, adjustment, and deliverable-creation process. This workflow requires the most user-interaction time, but it provides the most control via analysis-based adjustments, and it may provide the best overall results, depending on your data and your requirements.

As an alternative, you could use the **Batch Processing** command, which will automatically run the calibration, adjustment, and deliverable-creation process based on selected parameters, greatly reducing the user-interaction time. This workflow can also provide good overall results, depending on the processing strategy you choose.

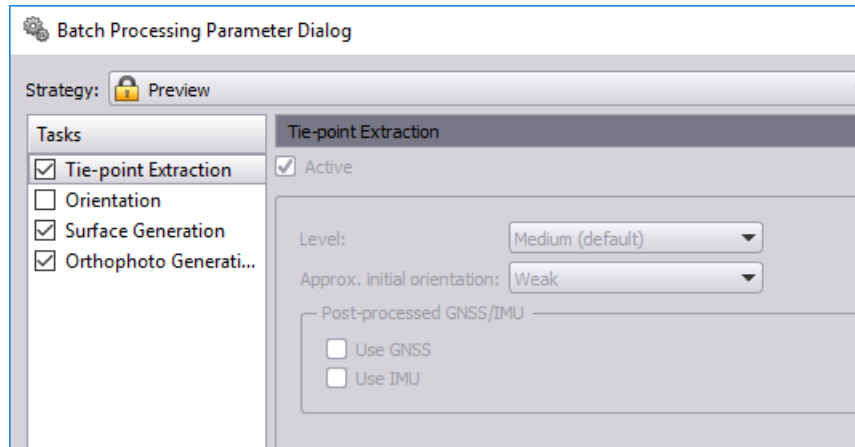
For this tutorial, you will use the **Batch Processing** command.

Note: For detailed instructions on using all of the features and options available with both the **Georeferencing** command and the **Batch Processing** command, see the UASMaster documentation.

9. Before continuing, select **Project > Save** to save the changes you have made to the project.
10. If the **Area Mapping** pane is not already displayed, click the **Area Mapping** button located on the right side of the **UAS ApplicationsMaster** window to display it.



11. Click the **Batch Processing** button to display the **Batch Processing Parameter** dialog.
12. In the **Strategy** drop-down list, select **Preview**.

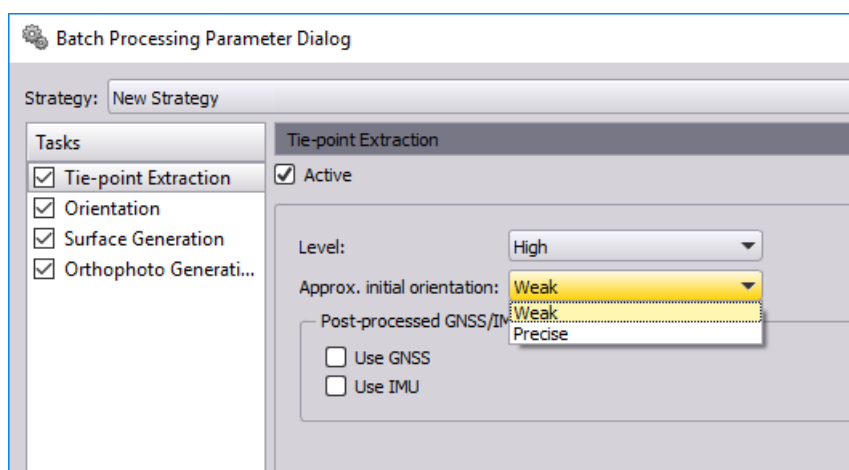


With this option, the **Tie Point Extraction**, **Surface Generation**, and **Orthophoto Generation** task check boxes are checked by default.

As the name implies, the **Preview** strategy is intended to provide a low-resolution preview of your data using the shortest processing time possible. It is not intended to provide the high-quality deliverables that are possible when using the other available strategies: **DSM and True Ortho** and **DTM and Classic Ortho**. For this tutorial the **Preview** strategy will enable you to quickly process the data, create rough deliverables, and view the results in Survey Office, thus completing the demonstration of the SO/UASMaster workflow as expediently as possible.

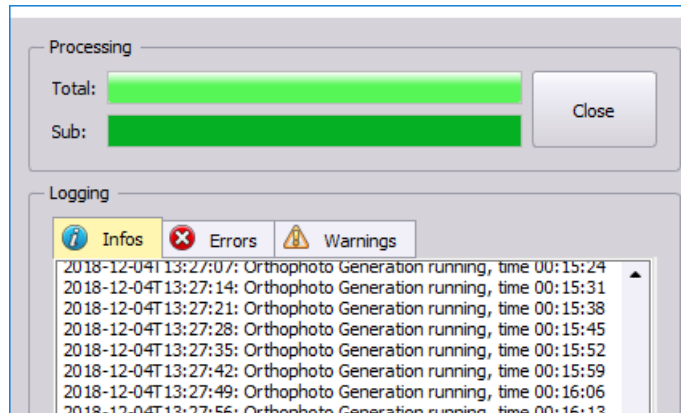
Note that each of the predefined strategies is locked and its parameters cannot be modified.

13. Try selecting different predefined **Strategy** options to view the batch processing tasks and parameters used for each. To view all of the parameters available with each task type, create a new editable strategy by clicking the **Create new engine strategy** button located to the right of the **Strategy** drop-down list and clicking **OK** in the **Add new strategy** dialog.



14. When you are done reviewing the different options, ensure that **Preview** is still selected in the **Strategy** drop-down list along with its default options.
15. Click the **Start** button. Then, in the **UAS Processing** message dialog, click **Yes**.

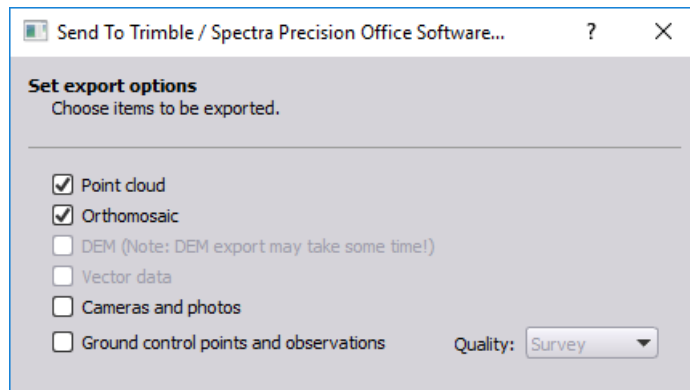
A **Processing** window displays showing the progress of the process. Depending on your computer, the process could take up to 30 minutes. A log is dynamically updated on the **Infos** tab during processing. You can view any errors or warnings generated during processing on the appropriate tab.



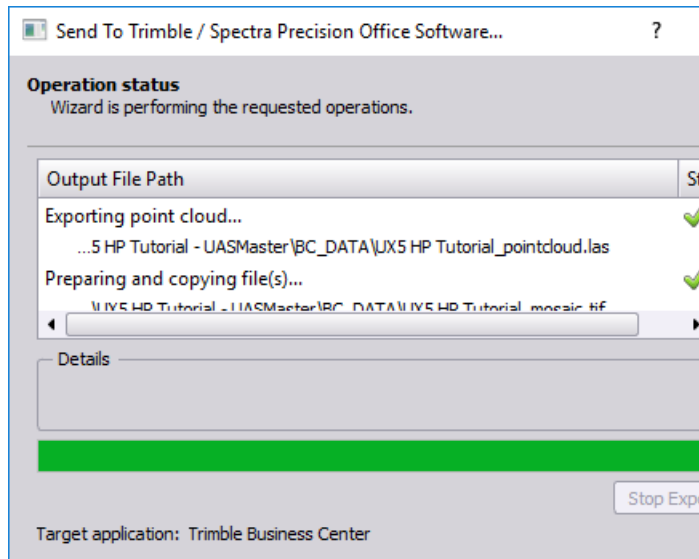
16. When processing is complete, click the **Close** button.

Now that the process is complete and deliverables have been created, you are ready to upload the deliverables back into your SO project.

17. In the **UAS ApplicationsMaster** window, select **Project > Send to**.
18. In the **Send to** dialog, check only the **Point cloud** and **Orthomosaic** options, as shown below. Then click the **Next** button.

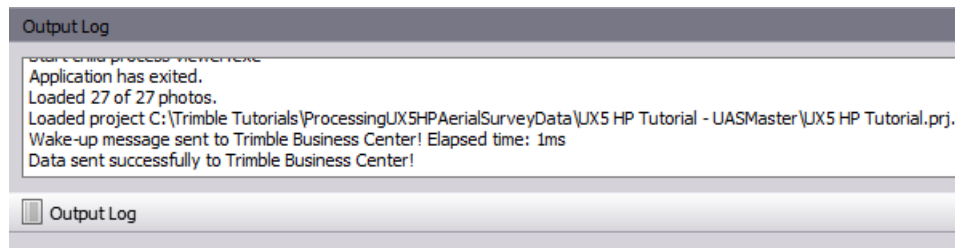


19. On the second screen in the **Send to SO** dialog, ensure the **Target** application is **Survey Office** and click the **Send** button.



Note that the orthomosaic file is being created in a newly created *BC_DATA* folder located inside the *..\ProcessingUX5HPAerialSurveyData\UX5 HP Tutorial* folder.

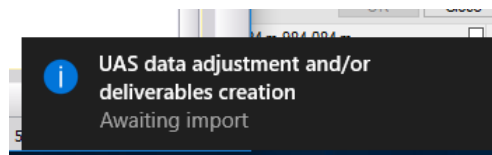
20. Click the **Output Log** button located at the bottom of the **UAS ApplicationsMaster** window to display the **Output Log** pane, if it is not already displayed.



You are now ready to import the deliverables into SO.

Step 6. Import deliverables into SO

After you click the **Send** button in the **Send to SO** dialog, a notification is displayed on your desktop indicating that the processed data is ready to be imported into SO.



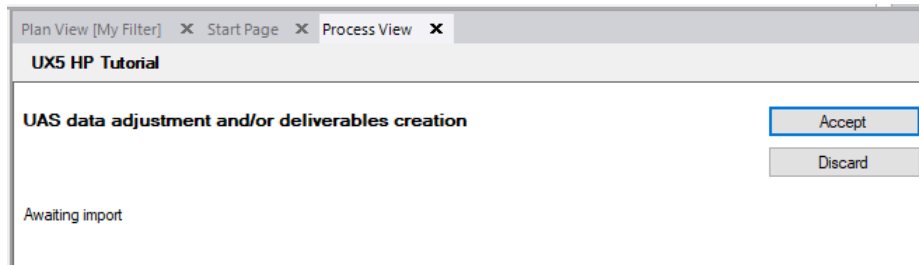
In addition, one of the following occurs:

- If SO is running and the original project is open, a new **Process View** tab displays, allowing you to import the data. This is your case for this tutorial, since you have not closed SO.

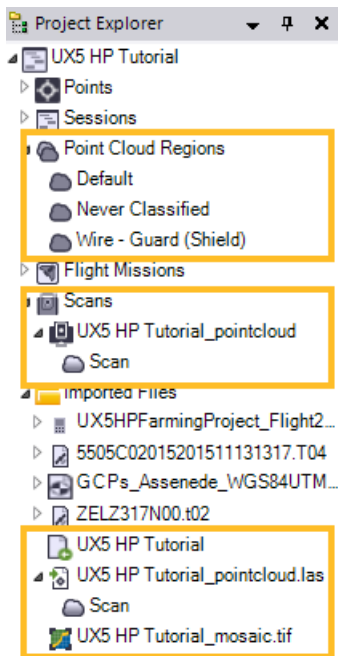
- If SO is running but the original project is not open, a new **Process View** tab displays, allowing you to open the original project and import the data.
- If SO is not running, the application launches with no project open and a new **Process View** tab displays, allowing you to open the original project and import the data.

In Survey Office, do the following:

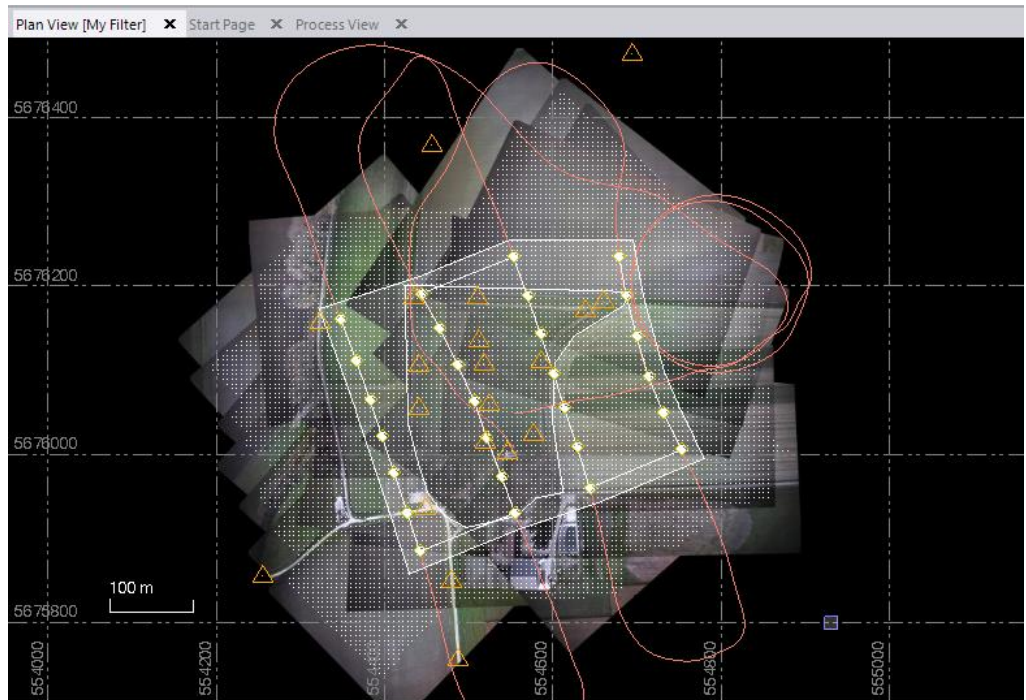
1. In the **Survey Office** window, select the **Process View** tab and click the **Accept** button.



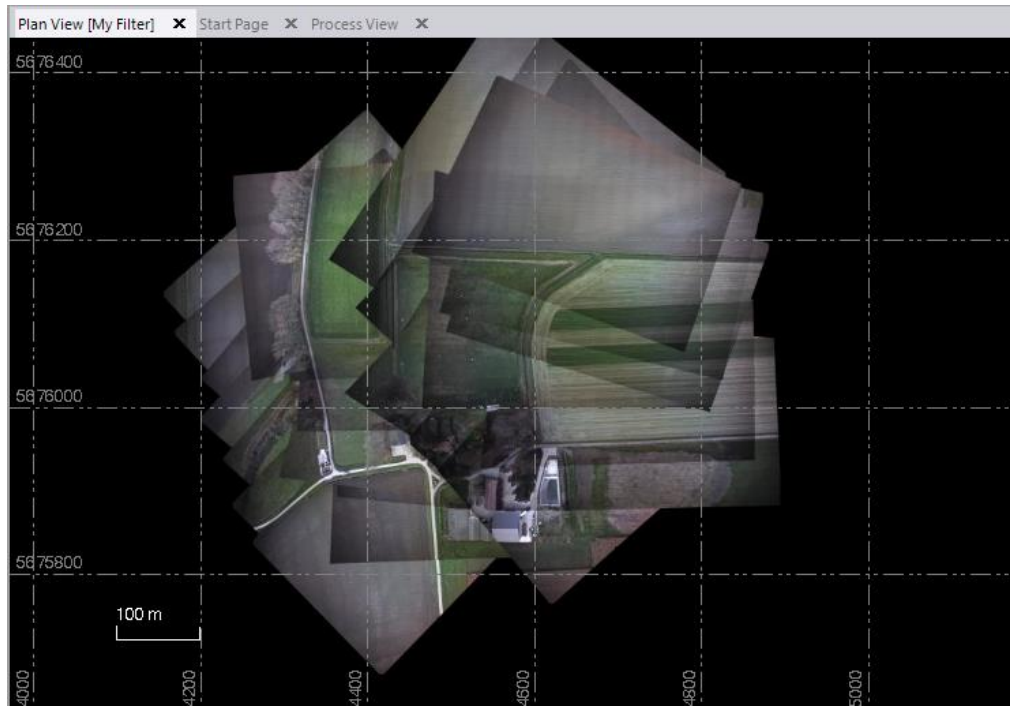
When the import is complete, you can see the newly imported georeferenced image (orthomosaic) file (TIF) and point cloud file (LAS) nested beneath the **Imported Files** node in the **Project Explorer**. In addition, a new **Point Cloud Regions** node and **Scans** node are displayed.



The imported georeferenced (orthomosaic) image and point cloud are displayed on the **Plan View**. As you can see, the resolution of the point cloud is very low and the orientation of the images in the orthomosaic is not correct, as expected, due to the expedient **Preview** processing strategy (including the lack of orientation) used in UASMaster.



2. In the **View Filter Manager**, uncheck the following options to better see the orthophoto.
 - **Raw Data > PP Continuous**
 - **Raw Data > Point**
 - **Photogrammetry** (entire list)
 - **Scans**



If you had processed this data using the Georeferencing workflow or a more refined Batch Processing strategy (along with tie-point extraction and orientation) in UASMaster, the deliverables imported into SO would be of much higher quality. You could then use the various Point Cloud commands to process, edit, classify, and view the imported point cloud. Or, you could use Photogrammetry measurement commands to make measurements on the imported orthomosaic. In addition, you could use the Export command to share the files or import them into other applications.

This completes the tutorial.