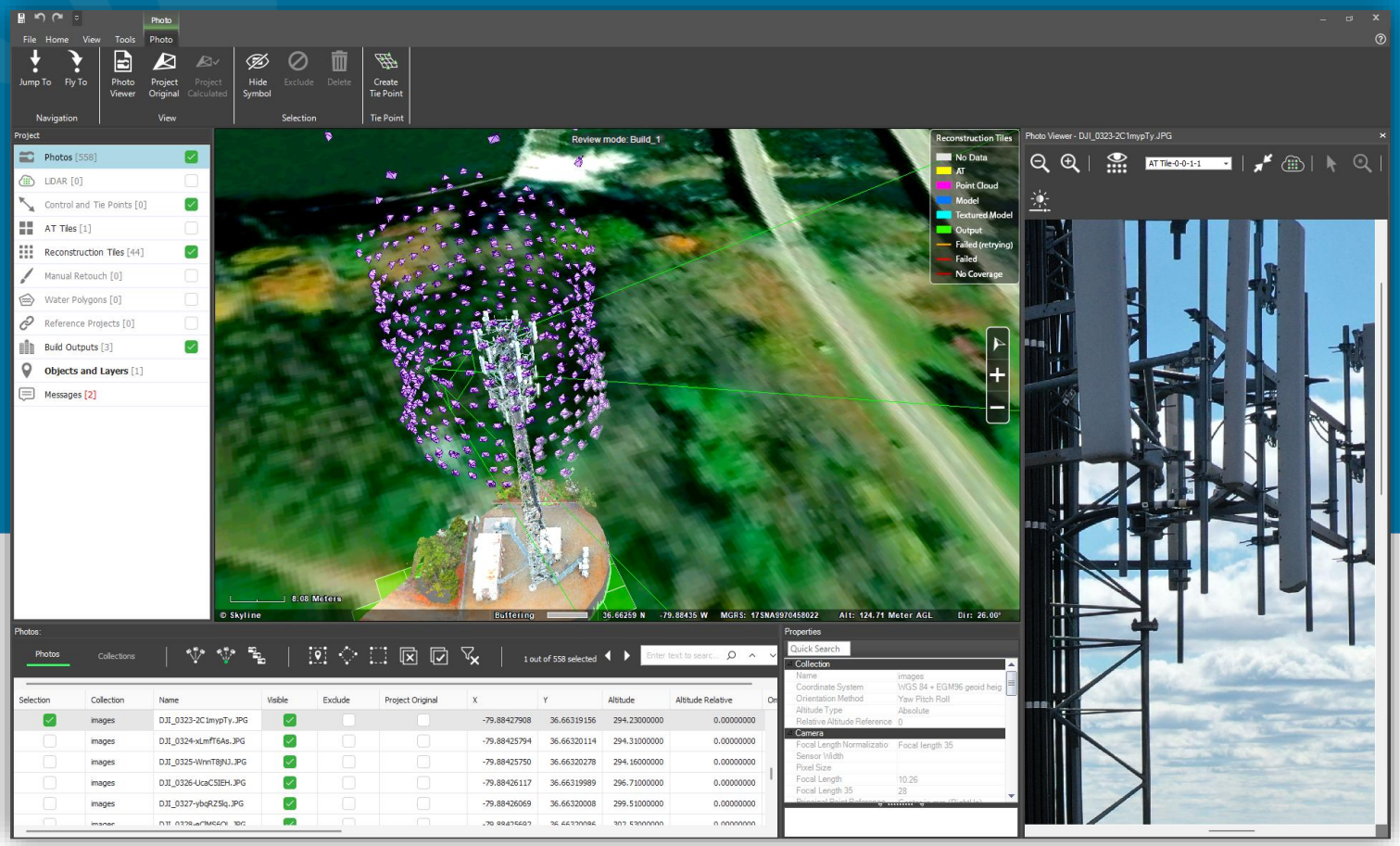
PhotoMesh

Release Notes

V 8.0.3



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OVERVIEW

Skyline's PhotoMesh application fully automates the building of high-resolution, textured, 3D mesh models. from oblique and nadir photographs and Lidar captured from street view, drones, UAV and airplanes. PhotoMesh's breakthrough technology is based on the highest-performance photogrammetry, computer vision, and computational geometry algorithms. PhotoMesh offers a range of output options including standard 3D model (3DML, OSGB, DAE, OBJ), raster (Orthophoto, DSM, DTM) and point cloud (LAS) formats. PhotoMesh's 3DML format can be transformed into powerful geospatial data that fully supports spatial operations and attribute queries, by loading it into TerraExplorer and merging it with classification information. All supported formats can be published from TerraExplorer Pro to SkylineGlobe Server for viewing in Skyline 3D viewers (TerraExplorer for Desktop, TerraExplorer for Web and TerraExplorer for Mobile) and 3rd party viewers (Cesium, ESRI, etc.).

Output Quality Improvements

- **Enhanced True Orthophoto Quality:** Improved photo selection process for True Orthophotos provides more consistent texturing in dynamic scenarios (such as changing shadows, moving vehicles, and vegetation variations). This update also features sharper edges and enhanced clarity.
- **Enhanced Quick Orthophoto Quality:** Improved algorithms for better handling of break lines enhance the quality of Quick Orthophotos.
- **Improved Support for Close-Range Modeling:** Leverages the Depth Anything AI algorithm to focus more precisely on target elements. This release also features improved handling of close-range data collections in limited coverage areas and other challenging scenarios, boosting aerotriangulation success rates.
- **Water Polygon Improvements:** New options ensure better handling of water polygons, even in challenging environments such as whitewater areas.

Increased Compatibility

- **Reference Project Mechanism Enhancements:** Improved performance when utilizing reference data in projects without GPS information. New Reference Project report graphs enhance visualization of referencing adjustments.
- **Enhanced Vertical Datum Transformation Support**: The PhotoMesh 8.0.3 installation kit now comes equipped with an extensive collection of Grid Shift Files (GTX, GSB, TIFF). These files enhance the software's ability to perform precise vertical datum transformations by providing elevation correction values, ensuring more accurate height measurements across various geographic coordinate systems.
- **Fixes for 3D Tiles Output Format:** Enhanced support for the 3D Tiles 1.0 format, ensuring greater compatibility across various 3D viewers.

Stability and Performance Enhancements

- **Stability Improvements for Large Project Production:** Enhanced stability boosts processing efficiency for larger projects.
- **Optimized Production Time:** Reconstruction algorithm optimizations reduce production times across various scenarios by up to 20%.
- **Fusers Pool Fixes**: Multiple fixes and optimizations implemented in the fusers pool ensure reliability and smoother performance.

Performance Enhancements

- **Project Reporting**: Improved reference project reports and graphs. Reference ("base") projects are often added to a project when building a project that overlaps partially or entirely with a different project that will be overlaid on the same map in a client viewer. When building the new project, PhotoMesh establishes a correspondence between points in the reference project and target project, so that the positions of identified features in the target project match the geographic positions of the same features in the reference project.
- **Data Preparation**: Added a failure threshold setting, configurable via the PhotoMesh API or the PhotoMesh.exe.config file, to better manage data preparation failures.
- **Improvement in PM 802**: Enhanced tile generation by including vertexes in the bounding box (BBox) and splitting large tiles to improve processing efficiency.

Output Quality Improvements

- **Orthophoto Quality:** Significant improvements in the quality of orthophotos and True orthophotos.
- **DSM Output:** Enhanced detail in Digital Surface Model (DSM) outputs for more precise topographic data.

New Flags

New flags available through Skyline support to do the following:

- Generate compressed 3D Tiles (3TZ format).
- Generate compressed OSGB files (zip format).
- Generate Normalized Difference Vegetation Index (NDVI) orthophoto outputs.

Technical Advances

- **Containerization with Docker:** In PM 8.0.2, PhotoMesh fusers have been successfully containerized with Docker and deployed in both AWS EKS and an on-prem Kubernetes environment. With PhotoMesh Fuser's Dockerfile, you can now easily create your own Docker image and automate management of your fuser resources.

Preset Updates

- **Enhanced True Ortho and DSM Presets:** Improved noise reduction and point accuracy in the DPC point cloud, increased tile consistency, and reduced processing times with the SmoothSurface setting disabled.
- **Quick Ortho Enhancements:** Adjusted DPC overlap mode to -dpc_om 3 (smaller triangles) for better texture preservation on building tops and reduced ground noise.

Stability Improvements and Bug Fixes

- **Smeared or Black Textures (Holes):** Fixed an issue causing smeared or black textures (holes) in the rapid orthophoto.
- **Double Image**: Resolved a double image issue that occurred when building a project using the "Rapid Ortho Composite" preset.
- **Project Opening Error in PM 801:** Corrected an error that prevented projects from opening.
- **3DML Output Limitation:** Addressed a bug in PM 801 where generating more than ten 3DML outputs resulted in new outputs incorrectly overwriting the tenth model instead of creating subsequent ones (e.g., #11, 12, 13).
- **PM GCP Editor Viewer Limitation:** Improved the PM GCP editor viewer's capability to display large images.
- **Fixed Match2.unt Crash:** Resolved an issue where having a space before the file extension caused the Match2.unt process to crash.
- **Build Deletion Issue Resolved:** Fixed a problem in the Build Version Manager where builds could not be deleted.
- **Missing GCP Notification Fix:** Resolved an issue where PhotoMesh would run indefinitely without alerting the user when no ground control points were present in a project. The system now provides a prompt notification.
- **AWS Fuser Resource Management:** Fixed a bug that caused an infinite round-trip between the manager and AWS by introducing a two-minute timeout to prevent this issue.

Model Quality and Output Improvements

New Presets

- Tile Generation for Close Range Presets: Eliminates tile gaps that create a "floating" effect on upper segments of vertical structures, such as towers, ensuring they appear connected to lower portions.
- New Enhanced True Orthophoto Preset: Introduces an alternative 3D correlation method focused on horizontal surfaces to better represent vertical structures and complex geometries. Best used with nadir collections that have high overlap.
- New Camera Calibration Refinement for Non-Metric Sensors and Lenses AT Preset: Adds an extra Bundle Block Adjustment iteration using a unique camera calibration method to address image geometry inconsistencies in non-metric sensors and lenses. Recommended for cameras with issues such as large distortions, rolling shutter, auto-zoom, auto-stabilization, and motion-based distortion.
- Modified the default build setting to set the origin of Ortho tiles at the pixel's corner instead of the center, aligning with the accepted standard.

New Settings

Introduced two new settings, adjustable via configuration files:

- ImagesPerTask: Configures the number of images allocated per task in the Image Processing stage, allowing for more flexible task management.
- ImageProcessingMaxFailThreshold: Establishes a failure threshold for the Image Processing task, whereby exceeding this limit will result in the task being marked as failed.

NIR Photo Calibration

PhotoMesh 8.0.1 includes an optional flag that provides advanced calibration of Near-Infrared (NIR) photos during the photo preparation step. Using DJI Exif tags (drone-dji:BlackLevel and drone-dji:SensorGainAdjustment) embedded within the captured photos, PhotoMesh normalizes the light sensitivity and establishes consistent baseline black levels across all NIR photos. This calibration process is critical for ensuring uniform reflectance measurements throughout the imagery, thereby effectively neutralizing the impact of variable sunlight conditions which can otherwise compromise the quality and analytical value of NIR data.

Stability Improvements and Bug Fixes

Project Build

- Fixed an issue where the number of photos participating in the build was not updated after changes to the effective range value.
- Resolved an issue where some build stages failed or entered a loop on German locale machines due to decimal separator issues.
- Fix to the "More Aggressive Match" and "Reconstruction Close Range with Long Lens" presets

Fuser Management

- Conducted a comprehensive refactor and stability enhancement of the fusers pool.
- Corrected a display issue in fuser manager window that incorrectly showed zero active fusers.
- Fixed inaccurate reporting in the Build manager regarding the number of required, allocated, and maximum fusers.
- Prevent job release failures caused by fuser machine reboots during builds.
- Addressed an issue where fusers would get stuck and fail to display completion percentage.
- Enhanced user data management by ensuring the deletion of the fuser's share folder alongside its intermediate files.

Stability Improvements and Bug Fixes

AWS Stability and Automation Enhancements

- Resolved issues with fusers running on AWS cloud, including one related to a malfunctioning .dll file that caused installation problems.
- Fixed issue where builds in AWS would fail due to the use of reserved values as tag keys.
- Addressed InvalidArgument error when using AWS fusers in regions without specified subnet.
- Resolved a potential issue where duplicate keys on AWS fusers could disrupt operation.
- Enabled the "Build and Rerun Failed Tasks" functionality using the PhotoMesh Project Queue REST API.

Usability

- Introduced a new logging system where a separate out.log file is created for every task, addressing the issue of concurrent log access in multi-machine environments.
- Fixed Photos List "Exclude" checkbox issue where exclusion mark was not initially visible.
- Allow selection of reconstruction tiles after creating a new modified terrain object in the area, improving user experience.

Reports

- Fixed error affecting reporting when one of the AT tiles has no calculated photos.
- Addressed a bug that caused projects with reference images to be inaccurately represented in the connection and projection error maps.

Quality and Performance

Aerotriangulation

- Improved performance for projects with unreliable/No GPS
- Improved accuracy for projects with unreliable/No GPS
- New option to define custom position and orientation accuracy settings for each collection

Improved mesh mode quality

- Close range, sub-centimeter collections
- Multiple collections with large resolution variance
- Clean noise
- Remove gaps in low-resolution pyramid levels

Accelerate production time

- Optimization for close range and vertical collections
- Optimization for wooded area

Automatic Ground Control Points

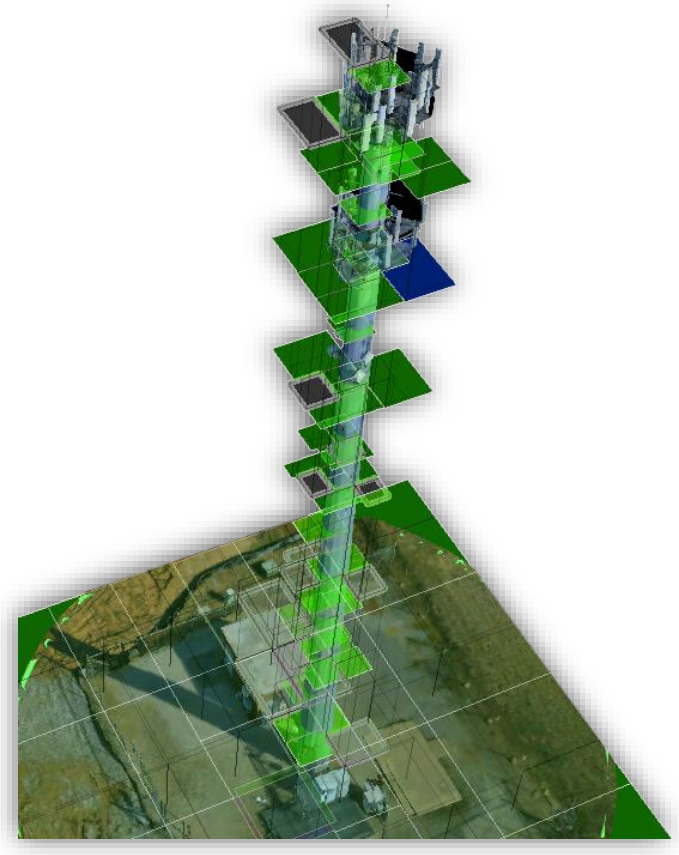
The latest version of PhotoMesh has been enhanced with an automatic control point template detection feature, which optimizes efficiency by enabling fully automated control point marking. After selecting a template that matches your marker type, such as a checkerboard or cross, PhotoMesh can automatically detect the control point markers in your photos. Any auto-marked control points can also be manually adjusted or entirely overridden, if needed.

Data Validation

The latest version of PhotoMesh includes a comprehensive data validation process for your projects, immediately after loading photos. This process checks for potential issues and displays a detailed dialog with warnings and errors specific to each collection and photo, as well as providing suggestions on how to fix them, ensuring that your project is free of errors and runs smoothly.

Dynamic Tiles

New adaptive 3D tiling algorithm optimizes production time and quality for vertical close-range collections, such as towers, bridges and tall buildings.



Manual Retouch Improvements

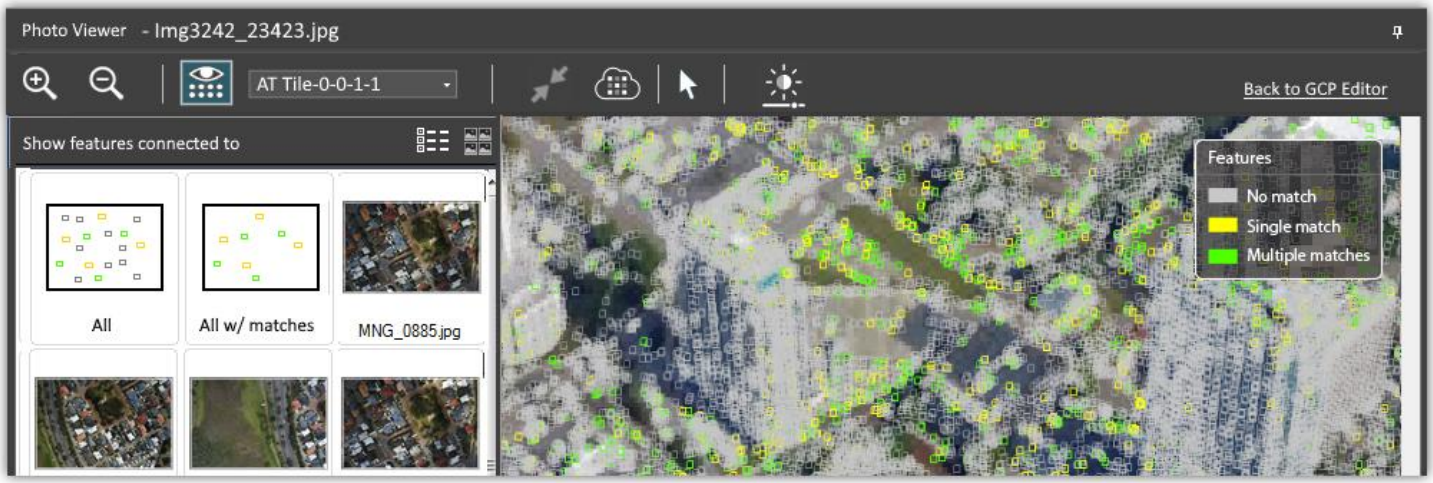
A new set of improvements has been added, including "Remove moving cars" texturing option, that is specifically designed to tackle reconstruction issues caused by moving vehicles in the photographed area, such as cars partially sunk in the road since only some of the photos captured the car in a particular spot. This option textures the polygon area only with photos that do not include moving cars. Users can now also fill retouch polygon areas with a single color or a specific texture or use photos from the area. Feature layers with retouch polylines/polygons can be created in PhotoMesh or imported.

The manual retouch tool has been further enhanced with the ability to perform basic retouch operations on orthophotos in a 2D mode, in addition to the previously supported mesh layer format, for greater flexibility and precision in your retouch projects.

Photo Viewer Changes

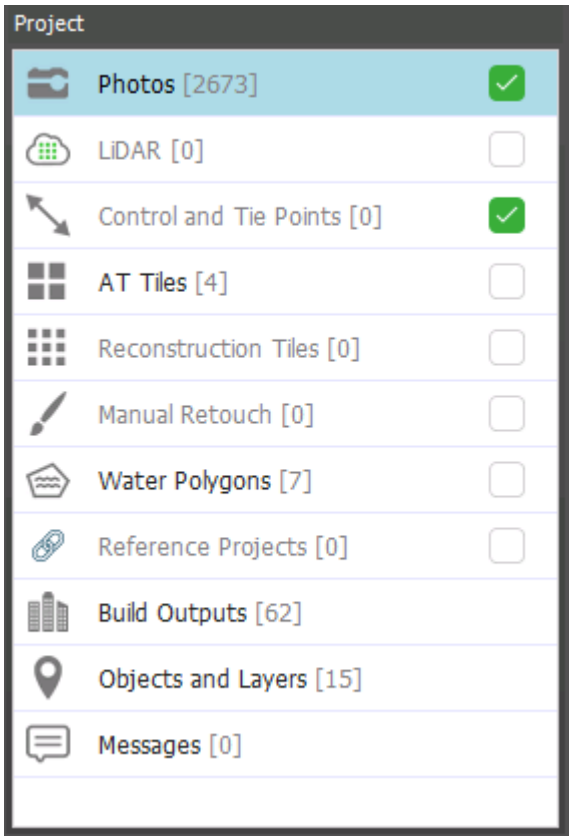
PhotoMesh 8.0 introduces a host of new and exciting improvements to the Photo Viewer, that make it more powerful and user-friendly than ever before. Open the viewer from multiple locations, including the photos list, photo ribbon, control point editor, or when showing photos in point. With the new option to open multiple viewer popups, you can now easily analyze the strength of the features in multiple photos at once.

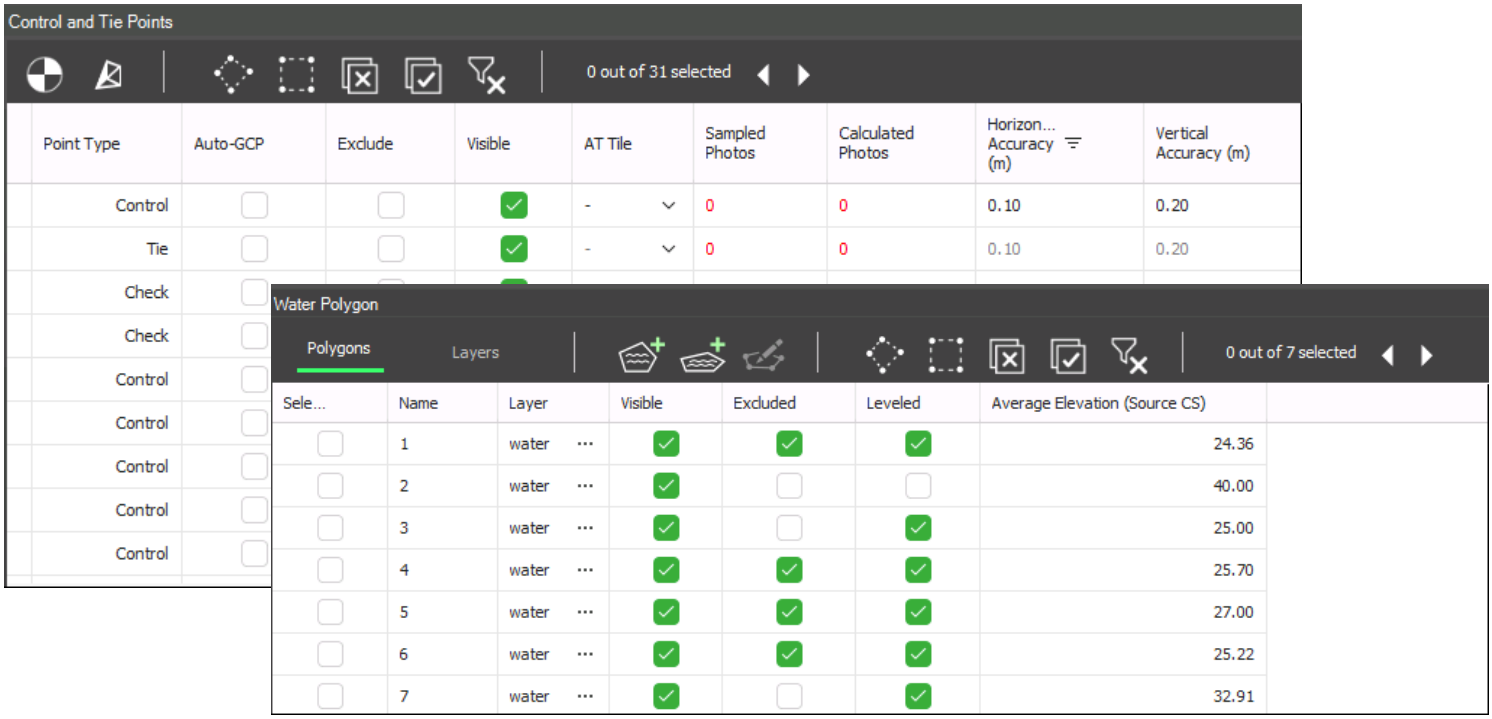
We've also added new capabilities to the viewer, such as the "Dim" mode which darkens the photo, highlighting feature markers and making them easier to see. The "Show features" command now offers the choice to show matched features identified in the preliminary match phase of the AT step or from the sparse point cloud whose match quality was validated during the AT's bundle adjustment process. In feature display mode, you can select which features to display in the photo viewing window, whether it's all features, only features found in at least one more photo, or only matched features between the photo selected in the photo panel and the main photo. And you can even select a specific feature and identify all photos that contain that feature.



GUI Changes

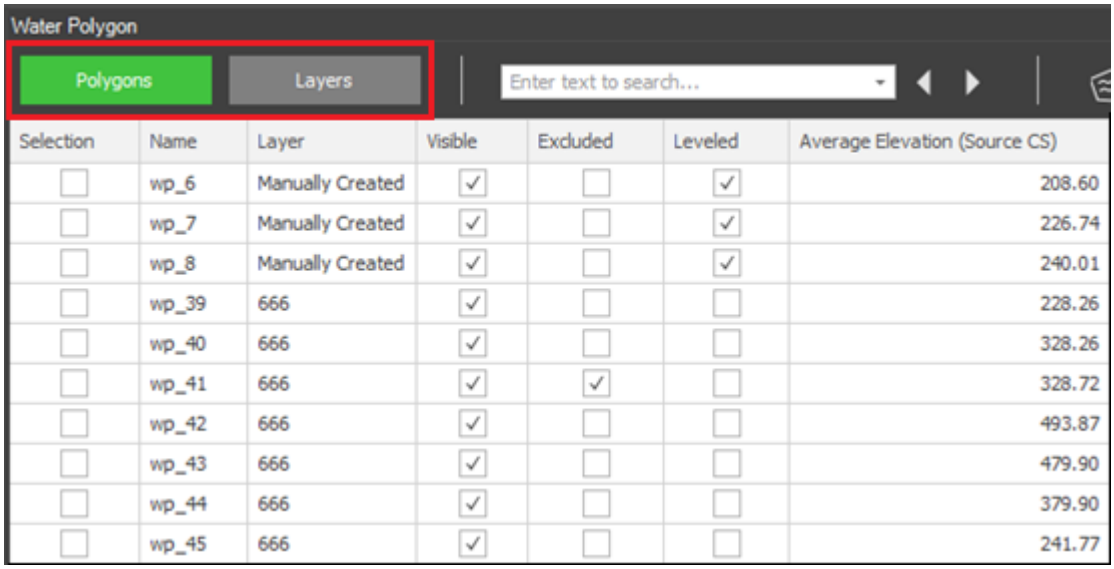
In the 8.0 release, a new Photos Wizard and a redesigned user interface facilitate a more intuitive user engagement, and increase your situational awareness throughout the mesh model preparation and construction process. PhotoMesh 8.0 also introduces a new layout for the Project Tree, with a one-level index control and the transfer of control points output, object/layer, and water polygon information from the Tree to dedicated item lists. This change streamlines the GUI and makes for a more intuitive workflow experience.





Water Polygons

In PhotoMesh 8.0, we've streamlined the water polygon creation and editing process with the introduction of a new Water Polygon list. This list consolidates all water polygon properties and settings, such as visibility, inclusion in the project, and water level constancy, in one convenient location, eliminating the need for a separate property sheet. The Water Polygon list has two tabs: Polygons and Layers, providing an easy way to view and manage all individual polygons in the project and polygon layers respectively.



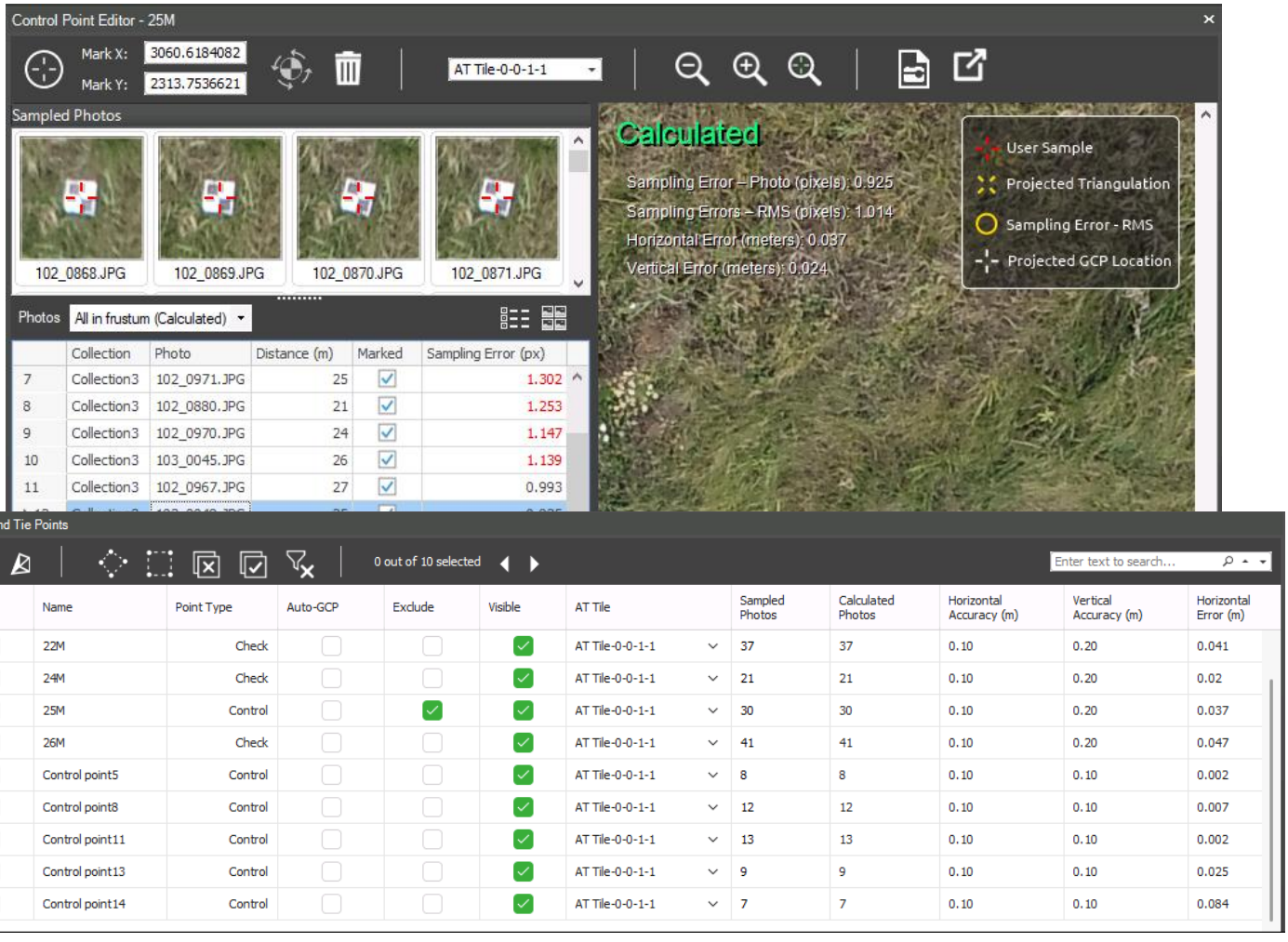
Selection	Name	Layer	Visible	Excluded	Leveled	Average Elevation (Source CS)
☐	wp_6	Manually Created	☑	☐	☑	208.60
☐	wp_7	Manually Created	☑	☐	☑	226.74
☐	wp_8	Manually Created	☑	☐	☑	240.01
☐	wp_39	666	☑	☐	☐	228.26
☐	wp_40	666	☑	☐	☐	328.26
☐	wp_41	666	☑	☑	☐	328.72
☐	wp_42	666	☑	☐	☐	493.87
☐	wp_43	666	☑	☐	☐	479.90
☐	wp_44	666	☑	☐	☐	379.90
☐	wp_45	666	☑	☐	☐	241.77

AWS Improvements: Fuser Throttling

New Launch Rate setting lets you control the maximum number of fuser instances launched per minute, e.g. if Maximum Instances was set to 200, and the Launch Rate to 50, the Build Manager will spread the launch of the fusers over 4 minutes. This prevents a potential bottleneck that could be caused by a large number of fusers attempting to read the build data at the same time.

Control Point Editor

In PhotoMesh 8.0, we've streamlined the control point editing process by introducing a new control point list that consolidates control point properties and their editing in one place, while reserving the control point editor for marking control points in photos. You can seamlessly navigate between the editor and list using either the "Open GCP Editor" button in the list's toolbox or by selecting a control point row in the list, when the GCP editor is open.



Multi-Fuser Support

PhotoMesh now formally supports the launching of multiple fusers on powerful machines to improve overall production performance and fully utilize the computer's power. It is recommended that a minimum of 16 GB RAM and 8 cores be available per fuser. In addition to standard fuser use, PhotoMesh also offers two options for auto-scaling of fusers to enable dynamic allocation of fusers based on project requirements:

- **Amazon Web Services (AWS) Fusers** – AWS fuser instances can be dynamically launched whenever there are unassigned pending fuser tasks, to further accelerate model creation.
- **Fusers Pool** – Fusers can be shared between several PhotoMesh Build Managers in your organization, enabling each machine running PhotoMesh to use the combined resources of all the machines in the pool.

New Output Options

- PhotoMesh supports the latest 3D Tiles, SLPK, and o3DML output formats
- Point cloud output colorized by the number of correlated photos
- Watermark option has been removed. In PhotoMesh evaluation version, output is generated without a watermark, but it is mandatory to include a Skyline copyright notice and logo.
- Optimized mesh model to reduce size without compromising on quality
- New option to export the selected photos' aerotriangulation information to a CSV file.
- True orthophoto and elevation outputs are now compliant with the Cloud Optimized GeoTIFF (COG) standard, allowing for efficient streaming and partial downloading of web-based imagery

Quality Report

New Quality Report (PDF), containing statistical and graphical information about your project's build and its aerotriangulation and reconstruction results, highlights key information and alerts you to potential problems such as missing information, triangulation errors, or failed tiles so you can address and resolve the necessary issues. It includes four maps that graphically depict information about photo matches, level of detail, position accuracy and more.

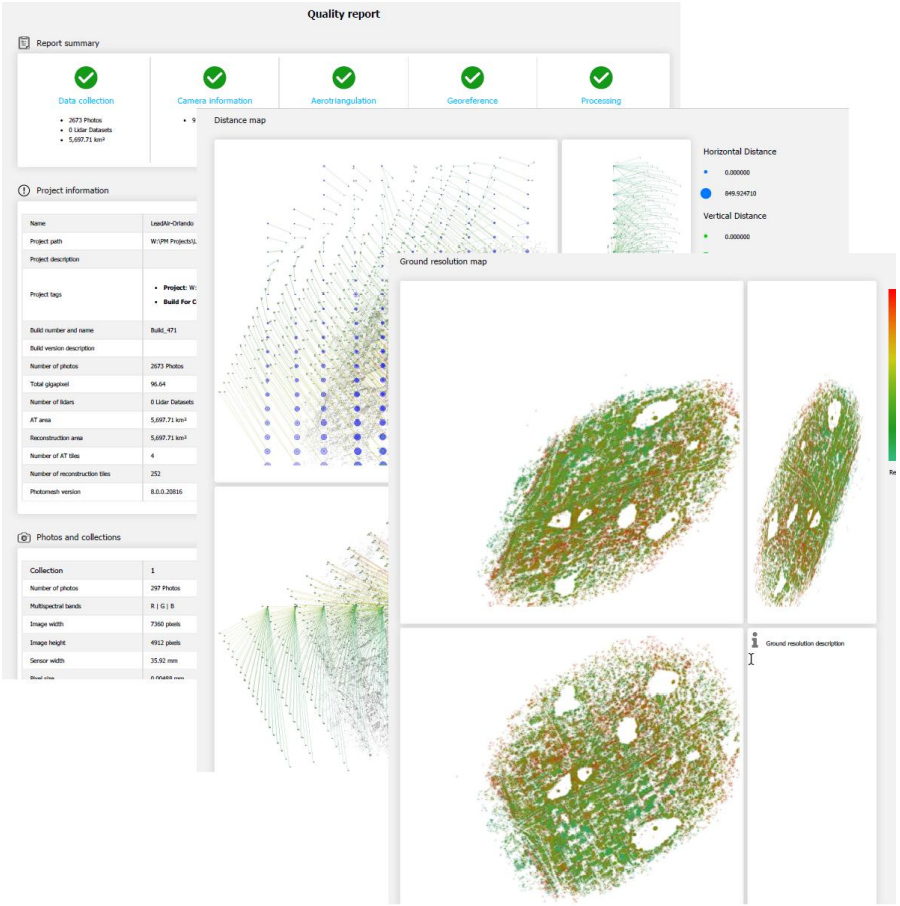
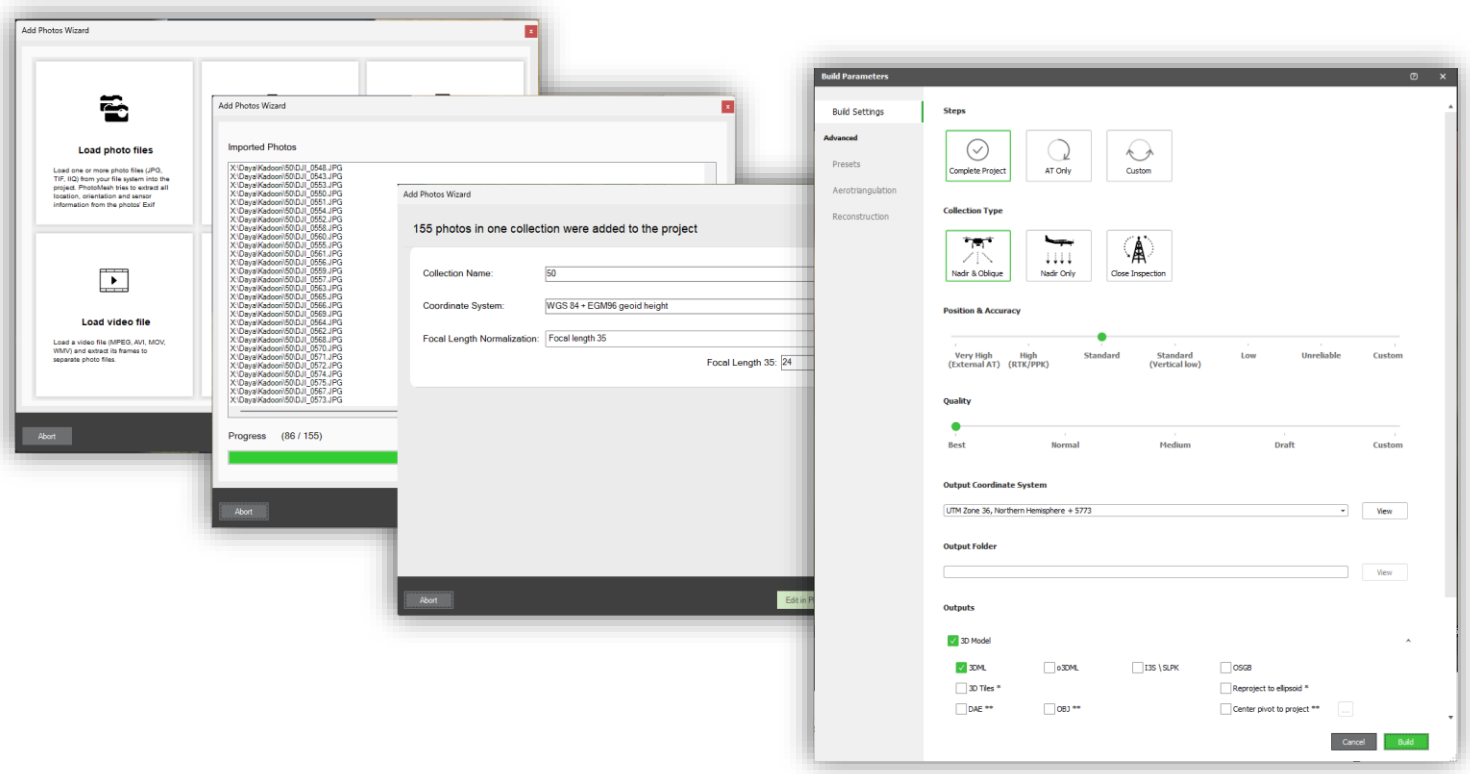


Photo Wizard

The new PhotoMesh Wizard streamlines the process of adding photos to a project by consolidating all load and import options, including photo files/folders, Excel/XML photo list file, video, and photos with metadata into a single, user-friendly dialog. This eliminates the need to navigate multiple menus and simplifies the process of bringing photos and metadata into your project. In addition to this general revamping, the following specific improvements and capabilities have been introduced:

- CSV Import – PhotoMesh now remembers and retains last mapping of CSV columns to corresponding photo properties. This means that for subsequent imports with the same CSV file, you won't need to re-map the columns.



Build Wizard

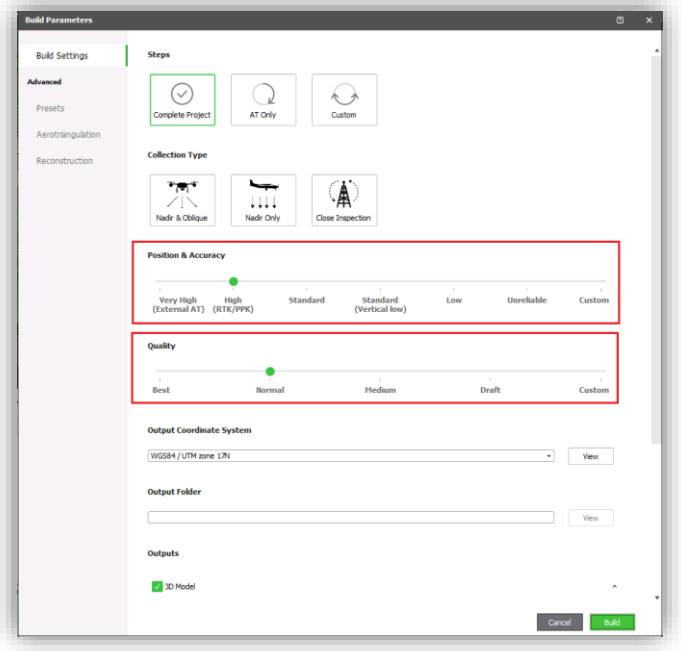
The Build dialog now includes a simplified view that makes it easier to use. In this view, all the main settings for a standard build are consolidated in one tab labeled "Build Settings." Along with this change, some styling enhancements have also been made to the dialog.

Several new presets have been added to make it easier that make it easy to automatically set the parameters that will generate the optimum output for your project's data :

- **Close Inspection** - For projects with a single object captured from all perspectives. PhotoMesh focuses on the foreground object to achieve best image correlation relative to the close-range object and optimizes 3D reconstruction for modeling of thin features and complex geometry.
- **Skeletal Objects** – Aggressive cleaning of spaces within skeletal objects, resulting in a cleaner, more visually accurate 3D model. This is particularly effective for objects like telecommunications towers and other mostly hollow objects.
- **Nadir Only Dataset** – Improves edge sharpness and overall orthophoto quality.

We've also incorporated two new sliders:

- **Position Accuracy slider** - Allows you to determine what weight should be assigned to provided camera positioning when performing aerotriangulation.
- **Output Quality slider** - Includes a Draft mode option for faster processing.



REQUIREMENTS – PHOTOMESH

Operating System

Windows® 10 / 11, Windows® Server 2016 / 2019 / 2022 – 64-bit required.

Ubuntu 18.04 and Debian 10.0 – 64-bit required (Only for PhotoMesh fusers)

Processor (per fuser)

4 cores (8 cores recommended). PhotoMesh works best in a multi-core environment and can utilize multiple CPU's and hyper-threaded processors

System Memory (per fuser)

16 GB RAM (32 GB recommended)

Video Card

1GB of video memory (2GB or more recommended). Pixel and vertex shader v3.0.

Additional Software

.Net Framework 4.6.1 required

For additional information, check out the PhotoMesh section of our knowledge base.

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