

The PhotoMesh logo, consisting of a white stylized globe icon with a grid pattern.

# PhotoMesh

## Data Sheet

V7.7



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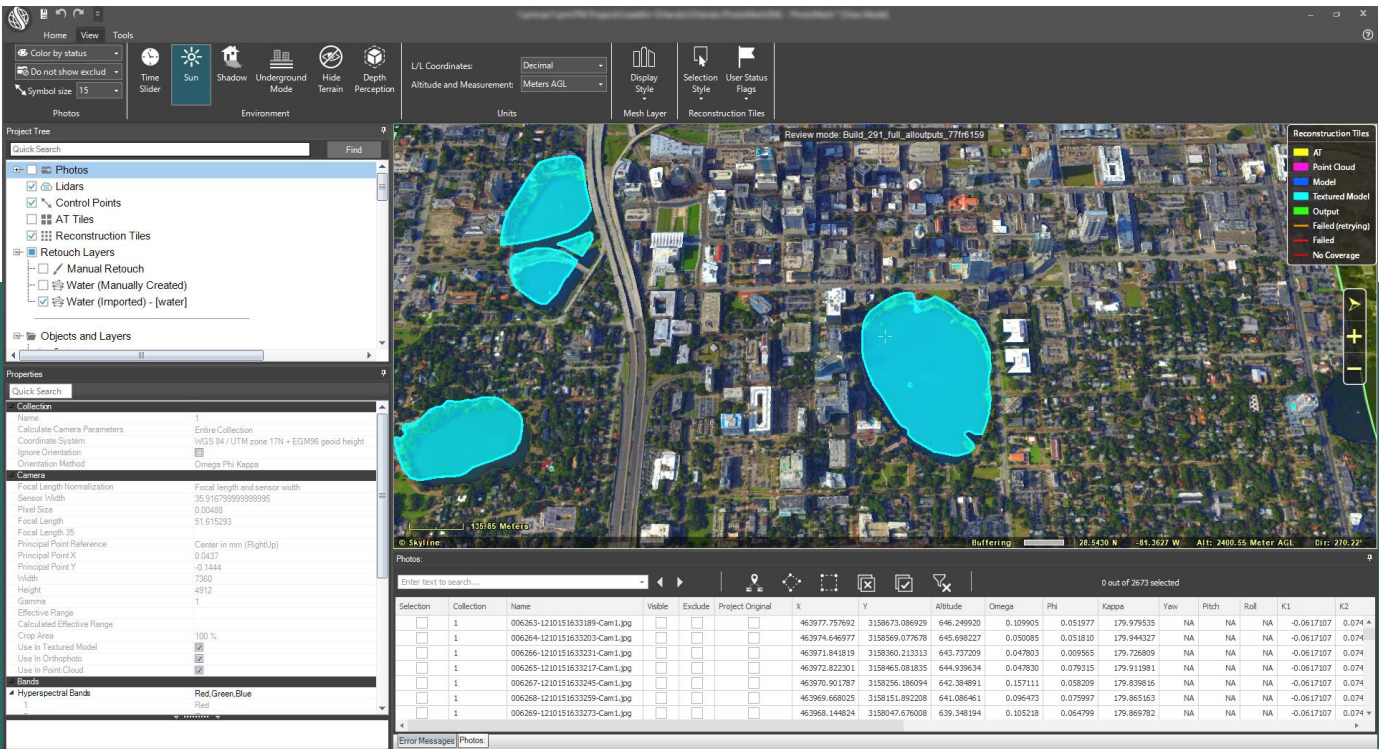


# OVERVIEW

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. Combining any number of photographs, in a wide range of formats and resolutions, PhotoMesh generates highly-detailed 3D models that provide the real-world context and visualization so critical to decision making in a multitude of industries. These models can be viewed and queried using TerraExplorer or other 3D and GIS products.

PhotoMesh employs elaborate tiling mechanisms to efficiently handle projects with even hundreds of thousands of photos. Running on standard hardware, PhotoMesh can also exploit computer clusters and cloud computing to run a single project simultaneously on hundreds of fuser machines. Sharing the workload involved in generating PhotoMesh output vastly accelerates all steps of the build.





## High Quality

PhotoMesh generates a full-3D mesh model that faithfully reproduces even small-scale details such as cars, trees, fences, and walls - all with advanced color balancing and high-quality texturing.



## Scalability

PhotoMesh efficiently handles even hundreds of thousands of photos using an elaborate tiling mechanism. PhotoMesh exploits multi-computer architecture (fusers) to further accelerate database creation, running a single project simultaneously on hundreds of machines.



## High Performance

PhotoMesh can run its efficient algorithms fluidly on standard GPUs, or exploit multi-core and multi-computer processing to further accelerate database creation. A single project can run simultaneously on hundreds of fuser machines, processing tens of square kilometers per day.



## Production Automation

Robust REST APIs allow developers to create, monitor, and manage project queues and to automate PhotoMesh production flows on local machines, remote servers, and the cloud.



## Cloud Ready

PhotoMesh can exploit computer clusters and cloud computing to run a single project simultaneously on hundreds of fuser machines. Sharing the workload involved in generating PhotoMesh output vastly accelerates the build process.



## Output Formats

PhotoMesh's result can be exported in various multi-resolution 3D models (3DML, OSGB DAE, OBJ), rasters (Orthophoto, DSM, DTM) and point clouds (LAS), ensuring full interoperability with 2D/3D GIS solutions.



## Source Image Flexibility

PhotoMesh supports most standard image formats (Jpg, Tiff, etc.) and video files, generating complete, true 3D mesh models from professional or drone-captured standard, unordered oblique, nadir, and ground photos.



## Usability

Intuitive GUI and powerful, versatile tools for accurate evaluation and adjustment of your input data and AT, including: a coverage map, photo inter-connection map, LIDAR data integration, control points, photo projection on terrain and LIDAR and much more.

# DATA COLLECTION

PhotoMesh makes it easy to combine data of a variety of formats and sources. PhotoMesh supports standard image formats (JPG, TIF, IIQ, hyperspectral, etc.), from professional or drone-captured standard, unordered oblique, nadir, and ground photos. It supports large frame sensors (200+ megapixels) and processing of photos with different resolutions and focal lengths. All the following photo formats and loading methods are supported:

- Standard image formats (Jpg, Tiff, etc.)
- Photos with hyperspectral bands (NIR)
- PhaseOne IIQ
- Video files (most formats)
- LIDAR (LAS, E57)
- Photos with metadata (e.g., sensor width, focal length, and orientation data).
- PhotoMesh supports importing from multiple aerotriangulation packages - Bingo, Inpho, VisionMap, Stellacore, and others
- Photo list files with all photo and photo collection information (Excel, ContextCapture XML, or CSV)



# OUTPUT FORMATS

Generate dense point clouds with detailed color info, true orthophotos, and 3D mesh models in a range of formats for compatibility with most standard GIS tools and analysis software. Georeferenced 3D models can be produced in any coordinate system

- 3D Mesh: 3DML, 3D Tiles, DAE, OBJ, OSGB, I3S/SLPK
- Point Cloud: LAS, LAZ
- Orthophoto: GeoTiff
- Digital Surface Model (DSM): GeoTiff, LAS, LAZ
- DTM/DEM: GeoTiff



PhotoMesh generates a full-3D mesh model with advanced color balancing and high-quality texturing.

- High quality 3D edge mechanism
- Enhanced reconstruction of even small scale objects like poles, fences and thin walls
- Improved texturing algorithm for a crisper, cleaner look

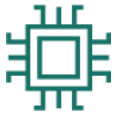


# HIGH QUALITY

PhotoMesh employs the highest-performance photogrammetry, computer vision, and computational geometry algorithms, to ensure that you get the full operational picture with high-resolution, accurate 3D representation. PhotoMesh faithfully reproduces even small-scale details such as cars, trees, fences, and walls, all with advanced color balancing and high-quality texturing.

- Enhanced noise removal, filtering, and outlier detection
- Water polygon for automated clean-up of water bodies
- Edge extraction, and automatic break-lines
- Corner enhancement
- Improved texture selection
- Optimized mesh triangle count based on model complexity
- Smoothing algorithms used to improve DSM quality and LIDAR textures.
- Built-in presets make it easy to automatically set the required parameters to generate the optimum output for your project's data: e.g., clean point cloud noise and sky background from photos, improve build results in low overlap, nadir projects, improve color balancing, close range optimization, auto-color correction, and more





## STANDARD, LOW COST HARDWARE

- Utilizes multi-core architecture
- 16-32 GB RAM
- Dedicated GPU not required



## SCALABLE ARCHITECTURE

- Designed for computer clusters and for private/commercial clouds
- Multi-computer architecture (PhotoMesh fusers)
- Single project can run simultaneously on hundreds of fuser machines



## PROCESSING CAPABILITIES

- Processes around 10 gigapixels per day and per PhotoMesh fuser (8 cores) on average
- Handles very large data sets
- Divide project into large aerotriangulation (AT) tiles
- Divide each AT tile into small reconstruction tiles







## FUSERS

Dramatically accelerate processing time by using network fusers to enable multiple computers to share the processing load. The master computer utilizes the computing power of the network's client computers by connecting to PhotoMesh fusers on the client machines. The fuser remains idle until used by the master computer on the network.



## FUSER POOLS

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. A distributed management approach is used to manage the pool fusers, whereby each PhotoMesh Build Manager manages its own fuser needs and resources by requesting fusers from the pool when generating a build and returning the fusers when they are no longer needed.



## GIGAPIXEL CREDITS

The PhotoMesh Gigapixel (GX) licensing mechanism allows you to apply gigapixel credits towards the building of your PhotoMesh projects based on the number of gigapixels in each project. This mechanism can be implemented by pre-purchasing a bank of gigapixel credits, loading them to your local Skyline Floating License Server (SFLS), and then applying them to project photos when building a project, or by sending a request to Skyline.

# CLOUD READY

PhotoMesh can run on a cloud environment, such as Amazon Web Services to scale production up and down based on resource needs – even within a single project. AWS virtual fuser machines (i.e., spot instances) can be dynamically launched whenever there are unassigned pending fuser tasks, to further accelerate model creation.

PhotoMesh Build Manager continuously monitors the fusers' progress and status and the processing requirements of the current step, adding and terminating AWS fusers as required. Users only pay-per-use, thus avoiding any significant upfront investment or wasted resources.



PhotoMesh can exploit computer clusters and cloud computing to run a single project simultaneously on hundreds of fuser machines. Sharing the workload involved in generating PhotoMesh output vastly accelerates all steps of the build

## EDITOR

The main PhotoMesh working area for various workflow actions such as preparing, submitting for processing, monitoring, and reviewing the build.

- Define photo and photo collection properties
- Define project area and build properties
- Define ground control points and tie points
- During build - view and analyze tile models
- Show LIDAR on terrain and associate LIDAR with their trajectory data
- Define or import water body polygons,
- Edit mesh imperfections

## FUSER

Worker component of PhotoMesh which allows you to share the workload involved in processing the different build steps between several computers on the same network. The master computer utilizes the computing power of the network's client computers by connecting to PhotoMesh fusers on the client machines. 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. PhotoMesh can also work with Amazon Web Services (AWS), adding and terminating virtual fuser machines, to scale a project up and down based on resource needs.

## BUILD MANAGER

Manager application that is responsible for managing the build process and PhotoMesh fusers. PhotoMesh Build Manager keeps track of all build tasks and fusers, distributing tasks among the fusers and assigning new tasks as fusers complete their tasks and become available. During the build process, PhotoMesh Build Manager monitors the build and provides the user with detailed information about the progress of each build step and fuser status and progress.



## IMAGERY ACQUISITION

All visible surfaces of the intended object or scene must be photographed from multiple overlapping viewpoints. The accuracy of the resulting 3D mesh model is affected by several factors including: input image resolution and quality, lens distortion, overlapping ratio, directionality, and lighting. PhotoMesh optimizes the accuracy of the 3D mesh model by selecting the best photos for each area.



## LOAD PHOTOS

Load photos and other input sources into a project

- Photo files from disk (JPG, TIF, IIQ).
- Photo list with photo data and photo file paths (Excel/XML/CSV)
- Video from which PhotoMesh extracts individual image frames.
- Photos with AT and other metadata (e.g., Inpho, Bingo, Stellacore)
- LIDAR data (.las, .laz or .e57 formats)



## PREPARE PROJECT

Versatile and configurable tools for evaluating and improving input data:

- Integrate LIDAR with project photos.
- Display color-coded coverage map and inter-connection map to evaluate AT quality
- Improve position accuracy and AT results using ground control points and tie points

## MANAGE FUSERS

Fusers allow you to share processing workload between several computers on the same local network. Fusers can be shared between several Managers, enabling each machine to use the combined resources of all machines in the pool. PM can also work with Amazon Web Services (AWS), adding and terminating virtual fuser machines, based on resource needs.



## BUILD MODEL

Launch PhotoMesh Build Manager to begin the build process. The build process provides flexibility both with regard to the area of the project being built (entire or selected area) and the build steps that are to be performed. Build parameter presets make it easy to automatically set the required parameters to generate the optimum output for the project's data as well as to share user-defined build settings between projects.



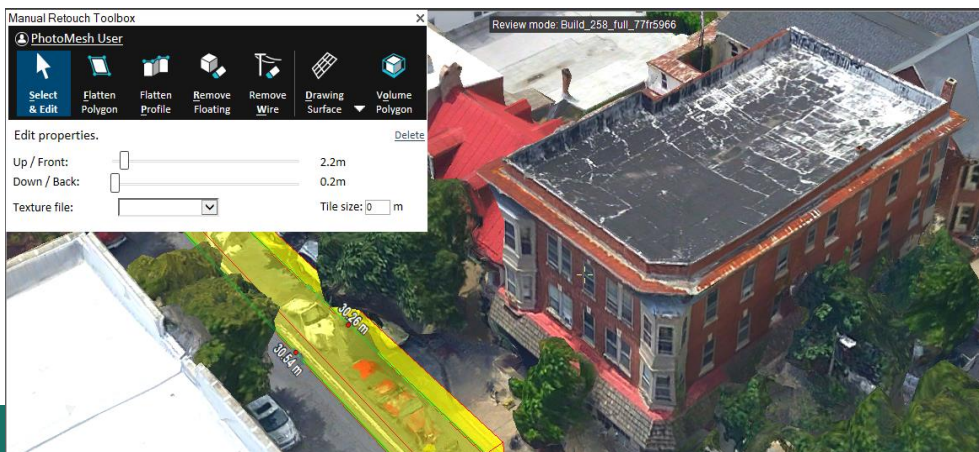
## MANAGE AND REVIEW BUILD

Throughout the build process, you can monitor build progress from PM Build Manager and view the build data already created in the PhotoMesh 3D Window. After a build is complete, water bodies can be defined by drawing or importing a water body polygon, and mesh imperfections can be marked for retouch. You can easily rebuild the entire project, error tiles, or selected tiles.

# ADVANCED GUI AND TOOLS

PhotoMesh provides powerful and versatile visualization capabilities and tools for both preparation of your initial AT and build and then evaluation and modification of a build before rebuilding.

- Project photos on terrain and LIDAR to see if they fit the terrain imagery or to better understand their position
- Color-coded map analyzing photo coverage in every point of the AT area
- Color-coded connection map that indicates the level of photo interconnection
- Ground control points to improve accuracy of model position
- Tie points to establish a correspondence between project photos and improve aerotriangulation results
- Build Manager that provides comprehensive information on the progress of each build step and active fusers, highlighting tiles with errors, and allows the viewing of intermediate data while the build is in progress
- Display and compare original and calculated camera positions
- View AT or reconstruction tile results in the 3D Window. Tiles are colorized according to their processing status.
- Open and review build output in TerraExplorer.
- Draw or import a water body polygon to enable PhotoMesh to model and texture a water body successfully.
- Powerful manual retouch tool for marking mesh imperfections for retouching directly in PhotoMesh.
- Range of rebuild options so you only rebuild what needs rebuilding: entire project, error tiles, or selected tiles. PhotoMesh can automatically determine what processing is required to apply the changes to the project, by rebuilding the project from "Auto".





# PRODUCTION AUTOMATION

## PHOTOMESH API

REST API to automate most of the production phases, e.g., load photo files or list, set AT and reconstruction areas, begin and manage a build, and create new build versions.

## PROJECT QUEUE API

REST API to create a project queue, and then activate, monitor, and manage the queue processing. The project queue is created using the add API method, in which a project queue JSON file is passed that lists all the tasks that should be performed for each of the projects in the project queue.



Robust REST APIs allow developers to create, monitor, and manage project queues and to automate PhotoMesh production flows on local machines and remote servers. PhotoMesh's Automation Dashboard provides quick access to all automation settings and documentation. Clear, easy-to-use, interactive API documentation makes it easy to implement these APIs.

# REQUIREMENTS

Operating System	Windows® 7 / 8 / 10, Windows® Server 2012 R2 / 2016 / 2019 – 64-bit required. Ubuntu 18.04 and Debian 10.0 – 64-bit required (Only for PhotoMesh fusers)
System Memory	16 GB RAM (32 GB recommended)
Video Card	1GB of video memory (2GB or more recommended). Pixel and vertex shader v3.0.
Processor	4 cores (8 cores recommended). PhotoMesh works best in a multi-core environment and can utilize multiple CPU's and hyper-threaded processors
Additional Software	.Net Framework 4.6 required

[For additional information, check out our PhotoMesh knowledge base](#)



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