



GeoSpatial Office Software  
March 2018, V 9.0  
June 2018, V 9.0.1  
July 2018, V 9.0.2  
October 2018, V 9.0.3  
November 2018, V 9.1.0

## Release Notes for Major Release UASMaster 9.1

**Note:** These release notes have been renewed for version 9.1. This major release includes various fixes and improvements. We highly recommend always updating to the latest software release. Also note that inpho's WiBU licensing system also is updating their libraries constantly. To guarantee for stable license access, Trimble strongly recommends updating the WiBU libraries. All files are ready for download at <http://www.trimble.com/imaging/downloads>.

This version doesn't need a new license if version 9.0 is currently installed.

### License requirements for updates:

- Updating to a PATCH release (e.g. Version 9.0.x from 9.0) does not require a new license to be installed if any earlier 9.0.x version is already available.
- Updating to a MAJOR release (e.g. Version 9.1 from 9.0.x) does not require a new license to be installed if any earlier 9.0.x version is already available.
- **Updating a MAIN release (e.g. 9.0 from 8.x) does require a new license** to be installed. The previous version (8.x) will also run with this license. Users with a maintenance contract as of October 2017 are entitled to download and use the new release. Dongle update files are automatically issued – if you did not get a notification, please contact us on [imaging\\_license@trimble.com](mailto:imaging_license@trimble.com)

The software may be downloaded from here: <http://www.trimble.com/imaging/downloads>



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## What is UASMaster?

UASMaster is one of Trimble's UAS processing software solutions. UASMaster is engineered on the basis of the well-established Inpho advanced airborne photogrammetry / airborne LiDAR processing software suite. It offers full automatic geo-referencing, point-cloud generation as well as ortho-mosaic generation including refinement and editing tools for all deliverables as well as basic mapping and value adding functionality (e.g. point cloud classification).

UASMaster is available as a standalone solution as well as combined with **Trimble Business Center**. Trimble Business Center combines typical survey workflows and survey data types (GNSS, total stations, v10 data...) in one tool. Within TBC, users also find the appropriate tools to add value to their generated data (e.g. calculating volumes, using the CAD module etc.). The TBC Advanced Photogrammetry license combines the photogrammetry workflows of UASMaster with all the TBC workflows in one product. Note that GNSS base-line processing for UAS with high quality GNSS is only available through TBC.

UASMaster is outstanding through its high flexibility. UASMaster requires little more expertise but still is much easier to use than traditional photogrammetric software. It offers many more tools to refine results and edit results. More flexible parameters are available as well as pre-defined strategies for different application scenarios and accuracy/performance requirements. UASMaster processes data from also non-Trimble UAS manufacturers. All the input and output data as well as the complete project environment is compatible to the advanced Inpho modules, so users may step into the professional Inpho software workflow at any point. So UASMaster is the perfect UAS processing software for photogrammetric specialists as well as ambitious users adopting photogrammetry more and more as a surveying tool.

Generally, Inpho modules are highly automated, providing an outstanding level of accuracy and confidence. Inpho is suited for massive data volumes in processing, refining and editing as well as for visualization of deliverables. Inpho deliverables create the basis for a manifold of vertical applications in different markets such as survey, energy and natural resources, environmental research, cities and buildings, (urban) planning, monitoring, agriculture, cadaster and many more.



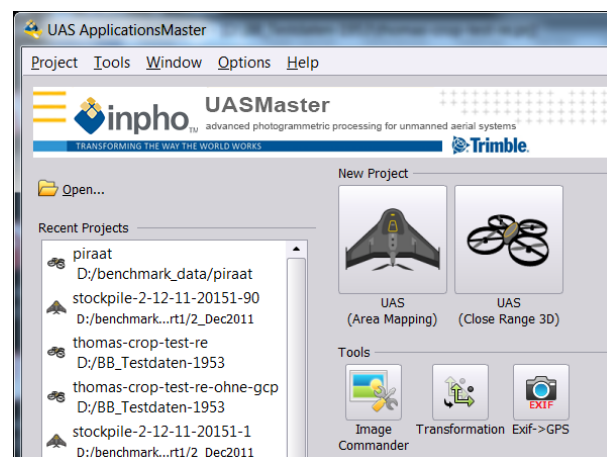
## What's new in the Main Release UASMaster 9.0?

UASMaster 9.0 is a new main release of our UAS photogrammetry software module. A main release always includes a variety of bug fixes and technical improvements as well as new features and tools. Updating to a main release typically does require a new license. For 9.0 project files a project type for 3D reconstruction was added. Therefore, projects created in version 9 cannot be used in previous versions but it is no problem to use project files from the previous version for the current one.

### Full 3D Reconstruction with multi-copters and handheld cameras

UASMaster now is completed with full 3D reconstruction capability. The software incorporates two independent workflows with each being optimized for its specific processing requirements.

- The “Area Mapping” workflow is focusing on near nadir projects with classic straight flight lines, typically having approximate positions for photo exposures available. Nadir geometry and approximations generally help to keep processing times low.
- The new second workflow “Close Range 3D” is optimized for close-range geometry. Often multi-copter flights have circular flightpaths around objects to be reconstructed. Other survey projects rely on imagery taken from the ground with ordinary cameras – even smartphones.



This new capability in UASMaster allows generating complete 3D models of objects such as buildings, pylons etc. as well as correct representation of vertical structures in mining areas.

### Full 3D Point Clouds with new matching algorithm of directly from Georeferencing tie-points

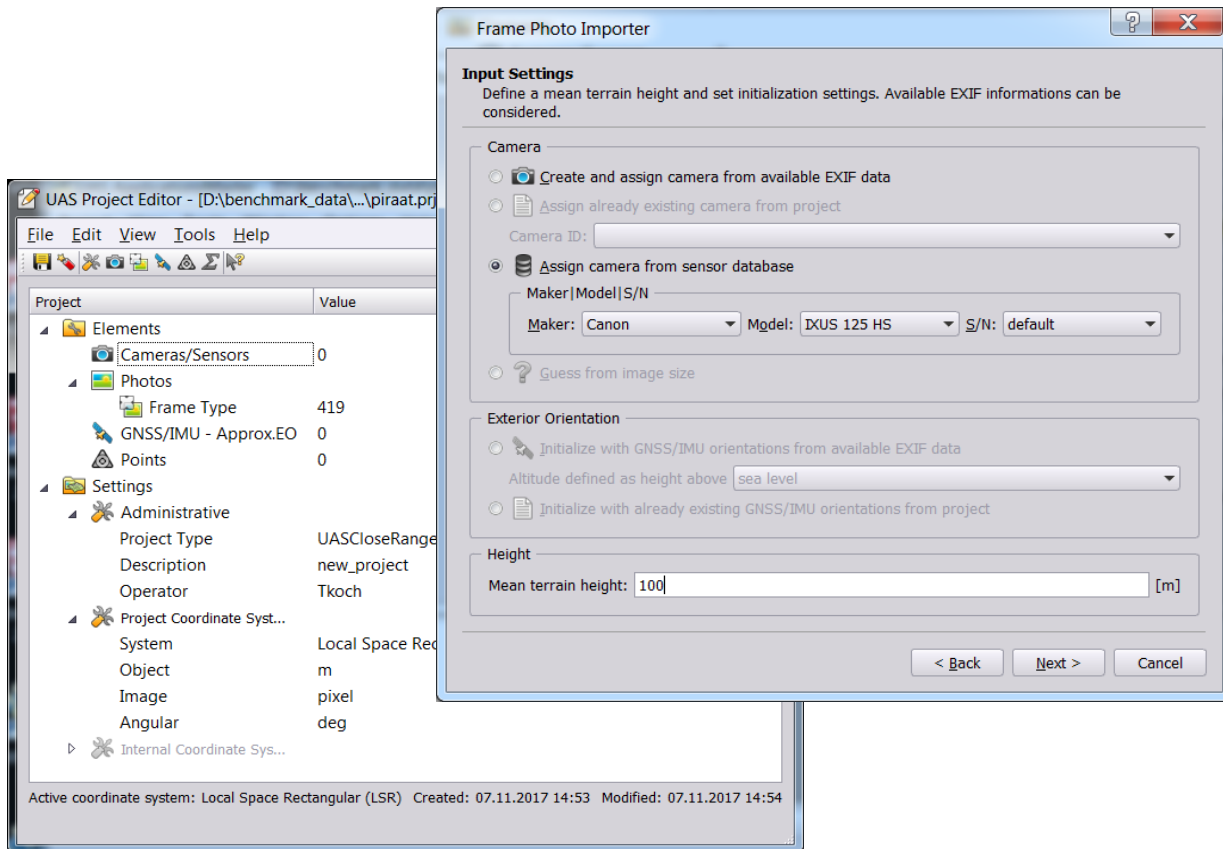
A new “Close Range 3D” workflow directly creates dense 3D point clouds. Furthermore, the tie-points from the georeferencing process can be utilized to deliver a sparse 3D LAS point cloud. The 3D point cloud workflow is tightly linked to the tools in Trimble Business Center and/or Trimble RealWorks. Those software products can visualize, edit and further process the UASMaster LAS file into actionable information. Trimble Business Center as well as Trimble RealWorks provides not only surveyors with a complete toolset for working with point clouds and TIN models but also connects the UAS acquired data with additional data coming from e.g. laser-scanning and total stations.





## Processing without known camera parameters or approximate exposure positions and simplified project setup

UASMaster leverages all data associated with the flight – known camera calibration parameters (e.g. calibrations from previous computations), high-quality GNSS and IMU direct georeferencing data etc. Those additional data types keep challenging projects stable, accurate and robust. Direct-Georeferencing workflows keep processing requirements to a minimum.



Depending on how imagery was acquired, high-performance UAS, low-cost UAS, handheld cameras, in some cases camera parameters are totally unknown and not even approximate exposure positions are available.

For those cases UASMaster users can easily setup their projects by just importing the imagery from multiple (sub-) folders. Using ground control points for references, using high-quality or approximate GNSS/IMU (position and attitude) and assigning a calibrated camera is optional.

While importing imagery, camera parameters are extracted from image metadata (EXIF), simply assumed by analyzing the image files or users can still associate a camera template if they know the camera type.

No further flight information (e.g. flight-lines, standard deviations/tolerances...) is required – just load your images, define a working coordinate system and you are good to go.



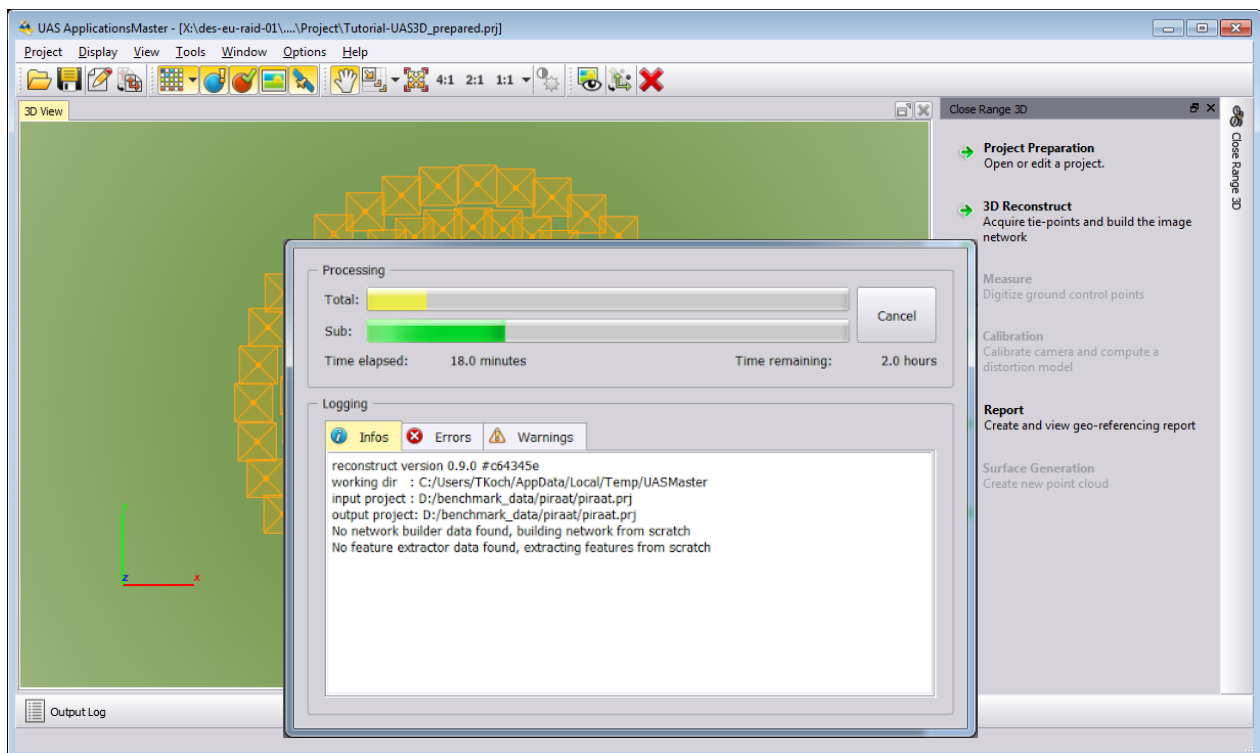


## Simplified Processing Parameter Selection

Most of the processing parameters for a UAS project for geo-referencing, point cloud generation and OrthoMosaic production can automatically be chosen by the processing engine itself. UASMaster 9.0 now limits the number of processing parameter to manually set to an absolute minimum. The number of definable parameters still ensures enough flexibility to successfully process challenging datasets while being manageable even for the novice user.

The workflow for “Close Range 3D” is sub-divided into just a few steps:

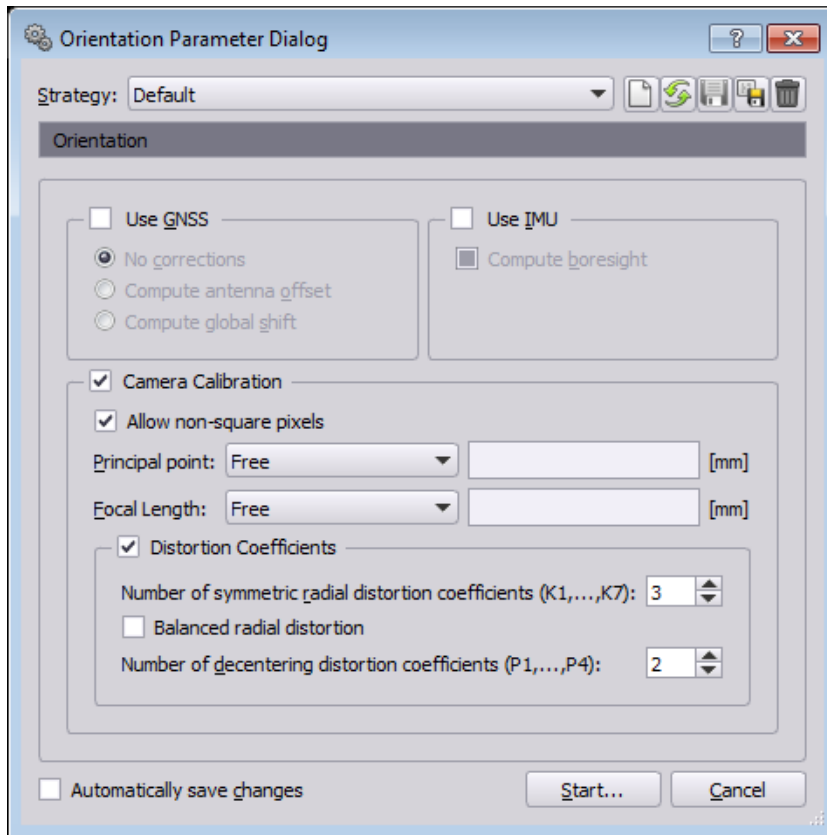
- Project preparation
- 3D reconstruction (tie-point matching and relative geo-referencing)
- Optional: Interactive measurement of ground control points
- Optional: Calibration ( absolute positioning/geo-referencing and scaling, camera calibration, GNSS/IMU calibration)







While the 3D reconstruction (tie-point matching and relative geo-referencing) is covered with 2 processing parameters, only (image resolution and tie point density), the calibration parameters offer little more complexity to get the highest quality out of your imagery:



Note that camera calibrations and the constrained use of GNSS and IMU are optional, as well as calibration and correction of associated shifts and offsets.

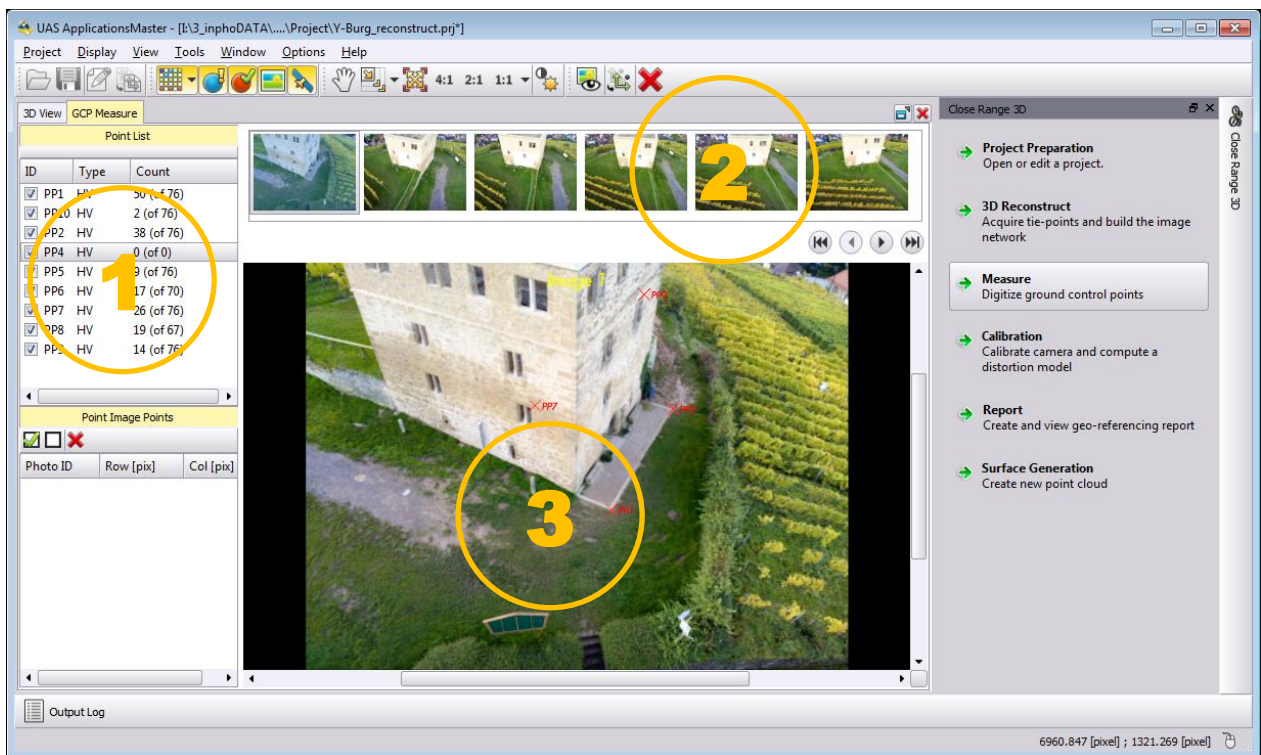
- Generation of dense point cloud with new algorithm
- Optional: Export of sparse point cloud (from tie points) as LAS file
- Optional: Export of dense cloud (from surface generation) as LAS file



## Simple Reference Ground Control Point Measurement for 3D Reconstruction Projects

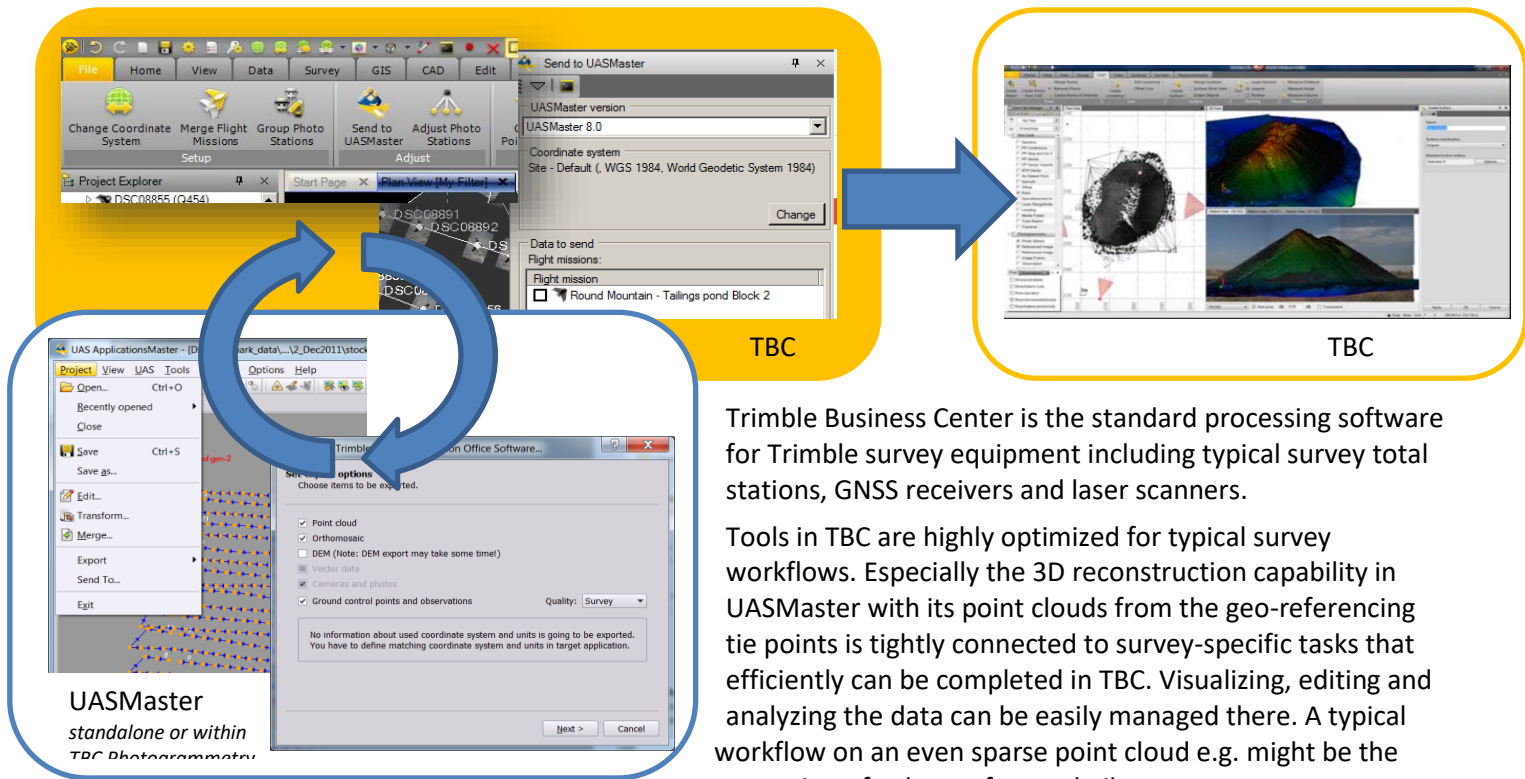
The photo measurement tool for “Close Range 3D” projects has been greatly simplified in contrast to the manifold of options available in an aerial mapping project.

1. Simply select any reference point from the point list
2. Choose an image where that point can be located in
3. Pick the point in the 100% view of this image
4. After two image measurements, the list of images is filtered according to the calculated image positions of the reference point





## Streamlined workflow between Trimble Business Center and UASMaster



Trimble Business Center is the standard processing software for Trimble survey equipment including typical survey total stations, GNSS receivers and laser scanners.

Tools in TBC are highly optimized for typical survey workflows. Especially the 3D reconstruction capability in UASMaster with its point clouds from the geo-referencing tie points is tightly connected to survey-specific tasks that efficiently can be completed in TBC. Visualizing, editing and analyzing the data can be easily managed there. A typical workflow on an even sparse point cloud e.g. might be the computation of volumes for stockpiles.

After completing the 3D reconstruction and geo-referencing step in UASMaster, all data is ready to be exported to TBC. Simple checkboxes define what type of data is to be handed over (e.g. image orientation, LAS point clouds...). In TBC all exported data then might be combined with data coming from additional sources like terrestrial laser scanning for further processing.

### Support for imagery up to 100 Mpixel

UASMaster 9.0 now supports imagery with up to 100 Mpixel for maximum quality in UAS projects. In addition to the excellent support of high-quality GNSS/IMU direct georeferencing data, professional high-resolution cameras provide rich detail in combination with great robustness and precision.



## List of Changes

### Main window and project handling

Change	Description
<b>New Feature 9.1: Radiometric correction of input images</b>	With version 9.1 an automatic radiometric correction of the input images will be executed. This results in better RGB color for the matched 3D points.
<b>Change 9.1: Limitation of project size for UASMaster(Area Mapping) projects abrogated</b>	The general limitation of the project size in the last version is abrogated. This limitation is still valid for SGM point cloud generation. This limits the processing especially for UAS (Close Range 3D) projects. Creating the point cloud using the FBM or the CBM method which is available for UAS (Area Mapping) has no limitations. A message will inform you during project import or project setup if the project size of 300 Gpixel is achieved.
<b>New Feature 9.0.3: Support of images up to 103 Mpixel</b>	The limitation in image size is extended from 100 Mpixel to 103 Mpixel.
<b>New Feature 9.0.3: CGCS2000 added</b>	The Chinese geodetic coordinate system 2000 (CGCS2000) has been added. It can be selected from the coordinate system list or based on the country selection.
<b>Information 9.0.3: License check of UASMaster</b>	To support any new upcoming TBC versions, the license check in UASMaster has been updated.
<b>Fix 9.0.3: Wrong strategy parameters in batch processing</b>	When modifying the settings from the batch processing parameters dialog, it could happen that additional settings were erroneously introduced, i.e. a blunder detection step was added prior to the DSM/DTM generation.
<b>Fix 9.0.3: Batch processing with projects in feet units</b>	The generation of classic orthophoto failed for feet projects when using the batch processing strategy 'DTM and Classic Ortho'. This is now handled correctly.



<b>Fix 9.0.3: Usage of international characters</b>	<p>The usage of international characters has been enhanced.</p>
<b>Fix 9.0.2: Strategy “Save As” works not correctly</b>	<p>If in the strategy dialog of the Close Range 3D workflow new parameter settings were saved, or existing were edited or removed but the dialog was left with CANCEL, all made changes were no more visible although the changes were applied. This is fixed with version 9.0.2.</p>
<b>New Feature 9.0.1: Swedish Geoids</b>	<p>During the installation of version 9.0.1 the Swedish geoid files will be added to the geoid data base.</p>
<b>Fix 9.0.1: Harmonized default strategies and values</b>	<p>All default strategies and values were checked and if necessary corrected if the reset values didn't correspond with the default settings.</p>
<b>Fix 9.0.1: UASMaster (Close Range 3D) - Reload of dense point cloud after canceled or unsuccessful run</b>	<p>In case of an unsuccessful or cancelled run of a point cloud an already existing point cloud was deleted at the beginning of the process. Therefore it could not be loaded, resp. displayed again. The workflow in UASMaster (Area Mapping) keeps the existing point cloud and remove resp. replace it when the generation of the new point cloud was successful. Version 9.0.1 will adapt this behavior also for UASMaster (Close Range 3D).</p>
<b>Fix 9.0.1: Defined working directory</b>	<p>The user defined working directory was not considered. Instead the default directory C:\Users\&gt;USER NAME&gt;\AppData\Local\Temo\UASMaster was used. This is fixed.</p>
<b>Information 9.0.1: EXIF importer settings</b>	<p>The limitation for importing EXIF image pixel size information was 1-10 µm. For version 9.0.1 this limitation was increased to 1-20 µm.</p>
<b>Information 9.0.1: Updated error message for projects with missing EO for images</b>	<p>A transformation from one into another system, e.g. from UTM 32N to DHDN Gauss Kruger 3, will not work if the project setup consists of images without assigned exterior orientation. The current error message has been improved to clarify the problem. New error message: "Check EO of listed photos. Position and rotation must have been initialized! No EO of photos was transformed!"</p>



<p><b>New Feature 9.0: Imagery up to 100Mpix</b></p>	<p>The limit for images was increased from 81Mpix to 100Mpix. Note that larger images result in longer processing times.</p>
<p><b>New Feature 9.0: New project type for “Close Range 3D”</b></p>	<p>A new project type is introduced for multi-copter projects flown in non-straight flight lines and oblique geometry (e.g. around buildings, stockpiles etc.) and for imagery acquired with handheld cameras. These projects do not essentially require any other information than the imagery itself to be able to be processed. For 3D reconstruction the final product is a dense 3D point cloud that is suitable for much applications in surveying workflows (TBC), e.g. calculating volumes.</p>
<p><b>New Feature 9.0: Unknown camera parameters, unknown exposure positions</b></p>	<p>UAS hardware is available in a variety of different configurations. High-quality drones with metric cameras are available as well as low budget drones without any high-accurate GNSS or with unknown camera geometry. UASMaster 9.0 now has the ability to process imagery without knowing anything about the camera or photo positions. For project setup, the only essential parameters are loaded imagery and a working coordinate system.</p>
<p><b>New Feature 9.0: Distortion coefficients</b></p>	<p>In version 9 the distortion values can be defined in inpho or USGS definition.</p>
<p><b>New Feature 9.0: Data transfer from and to Trimble Business Center, HCE, Spectra Precision Survey Office</b></p>	<p>If a project will be sent from TBC to UASMaster 9.0, the upcoming dialog which serves for defining the path of the new project, is extended about the definition which project type (Area Mapping or Close Range 3D) should be created.</p>
<p><b>Change 9.0: No standard deviation settings</b></p>	<p>For users not knowing about the input quality of their data, standard deviation settings in the project (tolerances) can be left blank. The processing engine itself will calculate internal defaults in those cases.</p>
<p><b>Change 9.0: No necessary strip definition</b></p>	<p>The strip definition in the project setup for “Close Range 3D” has been removed.</p>
<p><b>Fix 9.0: “done” status at the end of radiometric corrections</b></p>	<p>The vignetting correction and global tilting correction in the image commander now displays a “done” status message as soon as the corrections are finished.</p>



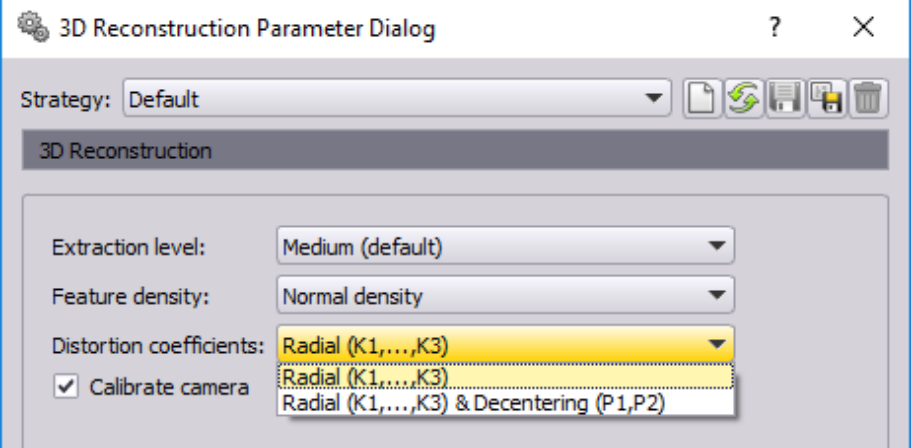
<b>Fix 9.0: JPG2000</b>	The new version fixes several issues related to JPG2000 image formats.
<b>Fix 9.0: Handling of project units</b>	With the new version, the project unit settings are consistently used for all displayed values on the user interfaces.
<b>Limitation 9.0: No support for non-ASCII characters and UNC Paths</b>	Localized operating systems or data types may use local characters that are non-standard for international use. Some of the routines in our software do not fully support those non-ASCII characters which might lead to unexpected results or behavior. Also note that the current version does not support UNC paths for file names.

## Georeferencing

Change	Description
<b>Fix 9.0.3: Image extend consideration for tie point extraction</b>	In case of “Shift cameras” the tie point generation did not cover the complete image. The post-processing removed all matched points outside the image format assuming a PPA of zero. Now the current PPA will be taken into account and therefore also the matched points.
<b>Fix 9.0.3: 3D Reconstruction with LSR coordinate system</b>	The orientation and tie point extraction (“3D Reconstruct” with “Close Range 3D” projects) failed in case a LSR (local space rectangular) coordinate system was selected in combination with no GNSS and GCP information. This has been fixed, projects can now be processed successfully.
<b>Fix 9.0.3: Update of principal point in project editor</b>	After a camera calibration, the update of the principal point in the project editor was not correct. Instead of the new computed value, the dialog still showed a value of 0,0.
<b>Fix 9.0.3: Processing speed</b>	The processing speed in specific steps has been enhanced.





<p><b>New Feature 9.0.2: UASMaster Close Range 3D workflow - Possibility to apply radial distortion coefficients only</b></p>	 <p>With version 9.0.2 the user can decide to apply for the camera calibration during the tie point extraction the radial distortion only or the radial and tangential coefficients. This new feature helps to successfully process i.e. copter flights moving forward and backward, without turning 180° for each strip.</p>
<p><b>Information 9.0.2: The camera calibration parameter “Allow non-squared pixels” are no more available</b></p>	<p>UASMaster will no more provide the calibration of non-squared pixels because this information cannot be applied for the generation of the dense point cloud.</p>
<p><b>Improvement 9.0.1: Extended report file</b></p>	<p>The report file of the georeferencing was extended by a polynomial distortion table and a polynomial distortion graphic.</p>
<p><b>Improvement 9.0.1: Better performance of camera calibration</b></p>	<p>The calibration step was optimized to speed up the navigation through elements. This results in a better performance.</p>
<p><b>Fix 9.0.1: Use of GNSS positions although they were deactivated</b></p>	<p>The GNSS information was used for georeferencing although the use of GNSS was denied. If the GNSS data were wrong, e.g. the height, it was not possible to do the camera calibration until the GNSS entries in the Project Editor were removed. This is fixed.</p>



<p><b>New Feature 9.0: 3D-Reconstruction</b></p>	<p>UASMaster 9.0 now can do the geo-referencing for multi-copter flights with arbitrary flight patterns and oblique views (e.g. flights around buildings, stockpiles etc.) as well as for imagery acquired with any hand-held frame camera. Therefore, the new project type “Close Range 3D” was created.</p>
<p><b>New Feature 9.0: Processing without any approximate positions</b></p>	<p>Approximate positions as essential initial information is not required for “Close Range 3D” projects.</p>
<p><b>New Feature 9.0: Processing without known camera parameters</b></p>	<p>During image import in the project setup coarse camera parameters are extracted from the pure image file. This coarse camera definition is good enough for further processing in UASMaster. For accurate deliverables, a calibration of the camera in the geo-referencing process, however, is essential.</p>
<p><b>New Feature 9.0: Photo Measurement Tool for close-range 3D reconstruction projects</b></p>	<p>A new photo measurement tool for “Close Range 3D” projects is created. The new interface focuses on ease of use with only a basic set of tools to measure reference points.</p> <ul style="list-style-type: none"> <li>- Selecting ground control points</li> <li>- Selecting images for measurements</li> <li>- Picking a coordinate in the image</li> <li>- The set of images to select from is filtered after two measurements are available for a control point.</li> </ul>
<p><b>Fix 9.0: Boresight misalignment handling for projects with more than one camera</b></p>	<p>For projects with more than one camera the IMU boresight misalignment values were not handled correctly. This is fixed.</p>
<p><b>Fix 9.0: Stability of photo measurement tool</b></p>	<p>The new version fixes some stability issues with the photo measurement tool when saving control point measurements.</p>



## Point Cloud Generation

Change	Description
<p><b>New Feature 9.1: Generation of 3D textured meshes from point cloud</b></p>	<p>The generation of 3D textured meshes from point cloud is available supporting different formats:</p> <ul style="list-style-type: none"> <li>• Native OpenSceneGraph Binary (OSGB)</li> <li>• Wavefront (OBJ)</li> <li>• Cesium 3D Tiles</li> <li>• COLLADA - Digital Asset Exchange (DAE)</li> <li>• Native OpenSceneGraph Binary (IVE)</li> </ul> <p>UASMaster does not offer a viewer. We recommend free available 3<sup>rd</sup> party viewers, e.g. the “OpenSceneGraph Viewer” or the “Cesium Web Viewer”.</p>
<p><b>Improvement 9.1: Point cloud quality</b></p>	<p>Version 9.1 offers an improved point cloud quality concerning completeness and noise.</p>
<p><b>Improvement 9.0.3: Dense matching update</b></p>	<p>The matching algorithm for dense matching was improved.</p>
<p><b>New Feature 9.0.2: Parameters added to get best results for dense point cloud</b></p>	<p>UASMaster surface generation will provide now controlling parameters to influence the quality and processing time for the generation of the dense point cloud.</p> <p>For more information, use the “What’s This?” function.</p>



<p><b>Fix 9.0.1: Generation of dense point cloud</b></p>	<p>The library used for the generation of the dense point cloud is updated, together with a fix of a problem in the handling of distortions for internal parameter settings. This will result in better dense point clouds.</p>
<p><b>New Feature 9.0: Dense 3D point cloud</b></p>	<p>In version 9 a new dense point cloud generation is added. For UASMaster Close Range 3D this 3D point cloud is the final result. It is prepared for use in TBC or Trimble RealWorks as base for further use, e.g. volume calculation, profile cuts etc.</p>
<p><b>New Feature 9.0: Sparse 3D point cloud</b></p>	<p>Version 9 offers the possibility to create a sparse 3D point cloud using the tie-point from the georeferencing process. This fast option may sufficient for some applications.</p>



<b>New Feature 9.0: GPU Support for dense point cloud generation</b>	Geo-referencing in 3D reconstruction projects now benefit from GPU processing if suitable graphics cards are detected.
<b>Recommendation 9.0: Provision of free disk space</b>	The temporary files for the generation of the dense point cloud will need huge disk space which could reach the 20-times space of the input data. Therefore, provide enough space for the temporary structure.

## Point Cloud Editing, CAD Functionality

Change	Description
<b>Fix 9.0.1: UASMaster recently does not show layers after the DXF file import</b>	In case the DXF file header does not declare the layers UASMaster does not show layers after the import. UASMaster is now able to show the layers after the import of DXF files without header declaration.
<b>Fix 9.0.1: Fit view</b>	The main view was lost after using the “Fill area” function in UAS Edit. This is fixed.
<b>Improvement 9.0: File information</b>	The information displayed with the “Vector File Info” tool is now clearly showing the size in X and Y.
<b>Improvement 9.0: Units in filter settings</b>	Angular values in the filter settings have been changed from arc tan to degree.
<b>Fix 9.0: No data values in GeoTIFF headers</b>	The new version can now correctly work with no data values for statistics in a GeoTIFF header.
<b>Fix 9.0: Generating point cloud overviews with negative point coordinates</b>	The creation of the octree structure used for the point cloud overview was defective if all points showed negative coordinate values.



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