Digital Photogrammetric System

# PHOTOMOD

Version 7.5

# USER MANUAL

## Processing of UAS data

RACURS

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# 1. About

## 1.1. Purpose of the document

This document contains detailed information about UAS data processing in the *PHO-TOMOD UAS* program. The document contains recommendations of processing order, program properties to obtain the best results, and also contains description of additional possibilities when working with UAS data.

## 1.2. Brief description of system features

The *PHOTOMOD UAS* program is purposed to process data from unmanned aircraft system (UAS). There is a limit on using of the source data when working with program.

⚠ Only central projection images with size not more than 100 Mpix could be used a source data.

The following definitions for UAS projects processing are provided in the program:

• preliminary preparing of source images;

• images interior orientation;

• relative orientation of images;

• input and measurement of GCP coordinates;

• Images exterior orientation;

• vectorization;

• stereovectorization;

• building DEM;

• creating orthomosaic;

• creating digital map;

• creating 3d-models.

## 1.3. Technical Support

The Racurs company technical support provides the actual information about system functionality, characteristics, price and services.

For technical support use one of the following ways:

- e-mail: support@racurs.ru;

- phone: +7 (495) 720-5127;

- mail: RACURS Co., Ul. Yaroslavskaya, 13-A, office 15, Moscow, Russia;

## 1.4. Distribution kit

The *PHOTOMOD UAS* program is a stand-alone software, which does not require the *PHOTOMOD* system installation. Also the program could be launched as a module of the *PHOTOMOD* system.

License software distribute in a branded box.

The company name is place on the front. On the reverse side are placed address, technical support service phone and e-mail, web-site of company.

The system distribution kit includes:

- CD-ROM containing the system setup files and the documentation files in PDF format;

- ʼSystem installation and configuration Manual;

- Unique hardware lock key (see Section 2.4).

## 2. System installation

Prior to the system installation it is desirable to insert *Sentinel HL* security key into the USB-socket of the workstation.

The system required 2 GB of free hard disk space.

To start the system installation, launch the `setup.exe` file or input the installation software and launch the `autorun.exe` file.
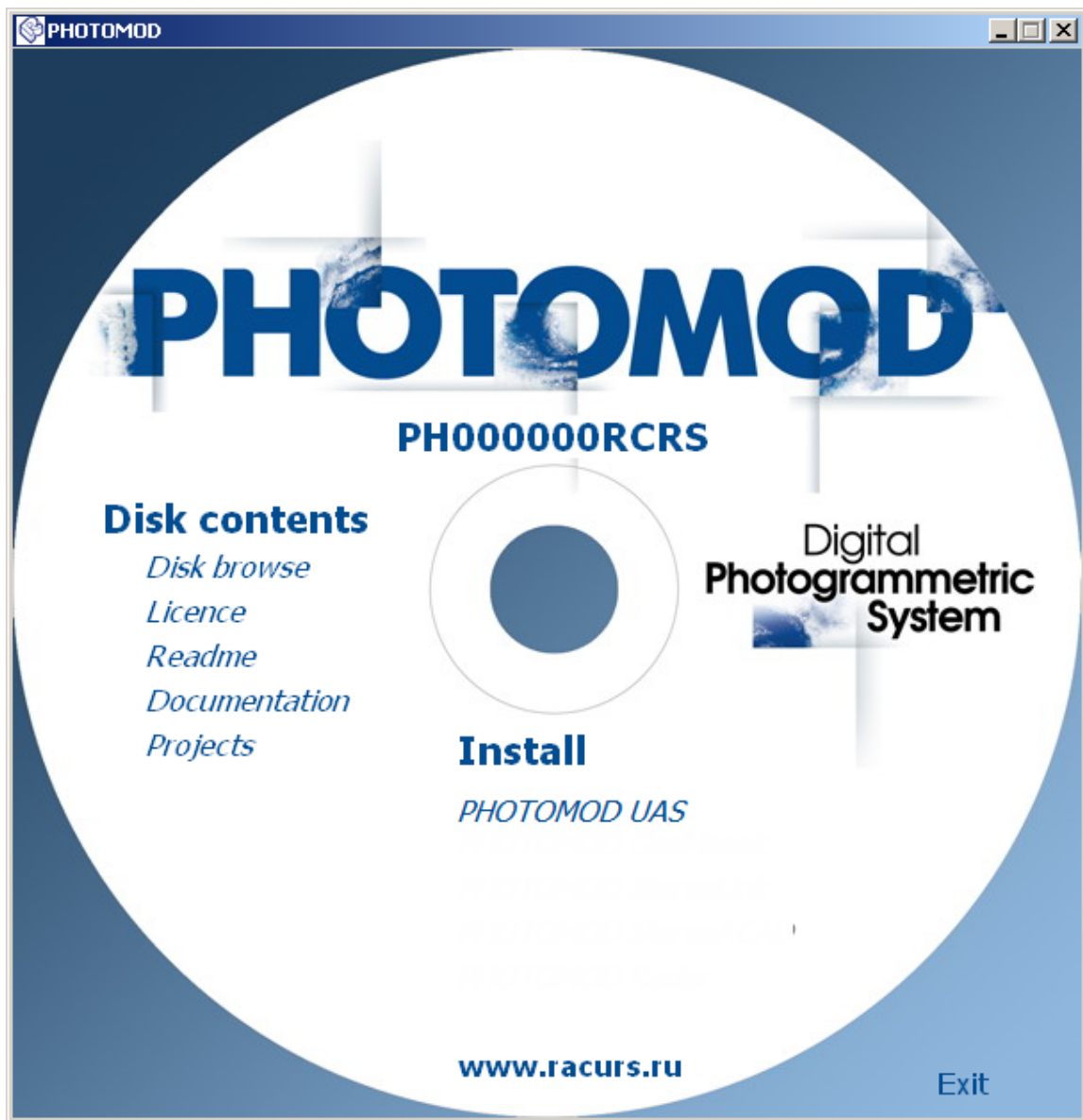
The **PHOTOMOD** window opens.

Fig. 1. PHOTOMOD installation window

Click **Install › PHOTOMOD UAS**. The **Installation PHOTOMOD 7 UAS** window opens.

The system initial installation process consists of a sequence of steps with instructions.

> In case of cancel at any step, installed program files and data are not removed. To complete the system installation, restart the `autorun.exe` or `setup.exe` file and go through all steps again.
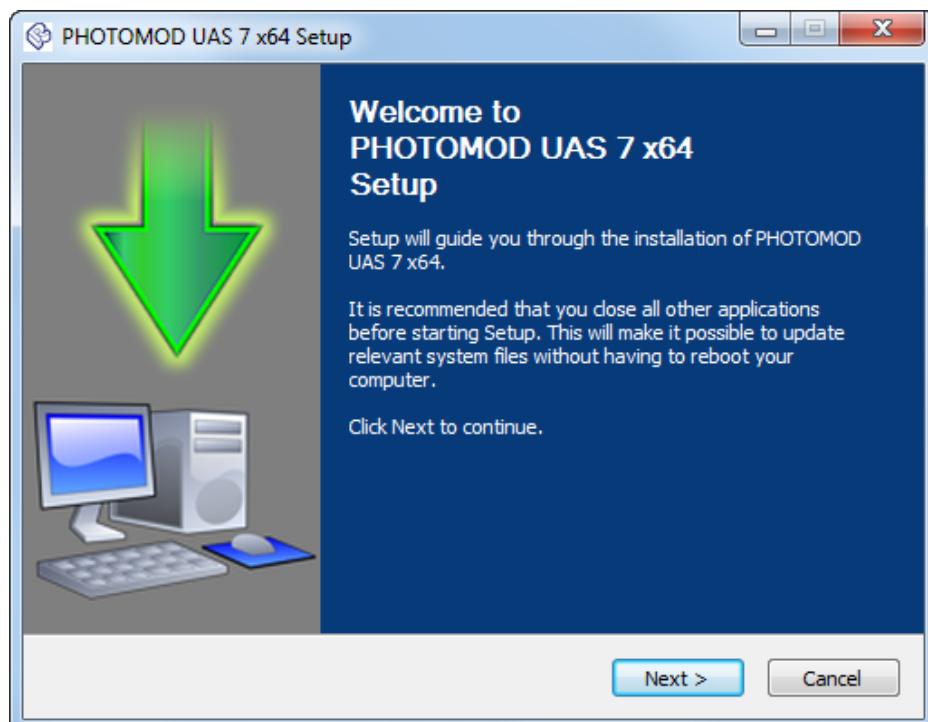
## 2.1. Preparation step

> It is strongly not recommended to install the system in folder with name, which contains letters, different from Latin. By default for the *C:\Program Files\PHOTOMOD_7_UAS_x64* folder is used.
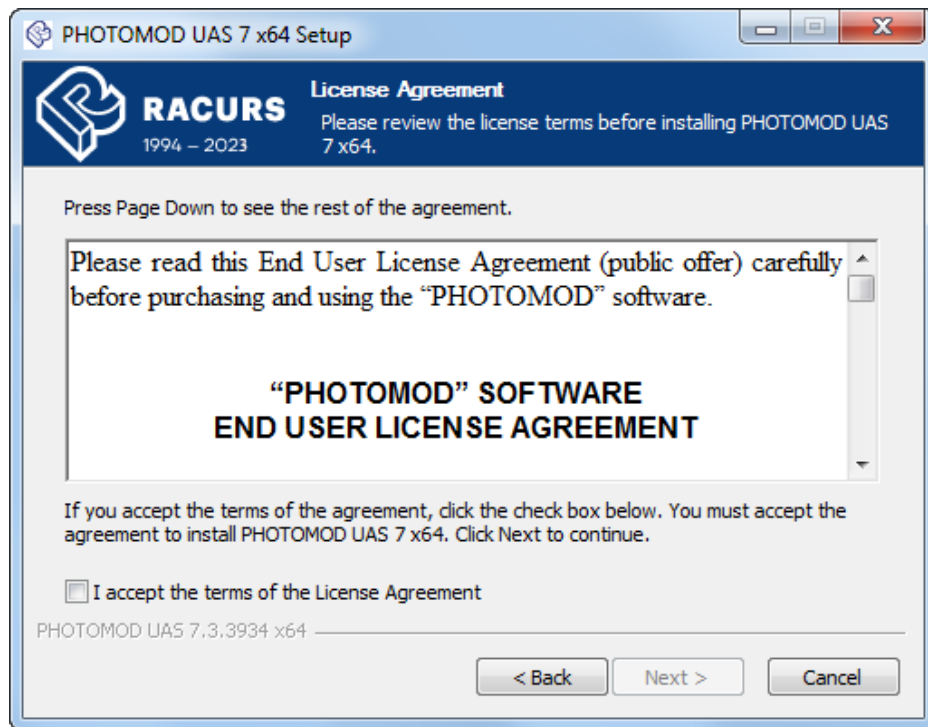
1.  Choose the installer language. Click OK;
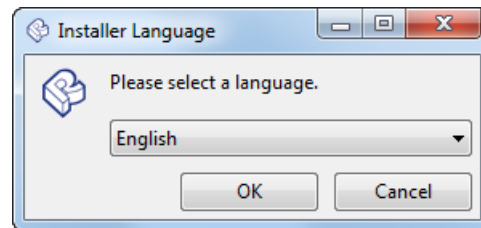


2.  Read the welcome and warning messages. Click the **Next** button.



3.  Read the license agreement. If you agree with it, set the **I accept the terms in the License Agreement** checkbox on and click the **Next** button.

4.  Define the folder to install the program files of the system. Click the **Next** button.
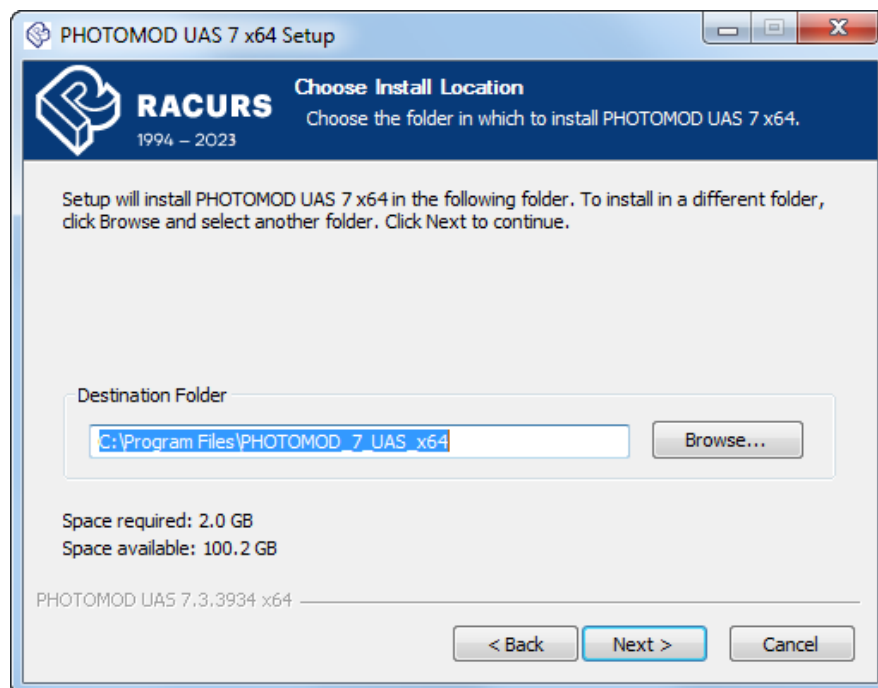


5.  Enter a folder name for the PHOTOMOD programs and modules in the Windows **Start** menu. A shortcuts in the *Windows* **Start** menu will be created by default. Otherwise – clear the appropriate checkbox. Click the **Install** button.
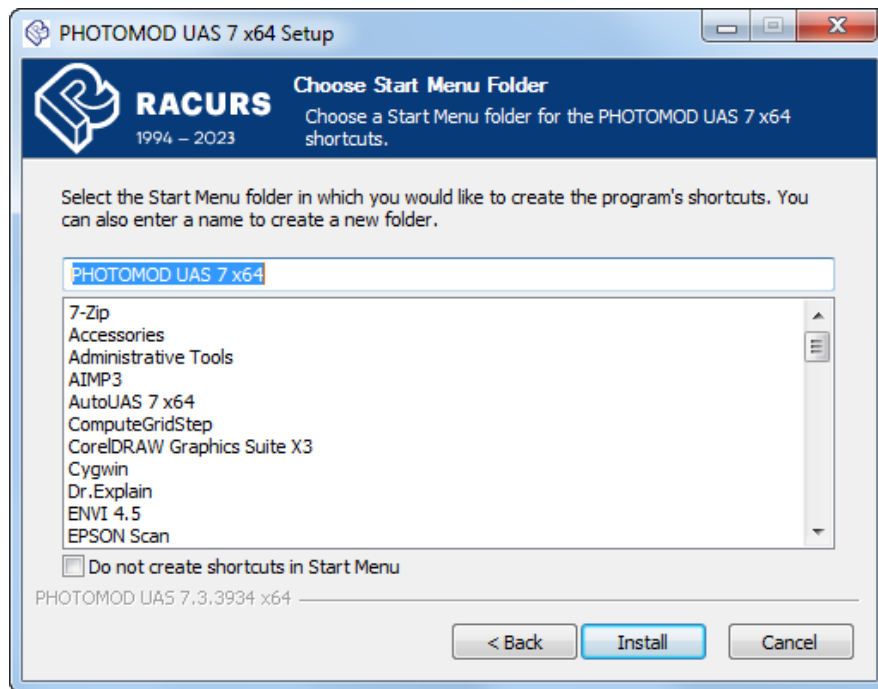
## 2.2. File copy stage

1. Wait until the installation is complete;



2. When installation complete perform one of the following actions:

- [optional] clear the **Start PHOTOMOD UAS x64** checkbox and click the **Finish** button to complete the installation process without program launch;

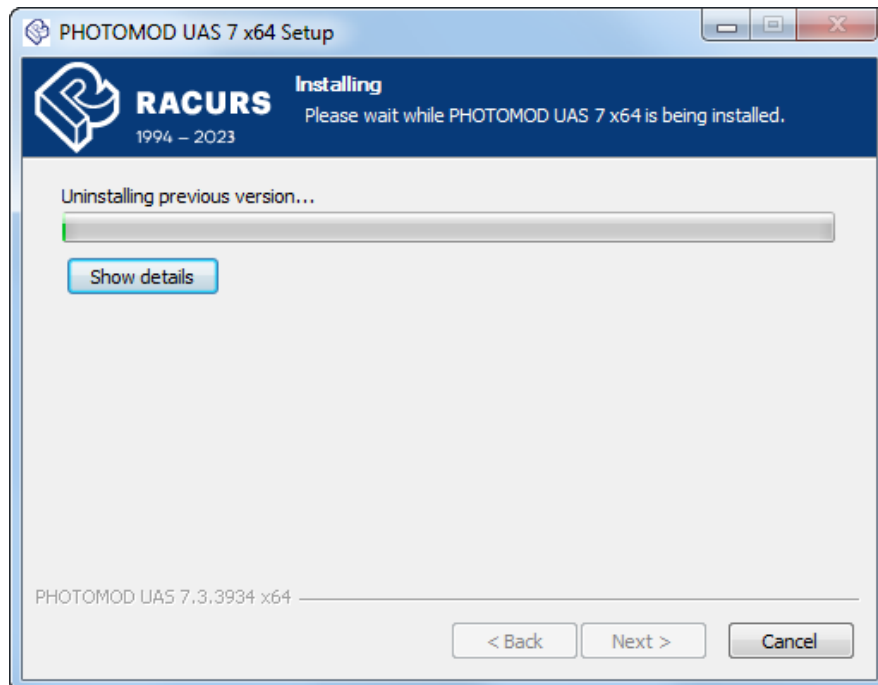- [optional] leave the **Start PHOTOMOD UAS x64** checkbox set and click the **Finish** button to proceed to the system configuration stage.

> The **Create shortcuts on Windows desktop** checkbox is set on by default. Clear it if needed.

> If the **Start PHOTOMOD UAS x64** checkbox is set, the *PHOTOMOD UAS* program will launch automatically.
>
> If the security key or security key drivers (they must be installed automatically during the program installation) were not found, the error message displays.
>
> Make sure that the *Sentinel HL* security key is inserted into the USB-socket of the workstation. Install the security key drivers manually and restart the system.
>
> In case of problems contact the Racurs company technical support service (see *Section 1.3*).

## 2.3. System configuration stage

During the first launch of the system, the message about the required detailed configuration appears. The initial setup of the program can be performed in various ways, depending on the circumstances of the system installation on a particular workstation. The most common situations are the following:

- The system was installed on this workstation for the first time. The user needs to create a folder for storing settings, a resource system, and profiles for organizing local and/or network work. This procedure will be discussed in detail below in this chapter.

- If other *Racurs* software products (*PHOTOMOD*, *PHOTOMOD Conveyor*) are already installed and configured on the workstation, the user can quickly connect the installed program to existing profiles and resource systems.

  If the connection did not occur automatically during the first launch of the installed program, then in the **Initial setup** window that opens (see below), an already existing **settings folder** used by previously installed software products is indicated;

- The system is installed and configured on several workstations connected to each other via a local network. A new computer is added to the local network where this program was installed for the first time. Connecting such a workstation to an existing network profile is described in "Connecting to existing network profiles" chapter of "General information" User Manual.

## 2.3.1. Fast system configuration

During the first launch of the system the *PHOTOMOD UAS* initial (fast) setup windows are opened.

> If other *Racurs* software products (*PHOTOMOD*, *PHOTOMOD Conveyor*) are already installed and configured on the workstation, the user can quickly connect the installed program to existing profiles and resource systems. To do this choose the already existing **settings folder** used by previously installed software products in **PHOTOMOD initial setup** window.
>
> To minimize the process of the program quick setup and go to the **PHOTOMOD initial setup** window (as part of the standard setup of the program), close the quick setup window (or click **Cancel**).

1. Click the ⟨...⟩ button to select a physical folder on a local PC to store *resources* of the *PHOTOMOD UAS* projects (see the "Main definitions of resources system" chapter of the "General information" User Manual). Click OK.

   > It's impossible to use logical disk root folder.

   > Resources can take up a significant amount of free space on hard drive.
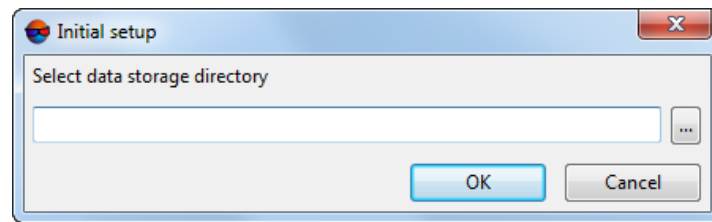
Fig. 2. Choosing a folder to store the projects (an intermediate data)

2.  In the **Settings folder** field is displayed path to the *PHOTOMODUAS7.VAR* folder, that is used to store configuration files. Click the [ ... ] button to change path to configuration folder or click OK to finish fast system configuration and create the *local profile* automatically (see the "Creating local profile" chapter of the "General information" User Manual).
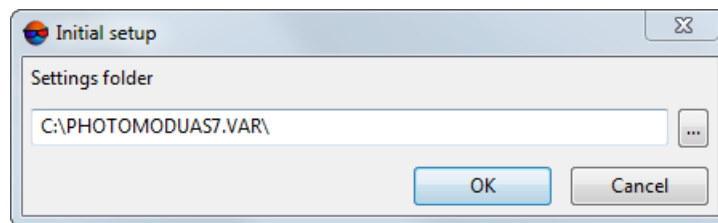


Fig. 3. Choosing a folder to store the configuration files

> The *Control Panel* module is used to configure detailed system settings during the further work. More details about program resources, recommendations on organizing of local or network work, and about creating profiles and virtual folders connecting see the "Control Panel. Profiles management" chapter of the "General information" User Manual.

## 2.3.2. Advanced system configuration

If the existing folder for data storage (or configuration files folder) are not specified during the fast system setup, the message about the required detailed configuration appears. To do this, perform the following:
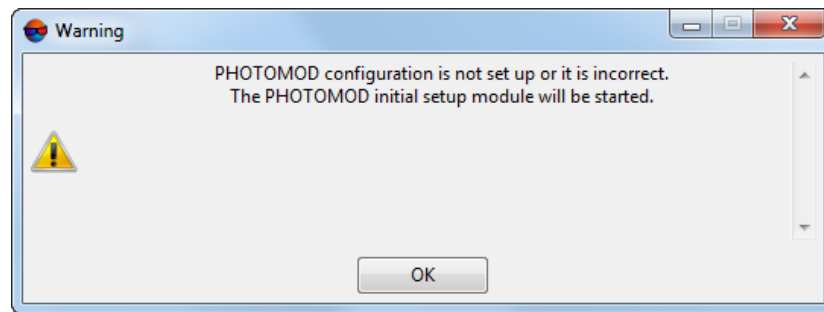
1.  Click OK.

Fig. 4. Information message

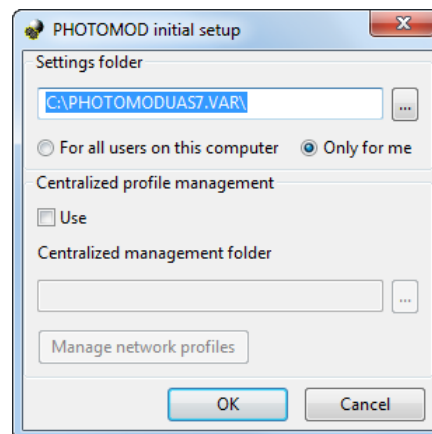2.   The **PHOTOMOD initial setup** window opens:



Fig. 5. The "PHOTOMOD initial setup" window

In the **Settings folder** section is displayed path to the *PHOTOMODUAS7.VAR* folder, that is used to store configuration and temp files. Click the [ ... ] button to change path to configuration folder.

> If other *Racurs* software products (*PHOTOMOD*, *PHOTOMOD Conveyor*) are already in-stalled and configured on the workstation, the system provides for connecting the program to existing profiles and resource systems.
>
> For this, the **settings folder** is to be specified which is used by these software products. In this case, the user will not be required to perform the steps described below to create a new local profile.

> Choose **For all users on this computer** to use one configuration folder for all users of current workstation, otherwise choose **Only for me**.

In the **Centralized management folder** section set the **Use** checkbox on and define a folder.

> Creation of a *local profile* is described in this Chapter. *Network profiles* management is described in "Creating network profile" chapter of the "General information" User Manual.

3.  An info that at least one *local profile* is to be created appears:
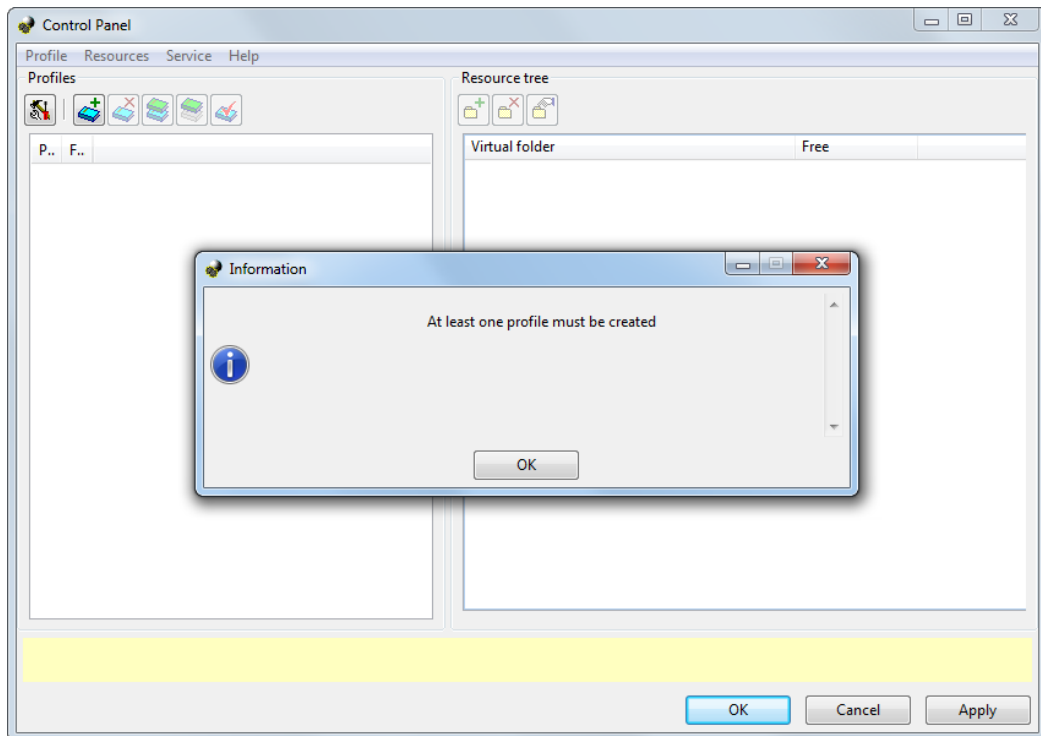


Fig. 6. Information message

Нажмите OK.

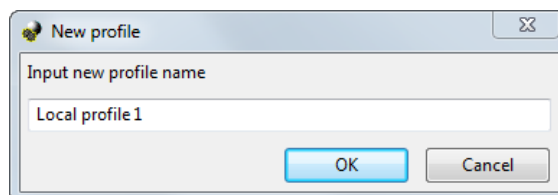4.  Specify a *local profile* name:



Fig. 7. Local profile name setup

Click OK.

5.  Input a **virtual folder name** – arbitrary text used to identify data in folder.
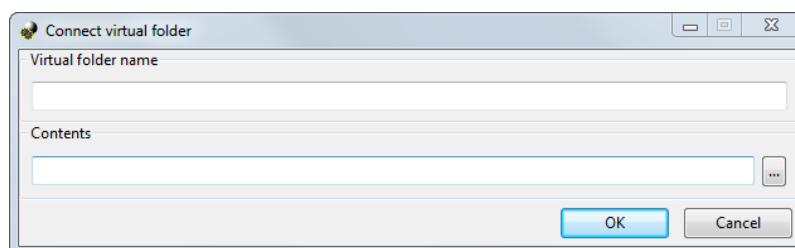
Fig. 8. Connect virtual folder

In the **Contents** section choose a physical space for connecting as a virtual folder:

• choose **Folder** to use only one *network or local* physical folder click the [ ... ] button and choose a folder;

> It's impossible to use logical disk root folder.

> To connect folder only read access for this folder is required.

> Local profile folder could be placed both on a workstation, where the system runs, and on any workstation of the network.

• [optional] choose **Storage group** to use several local or network folders as virtual.

> The use of a group of storages is described in detail in "Storages" chapter of the "General information" User Manual.

Click OK.

## 2.4. Sentinel hard lock key

The distribution kit includes the unique hard lock key from *Sentinel HL* (previous called *HASP*), to protect the system and data from software piracy and unauthorized dissemination.

Prior to work in the program, it is needed to insert *Sentinel HL* unique security key into the USB-socket of the workstation. The security key drivers should be installed on the workstation too.

If the *Sentinel HL* hard lock key or security key drivers (they must be installed automatically during the program installation) are not found, the error message of protection system displays. Contact the Racurs company technical support service (see *Section 1.3*) to for the consultation.

In case of problems with installation of security key drivers, install it manually. To do this open the *Hasp\Sentinel_HASP_Run-time_setup* folder from the installation CD and

launch the `HASPUserSetup.exe` file. Install security key drivers with default parameters. You can also download the last version of security key drivers on this link.

To check congruity of hard lock key perform the following:

1.  Choose **License info** in the right-click menu of the *System Monitor module* (the  icon in the *Windows* system tray). Process of licences checking starts. After checking, the **PHOTOMOD Distribution info** windows opens.
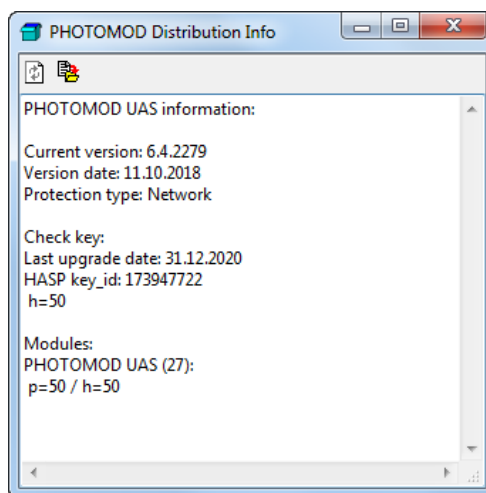


Fig. 9. Distribution Info

2.  Compare the unique number of security key in the `Serial number` line with the number on hard lock key.

3.  Compare quantity of license for modules in each line below the name of module. Quantity of licence in the hard lock key and in certificate should be equal.

> *'h'* is quantity of licence in the hard lock key, *'p'* is quantity of licence in certificate.

4.  If number are not equal contact the RACURS company technical support service.

> If there is not enough RAM or resource-intensive tasks are performed on workstation with the secure key, The protection system failure or loss of data are possible.

## 2.5. System deinstallation

To remove the system from computer, close all modules of the system and choose **Start › Programs › PHOTOMOD 7 UAS x64 › Uninstall PHOTOMOD UAS x64** or use standard tools in **Control panel** of *Windows file system*.

# 3. Interface and its elements

## 3.1. Work area interface

The GUI contains the following elements:

• the main menu, which contained the all program functionality (*A*);

• the main toolbar is used for quick access to main program functions and also contains **Aerial Triangulation**, **Compute DEM** and **Compute Orthophoto** tabs (*B*). The tabs layout and content displays the main steps of UAS data processing workflow;

• the optional toolbars is used for quick miscellaneous program functions access (*O*);

> Toolbars could be placed only one-lined, horizontal or vertical.

• the 2D-window, used for data displaying, contains the following elements:

   ○ the toolbar is used for the 2D-window modes managing (*C*);

   ○ the work area is used for viewing and processing with loaded data of mosaic project (*F*);

   ○ the navigation bar is used for fast moving on the specified block images area of mosaic project (*D*);

   > By default on launch of the program layers are not shown in the navigation window. If necessary, click the **Navi** tab and choose layers to display.

   ○ the *Layer manager* is used for managing of project layers (*E*);

   ○ the axes direction of project coordinate system (*M*);

   ○ the status bar is used for viewing current real (ground) and pixel marker coordinates and brightness, contrast and gamma data adjustment in the work area (*G, K, L*).

   > When place marker is on the area out of image or on background, brightness is indicated as *NULL*.
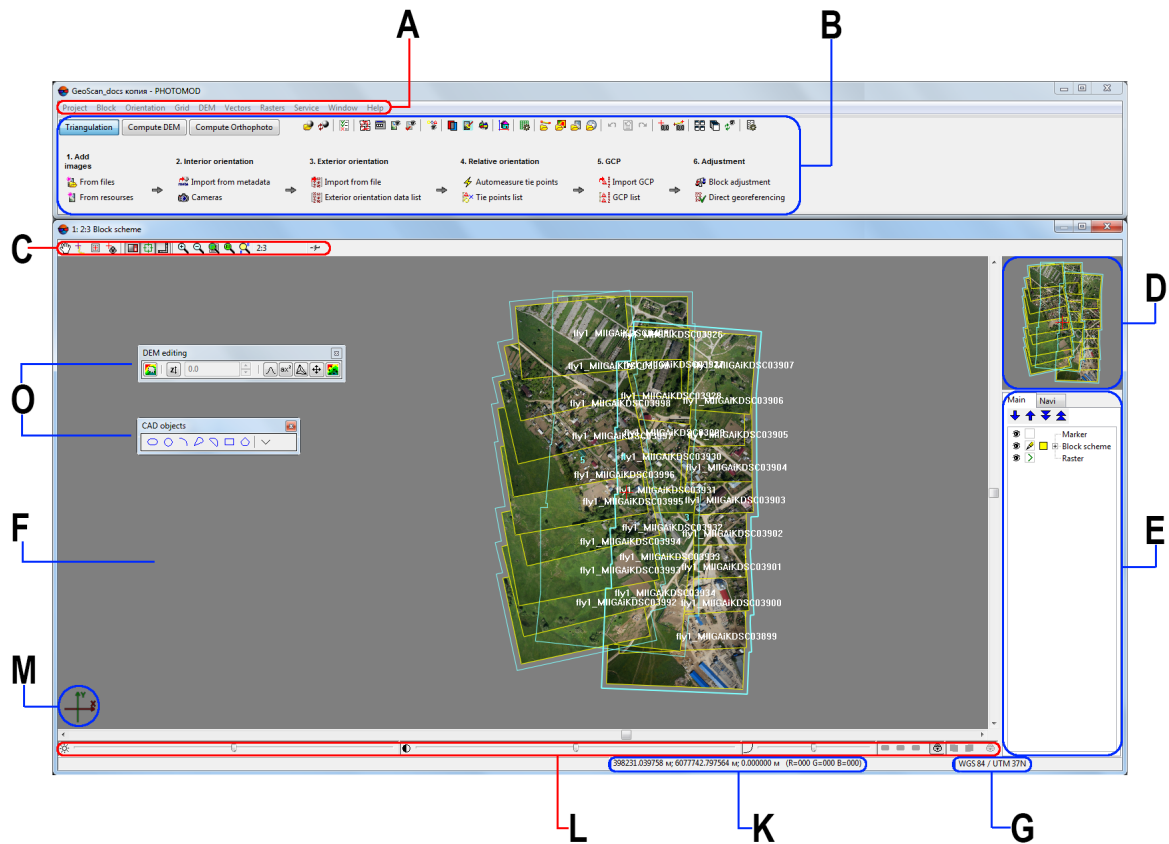
Fig. 10. The main program's window

## 3.2. The main toolbar

The main toolbar is used for quick access to main program functions and also contains **Aerial Triangulation**, **Compute DEM** and **Compute Orthophoto** tabs. The tabs layout and content displays the main steps of UAS data processing workflow;

Table 1. Brief description of main toolbar

| Buttons | Function |
|---------|----------|
| | allows to open block editor window (see the 'Project creation' User Manual) |
| | allows to reload project to display the last saved version of project |
| | allows to perform import of exterior orientation from metadata |
| | allows to open block layout window (see the 'Aerial triangulation' User Manual) |
| | allows to open block editor window (see the 'Project creation' User Manual) |

| Buttons | Function |
|---|---|
| | allows to display all images, loaded to project, in the **Block scheme** window |
| | allows to display only selected on scheme images in the **Block scheme** window |
| | allows to load triangulation points |
| | allows to open 2D-window for selected stereopair (see the 'Vectorization' User Manual) |
| | allows to launch the *DustCorrect module* to edit MS-TIFF images (see the Project creation User Manual) |
| | allows to run the *GIS Panorama Mini* (this software is not included with the *PHOTOMOD* but can be installed separately) |
| | allows to launch the 3D-mod module |
| | allows to create, open and save regular nodes grid (see the 'Create DTM' User Manual) |
| | allows to load vector file into the project (see the 'Vectorization' User Manual) |
| | allows to load DEM file |
| | allows to load georeferenced raster image to project as a layer |
| | allows to load web-map |
| | allows to undo the last action (see the 'General system's parameters' User Manual) |
| | allows to display the list of last actions (see the 'General information about system' User Manual) |
| | allows to redo the last undone action (see the 'General system's parameters' User Manual) |
| | allows to open the **Marker** window (see the menu description in 'Vectorization' User Manual) |
| | allows to open the **Measurements** window (see the menu description in 'Vectorization' User Manual) |
| | allows to tile 2D-windows |
| | allows to stack 2D-windows |
| | allows to refresh all opened 2D-windows |
| | allows to open the general program parameters window (see the 'General system's parameters' User Manual) |

If the *GIS Panorama* executable file is not found, an appropriate system message will appear. The software description and URL hyperlink (for download) are indicated in this message.
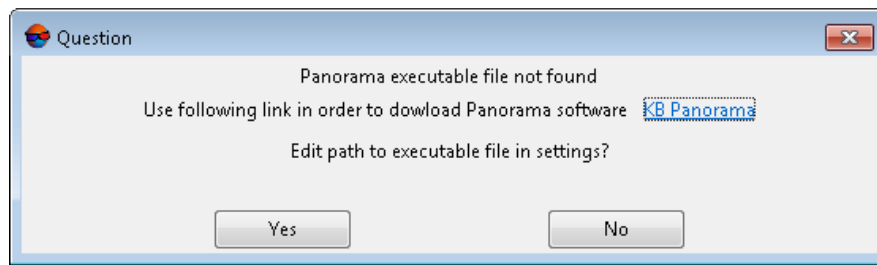
Click **Yes** to go to path settings (see the "Paths settings" chapter of the "General system's parameters" User Manual.

Table 2. Brief description of the "Triangulation" tab of the main toolbar

| Buttons | Function |
|---|---|
| **From files** | is used for adding image files, locating in the resources out of active profile, to the selected strip (see the "Adding images from files" chapter of the "Creating project" User Manual) |
| **From resources** | is used for adding image files, locating in the resources of active profile, to the selected strip (see the "Adding images from resources" chapter of the "Creating project" User Manual) |
| **Import from metadata** | allows to perform import of exterior orientation and interior orientation parameters from metadata (see the "Import orientation from metadata" chapter of the "Aerial triangulation" User Manual) |
| **Cameras** | allows to input/edit parameters of project cameras, and also to assign cameras to project images (see the "Images interior orientation" chapter of the "Aerial triangulation" User Manual) |
| **Import from file** | allows to perform import of exterior orientation data from file of text format (see the "Import of exterior orientation parameters" chapter of the "Aerial triangulation" User Manual) |
| **Exterior orientation data list** | allows to open exterior orientation data list (see the "List of exterior orientation parameters" chapter of the "Aerial triangulation" User Manual) |
| **Automeasure tie points** | allows to setup and start automatic tie points measurement using UAS data (see the "Automatic measurement of tie points coordinates (aerial survey)" chapter of "Aerial triangulation" User Manual) |
| **Tie points list** | allows to open **tie points list** (see the "The "Triangulation points" window" chapter of the "Aerial triangulation" User Manual) |
| **Import catalog** | allows to perform import of ground control points from `*.txt` and `*.csv` files (see the "Import of GCP catalogue" chapter of "Aerial triangulation" User Manual) |

| Buttons | Function |
|---|---|
| ▲ **GCP list** | allows to open **GCP list** (see the "GCP list" chapter of the "Aerial triangulation" User Manual) |
| **Block adjustment** | allows to open the **adjustment** toolbar (see the "Block adjustment" User Manual) |
| **Direct georeferencing** | allows to perform adjustment using imported exterior orientation parameters (see the "Aerial triangulation" and "Block adjustment" User Manuals) |

Table 3. Brief description of the "Compute DEM" tab of the main toolbar

| Buttons | Function |
|---|---|
| **Compute points** | allows to start automatic points calculation (see the "Points automatic calculating" chapter of "DTM Generation" User Manual) |
| **Buildings and vegetation filter** | allows to launch the buildings and vegetation filter *for points* (see the "Buildings and vegetation filter" chapter of "DTM Generation" User Manual) |
| **Build TIN** | allows to build TIN by points and breaklines (**Ctrl+N, T**, see the "Building TIN" chapter of "DTM Generation" User Manual) |
| **Build from TIN** | allows to build DEM by loaded TIN (**Ctrl+N, D**, see the "DEM creation by TIN" chapter of "DTM Generation" User Manual) |
| **Build contours** | allows to create contour lines by DEM (see the "" chapter of "DTM Generation" User Manual) |
| **Dense model** | allows to build dense DEM using SGM method (see the "Dense DEM generation using SGM method" chapter of "DTM Generation" User Manual) |
| **Buildings and vegetation filter** | allows to launch the buildings and vegetation filter *for DEM* (see the "Buildings and vegetation filter" chapter of "DTM Generation" User Manual) |
| **Fill NULL cells** | allows to restore null cells of DEM using the smooth interpolation method (see the "Filling null cells using smooth interpolation" chapter of "DTM Generation" User Manual) |

Table 4. Brief description of the "Compute Orthophoto" tab of the main toolbar

| Buttons | Function |
|---|---|
| **Orthorectification** | allows to display the orthorectification toolbar (**Ctrl+Alt+M**) (see the Orthomosaic building User Manual) |
| **Start GeoMosaic** | allows to start *PHOTOMOD GeoMosaic* program (see the The Orthophotomaps creation User Manual) |

## 3.3. Brief description of main menu

The program main menu contains the menu items for mosaic creation, vector data processing, additional applications starting and setting parameters.

Table 5. Main menu

| Menu | Function |
|---|---|
| **Project** | contains menu items to create, open, save and convert project, and also to get an information about project |
| **Block** | allows to form images block of mosaic project |
| **Orientation** | contains menu items to interior orientation, load and use ground control and triangulation points, exterior orientation parameters and also to import and export triangulation points for various formats |
| **Grid** | allows to create, open and save regular nodes grid (see the "Regular grid of nodes" chapter of the "Create DTM" User Manual) |
| **Terrain** | allows to prepare the base layers for the further DTM/DSM creation: calculating 3D-points, building TIN & textured TIN 3D surface, building DEM, building LAS point clouds, building true ortho, building smooth contours |
| **Vectors** | purposed for creating, editing, import/export of vector data (see the "Vectorization" User Manual) |
| **Rasters** | allows to load and georeference raster images, and also to launch additional modules for editing and orthorectification images |
| **Service** | allows to launch applications, load additional data, set general parameters and edit coordinate systems |
| **Window** | allows to open additional toolbars and windows: new 2D-window, Marker and Measurements windows, window of Object Attributes (see "The "Windows" menu" chapter of the "General information about system" User Manual) |
| **Help** | allows to start the *"Help"* system |

## 3.4. The "Project" menu

Table 6. Brief description of "Project" menu

| Menu items | Function |
|---|---|
| **New...** | allows to create a new project (see the "Project creation" chapter of the "Creating project" User Manual) |
| **Open/Manage** (**Ctrl+Alt+O**); | allows to open the project management window (see the "Project management window" chapter of the "Creating project" User Manual) |

| Menu items | Function |
|---|---|
| **Copy** | allows to create a copy of project selected in the list (see the "Copying project" chapter of the "Creating project" User Manual) |
| 🔄 **Reload** | allows to reloads a project to update it after changes appeared during mutual work |
| **Synchronize** | allows to re-calculate a project data after editing of some parameters, e.g. re-calculates interior orientation after changing camera parameters |
| **Close** | allows to close current project and to start "without project" mode (see the ""Without project" mode" chapter of the "Creating project" User Manual) |
| **Properties** | allows to open the window used to view and edit some parameters of opened project (see the "Project properties" chapter of the "Creating project" User Manual) |
| **Recent** | allows to open a list of projects opened recently in the system |
| 🔧 **Join projects...** | allows to merge data from several projects of active profile (see the "Joining projects" chapter of the "Creating project" User Manual) |
| 📋 **Project state** | allows to display processing status of the following project stages (see the "Viewing project report" chapter of the "Creating project" User Manual) |

## 3.5. The "Block" menu

The **Block** menu, buttons of **Block editor** window's toolbar and **Block forming** additional toolbar are used to work with images block in 2D-window.

It includes extended features for images block forming, as well as additional functions for block scheme creation and obtaining of auxiliary data.

Some menu items allow to manage operations with selected images in 2D-window. The **Tools** additional toolbar is used for group selection (highlighting) of images block in 2D-window (see the "Vectorization" User Manual).

Detailed information about **Block** menu items, buttons of **Block editor** window's toolbar and **Block forming** additional toolbar see in the "Project creation" User Manual.

Table 7. Brief description of the "Block" menu

| Menu items | Function |
|---|---|
| 📁 **Add images from files** | allows to add image files, locating in the resources out of active profile, to the selected strip (see the "Adding images from files" chapter in "Creating project" User Manual) |

| Menu items | Function |
|---|---|
| ![] **Add images from resources** | allows to add image files, locating in the resources of active profile, to the selected strip (see the "Adding images from resources" chapter in "Creating project" User Manual) |
| **Add images from resource folder** | allows to automatically add images from specified folder of active profile resources to selected strip, with or without its subfolders |
| **Split to strips** | contains menu items used to split images block to strips automatically using images names or exterior orientation parameters (see the "Splitting into strips" chapter in "Creating project" User Manual) |
| ![] **Block editor** (**Ctrl+Alt+B**) | allows to open the **Block editor** window |
| ![] **Block layout** (**Ctrl+Alt+L**) | allows to open the **Block layout** window to build block scheme in 2D-window considering source or acquired data (see the "Aerial triangulation" User Manual) |
| **Create overlap map...** | allows to create map of images and/or strips overlap in new vector layer (see the "Creating overlap map" chapter of the "Creating project" User Manual) |
| **Additional** | contains the **Additional** menu (see below) |

Table 8. Brief description of the "Block" menu (Additional)

| Menu items | Function |
|---|---|
| ![] **Add strip** | allows to add new strip |
| ![] **Delete strip** | allows to delete selected strips of block in 2D-window |
| ![] **Strip properties** | used to view and edit properties of selected strips – strip's name and type (regular or irregular) |
| **Invert image order in strip** | allows to invert strips order |
| **Selected strips to block start** | allows to move selected strips to the beginning |
| **Selected strips to block end** | allows to move selected strips to the end |
| ![] **Add strip** | allows to add new strip |
| ![] **Delete strip** | allows to delete selected strips of block in 2D-window |
| ![] **Strip properties** | used to view and edit properties of selected strips – strip's name and type (regular or irregular) |
| ![] **Move selected strips up** | allows to move selected strips one strip up |
| ![] **Move selected strips down** | allows to move selected strips one strip down |
| **Make selected strips irregular** | allows to change regular strip to irregular |
| **Make selected strips regular** | allows to change irregular strip to regular |
| ![] **Delete images** | allows to remove selected images from project |
| **Delete images selectively...** | allows to select images in accordance with specified criteria for deleting (see the "Deleting images selectively" chapter of the "Creating project" User Manual) |

| Menu items | Function |
|---|---|
| **Image properties** | is used to display and edit properties of selected image |
| **Move images** | opens a group of menu items used to images block editing; allows to invert images order in a strip, and to move selected image left/right/up/down |
| **Image radiometric correction** | allows to perform radiometric correction of selected image (see the "Radiometric correction" chapter in the "Project creation" User Manual) |
| **Show images** | allows to show images of block in 2D-window if the limitation on images display is specified on the **Block scheme \| Raster** tab in the **Settings** window (see "General information" User Manual) |
| **Show selected images only** | allows to turn on/of selected images display |
| **Check images** | allows to check images, for example, to find images, where radiometric correction is recommended |
| **Mark all images as checked** | allows to exclude project images validation - check their presence and compliance to images files during project opening at the next working session |
| **Marker to selected image** | allows to move marker to center of the image, selected in the list of the **Block editor** window |
| **Brightness adjustment** | allows to build brightness adjustment for all block scheme (see the "Brightness adjustment" chapter in the "Project creation" User Manual) |
| **Delete brightness adjustment** | allows to delete the brightness adjustment results (see the "Brightness adjustment" chapter in the "Project creation" User Manual) |
| **Rotate selected images** | allows to rotate selected images at any angle relatively to initial or current position of block images |
| **Rotate images by block layout** | allows to rotate all or selected images of block considering block layout data; images don't rotate if the **w\o layout** was used (see the "Aerial triangulation" User Manual) |
| **Set GSD for selected images** | allows to define/calculate GSD value in meters for all or selected images of block (see the "Specifying ground sample distance (GSD)" chapter in the "Project creation" User Manual) |
| **Create vector layer from block layout** | allows to create vector layers with common block outline, boundaries of all images or selected image of the block (see the "Creating vector layers from block layout" chapter in the "Project creation" User Manual) |
| **Build pre-regions** | allows to create pre-regions by images/stereopairs to provide joint work on a project (see the "Creation pre-regions for a block" chapter in the "Project creation" User Manual) |
| **Export block layout to KML...** | allows to export block scheme to KML format |

# 3.6. The "Orientation" menu

To perform work on data collection for aerial triangulation serves the **Orientation** menu, and also buttons of the main toolbar and of the **AT** additional toolbar.

Table 9. Brief description of the "Orientation" menu

| Menu items | Function |
|---|---|
| **Manage projects cameras** (**Ctrl+Alt+I**) | allows to input/edit parameters of project cameras, and also to assign cameras to project images (see the "Project cameras management" chapter of the "Aerial triangulation" User Manual) |
| **Import orientation from metadata...** | allows to perform import of exterior orientation from metadata (see the "Import orientation from metadata" chapter of the "Aerial triangulation" User Manual) |
| **Import exterior orientation** | allows to open the Exterior orientation data list (see the "Import of exterior orientation parameters" chapter of the "Aerial triangulation" User Manual) |
| **Automatic tie points measurements** | contains menu items used to measure tie points coordinates in automatic mode (see the "Automatic measurement of tie points coordinates (general information)" chapter of the "Aerial triangulation" User Manual) |
| **Tie points list** (**Ctrl+Alt+T**) | allows to open catalogue of all *tie points* with their measurements (see "The "Triangulation points" window" chapter of the "Aerial triangulation" User Manual) |
| **GCP list** (**Ctrl+Alt+G**) | allows to open catalogue of *all ground control points*, including non-measured on block images (see the "GCP list" chapter of the "Aerial triangulation" User Manual) |
| **Block adjustment** (**Ctrl+Alt+S**) | allows to open the adjustment module, to view adjustment results and errors correction (see the "Block adjustment" User Manual) |
| **Direct georeferencing** | allows to perform adjustment using imported exterior orientation parameters |
| **Subblock analysis** | allows to perform the subblock analysis by triangulation points (see the "Subblock analysis" chapter of the "Aerial triangulation" User Manual) |
| **Processing report** | allows to create the processing report (see the "Processing report" chapter of the "Aerial triangulation" User Manual) |
| **Delete adjustment results** | allows to delete adjustment data (see the "Block adjustment" User Manual) |
| **Additional** | contains the **Additional** menu (see below) |

Table 10. Brief description of the "Orientation" menu (Additional)

| Menu items | Function |
|---|---|
| 📑 **Report on interior orientation** | allows to open a report about interior orientation results (see the "Report on interior orientation" chapter of the "Aerial triangulation" User Manual) |
| 🔲 **Manual interior orientation** | [only for film camera images] allows to measure manually coordinates of fiducial marks on images (see the "Manual measurement of fiducial marks coordinates" chapter of the "Aerial triangulation" User Manual) |
| 🔲 **Semiautomatic interior orientation** | [only for film camera images] allows to perform semiautomatic interior orientation, which is to use image-standard with template of fiducial marks position used to search the same fiducial marks on other project images (see the "Semi-automatic interior orientation" chapter of the "Aerial triangulation" User Manual) |
| 🔲 **Automatic interior orientation** | [only for film camera images] is used to perform automatic interior orientation, which is the automatic recognition of fiducial marks by their type, peculiar to certain analog camera images (see the "Automatic interior orientation" chapter of the "Aerial triangulation" User Manual) |
| √α **Calculate interior orientation** | allows to re-calculate interior orientation parameters (see the "Images interior orientation" chapter of the "Aerial triangulation" User Manual) |
| **Delete interior orientation data** | allows to open the **Select images** window that is used to delete results of fiducial marks measurements on selected images (see the "Images interior orientation" chapter of the "Aerial triangulation" User Manual) |
| **Quick Ties** | contains menu items used to perform quick ties in order to use the data for block layout creation (see the "Manual images linking (quick ties)" in "Aerial triangulation" User Manual) |
| 🔳 **Open selected images for measurements** | allows to open the **Points measurement** module used to measure points coordinates in manual mode on images *selected* in 2D-window (see the "" chapter of the "Aerial triangulation" User Manual) |
| 🔳 **Open images containing marker** (**Ctrl+Alt+K**) | allows to open the **Points measurement** module used to measure points coordinates in manual mode on *images, that contain marker position in 2D-window* (see the "The "Points measurement" module" chapter of the "Aerial triangulation" User Manual) |
| 🔳 **Open in-strip stereopair** | allows to open the **Points measurement** module used to measure points coordinates in manual mode on selected *in-strip stereopair* in 2D-window (see the "The "Points measurement" module" chapter of the "Aerial triangulation" User Manual) |

| Menu items | Function |
|---|---|
| ⊞ **Open inter-strip stereopair** | allows to open the **Points measurement** module used to measure points coordinates in manual mode on selected in 2D-window *inter-strip stereopair* (see the "The "Points measurement" module" chapter of the "Aerial triangulation" User Manual) |
| 📄 **Report on relative orientation** (**Ctrl+Alt+R**) | allows to open the report with results of images relative orientation in order to perform analysis and removal of errors in tie points measurements (see the "The "Points measurement" module" chapter of the "Aerial triangulation" User Manual) |
| 🎁 **Delete point measurements** | allows to choose types of triangulation points to be deleted and delete them (see the "The "Triangulation points" window" chapter of the "Aerial triangulation" User Manual) |
| ✖ **Clear point catalogue** | allows to remove the whole list of triangulation points (GCP, check, tie) from triangulation points catalogue (see the "The "Triangulation points" window" chapter of the "Aerial triangulation" User Manual) |
| 🗺 **Load triangulation points** | allows to load measured coordinates of triangulation points to 2D-window with possibility to setup of display of certain type of points (see the "Triangulation points display in 2D-window" chapter of the "Aerial triangulation" User Manual) |
| **Delete points outside useful areas** | allows to delete points out of useful areas (with specified background color) (used mainly during automatic points measurements on spaceborne images) |
| **Delete border points** | allows to delete points of selected types from near-boundary areas of project images marked in the list (see the "Deleting points at image boundaries" chapter of the "Aerial triangulation" User Manual) |
| **Delete duplicated points** | allows to delete tie points duplicates (see the "Removing point duplicates" chapter of the "Aerial triangulation" User Manual) |
| **Import** | contains menu items used to import of triangulation points measurements from files of PAT-B, X-Points formats from PHOTOMOD 4.x (XPT) projects, as well as data import from flight path file (see the "Import of triangulation points" chapter of the "Aerial triangulation" User Manual) |
| **Export** | contains menu items used to export of triangulation points measurements to files of PAT-B and X-Points formats, and for export of ties or GCP for further use them in *Geomosaic module* (see the "Export of triangulation points" chapter of the "Aerial triangulation" User Manual) |
| 🎲 **List of exterior orientation parameters** | allows to open the Exterior orientation data list (see the "List of exterior orientation parameters" chapter of the "Aerial triangulation" User Manual) |

| Menu items | Function |
|---|---|
| **Export exterior orientation...** | allows to perform export of list of source exterior orientation parameters and adjustment results to PAT-B and CSV formats (see the "Export of exterior orientation parameters" chapter of the "Aerial triangulation" User Manual) |
| **Load projection centres as vectors** | allows to load projection centres data as vector point objects and to open them in 2D-window to perform analysis, at that an image name is saved to the Name point attribute |
| **Create images georeferencing files** | allows to perform export of georeference data after preliminary block exterior orientation and adjustment (to files of *ArcInfo World File* and *MapInfo TAB* formats) |
| **Select subblock** | allows to select part of block images to perform adjustment |
| 🌠 **Adjustment in batch mode** | allows to specify adjustment parameters and to perform block adjustment without using the the **Adjustment** toolbar (see the "Block adjustment" User Manual) |

## 3.7. The "Terrain" menu

Table 11. Brief description of the "Terrain" menu

| Menu items | Function |
|---|---|
| **Points** | The **Points** menu contains usual menu items used for automatic points measurement, filtering, import and export (see the "Points" chapter of the "Creating DTM" User Manual) |
| **TIN** | The **TIN** menu contains menu items used to load and save TIN layers, as well as to perform different operations on creation, editing and accuracy control of TIN building |
| **DEM** | The **DEM** menu contains standard menu items used to load and save DEM layers, as well as menu items used to perform various operations on DEM creation, accuracy control, filtering and editing |
| **Compute volumes** | allows to calculate a volume (i.e. *embankment* or *excavation*) located between DEM surface and **arbitrary** Z-plane or in a more complex case, the volume which is the overlap between the two (roughly, "top" and "bottom") **DEM** or **TIN** surfaces (see the "Volumes calculation" chapter of the "Creating DTM" User Manual) |
| **Contours** | The **Contours** menu contains usual menu items used for contours generating, editing, import and export (see the "Contour lines" chapter of the "Creating DTM" User Manual) |

| Menu items | Function |
|:---:|:---|
| **LAS** | The **LAS** menu contains usual menu items used for converting the LIDAR data to DEM which is saved into the file of active profile (see the "LIDAR Data processing" User Manual) |
| **3D-Mod** | The **3D-Mod** menu allows to run module for creation 3d-objects based on 2D-vectors (see the "Three-dimensional modeling" User Manual) |

## 3.7.1. The "TIN" menu

The **TIN** menu contains standard menu items used to load and save TIN layers, as well as to perform different operations on creation, editing and accuracy control of TIN building.

The **Points** menu is located in the **Terrain** menu.

Table 12. Brief description of the "TIN'$QUOTE$"menu

| The TIN menu | Function |
|:---:|:---|
| **Load TIN...** (**Ctrl+O, T**) | allows to load TIN from `*.x-tin` file (see the "TIN loading" chapter in "DTM Generation" User Manual) |
| **Recent** | allows to perform the quick access to recently loaded TIN files |
| **Save** | allows to save or rewrite active TIN layer as file with `*.x-tin` extension (see the "TIN saving" chapter in "DTM Generation" User Manual) |
| **Save as...** | allows to save active TIN layer with new name as file with `*.x-tin` extension (see the "TIN saving" chapter in "DTM Generation" User Manual) |
| **Close** | allows to close TIN |
| **Close all opened layers** | allows to close all opened TIN layers |
| **Layers visibility** | contains menu items which allow to perform batch management of TIN layers visibility in the *Layer manager* |
| **Build** (**Ctrl+N, T**) | allows to create TIN using loaded base layers (see the "Building TIN" chapter in "DTM Generation" User Manual) |
| **Build 3D-TIN...** | allows to create textured 3D-TIN surfaces (see the "Creation of textured TIN 3D surface" chapter in "DTM Generation" User Manual) |
| **Build 3D-TIN (Batch mode)** | allows to create textured 3D-TIN surfaces in batch mode (see the "Batch 3D-TIN creation" chapter in "DTM Generation" User Manual) |
| **Convert 3D-TIN CS** | allows to change coordinate system of 3D-TIN (see the "Transformation of 3D-TIN coordinate system" chapter in "DTM Generation" User Manual) |

| The TIN menu | Function |
|---|---|
| **Filter** | contains menu items which can be used to filter DEMs (see the "TIN filtering" chapter in "DTM Generation" User Manual) |
| **Export** | Contains menu items to export results of TIN creation to DXF and CSV formats (see the "Export TIN" chapter in "DTM Generation" User Manual) |
| **Import** | Contains menu items allowing to import TIN from different formats (see the "Import TIN" chapter in "DTM Generation" User Manual) |
| **Additional** | contains the **Additional** menu (see below) |

Table 13. Brief description of the "TIN'$QUOTE$"menu (additional)

| The TIN menu | Function |
|---|---|
| **Restore...** | allows to restore TIN from contours (see the "TIN restoring" chapter in "DTM Generation" User Manual) |
| **Compute border** | allows to create TIN border in automatic mode (see the "TIN borders creation" chapter in "DTM Generation" User Manual) |
| **Rebuild** | allows to rebuild TIN after editing of base layer objects (see the "TIN re-building" chapter in "DTM Generation" User Manual) |
| **Check against adjustment points** | is used to control TIN creation accuracy by triangulation points (see the "Check against adjustment points" chapter in "DTM Generation" User Manual) |
| **Check against vector objects** | is used to control TIN creation accuracy by vector objects, which were not used during TIN creation (see the "Check TIN against vector objects" chapter in "DTM Generation" User Manual) |
| **Verify topology...** | is used to check topology of TIN creation (see the "Verifying of TIN topology" chapter in "DTM Generation" User Manual) |
| **The area of a polygon on the surface** | allows to calculate TIN surface area within a polygon (see the "TIN area info" chapter in "DTM Generation" User Manual) |
| **Calculate area** | allows to calculate TIN projection area on plane and area of TIN 3D surface (see the "TIN area info" chapter in "DTM Generation" User Manual) |
| **Statistic** | is used to view statistic information about TIN (see the "General TIN info" chapter in "DTM Generation" User Manual) |
| **Interpolate** | allows to interpolate TIN to smooth DTM in order to build or enhance contour lines (see the "Smooth TIN interpolation" chapter in "DTM Generation" User Manual) |

| The TIN menu | Function |
|---|---|
| **Convert to vector layer** | allows to convert TIN into a vector layer (see the "Converting TIN into a vector layer" chapter in "DTM Generation" User Manual) |
| **🏠 Embed objects** | Allows to embed vector objects layer to created TIN (see the "Insert objects into TIN" chapter in "DTM Generation" User Manual) |
| **Export** | Contains menu items to export results of TIN creation to DXF and CSV formats (see the "Export TIN" chapter in "DTM Generation" User Manual) |
| **Import** | Contains menu items allowing to import TIN from different formats (see the "Import TIN" chapter in "DTM Generation" User Manual) |
| **On/Off TIN visibility** (**Ctrl+T**) | allows to enable/disable editable TIN layer visibility |

## 3.7.2. The "DEM" menu

The **DEM** menu contains standard menu items used to load and save DEM layers, as well as menu items used to perform various operations on DEM creation, accuracy control, filtering and editing.

The **DEM** menu is located in the **Terrain** menu.

Table 14. Brief description of the DEM menu

| Menu items | Function |
|---|---|
| **Load DEM...** (**Ctrl+O, D**) | allows to load DEM from *.x-dem file (see the "DEM loading" chapter in "DTM Generation" User Manual) |
| **Open from file...** | allows to load DEM from external data without its conversion to internal format (see the "DEM loading" chapter in "DTM Generation" User Manual) |
| **Recent** | allows to perform the quick access to recently loaded DEM files |
| **Save copy** | allows to save opened DEM to a new file (see the "DEM saving" chapter in "DTM Generation" User Manual) |
| **Save selection** | allows to save DEM area (see the "DEM saving" chapter in "DTM Generation" User Manual) |
| **Close** | allows to close DEM |
| **Close all opened layers** | allows to close all opened DEM layers |
| **Layers visibility** | contains menu items which allow to perform batch management of DEM layers visibility in the *Layer manager* |
| **Build DEM...** | contains menu items used to create DEM with help of various source data (see the "DEM creation" chapter in "DTM Generation" User Manual) |

| Menu items | Function |
|---|---|
| **Filter** | contains menu items which can be used to filter DEMs (see the "DEM filtering" chapter in "DTM Generation" User Manual) |
| **Fill null cells** | contains menu items used to restore blank cells of DEM using various methods (see the "Null cells in DEM" chapter in "DTM Generation" User Manual) |
| **Import...** | contains items used to import DEM from files with `*.grd`, `*.asc`, `*.tif`, `*.dem`, `*.mtw`, `*.dt1`, `*.dt2`, `*.img`, `*.pix`, `*.hgt` extensions (see the "DEM import" chapter in "DTM Generation" User Manual) |
| **Batch import** | is used to simultaneous import of multiple DEM (see the "Batch DEM import" chapter in "DTM Generation" User Manual) |
| **Batch import from folder** | is used to simultaneous import of multiple DEM from a specified folder (see the "Batch import from folder" chapter in "DTM Generation" User Manual) |
| **Export...** | contains menu items used to perform export of DEM to different formats (see the "DEM export" chapter in "DTM Generation" User Manual) |
| **Additional** | contains the **Additional** menu (see below) |

Table 15. Brief description of the DEM menu (additional)

| Menu items | Function |
|---|---|
| **Save as georeferenced raster...** | allows to save a DEM as a raster file with geodetic reference (see the "DEM saving" chapter in "DTM Generation" User Manual) |
| **Build DEM...** | contains menu items used to create DEM with help of various source data (see the "DEM creation" chapter in "DTM Generation" User Manual) |
| **Rebuild by TIN** | allows to recreate DEM after changing of TIN base layer (see the "DEM creation by TIN" chapter in "DTM Generation" User Manual) |
| **Restore** | is used to restoring of DEM consistency, which may be disrupted by applying various operations or DEM filtering (see the "DEM recovering" chapter in "DTM Generation" User Manual) |
| **Slope based filter** | allows to filter objects based on slope angle (see the "Slope based filter" chapter in "DTM Generation" User Manual) |
| **Filter by image properties** | allows to filter DEMs depending on image characteristics (see the "Filter by image properties" chapter in "DTM Generation" User Manual) |
| **Cut DEM by Z-range** | allows to convert DEM cells with specified elevation to null cells (see the "Converting cells to null" chapter in "DTM Generation" User Manual) |
| **Set elevation in selected polygons...** | allows to set the same elevation of DEM cells inside and outside of selected polygons (see the "Change |

| Menu items | Function |
|---|---|
|  | DEM parts elevation" chapter in "DTM Generation" User Manual) |
| Interpolate elevation in selected polygons... | allows to interpolate a value of DEM cells inside and outside of selected polygons (see the "DEM interpolating" chapter in "DTM Generation" User Manual) |
| Cut by selected polygons | is used to edit coverage area of DEM (see the "DEM cutting by polygons" chapter in "DTM Generation" User Manual) |
| Cut null edges | is used to remove edge areas of DEM, that include blank cells (see the "DEM cutting by polygons" chapter in "DTM Generation" User Manual) |
| Transpose | is used to transpose DEM from the left coordinate system to the right one and vice versa (see the "DEM transpose" chapter in "DTM Generation" User Manual) |
| Transform to another coordinate system | allows to change coordinate system of DEM (see the "Transformation of DEM coordinate system" chapter in "DTM Generation" User Manual) |
| Batch transform to another coordinate system | allows to change coordinate system of multiple DEMs (see the "Batch transformation of DEMs coordinate system" chapter in "DTM Generation" User Manual) |
| Rebuild considering last adjustment | allows to recreate DEM considering results of the last adjustment (if the project was adjusted after DEM creation once more – see the "Rebuilding DEM considering last adjustment" chapter in "DTM Generation" User Manual) |
| Shift | is used to parallel displacement of DEM by axes (see the "DEM shift" chapter in "DTM Generation" User Manual) |
| Split DEM into sheets | allows to split DEM into sheet to save DEM in parts in separate files (see the "Split DEM into sheets" chapter in "DTM Generation" User Manual) |
| Merge DEMs | allows to merge DEMs, that have overlap area (see the "DEM merging" chapter in "DTM Generation" User Manual) |
| Accuracy control | is used to perform accuracy control DEM creation using various data (see the "Accuracy control of DEM creation" chapter in "DTM Generation" User Manual) |
| Compute volumes | allows to calculate a volume (i.e. *embankment* or *excavation*) located between DEM surface and **arbitrary** Z-plane or in a more complex case, the volume which is the overlap between the two (roughly, "top" and "bottom") DEM surfaces (see the "Volumes Calculation" chapter in "DTM Generation" User Manual) |

| Menu items | Function |
|---|---|
| **Calculate slope map** | allows to calculate a slope map (see the "Slopes map creation" chapter in "DTM Generation" User Manual) |
| **Convert to points...** | allows to convert DEM cells to points with specified simplifying (see the "Convert DEM to points" chapter in "DTM Generation" User Manual) |
| **Convert to LAS** | allows to convert DEM to LAS point cloud (see the "Convert DEM to point cloud (LAS)" chapter in "DTM Generation" User Manual) |
| **Write points to DEM** | allows to add points to DEM that helps to refine DEM cells values (see the "Adding of points to DEM" chapter in "DTM Generation" User Manual) |

## 3.7.3. The "Contours" menu

The **Contours** menu contains usual menu items used for contours generating, editing, import and export.

> The **Contours** menu is located in the **Terrain** menu.

Table 16. Brief description of the "Contours" menu

| Menu items | Function |
|---|---|
| **Load...** (**Ctrl+O, V**) | allows to load contour lines from `*.x-data` file (see the "Vectorization" User Manual) |
| **Recent** | allows to perform the quick access to recently loaded contour lines |
| **Save** | allows save or rewrite active contours layer (see the "Saving contour lines" chapter in "DTM Generation" User Manual) |
| **Save as...** | allows to save active layer with new name (see the "Saving contour lines" chapter in "DTM Generation" User Manual) |
| **Save selected as...** | allows to save *just* selected contours (see the "Saving contour lines" chapter in "DTM Generation" User Manual) |
| **Close** | allows to close contour lines layer |
| **Build contours** | contains menu items used to create contour lines with help of various source data (see the "Contour lines generation" chapter in "DTM Generation" User Manual) |
| **Import** | contains items used to import contour lines from files with different extensions (see the "*Import of vector objects*" chapter of the "Vectorization" User Manual) |
| **Export** | contains menu items used to perform export of contour lines to files with different extensions (see |

| Menu items | Function |
|---|---|
| | the "*Export of vector objects*" chapter of the "Vector-ization" User Manual) |
| **Prepare/export contours sheets** | allows to save, edit, and export contours within the given notation sheets to the Panorama format (see the "Export of contours sheets" chapter in "DTM Generation" User Manual) |
| **Additional** | contains the **Additional** menu (see below) |

Table 17. Brief description of the "Contours" menu (additional)

| Menu items | Function |
|---|---|
| **Build contours** | contains menu items used to create contour lines with help of various source data (see the "Contour lines generation" chapter in "DTM Generation" User Manual) |
| **Check contours intersections...** | allows to check created contours for crossing/self-crossing, that occur after operation of contours smoothing (see the "Control of contours crossing" chapter in "DTM Generation" User Manual) |
| **Check contours by points** | allows to perform quality control of contours creation using regular points, if they were not used for contours creation (see the "Check contours by points" chapter in "DTM Generation" User Manual) |
| **Merge contours...** | allows to merge created contours in automatic or manual mode (see the "Contours merging" chapter in "DTM Generation" User Manual) |
| **Check merging contours...** | allows to check contours for breaks that occur after manual or automatic contours merging (see the "Check of contours merging quality" chapter in "DTM Generation" User Manual) |
| **Contours connecting** | allows to connect created contours automatically or manually (without merging into a single vector object – see the "Contours connecting" chapter in "DTM Generation" User Manual) |
| **Check contours vertices** | allows to check elevations of created contours vertices (see the "Check elevations of contours vertices" chapter in "DTM Generation" User Manual) |
| **Precision of objects coordinates** | allows to set a precision of vector objects coordinates at level of decimal places (see the "Precision of objects coordinates" chapter in "DTM Generation" User Manual) |

## 3.8. The "Raster" menu

The system provides the **Raster** menu to perform various operations with raster images.

Table 18. Brief description of "Raster "menu

| Menu items | Function |
|---|---|
| **Orthorectification** | allows to create orthophoto production and mosaicking (see the "Orthorectification" User Manual) |
| **GeoMosaic** | allows to run the *GeoMosaic program* allows to create the orthomosaic from georeferenced orthorectified aerial and satellite imagery, splitting of created orthomosaic with the capable of saving sheets in popular raster file format (see the "Orthophotomaps creation" User Manual) |
| **Raster Converter** | allows to launch the *Raster Converter* program for preparing and converting raster images into the internal format files and then for placing them in active profile resources (see the "General information" User Manual). |
| **ImageWizard module** | allows to edit path to image files (see the "ImageWizard Adjustment of images" chapter in "Creating project" User Manual) |
| **Load georeferenced images (files)** | allows to load georeference images from folder in *Windows file system* (see the "Georeferenced external data" section of the "Aerial triangulation" User Manual and the "Pseudo-stereo mode" section of the "Vectorization" User Manual) |
| **Load georeferenced images (resources)** | allows to load georeference images from active profile resources (see the "Georeferenced external data" section of the "Aerial triangulation" User Manual and the "Pseudo-stereo mode" section of the "Vectorization" User Manual) |
| **Load web-map** | allows to load georeferenced web-maps from the Internet (see the "Web-map loading" chapter in "Creating project" User Manual) |
| **Show rasters** | allows to use one of three modes of displaying raster images in 2D-window: **Cached only** (**Ctrl+Shift+1**), **Depending on zoom** (**Ctrl+Shift+2**) or **Source only** (**Ctrl+Shift+3**) |
| **Additional** | contains the **Additional** menu (see below) |

Table 19. Brief description of "Raster "menu (additional)

| Menu items | Function |
|---|---|
| **Image georeferencing** | allows you to perform georeferencing images by geodetic coordinates GCP points, obtained from vector/raster maps or from a list of file *.txt (see the "Aerial triangulation" User Manual) |
| **Affine georeference correction** | allows you to perform affine correction of georeferenced images (see the "Affine georeference correction" chapter in "Creating project" User Manual) |
| **Save raster layer** | allows to save a georeference raster image of the active layer with specified parameters in output file |

| Menu items | Function |
|---|---|
| | format (TIFF, MS-TIFF, MegaTIFF – see the "Saving of raster image" chapter in "Creating project" User Manual) |
| **Close all opened layers** | allows to close all opened raster layers |
| **Layers visibility** | contains menu items which allow to perform batch management of raster layers visibility in the *Layer manager* |
| **ScanCorrect** | allows to run the *ScanCorrect* program for compensation of metric errors occurred when scanning graphical data on flatbed polygraphic scanners (see the "ScanCorrect program" User Manual) |
| **Dust Correct** | allows to 'clean' images of dust particles, photo emulsion defects etc (see the "Dust Correct" chapter in "Creating project" User Manual) |
| **Clear cache** | allows to delete raster cache from RAM |
| **Images order** | allows to rearrange block images by z-order |
| **Rebuild Mega Tiff pyramids** | allows to rebuild image pyramids for MegaTIFF images (see the "Image pyramid creation" chapter in "Creating project" User Manual) |
| **Adjust zoom** | allows to set zoom of images in 2D-window by set GSD in pixels |

# 3.9. "Service" menu

Table 20. Brief description of the "Service" menu

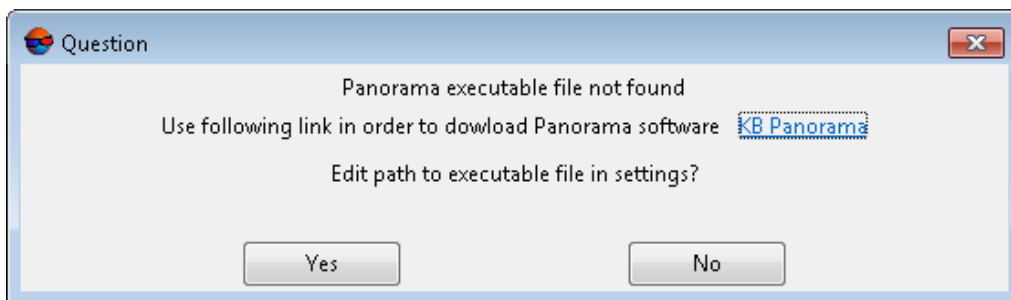| Menu | Function |
|---|---|
| **Explorer** | allows to open the *PHOTOMOD Explorer* module to view resources system (see the "PHOTOMOD Explorer module. Resources management" chapter in "General information" User Manual) |
| **GeoCalculator** | allows to launch the GeoCalculator program that is used for coordinates transformation form one reference system to another |
| **GIS Panorama** | allows to run the *GIS Panorama Mini* (this software is not included with the *PHOTOMOD* but can be installed separately) |
| **Show in Google Maps** | allows to display area on images in the GoogleMaps service (Internet connection required); it is possible only for projects in geodetic coordinate systems or if the coordinate system could be transformed to geodetic |
| **Show in Yandex Maps** | allows to display area on images in the YandexMaps service (Internet connection required); it is possible only for projects in geodetic coordinate systems or if the coordinate system could be transformed to geodetic |

| Menu | Function |
|---|---|
| **Recalc working area** | allows to refresh 2D-window and fit displayed area depending on load data |
| **Activate mouse driver** | allows to turn on/off defined mouse driver |
| **Mouse setup** | allows to setup or connect mice, including special mice, hand wheels and foot pedals, and also to macros setup (see the "Using of special mice, hand wheels and foot pedals in the system" chapter in "General information" User Manual) |
| ↶ **Undo** (**Ctrl+Z**) | allows to cancel the last operation of vector objects editing on a layer (see the "Undo editing operations" chapter in "Vectorization" User Manual) |
| ▤ **Undo log** | allows to open the **Undo log** containing a list of recent editing operations (see the "Undo editing operations" chapter in "Vectorization" User Manual) |
| ↷ **Redo** (**Ctrl+Shift+Z**) | allows to redo the last undone operation (see the "Undo editing operations" chapter in "Vectorization" User Manual) |
| **Last log** | allows to display the last log of system actions |
| **Parameters** | allows to open the window to set the general parameters of the system |
| **Additional** | contains the **Additional** menu (see below) |

Table 21. Brief description of the "Service'$QUOTE$"menu (additional)

| Menu | Function |
|---|---|
| **Distributed Processing** | contains menu items to run, test and setup distributed processing (see the "Distributed Processing" chapter in "General information" User Manual) |
| **Working coordinate system** | allows to choose working coordinate system (see the Project creation User Manual) |
| **Autodetect Gauss-Krueger zone** | allows to detect the Gauss-Krueger zone automatically for the selected object, provided that any Global coordinate system is used (see the "Automatic detection of the Gauss-Krueger zone" chapter in "General information" User Manual) |
| **CSV converter** | allows to launch the CSV converter to transform points coordinates in CSV and TXT files and also for other transformations for CSV files (see the "CSV converter" chapter in "General information" User Manual) |
| **Load atlas** | allows to load the World map to a new vector or raster layer (see the "Loading atlas" chapter in "General information" User Manual) |
| **Save scene** | allows to save visible part of images in active 2D-window as a raster image with specified size and quality |

| Menu | Function |
|---|---|
| **Customize hotkeys** | allows to adjust hotkeys using in the system, edit, delete or create new hotkeys (see the "Customize hotkeys" chapter in "General information" User Manual) |
| **Customize fast commads** | allows to use so called shortcut commands, the custom button combinations for quick access to various functions when working with the layers such as **Vectors**, **DEM**, **Raster**, **Grid**, or **TIN** (see the "Shortcut commands" chapter in "General information" User Manual) |
| **Save options** | allows to save projects parameters and use it automatically when restart the system |

If the *GIS Panorama* executable file is not found, an appropriate system message will appear. The software description and URL hyperlink (for download) are indicated in this message.



Click **Yes** to go to path settings (see the "Paths settings" chapter of the "General system's parameters" User Manual.

## 3.10. The "Windows" menu

Table 22. Brief description of the ' Windows ' menu

| Menu items | Function |
|---|---|
| **New 2D-window (block)** | allows to open window with a block scheme |
| **New 2D-window (stereopair)** (**Ctrl+Alt+W**) | allows to open window with a stereopair |
| **3D-window** | allows to open the 3D-window (see the "General information" User Manual) |
| **Marker window** (**Ctrl+Alt+C**) | allows to open marker parameters window (see the "'Vectorization" User Manual) |
| **Measurements window** (**Ctrl+Alt+D**) | allows to open window that allows to perform measurements by images (see the "Vectorization" User Manual) |
| **Classifier** | allows to open the **Classifier** window to show set of standard vector objects attributes (see the "Classifier $QUOTE$" chapter in the "Vectorization" User Manual) |

| Menu items | Function |
|---|---|
| 🄰 **Objects attributes** | allows to open the **Attributes** window to display attributes of selected vector objects (see the "Vector objects attributes $QUOTE$" chapter in the "Vectorization" User Manual) |
| **Toolbars** | contains menu items allows to open additional toolbars |
| **Additional** | contains the **Additional** menu (see below) |

🎓 *See detailed description of the system's windows* in the "General information about the system" User Manual.

👉 To get quick access to the *main* windows of the system, select **Windows › Toolbars › Windows**. The **Windows** toolbar is opened.

Table 23. Brief description of the ' Windows ' menu (Additional)

| Menu items | Function |
|---|---|
| ▦ **Block editor** | allows to open block editor window (see the 'Project creation' User Manual) |
| ▦ **Block layout** | allows to open the block layout window (see the 'Aerial triangulation' User Manual) |
| **Show all toolbars** | allows to show all toolbars |
| **Find all toolbars** | allows to show all opened toolbars in visible part of the screen |
| **Temporarily hide toolbars** (**TAB**) | allows to hide/show all opened toolbars |
| **Image list...** | allows to open the **Images list** window (see the 'Creating project' User Manual) |
| **New 2D-window (single image)** | allows to open window with image selected on a block scheme |
| **Open image under marker** | allows to open all 2D-windows with marker place. Press and hold **Alt** key while clicking the menu item to open images with 1:1 zoom , otherwise, full images are displayed |
| **Close all single image windows** | allows to close all 2D-windows with images |
| 🔄 **Refresh all 2D-windows** | allows to refresh information in all opened 2D-windows |
| **Arrange** | contains menu items allow to arrange opened 2D-windows in a work area with one of the following ways:<br><br>• ▦**Tile** (also on the main toolbar) – allows to tile 2D-windows;<br><br>• ▥ **Row** – allows to row 2D-windows;<br><br>• ▤ **Column** – allows to column 2D-windows;<br><br>• ▤ **Stack** (also in the main toolbar) – allows to stack 2D-windows. |

| Menu items | Function |
|---|---|
| **Stereopairs** | contains menu items allows to move to other stereopairs (see the 'Vectorization' User Manual) |
| **Triangulation points coordinates** | allows to show table with triangulation points coordinates |
| **Triangulation points view control** | allows to choose triangulation points to display |
| **Contours classifier table** | allows to open contours classifier window to edit parameters of contours display (see the 'DTM generation' User Manual) |
| **Objects list** | allows to display list of active layer vector objects (see the 'Vectorization' User Manual) |
| **Marker motion in pixel coordinates** | allows to set on the mode allows to move marker in stereopair 2D-window in pixel coordinates |
| **Zoom all in** (**Shift+* NumPad**) | allows to zoom in all 2D-windows |
| **Zoom all out** (**Shift+/ NumPad**) | allows to zoom out all 2D-windows |
| **Layer view mask** | allows to use a view mask for active layer (see the 'General information' User Manual) |
| **Windows list** | allows to view list of opened 2D-windows |

# 3.11. The "Block editor" window

The **Block editor** window is used to form a block of project images.

The **Block editor** window contains a table of created strips and images loaded to project and contains tools for images block editing.

The **Block editor** window is synchronized with 2D-window , so all changes in the images list of the **Block editor** (choosing, adding, deleting, moving of strips and images) are shown in the block scheme in 2D-window and vice versa.

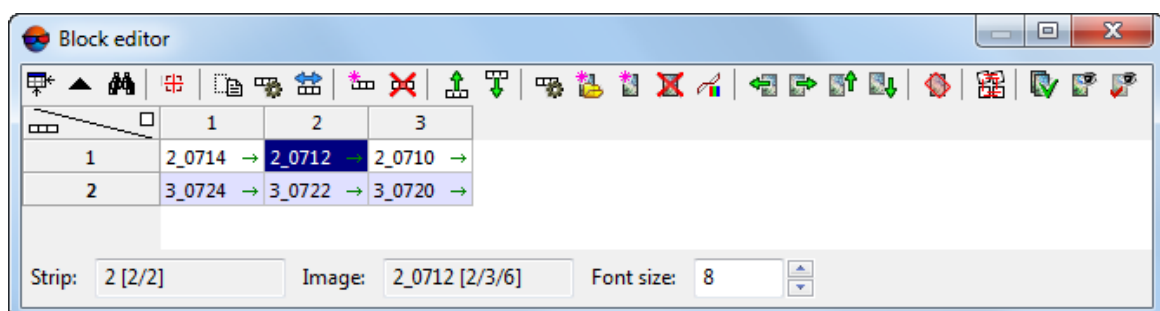Choose the **Block › Block editor** (**Ctrl+Alt+B**) to open the **Block editor** window.



Fig. 11. The "Block editor" window

The **Block editor** window contains the following elements:

• toolbar to form and edit block images;

- the list of existed strips and loaded there images;

- the status bar with the following data:

  ○ **Strip** – the `Strip name [item No/total]` is displayed for strip selected in the table;

  ○ **Image** – the `Image name [item No/total in strip/total in block]` is displayed for image selected in the table;

  ○ **Font size** – allows to change the font size of table text.

To select (highlight) the image in the **Block editor** window click the image name in the list. To select strip click on the name of strip.

> To select multiple images\strips use **Shift** and **Ctrl keys**

> To highlight several images in 2D-window use additional toolbar of group selection (see the *Tool* section in the "Vectorization" User Manual).

The **Block** menu items, buttons of the **Forming block** toolbar and the toolbar of the **Block editor** window.

Table 24. The toolbox of "Block editor" window

| Buttons | Function |
|---|---|
| | allows to change the **Block editor** window size so that window displays all list of strips/images |
| | allows to show/hide the list of strips/images and the status bar to comfort work with block images in 2D-window (in the **Block editor** window only toolbar displays) |
| | is used to search for an image by name (part of name) |
| | allows to select in the list initial images, which contain marker position |
| | allows to edit names of several strips of the block at the same time |
| | is used to display and edit properties of selected strip (name and type of strip) |
| | reverse images in the strip order |
| | allows to add new strip |
| | allows to remove selected strip |
| | allows to move selected strip up by one strip |
| | allows to move selected strip down by one strip |
| | is used to display and edit properties of selected image |
| | is used for adding image files, locating in the resources out of active profile, to the selected strip |
| | is used for adding image files, locating in the resources of active profile, to the selected strip |
| | allows to remove selected images from project |
| | is used to radiometric correction of selected image |

| Buttons | Function |
|---|---|
| ⬅, ➡, ⬆, ⬇ | allows to move selected images left/right/up/down |
| 🔄 | allows to rotate selected images to any angle in relation to source or current image's position in block scheme |
| 🔧 | allows to open the **Block layout** window to build block scheme in 2D-window considering source or acquired data (see the Aerial triangulation User Manual) |
| 📋 | allows to open the *ImageWizard* window to setup images |
| 🖼 | allows to show block images in 2D-window, if they were not displayed during project loading, due to limitation specified in the program's setting window (see the "General system's parameters" User Manual) |
| 🖼 | allows to set on/off displaying only selected images mode |

# 4. Workflow of UAS processing

Prior to UAS data processing it is necessary to perform the following actions:

- Creating and selecting active profile – creating local profile or creating/connecting network profile to place all project/project group files – resources, and selecting the profile as active;

- Creating UAS project (see the "Creating new project" chapter of the "Creating project" User Manual).

> ☞ The *PHOTOMOD UAS* program is purposed to process **Central projection** projects only (see the "Project types" chapter of the "Creating project" User Manual). The function of fast project creation is supported for the **Central projection** project type (see the "Fast project creation" chapter of the "Creating project" User Manual). Fast project creation allows for automatic execution of some primary project processing stages which are usually executed manually. This method facilitates and accelerates data processing. Fast project creation is also recommended while working with *PHOTOMOD UAS* software, but only if high quality initial data are available, i.e. `*.jpg` or `*.tiff` images, as well as interior and exterior orientation elements.

Processing of data acquired by UAS implies performing the following steps: **Aerial Triangulation**, **Compute DEM**, and **Compute Orthophoto** (see Section 3.2).
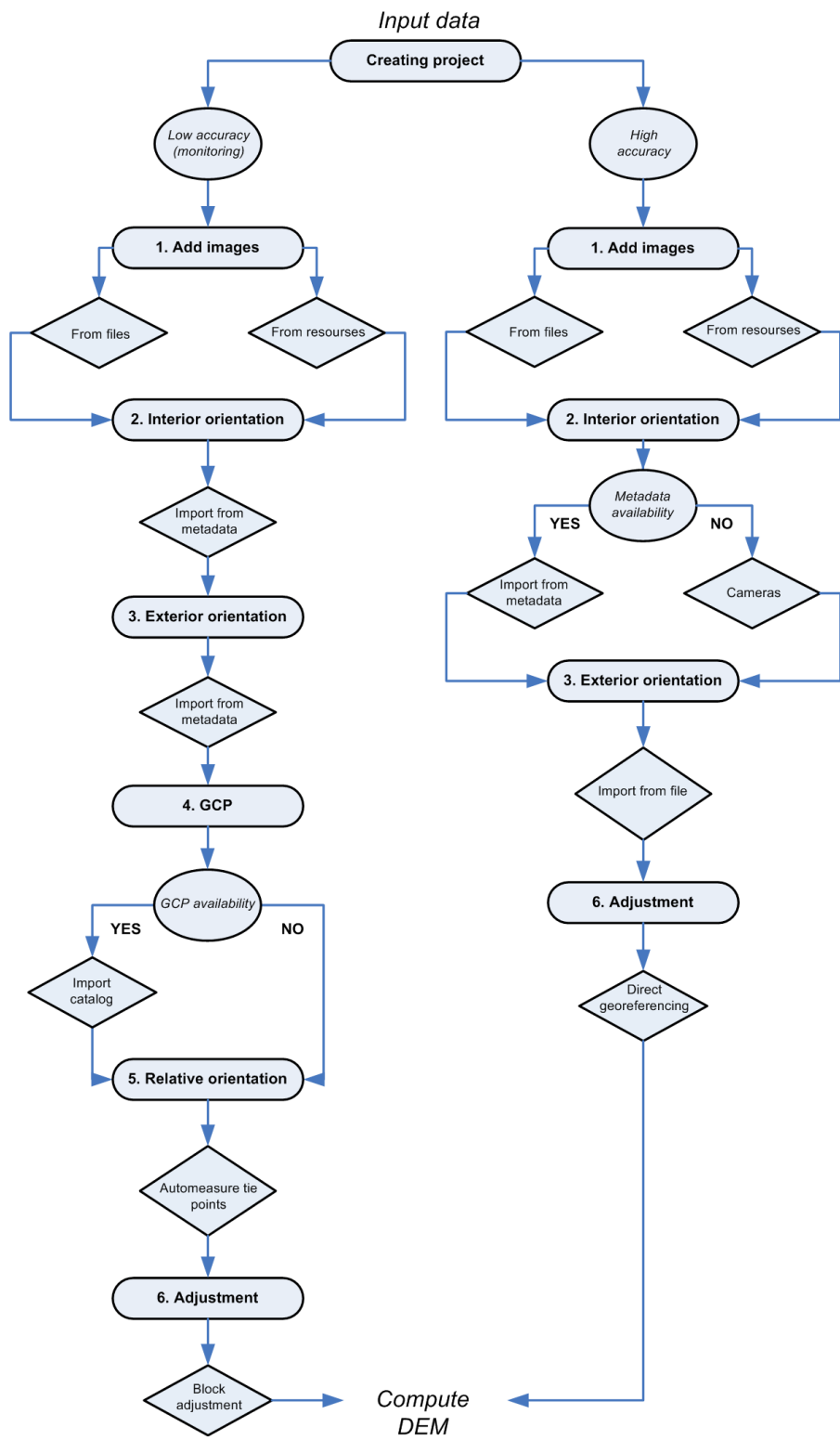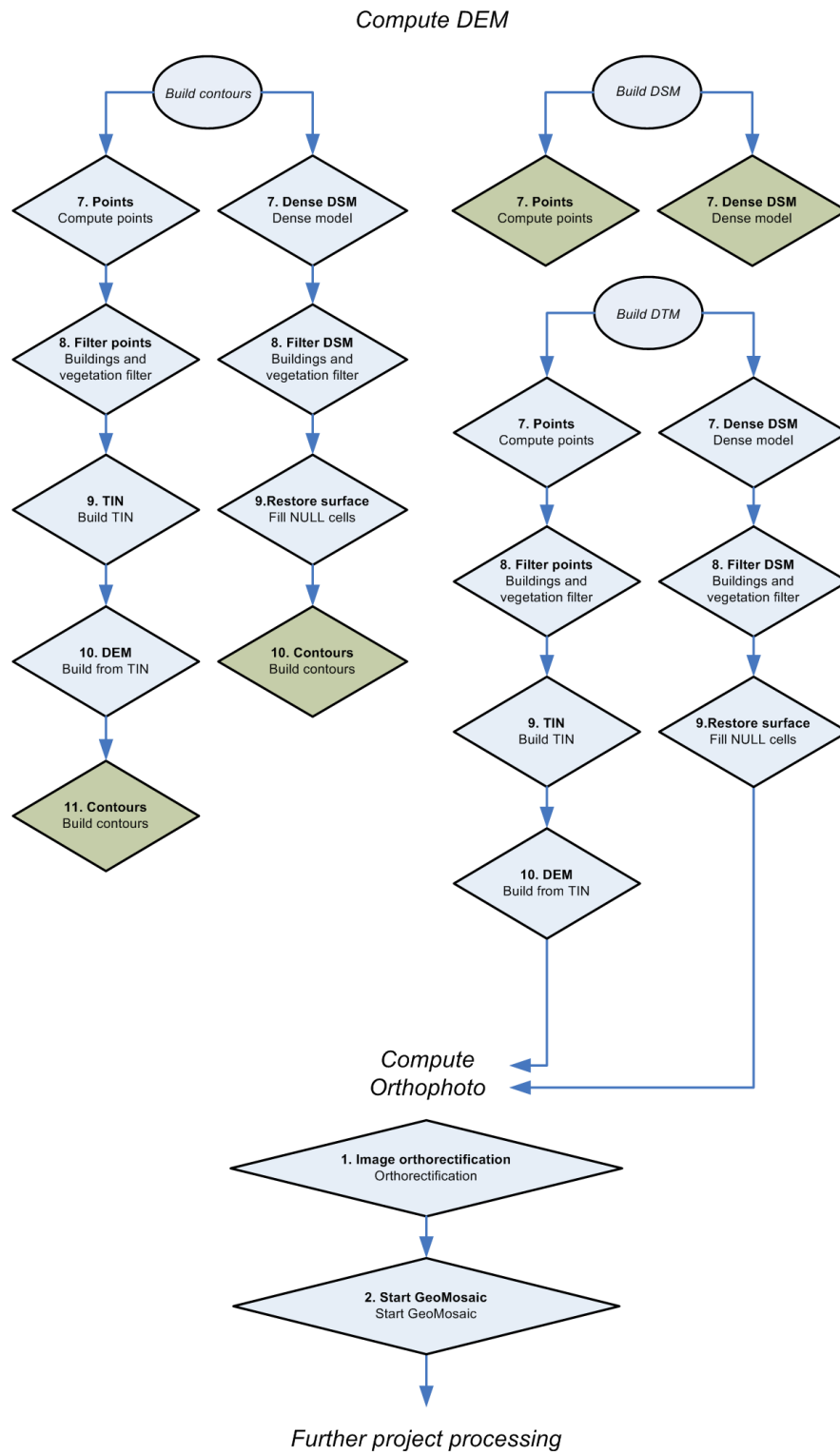
Fig. 12. Workflow of UAS processing

*Compute DEM*



Fig. 13. Workflow of UAS processing

# Appendix A. Input and output data

**Input data**

During the project creation, aerial triangulation and block adjustment the following source data is used:

- [optional] The *list of GCP coordinates* is necessary for block adjustment. The system provides opportunity to measure GCP coordinates manually and also to perform import of GCP list from a text file.

- [optional] The *list of projection centers* coordinates to process central projection images. The program also provides the ability to import on-board data (coordinates) about projection centers from CSV files.

> Block adjustment could be process only by projection centers without using ground control points. It is recommended to use GCP coordinates to increase adjustment accuracy.

- *Raster images*

  For working with images in program , it is recommended to use MS-TIFF internal raster format, which is the TIFF format with overview pyramid (set of subsampled images copies) for higher image display performance.

  The *Raster Converter* module is used to preliminary raster image processing. It is possible to convert image into internal format both manually, before creating project, and on the stage of adding images into project with saving converted images into active profile resources. See the *Raster Converter module* description in the "General information" User Manual.

  The following image formats are available to process central projection images:

  ○ JPEG (JPEG);

  ○ Tag Image File Format (TIFF) TIFF и GeoTiff format, included tags for saving of georeference information;

  ○ Windows Bitmap File (BMP);

  ○ Advanced Systems Format (ASF).

- *Information about coordinate system and map projection* – during project creation it is necessary to define coordinate system of GC points. By default there is an International coordinate system database and map projection (see the details in the "Geo-Calculator" User Manual);

- also it is possible to use the following exterior data:

  ○ import of triangulation points from PAT-B and X-POINTS;

  ○ import of ground control points from text files *.txt and *.csv (see above *The list of GCP coordinates*);

  ○ import of interior and exterior orientation data from metadata;

  ○ import of external orientation data from PAT-B and CSV-files (see above *The list of projection centers*);

  ○ GPS data;

  ○ import additional data from different formats.

**Output data**

The program allows to process UAS data and acquire all types of value added photogrammetric products: DEM, 2D and 3D-vectors, orthomosaics.

There are the main output products:

• *Digital Terrain Model (DTM)* – digital cartographic presentation of terrain surface both as regular grid of elevations (DEM) and as triangulated irregular network (TIN). They are used for solving applied research problems.

• *3D vector objects* – used for creating a topographical base for cartographic production or as source data for a mathematical representation of a scene in three-dimensional digital terrain modeling;

• *orthophoto production* – single raster images in the form of a single frame or a set of sheets in a selected map projection with marginalia. In the resulting image, geometric and photometric distortions are corrected, creating seamless, color-balanced orthophotos with uniform brightness as an output;

• *3D models of terrain* – can be used to solve applied research problems, as well as for creation of multimedia presentations and commercials.

> There is opportunity to export all photogrammetric products to various formats.

# Appendix B. The PHOTOMOD7UAS.VAR configuration folder

At the stage of system first configuration is automatically created the *PHOTOMODUAS7.VAR* folder. This folder is used to store configuration, temporary and other system files.

Only one *PHOTOMODUAS7.VAR* folder creates, even for several installed copies of the system.

⚠️ It is not recommended to place the configuration folder in the net, because it leads to slowing of system's work.

*PHOTOMODUAS7.VAR* folder contains the following files and folders:

• *AutoSave* folder – is used to store autosaved data:

• *Config* folder – is used to store files of general parameters of all profiles;

> ☞ It is possible to return to default parameters in case of changing configuration file. To do this, remove a configuration file in the *PHOTOMODUAS7.VAR* folder and restart the system. Default configuration file are copied from the *PHOTOMODUAS7.VAR\Config* system files folder.

> ☞ Both global settings and settings for the local profile is loaded at startup of the system and saved when you exit. Local project settings is loaded when loading a project and saved when project closing. In case of working without projects, settings are stored in the *PHOTO-MODUAS7.Var\Profiles\[profile_name]\VoidProjOptions.x-ini* file.

• *Logs* folder – is used to store log-files for all profiles;

• *Profiles* folder – is used to store all parameters for each profile separately. The list of local and network profiles is also stored in the folder. It is the same list as in the **Control Panel** module (see the "Control Panel. Profiles management" chapter of the "General information" User Manual). Configuration file with resource structure and path to local/network folder is also stored in folder of each profile;

> ☞ New subfolder creates for each profile.

• *Tmp* folder – is used to store temporary files;

• *UserData* folder – is used to store data out of resources system;

• *policy.x-ini* file – contains general information about configuration parameters (active profile name, name and path to centralized management folder and so on).