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Safety considerations
Before flying with UgCS you must understand this statements:

1. It is the responsibility of the user to operate the system safely in order to avoid harming other people, animals, legal property or encountering other damages by taking unnecessary risks.

2. The user must be acquainted with, and comply with location-specific legal regulations before using UgCS.

3. Please make sure that the first waypoint is located close to the actual take-off location and there is no significant vertical drop.

4. Also, make sure that a correct take-off point altitude is specified before flight. For doing this, please refer to page “Take-off Altitude” of this manual. It is important to do this because the barometer readings can change between power-on, route upload and take-off.

5. In the case of strong wind, using automatic take-off and landing is not advised and could lead to a crash. In a scenario like this, it is safer to take off and land the vehicle in manual mode. Automatic mode should be switched on only when in mid-air.

Installation and System Requirements
There are two installation modes for all operating systems:

- “Simple deployment” installs all the components on a single computer and runs the components as processes inside a user session;

- Users with advanced requirements can choose the “Advanced deployment” option that allows the installation of different components on separate machines and/or the ability to run them as separate services.

System requirements for Simple installation

<table>
<thead>
<tr>
<th>OS</th>
<th>Windows</th>
<th>macOS</th>
<th>Linux</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating system</td>
<td>Windows 7 with SP1 or later; Windows 8; Windows 10*</td>
<td>64-bit</td>
<td>OS X Maverick 10.9 or later*</td>
</tr>
<tr>
<td>CPU</td>
<td>Core 2 Duo or Athlon X2 at 2.4 GHz</td>
<td>Recommended: 4 GB of RAM</td>
<td></td>
</tr>
<tr>
<td>Memory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard drive</td>
<td></td>
<td>2 GB of free space</td>
<td></td>
</tr>
<tr>
<td>Graphics hardware</td>
<td>Graphics card with DirectX 9 support (shader model 2.0). Any card made since 2004 should work.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network</td>
<td></td>
<td>TCP/IPv4 network stack</td>
<td></td>
</tr>
<tr>
<td>Screen resolution</td>
<td>Minimum supported screen resolution: 1024x768</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Please note that the software has not yet been tested on server versions of Windows and OS X. Windows Vista is not supported.
System Requirements for Advanced Installation

<table>
<thead>
<tr>
<th>OS</th>
<th>UgCS client</th>
<th>UCS</th>
<th>VSM</th>
<th>Emulator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating system</td>
<td>Windows: Windows 7 with SP1 or later; Windows 8; Windows 10* 64 bit</td>
<td>macOS: OS X Maverick 10.9 or later* 64 bit</td>
<td>Linux: Ubuntu 16.04 LTS 64 bit</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPU</td>
<td>Core 2 Duo or Athlon X2 at 2.4 GHz</td>
<td>1 GHz processor (Intel Celeron or better)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory</td>
<td>2 GB RAM recommended</td>
<td></td>
<td>512 Mb RAM</td>
<td></td>
</tr>
<tr>
<td>Hard drive</td>
<td>1 GB free space</td>
<td></td>
<td>256 Mb free space</td>
<td></td>
</tr>
<tr>
<td>Graphics hardware</td>
<td>Graphics card with DirectX 9 support (shader model 2.0). Any card made since 2004 should work.</td>
<td>VGA capable of 1024x768 screen resolution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network</td>
<td>TCP/IPv4 network stack</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screen resolution</td>
<td>Minimum supported screen resolution: 1024x768</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Please note that the software has not yet been tested on server versions of Windows and OS X. Windows Vista is not supported.

**Windows**

For quick installation follow these steps:

1. Run the installer ugcs-2.12.exe;
2. Follow the “Getting started” instructions in this manual;
3. Read the license agreement carefully (see End User License Agreement in a separate file).

**Linux**

For Linux, .deb packages are available on our website ugcs.com. For Linux installation instructions please go to http://apt.ugcs.com/doc.

**macOS OS**

For quick installation follow these steps:

1. Run the installer ugcs-2.12.dmg;
2. Follow the installation guide;
3. Read the license agreement carefully (see End User License Agreement in a separate file).
Overview

Your typical operation with UgCS and UAV will consist of the following steps:

- connecting drone to UgCS;
- checking drone parameters;
- deciding where to fly and planning the route;
- performing actual flight;
- making post flight analysis, replaying telemetry, geocoding data.

UgCS user interface consists of three main views:

1. **Mission editor.** Here operator may plan routes (left part of the screen) and operate drones (right part of the screen), including route uploading, command issuing and telemetry reception.

![Figure 1. Mission editor](image1.png)

2. **Telemetry player.** Here operator may perform post flight analysis and replay telemetry for selected vehicle. Also image geocoding available here.

![Figure 2. Telemetry player](image2.png)
3. **Main menu.** Here operator gets access to various application configuration settings

![Figure 3. Main menu]

### License activation

After the download and installation of UgCS it has limited functionality: the option to upload routes to vehicles is disabled, except the emulators. To activate full functionality of UgCS the license has to be activated.

To activate your UgCS, please enter/paste the UgCS Activation code received in e-mail after the purchase into the field “Menu” -> “License” and confirm by clicking the “Activate” button. After successful activation a confirmation window stating “Activated” will be displayed.

To obtain an UgCS Activation code compare features and prices, visit UgCS online-store [www.ugcs.com](http://www.ugcs.com) or send a request to ugcs@ugcs.com.
Standard operations

Mission editor: flight preparation

By default mission editor is the first view after application start. UgCS version number of application is available in the upper left corner of the application window. Please provide the UgCS version number when you contact UgCS technical support. Please see Figure 4 for more detailed explanation of main functionality.

![Figure 4. Mission editor](image)

<table>
<thead>
<tr>
<th>#UI block</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>MENU button to access <strong>Main Menu</strong> settings. To switch between Mission editor and Telemetry player, and to Exit (Quit) software. In Mission editor mode available functions are: to Create new, Open, Stop editing, Remove, Import, Export mission. Functions in Telemetry players mode: Create new layout and Import/Export telemetry.</td>
</tr>
</tbody>
</table>
| **2** | From left to right: Add new route button, following by list of created Route cards. Each Route card indicates: Route name, Assigned vehicle profile, Route calculation status and Parameter setting button (right bottom corner of the Route card).
  - Hovering cursor over Route card - short route status will be displayed.
  - Click the Route calculation indicator to open / hide Route log.
  - Double-click on Route card will recenter your point of view to appropriate route on map.
**Route calculation indicators:**
  - Green check is displayed - if route is calculated and it is ready for upload to drone;
  - Yellow dot is displayed - if route is not calculated. If calculation doesn’t start automatically, push on the yellow dot;
  - Red exclamation is displayed, if route is calculated with errors. |
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td><strong>Route planning</strong> tools and associated tool’s settings window - select a tool, draw route segment on the map, then configure parameters in route’s tool setting window. <strong>Note:</strong> available Route planning tools can differ, depending on vehicle type. To draw a route double-click (or SHIFT+click) on the map. To draw a free hand curve hold Alt+left click and draw by moving mouse on the map.</td>
</tr>
<tr>
<td>4</td>
<td><strong>Measurement</strong> tools: Distance, Area and Visibility measurement tools.</td>
</tr>
<tr>
<td>5</td>
<td><strong>No-Fly-Zone</strong> drawing tools: Polygon and Conical drawing tools.</td>
</tr>
<tr>
<td>6</td>
<td><strong>Compass, cursors coordinates on map</strong> and <strong>elevation</strong> indicator. To return map to North-up view, click the compass icon.</td>
</tr>
<tr>
<td>7</td>
<td><strong>Route log</strong> - all route related notifications are displayed here. To open the log, click on route card’s calculation status indicator.</td>
</tr>
<tr>
<td>8</td>
<td><strong>Vehicle log</strong> - recent vehicle related notifications appear here, but will disappear after some time. To open full vehicle notification list select <strong>Show log</strong> button.</td>
</tr>
<tr>
<td>9</td>
<td><strong>Show / hide route log</strong> button.</td>
</tr>
</tbody>
</table>
| 10 | **Vehicle command** buttons - these commands are never blocked, enabling pilot to send any command to the vehicle at any time. **Note:** Vehicle command buttons can differ, depending on vehicle type.  
   - If button is dark grey - it is active and command can be sent to vehicle. If button is light-grey - based on telemetry data, it is not possible to send command to vehicle - the button is inactive.  
   - If button has green border, then according to telemetry data the vehicle is in current mode. (In the example screenshot the vehicle is Armed in Auto mode.)  
   - Some commands may require confirmation before activation, then additional window will appear. |
| 11 | **Telemetry window** for selected vehicle. |
| 12 | From right to left: **Add vehicle** button, enables to add vehicle to mission from list. Usually all vehicles connected via datalink to computer are automatically added to the list. **Vehicle cards** will be displayed to the left from **Add vehicle** button indicating: Vehicle name, Battery status, Uplink level, Downlink level, GPS status (satellites count) and settings button (right bottom corner on Vehicle icon).  
   - Hovering cursor over Vehicle card - basic information about the vehicle is shown (name, profile, serial number, connection port)  
   - Double-click on the Vehicle card will recenter your point of view to the appropriate vehicle position on the map. |
| 13 | **User interface minimise / restore** button - to hide or show all user interface (UI) elements. |
| 14 | **Clock** - to see clock with milliseconds, hover mouse cursor over the clock. |
| 15 | **Licence status indicator** - displays your UgCS software licence activation status: if green - the licence is activated, if yellow - not activated. |
| 16 | **Video recording indicator** - during video recording the square is red, otherwise - white. |
| 17 | **ADS-B indicator** - ADS-B receiver connection status: if ADS-B receiver is connected the indicator is green, if not connected - grey. |
| 18 | **Input mapping** (keyboard symbol) - keyboard and joystick configuration to check mapping and calibration for connected devices. |
Basic operations with missions

Mission is like a workspace that combines routes and vehicles and covers following parts of your UAV operation life-cycle:

- Planning routes;
- Controlling vehicles.

As mentioned earlier, mission editor can be divided in left and right parts. All route editing controls and tools reside on the left part of the screen. All vehicle related things reside on the right side.

Before diving deeper into route planning it is important to understand concepts that are used in UgCS. It is important to understand what is vehicle platform, vehicle type, vehicle profile and real vehicle.

Think about vehicle platform as of autopilot type. E.g., DJI A3 is a platform as well as Micropilot. Vehicle type defines the frame type: multirotor, fixed-wing. Vehicle profile is a preset of parameters mapped to a vehicle platform and vehicle type. Vehicle – is a real vehicle instance identified by id, platform and type. Vehicle is linked to some vehicle profile.

Imagine you fly DJI A2 multirotor. For different tasks you use batteries of different capacity and different cameras. In this case it makes sense to create two profiles for DJI A2 with different cameras and battery settings and use these profiles during route planning.

Another important thing to note is that during route creation you select vehicle profile and not real vehicle instance. So, later planned route can be uploaded to several vehicles of the same profile.

Let’s go through the simple scenario of creating route and running it with your drone (refer to Figure 4 for block numbers):

1. In route list (block 3) press “Add new route” button;
2. “New route creation” window is displayed;
3. Leave “Create from scratch” marked and press “Next”;
4. On the second step give a name to a route, select vehicle profile, press “Next”;
5. On the last step you may leave default parameters as is. More information about this window can be found in section “Route parameters and path finding”. Press “Ok”. You’ll see new route card in route list with specified name;
6. Now add some figures from route planning tools (block 7). Simplest thing is to add waypoints. Select tool from toolbar and add figure on a map using double click or “SHIFT”+ click. Each
figure has associated inspector window with such important parameters like coordinates, altitude, speed that will be applied to a vehicle after this figure, turn type and some more;

7. Our path finding algorithm calculates actual path after you stop editing route for few seconds. Status of calculation can be seen in right upper corner of route card;

8. After route is successfully calculated you can upload it (see commands in block 11), arm vehicle and turn on automatic flight mode.

**IMPORTANT!** Operation procedures differ for each vehicle type. E.g. some of them may start from the ground, others require manual take-off to safe altitude. Please read carefully your vehicle operation guide and also UgCS “How to connect...” manuals. Pilot MUST know how to act in emergency situations.

Note: safety is always a responsibility of pilot!

### Screen operations:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Keyboard or mouse combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draw segments</td>
<td>Double click left mouse button / SHIFT+left mouse button / Alt+hold left mouse button and draw free-handly</td>
</tr>
<tr>
<td>Close polygonal objects</td>
<td>Draw polygon segments, set last segment near to first or drag last segment onto first segment to close polygon</td>
</tr>
<tr>
<td>Select segment</td>
<td>Left mouse-click on segment</td>
</tr>
<tr>
<td>Select multiple segments</td>
<td>(Win, Linux) CTRL+right mouse click on a figure / (macOS) cmd+right mouse click on a figure</td>
</tr>
<tr>
<td>Select all segments</td>
<td>(Win, Linux) CTRL+A / (macOS) cmd+A</td>
</tr>
<tr>
<td>Move selected segment(-s)</td>
<td>Hover figure basement, hold left mouse button and drag</td>
</tr>
<tr>
<td>Move map left, right, up, down</td>
<td>Hold left mouse button and drag / left, right, up, down keys</td>
</tr>
<tr>
<td>Zoom in</td>
<td>Mouse wheel / minus key / zoom in gesture</td>
</tr>
<tr>
<td>Zoom out</td>
<td>Mouse wheel / plus key / zoom out gesture</td>
</tr>
<tr>
<td>Rotate screen camera left, right, up and down</td>
<td>Hold right mouse button and move mouse / hold Shift + left, right, up, down keys.</td>
</tr>
</tbody>
</table>

### Route planning tools

Route planning tools are organised as a tool bar (see Figure 4. Mission editor #3) Usage algorithm for each tool:

1. Select tool on the toolbar;
2. Draw figure on map. Figure may contain one or several base points;
3. Change parameters in tool inspector;
4. Optionally add actions in tool inspector.
Rule of thumb is that speed changes and actions take effect starting from the first calculated point of a figure in which changes are defined.

**Note:** On mouse hover over a selected waypoints, distance to the neighbouring segments will be displayed as hints on the corresponding paths. During the adjustments of any segment distance to the neighbouring segments will be displayed until the route is calculated.

Some parameters are common for almost all tools:

**Flight speed** - flight speed of the drone for this segment. The speed is along the straight 3D line from current WP to next WP. Should not exceed the maximum speed specified in the vehicle profile settings. Must be a positive number.

**Avoid obstacles** – flag to be set if buildings have to be taken into account when planning the path. Do not uncheck without specific need to do so.

**Avoid terrain** – flag to be set if the path has to satisfy a minimum height over terrain condition (the corresponding value is one of vehicle parameters). Do not unset this flag unless necessary.

**Turn type** – the way how segments will be passed by vehicle. There are different ways of passing a waypoint for each autopilot. For Ardupilot these are Straight and Spline. For DJI autopilots these are Stop and Turn (default), Bank and Adaptive bank. You can find more information about the supported turn types and their descriptions for your vehicle in the vehicle Manuals (ex. DJI Manual). Default turn types doesn’t have an icon on the corresponding waypoints at route planning window like other turn types do.

**Action execution parameters (not available for Takeoff, Waypoint, Landing):**

- Every point – actions will be generated on all waypoints;
- At start – the algorithm will generate actions only on the first waypoint;
- Forward passes – actions will be generated on all points during pass, payload disabled at turns (available only for Photogrammetry and Area scan tools).

**Take-off**

Take-off tool is used to mark the target position after take-off. Vehicle is expected to be launched from the ground level at the Takeoff position.

Availability of this tool depends on vehicle type.

**Waypoint**

**Waypoint** tool is the default tool. To create a new waypoint, press and hold “Shift” key while simultaneously dragging up from the ground to the desired height or just double-click on the map. Therefore, not only the location but also the required altitude of the waypoint is set in one motion. The waypoint’s position can be adjusted more precisely later. The pin can be dragged by its base to change latitude and longitude. Dragging the pin by its head changes the altitude of the waypoint. Alternatively, coordinates can be corrected in numerical form using the properties window of the waypoint. Multiple waypoints can be drawn in sequence. Each waypoint you draw creates a new route segment connecting particular waypoints.
**Photogrammetry**

Route points are placed at the same height relative to the ground. This height is calculated based on camera settings and set GSD value. Calculated parameters (number of passes, number of camera shots, etc.) are displayed in route log window (see Figure 4, 13). Photogrammetry tool is available for 

_UgCS ONE, UgCS PRO and UgCS ENTERPRISE_ licence.

**Note:** Photogrammetry tool requires a camera to be selected as a payload. The camera must have properly specified (positive) values of focal distance, sensor size (width and height), and sensor resolution (horizontal and vertical).

Additionally to all common options, these features are available for Photogrammetry tool:

- **Move / Rotate segment** - select+hold the blue circle in centre to drag-and-drop Area scan segment to other location. Select+hold circle’s rim to rotate whole segment.

- **Camera** - payload that is assigned to a profile. In case of multiple cameras attached to profile it is allowed to select which one to use for area scanning.

- **Ground resolution** (_GSD, cm_) – approximate ground resolution for resulting images (in centimetres per pixel).

- **Forward overlap** (%) – ratio of the overlap in neighbouring frames (consecutive by motion vector, see the scheme below). Value is set in the range from 1% to 90%.

- **Side overlap** (%) – ratio of the overlap in neighbouring frames (placed in neighbouring rows, see the scheme below). Value is set in the range from 1% to 90%.

- **Camera top facing forward** – concerns the camera orientation to the motion vector. If the flag is set, then it is assumed that the camera is oriented so that the frames overlap over the upper frame boundary motion vector. If the flag is removed, then the frames overlap along the lateral frame boundary.

- **Direction angle** - used to change the direction of the main scanning progress. By default, the algorithm calculates a route scan in a bounded polygon so that the main course of the scan is performed in the direction of "South-North".

- **Additional waypoints** – if the flag is cleared, the algorithm generates only the turning points. If the flag is set, additional waypoints for camera shooting will be generated depending on overlap and camera settings.

- **Overshoot, m** - adds extra segment to both ends of each survey line to enable extra space for turns.

- **Overshoot speed, m/s** - option to decrease/increase vehicle speed for overshoot segment while passing turns.

- **Altitude type** - _AMSL or AGL to set Flight height_.

Altitude AMSL is being calculated from lowest point using GSD. But the number of shots required to meet forward overlap and side overlap constraints are being calculated using altitude difference between calculated flight altitude AMSL and highest point of the area.

**Allow partial calculation** – option to allow route calculation in these cases:

- a. The part of route exceeds maximum AMSL of route

- b. Relief height is unavailable at some point(s) of route
c. The part of route exceeds the maximum fence radius

d. The part of route in No-fly zone (NFZ)

No action at last point – remove action for last waypoint.

**Note:** For those pilots who have autopilot that supports camera triggering by distance or time, there is automated algorithm that calculates and sets the according parameters. It is not necessary to use this approach with Actions in every point parameter.

![Sample photogrammetry route](image)

*Figure 5. Sample photogrammetry route*

**where “fo” - forward overlap, “so” – side overlap**

**Calculation:**

1. Calculate the altitude required for camera recording:
   a. \( \text{heightAgl} = \frac{f \times \text{GSD} \times \text{sensorWidthPx}}{\text{sensorWidth}}; \)
   b. \( \text{heightAgl} = \frac{f \times \text{GSD} \times \text{sensorHeightPx}}{\text{sensorHeight}}; \)
   c. Selected minimum value calculated of heightAgl.

2. Calculate the frame size:
   a. \( \text{frameWidth} = \frac{\text{sensorWidth} \times \text{heightAgl}}{f}; \)
   b. \( \text{frameHeight} = \frac{\text{sensorHeight} \times \text{heightAgl}}{f}. \)

   **where “f” is True focal distance**

The scanning area is partitioned into frames of calculated sizes with given overlaps. The direction of passage is selected using Direction angle. The route is based on the “snake”.

**AGL Tolerance, \( m \)** – enables to fly straight trajectories over slightly wavy landscape, by specifying how precisely the UAV should follow required altitude above ground. To maintain specified height additional waypoints will be added if difference of height is larger than AGL tolerance. The smaller AGL tolerance value, the more amount of waypoints will be generated. If AGL tolerance is set 0 (zero) UAV's altitude will be constant throughout route, but many additional waypoints will be added.

**No action at last point** – removes action for last waypoint.

**Double grid** - if enabled, adds a second grid to the survey are in a 90 degree angle according to first grid.
**Area scan**

Area scan is similar to Photogrammetry tool, except for Area scan there is no need to set Ground resolution (GSD) and camera settings. This is a simpler way to plan flights over area. Parameters to specify: height, side distance and perimeter.

Additionally to all common options, these features are available for Area scan tool:

**Move / Rotate segment** - select + hold the blue circle in centre to drag-and-drop Area scan segment to other location. Select + hold the circle’s rim to rotate whole segment.

**Flight height** – altitude of flight along the area.

**Altitude type** – AMSL or AGL to set Flight height.

**Side distance** – size in meters between lengthwise route lanes.

**Direction angle** - used to change the direction of the main scanning progress. By default, the algorithm calculates a route scan in a bounded polygon so that the main course of the scan is performed in the direction of "South-North".

**Overshoot, m** - adds extra segment to both ends of each survey line to enable extra space for turns.

**Overshoot speed, m/s** - option to decrease/increase vehicle speed for overshoot segment while passing turns.

Allow partial calculation - option to allow route calculation in this cases:

a. The part of route exceeds maximum AMSL of route

b. Relief height is unavailable at some point(s) of route

c. The part of route exceeds the maximum fence radius

d. The part of route in No-fly zone (NFZ)

Also you can get route calculation error if trajectory fixed height is lower than safe height over terrain at some route point.

**AGL Tolerance (m)** - enables to fly straight trajectories over slightly wavy landscape, by specifying how precisely the UAV should follow required altitude above ground. To maintain specified height additional waypoints will be added if difference of height is larger than AGL tolerance. The smaller AGL tolerance value, the more amount of waypoints will be generated. If AGL tolerance is set 0 (zero) UAV’s altitude will be constant throughout route, but many additional waypoints will be added.

**No action at last point** – removes action for last waypoint.

**Double grid** - if enabled, adds a second grid to the survey are in a 90 degree angle according to first grid.

**Circle**

**The Circle** tool makes the route go around the specified point at a required distance the vehicle facing to the centre (if autopilot supports it). If one does not require the vehicle to face centre, just
set Yaw angle at 0° and the vehicle will fly facing the flight direction. Creating a circle is similar to creating a waypoint. To change the radius of the circle, drag the circular part of the pin. The radius can be specified in the properties of the circle in numerical format. Like with waypoints, circles can be added to the route in sequence.

*All common options available for this tool plus:*

**Number of laps** – number of full turns the drone has to make around the circle.

**Fly clockwise** – flag indicates whether the drone will fly clockwise (checked) or counter clockwise (unchecked).

**Number of approximating points** – number of basic waypoints generated. If left blank, this parameter will be automatically determined from the radius of the circle.

**Follow terrain** – if enabled all generated waypoints have the same altitude from ground (AGL altitudes are equal). If disabled, all the points will have equal AMSL altitudes

**Perimeter**

*Also all common options available for this tool plus:*

**Flight height** – altitude of flight along the perimeter. This altitude is not affected by the altitude type chosen for the route.

**Number of laps** – number of times the drone flies along the perimeter.

**Landing**

Landing tool is used to mark the landing position and parameters. Availability of this tool related to vehicle type.

Landing waypoints are associated with descent rate parameter that can be found in vehicle profile.

**Note:** The landing algorithm for planes in UgCS has two basic points – the waypoint at which the landing sequence starts and the landing point. The landing trajectory is a straight line between both of these points, provided there are no obstacles between them. The landing trajectory is calculated based on the glide slope parameter.

The glide slope parameter is set in the vehicle profile settings. It might be, for instance, 10%. This means that for each 100 m the plane travels to the landing point it decreases its altitude by 10 m.

The landing ground speed parameter is the speed set in vehicle profile. This speed should be set to a low value so that, if automatic flaps are enabled for the plane, they are deployed.

**Modifier: Insert new route segment before the current one**

Click the insert new segment route icon to add a new segment before the current segment.

**Modifier: Draw a curve with automatic points**

Activate «Curve points» by clicking the icon + hold left mouse button and drag cursor to draw a line without holding Ctrl button. For macOS you don’t have to hold any key, just click the left mouse button and draw.

Another way is to draw a line on the map and UgCS will automatically set planning algorithms (WPs, points of perimeters, etc.) along the trajectory. For this action you must hold Ctrl button on the keyboard + left mouse button and draw a line on the map. For macOS you have to hold alt (option).
**Measurement tools**
Several tools are available to ease mission planning (Figure 4. Mission editor #8):

- **Distance measurement** tool allows you to draw a line, and displays its length.
- **Area measurement** tool allows you to draw a polygon, and shows the size of the area.
- **Visibility range** tool allows you to place a point and find the distances to all obstacles around that point. The tracing is performed on a horizontal plane.

To deselect current tool click the tool icon.

**Actions**

**Wait**
*Wait* action – wait in the current waypoint for a certain time (seconds).

**Set yaw**
*Yaw* action specifies the nose angle relative to the movement direction or to North direction. Choose option “Next WP” or “North”. The value must be in range from 0° to 360°.

**Set POI**
Point of interest (POI) sets the point of interest for the vehicle to face towards during the flight. It can be set either by entering a latitude, longitude, and altitude in a numerical form or by clicking the Crosshair button in the action properties and drawing the POI in the same way that waypoints are drawn (holding the Shift button and clicking on the map). After inserting the POI, click the crosshair icon again to exit POI mode.

**Camera by time**
Camera mode by time allows you to shoot a series of images with a time delay between them. You can add a delay before the shot series are started. The series will consist of an automatically calculated number of shots with an interval between them.

**Camera by distance**
Camera mode by distance allows to shoot a series of images with a specified distance between shots. Delay parameter can be added before the series of image taking is being started. The series will consist of an automatically calculated number of shots with a distance between each.

**Note:** For now Camera by distance action is not supported by DJI drones.

**Note:** For both Camera mode by time and Camera mode by distance there is Auto option available if used with Photogrammetry tool. If enabled (by default) it sets the action parameters according to provided Photogrammetry parameters and will take a distinct number of camera shots. The calculated parameters are displayed in log window after route calculation (#13, Figure 4. Mission editor).

Auto parameter can be disabled and the parameters can be set manually.

**Set camera attitude / zoom**
The *Set camera attitude / zoom* action enables to change the angle for camera roll, tilt and yaw and to set the required camera zoom level. Angle can be set from 0° (inclusively) through 360° (exclusively). Zoom levels are integral positive values.
In UgCS for DJI the value of zoom level is displayed between zoom buttons. This value varies for different DJI cameras according to camera value range. Therefore, before setting the Set camera attitude action value, check the border zoom values of the camera.

The Zoom settings of UgCS is limited by optical zoom range of particular camera.

**Note:** due to the different technical approach of Z30 it is not possible to see the correct zoom values in UgCS for DJI - for now the workaround to use this functionality is to find the desired zoom value empirically.

**Note:** Some vehicles are not supporting this action.

**Camera mode**
Camera mode allows you to choose one of the following modes: “Start recording” for continuous video recording, “Stop recording” to stop it and “Shot” for taking a single photo.

**Panorama**
Panorama action – allows the vehicle to slowly rotate in the specified waypoint to take a video panorama or shoot a series of photos while rotating

**Note:** The **Point of interest** action does not affect connection between the route segments for which it is set.

**Set Servo**
Action to control PWM controllable peripherals, e.g. retracting/extension a landing gear, LED control, etc. Selected segment and set Servo ID and value of impulse-width in microseconds.

**Repeat Servo**
The same action as **Set Servo** with two additional parameters: to delay the action - Servo Delay in seconds and Servo Cycle Count to set number of repetitions.

**Note:** **Set Servo** is supported by Ardupilot; DJI: A2, WooKong-M, Naza-M V2. **Repeat Servo** is supported only by Ardupilot.
Change route’s start point (e.g. after battery change)

By default, vehicle starts mission from first waypoint. It is possible to manually select from which route’s waypoint vehicle should start the mission. This functionality can be used to change battery, for large area scanning, etc.

To change start point click “Parameters” button on route card, click “Change start point” (Figure 6. Change start point) and on the map select the waypoint from which route should be started. New starting point will be marked with a Flag icon next to it, also Route’s card will be marked with the Flag icon.

The route is automatically recalculated. Upload route to vehicle.

If route’s start point is changed a check-box for Upload is added to choose whether the vehicle should fly directly to changed start point or through first waypoint.

To reset the selected start point to first waypoint in Route’s card drop-down parameters menu click “Clear start point” (see Figure 6. Clear start point).

Every vehicle profile has maximum waypoint limit that can be uploaded at once and maximum travel time. If planned mission has larger waypoint count or exceeds maximum allowed travel time a notification will be displayed:

- Estimated flight time exceeds the maximum possible flight time specified for the vehicle profile.
- Route is longer than autopilot can accept at once (N waypoints allowed).

In this cases route will be uploaded partially. At this case when you press upload button warning message appears (see sector Troubleshooting).

Add or edit common actions for multiple segments

While holding CTRL (cmd for macOS) select multiple segments to add or edit common actions. To select all segments, click CTRL+A for Windows or cmd+A for macOS.

When selecting multiple segments these functions will be available:

- add new action;
- delete action;

**Note:** Actions can be added/edited for segments if actions are in the same order and have same value.

### Invert segment order

Enables to change direction of the flight to the opposite course i.e. invert.

### Route to waypoints

Enables to convert Photogrammetry or Area scan to route of waypoints

### Split route

To split initial route into two or more parts.

There are several options to split a route:

- Manualy - split a route at specific segment(s). In order to split into more than two parts, enter multiple segment numbers separated by a comma. The defined segment number will be the last segment of the first route part.

- Split by distance - split routes at a specific distance which is defined in Distance field.

- Tolerance - if existing waypoint is within the tolerance range of the split position, existing waypoint will be used. Otherwise, a new waypoint will be created.

- Limit - define allowed number of parts into which the route should be split.

Overshoot defines section added before each split part except the first one.

### Merge routes

Enables to unite two separate routes into one route.

### Route parameters and path finding

#### Route parameters

Third step is to review and set missing parameters of the route. In order to ensure a safe execution of the mission, it is crucial to understand and review all parameters before route is confirmed.

![Figure 7. Route parameters](image-url)
**Home location** - is a point to which the vehicle should return in the case of a failsafe condition being triggered automatically or the operator giving the command to return home. Failsafe execution conditions usually include emergency situations such as loss of RC or low battery charge level.

Option “Do not modify” defines that autopilot actions for this settings are not modified. Option is located in the drop-down list for each Fail safe action.

The home position can be set explicitly, or the first waypoint of the route can be set as the home location (Figure 7. Route parameters). If it is set explicitly, the coordinates can be specified in numerical form; either decimal or degrees-minutes-seconds (DMS) formats can be used.

**Note:** To switch to the decimal degrees format, click on the °/′″ button. To switch back to the DMS format, click on the °/′″ button.

An alternative and usually more convenient way to set the home position is to point it on the map. Click the button with the crosshair icon to use this option. As soon as the map is loaded, the location can be defined by dragging with left mouse button while holding the “Shift” key. A pin will appear and one is able to change its height depending on the position of the mouse pointer (Figure 8). After the location has been chosen, clicking on the OK button takes you back to the wizard.

![Figure 8. On-the-map selection of home location](image)

After uploading the corresponding mission, home location will be visible on map as a green circle with a yellow “H” within it. Additionally, if the home location altitude is above ground level, a vertical line similar to a waypoint will be displayed above it.

**Note:** Every time the home location of a vehicle is changed, an informative message in the Log window will appear.

During mission, execution or manual flight in the heading indicator the direction to home location will always be displayed as a red triangle with “H” within it. Above that, one can see the angle to home location and if home location is not set, it displays “N/A”.

Additionally, it is possible to view additional data about the home location by moving the mouse cursor on it. The available information consists of corresponding vehicle, current distance to the vehicle, coordinates and altitude of the home location and ground elevation at that point.

For ease of use, it is possible to view home location of the vehicle by clicking on “Focus on home location” command in the corresponding vehicle context.
**Note:** Every autopilot and thus vehicle might handle Home Location functionality different. For safe use, please read the corresponding section in your vehicles VSM User guide.

![Vehicle context menu](image)

**Figure 9. Vehicle context menu**

*Maximum altitude* is the altitude limitation for the route. Note that this altitude changes its type (above mean sea level or above ground) as one changes the altitude type for the route (see below).

*Emergency return altitude* is the altitude used by the vehicle to return to the home position in emergency cases or when the operator recalls it during the mission. This altitude is default when you make new waypoint by double-click on the map.

*Altitude origin* specifies whether altitudes are calculated from the mean sea level or from the level of terrain. Usually it is more convenient to specify altitudes relative to the ground level. Please note that once the choice is made, all the altitudes specified in the created route are interpreted in the chosen type. There is the option to change the altitude origin afterwards via the route options window.

*Trajectory type* is the parameter for defining the pattern of the route between two waypoints. Choosing the *Straight* option results in a direct line segment between the points whilst the *Safe* option generally produces two segments, one vertical and one horizontal, as schematically shown below.

The behaviour of vehicles in different types of trajectories, and applicability of failsafe conditions, depend on the autopilot’s capabilities. For more information, check the manual and specifications of the device.

![Safe trajectories](image)

**Figure 10. Safe trajectories**

*Action on GPS loss, action on RC loss, action on battery discharge and datalink loss* are the pre-defined emergency actions. In all cases the option to wait or to land the vehicle can be chosen.
Options to return to home position and to continue flight along the route are also available, provided GPS is operational.

Usually it is only required to specify the home position and safe altitude; other parameters have reasonable default values based on known vehicle properties. Still, it should be ensured that defaults are correct. The software will perform checks and will cancel route creation if incorrectly defined or conflicting values of parameters are present. Notifications about errors in values are displayed at the bottom of the window, and the particular parameter is highlighted.

**Mission Calculation**

After the route has been formed with all segments in place and their parameters are double checked, the mission is ready for processing.

The calculation process is executed automatically. The mission is automatically saved when the route calculates. Calculation might take some time.

During the calculation process the route is checked for feasibility according to predefined rules. First it checks whether figures and parameters are specified correctly. All polygons must be closed and all parameters must be correctly specified before proceeding. Correct parameters must also be supplied for actions attached to the route segments.

Calculated route build around NFZ and (refer par. “No Fly Zones”) and buildings.

To ease error correction for a route, a message is displayed pointing to incorrect values before route calculation proceeds. The first route segment with an invalid parameter is automatically selected. After the problem has been fixed automatically start route re-calculation. If no more errors are found, the calculation process will be launched.

In the card of route has status icon display of the route calculation (in the upper right corner).

- green check mark - the route is calculated, no errors are detected;
- yellow circle with a rotating - there is a route calculation;
- red triangle with an exclamation point - in the itinerary there is an error, you must change the parameters of points in the route.

You can always access log file saved on disk, see Troubleshooting section for default log paths.

**Saving map for offline usage**

To save elevation information around camera view point for offline usage you should click Map Options and choose *Offline map* or select this command from right-button mouse menu.

![Figure 11. Map options menu](image)
Cache file with 1 km radius will be saved for current map provider. Wait until animated progress bar on the button will disappear. Do not forget to press Offline map button after any camera view point changing for getting proper data.

Parameter “cacheRadius” in map.xml configuration file enables to control radius of map caching area.

Map layers
“Layers” button (Figure 11. Map options menu) opens window with map layers’ configuration menu. Two map providers can be used at the same time, meaning that one of them is used as Base map tile provider (Google Hybrid, for example) (Figure 12. Map layers window, a) and another is used as an Overlay tile provider (OpenWeatherMap, for example) (Figure 12. Map layers window, b), which, for example, can add street names or show weather (refer. par “Map providers”). You can check map for terrain absence by toggling “Show terrain absence” checkbox (Figure 12. Map layers window, c). Area without terrain would be shown with red colour.

Click on Buildings (refer par. “Importing buildings on a map”) and Placemarks (refer par. “Working with placemarks”) checkboxes to display it on map (Figure 12. Map layers window, d). Also you can enable any single Terrain source (refer par. “Importing 3rd party elevation data”) as a layer on the map by selecting it from list (Figure 12. Map layers window, e) and focus camera on it by pressing Focus button. The same is for Building sources list on the right side of the Layers window (Figure 12. Map layers window, f). To highlight a imported source (elevation or buildings) on the map with green colour you should select if from the list. To display No fly zones (refer par. “No Fly Zones”) on map toggle checkboxes Aerodrome zones and Custom zones (Figure 12. Map layers window, g).
### Mission editor: flight execution

#### Commands explained

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upload</strong></td>
<td>Upload current mission to vehicle. See command result at log window.</td>
</tr>
<tr>
<td>Arm \ Disarm</td>
<td>Activates \ deactivates all systems and makes the vehicle ready for flight. See command result at log window.</td>
</tr>
<tr>
<td>Auto \ Manual Mode</td>
<td>Setting selected vehicle to Auto or Manual mode. When in Auto, vehicle start execution of uploaded mission (if Armed).</td>
</tr>
<tr>
<td>Click &amp; Go</td>
<td>When you press “Click &amp; Go” button you need to make double click or SHIFT + click on the map to define target waypoint. If command sent successfully vehicle will move towards the specified point (if Armed). You will see dashed line connecting vehicle and target point. If you hover the point head, you will see distance to approach and estimated time.</td>
</tr>
<tr>
<td>Joystick</td>
<td>Enable joystick control mode. See Joystick section for more information.</td>
</tr>
<tr>
<td>Hold</td>
<td>Suspends current operation. In case of execution mission (Auto mode) puts it on hold. In case of Click &amp; Go - flight stops the vehicle (loiter around current position in case of plane) and clears current target point. In case of Landing holds landing.</td>
</tr>
<tr>
<td>Continue</td>
<td>Continues mission execution from point where mission put on hold.</td>
</tr>
<tr>
<td>Land</td>
<td>Lands the vehicle at the current point.</td>
</tr>
<tr>
<td>Return Home</td>
<td>Returns the vehicle to the Home Point. Important! If the vehicle is within 30m from Home position it will land immediately.</td>
</tr>
<tr>
<td>Camera trigger</td>
<td>Shots the camera manually.</td>
</tr>
<tr>
<td>Emergency land</td>
<td>Sending command to make emergency land.</td>
</tr>
<tr>
<td>Take-off</td>
<td>Take-off vehicle from ground.</td>
</tr>
</tbody>
</table>
**Take-off point altitude**

Take-off altitude – is the altitude above mean sea level that used by autopilot to calculate altitude. For Ardupilot it sets automatically when you select Home Point. For others it sets to altitude below Home Point when mission uploads to disarmed vehicle. In other cases, it can be set manually (see Figure 14).

![Figure 14. Setting take-off altitude](image)

**Note:** it is highly recommended to always check altitude values. Altitude drift problems cannot be solved by software only and require operator attention. Always check, after power cycling a vehicle or mission upload, whether the altitude is reported correctly. UgCS tries to detect such conditions and issues a warning “It looks as if you have to power on/off your drone in order to reset barometer...” if RAW altitude reported by the vehicle is very different from 0 at the time of mission upload.

After setting the take-off altitude it is displayed in the vehicle card.

**Click & Go**

Click & Go mode allows to interactively command vehicle to fly to a target location by clicking on the map. Once the location is reached, copter will hover at reached location, waiting for next command. This behaviour is implemented as a mini mission containing two waypoints: current drone position and target point.

In order to start Click & Go mission, set a target point on the map to which the copter has to fly and confirm it.
Steps:

- Press “Click & Go” command (Figure 15. Click & Go);

![Image of Click & Go command](image)

- Click on the map to set the target point;

- Adjust additional parameters “AGL alt”, “Speed” and “Heading” if needed and confirm to send the command to the drone (Figure 16. Click & Go parameters);

![Image of Click & Go parameters](image)

- Press «OK» button or «Enter» key.

**Heading** is the angle between north direction and the vehicle bow. By default “Heading” is set collinearly according to flight direction. The drone will fly to new target point all the way in set “Heading” angle after the command is sent to the vehicle. If the “Heading” field is left blank (not 0, but empty) - the vehicle will fly using current heading. It is also possible to adjust the heading by moving the arrow of the target waypoint.

When you perform Click & Go mode for drone on the ground it firstly go up to “Minimal safe altitude” (default – 5m, can be changed at Settings – Drone Specific Settings) and then going to selected point.

It may be necessary set Take-off point altitude (Take-off point altitude).

If you interrupt some action trigger (Camera by time, Camera by distance and etc.) with Click & Go command this action will not be performed when you click Continue button. Actions at next waypoints will work as usual.

Continue button will be inactive if Click & Go action is interrupted i.e. by pressing Hold button.

**Vehicle notifications and log**

Events related to command execution and related to UAV appears at bottom right corner. Later system clean up these messages from log window. But you can find all messages in log file selected vehicle (press the button “Show log”).
Video display and recording

UgCS allows you to watch and record video. Click drop-down menu of vehicle (Figure 9) and tick Show video to open Video window. If you want to hide Video window, clear check-box Show video. In video window select the source videostream. You can Start or Stop recording using appropriate buttons (related to license and vehicle type), or share video.

To display video from UgCS vehicles from DJI need to set the flag "Enable Live Stream" in the mobile app’s settings.

Configure connection to the Videostream

Video Service is a standalone component designed to grab video data from various video sources and to stream it to UgCS clients. Video Service runs under control of Service Manager.

"Show video" check-box shows/hides video window in UgCS. To expand video window to full screen double-click on it. To view a list of available video streams, press button in top right corner in video-stream window (button with triangle). To broadcast video data to web services use Share button. All available video sources will be displayed in video window. Select a source to share videostream. Record video of any source and play it using media player. In Windows OS recorded files are located:

C:\Users\USER_NAME\AppData\Local\UgCS\video\.

To share video-stream click Share. The window "Share <source_name>" is opened.

As example, to use Ustream service (http://www.ustream.tv/) set channel’s URL and to set flag of permission to broadcast to service. Check video stream on Ustream channel. Note there can be a delay - it is set by default in Ustream service.
Video Service provides information about available video sources to UgCS client so you can pick up desired stream just from particular client (Figure 18. Configure connection to the Videostream).

**Telemetry window**

![Telemetry window](image)

When the mission is in progress the telemetry window (Figure 19) is shown. Four gauges at the top of the window show the battery charge level, number of GPS satellites visible, the quality of the downlink channel and state of connection to remote controller. These gauges will have a white, orange or red colour depending on the charge or the quality of the signal.

Next line represents state of vehicle – Armed (all systems are activated and the vehicle is ready for flight) or Disarmed (all systems are deactivated and the vehicle is not ready for flight) and control - automatic flight mode or manual mode.

**Altitude Raw** – altitude data sent from the vehicle (without any additional interpretation). This value based on GPS and/or barometer data

**Altitude AGL** - shows current vehicle altitude above ground level. Accuracy of this value depends on the digital elevation model of the map for the particular region. The value is calculated thusly: Altitude AGL = Altitude AMSL - Elevation.

**Altitude AMSL** - shows the current altitude of the vehicle above mean sea level. This value is based on Raw altitude data. The value is calculated thusly: Altitude AMSL = Take-off point altitude + Raw altitude.

**Vertical speed** - indication of how fast a vehicle is rising or descending. A positive value means an increase of AMSL altitude, and negative means descending.
**Horizontal speed** - horizontal component of the vehicle speed or Ground Speed.

**Air speed** - shows the speed of the vehicle through the air. This value is available only if vehicle is equipped with an airspeed sensor.

**Elevation** - AMSL of landscape under the current location of the vehicle. Depends on the digital elevation model for the region. Landscape elevation shown in meters above the mean sea level.

**Latitude and longitude** - current latitude and longitude (WGS-84 coordinates) of the vehicle, calculated according to GPS coordinates.

**Distance to home** - distance from vehicle to home position.

Four more elements, below the list of values, display the current attitude of the vehicle: pitch, roll, heading, course and angle to home location.

**Note:** In the heading indicator, direction to home location displayed as a red triangle with “H” within it. Above that, one can see the angle to home location and if home location is not set, it displays “N/A”.

**Downlink / Uplink** – connection status.

Telemetry is recorded and values are saved to the database. Usually a vehicle reports its state multiple times per second. All reported data is saved to disk. The telemetry data can take up a large amount of available space.
Telemetry player

Telemetry values recorded during the flight can be re-played to closely resemble actions that happened during the actual mission execution. To open the player, click Menu and choose Telemetry Player. Click Menu and choose Mission editor to return to mission view.

It is necessary to select the vehicle whose telemetry was recorded. You can do it the same way as in the Mission view. Please view the “Adding a Vehicle” section for further information. Telemetry displayed for all added vehicles. Then click the button “Open calendar” and use the calendar to choose the date on which the flight took place; all the dates having recorded telemetry are highlighted in the calendar.

Navigating timeline

If the telemetry data was recorded, it is displayed on a timeline (Figure 21. Telemetry player). It might take some time to load the mission player and the recorded data.

Under the section with the recorded telemetry indication, the icons are displayed. Icons are schematic representations of commands that were sent to the macOShine at the time.

**Note:** For emulator vehicle telemetry doesn’t store by default. On telemetry player you can see icons only, without recorded data.
Icons correspond to the following commands:

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Icon" /></td>
<td>Upload</td>
</tr>
<tr>
<td><img src="image2.png" alt="Icon" /></td>
<td>Arm</td>
</tr>
<tr>
<td><img src="image3.png" alt="Icon" /></td>
<td>Disarm</td>
</tr>
<tr>
<td><img src="image4.png" alt="Icon" /></td>
<td>Auto Mode</td>
</tr>
<tr>
<td><img src="image5.png" alt="Icon" /></td>
<td>Manual Mode</td>
</tr>
<tr>
<td><img src="image6.png" alt="Icon" /></td>
<td>Joystick Mode</td>
</tr>
<tr>
<td><img src="image7.png" alt="Icon" /></td>
<td>Click &amp; Go</td>
</tr>
<tr>
<td><img src="image8.png" alt="Icon" /></td>
<td>Hold</td>
</tr>
<tr>
<td><img src="image9.png" alt="Icon" /></td>
<td>Continue</td>
</tr>
<tr>
<td><img src="image10.png" alt="Icon" /></td>
<td>Return Home</td>
</tr>
<tr>
<td><img src="image11.png" alt="Icon" /></td>
<td>Land</td>
</tr>
</tbody>
</table>

*Table 1. Telemetry player workspace*

First, move seek bar (Figure 20) to a time when telemetry has been recorded. To start playback, use *Play* button (Figure 20). At any moment playback can be paused using *Pause* button.

To navigate through the timeline one can use mouse and just *click and drag* in the desired direction or use the buttons to the right of the timeline. To zoom in or out one can use mouse wheel or the “+” or “−” buttons next to the timeline.

Playback speed can be adjusted using the speed button on the top side of the screen (Figure 20). Button “1x” provides a normal speed. Speed can be increased by up to eight times (button “8x”).

To delete the recorded telemetry from the selected vehicle, click on vehicle avatar in the left corner (Figure 20). It is possible to delete only the telemetry currently seen on the timeline by clicking “Clear selected telemetry” (Figure 20). To remove all telemetry from the selected vehicle, choose “Clear all telemetry” (Figure 20).
The software automatically saves the current Player layout and selected vehicles, so that next time the client is used it will return to its previous state. To rename the current layout, just click on its name (Figure 20). It is also possible to save many different layouts. To do so, click Menu next to the layout name (Figure 20) and create a new layout.

**Note:** All the values displayed in the mission player are the recorded values. No real time data is shown or produced.

---

**Exporting/importing telemetry**

You have an opportunity to import or export telemetry. To import telemetry data just click “Import telemetry”; to export click “Export telemetry” and locate the desired file. Telemetry records are saved in binary format.

Note that existing timeline frame defines start and end positions for export procedure.

---

**Exporting video**

If during the flight the video recording function is enabled, it is possible to export and save the video as a file from the Telemetry Player. Choose the vehicle and click Export button, choose directory and click Save. Also you can delete exported video file by clicking Remove button.

---

**Playing video**

During the playback of telemetry, it is possible to play also the recorded video. Click the properties drop-down list on the vehicle's card and check the “Show video” box. The video will be played in the newly opened video window.

To enlarge the video window onto the entire screen - double-click on it.

---

**Geotagging**

UgCS allows to tag images taken from your drone with coordinates from recorded telemetry. Important note is that you need to know gap between your camera clock and clock on computer that recorded the telemetry.

**HINT:** the easiest way to remember the time difference is to shoot your computer clock with a camera on a drone. After that you’ll be able to compare time on the image with “modified” attribute of the picture. If you hover clocks placed in top right corner of UgCS you will get a hint with current time detailed up to milliseconds.

Geotagging tool is available from context menu of vehicle in telemetry player (Figure 20).

After pressing “Geotagging” you will get next window (Figure 23. Geotagging window).
Press “Browse” to select images. For now, we support only JPEG.

You will see number of images time from the first and last image as start and end time.

The process of geotagging is pretty straight forward. We take image and try to find the closest telemetry record in the database. To make the search as more precise as possible you need to know camera time offset – the difference between camera clock and computer (where telemetry was initially recorded) clock.

If you process data on the computer with clock configured for another UTC time zone than your camera time zone, then you need to check “Set camera UTC time zone if it’s different from PC UTC time zone” and specify your camera UTC time zone.

After everything is configured you can press “Process”. Algorithm will try to find coordinates for the pictures.

After processing you can press “Show on map” to see camera position for each picture taken.

And if everything is fine, select altitude type from dropdown list - AMSL, AGL, RAW or None and press “Write tags to image files” to save coordinates and selected altitude as EXIF tags into pictures.

**How to prepare photo for geotagging processing**

1. In order to synchronize time between your capturing device and UgCS client, you need to make several photoshoots of UgCS client screen with open time toolbar.
   a. In UgCS client navigate your cursor over current time widget, located in the top right corner.
   b. The Time toolbar will appear.
   c. Take your camera and shoot the computer screen.
2. Connect your device to the PC/notebook for telemetry data receiving from the drone.

3. Execute mission in automatic or manual mode with camera working in periodic photo mode.

How to write geotags to photo files

1. Copy photo files from camera and backup it.

2. Open telemetry player. Add drone to the vehicle list. Check what you can find telemetry data for selected drone.

3. Open geotagging window for selected drone.

4. Calculate time offset value. For this calculation you should compare camera time and photo time.
   a. Please photo UgCS desktop time by camera and select time from picture - this is photo time;
   b. Open UgCS client -> telemetry player -> add vehicle -> open geotagging window;
   c. Click Browse and select photo from previous step;
   d. Then you can see camera time in geotagging window at string after words “start time”;
   e. Calculate difference between two values in seconds.

5. Add all photos from camera (exclude photo with screen).

6. Set calculated camera offset. If you need you can set time zone of the camera.

7. Process and save geotags to photo files.
Main menu

To go to the “Main menu” is necessary to open the list and select the «Main menu». In the Main menu you will see the sections in Figure 25. Main menu.

Vehicles

This section contains all the registered UgCS vehicles.

You can set a filter according to the a platform type of the vehicle profile and sort vehicle by name (Figure 26. Main menu - Vehicles #1).

Table of parameters that should be filled for the vehicle.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Mandatory</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Registering a New Vehicle
To register a new vehicle, connect your vehicle to UgCS and ensure that the VSM for that vehicle type is running. For more information on specific vehicle workflows please refer to our manuals.

Provided that the vehicle is supported by UgCS, the VSM should detect a new connection and a new record in the vehicle list in the UgCS client should be created.

After the automatic detection of vehicles in UgCS you can see a vehicle card in the vehicle menu – vehicle list. UgCS will choose the most suitable vehicle profile for the vehicle.

Editing a Vehicle
If necessary, you can select a different profile for the device manually or edit the current profile. To select the profile for the vehicle you must click the “Edit” buttons (#3 - on the Figure 26. Main menu - Vehicles). After this, you can select a predefined vehicle profile.

You need to restart the VSM after configuration changes.

Removing a Vehicle
You can remove a vehicle from the list manually by pressing the button “Remove” (#4 - on the Figure 26. Main menu - Vehicles).

<table>
<thead>
<tr>
<th>Vehicle name</th>
<th>User defined vehicle name</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tail number</td>
<td>Former ID field. Tail number of the vehicle.</td>
<td></td>
</tr>
<tr>
<td>ICAO address</td>
<td>ADS-B unique identification number.</td>
<td></td>
</tr>
<tr>
<td>Platform</td>
<td>Vehicle platform. You can edit this field in the vehicle profile list.</td>
<td></td>
</tr>
<tr>
<td>Profile</td>
<td>Choose an available vehicle profile or create a new vehicle profile</td>
<td>Yes</td>
</tr>
<tr>
<td>Payloads</td>
<td>View selected payload for the vehicle</td>
<td></td>
</tr>
<tr>
<td>Altitude mode, m</td>
<td>Current take-off point altitude. For more information about this field please see the “take-off altitude” section</td>
<td></td>
</tr>
<tr>
<td>Downlink connected</td>
<td>Downlink connection status</td>
<td></td>
</tr>
<tr>
<td>Uplink connected</td>
<td>Uplink connection status</td>
<td></td>
</tr>
</tbody>
</table>
Vehicle profiles

This section contains all the base and custom vehicles profiles of UgCS.

In the left column (Figure 27, 1) is a list of all vehicle profiles and the button to “Create new” profile from scratch. On the right (Figure 27, 2) all vehicle profile block-cards are listed.

Table of parameters for vehicle profiles

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Mandatory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main section</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle profile name</td>
<td>User defined vehicle profile name</td>
<td>Yes</td>
</tr>
<tr>
<td>Type</td>
<td>Vehicle type (helicopter, multicopter, fixed-wing).</td>
<td>Yes</td>
</tr>
<tr>
<td>Platform</td>
<td>Choose a vehicle platform from the available variables</td>
<td>Yes</td>
</tr>
<tr>
<td>Payloads</td>
<td>Edit available payloads for the vehicle profile</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Battery section</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charged battery voltage</td>
<td>Battery fully charged at voltage, V, shown as 100%. Voltage value shown in</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>white colour if between this voltage and normal voltage.</td>
<td></td>
</tr>
<tr>
<td>Normal battery voltage</td>
<td>Normal battery voltage V. Voltage value shown in white if at or above this</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>voltage, shown in yellow if below this voltage.</td>
<td></td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
<td>Status</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Low battery voltage</td>
<td>Low, but sufficient voltage, V. Voltage value shown in yellow if at this voltage or between low and normal voltage. Voltage value shown in red if below this voltage.</td>
<td>Yes</td>
</tr>
<tr>
<td>Discharged battery voltage</td>
<td>Battery zero level, V, shown as 0%. Shown in red.</td>
<td>Yes</td>
</tr>
<tr>
<td>Normal battery power level(^1), %</td>
<td>Normal battery level, percentage. Value in percent is shown yellow if below this value.</td>
<td>No</td>
</tr>
<tr>
<td>Low battery power level(^2), %</td>
<td>Low battery level, percentage. Value in percent is shown red if below this value.</td>
<td>No</td>
</tr>
<tr>
<td>Battery weight</td>
<td>Battery weight, kg</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>GPS section</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal number of GPS satellites</td>
<td>Normal number of satellites to provide a good level of accuracy. Shown in white colour if at or above this level. Number of satellites shown in yellow colour if below this level and between normal and low level.</td>
<td>Yes</td>
</tr>
<tr>
<td>Low number of GPS satellites</td>
<td>Low number of GPS satellites while still being enough to launch the vehicle. Number of satellites shown in yellow colour if at this level or between this and normal level. Number of satellites shown in red colour if below this level.</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Telemetry section</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal telemetry level</td>
<td>Normal telemetry level. Telemetry level value shown in white colour if at or above this level. Telemetry level value shown in yellow colour if below this level and between normal and low level.</td>
<td>Yes</td>
</tr>
<tr>
<td>Low telemetry level</td>
<td>Low telemetry level. Telemetry level value shown in yellow colour if at this level or between this and normal level. Telemetry level value shown in red colour if below this level.</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Routing section</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. waypoints</td>
<td>Maximum supported WPs by flight controller</td>
<td>Yes</td>
</tr>
<tr>
<td>Waypoint acceptance radius</td>
<td>3D distance of the vehicle from approach waypoint sufficient to consider point as reached. Please refer to autopilot documentation to check applicability of this parameter.</td>
<td>Yes</td>
</tr>
<tr>
<td>Max altitude AMSL</td>
<td>Maximum allowed altitude AMSL, m</td>
<td>Yes</td>
</tr>
<tr>
<td>Max altitude AGL</td>
<td>Maximum allowed altitude AGL, m</td>
<td>Yes</td>
</tr>
<tr>
<td>Fence radius</td>
<td>Radio link range radius, m</td>
<td>Yes</td>
</tr>
<tr>
<td>Maximum travel time</td>
<td>Maximum flight time in seconds</td>
<td>Yes</td>
</tr>
<tr>
<td>Safe height over terrain</td>
<td>Minimal allowed distance to terrain for the vehicle, m. Small vehicles can fly very close to terrain but larger ones should fly higher</td>
<td>Yes</td>
</tr>
<tr>
<td>Parameter</td>
<td>Description</td>
<td>Used</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Safe distance to obstacle</td>
<td>Minimal allowed distance to obstacles for the vehicle, m</td>
<td>Yes</td>
</tr>
<tr>
<td>Max. climb rate</td>
<td>Maximum climb speed of copters for take-off waypoints, m/s</td>
<td>Yes</td>
</tr>
<tr>
<td>Max. descent rate</td>
<td>Maximum descent rate of copters for landing waypoints, m/s</td>
<td>Yes</td>
</tr>
<tr>
<td>Max. horizontal speed</td>
<td>Maximum horizontal speed, m/s</td>
<td>Yes</td>
</tr>
<tr>
<td>Default climb rate</td>
<td>Default climb speed of copters for take-off waypoints, m/s</td>
<td>Yes</td>
</tr>
<tr>
<td>Default descent rate</td>
<td>Default descent rate of copters for landing waypoints, m/s</td>
<td>Yes</td>
</tr>
<tr>
<td>Default horizontal speed</td>
<td>Default horizontal speed relative to ground, m/s</td>
<td>Yes</td>
</tr>
<tr>
<td>Fixed-wing section*</td>
<td>Used as default speed for route segments and for Click &amp; Go mode.</td>
<td></td>
</tr>
<tr>
<td>Glide slope, %</td>
<td>Default glide slope, %</td>
<td>Yes</td>
</tr>
<tr>
<td>Airspeed during landing approach</td>
<td>Airspeed for fixed wing aircraft when approaching landing</td>
<td>No</td>
</tr>
<tr>
<td>Landing ground speed, m/s</td>
<td>Plane ground speed in last flight segment to landing point, m/s</td>
<td>Yes</td>
</tr>
<tr>
<td>Landing flare altitude</td>
<td>Altitude in meters at which Landing Flare will be engaged, this parameter is secondary to landing flare time parameter</td>
<td>No</td>
</tr>
<tr>
<td>Landing flare time</td>
<td>Time in which fixed wing aircraft should reach ground during landing, when landing flare will be engaged, motors stopped and heading locked</td>
<td>No</td>
</tr>
<tr>
<td>Minimum landing pitch</td>
<td>Minimum pitch in ° during final landing stage (after flare), the algorithm will control pitch above this value to achieve proper sink rate</td>
<td>No</td>
</tr>
<tr>
<td>Controller sink rate to pitch gain during flare</td>
<td>Sink rate gain for pitch demand during final landing stage, m/°</td>
<td>No</td>
</tr>
<tr>
<td>Weighting applied to speed control during landing</td>
<td>A value closer to 2 will result in plane ignoring height error during landing (will keep nose up), a value closer to 0 results in plane ignoring speed error (use with caution, could result in plane stall)</td>
<td>No</td>
</tr>
<tr>
<td>Maximum pitch in auto flight</td>
<td>Controls maximum pitch in ° during automatic mode, Range: 0 to 45°, if set to zero, Maximum pitch param. will be used</td>
<td>No</td>
</tr>
<tr>
<td>Maximum pitch</td>
<td>The maximum commanded pitch up angle, Range: 0 to 90°</td>
<td>No</td>
</tr>
</tbody>
</table>
It is displayed the percentage that reported by the vehicle, if it is supported. If the vehicle does not report the remaining charge as a percentage, the UgCS calculates the percentage based on the voltage values from the vehicle profile.

<table>
<thead>
<tr>
<th>Minimum throttle</th>
<th>Minimum throttle setting in % which Autopilot will apply. For final landing stage this is ignored.</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landing sink rate (final stage)</td>
<td>The sink rate in meters/second for final landing stage. Range: 0.0 to 2.0</td>
<td>No</td>
</tr>
<tr>
<td>Enable rangefinder for landing</td>
<td>Enables the use of a rangefinder for automatic landing. The rangefinder will be used both on the landing approach and for final flare</td>
<td>No</td>
</tr>
<tr>
<td>Minimum rangefinder distance</td>
<td>Minimum distance in centimeters that rangefinder can reliably read</td>
<td>No</td>
</tr>
</tbody>
</table>

**Basic section**

| Height** | Vehicle height, m | Yes |
| Width** | Vehicle width, m | Yes |
| Length** | Vehicle length, m | Yes |
| Wind resistance** | Maximum allowed wind speed, m/s | Yes |
| Dry take-off weight** | Dry take-off weight, kg | Yes |
| Maximum take-off weight** | Maximum allowed weight, kg | Yes |

1 It is displayed the percentage that reported by the vehicle, if it is supported. If the vehicle does not report the remaining charge as a percentage, the UgCS calculates the percentage based on the voltage values from the vehicle profile.

2 It is displayed the percentage that reported by the vehicle, if it is supported. If the vehicle does not report the remaining charge as a percentage, the UgCS calculates the percentage based on the voltage values from the vehicle profile.

* Display section depends on the type of vehicle;
** Currently ignored and reserved for future versions.

### Adding a New Vehicle Profile

You can add a new vehicle profile by creating a new card and filling in the parameters.

### Editing a Vehicle Profile

You can edit a vehicle profile by clicking on the profile card and pressing the “Edit” button. You can choose different avatars (3D) for vehicles by choosing avatars for the vehicle profile and can also edit parameters.

**Note:** Profile changing leads to route convert procedure that can cause errors in some cases. If occurs, you would be notified with message and can choose accept or cancel changes.

### Copying a Vehicle Profile

You can copy an existing vehicle profile by selecting the profile and clicking on “Copy” button. It will create a duplicate of the selected profile with a “- Copy” suffix. Works exactly the same as “Edit” (see above), except it will save a new copy upon confirmation.

### Delete a Vehicle Profile

You can delete new or copied a vehicle profile. To remove the vehicle profile, select the profile and click “Remove”.

You cannot remove the basic profiles of vehicles. Basic profiles - is system profiles during program installation.
## Payloads

Choose a predefined payload card or create a new payload card defining payload’s parameters.

### Table of payload parameter description:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Mandatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payload name</td>
<td>User defined payload name</td>
<td>Yes</td>
</tr>
<tr>
<td>Weight</td>
<td>Camera weight, kg</td>
<td>Yes</td>
</tr>
<tr>
<td>True focal length, mm</td>
<td>True focal length</td>
<td>Yes</td>
</tr>
<tr>
<td>Sensor width, mm</td>
<td>Physical sensor width in metric units</td>
<td>Yes</td>
</tr>
<tr>
<td>Sensor height, mm</td>
<td>Physical sensor height in metric units</td>
<td>Yes</td>
</tr>
<tr>
<td>Sensor horizontal resolution, px</td>
<td>Sensor horizontal resolution in pixels</td>
<td>Yes</td>
</tr>
<tr>
<td>Sensor vertical resolution, px</td>
<td>Sensor vertical resolution in pixels</td>
<td>Yes</td>
</tr>
<tr>
<td>Minimum triggering interval</td>
<td>Minimum time interval between two neighbouring shots</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Advanced topics

Configuration

Connections
The Core service section defines HCI and VSM connections to a UCS. By default, it points to the local instance. In case of a multi node deployment network the address of the UCS can be specified.

The use of proxy enables to specify a HTTP proxy server. Proxy settings can be configured in MENU -> Configuration -> Connections. This setting can affect the loading of map.

VSM
Records for each of VSM servers. By default points to local instances. If you have a dedicated VSM installation and want core services to connect to it, add a new record with the appropriate host and port fields.

Screen Resolution
On this screen you can adjust the window resolution. Changes apply immediately.

Skin
Here one can choose from four available colour schemes – Default, Classic, Khaki and Pony. Changes apply immediately.

Language
On this screen you can select the language for the user interface.

Measurement
On this screen you can choose the measurement system for the user interface.

Sound
On this screen you can disable the sound signal in the UgCS client. Sound signals are used to notify user about errors in the vehicle log.

Performance
You can decrease the client performance for battery saving by enabling the “Battery saving mode” flag. For maximum performance the “Battery saving mode” flag should be disabled.

To increase client performance, enable “Show buildings without textures” flag.

Appearance
On this screen you can choose turn on or turn off 3D avatar smoothing.

Xbee connector
UgCS supports XBee networks as a datalink. Please refer to our “XBee connector manual” for more information.

Automatic VSM Discovery
UCS can automatically discover local VSM instances (running on the same macOSHine or on a host in a local area network) using Simple Service Discovery Protocol (SSDP). For this purpose, VSM
processes advertise their locations (host and port to connect to) on startup and respond to the UCS search requests. When UCS discovers an unknown location, it attempts to connect to it.

Automatically discovered VSM instances do not appear in the user “VSM Configuration” list. It can be managed manually. UCS connects to the user-defined VSM instances alongside with the discovered ones.

**Note:** emulator VSM does not use SSDP to avoid spam in the local network. It works only on the same computer as UCS.

Also note that SSDP works only for nodes located in the same subnetwork. So, for example it will not work for internet connections or over the gateway.

See specific VSM manuals for more information about configuration and settings.
No Fly Zones

No-fly zones (NFZ) are areas on the map where flying is prohibited. NFZ can be divided into two categories – aerodrome zones, which are in-build into UgCS and custom zones which can be created by the operator.

Creating a custom NFZ

The operator can create a custom NFZ of either of the two shapes:

- Prism
- Cone

NFZ can be created by clicking on one of the two bottom icons on the No-Fly-Zone drawing tools (Figure 4. Mission editor #9) and shift-click on the map.

To create a NFZ in the form of a prism, at least 3 points are necessary. The cone NFZ requires only one point. To finish creating a NFZ click on the selected NFZ icon again. To edit the finished NFZ click on the zone on the map. To delete a NFZ click on the trash can icon in the editing screen.

Following parameters for each of the NFZ can be changed:

- Name of NFZ
- No-fly zone starts from – altitude from which the NFZ begins. By default this parameter is set to 0 m AGL.
- Ground or sea level – change the altitude origin between AGL and AMSL
- Height – the altitude at which the NFZ ends. By default this parameter is set to infinity.

For the cone NFZ there are two additional parameters:

- Base radius – radius of the base of the flight zone. By default this is set to 100 m.
- Top radius – radius of the top of the flight zone. This parameter can be used only if the height parameter for the cone NFZ is not infinity.

**Note:** If NFZ width is less than one meter it is not taken in account for route's calculation.

Disabling NFZ

To disable NFZ, enter route settings and deselect either Aerodrome zones or Custom zones, whichever you want to not take into account when creating the route.

**Note:** this feature is enabled only for UgCS with activated Licence (refer par. “License”)

NFZ visibility

To change the visibility of NFZ, click on the Map options (icon globe) button at the very top right-hand corner of the screen and click on the Layers button. In window you will be able to deselect Aerodrome zones or Custom zones so that they are not displayed on the map. Keep in mind that this does not disable the NFZ, it simply hides them. If you want to disable NFZ, refer to the section “Disabling NFZ”.

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NFZ and route-creation algorithms
UgCS will not be able to calculate a mission with single waypoints in a NFZ. However, if a part of a circle or an Area scan mission intersects a NFZ, the flight path will be calculated around the NFZ automatically.

3rd party mapping data
Map of UgCS contains 3 layers:

1. First layer is georeferenced tiles.
2. Second layer is elevation. Elevation contains elevation data with reference to the coordinates (e.g., landscape).
3. Third layer 3D Models which consist of polygons and georeferenced tiles. These layers are managed by Geoserver. This layer is optional.

Importing georeferenced images
To display the orthophoto in UgCS import picture orthophoto. To do this, create a new source with a unique name and download the photo in it. New source creation is available in the map source in one of the providers of Geoservers. Then save your changes (press «Save» button). Next, go to the Mission Editor, click on the globe icon (“Map options”) in the upper right pane. Select «Layers» in drop down list. “Map layers” window is opened. In the block «Overlay tile provider» in the drop-down list, choose name of the source that you imported. «Focus» button moves the map to the imported object.

Importing 3rd party elevation data
Additional elevation source for particular area (besides default elevation sources) can be imported. For each area create a unique object in MENU -> Main menu -> Configuration -> “Elevation z-order”. “Elevation z-order” is the list which contains all elevation sources that may be used. Firstly add the necessary source to the list. The order of objects in the list is also important, because it determines the priority of objects in Terrain sources. To change the order of priorities go to Main menu -> Configuration -> Elevation z-order. Select the elevation source and use the arrow buttons to change the sequence of sources.

The route on the particular area is calculated according to the priority of elevation source.

Note: UgCS supports ArcASCII, GeoTiff and SRTM formats, but all GDAL Raster Formats (more details http://www.gdal.org/formats_list.html) that feature Georeferencing should work.

Importing buildings on a map
To display the 3D buildings on the map of UgCS and take into consideration when route is calculated import 3D models of buildings.

Add new building source in “Geoservers” menu. Go to “Geoservers” menu and click “Local Geographic Server”. After that button “Manage building sources” is available. Then create new one by pressing “New source” button. Building models are added automatically in the list “Building sources”.

“Building sources” list contains all building sources that may be used. You have the ability to edit the list “Building sources”.

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www.ugcs.com
Now the added building source is ready to be used. Imported building models will be loaded to current building source.

For building model import make click on the globe icon (Map options) on the upper menu bars and selects “Add building” from the drop-down menu. In window “Add a building from KMZ” choose local geoserver from drop down list, press the button “Browse” and find file or files. Then click “All” to select all files or click “Select” to select only one file. Next, choose required 3D models and press the button “Add”.

Note: UgCS supports the import of *.KMZ files.

Working with placemarks

Placemarks are part of UgCS functionality that is meant for informing user about possible dangers in a place on map. It is also possible to add custom markers and use them for individual purpose.

Placemarks are structured in categories. Currently there are three categories:

- **HAZMAT** – describes dangerous goods (solids, liquids or gases) that can be harmful
- **Incidents** – to warn about dangers caused mainly by human activity
- **Natural Events** – for warning about natural disasters or dangers

To place a placemark do a right mouse click on desired area, select “Create placemark here” and chose from the available placemarks in the desired category to add a new placemark on the map.

![Placemark menu](Figure 28. Placemark menu)

You can also add description to placemark to not forget the purpose of placing it.

![Placemark creation window](Figure 29. Placemark creation window)

To remove a placemark, one must do a right mouse click on the placemark and chose “Delete placemark”. It is also possible to move a placemark by doing a right mouse click on a placemark,
choosing “Move placemark” and then doing a left mouse click on the area one wants to move the placemark to (Figure 30. Window to edit Placemark).

![Figure 30. Window to edit Placemark](image)

It is possible to import custom markers in *.KML format using UgCS Client. Click the globe icon (Map options) on the upper menu bar and select “Import placemarks from KML” from the drop-down menu. UgCS supports import *.KML and *.KMZ files containing the point description.

**Orthomosaic**

UgCS supports ortophotomosaic creation. It means after you got some images during the flight you can get one picture composed from these images. UgCS compose it using coordinates (from EXIF data) and overlap info. For UgCS OPEN and UgCS ONE licences the number of images is limited to 20 items. For UgCS PRO and UgCS ENTERPRISE licences it is unlimited.

**Show camera position**

UgCS can show camera’s position where the camera shutter has tripped. This option can be used by click the globe icon (Map options) on the upper menu bars and selects “Show image center” from the drop-down menu. Choose the photo or photos with georeferenced in the file browser and click “Select” or “Select all”. After importing files on the map center of each frame will be display as mark. On the window “Image center” coordinates of marks can be export as *.CSV file (“Write report in CSV” button).

For hide image centers click the globe icon (Map options) on the upper menu bars and selects “Hide image centers” from the drop-down menu.
**ADS-B**

UgCS supports ADS-B (Automatic dependent surveillance-broadcast) receivers and transponders. When using ADS-B receiver, UgCS warns the user about collision possibilities between vehicles. If using an ADS-B transponder, one can configure and use it during flight with the help of UgCS.

**Receiver**

UgCS gives warnings about dangerous convergences concerning vehicles controlled by UgCS, and vehicles observed by UgCS, via the microADS-B receiver. Collision possibility calculation is based on three parameters:

- H – horizontal distance (meters)
- V – vertical distance (meters)
- T – warning time (seconds)

Values for the vehicles, controlled by UgCS:

- H = 20 m
- V = 15 m
- T = 60 sec.

Values for the vehicles, observed by UgCS:

- H = 9 260 m (5 NM)
- V = 300 m
- T = 60 sec.

Warnings about possible collisions appear in the log window if vehicles, during the minimal convergence, would, in the future, violate both boundaries (H / V) of any other vehicle in a time less than T. A warning is not displayed if the minimal convergence occurred in the past and the vehicles fly apart from one another.

A warning is cleared if one of the following events occurs:

- The minimal convergence persisted in the past and the spread angle between the trajectories is more than 20 degrees;
- The minimal convergence persisted in the past and spread angle between the trajectories is less, than 20 degrees and the areas of the vehicles are not violated.

Warnings are created only for vehicles which have been added to the vehicle list. When control is released, all current alerts for that vehicle are removed.

An indicator in the top right corner shows whether any ADS-B receivers are currently connected. It is displayed green if a connection with at least one such device is active, and grey otherwise.

**Transponder**

If your vehicle is equipped with an ADS-B Transponder or you wish to do so, it is possible to configure and transmit ADS-B messages using UgCS. As of this moment UgCS supports Sagetech XPS-TR Mode S transponders. The following main functions for ADS-B Transponder configuration and usage are available:
• To set ADS-B modes;
• To set parameters;
• To display annunciators;

The following list of parameters are available:

• **SQUAWK**: must contain of four octal digits. Allowed digits are: 0, 1, 2, 3, 4, 5, 6, 7.

• **ICAO Address**: must contain of six hexadecimal digits. Allowed digits: 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F.

• **Aircraft registration (tail number)**: must contain of up to 8 symbols. Allowed are: 0-9, A-Z.

• **Flight ID**: must contain of up to 8 symbols. Allowed are: 0-9, A-Z.

• **IDENT* flag**: Yes (single direction button)

• **External altitude**: Yes/No

*http://aviation.stackexchange.com/questions/3049/how-does-ident-work

Transponder parameter usage:

• ICAO Address and Aircraft registration/Tail number will remain the same for a specific vehicle in most of the cases. These parameters can be set in Vehicle Parameters section Figure 32).

• SQUAWK parameter can be defined when necessary any time during the flight (Figure 31, a).

• Flight ID should be set during preparation for take-off. That can be done in the Preflight section (Figure 31, b).
Available transponder modes (Figure 31, c):

- **OFF** – Transponder is turned OFF
- **STBY** – Standby mode. Transmission does not happen, device is set to low power consumption, is ready for start-up with reduced warm-up time.
- **ON** – Transponder is transmitting and receiving data, but no altitude information is transmitted.
- **ALT** – Same as “ON” mode with the additional transmission of vehicle altitude.

The following error codes can be displayed:

- **XPDR** – General error code that is displayed if any of the following errors have occurred.
- **TEMP** – If transponder temperature sensor reports an error.
- **GPS** – Is displayed if there is no GPS signal.
- **ICAO** – If there is no valid ICAO address set.
- **ES** – Is displayed if the extended squitter has failed.

![Figure 32. Vehicle parameter menu where Tail number and ICAO address can be set](image1)

![Figure 33. ADS-B settings menu displaying XPDR and GPS error codes](image2)
Import route from KML

UgCS PRO and UgCS ENTERPRISE licence enable to import KML-files.

To import a route from KML files then click "Add new route" button (plus sign). Select “Import from file”, click “Browse” to locate, and confirm with “Select”.

“LineString” segments of the KML file will be imported as simple Waypoint route.

“LinearRing” segment can be imported as “Area scan”, “Photogrammetry” or “Perimeter” route type.

![Figure 34. Import KML file](image)

A message with UgCS licence upgrade option will be displayed, if current licence has disabled KML import functionality:

![Figure 35. Licence upgrade info message](image)
Import route from CSV

UgCS enables to import CSV files. In order to import CSV files, click on the “Add new route” button (plus sign). Choose “Import from file”, click “Browse”, to locate the CSV file and confirm with “Select” and confirm with “Next”.

![Image of route import screen]

In the next screen select the preferable vehicle profile.

CSV file must have 3 mandatory fields: "Latitude", "Longitude", "AltitudeAGL". Fourth field "Speed" is optional. Please note the header is ignored if it consists letters.

Measurement units used:

- "Latitude" & "Longitude" - degrees
- "AltitudeAGL" - m (AGL)
- "Speed" - m/s

Separator - ',', (comma)

**Example:**

```
Latitude, Longitude, AltitudeAGL, Speed
37.7710593,-109.8174241,20,5
37.7728543,-109.8179159,10,7
```

**Joystick**

Joystick/Keyboard (Input control) is used to control vehicle or payload. Several input controls can be used simultaneously.

Control flow from input device should be sent to the vehicle only if:

- vehicle is under control of the operator;
• client window is active;
• vehicle is selected in UI.

“Keyboard” button allow to check connected devices, their mappings, calibration and to make settings (Figure 4. Mission editor #5).

JOYSTICK mode control channel:

Joystick mode is inherently more fragile than direct manual control via RC transmitter as it involves many different data links and components:

Joystick device --> UgCS client --> server --> VSM --> Radio --> Radio --> Autopilot

If any of the above links fail, the joystick control is broken.

**Fine-tuning axes via the GUI**

You can customize any of the axes using the interface. When you click on the parameter to open a modal window fine tuning single axis selection.

![Figure 37. Window fine-tuning single axis](image)

The window shows a list of the settings of the axes of the input to the output axis of the profiles and devices (Figure 37. Window fine-tuning single axis). If the settings of axes more than fit the window to the right appears scroller.

You can perform the following actions:

• to add configuration for the profile that does not yet have such an axis settings;
• add individual input button to configure axis;
• calibrate input device for this axis;
- delete all what can be added;
- Configure boundaries and point zero, non-linearity and "deadband";
- to see the results of device settings.

**Add axis settings for a profile, which does not yet have such a the axis settings**
In the main window select the axis (function) that is, clicks the mouse and opens the configure axis. If an axis has no settings for this profile, you can select a dropdaune the name of the device, which currently uses the specified profile and click "add axis (axis).

**Adding a single input button to configure axis**
Axis settings window click on the "+" in the appropriate box for your device. Click on the desired device.

**Calibration of input devices for axles**
Pressing the button "calibrate" (calibrate) enables the calibration mode. Movement along the axis of the device determines its minimum, maximum, and average values for the input. You will be prompted to accept or reject the changes.

**Remove individual buttons and axes**
To remove, use the trash icon. To remove the entire axis, a similar button at the beginning of the line, next to the device name and profile. While not pressed "Save", you can return all settings window closes without saving.

**Setting minimum, zero, peak, nonlinearity, the "dead zone"**
These settings apply to the "input" signal from the control device in relation to the value of the main axis, and are displayed as numbers with two decimal places. You can configure them manually. Minimum, zero, determine the maximum under what values on input, will -1, 0 and 1. Next, the output function is converted to a parameter with nonlinearity of the curve, and adjusted around the "deadband" to non-zero values started immediately behind the range (it is set to +-n around a given value of zero). Derived values you can see at the bottom, in the form of graphics input to the output. A line chart displays both the function and the current i/o device on it. The side graphics these same data displayed in numeric form.

**Note:** Features work with the keyboard!

For the keyboard has the following differences from other devices:
- when you add a keyboard will not start search input axis;
- the current value is not displayed on the chart and you are not prompted to calibrate;
- not showing the input axis value zero, non-linearity and dead zone.
UgCS ENTERPRISE configuration

Service manager

UgCS consists of many components to ensure maximum flexibility in the use of. Service manager is a utility for managing the components of UgCS.

Checking the Components and Running the Application

Windows

UgCS will start automatically after the installation.

You can start UgCS Client by clicking shortcut icon on desktop. UgCS Client is a GUI application which starts UgCS Service manager and all necessary processes. All processes will be closed after exiting from UgCS Client. Alternatively, you can run the service manager by clicking the icon on desktop.

UgCS Service manager will start the required background processes: universal control server (UCS), vehicle specific modules (VSM) and the emulator.

![UgCS Service manager and UgCS client shortcuts](image)

Figure 38. UgCS Service manager and UgCS client shortcuts

If service manager starts properly, it can be found in system tray. Please check that all services are running. If a service has stopped, it should be launched from the system manager’s menu.

Note: “Administrator” privileges are required to run the services.

If UgCS components are installed as Windows Services, it is possible to open the “Windows Services” panel through the UgCS system tray icon.

![UgCS Service manager menu on Windows OS](image)

Figure 39. UgCS Service manager menu on Windows OS

The desktop icon launches the UgCS Client. UgCS configuration is done automatically.
You can start and stop the components UgCS using the context menu of service manager. And also manage the automatic launch of the components (Figure 39. UgCS Service manager menu on Windows OS).

**macOS OS**
You can start UgCS by clicking the UgCS client icon in Launchpad.

After successful installation the Launchpad has folder UgCS with two shortcuts (UgCS Service manager and UgCS client). UgCS client will start GUI application, but UgCS Service manager will start all necessary processes (Figure 40. UgCS Service manager menu on macOS OS).

After starting the UgCS Service manager and UgCS client, the rest is done using the same method as in Windows. Please refer to the Windows section for more information.

![Figure 40. UgCS Service manager menu on macOS OS](image)

**Linux**
For Linux installation instructions please go to http://apt.ugcs.com/doc.

The UgCS Client is started using the terminal command “$ ugcs-client” or from a desktop shortcut. All server applications on Linux will start as a service automatically.

**Deploying UgCS components to separate computers**
Any component of UgCS can be installed on a separate computer.

Installing prerequisites is carried out using the installer when selecting "Advanced deployment".

In the next step, you choose the components that will be installed on your computer and components configuration (ports, ip addresses, etc.).

**Configure connection from the client to the server USC**
If you have a UgCS PRO or UgCS ENTERPRISE licence, then you can connect additional clients from other computers to the USC server.

To establish connection it is necessary to click "Choose another server" when the client starts up. Change the ip address to the address of the USC server and click "Retry".

**Configure connection from the USC to the server VSM**
When USC starts the server automatically contains all the VSM servers in the same network subnet, or WiFi.

If you want to add VSM server from a different subnet, then you must specify the address and port in the application settings (Main menu, Configuration, VSM-> add)
Custom maps

Map providers

You can configure custom providers of map images. There are four kinds of providers currently supported: WMS providers, TileJSON providers, MBTiles providers and providers using the Google XYZ addressing system. To edit the list of usable providers, choose Map providers from the configuration menu. At the right, the list of registered providers will be shown (Figure 41. Map providers menu).

Currently the following map providers are supported in #1 on the Figure 41. Map providers menu:

To edit the provider data, click on the corresponding item and choose the Edit option in the top right corner. Removal is also available (Figure 41. Map providers menu).

When editing the provider data, you may set its type (Tiles for the providers using the Google XYZ addressing system, WMS for the WMS providers, MBTiles, Google map, and Bing maps) (Figure 42. Google hybrid provider information, a). The URL field contains the template of addresses, with which map images can be downloaded for the WMS and Tiles options (Figure 42. Google hybrid provider information, b). You can add a Description which will display in the tooltip of the map provider when
you select it (Figure 42. Google hybrid provider information, c). You can also set a maximum cache size for every map provider (Figure 42. Google hybrid provider information, d). This is the maximum space the cache will be allowed to take up on the hard drive. After unchecking “Cache never expires” you will be able to set a period (in hours) after which the cache will be cleared (Figure 42. Google hybrid provider information, e). After the cache is cleared it will reload from the internet.

Figure 42. Google hybrid provider information

“Clear cache” button delete cache file for current map provider from hard drive.

**Tiles**

Type is for providers that are using the Google XYZ addressing system. You can paste URLs of providers such as:

- **Open cycle map** - http://tile.opencyclemap.org/cycle/{2}/{0}/{1}.png
- **Hike & Bike** - http://a.tiles.wmflabs.org/hikebike/{2}/{0}/{1}.png

**WMS**

For the WMS providers the URL is parsed and the real URL is synthesized during requests. The URL should contain at least the “layers” parameter.

For example: http://x.osm.omniscale.net/proxy/service?layers=osm

Other supported parameters are (they override defaults if specified):

- “crs” - Specify CRS to use. Currently supported values:
  - “epsg:3857” - Spherical Mercator (default)
  - “epsg:4326” - Geodetic projection
  - “crs:84” - Geodetic projection (differs from epsg:4326 only by axes order)
  - “styles” - default is empty.

Other specified parameters are either ignored and not included in the request URLs or overridden by request-specific generated values.

**TileJSON**

An example for overriding CRS: http://data.worldwind.arc.nasa.gov/wms?layers=esat&crs=crs:84
For the TileJSON providers the URL no need changes. You can paste your TileJSON provider URL as is. For example: http://earthatlas.info/nz/tiles/nz-popden.tilejson

For the providers who use the Google XYZ addressing system, the URL might need some changes which are shown below.

Supply URLs in a parameterized form containing tokens {X}, {Y}, and {Z} or {0}, {1}, and {2}. If you have an address at hand containing {X}, {Y}, and {Z} tokens, you must respectively substitute {0}, {1}, and {2} for them, preserving the order they are used in.

http://map.host.com/europe/{Z}_{X}_{Y}.jpg  ———>  http://map.host.com/europe/{2}_{0}_{1}.jpg

**MBTiles**

To add new provider with the type MBTiles you have to specify URL address or browse it local at your macOSShine by choosing *.mbtiles file (Figure 43).

To add a new provider, click Map providers > Add, then fill out the fields and click Save. Note that any changes made to the list of providers will not affect the application until it is restarted.

**Note:** There must be at least one provider on the list; otherwise, you will not be able to access the map.

**UgCS Geoserver**

This map provider for sources which provided by Local Geoserver and will be added automatically when new map overlay uploaded. See more information in “Manage map sources” section below.

**Geoservers**

Geoserver is a UgCS component meant for custom map source, elevation source and 3D model import. It is installed together with UgCS and allows users to import custom DEM (Digital Elevation Model) data as elevation source for a specified region and upload georeferenced raster data to geoserver.
Manage map sources
All this data is managed by sources. To add a new data source, one must either add data to an existing elevation or map source or create a new one. To do so, one must go to “Main Menu”, “Configuration” then choose “Geoservers” and by clicking “Edit” on “Local Geographic Server” one can access manage sources menu.

Choose “Manage map source” to add or modify existing map data source. Select “New source” button and enter its name. Press “Create” button and upload your georeferenced data to server.

After successful uploading a new map provider will be created at “Layers” menu in mission inspector and telemetry player windows. Press “Focus” button to navigate directly to this overlay.

Manage elevation sources
To add a new elevation source, one must either add data to an existing elevation source or create a new one. To do so, one must go to “Main Menu”, “Configuration” then choose “Geoservers” and by clicking “Edit” on “Local Geographic Server” one can access manage sources menu.

One can create up to four different elevation sources and each of those may contain several elevation files. To do so select “Manage elevation sources”.

Choose “New source” button, enter name for your data and press Upload button to choose local file of terrain.

After successful upload see Elevation z-order section to add your source to list containig all elevation sources that may be currently used.

Elevation z-order
Currently UgCS supports ArcASCII, GeoTiff and SRTM formats, but all GDAL Raster Formats that feature Georeferencing should work.

To use an elevation source, it must be first added to “Elevation z-order” list. This list contains all elevation sources that may be currently used. First add the necessary source to the list. The list order is also important, because it determines the priority of a source – higher listed sources are of higher priority and lower listed accordingly are of lower priority.

Now the added elevation source is ready to use and the route will be calculated according to the elevation source of highest priority for the specific area.

Building sources
Currently UgCS supports the import of *.KMZ archives and *.KML files with external links.

To add new building source you should create it in “Geoservers” menu. The same as for elevation sources one must go to “Geoservers” menu and by clicking on “Local Geographic Server”, one can access “Manage elevation buildings” menu. Then create new one by pressing “New source” button.

After that one must add created source to “Building sources” list. As for elevations sources that list contains all building sources that may be currently used. Press “Add” button and select created source.

---

1 [http://www.gdal.org/formats_list.html](http://www.gdal.org/formats_list.html)
Multioperator work
The UgCS allows you to work on one mission by different users from different computers.
This option is available only for UgCS PRO and UgCS ENTERPRISE licenses.

User list management
For the convenience and control, you can create a number of users who can have either "Admin" or "Operator" role.
To create a new user navigate to Main menu - > Users. Click on "Create new". Fulfil all the fields and specify the role. After that click "Save".
"Operator" role differs from the "Admin" role with only one function. Operator cannot create and edit list of users

Collaboration on mission
Collaboration work on one mission from different computers is possible if proper configuration of UgCS clients is done. See paragraph: Configure connection from the client to the server USC.
In this case, vehicles of all participants are available for all participants. The first user who opens the mission has the permission to edit it. Other users are allowed only to view the mission. To refuse edit permission of mission the current mission editor should click “Stop editing” in the menu "Menu". New mission editor should click “Edit” in the menu "Menu".
You can use the same scheme to give vehicle control to another person. Click “Release control” in the vehicle drop down menu to do this. To take vehicle control click “Gain control” in the vehicle drop down menu. In vehicle card you can find icon with man (top left corner). Hover cursor on the icon and the hint shows who locked the vehicle.
## Drone specifics

### Commands

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<th>Dis-arm</th>
<th>Auto Mode</th>
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<th>Take-off</th>
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**Legend:**
- W: Wait
- L: Land
- H: Go home
- C: Continue
- Default value
## Turn types

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</table>
License types and feature comparison

After the download and installation of UgCS it has limited functionality: the option to upload routes to vehicles is disabled, except the emulators. To activate full functionality of UgCS the license has to be activated (see chapter Licence activation).

To obtain an UgCS Activation code compare features and prices, visit UgCS online-store [www.ugcs.com](http://www.ugcs.com) or send a request to ugcs@ugcs.com.

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<td>For UAV professionals.</td>
<td>For companies operating a fleet of drones.</td>
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<tr>
<td>Fully functional multi-drone ground control software for professional UAV mission planning. Digital elevation model (DEM) and KML file import enabling map customisation, ADS-B receiver support to ensure flight safety.</td>
<td>Suitable for companies operating a fleet of different manufacturer drones, requiring a unifying ground station solution. ADS-B transponder support, multi-node deployment, enabling operating a central server with unlimited connections to UgCS server.</td>
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### FEATURES COMPARISON

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<td><em>simple mission planning</em></td>
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<tr>
<td>Photogrammetry planner with GSD support</td>
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<td>Flying long routes with battery exchange</td>
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<td>Immersive 3D mission planning environment</td>
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### Supported Drones and Autopilots

| DJI drones | |
| Phantom 4 PRO+, Phantom 4 PRO, Phantom 4, 3 and 2, Inspire 1, Inspire 2, A3, Matrice 600, Matrice 200, Matrice 100, Mavic Pro, A2, N3, Naza-M v2, WooKong-M, Vision2+, Ace One | Y | Y |
| Ardupilot (Pixhawk) | Y | Y |
| Px4 (Pixhawk) | Experimental | Experimental |
| Mikrokopter | Quadro XL, Octo XL, Hexa | Y | Y |
| Microdrones | MD4 series | Y | Y |
| MicroPilot | Multicopter, Helicopter, Plane | Yes, experimental | Yes, experimental |
| Lockheed Martin | Kestrel, Indago | Y | Y |

### Post-flight analysis and Image processing

<p>| | |
| | |
| Geotagging | Y | Y |
| Telemetry player | Y | Y |
| UgCS Mapper (BETA) | Y | Y |</p>
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<tr>
<td>No-Fly zones - airport registry</td>
<td>Can be disabled</td>
<td>Can be disabled</td>
</tr>
<tr>
<td>No-Fly zones - custom zones</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Fly zone limits for routes</td>
<td>No Limits</td>
<td>No Limits</td>
</tr>
<tr>
<td><strong>ADS-B Support</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADS-B Receiver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADS-B Receiver (microadsb)</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>ADS-B Receiver (Ping RX)</td>
<td>Coming soon</td>
<td>Coming soon</td>
</tr>
<tr>
<td>ADS-B Transponder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sagetech XP</td>
<td>X</td>
<td>Y</td>
</tr>
<tr>
<td>ADS-B Transmitter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skysense BCON¹</td>
<td>X</td>
<td>Coming soon</td>
</tr>
<tr>
<td><strong>Video features</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Video recording</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Camera footprint</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Video streaming from UgCS for DJI to UgCS Desktop</td>
<td>Experimental</td>
<td>Experimental</td>
</tr>
<tr>
<td><strong>Multi-operator / Multi-drone support</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multinode installation</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Connections to UCS server</td>
<td>3</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Multi-drone support</td>
<td>Unlimited</td>
<td>Unlimited</td>
</tr>
<tr>
<td><strong>Support</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public forum</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>E-mail support</td>
<td><a href="mailto:support@ugcs.com">support@ugcs.com</a></td>
<td><a href="mailto:support@ugcs.com">support@ugcs.com</a></td>
</tr>
<tr>
<td>Phone support 5x8</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Support 24x7</td>
<td>Request quote <a href="mailto:ugcs@ugcs.com">ugcs@ugcs.com</a></td>
<td>Request quote <a href="mailto:ugcs@ugcs.com">ugcs@ugcs.com</a></td>
</tr>
</tbody>
</table>
# Troubleshooting

## Errors and warnings

<table>
<thead>
<tr>
<th>Messages</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only a part of the calculated route from point # to point # will be uploaded to the vehicle. Please control your battery during the flight to return home vehicle before point of NO-RETURN.</td>
<td>Count waypoint exceeds the maximum specified in the vehicle profile. You can change the route or <strong>Change start point</strong>. Then the part of route will be cut before the first dot (if there is a point), and after a Max point specified vehicle profile. <strong>Note:</strong> When you uploading mission to vehicle, actual number of loaded points may be different. So if you have huge mission with a lot of waypoint please check log file to know how many waypoints really uploaded to vehicle. This log on Windows usually at C:\Users\USER_NAME\AppData\Local\UgCS\logs \VEHICLE_VSM_FOLDER\</td>
</tr>
<tr>
<td>Estimated time of flight by route () exceeds the maximum flight time specified for the vehicle profile (). Please control your battery during the flight to return home vehicle before point of NO-RETURN.</td>
<td>Estimated flight time exceeds the maximum possible flight time specified for the vehicle profile. You can change the route or <strong>Change start point</strong>. Then the part of route will be cut before the first dot (if there is a point), and after a Max point specified vehicle profile.</td>
</tr>
<tr>
<td>Display warning message in route calculation result</td>
<td>Please delete duplicate action.</td>
</tr>
<tr>
<td>Segment #:</td>
<td></td>
</tr>
<tr>
<td>Warning: found more than one camera by time/distance actions on a segment. Used only first one for processing.</td>
<td></td>
</tr>
<tr>
<td>For only DJI vehicle on the mobile app: After changing the camera settings, the image is not displayed or a black screen is displayed.</td>
<td>Check camera settings.</td>
</tr>
<tr>
<td>There is a known issue of Arducopter firmware below 3.5.3 - which can result the autopilot to crash when multiple WPs with &quot;Turn Type&quot;=&quot;Spline&quot; and &quot;Wait&quot; action added are located at the same location.</td>
<td>In order to avoid this, please use the &quot;Turn Type&quot; = &quot;Straight&quot; or move the WPs apart.</td>
</tr>
</tbody>
</table>