Sky-Watch Drone Manager

User Manual

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USER MANUALS ARE AVAILABLE ON SUPPORT.SKY-WATCH.COM CUSTOMER SUPPORT PORTAL WEBSITE.

Limited Warranty

SKY-WATCH PRODUCTS ARE COVERED BY 12 MONTHS WARRANTY AS FULLY SPECIFIED IN SKY-WATCH STANDARD TERMS & CONDITIONS OF SALES AND DELIVERY. PLEASE NOTE THAT WARRANTY DOES NOT APPLY TO ANY DEFECTS OR DAMAGES WHERE THE SKY-WATCH PRODUCTS HAVE BEEN OPERATED OR SERVICED BY NON-CERTIFIED PERSONNEL. CERTIFICATION HERE RELATE TO THE SKY-WATCH TRAINING AND CERTIFICATION PROGRAMS FOR OPERATORS AND SERVICE PERSONNEL.

Always comply with Civil Aviation regulations and other applicable laws, act responsibly and follow the instructions in your Product User Manuals.

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1 Introduction

The Sky-Watch Drone Manager (SDM) is an advanced software tool for flying Sky-Watch UAVs and managing their data. SDM will run on Windows 11 tablets and computers. This document is an in-depth manual to mission planning and monitoring UAVs with SDM.

INFO: The latest version of this document can always be found at the Customer Support Portal (support.sky-watch.com).

1.1 Applicable Vehicles

This manual covers the following vehicles.

Applicable Vehicles
Heidrun RQ-35
Heidrun Mapping

1.2 Download and Install SDM

Always make sure to download and install the latest version of SDM.

1.2.1 How to Download SDM

Latest version of SDM can be found at the Customer Support Portal (support.sky-watch.com). Access and download require username and password. If you can't remember your username, please contact our support team at support@sky-watch.com.

Step 1 Log in to Sky-Watch Customer Support portal.

Step 2 Click the link 'Download Section' – this is where all download resources can be found.

Step 3 Click the SDM folder.

Step 4 Select the file(s) to download and click 'Download'.

1.2.2 How to Install SDM

Make sure you have downloaded the latest version of SDM.

Step 1 Open the Sky-Watch Drone Manager setup file.

Step 2 Make sure you read and understand the license information.

Step 3 Click install.

INFO: Once the installation is complete, you will find SDM in the Start menu.

INFO: The SDM program files are installed in
C:\Program Files (x86)\Sky-Watch\Sky-Watch Drone Manager

1.2.3 Vehicle Licenses

Every vehicle type has its own license file that is needed by SDM to connect and control that type of vehicle. Licenses will be activated on the tablets from the factory. Please contact our support team at support@sky-watch.com if you are missing a license file.

INFO: To activate a license file simply copy it to
\Documents\Sky-Watch\Licenses and restart SDM

2 Getting Started

2.1 Menu Panel

The SDM covers everything from flight planning to data processing. Various parts of SDM are accessed via the Menu Panel. The Menu Panel is opened by clicking the Sky-Watch logo in the top left corner of the screen.

Menu Panel

2.1.1 Sub-parts of SDM

From the Menu Panel different parts of SDM is accessed.

Fly
Make flight plans and control Sky-Watch UAVs.

Logs
Import and manage flight logs.

Process
Process UAV data, inspect flight paths and geotag images.

System
Update and keep track of system components.

Settings
General SDM settings.

2.1.2 True Full Screen Mode

True Full Screen Mode can be toggled on and off using the button in the Menu Panel.

Enable True Full Screen Mode
Hides the window border and the Windows task bar.

Disable True Full Screen Mode
Shows the window border and the task bar

INFO: True Full Screen Mode leaves more screen area for the SDM and will improve the overall experience of the UI. It is recommended to run SDM in True Full Screen Mode especially on tablets and other small monitors.

2.1.3 How to Close SDM

To close SDM, use the Close button located in the bottom of the Menu Panel.

INFO: All progress and data are saved upon closing the SDM. Close the SDM and resume your work at any time.

2.2 Vehicle Type

The very first time SDM is run, you must select the type of vehicle you want to control. Selecting the vehicle automatically sets the SDM up with the features relevant for the selected vehicle type.

ATTENTION: If your PC/tablet comes directly from Sky-Watch, the Vehicle type will already have been set correctly.
If you run SDM on other hardware or fly multiple vehicle types, then always make sure you have selected the correct Vehicle type to unlock all the features associated with your UAV.

INFO: The number of available vehicle types will vary based on which Vehicle Licences you own.

2.2.1 How to Change the Vehicle Type

To connect to a new vehicle type, you must change the vehicle type in the SDM settings:

Step 1 Open the Menu Panel

Step 2 Go to "Settings".

Step 3 Change the Vehicle Type to the vehicle you want to control.

Step 4 Click on "Select & Restart" to restart the SDM and make the change take effect.

ATTENTION: If you do not own multiple types of Sky-Watch UAVs, it is not necessary to change the vehicle type.

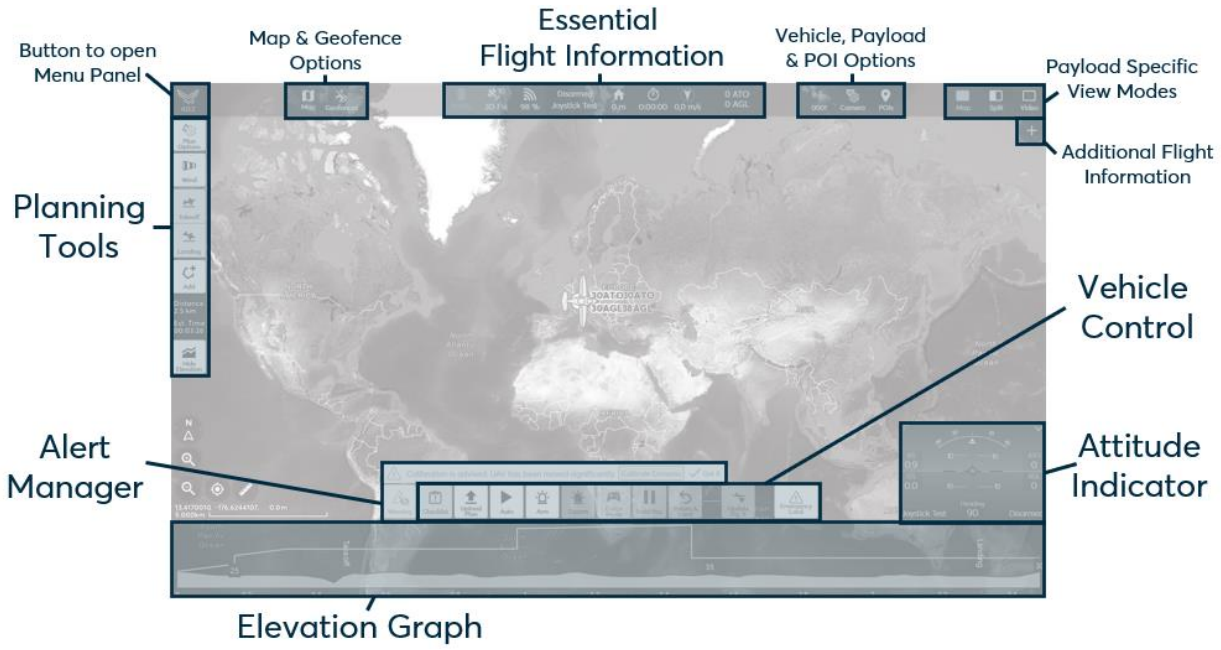
2.3 Flying Sky-Watch UAVs using SDM

The SDM features a shared view for flight planning and controlling UAVs. This feature-rich, yet user-friendly interface lets you plan, monitor, and control your Sky-Watch vehicles, allowing you to adjust and re-upload plans on the fly. This is found under Fly in the Menu Panel.

The integration of planning and control into one view, lets you take advantage of features like continuing plan from segment and adjusting the plan based on the UAVs wind estimate. Furthermore, SDM gives you access to the Elevation Graph and the Alert-Manager. These are tools that will let you inspect your flight plan and warn you if any un-safe condition appears – all for a safe and secure flight.

2.3.1 The Interface for Flying Sky-Watch UAVs

To plan and fly, go to Fly in the Menu Panel. Features are grouped based on their coherence.



- Button to open Menu Panel
  By default, the Menu panel automatically closes to maximize screen size when flying UAVs using SDM. To open the menu panel, click on the Sky-Watch logo in the top left corner.

- Map & Geofence Options
  From the top bar you can access Map Options and Geofences.

- Vehicle Status
  Status information from the connected vehicle – See Flight information

- Vehicle, Payload and POI Options
  From the top bar you can access the Vehicle options, Camera options (available based on the selected Vehicle Type) and the list of Points of Interest (POIs)

- Payload Specific View Modes
  Payload specific view modes will be available based on the selected Vehicle Type. SDM lets you bring the video feed into split view or full screen – See Payload Specific Information and Control

- Planning Tools
  Tools for creating and adjusting flight plans - See Flight Planning.

- Vehicle Control
  Tools for controlling your vehicle – See Vehicle Commands.

- Alert Manager
  The alert manager is located next to and above the Vehicle Control and will give you various info messages, warnings, and alerts when relevant - See Alert Manager

- Elevation Graph
  Inspect your flight plan relative to the terrain – See Elevation Graph.

- Attitude Indicator
  The attitude indicator shows you vital information about your vehicle's current attitude and other statuses – see Attitude Indicator

2.3.2 Tips for Touch Interfaces

The planning and vehicle control features are designed for use on touch screens. Here are some tips for the interaction on touch devices.

- Map navigation
  To pan the map: Drag the map using one finger.
  To zoom in/out: Pinch the map using two fingers.

- Scrolling using touch
  To scroll on tablets there is no need to tap the scroll bar explicitly. Simply drag the whole area to scroll through options and lists.

- Secondary Mouse Clicks (Right click/Long press)
  SDM take advantages of the ability to perform secondary mouse clicks. On tablet, simply press and hold to perform a secondary click.

- Touch Sizes
  All buttons and tools in the are sized to allow for easy accessibility on touch screens when flying Sky-Watch UAVs.

2.4 Map Data

Map data is an essential part of any autonomous flight and used through different sub-applications in the SDM. Map data is provided by ESRI and contains:

- Imagery Data
  Actual footage of the ground.

- Elevation Data
  Information about the terrain level.

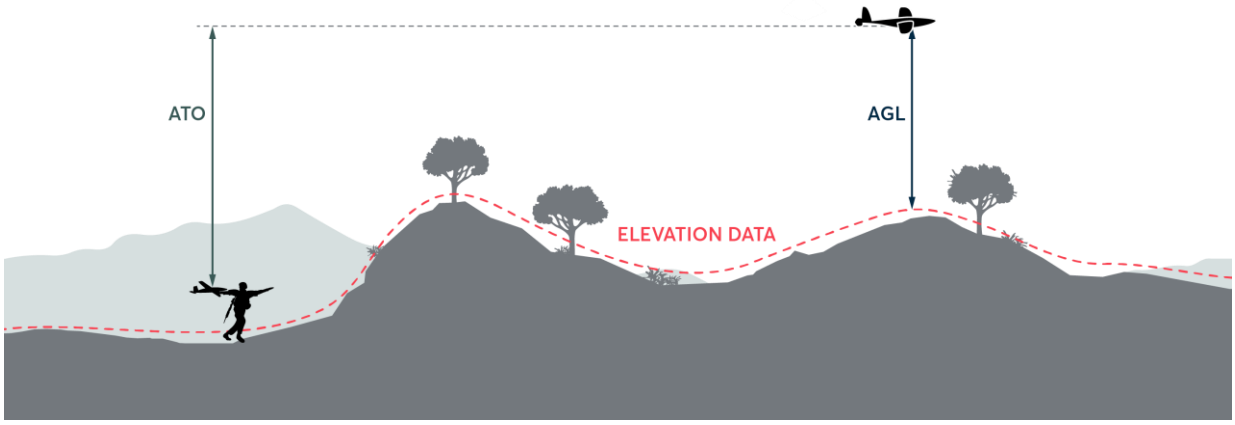
ATTENTION: Map data is available online directly from the ESRI Server. However, it is recommended to download offline maps to ensure optimal performance. SDM will automatically suggest you download an offline map, if you start planning a segment, without an offline map for the area.

2.4.1 Plan and Fly Above Ground Level (AGL)

SDM provides access to elevation data for planning and flying missions in 3 dimensions. When you meet altitude information in SDM you will be presented with two values ATO and AGL:

- Altitude Above Take-Off (ATO)
  This is the altitude relative to the take-off position.

- Altitude Above Ground Level (AGL)
  This is the altitude relative to the ground level in the elevation data.



ATTENTION: The elevation data does not contain obstacles such as buildings, trees, masts or other structures and vegetation on the ground. The planned flight altitude must allow the UAV to pass such obstacles. Sky-Watch cannot guarantee the accuracy of the elevation data supplied. It is the operator's sole responsibility to ensure a safe flight trajectory and altitude.

2.4.2 Map Buttons and Information

Map Buttons and Information are available in the bottom left corner of any map in the SDM. The options include:

Zoom In
Zoom in on the map

Zoom Out
Zoom out on the map

Centre
Auto zoom to all elements on the map

Measure Tool
Use the measurement tool to perform distance and area measurements on the map. Activate the measurement tool, by tapping the button and then start adding points on the map. Stop measuring by closing the measurement information box OR click the measure tool button again.

Map Compass – and Auto Rotate Map
The map compass is shown above the rest of the map buttons. By default, North is up. Auto-rotate map according to UAV heading can be enabled my tapping the

Map Compass. The map will then Auto rotate so that up is based on UAV heading or video feed if it is available.

Along with the Map Buttons the SDM will show you

- Mouse Position
  Coordinates and elevation at the mouse position on the map
- Map Scale
  A scaling bar to show how a distance on the map corresponds to the actual distance in metres.

2.4.3 Map Options

Map Options are available in the Top bar of "Fly". The Map Options include:

Map Layers
Opens the map layers dialog. Toggle between a list of offline maps and feature layers

Download Offline Map
Opens the download map options

Street Names
Toggles Street and place names on/off. Internet connection is required to show the street and place names.

Grid Lines
Toggles map gridlines on/off

2.4.4 How to Download Offline Maps

Instructions to download offline map:

Step 1 Open Map Options.

Step 2 Open "Download offline map".

Step 3 Make sure the area for download is visible on the screen (SDM automatically creates an offline map of the entire screen).

Step 4 Adjust the number of zoom levels.

Step 5 Press Download.

INFO: The number of zoom levels has a significant impact on how long it will take to download the map and how large the file size will be. Zoom level 18 or higher is recommended for landing areas and zoom level 14 or higher is recommended for flying fixed wing UAVs.

INFO: Offline maps can be shared between different PCs, by copying and pasting the map folders located in \Documents\Sky-Watch\Drone Manager\Maps

2.4.5 Available Offline Maps

The Map Layer dialog can be opened from the Map Options. To view the available offline maps, make sure "Offline Maps" is selected in the top of the Map Layers dialog.

Selecting a layer in the list highlights and zooms to the layer on the map. Each Map layer has a set of properties:

- Enable/disable Offline Layer
  Offline layers can be enabled/disabled using the checkmark for each layer.
- Layer Information
  Each layer is described with information and a thumbnail.
- Layer Name
  The layer name can be changed by clicking the name.
- Delete Layer
  Layers can be deleted (removed completely from the device) using the bin .
- Layer Ordering
  Layers can be moved up/down using the arrows . The first layer in the layer list is displayed as the topmost layer and so on.

INFO: Always check the layer order in case two or more map layers overlap.

2.4.6 How to Import Custom Tile Packages

Custom ESRI tile packages (.tpk) can be imported into SDM as offline maps

Step 1 Open Map Layers in Map Options

Step 2 Click Add Layer.

Step 3 Select the tile package for import.

INFO: ESRI provides tools such as ArcGIS Desktop for converting various map formats (raster and vector) into tile packages.

2.4.7 Available Feature Layers

Selecting a layer in the list highlights and zooms to the layer on the map. Each Map layer has a set of properties:

- Enable/disable Feature Layer
  Feature layers can be enabled/disabled using the checkmark for each layer.
- Layer Name
  The layer name can be changed by clicking the name.
- Layer Information
  Each layer is described with information such as type, size and when the layer was imported into SDM
- Delete Layer
  Layers can be deleted using the bin .
- Layer Ordering
  Layers can be moved up/down using the arrows . The first layer in the layer list is displayed as the topmost layer and so on.

INFO: Always check the layer order in case two or more map layers overlap.

2.4.8 How to Import KML/KMZ as Feature Layers

KML and KMZ layers can be imported into SDM as feature layers

Step 1 Open Map Layers in Map Options

Step 2 Make sure to select "Feature Layers" in the top of the Map Layers dialog

Step 3 Click Add KML/KMZ Layer.

Step 4 Select file for import.

INFO: Feature layers supports polygons, dots and lines. Feature layers are displayed on top of online maps. The layers must be imported as .kml or .kmz files.

2.5 Geofences

Geofence list is available in the top of the SDM. Along with a list of geofences, Geofence options are available from the bottom of the geofence list and includes:

Add on Map
Adds a new geofence on the map. You can then specify the size and shape of the geofence on the map.

Import
Import geofences from file on disc.

Delete All
Deletes all geofences in SDM.

2.5.1 Geofence Types

SDM allows two types of geofences:

Fly Only
Use Fly Only-zone if you know you can only fly in a restricted area. SDM presents warnings if the flight plan or the UAV exits the Fly Only-zone.

No Fly
Use No Fly-zones if you know restricted areas where the UAV must not enter. SDM presents warnings if the flight plan or the UAV enters the No Fly-zone.

ATTENTION: SDM presents warnings if the UAV breaches geofences but does not take control of the vehicle. It is always the pilot's sole responsibility to act and make sure that the UAV does not breach geofences.

2.5.2 How to Add geofence

Step 1 Open the geofence options .

Step 2 Select "Add on Map".

Step 3 Click on the map where you want the geofence.

2.5.3 How to Change Geofence Type

To change between Fly only ✈ and No Fly ✈ zones:

Step 1 Select the geofence either on the map or in the geofences list.

Step 2 Make sure the geo-fence is "un-locked".

Step 3 Toggle the "type"-option to the preferred selection.

2.5.4 How to Edit Geofence

- How to resize the Geofence polygon
  The Geofence polygon can be formed as desired by moving the corners of the Geofence polygon on the map.
- How to add a polygon Corner
  Click on one of the + markers on the plygon to add a new corner.
- How to move the Area Scan polygon
  The whole Area Scan Polygon can be moved by dragging the Geofence main icon ✈/✈.

2.5.5 How to Lock/Unlock Geofences

To prevent changes to a geofence:

Step 1 Select the geofence either on the map or in the geofences list.

Step 2 Click on the Lock 🔒 to lock/un-lock the geofence

INFO: When a geofence is locked it can no longer be adjusted or deleted until it is un-locked.

2.5.6 How to Delete a Geofence

To delete a geofence:

Step 1 Select the geofence either on the map or in the geofences list.

Step 2 Make sure the geo-fence is "un-locked"

Step 3 Delete the geofence using the bin 🗑.

2.6 Points of Interest (POIs)

Points of Interest (POIs) can be helpful when planning and carrying out mission. SDM also allows Sky-Watch UAVs to fly to POIs. The POI List can be found in the top of the screen. From here several options are available.

Add from Coordinate
Opens a dialog to add a POI by entering coordinates.

Export
Export POI list to file

Import
Import POI list from file

Delete All
Deletes all POIs

INFO: Imported POIs must be in a format readable by SDM: Sky-Watch POI List (.spl), GPS Exchange Format (.gpx) or KML/KMZ.

2.6.1 POI Types

In SDM POIs can be created from the map, the video feed or coordinate input. Furthermore, POIs can be shared between SDM and the Sky-Watch Camera Controller (SCC). All POIs are visible on the map and in the POI list. The different POI types include:

POI
POIs created on the map or from coordinate

Observation
Observations created from the video feed (Requires EO/IR Payload)

Transferred
When SCC and SDM are connected, all POIs are automatically shared between the two programs.

INFO: Transferred POIs can only be deleted from the application they where originally created.

2.6.2 How to Lock and Unlock POIs

POIs can be locked to make sure they are not moved or changed in any other way.

Step 1 Select a POI (either in the POI list or directly on the map).

Step 2 Click the lock / to lock and unlock the POI

2.6.3 How to Add a POI using the map

Step 1 Right click/Long press anywhere on the map.

Step 2 Select POI .

2.6.4 How to Add a POI from coordinate

Step 1 Open the POI List

Step 2 Select add POI from coordinate .

Step 3 Enter POI name, select format and enter coordinates

INFO: POI's can be added in a format by choice. Select between Lat/Lon, DMS, MGRS and UTM.

2.6.5 How to Rename a POI

Step 1 Select a POI (either in the POI list or directly on the map).

Step 2 Click the POI name.

Step 3 Enter new name.

2.6.6 How to Delete a POI

Step 1 Select a POI (either in the POI list or directly on the map).

Step 2 Delete the POI using the bin .

ATTENTION: This will permanently delete the POI.

2.6.7 POIs Captured from the Payload

Some Payloads supports capturing POIs via the video feed. These POIs are displayed along with any other POI in the POI list. For more information on how to capture POIs using the payload, see Payload Specific Information and Control

2.7 Connecting Your Vehicle to SDM

SDM automatically finds your Sky-Watch vehicle, no set-up in the software is required.

2.7.1 How to Connect Vehicle via Radio-link

Follow these steps to connect the vehicle to the SDM.

Step 1 Make sure you have selected the correct vehicle type.

Step 2 Connect ground radio to the device running SDM.

Step 3 Power on the vehicle and make sure it is within range of the radio.

Step 4 SDM automatically connects to the vehicle.

2.7.2 How to Connect Vehicle via USB

It is possible to connect Sky-Watch vehicles directly using USB cable.

Step 1 Make sure you have selected the correct vehicle type.

Step 2 Make sure any ground station or radios paired with the UAV have been turned off.

Step 3 Connect the vehicle battery.

Step 4 Connect vehicle directly to the device running SDM using USB.

Step 5 SDM automatically connects to the vehicle.

INFO: Data is transferred faster over USB than radio-link. Always use the USB connection when importing log files from your vehicle. The USB connection can also be used for uploading flight plans to reduce the upload time.

3 Flight Planning

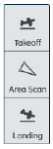
SDM flight plans are composed of a number of basic building blocks called Segments. The simplest flight plan contains a Take-off segment and a Landing segment - but a variety of Segment Types can be inserted to build plans that suit your needs. Apart from the segments your flight plan has some common Plan Options and information about the Wind Direction. All the flight planning tools are located in the left part of the screen and includes:

Plan Options

The Plan Options are general options for the flight plan, this includes the failsafe settings, camera selection, Maximum allowed altitude and other options that are common to the whole flight plan.

Wind

The Wind Direction is a key parameter when flying fixed wing UAVs. SDM lets you change the wind direction used for planning and automatically updates relevant segments in your flight plan accordingly.



Segments List

This is a list of all the Segments in the flight plan.

Add Segment Button

Use this button to add more segments to your flight plan.

Flight Plan Statistics

Distance and Estimated time to fly the plan.

Show/Hide Elevation Graph

Shows/Hides the Elevation Graph.

INFO: SDM flight plans are very flexible. At any time, you can change the plan options, change the wind direction or add/delete/change segments.

INFO: The Alert manager will help you while planning, by letting you know if the plan is incomplete, or your flight path intersects with the ground.

3.1 Plan Options

The Plan Options are common options for the entire flight plan.

3.1.1 How to Select Camera (Mapping UAVs Only)

Step 1 Open Plan Options and select Plan Settings.

Step 2 Select camera model for your plan.

ATTENTION: The camera selection is used to calculate image overlaps in Area Scan Segments and is only available for Heidrun Mapping UAVs. Not selecting the correct camera model may cause incorrect overlaps and faulty image data.

3.1.2 Maximum Allowed Altitude (Max Altitude)

The Max Altitude is the ceiling of the flight plan. It is not possible to plan any segment above this altitude. To change the Max Altitude:

Step 1 Open Plan Options and select Plan Settings.

Step 2 Select the maximum allowed altitude by adjusting the Max Altitude.

3.1.3 Maximum Allowed Loiter Radius

The maximum allowed loiter radius can be set from the plan settings:

Step 1 Open Plan Options and select Plan Settings.

Step 2 Select the maximum allowed radius by adjusting the Max radius.

INFO: This option is only available for fixed wing UAVs.

3.1.4 Ignore Elevation Data

Ignoring elevation data makes the flight plan assume the terrain is completely flat. This mode can be enabled if the terrain data is incomplete, faulty, or missing.

Step 1 Open Plan Options and select Plan Settings.

Step 2 Enable Ignore Elevation Data.

ATTENTION: Ignoring elevation data makes the flight plan assume the terrain is completely flat. The elevation graph will not show any ground elevation and you will not get any terrain related warnings. Only use this feature if elevation data is not available or faulty in any other way. Use this feature with great caution and at your own risk.

3.1.5 Fixed Wing Failsafe Settings

Failsafe settings are available in Plan Options. Use the failsafe settings to change the safety actions performed by the UAV in case of emergencies. The following options only apply to Sky-Watch fixed wing UAVs.

- Connection Loss Failsafe
  By default, the UAV will Return and land if the link has been lost for 1 minute. This setting can be ignored.

- GPS Failsafe
  Set the emergency procedure in case the GPS fix is lost. Option 1: The UAV will perform an immediate deep stall landing if the GPS fix is lost. Option 2: GPS recovery pattern (GPS failsafe). In this mode the UAV will try to stay airborne and head for take-off position, but the UAV will have no confirmation on its actual position and heading. This poses a severe risk of losing or crashing the UAV.

- Failsafe return and land pattern
  Select whether the UAV must climb to max mission altitude, remain it current altitude, or gradually change altitude towards the descent circle in case of return to land failsafe is initiated.

Emergency procedures are described in detail in the Sky-Watch Unmanned Aircraft Flight Manual for UAS (document number 900005707). SDM provides short descriptions for the emergency procedures as well, read them carefully before changing the failsafe settings.

ATTENTION: Changing the Failsafe Settings may be in direct violation with local regulations and authority. In some cases, it will significantly increase the risk of losing or damaging the vehicle. Always read the on-screen instructions carefully before changing the Failsafe Settings.

INFO: Failsafe settings are a part of the flight plan and can be changed while the vehicle is in the air. It is required to upload the flight plan for the failsafe settings to take effect.

3.1.6 How to Clear a Flight Plan

To clear all planned segments:

Step 1 Open Plan Options.

Step 2 Select Clear Plan .

ATTENTION: This will clear the Take-off and Landing and delete all other planned segments.

3.1.7 How to Restore the Last Uploaded Flight Plan

Sometimes it can be helpful to undo the changes to the flight plan, by restoring the last uploaded flight plan.

Step 1 Open Plan Options .

Step 2 Select Restore Last Uploaded .

ATTENTION: All changes to the current flight plan will be lost, when restoring the last uploaded plan.

3.1.8 How to Export a Flight Plan

You can export your flight plans to save them for later use.

Step 1 Open Plan Options .

Step 2 Select Export Plan .

Step 3 Select the export location and name for the flight plan.

3.1.9 How to Import Flight Plan

To import a flight plan:

Step 1 Open Plan Options .

Step 2 Select Import Plan .

Step 3 Navigate to and select the flight plan to import.

ATTENTION: The current flight plan will be cleared in order to import the flight plan. The flight plan must be in a format readable by SDM (.pln).

3.2 Wind Direction

The wind direction and wind speed are important properties when flying fixed wing UAVs. Getting the wind direction right is key to a safe landing and optimal image data.

From the Wind options you can change the wind direction used for planning and automatically update the entire flight plan. The wind direction can be set manually, from the UAV's heading (while the vehicle is grounded) or from the UAV's wind estimate (while the vehicle is airborne).

When changing the wind direction, two different arrows will appear.

- Light Arrow in the Back
  This is the active wind direction. All segments use this wind direction to layout the flight path.
- Dark Arrow in the Front
  This is the new wind direction. This is NOT used for the flight plan until it is accepted by the user. Once accepted, the whole flight plan is automatically updated.

INFO: You can always adjust the dark arrow, without using the changes for your flight plan. Use the Undo button to revert it back to the wind direction that is currently used for the flight plan.

3.2.1 How to Set the Wind Direction Manually

Step 1 Open the Wind options .

Step 2 Adjust wind heading by dragging the dark arrow OR by using the slider below.

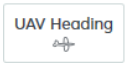
Step 3 Click Accept to confirm the new wind direction. The plan is automatically updated to reflect the changes.

3.2.2 How to Set the Wind Direction from the UAV Heading

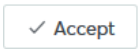
Step 1 Connect your Sky Watch UAV.

Step 2 Position the vehicle on the ground in direct head wind (the same heading that you will be launching your vehicle).

Step 3 Open the Wind options .

Step 4 Click on 

to get the wind from the vehicles heading

Step 5 Click 

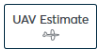
to confirm the new wind direction. The plan is automatically updated.

INFO: It is recommended to update your flight plan using this procedure before launching your Sky-Watch UAV.

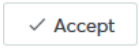
3.2.3 How to Set the Wind Direction from the UAV's Wind Estimate while the UAV is Airborne

Step 1 Make sure your vehicle is connected and has been airborne for at least two minutes.

Step 2 Open the Wind options  .

Step 3 Click on 

to get the wind from the vehicles estimate.

Step 4 Click 

to confirm the new wind direction. The plan is automatically updated.

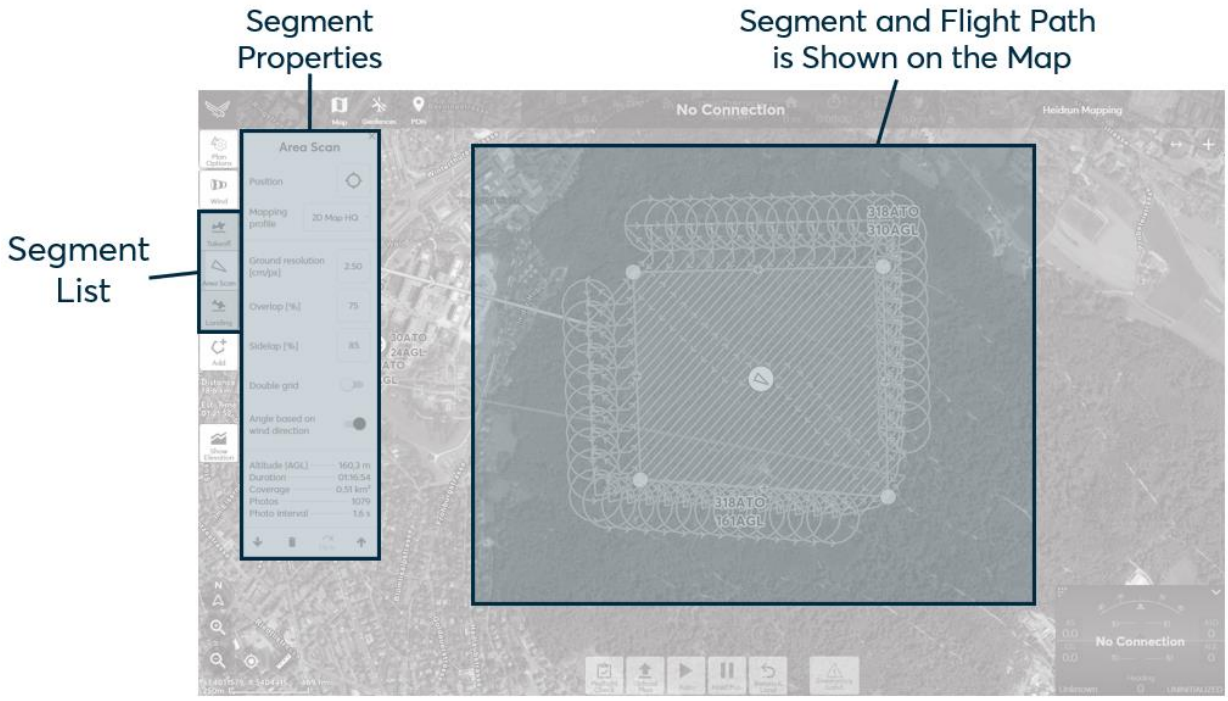
Step 5 Remember to upload the updated flight plan to the vehicle.

ATTENTION: The vehicle must be airborne for at least two minutes to acquire a valid wind estimate. Always check that the vehicle's wind estimate is similar to what you observe at the landing location before updating the flight plan.

INFO: It is recommended to update your flight plan according to your vehicle's wind estimate before landing the UAV.

3.3 SDM Segments – General Information

Segments are the building blocks for your Sky-Watch Flight Plan. Every flight plan must contain a Take-off segment and a Landing segment. Between these two segments a variety of segments can be inserted to build exactly the flight plan needed for your mission. For information about the specific segment properties, see Segment types.



3.3.1 How to Select a Segment

Selecting a segment automatically opens the segment properties. The segment properties are used to determine how the vehicle will complete the segment. The properties vary between Segment Types. A segment can be selected in several ways:

- Clicking on a segment in the segment list.
- Clicking on a segment icon on the map.

INFO: Segments can be de-selected by clicking anywhere on the map. This automatically closes the segment properties.

3.3.2 How to Add a Segment

Step 1 Click on the Add button below the segment list.

Step 2 Select the Segment Type you want to add to the flight plan.

Step 3 Click on the map, where you want the segment to be placed.

INFO: Take-off and Landing segments are automatically added to the flight plan. To position them on the map, see How to Position a Segment Using the Position Selector

3.3.3 How to Delete a Segment

Step 1 Select the segment you want to delete.

Step 2 Delete the segment by clicking on the bin in the bottom of the segment properties.

ATTENTION: This will permanently delete the segment.

INFO: Take-off and Landing segments must be part of any flight plan and cannot be deleted.

3.3.4 How to Re-arrange the Order of Segments.

Step 1 Select the segment you want to move back or forth in the flight plan.

Step 2 Use the up/down arrows in the bottom of the segment properties, to move the segment back and forth in the flight plan.

INFO: You can always see the order in which your segments are flown in the segment list. The topmost segment is the first, the second top most is the second and so on.

INFO: While flying, you are not limited to follow the order in which you have planned the segments, see continue plan from segment for more information about how to fly to any segment in your flight plan.

3.3.5 How to Position a Segment Using the Position Selector

All segments must have a position on the map. The position can be set using the position selector in the segment properties:

Step 1 Select the segment you want to place on the map.

Step 2 In the Segment Properties click on the position selector .

Step 3 Click on the map, where you want the segment to be placed.

INFO: Some segments, e.g. Take-off and Landing contain more positions. Placing the main position (the one that is presented in the top of the segment properties) will automatically layout other positions on the map. Once these are on the map they can be repositioned, simply by moving the map markers.

INFO: When adding new segments, the main position selector will already be active, simply click on the map where you want the new segment to be.

3.3.6 How to Move a Segment and Segment Sub Parts

Segments can be re-positioned using the position selector, but it is often easier to move the segment (or sub-parts of the segment) by moving the map markers on the map.

Step 1 Select the segment you want to place on the map.

Step 2 Drag the map marker to the position you want it to be.

3.3.7 Segment Status

Segment status is shown in the top right corner for each segment in the segment list. If there is no status icon present, it simply means that the segment is complete. A segment can have one of the following statuses.

Segment in-complete
The segment is in-complete and needs user input. This is typically caused by the segment (or parts of the segment) not being positioned on the map.

Warning
Warnings indicates an increased risk of damaging the vehicle or losing data. Always inspect the flight path if you see a segment warning.

Segment Processing
The Segment is being processed. Elevation data must be gathered to calculate the flight altitude and detect possible terrain collisions.

ATTENTION: If you are experiencing long processing times, it might be because you do not have an active offline map, in which case elevation data is pulled directly from the ESRI servers. This will significantly increase the time needed to process the flight path. It is recommended to always download offline maps.

3.4 Fixed Wing Segments

Segments have different properties based on the segment type. The available segments depend on the selected Vehicle Type in SDM. Always make sure you have selected the correct vehicle type. All fixed wing UAVs must have a valid flight plan with a take-off and a landing to launch the UAV.

3.4.1 Fixed Wing Segment Combability Table

The following list shows an overview of the segments available, depending on the selected Vehicle Type.

Segment	Availability
Take-off Segment	All Sky-Watch Fixed Wing UAVs
Landing Segment	All Sky-Watch Fixed Wing UAVs
Waypoint Segment	All Sky-Watch Fixed Wing UAVs
Loiter Wait Segment	All Sky-Watch Fixed Wing UAVs
Area Scan Segment	Heidrun Mapping
Corridor Scan Segment	Heidrun Mapping

3.4.2 Take-off Segment

All flight plans must start with a take-off segment. The take-off segment has the following properties:

- Take-off Position
  The location from where the vehicle is launched. This can be placed on the map by using the position selector or getting the position from the vehicle.
- Fast climb alt.
  The vehicle will climb in a straight line in the direction it is launched until reaching this altitude.
- Climb Circle Position
  After reaching the Fast Climb Altitude the vehicle will head to the Climb Circle. The Climb circle is automatically placed on the map when placing the Take-off Position.
- Climb Circle Exit Altitude
  The vehicle will climb to this altitude before leaving the climb circle.

ATTENTION: The take-off position is used for synchronizing the flight plan altitudes with the vehicle. Always launch the vehicle from this position.

INFO: The flight plan assumes that the vehicle is launched in head wind. The first part of the flight track is therefore locked according to the wind direction, and shown with a dashed line. It is possible to launch the vehicle in other directions, in such cases the vehicle will not follow the flight track in SDM until reaching the climb circle. It is

recommended to always launch the vehicle in the direction that is given by the wind direction.

3.4.3 Landing Segment

Landing segment properties:

- Landing Position
  The vehicle will land at this position. It is advised to keep all landing circles free of obstacles. The vehicle will land inside the green and red circle 90% of the time. For more information about the landing precision please consult your product specific manual.

- Entry alt.
  The vehicle will head towards the descent circle and target this altitude, as the first thing in the landing segment. The entry altitude is the altitude above the landing position.

- Deep stall alt.
  The vehicle will perform a deep stall from this altitude when landing.

- Approach WP Position
  The vehicle will use the Approach WP to ensure the landing is approached in head wind. The position of the Approach WP is automatically updated when changing the wind direction. It can be adjusted manually, but it is advised to keep it according to the wind.

- Descent Circle Position
  The vehicle will start the Landing segment from the Descent Circle where it will descend to the Deep stall altitude before continuing the landing sequence, by heading to the Approach WP.

3.4.4 Waypoint Segment

A Waypoint is the simplest segment in SDM. The Waypoint segment has the following properties:

- Position
  The position the vehicle will fly to.

- Altitude
  The altitude of the Waypoint (AGL).

3.4.5 Loiter Wait Segment

A Loiter Wait makes the vehicle loiter at this position until it is told to do otherwise by the operator.

- Position
  The position the vehicle will fly to.
- Loiter Type
  Select between a circular or figure 8 loiter type
- Altitude
  The altitude (AGL).

The rest of the parameters depend on the selected loiter type:

- Circular loiter
  For circular loiters you can specify the radius and the direction (clockwise vs counter clockwise)
- Figure 8
  For figure 8 you can specify the radius of the circular parts, the length between the two circular parts and the bearing of the figure 8.

INFO: To make the vehicle continue from a loiter segment, you can use the "fly to segment" feature, see Continue plan from segment.

3.4.6 Area Scan Segment

ATTENTION: The Area Scan Segment is only available for a subset of the Sky-Watch UAVs. The following options will not be visible to you, if your Vehicle Type does not support Area Scan Segments.

The Area Scan segment is used for mapping areas. It is an advanced Segment which automatically specifies a flying pattern based on the Area Scan properties and the Area Scan polygon defined in SDM.

- Position
  The centre position of the Area Scan Polygon.
- Mapping Profile
  SDM comes with different pre-sets for mapping missions. The mapping profiles can be used to quickly change the Area Scan properties according to the desired results.

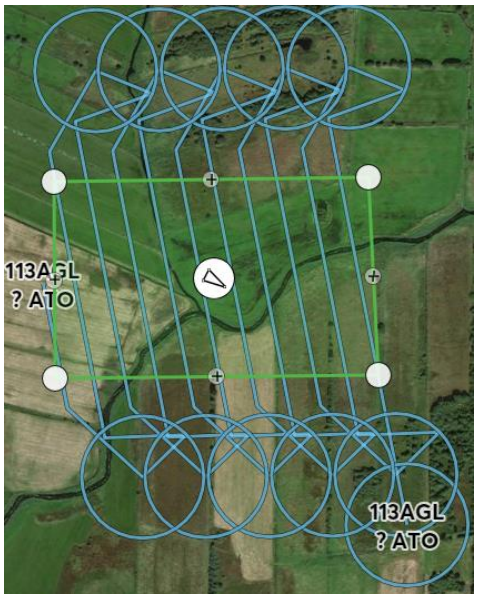
Once the Area Scan Polygon is placed on the map, it can be formed as desired:

- How to resize the Area Scan polygon
  The Area Scan polygon can be formed as desired by moving the corners of the Area Scan polygon (the green area) on the map.

- How to add a polygon Corner
  Click on one of the + markers on the plygon to add a new corner.

- How to delete a polygon Corner
  Right click/Long press on a waypoint and select "Delete".

- How to move the Area Scan polygon
  The whole Area Scan Polygon can be moved by dragging the Area Scan segment .



The Area Scan properties will automatically change based on the selected Mapping Profile. Area Scan Properties can also be specified individually for your own custom mapping profile.

- Ground resolution
  The size on ground in centimetres that is covered by a single pixel in the captured photos. Adjust this to match your requirements regarding the finest distinguishable details in the final mapping. Ground resolution affects flying altitude.

- Overlap
  The percentage one photo will overlap the next in the same mapping leg.

- Sidelap
  The percentage photos will overlap photos in the adjacent mapping legs.

- Double grid
  Adds a second overflight perpendicular to the first. Use double grid for accuracy and 3D mapping.

- Angle based on wind direction
  Locks the flight path according to the wind making sure the mapping mission is flown in crosswind for optimal result. Disable "Angle based on wind direction" to set the Line angle manually.

SDM displays the following statistics for the Area Scan:

- Altitude
  The lowest altitude the vehicle will fly in the segment. This altitude is calculated based on the desired ground resolution. The AGL may vary based on the terrain. Open the elevation graph to inspect the segment terrain and vehicle altitude.

- Duration
  The estimated time needed to fly the Segment

- Coverage
  The number of square kilometres mapped in the segment

- Photos
  Estimated number of photos in the Segment

- Photo interval
  The interval the photos must be captured with to acquire the desired overlap. Always check that your camera payload can capture photos with this interval.

3.4.7 Corridor Scan Segment

ATTENTION: The Corridor Scan Segment is only available for a subset of the Sky-Watch UAVs. The following options will not be visible to you, if your Vehicle Type does not support Corridor Scan Segments.

The Corridor Scan segment is used for mapping corridors like roads, rivers or the like. It is an advanced Segment which automatically specifies a flying pattern based on the Corridor Scan properties and the Corridor Scan lines defined in SDM.

- Add waypoints
  When enabled, clicking on the map adds a waypoint to the end of the sequence.

- Mapping Profile
  SDM comes with different pre-sets for mapping missions. The mapping profiles can be used to quickly change the Corridor Scan properties according to the desired results.

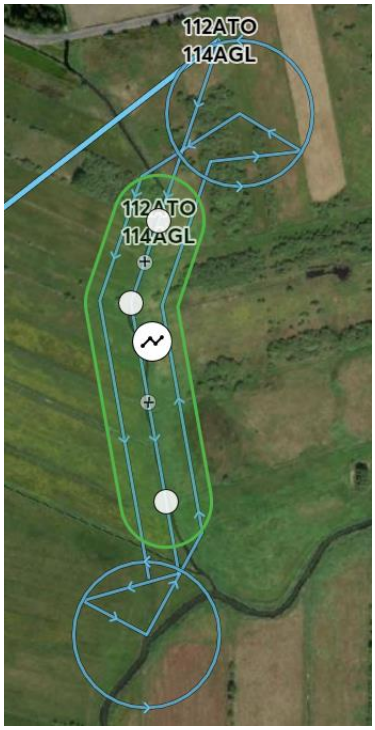
Once the Corridor Scan Sequence is placed on the map, it can be formed as desired:

- How to reshape the Corridor Scan sequence
  The Corridor Scan sequence can be formed as desired by moving the waypoints of the Corridor Scan sequence on the map.

- How to add a Waypoint to the corridor
  Click on one of the + markers on the sequence to add a new waypoint between two existing waypoints. Enable the "Add waypoints" button in the Corridor Scan properties pane to add a new waypoint at the end of the corridor.

- How to delete a Waypoint
  Right click/Long press on a waypoint and select "Delete".

- How to move the Corridor Scan sequence
  The whole Corridor Scan Sequence can be moved by dragging the Corridor Scan segment .



The Corridor Scan properties will automatically change based on the selected Mapping Profile. Corridor Scan Properties can also be specified individually for your own custom mapping profile.

- Ground resolution
  The size on ground in centimetres that is covered by a single pixel in the captured photos. Adjust this to match your requirements regarding the finest distinguishable details in the final mapping. Ground resolution affects flying altitude.

- Overlap
  The percentage one photo will overlap the next in the same mapping leg.

- Sidelap
  The minimum percentage photos will overlap photos in the adjacent mapping legs.

- Corridor width
  The width of the corridor that will be photographed.

- Line angle
  The maximum angle on corners that is acceptable to fly without a loiter turn. Images will be slightly tilted when turning without loiter turns.

- Serial
  When enabled the UAV will complete each line segment of the corridor before proceeding with the next. When disabled the entire corridor will be flown from one end of the segment to the other.

- Reverse order
  Whether the segment should be flown in reverse order or not.

SDM displays the following statistics for the Corridor Scan:

- Altitude
  The lowest altitude the vehicle will fly in the segment. This altitude is calculated based on the desired ground resolution. The AGL may vary based on the terrain. Open the elevation graph to inspect the segment terrain and vehicle altitude.

- Duration
  The estimated time needed to fly the Segment.

- Flight Distance
  The total length in meters flown in the Segment.

- Corridor Length
  The length of the corridor segment in meters.

- Photos
  Estimated number of photos in the Segment.

- Photo interval
  The interval the photos must be captured with to acquire the desired overlap. Always check that your camera payload is capable of capturing photos with this interval.

3.5 Flight Path Inspection

Always inspect your flight plan carefully before uploading it to your vehicle. SDM provides the approximate Flight Path, an Elevation Graph, and Plan Statistics to help you create a secure flight plan.

3.5.1 The Flight Path

The approximate flight path is shown with blue lines on the map. Always inspect the flight path and make sure it is completely free of obstacles.

Paths of the flight track that holds extra uncertainties are shown with a dashed line.

ATTENTION: The actual flight path may vary slightly from the path shown in SDM. The actual flight path also depends on the weather conditions. It is the operator's sole responsibility to ensure a safe flight trajectory.

INFO: Selecting a segment will highlight the part of the track associated with the segment.

3.5.2 Plan Statistics

The plan statistics are visible below the segment list. The flight plan statistics will show you:

- Distance
  The estimated distanced travelled by the vehicle to complete the flight.
- Est. Time
  The estimated time the vehicle is to complete the flight.

INFO: These stats are estimates. The actual time and distance will vary based on weather conditions and might differ from the estimates.

3.5.3 Elevation Graph

The elevation graph is found in the bottom of the screen and can be shown/hidden using the 

button below the segment list and plan statistics. Always inspect the elevation graph before uploading your plan.

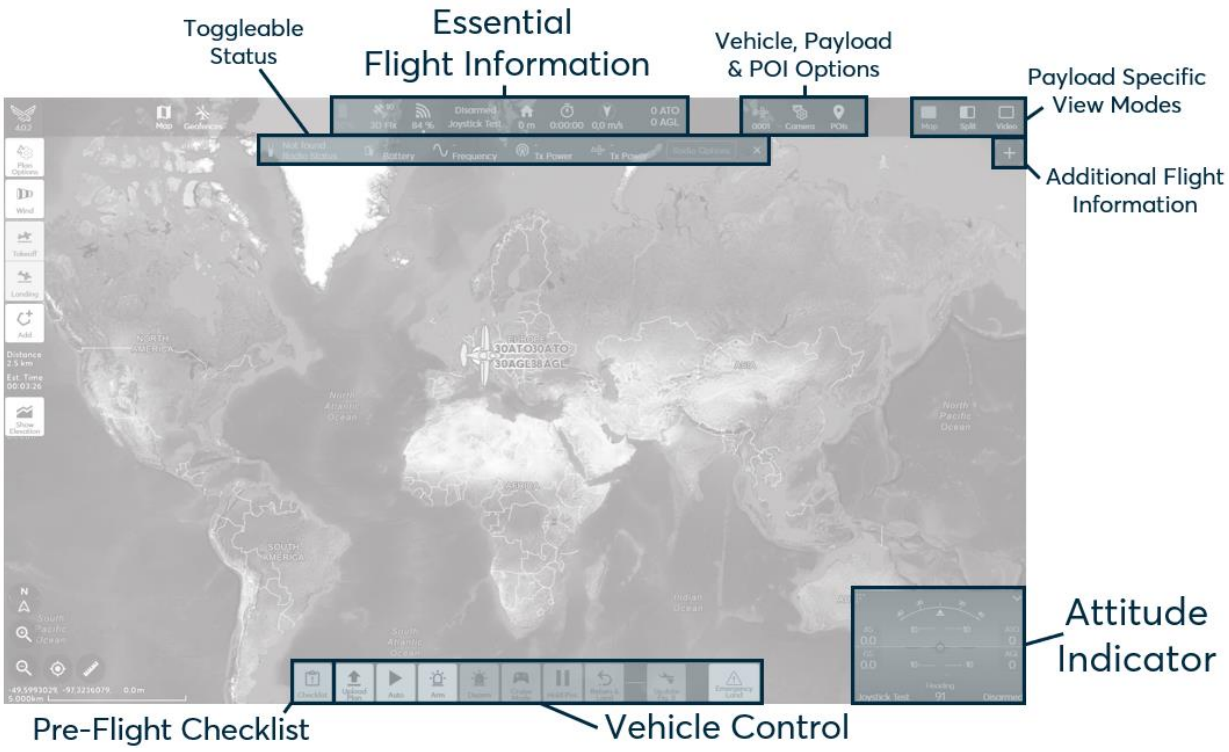
- For each segment the position where the vehicle will reach the lowest altitude is highlighted with the AGL.
- Vertical paths on the elevation graph illustrates that the vehicle might need to climb/descend at the target location in order to reach the altitude.
- Selected segments are highlighted with a green background.
- If the flight path intersects ground, the segment is highlighted with a red background and a warning message is displayed.
- Using a mouse, you can click on the elevation graph to pan to the position on the map.

ATTENTION: The elevation data does not contain obstacles such as buildings, trees, masts or other structures and vegetation on the ground. The planned flight altitude must allow the UAV to pass such obstacles. Climb and descent rates are estimated based on the Vehicle Type and the AGL must always be monitored by the pilot during flight. Sky-Watch cannot guarantee the accuracy of the elevation data supplied. It is the operator's sole responsibility to ensure a safe flight trajectory and altitude.

4 Monitoring and Controlling UAVs using SDM

4.1 Flight information

SDM provides all the information needed to perform a safe flight with Sky-Watch UAVs. Besides the Essential Flight Information required to fly your vehicle safely, the SDM also lets you customize a list of Additional Flight Information to suit your specific needs. Based on the selected Vehicle Type you will also be provided with Payload Specific Information and Control.



4.1.1 Essential Flight Information

The essential flight information is located in the top of the screen. This is all the information needed to complete a safe flight with Sky-Watch UAVs. The information in the top includes:

Battery
Shows battery charge level in percent.

GPS
The GPS status and number of satellites.

Link quality
Link quality in percent.

Armed and Mode status
Armed status and the current flight mode.

Home distance
Distance to the take-off position

Time
Elapsed time since last take-off

Wind information
The dark arrow shows the wind direction reported by the vehicle. The light arrow shows the wind direction used for the flight plan. The wind speed estimated by the vehicle is reported in m/s. This information is only visible if your Vehicle Type supports onboard wind estimation.

Altitude
Vehicle's altitude above take-off (ATO) and above ground level (AGL).

4.1.2 Toggleable Statuses

By clicking the icons in the Essential Flight information, additional information can be toggled on/off.

Toggleable Battery Status:

Shows battery current and battery voltage.

Toggleable GPS Status:

Satellites
Number of satellites visible to the GPS reciever

Accuracy
Position accuracy in meters.

Fix Quality
GPS fix quality

GPS Denied Options
Button to open GPS denied flight options, which will let you fly without GPS fix (EO/IR Payloads only).

Toggleable Link Status:

Radio Status
Radio connection status

Battery
Remaining radio battery in %.

Frequency
Radio frequency.

Tx Power
Local radio's current Tx power.

Tx Power
Vehicle's current Tx power

Toggleable Home Status:

Distance to Takeoff
Distance to the takeoff position.

RAL Distance
Distance to landing position, including estimated distance travelled while completing the planned landing sequence.

Toggleable Wind Status:

Est. Wind Direction
Wind direction estimated by the UAV.

Planned Wind Direction
Wind direction used in the current flight plan.

4.1.3 Vehicle, Payload and POI options

The Vehicle, Camera and POI Options are all located next to the Essential Flight Information in the top of the screen. They are easily accessible when you fly and lets you alter the options in-air. For more information about the list of available options see:

- Vehicle Options
- Camera Options
- Points of Interest (POIs)

4.1.4 Vehicle Options

The Vehicle Options are access in the top of the "Fly" screen. Whenever a vehicle is connected, the vehicle ID number is be displayed on the button. The Options include:

- Vehicle ID
  The vehicle ID number
- Flight Trail
  Specify the flight trail length and clear the flight trail. Adjust trail length to max using the slider to obtain an unlimited trail length.
- Maintenance
  Start the compass calibration and other maintenance features if they are available to your vehicle type.

4.1.5 Additional Flight Information

To the right a + button to add additional flight information is shown. Additional information includes:

- Payload specific Information and Control (available based on Vehicle Type)
  Based on the selected Vehicle Type the associated payload information and control will be visible by default. The payload information and control can be shown/hidden like any other status in the Additional flight Information list. For more info about what information and controls are available based on your payload, please see Payload Specific Information and Control

- Status List
  SDM lets you add additional custom information fields. All status entries reported by the UAV can be added to the list. By default, the list is hidden but can be displayed using the + button.

- Vehicle Messages.
  Show/Hide a log of all messages received from the flight controller. This info is for advanced users. All important messages and alerts will be displayed in the Alert Manager.

INTO: The elements in the Additional Flight Information list can be resized by dragging the bottom left corner. The default panel sizes can be restored by clicking the ↔ button.

4.1.6 Attitude Indicator

The attitude indicator animates the current pitch and roll and should always be visible when flying in Cruise Mode. The attitude indicator is located in the bottom right corner of the screen and can be resized by dragging the left top corner of the attitude indicator. Additional information is reported in numbers on the attitude indicator:

- AS
  Air Speed.

- GS
  Ground Speed.

- Heading
  The compass heading.

- ATO
  Altitude above Take-off.

- AGL
  Altitude above Ground Level.

- Mode status
  In the lower left corner, the vehicle's mode is displayed.

- Armed status
  In the lower right corner, the vehicle's armed status is displayed.

4.2 Vehicle Control

Access to the Pre-Flight Checklist and Vehicle Commands are located in the centre bottom of the screen and are essential to launch and control Sky-Watch UAVs.

4.3 Pre-Flight Checklist

The checklist will guide you through the steps to prepare your vehicle for launch. The Checklist button is displayed in Green when the Vehicle is ready for take off and in red if any of the mandatory steps are in-complete.

ATTENTION: Always complete the checklist before every flight.

INFO: Some steps in the list are mandatory, while others are optional. Optional steps are not required to perform a take-off, but it is always recommended to go through all steps for a safe and secure flight.

4.4 Fixed Wing Vehicle Commands

Following commands are available to Sky-Watch Fixed Wing UAVs.

Upload Plan
Uploads the flight plan to the vehicle. Only valid plans can be uploaded.

Auto
Puts the vehicle into autonomous mode. The vehicle will follow the plan while in auto. Sky-Watch fixed wing UAVs must be in auto to perform a take-off.

Cruise Mode
Maneuver the UAV using the On-screen Software Joystick.

Hold Position
Vehicle holds the current position. Sky-Watch fixed wing UAVs will loiter in circles to hold the position.

Return and Land
The vehicle will fly to the landing segment and perform a landing. For Fixed wing UAVs you will be asked how the vehicle should return to the landing segment:

Directly to Descent
The vehicle targets the descent circle and gradually climb/descends until reaching the landing entry altitude.

Maintain Current Alt
The vehicle maintains its current altitude, until reaching the descent circle.

Highest Mission Alt
The vehicle climbs to the highest mission altitude before it starts targeting the descent circle.

Update Fig. 8 (Only available with EO/IR payloads)
When using the Observe feature, you can easily update the bearing of a fig. 8 to match the view direction of the payload.

Emergency Land
The vehicle will perform an immediate emergency landing at its current position. This command requires an additional confirmation before being sent to the vehicle.

4.4.1 How to Launch Fixed Wing UAVs

Sky-Watch fixed wing UAVs must have a flight plan and be in Auto to be able to perform a take-off.

Step 1 Upload a valid flight plan to the vehicle using the upload plan command.

Step 2 Run through the checklist.

Step 3 When the checklist status changes to green, the vehicle is now ready for take-off.

ATTENTION: Always make sure your vehicle is in good condition, you have permission to fly, you launch the vehicle in head wind and the take-off is free of obstacles. See your vehicle specific manual for more information on the actual take-off.

4.4.2 How to Land Fixed Wing UAVs

Sky-Watch fixed wing landings are always executed autonomously by following the Landing segment uploaded with the flight plan (emergency landings are the only exception).

Step 1 Verify that the landing spot is free of obstacle and is approached in headwind, if not, then adjust the Landing Segment and/or the wind direction.

Step 2 The Alert Manager will notify you if the plan in SDM is no longer identical to the plan on the vehicle, in such case, the flight plan must be uploaded to the vehicle or reverted to match the last uploaded flight plan.

Step 3 Use the Return and land command to make the vehicle fly to the landing segment and perform the landing.

Step 4 After the UAV has reached the approach point, you can lower the altitude using the on-screen software joystick.

INFO: It is recommended to adjust the flight plan based on the vehicle's wind estimate before landing the vehicle (see How to set the Wind Direction from the UAVs Estimate). To reduce the time, it takes to upload the plan, already flown segments can be deleted.

4.5 Autonomous Flight

All Sky-Watch UAVs can be flown in two ways

- Autonomous mode (Auto)
  The vehicle follows the flight plan.

- Flying off-plan
  The vehicle is airborne, but not flying according to the uploaded plan.

INFO: Sky-Watch fixed wing UAVs must have a valid flight plan and be in Auto to be able to perform take-off and landings.

4.5.1 Continue Plan from Segment

SDM lets you continue your mission from any segment in the plan.

Step 1 Select segment.

Step 2 Click on Fly to in the bottom of the segment properties.

Step 3 The vehicle will fly to the segment and then continue the flight plan from there.

INFO: Fly to is only available when the flight plan in SDM is identical to the plan on the vehicle. The Alert Manager will give you a notice if they are not in Sync.

4.6 Flying Off-Plan

You can fly off-plan either using the software joystick to manually navigate the vehicle or by using built-in SDM features like "Fly-To" and "Observe". Temporary waypoints and flight patterns outside the flight plan are all marked with orange colours in SDM.

4.6.1 Fly to

The SDM lets you fly to any position when the vehicle has completed its take-off.

Step 1 Right click/long press anywhere on the map

Step 2 Select "Fly to".

Step 3 Adjust the altitude.

Step 4 Press Go! to make the vehicle go to the position.

INFO: All Sky-Watch Fixed Wing UAVs will perform a circular loiter, to keep the position.

INFO: Sky-Watch UAVs carrying video payloads allows you to look at the position by clicking the .

4.6.2 Observe in Figure 8 Pattern (Video payloads only)

SDM makes it easy to create an advanced figure 8 flight pattern. The is useful feature to keep the EO/IR payload looking at a specific position without reaching gimbal end points. To create an observe flight pattern:

Step 1 Right click/long press the position on the map you want to observe.

Step 2 Select "Observe". SDM now creates two markers on the map, the marker is the position on the map you want to observe. The marker is the center postion of the UAV trajectory - both can be moved seperatly.

Step 3 Adjust the altitude

Step 4 Press the to make the camera look at the observe position.

Step 5 Press Go! to make the vehicle go to the position.

INFO: To avoid situations where the camera payload has to turn 360 degrees, when reaching its gimbal end points it is advised to frequently update the figure 8 flight patter based on the view direction of the camera. This is easily done by using the "Update Fig. 8" button described in Vehicle Commands.

4.6.3 Fly to POI

SDM lets you fly directly to POIs when the vehicle has completed its take-off.

Step 1 Select a POI.

Step 2 Select "fly to".

Step 3 Adjust altitude.

Step 4 Press Go! to make the vehicle go to the position.

4.6.4 Observe POI (Video Payloads Only)

SDM lets you create an observe point directly from a POIs Select a POI.

Step 1 Select "Observe".

Step 2 Adjust altitude.

Step 3 Press the to make the camera look at the position

Step 4 Update the figure 8 position and size if required.

Step 5 Press Go! to make the vehicle go to the figure 8 flight pattern.

4.7 Navigation using joystick (Cruise Mode)

4.7.1 Navigating Fixed Wing UAVs using Software Joystick

Sky-Watch Fixed Wing UAVs can be maneuvered using the on-screen software joystick.

Step 1 Make sure the Attitude Indicator is visible.

Step 2 Enter cruise mode by clicking the cruise mode button in Vehicle Commands.

Step 3 Click and drag in the Attitude Indicator to maneuver the UAV.

INFO: Sky-Watch fixed wing UAVs keeps a constant altitude (ATO) and heading, when entering cruise mode. Use the onscreen joystick to maneuver the vehicle up, down, left and right.

INFO: A green joystick icon is displayed in the attitude indicator whenever it is possible to control the vehicle using the onscreen joystick.

4.8 GPS Denied Flight (EO/IR Only)

Besides the GPS Denied Recovery-failsafe, which can be selected in the Fixed Wing Failsafe Settings, SDM comes with advanced options to control the Heidrun RQ-35 when the GPS signal is missing or faulty.

In GPS Denied Flight the UAV ignores data from the GPS. Instead, it stays airborne based on other sensor data and reports an estimated position to SDM. GPS denied flight is enabled from the GPS Denied Flight Options, accessed by clicking the GPS status in the Essential Flight Information.

Attention: When in GPS denied flight, the UAV has no confirmation on its actual position, this poses a severe risk of losing the UAV. The UAV stays airborne and SDM provides tools to update the position manually and let you use most of the features in SDM. However, read the manual carefully before entering GPS Denied Flight – Make sure to understand the risk of using the feature and understand How to Launch UAV without GPS and How to Land the UAV in GPS Denied Flight.

4.8.1 Position Estimation and Manual UAV Position Updates

When GPS Denied Flight is enabled, the UAV stops using the GPS. Instead, it estimates its position based on information from other sensors and Drift Compensation from SDM. The actual position of the UAV might differ significantly from the estimated position reported by the UAV. SDM displays up to two UAV icons when GPS Denied Flight is enabled:

Estimated Position
The estimated position of the UAV is displayed as a red UAV Icon. This icon is always visible in GPS Denied Flight and is the UAV's estimated position.

Position Reported by the GPS (when available)
If the UAV has access to or regains GPS fix, a yellow UAV icon is displayed. This is the position reported by the GPS. Normally this will be the same as the actual position of the UAV and GPS Denied Flight can be disabled to reuse the GPS unless you suspect that the GPS signal is being spoofed.

If the GPS signal is missing or faulty (e.g., due to jamming or spoofing) The UAV can still be flown in GPS Denied Flight and SDM features like Look at position on ground and Fly to will be based on the estimated position.

The Estimated position is likely to become more and more incorrect over time. Therefore, SDM provides GPS Denied Flight Controls to re-locate the estimated position and add a Drift Compensation to minimize how much the estimated position drifts over time.

4.8.2 GPS Denied Flight Controls

GPS Denied Flight Controls becomes visible when GPS Denied Flight is enabled. They are located above the Attitude Indicator in the lower right corner of the screen.

The GPS Denied Flight Controls provides two essential features for GPS Denied Flight:

- Landmarks
  Landmarks are used to update the estimated position of the UAV in SDM.

- Drift Compensation
  Options to minimize how much the estimated UAV position drifts from its actual position over time.

4.8.3 Landmarks

The estimated UAV position, shown in SDM with a red Icon, is expected to drift from the actual position over time. To avoid it becoming too unreliable, SDM lets you update the estimated position using "Landmarks".

Any object or easily recognised pattern in the terrain can be used as a landmark. The object must be visible on the map in SDM and from the camera feed when the UAV is airborne.

Common landmarks are large buildings, crossroads, rivers or any other object or terrain pattern, that can be easily recognized from above.

To update the estimated UAV position in air, you will have to find the landmark using the video feed. When the Landmark is in the centre of the video, you can tell SDM that you are looking at the landmark using one of the two landmark buttons:

Select on Map
Click on the map where the landmark is located.

Use Observe
When using the Observe in Figure 8 Flight Pattern (EO/IR payloads only) or a Fly to you can register the landmark directly:
For Observe in Figure 8 Flight Pattern (EO/IR payloads only) the Observe point will be used as the location of the landmark.
For Fly to the centre of the loiter circle will be used as the location of the landmark.

When you register a landmark, SDM calculates the position of the UAV based on the angle of the camera and the flight altitude. The estimated position of the UAV is updated immediately. The accuracy of the estimated UAV position is dependent on the distance to the Landmark. A more downwards angle when looking at the landmark, gives a more precise UAV position. When the camera is angled close to the horizon the landmark buttons are disabled due to the high levels of uncertainty.

ATTENTION: Always make sure that the landmark is in the centre of the video feed. The easiest way to ensure this, is to track the object and then register the landmark.

INFO: The Look at position on ground, Fly to and similar features, are all affected by drifts in the estimated position of the UAV. By updating the position regularly, you will be

able keep track of the UAVs actual position and use most of the normal flight features in SDM. It is recommended to plan your flight with several landmarks ahead, if you plan to enter areas with no or faulty GPS. Time elapsed since the UAV position was last updated is displayed between the landmark buttons. How often to update the UAV position is dependent on flight pattern and wind condition (especially heavy gusts). Pay attention to how much the estimated UAV position is moving when updating the position, to determine if you should update the UAV position more often.

4.8.4 Drift Compensation

To minimize how much the estimated UAV position drifts from the actual position over time, SDM lets you add a drift compensation. The drift is mainly caused by the wind; hence drift compensation is reported like wind estimates with a direction and speed.

SDM calculates an estimated drift based on Landmarks. Every time you place a landmark SDM updates the estimated drift with the newly added information. The longer you fly and the more landmarks you have added, the more precise the SDM estimate will be. From the GPS Denied Flight Controls you can:

- Reset estimated drift
  If the wind changes significantly during the flight or the estimated drift seems off, the drift calculator can be reset, by clicking the ⟲-button. SDM requires a minimum of two landmarks and a minimum of 60 seconds elapsed from the very first landmark, to calculate a valid drift estimate.

- Use estimated drift
  The estimated drift can easily be made active. Simply click the >-button between the estimated and active drift. SDM keeps updating the drift estimate, when you add more landmarks, but you will have to press the >-button again to update the active drift with new information.

- Enter a drift manually
  By clicking on the active drift, you are able to adjust the drift manually. The drift consists of two factors: direction and speed. If you launch the UAV with GPS Denied Flight enabled, you should always enter the wind conditions as the drift compensation prior to launching the UAV.

INFO: If GPS Denied Flight is enabled while the UAV is already airborne, the UAVs wind estimate is automatiaclly used as the active drift estimate.

INFO: Factors like the state of the battery, Cruise throttle, etc. all impacts the actual drift of the UAV. The SDM estimate is based on the landmarks given by the user and accounts for all these drift factors – hence the drift might differ from the wind alone.

4.8.5 How to Create a Good Drift Estimate

It is recommended to use landmarks repeatedly throughout the flight, but a good drift estimate reduces how often you must update the estimated UAV position using landmarks. The recommended procedure to create a good drift estimate is:

Step 1 Create a Fly to loiter circle centred on the Landmark in the altitude you want to fly your mission – recommended loiter radius around 200 m.

Step 2 Track the landmark using the video feed.

Step 3 Update the Estimated UAV position by Use Observe for Landmark until the UAV is actually flying in the loiter pattern.

Step 4 Reset drift estimate using the reset ⟲-button.

Step 5 Repeatedly update the estimated UAV position by Use Observe for Landmark every 5th to 10th second – This creates data for the SDM drift estimator.

Step 6 Repeat Step 5 until the UAV has completed the loiter pattern at least one time and the drift estimate has converged towards a stable value.

Step 7 Click the >-button to send the drift estimate to the UAV and make it active.

INFO: It is recommended to create a good wind estimate using the above described procedure after enabling GPS denied flight or immediately after launching the UAV if it is launched without GPS.

INFO: If you suspect the wind has changed during the flight, reset the drift estimator and run the described procedure. The procedure can also be performed using the Observe in Figure 8 Flight Pattern (EO/IR payloads only) instead of a Fly to if it is more beneficial to the mission.

4.8.6 GPS Denied Flight Options

GPS Denied Flight Options are accessed by clicking the GPS status in the Essential Flight Information or from the Vehicle Options. The Options include:

- GPS Denied Flight
  Enables/Disables GPS Denied Flight

- Show GPS Position
  When this option is enabled, the position reported by the GPS (yellow UAV icon) is displayed on the map. Hide the yellow GPS icon if the position seems far off e.g. due to GPS spoofing. The position can also be hidden for training purposes when practicing GPS denied flights.

- UAV Position from Planned Take-off
  Set the UAVs current position to the take-off position in the flight plan. Always synchronise the UAV position with the flight plan using this option, before launching the UAV in GPS Denied Flight.

- UAV Position from Map
  Allows you to set the Estimated UAV position on the map. This option is mainly useful for training purposes, where the yellow UAV icon (see Position Estimation and Manual UAV Position updates) is visible. When flying in environments where GPS signal is momentarily reliable, it can also be used to update the estimated position without the use of Landmarks.

- Cruise Throttle
  This Options lets you adjust the cruise throttle between 41-50%. Since the UAV has no valid information about its ground speed in GPS denied flight, the pilot is responsible for adjusting the cruise speed manually. By default, the cruise speed is set to 45% in GPS denied flight. This is sufficient to perform most flight maneuvering successfully in normal weather condition (winds below 10 m/s).
  - Increase the Cruise throttle if you experience the UAV is having trouble moving forward (in heavy wind)
  - Decrease the Cruise throttle to save battery and when approaching landing postion.

4.8.7 How to Launch the UAV without GPS

Launching the UAV in an area with no or faulty GPS is based on the normal procedure for Launching Fixed Wing UAVs. The Main difference is that the UAV position must be updated manually before takeoff. This is easily done by using the "UAV Position from Planned Takeoff"-option in GPS Denied Flight Options. Furthermore, it is highly recommended to upload a manual drift estimate before the take-off. The full procedure to launch the UAV without GPS is:

Step 1 Identify a Landmark, that you can use to update the estimated UAV position when the UAV has performed its takeoff.

Step 2 Enable "GPS Denied Flight" in in GPS Denied Flight Options

Step 3 Upload a valid Flight Plan to the vehicle using the upload plan command.

Step 4 Go through the pre-flight checklist.

Step 5 Manually update the UAVs position using the UAV Position from Planned Takeoff.

Step 6 Enter a manual Drift Compensation (Use the wind direction and wind speed)

Step 7 The vehicle is now ready for take-off.

Step 8 Make sure to keep visual contact with the UAV in the sky, until you have updated the UAV position using Landmarks in SDM. It is recommended to let SDM calculate a drift estimate using the first landmark as described in How to Create a Good Drift Estimate, before proceeding with the actual mission.

ATTENTION: The UAV's estimated position is highly affected by throw direction and is likely to be very unprecise after the UAV has completed its take-off sequence. It is strongly advised to keep the UAV in Visual Line of Sight, until you have updated the UAVs position using Landmarks.

4.8.8 How to Land in GPS Denied Flight

As the UAV is not able to confirm its actual position, it is recommended to land the UAV manually using Cruise Mode and not by the automated Return and Land procedure described in How to Land Fixed Wing UAVs. You can do so using the on-screen joystick as described here:

Step 1 Ensure that the UAV is in line of sight.

Step 2 Bring the UAV to an adequate altitude for the landing (e.g., 30 m).

Step 3 Lower "Cruise Throttle" to a minimum in GPS Denied Flight Options.

Step 4 Retract the payload.

Step 5 Enter Cruise Mode and maneuver the UAV by dragging in the Attitude Indicator.

Step 6 Make sure to approach the desired landing spot in head wind.

Step 7 Press the Emergency Land button and confirm to initiate deep stall when the UAV is above the desired landing spot.

ATTENTION: Landing precision is highly dependent on the pilot's ability to maneuver the UAV using the joystick. Always select a landing location with enough free space, that you feel you can comfortably land the UAV without damaging the equipment.

5 Alert Manager

The Alert Manager warns you in case un-safe conditions appear.

ATTENTION: Always pay attention to the Alert Manager while flying. Flying your vehicle while any alert is present significantly increases the risk of damaging or losing your equipment.

INFO: If the Alert list is empty, the alert manager will disappear. As a rule of thumb, you are ready to fly when the alert list is empty. However, it is always the operator's sole responsibility to ensure a safe flight.

5.1.1 Alert Levels

Alerts are divided into three levels.

Alert
Conditions requiring immediate attention and/or with a high risk of damaging the vehicle. SDM plays a severe beeping tone (5 beeps long) when an alert is raised

Warning
No immediate risk of damaging the equipment but proceeding might cause un-safe conditions. SDM plays a three beeps long notification when warnings are raised

Info
No immediate threat of damaging equipment. No sound is played when info messages are raised.

INFO: Always read the information carefully, regardless of the alert level.

INFO: Info messages or warnings may be the reason some SDM features are disabled.

5.1.2 Audio warnings

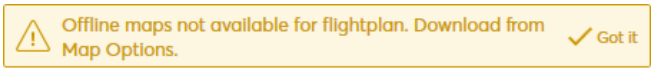
SDM plays a sound when an alert or warning is raised. The Audio warmings can be disabled in Application settings.

INFO: Changes limited to the flight plan only does not produce any sounds.

5.1.3 Acknowledging Alerts

Some alerts can be acknowledged by the user.

- Click on "Got it" to acknowledge the Alert and remove it from the Alert Manager.



ATTENTION: Only acknowledge alerts when you have completely read and understood the alert. It is recommended to fix the issue to automatically make the alert disappear instead of acknowledging it.

INFO: Not all alerts can be acknowledged by the user. Simply fix the cause of the alert to make it disappear.

5.1.4 How to Collapse the Alert Manager

The Alert manager can be collapsed by clicking on the alert button. This will hide the alert descriptions and instead it will:

- Show the number of Alerts.
- Take colour and icon based on the most severe alert in the list.

ATTENTION: Never ignore alerts, always take notice and action if required.

INFO: If a new alert appears, the Alert Manager will automatically open and show you the list of alerts.

5.1.5 Terrain Warnings and Awareness

To ensure safety during flight, SDM uses digital elevation data and UAV telemetry data to assess if the UAV trajectory in the near future will be critically close to the terrain (low AGL). Two levels of alerts can be raised based on this assessment.

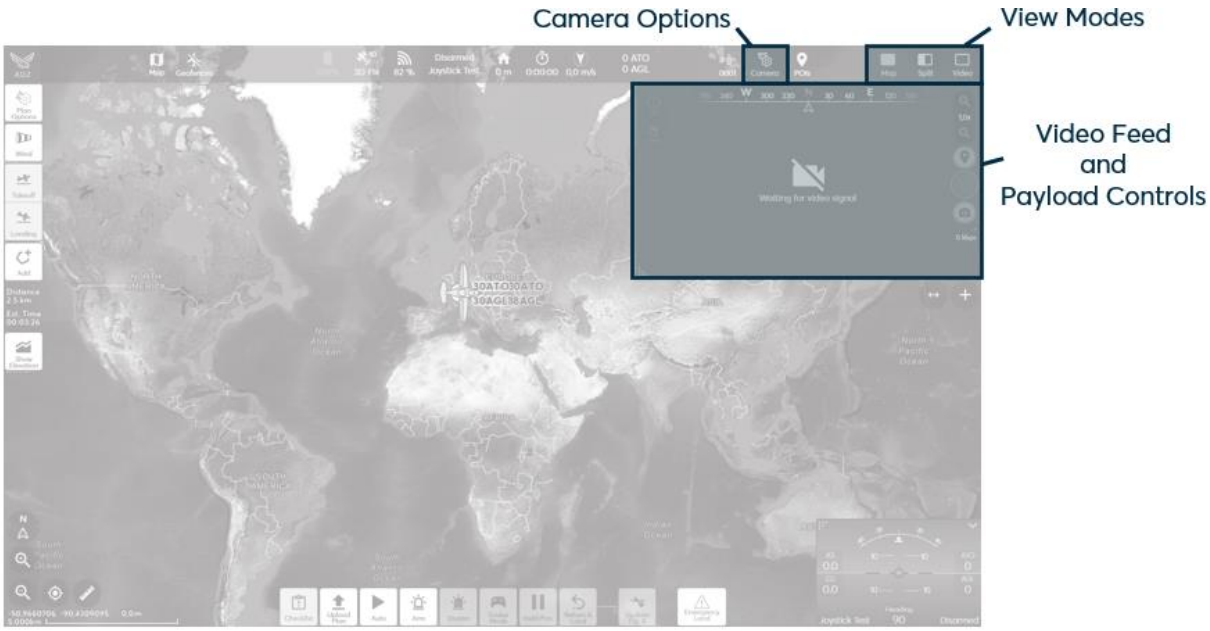
- An early warning (yellow)
  This is given when it is assessed that the UAV in the near future will be below critical altitude specified in either ATO or AGL.
- An alert (red)
  This is given when immediate user action is needed to avoid the risk of terrain collision. This warning is raised if the UAV is below critical altitude or in a very short time will be.

INFO: Both warnings include the predicted time before critical altitude is reached, given that conditions are unchanged.

ATTENTION: When any of these warnings are given, it is vital to act by increasing the altitude and/or turning away from the terrain in case of a sudden steep hill or mountain. It is recommended to use the manual cruise mode or the fly-to functionality to do this effectively.

6 Camera Control

SDM lets you control the video payload directly from the "Fly ✈"- interface. The Video feed is displayed as an Additional Flight Information with everything required to control the Video payload. SDM also lets you change View Mode, to bring the Video feed and the payload controls into fullscreen or split view.

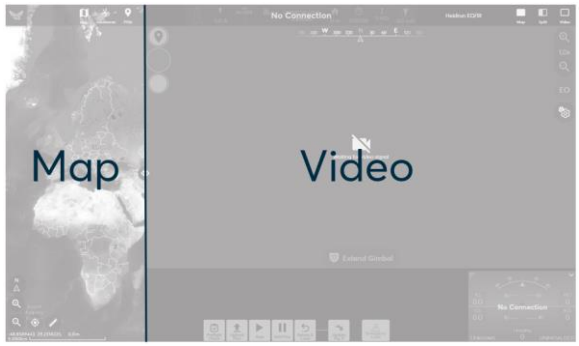


6.1 Camera View Modes

The view mode is changed in the top right corner of SDM and makes it easy to switch between "Map", Split" and "**Video**" view:

Map
In Map view the map fills the entire screen and video is displayed as a small overlay in the Additional Flight Information list in the top right corner of the screen. Use Map view for flight planning and when you need to get an overview of the mission area.

Split
In Split view, the main screen is separated in two: Map and Video. The Map/Video size can be adjusted by moving the screen splitter.



Video
Video fills the entire screen; the map is hidden completely.

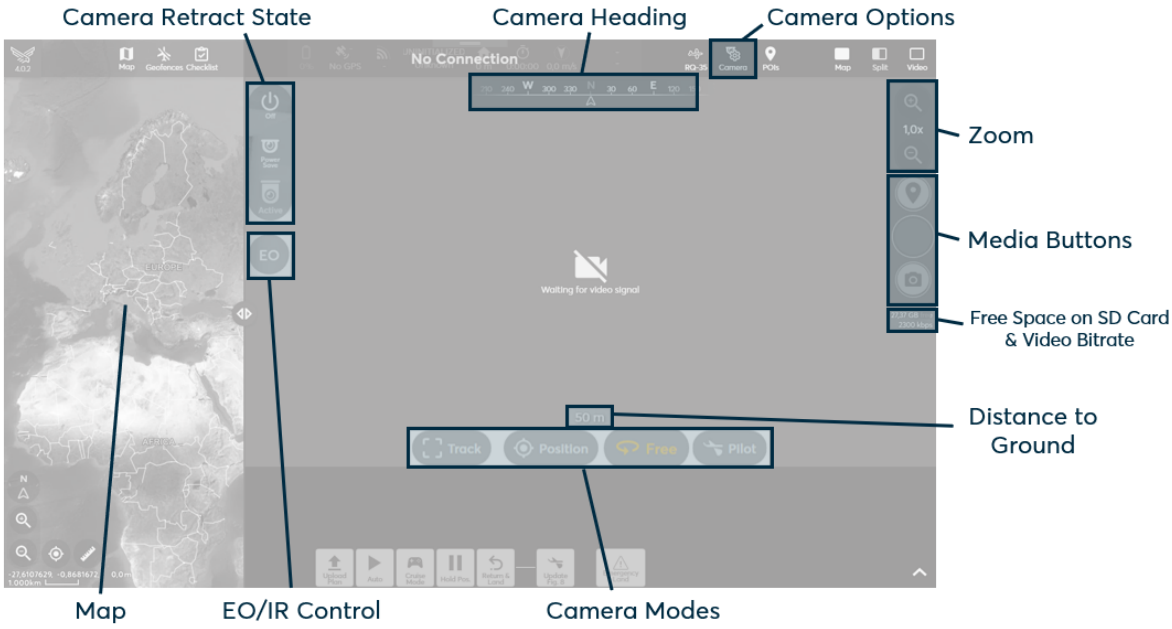
INFO: Flight critical information and control including Essential Flight Information, Attitude Indicator and Vehicle Commands are visible in all View Modes.

INFO: Camera controls are displayed as overlay in the video feed and is available in all View modes. The controls are hidden if the video view gets too small but will be shown if you enlarge the video feed in split or map view.

INFO: The Auto Rotate Map feature is toggled on by default in Split View and off in map view. In split view the map rotates according to the video so that up on the map is also up in the video feed. In map view, the Map is by default rotated with North up for flight planning and improved overview.

6.2 Camera Information and Control

The SDM camera controls are displayed on top of the video feed:



- Camera Retract State
  Change camera retract state between OFF, Power Save or Active.

- Camera Heading
  Heading bar that displays the heading of the camera and gimbal end points.

- Camera Options
  Options related to the camera and payload.

- Zoom Buttons
  Zoom in and out in the video. On touch screens, you can also pinch zoom in the video feed using 2 fingers. Using mouse, you can zoom using the scroll wheel.

- Media buttons
  Buttons to capture media.

- Free space on SD Card & Video Bitrate
  The amount of free space on the SD card and the current Video Bitrate

- Distance to Ground
  Distance from UAV to the ground in the centre of the video feed.

- Camera Control Modes
  Camera control mode defines how you control the payload when clicking in the video feed.

- EO/IR Control
  Change between EO (daylight) and IR (night) video if supported by the payload.

6.2.1 Camera Retract State

Control the Camera Retract State from the top left of the vide view and select between:

Off
The camera is turned OFF and retracted into the body of the UAV. This position protects the payload, and the camera should always be off when landing and powering off the UAV.

Power Save
The camera is powered ON but stays inside the body of the UAV. This camera position reduces the wind drag of the UAV, which provide a more battery efficient flight compared to "Active". However, the camera control is limited to simple pitch movements of the camera.

Active
The camera is powered ON and extended below the UAV body. This provides an undisrupted view towards the ground and lets you use all the advanced camera features in SDM, such as position mode and tracking.

INFO: Camera Retract State is automatically changed to Off when the UAV passes the align WP in the landing sequence.

INFO: Use Off and Power Save on long transits to reduce the battery usage if the video feed during the transit is irrelevant to the mission.

6.2.2 Camera Options

The camera options let you see and change:

- Type
  The payload type.

- Quality
  Select between automatic and fixed video bit rate. A fixed video bitrate ensures the same encoding and quality of the video throughout the whole flight, but video will studder and become unavailable at some point based on the link conditions to the local radio. The automatic bitrate selection allows you to lower the bitrate and quality of the video to extend the range in such cases. The video gradually becomes blurrier, but the video frame rate is more fluent when suffering from difficult radio link conditions and/or during jamming.

ATTENTION: Low video bitrates affect the video on the onboard SD-card as well as the video sent to the tablet.

- Minimum bitrate (only available when video quality is set to auto)
  Set the minimum allowed video bit rate. Use this option to ensure that the video quality is not lowered more than to a specific bitrate based on the given mission objectives. Minimum bitrate affects the video recorded to the onboard SD-card as well as the video sent to the tablet.

- Open Output Folder
  Opens the folder where media is stored on the tablet.

- Video overlay
  Toggle the various video overlay information, such as vehicle position, altitude, slant range etc. on/off.

- Flight Beacon (if the payload has one)
  Turn on/off the flashing diode on the payload. Select between the normal light diode (EO) or the infrared diode (IR).

Under Advanced you will find additional options:

- Record to Onboard SD Card
  By default, this option is enabled to store video recordings on the onboard SD card.

- Record to Disc
  By default, this option is enabled, so that recordings are stored locally on the tablet.

- Camera Pitch Calibration
  Opens the Camera Pitch Calibration Guide. Use this to tune the pitch angle of the view cone.

- Restart Camera and Onboard Processor
  In case you experience problems with the video feed, you can restart the camera together with the Onboard Processor.

6.2.3 Media Buttons

The Media Buttons are located in the right side of the video feed and includes:

Create POI
Freezes the Video frame and lets you tap or draw a square in the video feed to mark the point of interest.

Record
Start/Stop video recording.

Take Picture
Take a picture

INFO: Recorded media is stored locally in C:\Users*USER_NAME*\Documents\Sky-Watch\Drone Manager\Missions and are also added to the Mission Data Report.

ATTENTION: Pictures and POIs are only stored locally on the PC. Video recordings are by default stored on the UAVs onboard SD card.

6.2.4 Mission Data Report

Video POIs, Pictures and Video Recordings are exported to the "Mission Data Report". The mission data report is a pdf file and includes screenshots along with the following information for each saved media:

- Name
  The name of the media. Clicking on the name will automatically open the media file if it is in the same folder as the mission data report.
- Timestamp
  Date and time in UTC
- Coordinate of the UAV
  The position and altitude of the UAV.
- Coordinate of the media
  The position of the media. Along with the approximate slant range (distance between UAV and the ground in the centre of the image).

INFO: Mission data reports are stored in C:\Users*USER_NAME*\Documents\Sky-Watch\Drone Manager\Missions

6.2.5 How to Import Media from Onboard SD Card

To import the media stored on the UAV onboard SD card:

Step 1 Make sure the UAV is powered OFF.

Step 2 Remove the SD Card from the UAV and install it in your PC.

Step 3 Transfer the files to any location on your PC.

INFO: Delete the stored media on the SD after import, to make sure there is enough free space on the SD card for new data.

6.2.6 EO/IR Control (if IR is Supported by the Payload)

The EO/IR Commands are available from the left side of the video feed if IR is supported by the payload. Use the option to:

EO/IR Toggle EO/IR
Toggle between daylight (EO) and thermal camera (IR)

Calibrate IR (only visible when IR is active)
Calibrate the thermal image

6.3 Camera Control

You can control the EO/IR Camera payload in multiple ways:

- By tapping or swiping in the video feed
  See Camera Control Modes
- Using the map in SDM
  See Look at position on ground

6.3.1 Camera Control Modes

The SDM lets you control the Camera Payload in different modes when the Camera is in the Active state:

Track
Let's you track objects in the video feed. When in tracking mode, draw a square in the video feed around the object you want to track. The tracking square can be updated by tapping in the video feed or by drawing a new square.

Position
This mode lets you select a position on the ground from the video feed. The Payload will then keep the orientation at this coordinate. While this mode is enabled you can simply click or drag anywhere in the video feed to update the position to a new coordinate on the ground. The position will be displayed with a blue map marker on the map.

Free
When free mode is selected, you can move the camera freely. Control the camera by clicking, dragging, or swiping directly in the video feed.

Pilot
In pilot mode, the camera is fixed to look in the same direction as the UAV. It is possible to pitch the camera up and down by tapping in the video feed.

6.3.2 Look at Position on Ground

Another way to control the camera payload is to select where you want it to look using the map. This brings the camera in "Position"-mode and turns the payload to look at the position on the map. To use this feature:

Step 1 Right click anywhere on the map.

Step 2 Select look in the popup menu.

Step 3 The EO/IR payload now looks at the desired position.

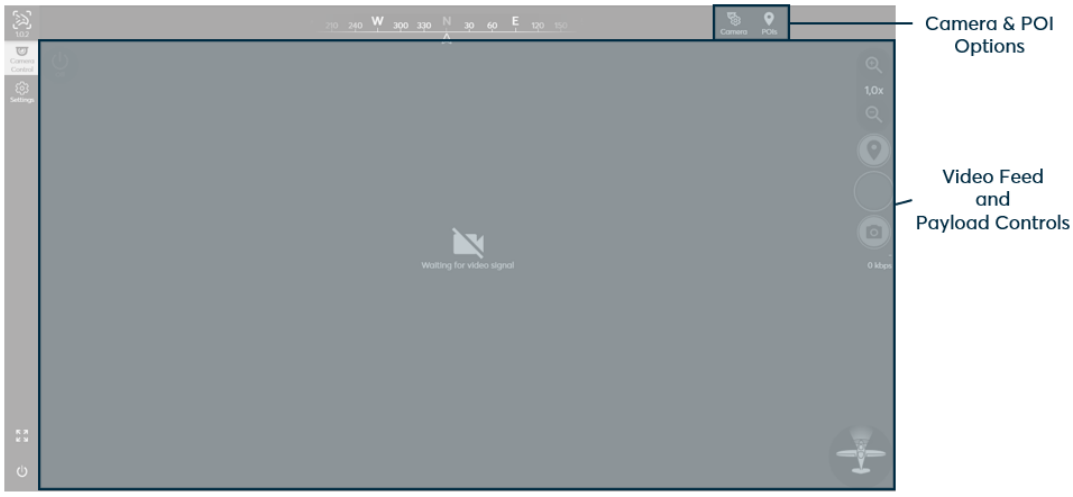
INFO: You can also make the camera look at the position of POIs or Fly To and Observe on the map by using the button when opening their options.

6.4 Sky-Watch Camera Controller (SCC)

The Sky-Watch Camera Controller is a stand-alone application to control Heidrun RQ-35 video payloads. SCC shares the exact same camera controls as SDM and the sections above on how to control the video payload apply to both SCC and SDM.

SCC is limited to camera control only. To control and maneuver the UAV, SDM is still required; hence it is not possible to launch and fly UAVs from SCC alone. Instead, SCC is a side application for SDM that makes it possible to separate the camera control from SDM to control the system from two tablets.

SCC comes with its own installer, but the layout and features of the application will be familiar to SDM users.



6.4.1 How to Connect SCC and SDM

To use Sky-Watch UAVs in a dual tablet setup SCC must have access to the same network as SDM and the UAV. A typical solution is to use a dual network dongle.

For more information on how to access SCC and connect to SDM, contact: support.sky-watch.com

6.4.2 How take Camera Control

Only one application can have the camera control at any time. Whenever your application does not have the camera control, a button to "Take camera control" is displayed in the centre of the video feed.

Simply click the button and confirm to take over the camera control.

ATTENTION: Mission reports and mission data is stored by the application having the camera control and capturing the media.

6.4.3 Camera Retract State in SCC

Whenever SCC has the camera control, the Camera Retract State is split between SDM and SCC:

SDM
Controls whether the payload is turned OFF and retracted in the UAV body, or turned ON.

SCC
SCC can toggle between Power Save and Active, whenever the payload is extended and turned ON.

6.4.4 POI Exchange Between SDM and SCC

The POI list is available from the top of the screen in both SDM and SCC. POIs are automatically exchanged between SDM and SCC. All POIs in SDM will show in the SCC POI list and vice versa. For more information, see Points of Interest (POIs).

INFO: You can use the Look at Position on Ground feature from the POI list in both SDM and SCC.

6.4.5 Camera Orientation Relative to Vehicle

The SCC has no map information and shows no view cone. Instead, the camera orientation relative to the UAV is displayed in bottom right corner of SCC. The camera orientation can be changed between

UAV Direction Up
The UAV is displayed with a fixed heading up. The View cone rotates based on the view angle.

Camera Direction Up
The camera view direction is fixed, and the UAV illustration rotates according to the view angle.

To toggle between fixed UAV or fixed Camera direction, simply click the graphic.

6.4.6 General SCC Settings:

SCC has some general application information and settings. These are accessed the same way as in SDM via the Menu Panel and includes:

- Version number
  See the full version number of SCC.

- SCC Update Checks
  SCC automatically checks for updates on startup. The update check can be disabled form the settings.

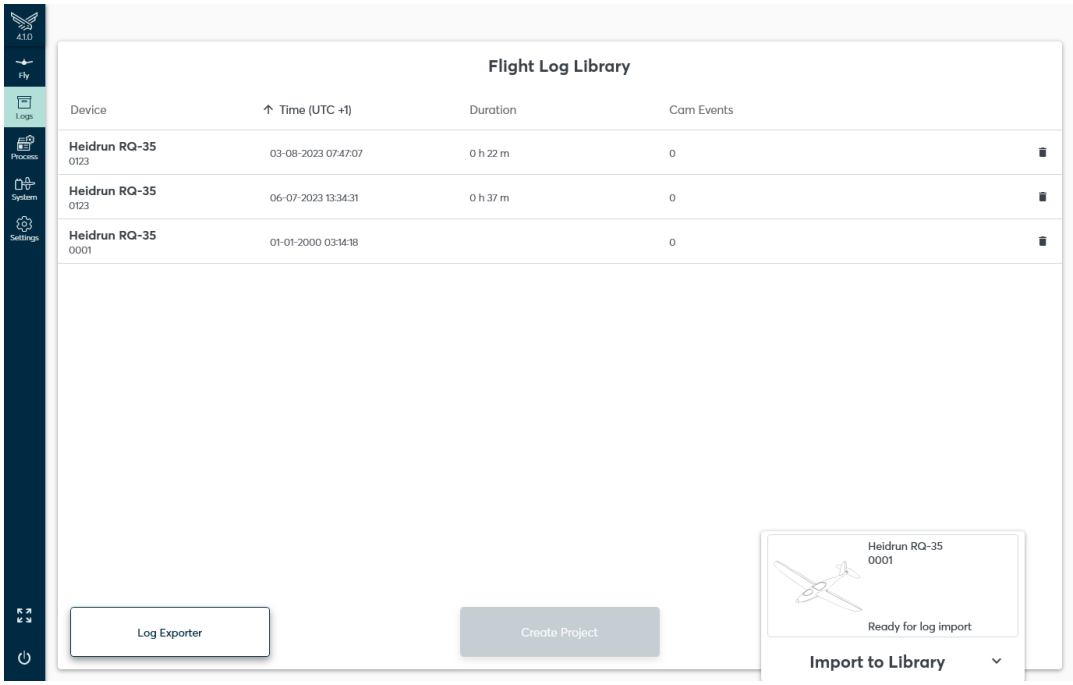
- Coordinate format
  Change the desired coordinate format used for the SCC application.

7 Flight data and Post Processing

Data is the most important output of any UAV mission. SDM provides tools for acquiring but also managing, inspecting, and using this data.

7.1 Flight Logs

The SDM provides a Flight Log Library to manage flight logs stored locally on the device running SDM. The Flight Log Library is accessed in Logs from the Menu Panel. From here flight logs can be imported, deleted and used for post processing projects. In the bottom right corner, a list of devices will appear if any are connected. Each device is represented with information such as ID, status and available disk space. A device can be selected by clicking on it, which will open a list of all the logs on the device.



7.1.1 How to Import Flight Logs into SDM

SDM lets you import flight logs into the Flight Log Library.

Step 1 Connect vehicle using USB cable (see How to connect vehicle via USB)

Step 2 Go to Logs in the Menu Panel

Step 3 Select device from the "import to Library" list.

Step 4 Import flight logs using the Import buttons or use Import All to import all logs from the vehicle.

INFO: The time and size information can be used to find the logs relevant to your project. Once the logs have been imported, additional information such as duration and number of camera events will be calculated and shown in SDM.

INFO: SDM can import multiple logs simultaneously. The logs will also continue importing in the background if the device view is closed. All flight logs are stored locally in \Documents\Sky-Watch\Drone Manager\data\logs\UAV Logs*Vehicle_ID* – The parent folder of a specific log can be opened by right clicking the flight log in the Log library list and select "open containing folder".

7.1.2 How to Delete Flight Logs on a Device

Logs on the device can be deleted using SDM.

Step 1 Connect vehicle using USB cable (see How to connect vehicle via USB)

Step 2 Go to Logs in the Menu Panel.

Step 3 Select the device from the import to Library list.

Step 4 Delete all logs on the device using the Delete All button.

ATTENTION: This will permanently delete all logs on the device. Always make sure that all flight logs required for further use has been successfully imported to the SDM.

ATTENTION: Always make sure your vehicle has enough free disk space for your next flight.

7.1.3 How to Delete Locally Stored Flight Logs.

All imported flight logs will show in the Flight Log Library. These flight logs can be deleted using the bin .

ATTENTION: This will permanently delete the logs from the device running SDM.

INFO: Multiple logs can be deleted simultaneously (mouse required). Select multiple logs (click and drag mouse) and use the Delete Selection button.

7.1.4 How to Collect and Export Logs for Incident reports

Besides the flight logs, SDM creates several logs with information about telemetry data, SDM statuses and radio data. These logs provide valuable information in case you experience problems with SDM or your UAV.

The SDM Log Exporter is a tool to help you gather log files located on your PC.

Step 1 Go to Logs in the Menu Panel.

Step 2 Make sure to import any relevant flight logs from the UAV.

Step 3 Open the Log exporter from the button corner of Logs.

Step 4 Enter start and end date.

Step 5 Press "Collect and Export" and choose a destination for the .zip collection of logs.

7.2 Process flight Data and Geotag Images

To geotag images, the SDM post processor provides an easy step-by-step guidance.

Step 1 Select flight.

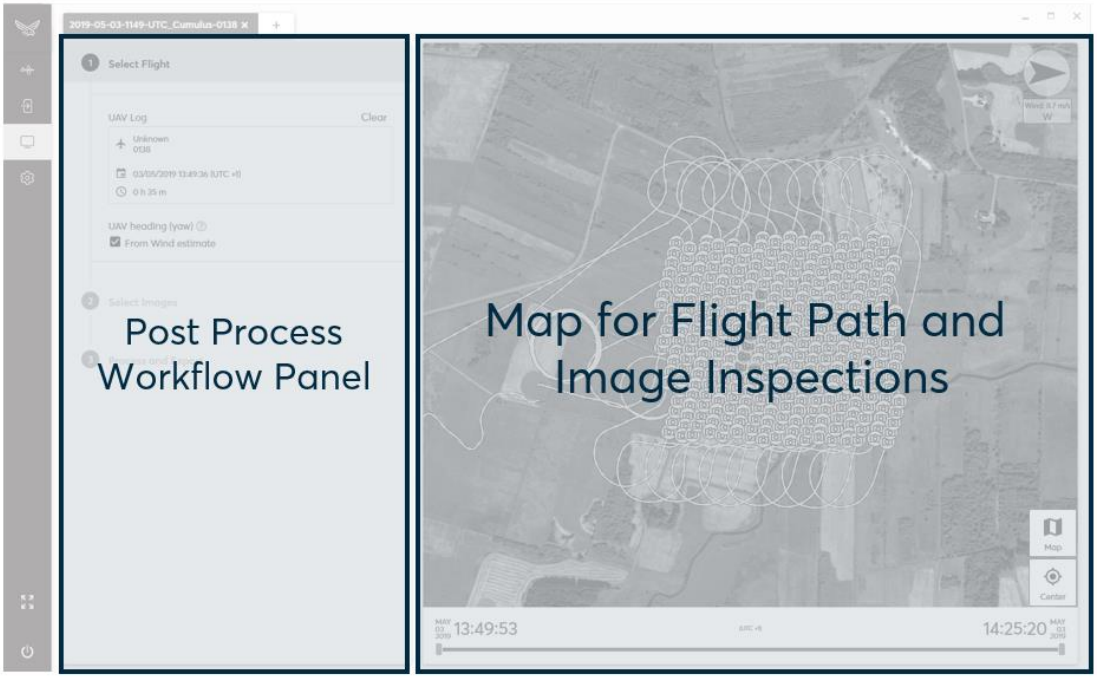
Step 2 Select images.

Step 3 Process and Export the results.

This workflow is built into the Step-by-step guide in the left panel of the SDM post processor. To the right a map will let you inspect the flight data to verify that the path and image data is correct before exporting the results.

INFO: The SDM Post Processor can be used for inspecting all types of flights not limited to the ones containing images. Use the Inspection tools to review any type of flight.

ATTENTION: Geotagging of images is only supported for fixed wing mapping UAVs.



7.2.1 Create Empty Post Processing Project.

It is possible to create an empty post processing project.

Step 1 Go to Process from the Menu Panel.

Step 2 Enter a new project name.

Step 3 Click on Create New Project to create new post processing project.

INFO: It is possible to Create Project from Flight Log directly from the Log Library. Creating projects directly from the logs is often a quicker option than creating empty projects.

INFO: It is possible to open more than one project at a time. Use the + button in the top to add another project.

7.2.2 Select Flight

Step 1 Create empty post process project.

Step 2 Click on Select UAV Log.

Step 3 Select the log for your project in the list.

INFO: If the project is created directly from the log library, the flight is already selected. See Create Post Process Project from Flight Log.

INFO: The flight log can be changed at any time, by clicking on the log information to select a new flight.

7.2.3 Create Post Process Project from Flight Log

SDM provides an alternative way to creating post processing project. Projects can automatically be created directly from the Log library.

Step 1 Go to Logs in the Menu Panel.

Step 2 Select a flight log for post processing.

Step 3 Press Create Project to create a post processing project based on the flight log. The project is automatically named based on the vehicle ID and time of the flight.

INFO: If a post processing project already exist, the existing project can be opened using the same button.

7.2.4 Select Images

To import images, the images must be available on the device running SDM. Simply take out the camera SD-card and plug it in to the computer if you have not already copied the images from the SD-card to the computer.

Step 1 Activate step 2 "select Images" in the post process workflow, by clicking on it.

Step 2 Select the folder in which the images are located.

Step 3 Select the camera used for the flight.

ATTENTION: Always store images in separate folders for each flight. SDM has advanced matching algorithms to match images but pointing to a folder containing images from multiple flights will in some cases yield faulty results. It is recommended to empty the cameras SD card after every flight – always keep track of your data.

INFO: It is possible to import images directly from the camera's SD card into SDM. Install the SD card in the device running SDM and select the folder containing images on the SD-card in the import procedure described above. The SD card must be connected until the images have been successfully exported to a new location.

7.2.5 Inspecting Flight Data

SDM lets you inspect the path and images from your flights. Always perform an inspection before exporting the results to verify that the data is as expected.

- Missing images
  Missing images are shown with red background. The most common reason for missing images is trigger events not firing on the camera due to a low photo interval (see Area Scan Segment). If many images are missing, it might be a sign that the selected flight log and images do not match each other.

- Image information
  Clicking on an image on the track opens the image details. The details include when the image was captured, the vehicle's position and a thumbnail of the image (if available).

- Matched images
  Matched images are shown with a grey background. Click on the image to open the image details and verify that the captured image is correct. The full image can be opened in Windows Photo app by clicking the image name in the details.

- Flight track
  The flight track is shown with a grey line. The track can be cropped using the cropping bar in the bottom of the post processor. Use the cropping bar for animating the vehicle's position at any time of the flight.

INFO: The SDM Post Processor can be used for inspecting all types of flight paths. It is not limited to flights with images.

7.2.6 Exporting Geotagged Images and Position Data

How to export geotagged image and position data:

Step 1 Ensure flight log and images have been successfully imported to the post processing project.

Step 2 Activate step 3 "process and Export" in the post processing workflow, by clicking on it.

Step 3 Click Apply Settings if the results have not already been calculated.

Step 4 Always Inspect the flight data and the image statistics before exporting the results.

Step 5 Select export folder.

Step 6 Select outputs. SDM provides optional geolocation files for the most common image stitching software. Select them using the checkboxes to include them in the export.

Step 7 Click 

8 System Overview

The System tab in the Menu Panel, makes it easy to get an overview of your system. Connected system components are displayed with relevant information and if any part of your equipment (SDM, UAV, Onboard Processor, Payload etc.) needs to be updated, it will be presented here.

8.1 Vehicle Options

Vehicle options can only be changed when the vehicle is on the ground. The Heidrun RQ-35 lets you encrypt the flight logs.

8.1.1 How to Enabled/Disable Log Encryption

To enable/disable Log encryption.

Step 1 Make sure the UAV is connected to SDM.

Step 2 Go to System from the Menu Panel.

Step 3 Click on "Options" on the UAV

Step 4 Enable/Disable the log encryption.

ATTENTION: All log information such as positions will not be available without decrypting the log. The log will not show any flight path in the SDM Processor. To decrypt, the log must be sent to Sky-Watch through the support customer channel.

8.2 Firmware Updates

Firmware update is handled by SDM in the System tab. SDM keeps track of your connected devices and reports if any updates are available. The procedure to update is the same for all Sky-Watch components (UAVs, Payloads, Onboard Processor etc.). To update firmware:

Step 1 Make sure the device you want to update is connected to SDM.

Step 2 Go to System from the Menu Panel.

Step 3 Select "Update" for the device you want to update.

Step 4 Follow the on-screen step by step guide.

INFO: SDM automatically notifies if updates are available.

INFO: UAVs must be connected via USB to run the firmware update.

8.2.1 How to Repair Firmware

If you suspect a device is holding corrupted firmware, SDM lets you Enable Firmware Recovery Options and repair by re-installing the firmware.

Step 1 Make sure the Firmware Recovery Options is enabled under Settings.

Step 2 Connect the device you want to repair.

Step 3 Go to System from the Menu Panel.

Step 4 Select "Repair" for the device you want to repair.

Step 5 Follow the on-screen step by step guide.

ATTENTION: Only repair if you experience problems with your system, which you suspect are caused by corrupted firmware!

8.2.2 How to Run UAV Firmware Recovery

If you cannot connect to the UAV from either radio or USB, and suspect that the firmware is corrupted, it is possible to run UAV firmware recovery.

Step 1 Make sure the Firmware Recovery Options is enabled under Settings.

Step 2 Make sure the UAV you want to recover is **NOT** powered on or connected to the PC.

Step 3 Go to System from the Menu Panel.

Step 4 Select Recovery Update for the device you want to recover.

Step 5 Follow the on-screen step by step guide.

ATTENTION: Only run UAV firmware recovery if you experience problems, which you suspect are caused by corrupted firmware and you cannot get access to the UAV flight controller in any other way. Always explore any possible reasons for the UAV not to connect (e.g. that UAV battery is not fully charged or the Connection link is disabled) before running the UAV firmware recovery.

8.3 Radio configuration and information

Advanced radio systems like the Silvus StreamCaster will be displayed in the system overview along with its status.

INFO: Not all Sky-Watch UAVs come with configurable radios. Only radios with configurable options are presented in the system overview.

8.3.1 How to Open Radio Options

To open the radio options page:

Step 1 Make sure your radio is turned on and connected to SDM.

Step 2 Go to System from the Menu Panel.

Step 3 Open the radio options by clicking the Options button on the radio device.

The radio options can also be accessed directly from the "Fly" screen in SDM.

Step 1 Open Toggleable Link Statuses by clicking the -icon in the top bar.

Step 2 Open Radio Options.

8.3.2 Radio Options

From the radio options page you have several options:

- Frequency
  Select between different frequency presents or enter custom frequencies.
- Power
  Change Transmit Power between fixed Tx power values or automatic power changes. By default, Sky-Watch UAVs automatically changes the Tx power, to reduce both battery consumption and the radio signature when the radio link is in good condition.
- Power Limiter
  SDM reduces the max Tx power until the UAV has been connected. This safety feature can be disabled if the UAV is unreachable due to a noisy environment.

- Antennas
  The antennas on the radio can be turned on/off individually. This feature is useful to change the antennas without losing connection to the UAV. Always disable the Antennas in SDM or turn of the radio, before unscrewing antennas from the radio.

- Security
  See and renew encryptions keys.

- Pairing
  If the UAV and local radio is unable to communicate it is possible to pair the UAV with the radio currently attached to SDM.

ATTENTION: Always make sure to apply a new radio configuration to both the local and the remote/UAV radios. Only apply configurations locally, if you suspect that the remote/UAV radio is unreachable due to a mismatch in the selected radio presets.

9 General

9.1 Compass Calibration

It is important that the UAV always has a calibrated compass to ensure the safety of the UAV and the precision of the payload data. SDM will notify you when it is time for a compass calibration. The compass calibration guide can be opened directly from the compass warning and will guide you through the calibration process – simply follow the on-screen instructions.

The calibration guide can also be accessed under "maintenance" in the Vehicle Options.

ATTENTION: Always run the compass calibration if the equipment has been close to large metal objects, magnets, scanners, or similar objects. Always calibrate the system if it has been transported by aeroplane and if it has not been calibrated for 6 months.

9.2 Application settings

SDM holds some general settings that will apply to all parts of the SDM.

9.2.1 Audio Warnings

Enable/Disable audio warmings. Disabling the audio will turn of all sounds coming from SDM.

ATTENTION: It is always recommended to have the audio warnings enabled to ensure pilots are notified if any critical warning is displayed by the system.

9.2.2 Vehicle Scan

SDM continuously scans USB/COM ports. This may prevent some third-party devices from functioning properly, hence it is possible to disable Vehicle scan in SD.M If Vehicle Scan is disabled SDM will not be able to connect with the UAV.

ATTENTION: The vehicle link must be open to connect to your vehicle. Do not disable the vehicle scanner unless you know what you are doing. Disabling the vehicle scan while the vehicle is in the air will disconnect the vehicle from SDM.

9.2.3 SDM Update Checks

SDM automatically checks for updates on startup. The update check can be disabled from the general settings.

9.2.4 Enable Firmware Recovery Options

When Firmware Recovery Options are enabled, you will be able to run firmware repair and recovery. To enable firmware recovery options:

Step 1 Go to Settings ⚙ from the Menu Panel

Step 2 Enable Firmware Recovery Options under Settings.

> ATTENTION: Firmware Recovery Options are by default disabled, and should only be enabled, if you experience problems with your system, which you suspect are caused by corrupted firmware.

9.2.5 How to Change Coordinate Format

To select your preferred coordinate format to use throughout SDM:

Step 1 Go to Settings ⚙ from the Menu Panel

Step 2 Select coordinate format under Settings.

9.2.6 Time Zone Selection

The SDM lets you specify the local time zone.

Step 3 Go to Settings ⚙ from the Menu Panel

Step 4 Select Time Zone under Settings.

> INFO: The Time Zone will be used to show various time specific information according to your local time zone.

9.3 Application Information

Application information is accessed in Settings ⚙ from the Menu Panel. The information includes:

- About
  Information about the SDM application including version number and copyright notice.

- Acknowledgments
  References to 3rd party libraries used in the SDM.

- Disclaimer
  Re-opens the SDM disclaimer.

- EULA
  Opens the End User License Agreement

- SDM Manual
  Opens this manual

- Unmanned Flight Manual
  Opens the unmanned flight manual

- Download Sky-Watch Camera Controller
  Access to download the installer for the Sky-Watch Camera Controller (SCC)

9.3.1 How to Find the SDM Version Number

The SDM version number is visible in the General SDM settings. The full SDM build number and application information can be found in the about section under settings:

Step 1 Go to Settings ⚙ from the Menu Panel.

Step 2 Open "About" under Application Information.

Step 3 The Version and build number will be visible in the dialog.

INFO: Always include version number and the software build number when contacting the Sky-Watch Customer Support Team.

9.4 Contact

If you experience any problems or bugs using the SDM, please contact Sky-Watch trough the customer support portal, found at support.sky-watch.com.

Make sure to send all relevant information including a good description of the issue, all relevant log files, screenshots etc.

The SDM Log Exporter is a tool to help you gather log files located on your PC. Open the Log Exporter and enter start and end date to collect and export log files. Make sure you

have downloaded logs from the UAV prior to collecting logs for incident reporting. For more information see How to Collect and Export Logs for Incident reports.

INFO: Access to the portal requires username and password. If you can't remember your login credentials, please contact support@sky-watch.com

9.5 Recommended Minimum System Requirements

Follow the recommended minimum system requirements below, to run SDM successfully.

System Requirements	
Operating system	Windows 11
CPU	i5 core at 2.3 GHz
Memory	4 GB RAM
Free space	8 GB of free space
Graphics hardware	DirectX 10-compatible GPU – 256 MB of memory minimum