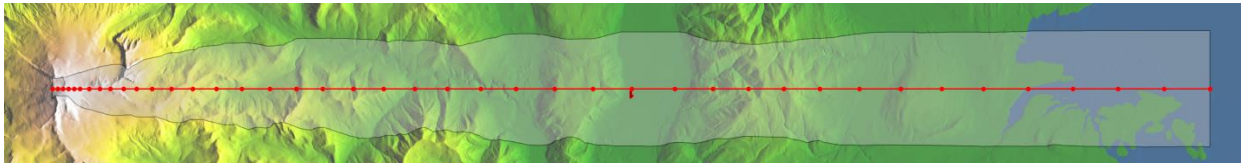


A step by step introduction to TopoFlight



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1 Introduction

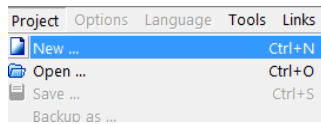
This document is intended to test the software for basic functionality.

2 Creating the area of interest with GoogleEarth



- Open GoogleEarth and create a polygon of the area you want to make a flight plan
- Save the file in KML format

3 Create the TopoFlight project

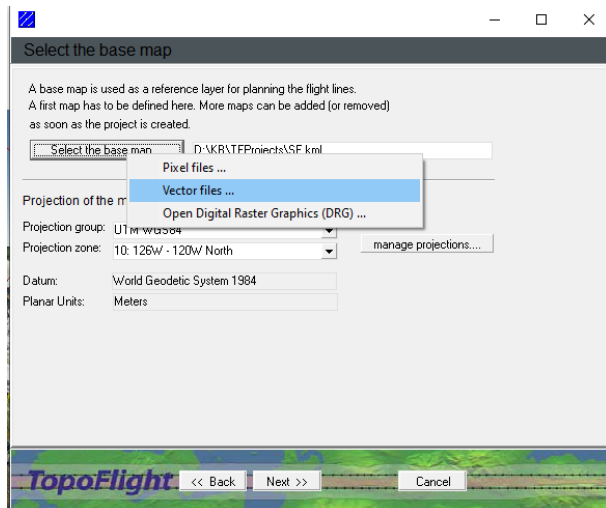


- Start TopoFlight
- Open the project wizard with Project/New...

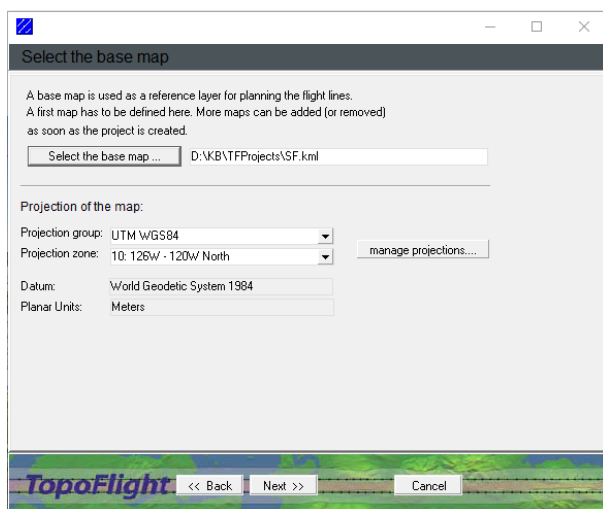


- Select the folder where the new project will be stored.

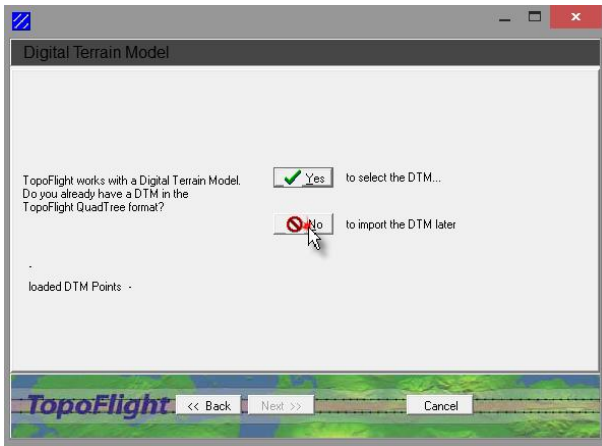
All project files will be stored within this folder. These are the shape files for the lines, image centers, etc. and all other profiles which belong to the project.



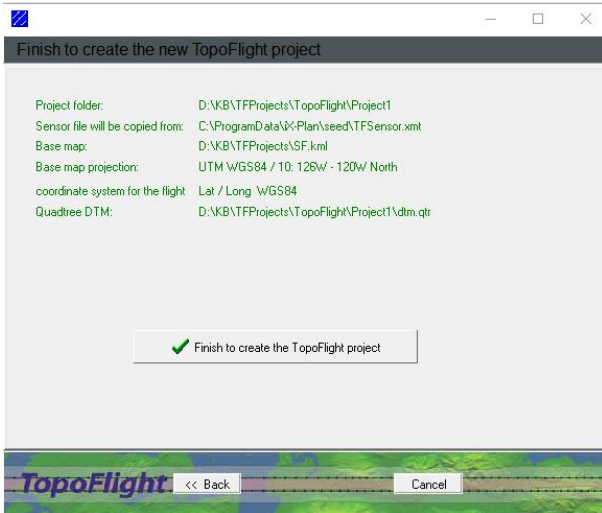
- Select the base map.
The base map is needed by TopoFlight to localize the region where the flight plan will be constructed. Additional maps like scanned topographical maps and vector data can be added later within TopoFlight as additional map layers.
- In this example the kml file created in GoogleEarth has been selected.



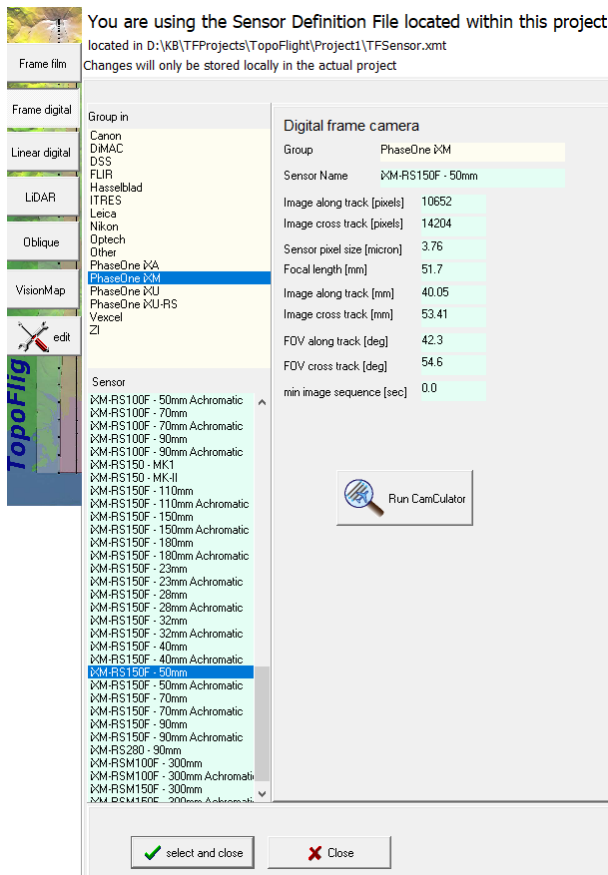
After the selection of the base map TopoFlight proposes the correct UTM zone.
If you want to flight plan in another zone then select the adequate projection group and projection zone.



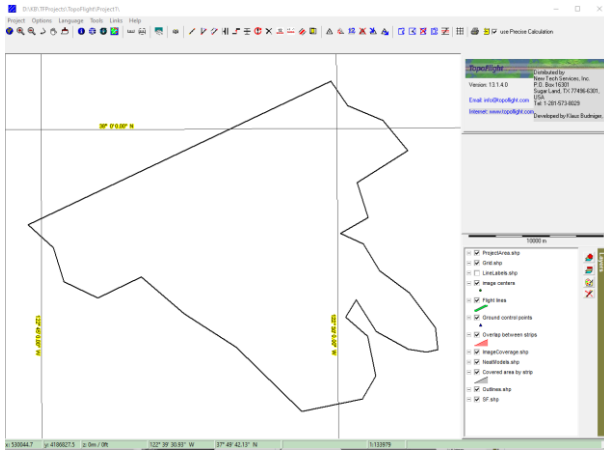
In this example we assume that we do not have yet a suitable DTM for the flight plan. We will import the DTM after we have created the project. So at this point select "NO" to indicate that the DTM will be imported at a later stage.



All the project parameters are defined. So click on the "finish" button.



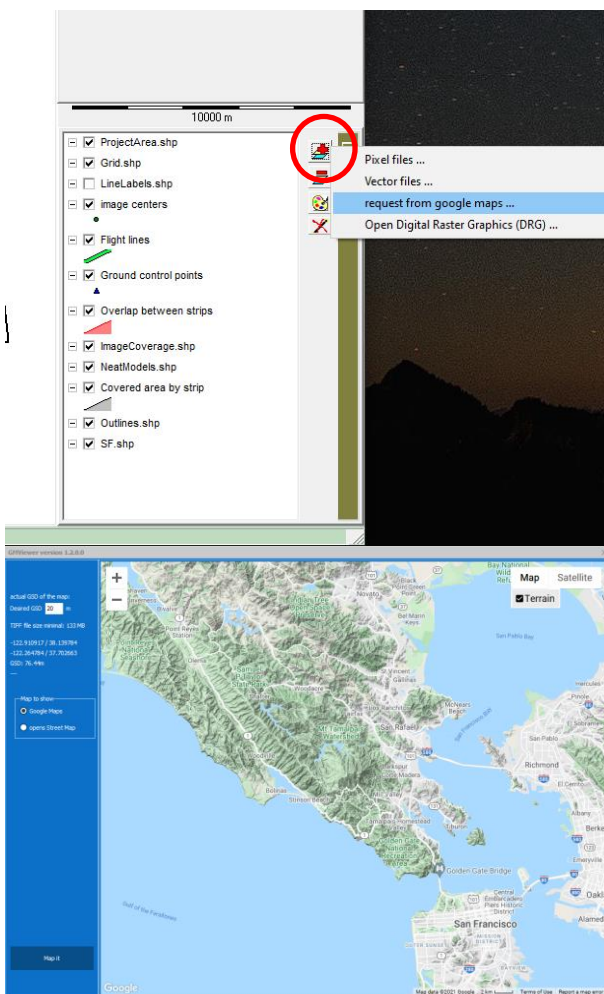
Select the camera to be used



Now the project is created.

The next step is to download a map

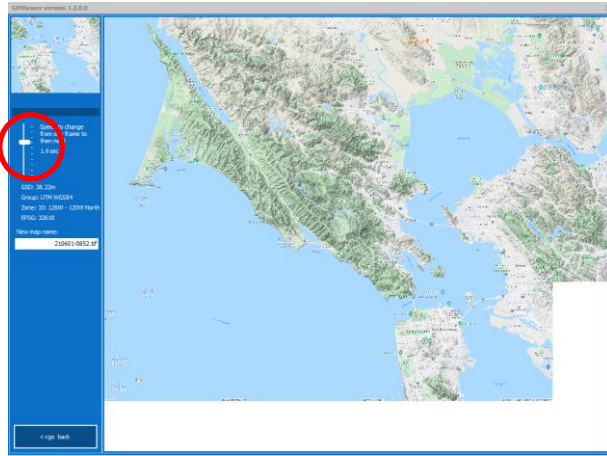
4 Download Google Map



Click on the add layer button and select "request from Google Maps"

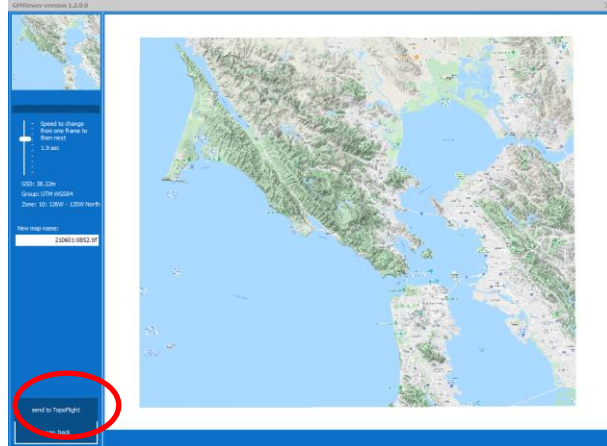
The dialog opens. The visible extent is the one which is visible by the current extent of the TopoFlight's map window.

- Select the GSD the map will be collected (default is 20m).
- Click on button "map it" so collection of the map can start

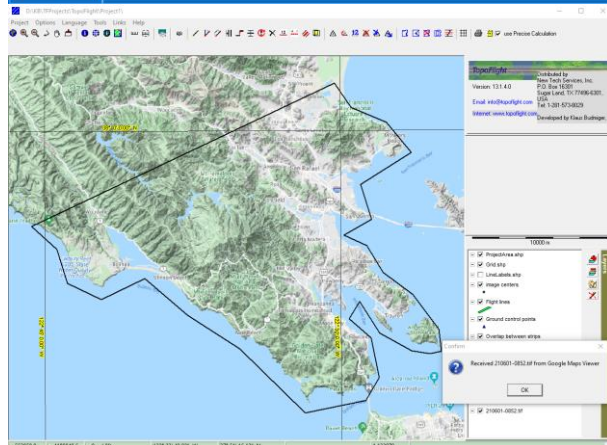


- Adjust the speed with which the program jumps from one image tile to the next.
- The speed depends of the speed of the internet connection. If it is too high then gaps will appear in the map.

After finishing collection the final map is displayed. Click on button "send to TopoFlight" to send the map to TopoFlight.

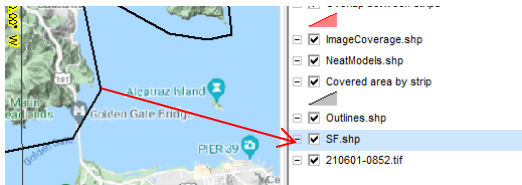


TopoFlight has received the map.

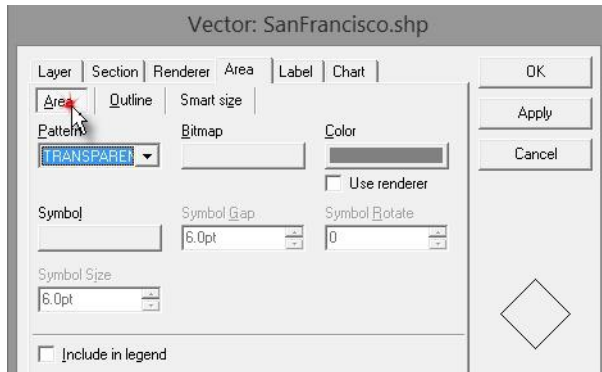


5 Changing the graphic representation of the outline polygon

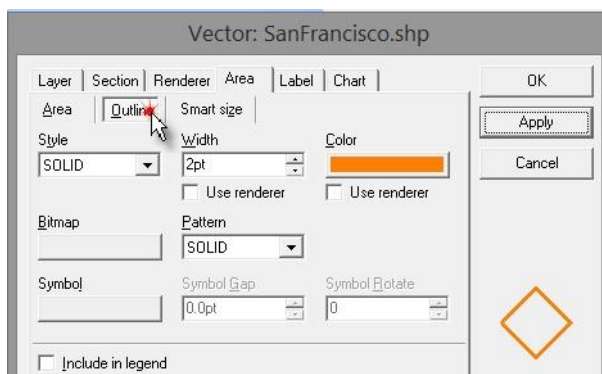
This chapter shows you how you can change the graphic appearance of the outline polygon or any other graphic element.



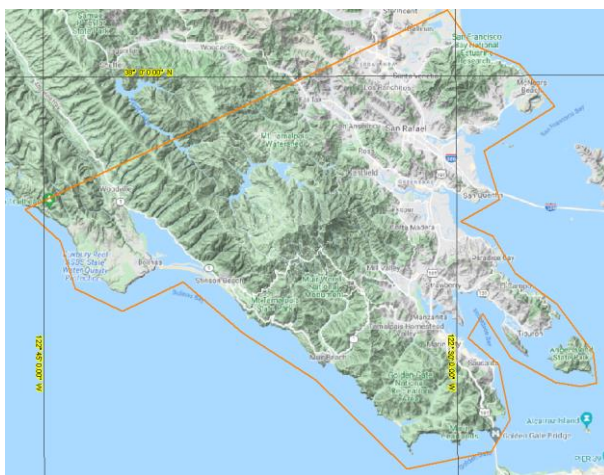
Double click on the layer you want to change the graphic attribute



- Select the "area" tab
- Set pattern to transparent
- Click apply to see the result in the map



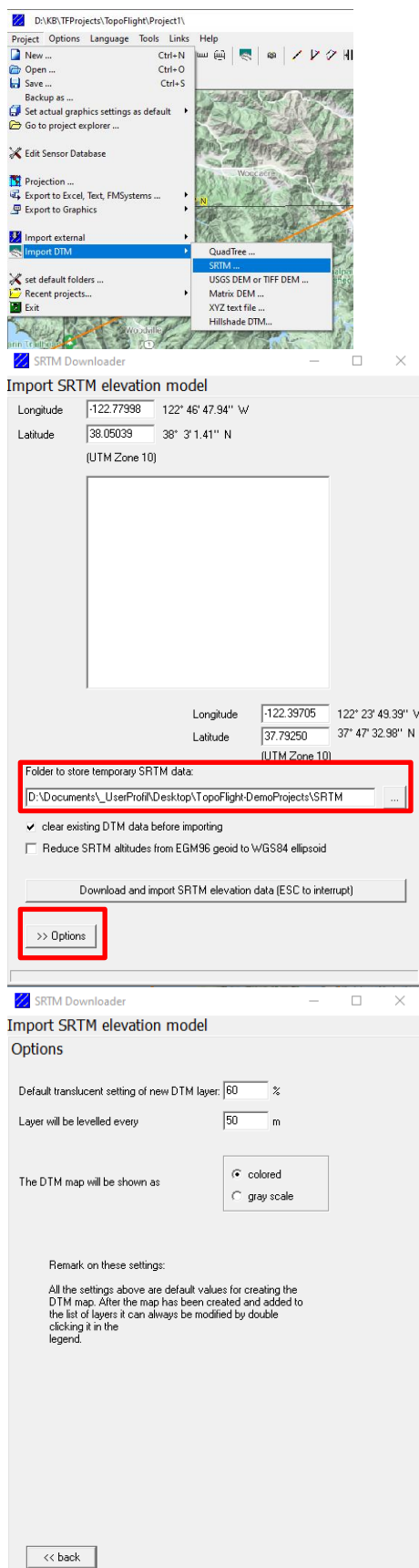
- Click on the "outline" tab
- Change the color to orange
- Change the line width to 2.0 points
- Click apply button to check the result
- Click on OK to quit the dialog



This is how the polygon looks after the changes.

6 Downloading a DTM

If a digital terrain model exists one can import it into TopoFlight with several methods. TopoFlight has built in the download of SRTM data which can be used in most cases.



- Zoom the map window to the extent for which you want to import the DTM

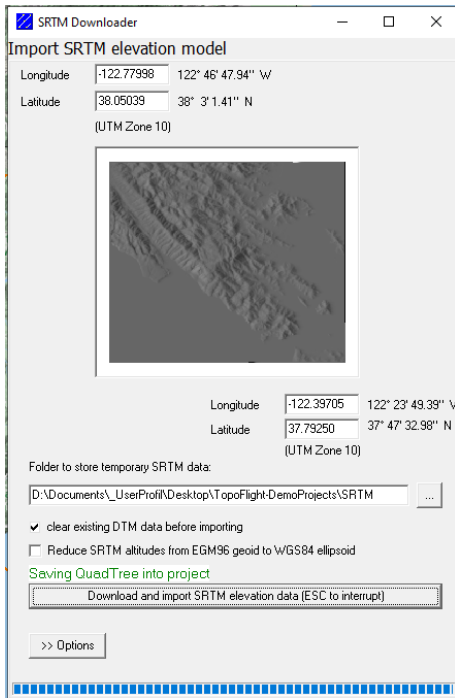
- Select the "Import DTM / SRTM" wizard

- The coordinates of the upper left and lower right corner of the actual visible map window is displayed. This is the extent TopoFlight intends to import the DTM.

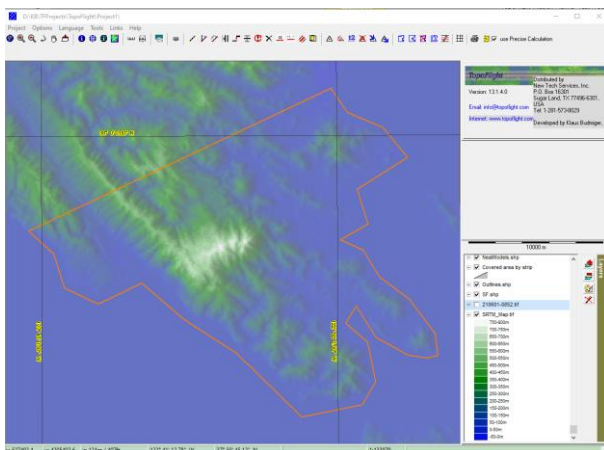
- Select the folder where temporary SRTM tiles will be stored.

- Select options if needed.

- The options set some default behavior on how to display the map of the DTM.



- Click the download button to start DTM import.
- In a first step the DTM tiles will be downloaded into the selected folder.
- After the download the single DTM files will be mosaicked to a 32 bit TIFF file.
- The 32 bit DTM TIFF file will be shown in the dialog as soon as ready.
- As the last step the DTM is converted to a TopoFlight - QuadTree database for high speed spatial access. The quadTree file will be stored within the project with the name "dtm.qtr".



- The project has now a new layer added: the DTM as TIFF32bit.
- In the project folder the DTM is stored as a quadtree file used by TopoFlight for high speed spatial access.

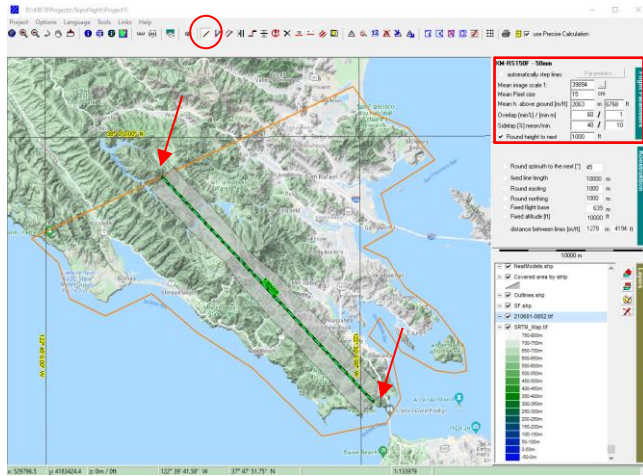


The coordinates of the current mouse position is displayed at the bottom of the map window. The terrain altitude is now displayed.

7 The first flight plan

7.1 Drawing a flight line

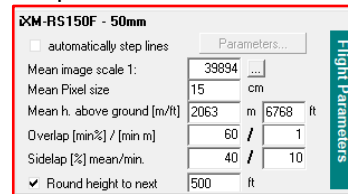
With the construct line tool single lines can be drawn by clicking once on the start of the line and a second click on the end of the line. The line will be calculated depending on the parameters set (like GSD, overlap, etc.).



- on the top menu bar click the “construct line” button



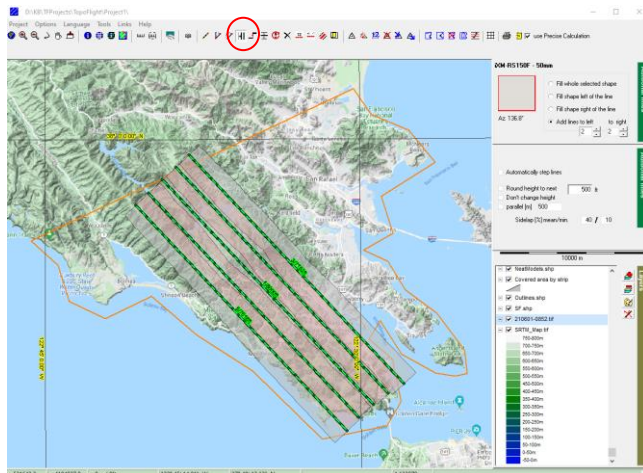
- In options set GSD value and overlap:



- Make *one click* at the start of the line
 - Make *a second click* at the end of the line

7.2 Adding parallel lines

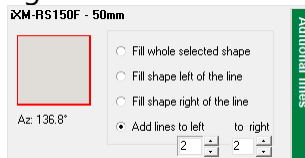
With the „add parallel lines” tool multiple lines can be added left and right of a selected line.



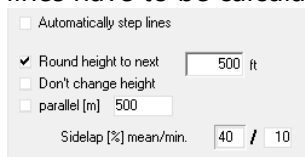
- On the top menu bar click the “add lines” button



- In details set the number of parallel lines to the left and right

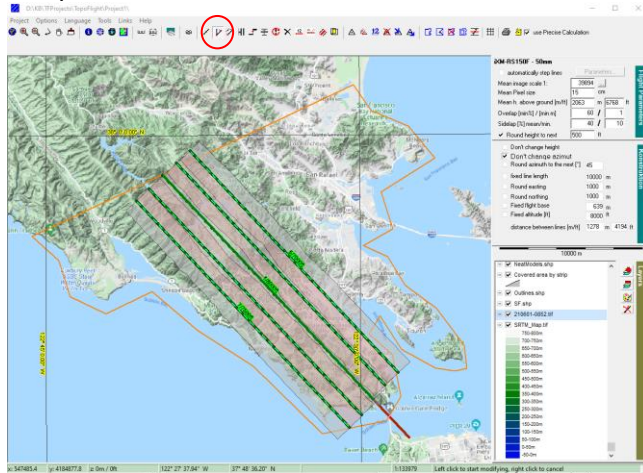


- Click on the line to which the parallel lines have to be calculated



7.3 Modify flight lines

Single lines can be modified by using the „modify line“ tool. Click once the line at one side of either sides of the line and position the line to the new position. Click again at the new end position. Then the corrected line will be calculated according to the parameters set in the detail fields.



DGM-RS150F - 50mm

automatically step lines

Mean image scale 1:

Mean Pixel size: cm

Mean h. above ground [m/Rt]: m / Rt

Overlap [min%] / [min m]: /

Sidelap [%] near/min: /

Round height to next: ft

Don't change height

Don't change azimuth

Round azimuth to the next [°]:

fixed line length: m

Round easting: m

Round northing: m

Fixed flight base: m

Fixed altitude [ft]: ft

distance between lines [m/Rt]: m / ft

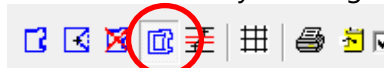
7.4 Deleting a single flight line



Click the “delete flight line” button and select the line which you want to delete.

7.5 Filling an area with flight lines

In this example the area of interest is selected to be filled automatically with flight lines.



- Klick the “select shape” button

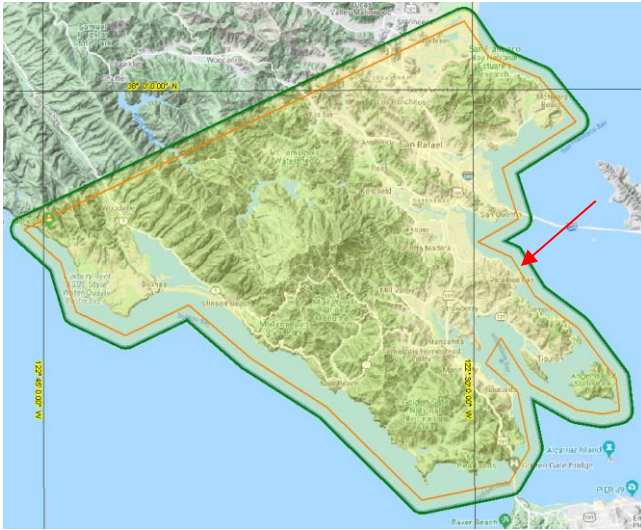
Select a shape as active area to construct lines
Select a closed shape to set it as the active area. Each new flight line will be stretched / cutted to the area

Buffer a shape (for visualisation only)
Select a shape to buffer. It has no effect on constructing flight lines. It is just a help for custom visualisations.

overshoot border by a number of images:

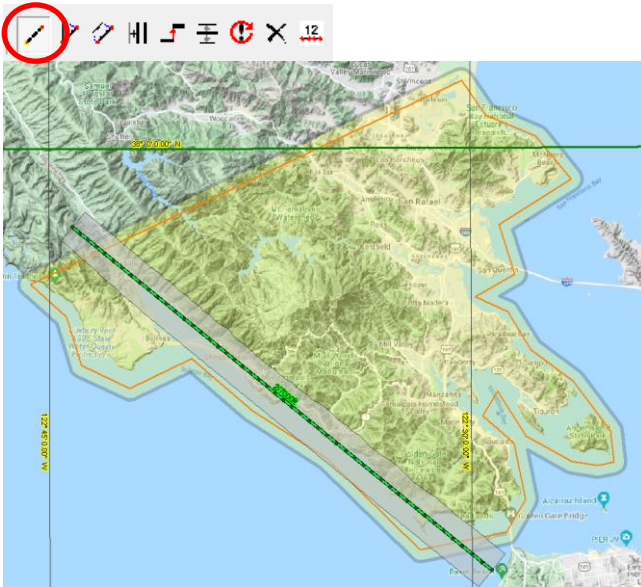
Extend [buffer] selected shape [m]:

The selected shape will be buffered by 600 meters and each line will be extended by 2 images.



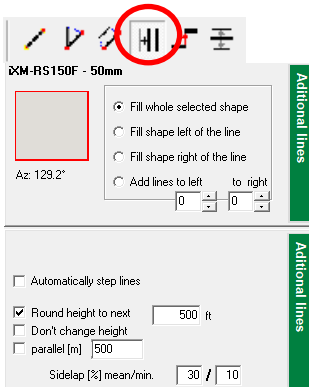
Select the shape

- Click on the polygon you want to select as active area
- As soon as you clicked the polygon it will be marked as a yellow colored area
- A buffer of 600 meters is applied



Draw the first line

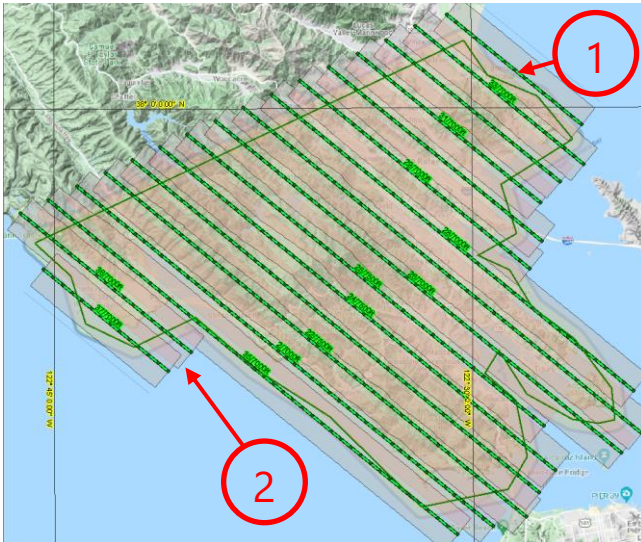
The first line is the reference line which helps to calculate the adjacent lines. The first line defines the overall direction of the lines. It is often in the direction of a highway a mountain ridge, etc. In this example the first line is drawn along the coast main direction. The line is automatically stretched to the border of the selected area (buffer) and is extended by the amount of images set in the dialog.



Fill the whole selected area with flight lines.

In this example:

- The whole area will be filled with lines
- The altitudes will be rounded to the next 500ft
- The overlap lateral will be 30% as a mean and won't drop below 10%

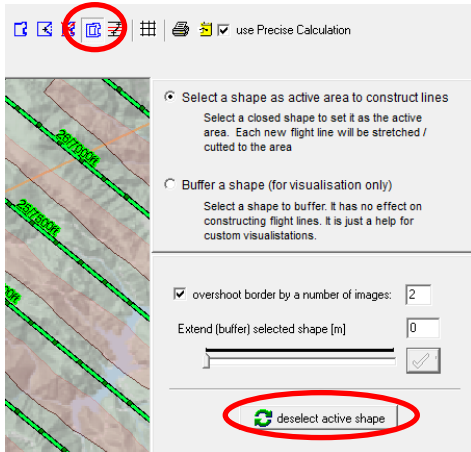


Based on the defined parameters the flight lines are now being calculated.

As a next step some flight lines will be edited

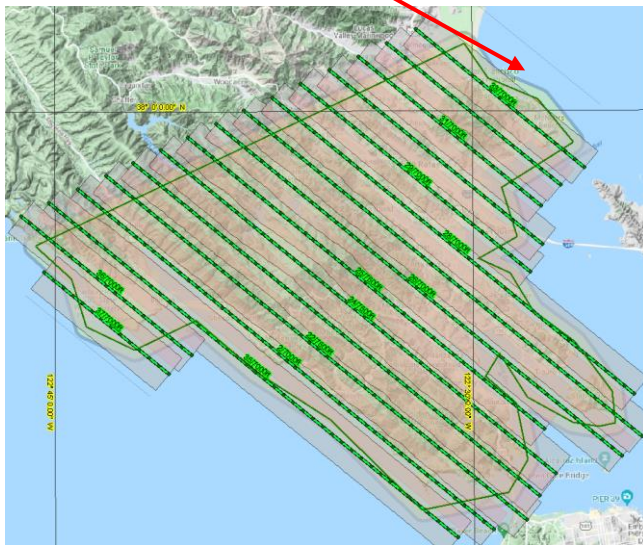
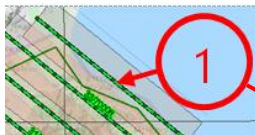
- 1 Delete one line
- 2 Shorten two flight lines

7.6 Modifying the flight plan



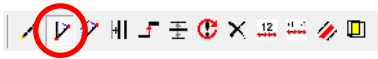
Unselect the active area

First of all deselect the active shape in order to prevent that the line will be extended each time you make a modification



Delete a line

- Select the delete line button
- Click the line to be deleted



XM-RS150F - 50mm

automatically step lines Parameters...

Mean image scale 1: 39894 ...

Mean Pixel size 15 cm

Mean h. above ground [m/ft] 2063 m 6768 ft

Overlap [min%] / [min m] 60 / 1

Sidelap [%] mean/min. 30 / 10

Round height to next 500 ft

Don't change height

Don't change azimuth

Round azimuth to the next [°] 45

fixed line length 10000 m

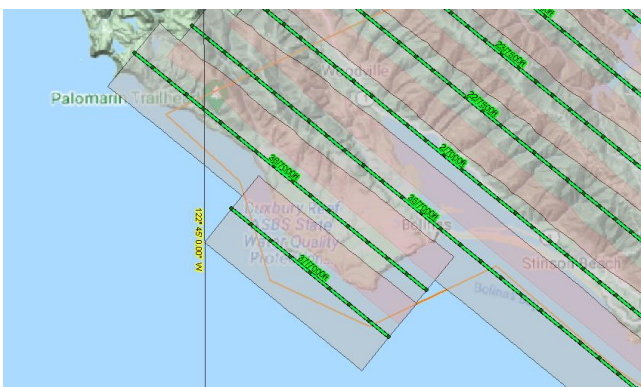
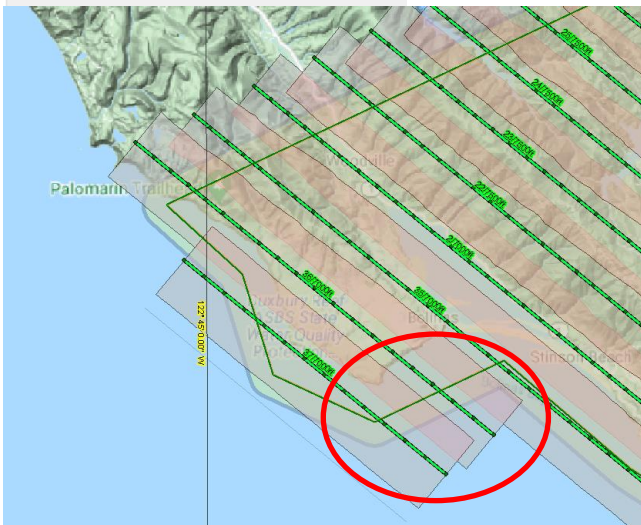
Round easting 1000 m

Round northing 1000 m

Fixed flight base 639 m

Fixed altitude [ft] 7000 ft

distance between lines [m/ft] 1278 m 4194 ft



Shorten or extend flight lines

by shortening the two flight lines:

- Select the option "don't change height" if you want to make sure that the altitude is not changing due to a shorter line (different portion of DTM)
- Select the option "don't change azimuth" if you want the line to be extended or shortened in the same direction
- Make the first click at the end of the flight line
- Make the second click at the location the flight line has to end

7.7 Renumbering the flight plan

Each flight line needs to have an own flight line number.



Next line: 2 1

reduced layers
restore layers

TEXT 1
 TEXT 2
 TEXT 3

Manually
 semi automatically, starting at: 1
 automatically, starting at: 1

Enumeration

Tag the line CENTER with a name:

Right click the tag field and select the value to set or enter a text right into a field

Line / Alt [ft] ft

Add line ID and image ID to ImageCenters.shp
Line and image separator _

tag all lines now

Enumeration

- 1 If you click on reduced layer button all layers except the flight lines are switched off. This helps to make the flight line annotation easier.
- 2 The number of the next line
- 3 Text1 – text3 can optionally be stored to each of the flight lines. It can be any text (like area name or others). The text will be stored in the line's field text1, text2, text3.
- 4 Manually click on each line to set its line number to the value shown in 2. Each time the line is clicked the line number is increased and ready for the next click.

Semi automatically

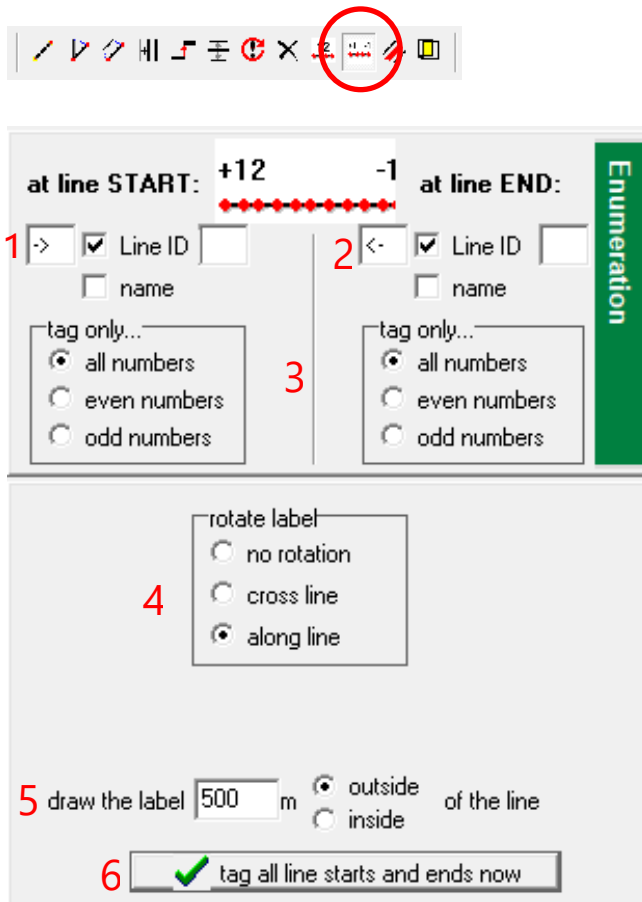
If you click semi automatically then you can draw a line crossing from the first to the last line you want to renumber. This is the most effective way of renumbering a whole flight plan in the order you want.

Automatically

Clicking on automatically will renumber all flight lines starting at the number you defined in 2.

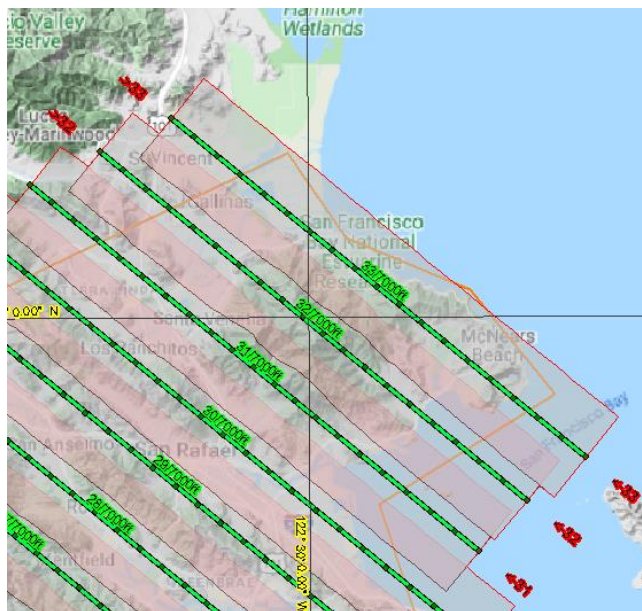
7.8 Annotate start and end of flight lines

There is a special layer called "LineLabels.shp"

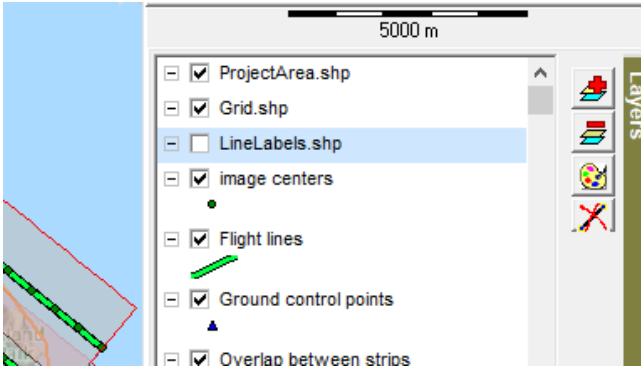


- Select the button to tag lines at start and end point

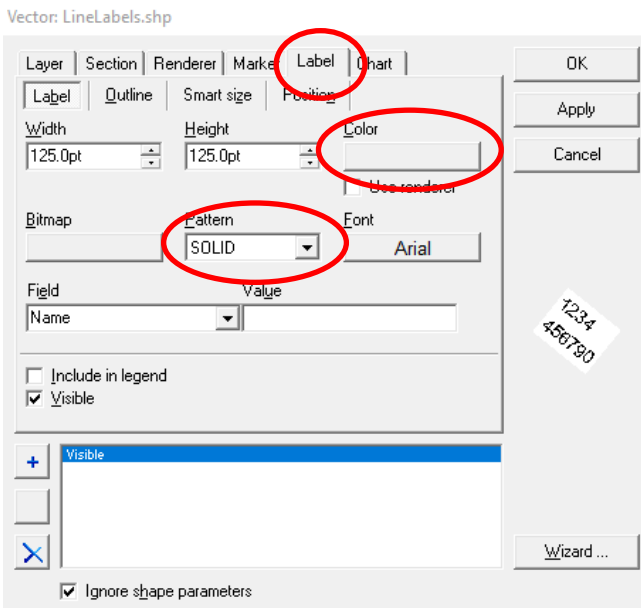
- 1 - Set a prefix which will be added at every start of the line
- 2 - Set a suffix which will be added at every end of the line
- 3 - Set the options to show all or only a part of the labels
- 4 - Set the label rotation
- 5 - Set the distance the label will have from the start or end-point
- 6 - Click the button to tag all lines



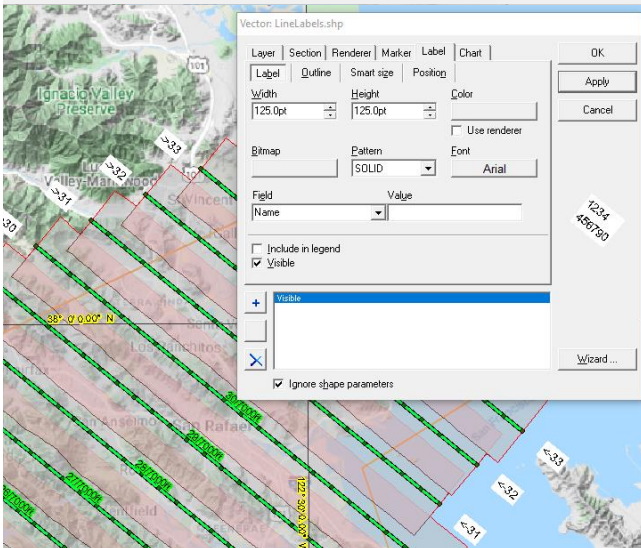
As a result the lines are now tagged at their start and end points



To change graphic representation of the labels double click the layer Line-Labels.shp

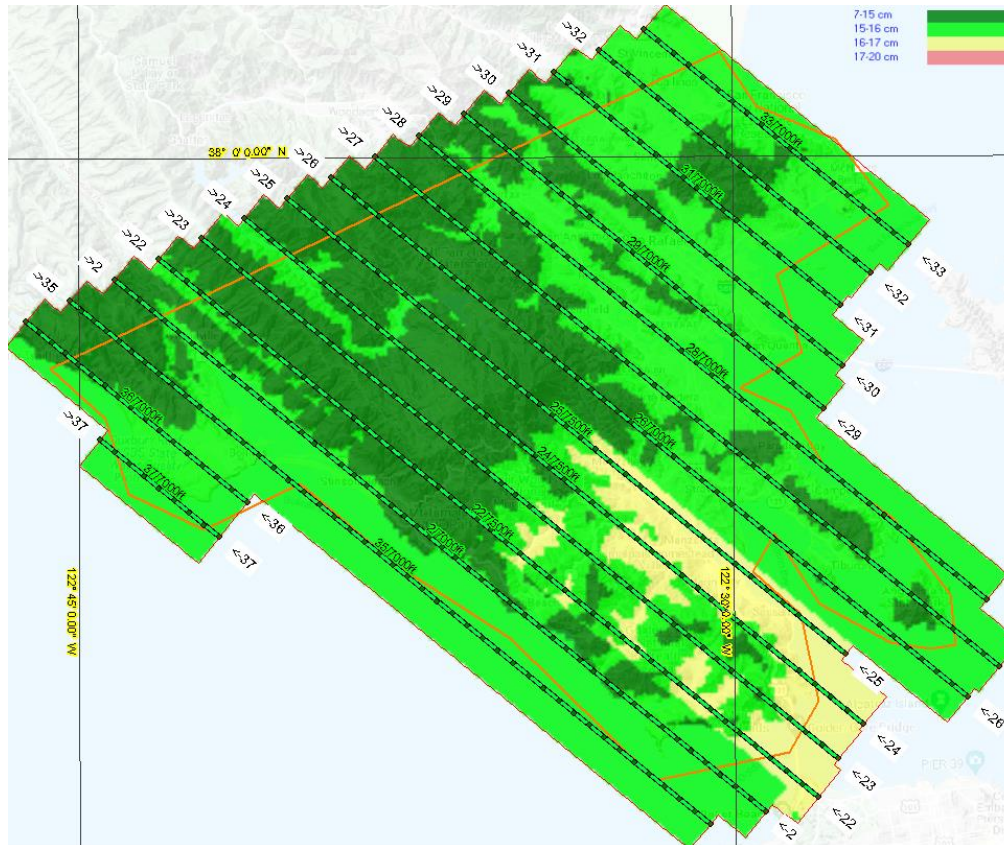


- Click on tab "Label"
- Select color "white"
- Select pattern "solid"
- Click button "apply"



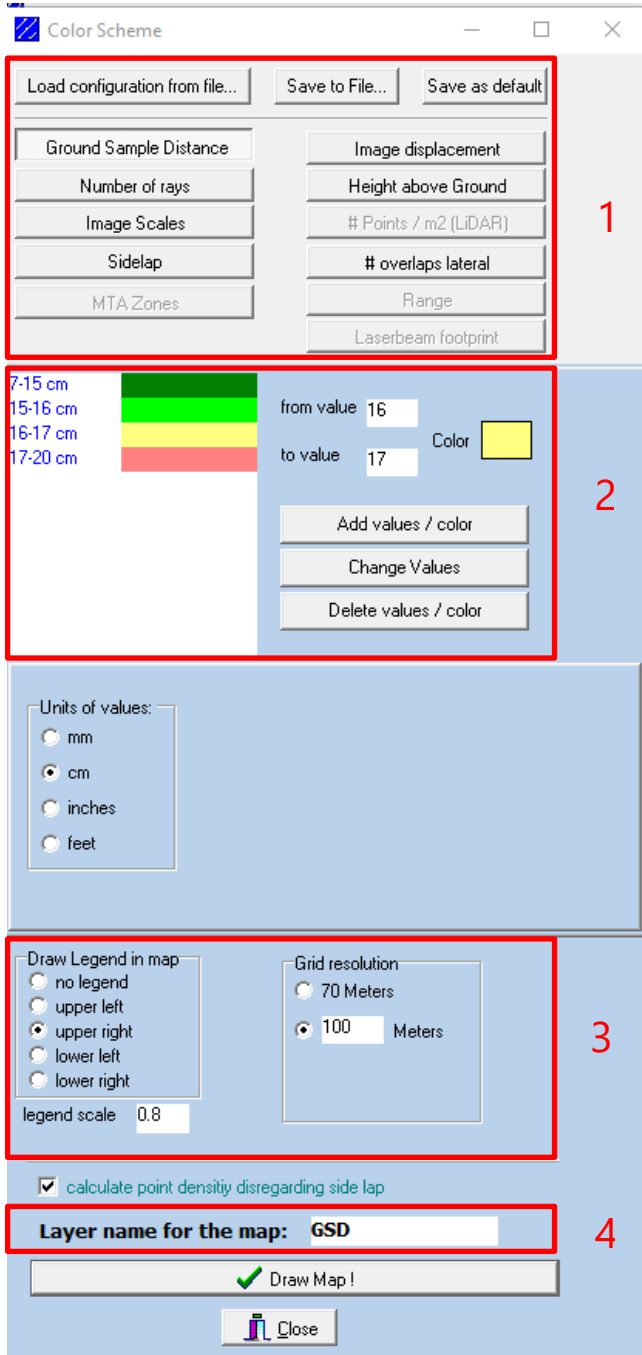
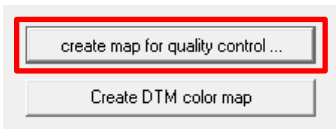
- After having clicked apply the changed annotation is shown.
- Click OK to accept the result.

8 Quality control of the flight plan



The most common proof that a flight plan (or the flown images) fulfills the project specifications is to create a

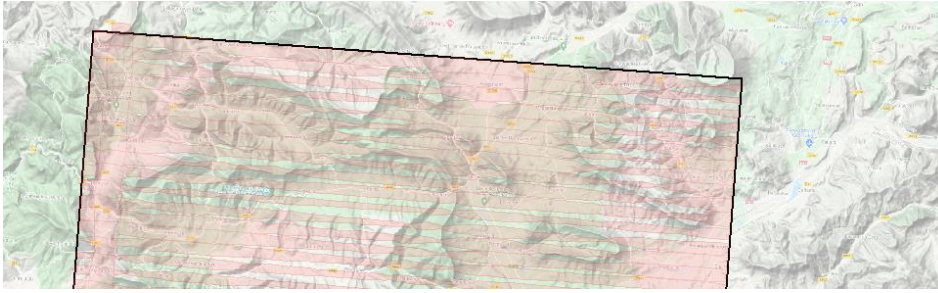
- Quality Control Map: shows the GSD value in an aerial image at each position.
- Number of Rays: shows for each position in how many images the point will be seen.
- Image Scales: shows the image scale in an aerial image at each position .
- Sidelap: Shows for all points along the outer boundary of the covered area of a flight line the lateral overlap in %.
- MTA zones: shows the transition zones between the different MTA zones for Riegl scanners.
- Image displacement: Used to study the "building lean" in an aerial image. At each position the "building lean" is being shown for a give object height. For instance if the building is 10 meters high, the color shows how many meters building lean will reside in the orthophoto.
- Height above Ground: shows for each point the vertical distance between the terrain and the airplane.
- #Point / m² (LIDAR): shows for each position how many points/m² will be reached in LIDAR measurements (calculation for OPTECH scanners, Riegl follow). The calculation of course does not take into account the different type of vegetation, construction, water, etc.)
- Range (LiDAR): shows the distance from the laser source to the point on the ground. This visualization is used to study eye safety and to check if laser distance is not out of range.
- Laserbeam footprint (LiDAR): shows the footprint of the laser beam on the ground. This is used to verify accuracy and resolution.



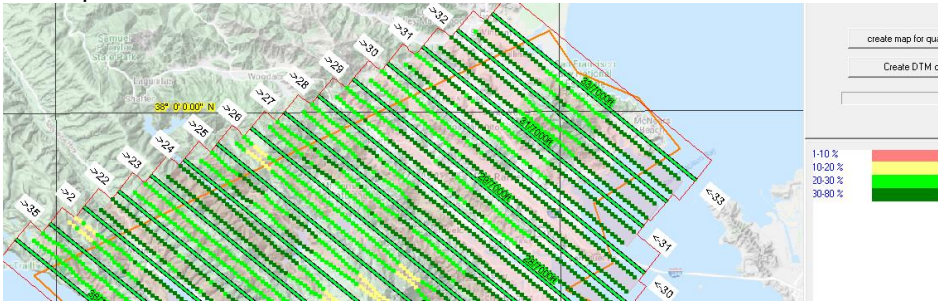
Click the buttons to create a quality control map an

- 1 - Color schemes can be stored and loaded to be used in other projects with the same parameters.
- The type of the map to be created can be selected here.
- 2 - Add new or modify existing ranges with their corresponding colors.
- 3 - Define if a legend has to be shown in one of the selectable corners
- The map will be created over the recent visible extent of the map. The output will be a georeferenced TIFF file. The default grid resolution is the size of one pixel of the screen projected to the ground. Higher values increase the speed of calculation.
- 4 - Set the name of the new map layer

Some examples:
Areas of side lap:



Sidelap in %:



Ground sample distance:

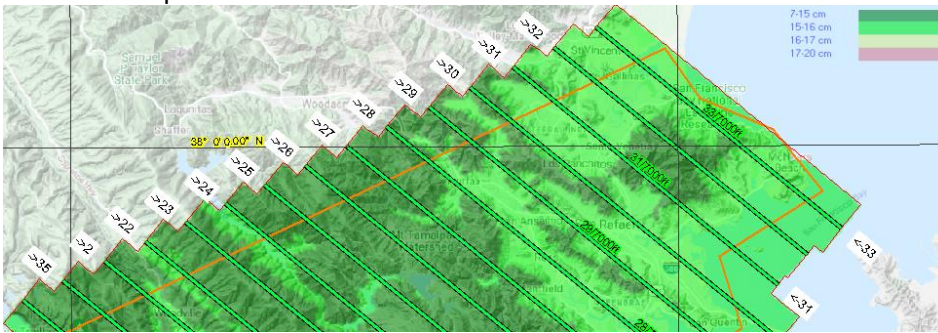
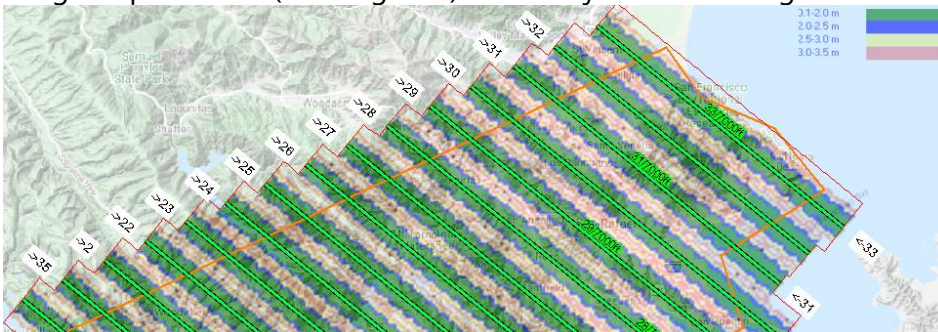
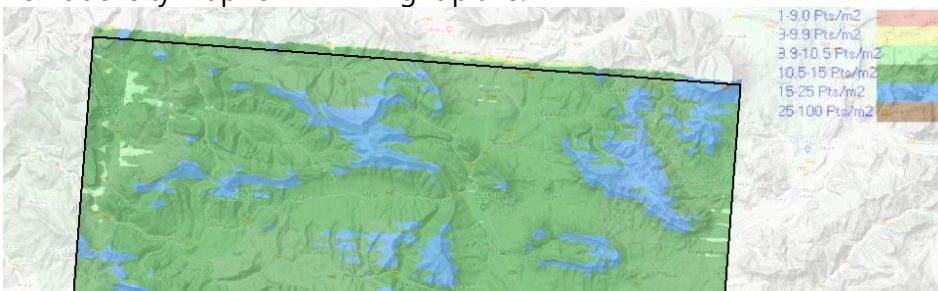


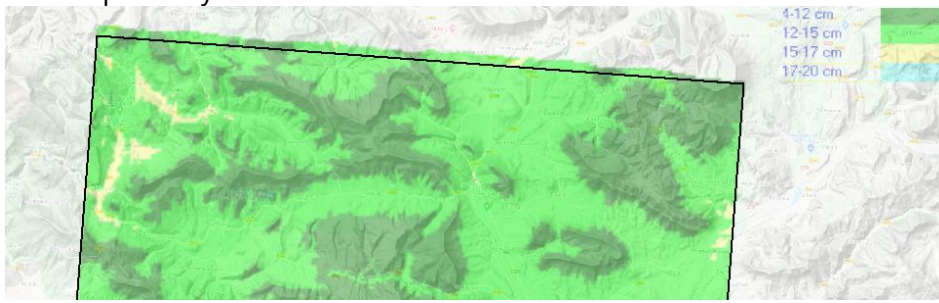
Image displacement (building lean) for an object of 10m height:



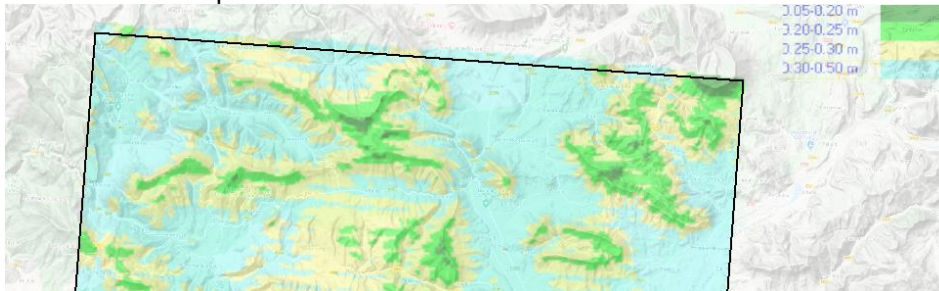
Point density map for LiDAR flight plans:



GSD in photo system combined with LiDAR:



Laser beam footprint:



Range for LiDAR

