

## Product Description Leica MissionPro, Version 11

**The new Leica MissionPro delivers state of the art 3D mission planning from your office to the world**

Leica MissionPro expands on what is best in airborne mission planning from both Z/I Mission and Leica FPES. Leica MissionPro is taking mission planning to another dimension. Additionally the new 3D virtual globe view makes planning easier and faster.

Leica MissionPro makes survey flight projects easier to manage:

- Optimized flight planning is the key to cost effective airborne image acquisition
- Flight evaluation enables good quality control at an early stage of the workflow
- Project management considerably increases mission productivity and cuts overall cost

Leica MissionPro covers all tasks in this step of the geospatial image chain. Leica MissionPro fits perfectly into Z/I Imaging and Leica Geosystems seamless workflow. The plethora of new features and supported sensor systems as well as a highly sophisticated interface make Leica MissionPro the logical choice for mission planning with Leica Geosystems and Z/I Imaging sensors and any other sensor systems as well.

This product description gives an overview of the most important features.

### Features of Leica MissionPro

#### Workflow

- Fully integrated into existing Z/I Imaging and Leica Geosystems workflows
- Seamless data flow from flight planning to photogrammetry, creation of ISPM project file
- Flight plan output for flight execution with Leica FCMS, Z/I Inflight and Leica ASCOT
- Flexible data export for further use of all flight data also for flight execution with 3<sup>rd</sup> party FMS
- Output of calculated and summarized data for flight preparation.
- Flexible data import and data export in different formats like \*.txt, \*.xls., \*.shp, \*.dgn, \*.kml

#### Project management

- Powerful reporting options of all planned and flown information for monitoring, accounting and further use in corporate workflows
- Output of calculated and summarized data for proposals and invoicing
- Flight plan database (SQL) enabling easy and efficient data handling of large projects
- Checking of progress in project
- Automatic generation of updated flight plans

## Flight planning

- Efficient flight planning for all types of sensors including Leica ADS40, ADS80, Leica ALS50-II, Leica ALS60, Leica ALS70, Z/I DMC, Z/I DMC II, Z/I RMK-D, Leica RCD30, Leica RCD105, Leica RC30, Leica RC20, Z/I RMK TOP and any other film or digital frame, line or ON/OFF sensors
- Flight planning for multi-sensor systems
- Flight planning using all common geographic and grid projections and datums
- Sophisticated computation algorithms using local DTM and global (SRTM and ASTER) DTM data automatically
- Interactive graphical flight planning using digital raster and vector maps
- Background maps from Web Map Service (WMS)-compliant map service providers
- Interactive flight planning using coordinates or GIS format files
- Parallel flight lines computed automatically to ensure stereoscopic coverage of areas of any shape
- Corridor mapping feature that either splits a polyline automatically for coverage with a minimum number of straight flight lines or generates a winding flight line for helicopter flights.
- Comfortable editing and modification of flight plans
- Easy optimization of flight plans by comparison of various area coverage possibilities
- User definable free line labeling (numbering) and definition of flight line sequence
- Output of calculated and summarized data for cost estimation, flight preparation and proposals

## Flight Evaluation

- Graphical presentation of the flight joined with the planning
- Evaluation of multiple flights
- Display of thumbnails taken with Z/I DMC, Z/I DMC II, Leica RCD30 and other frame cameras
- Perfect data flow to further processing steps
- DTM taken into account to check area coverage of flown data
- Output of calculated and summarized data for easy flight reporting and invoicing

## General

- Import of existing Z/I Mission and ASCOT mission plans
- Import of 3<sup>rd</sup> party mission plans in TXT format.
- Powerful utilities
  - Sun angle tool
  - AeroPlan70 for LiDAR setup
  - Georeferencing tool
  - Tool to convert DTMs to georeferenced bitmaps
  - In-flight map transformation editor
  - SRTM (Shuttle Radar Topography Mission) elevation data converter

## Hardware requirements

Leica MissionPro requires only standard PC hardware.

Minimum: Intel Core 2 or compatible processor with 7 GB Disk Space, 4 GB RAM and MS Windows XP, Vista or Windows 7. Supported for all OS on 32bit and 64bit systems.

Recommended: Intel Core i7 with 7 GB Disk Space, 8 GB RAM, 15GB space for SRTM data and 20 GB Cache on local disk, Windows 7 64bit.

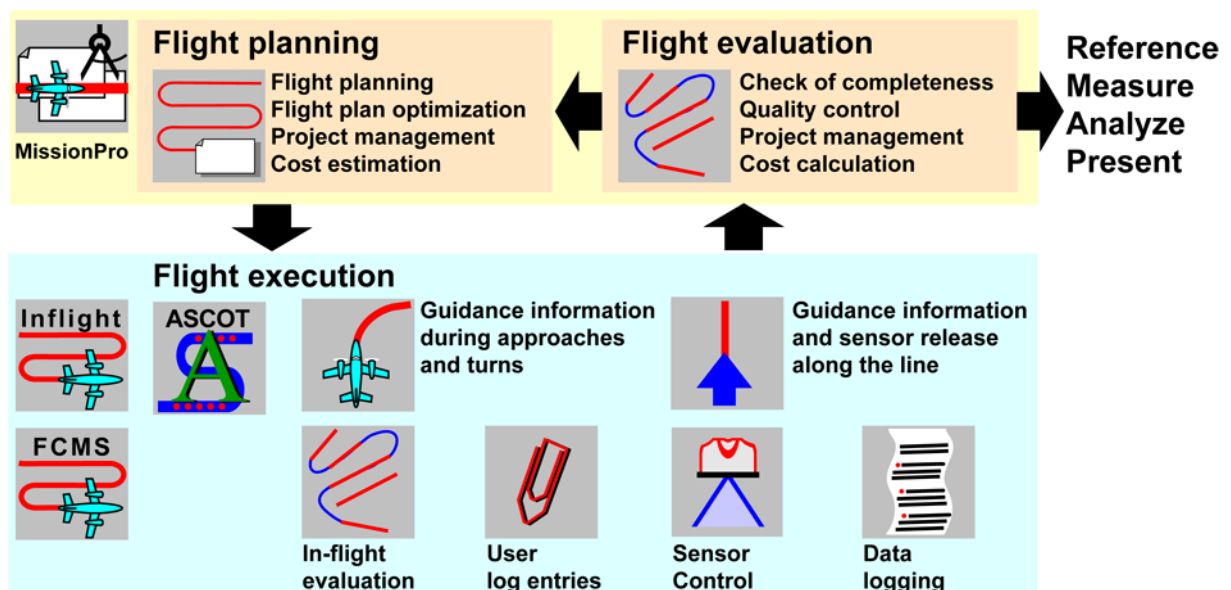
Leica MissionPro requires suitable graphic hardware. The screen resolution shall be at least 1280 x 1024 pixels. Usually the graphic card/chips from AMD/ATI or NVIDA meet the graphic performance requirements of Leica MissionPro. Also, graphic cards/chips with similar performance from other vendors will work.

No external CAD software is required for Leica MissionPro.

## Optimal workflow

A workflow with perfect interfaces is the key for very effective work. Leica Geosystems' and Z/I Imaging proven integrated workflow starts with Leica MissionPro for flight planning. Leica MissionPro has a perfect interface to Leica FCMS, Z/I Inflight and Leica ASCOT for flight execution. This flight management software ensures optimized survey flights. After the survey flight, the flight data are transferred to Leica MissionPro for flight evaluation. The entire tightly-integrated workflow uses a powerful flight plan database. This seamless interfaces increases productivity and cuts cost. With Leica MissionPro, managing large projects becomes an easy task.

### Workflow Flight planning – Flight execution – Flight evaluation

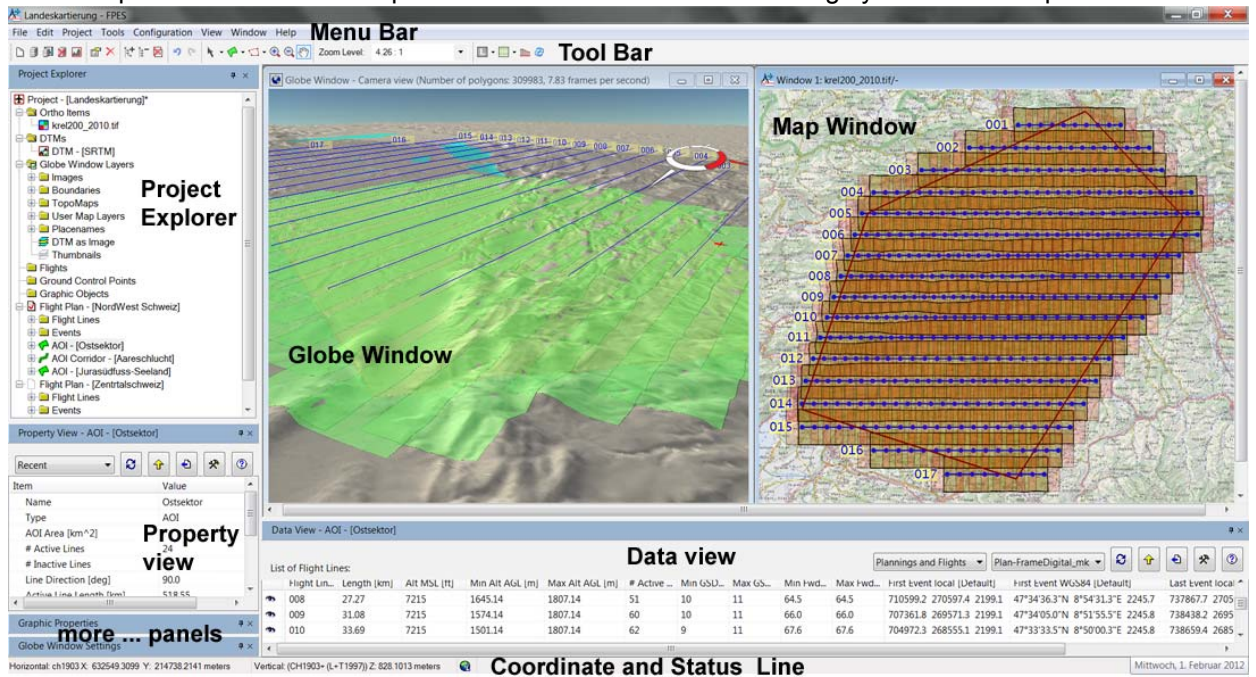


Details about Leica FCMS and Z/I Inflight are given in the corresponding product descriptions  
See <http://www.leica-geosystems.com>  
and <http://www.ziimaging.com>



# Leica MissionPro 3D and 2D planning environment

The graphical user interface is easy to learn and enables easy use of Leica MissionPro. Functions can be selected either from the menu or by using icons on the toolbar. The workspace below the menu and icons is split into the area for Map and Globe Windows and several highly customizable panels.

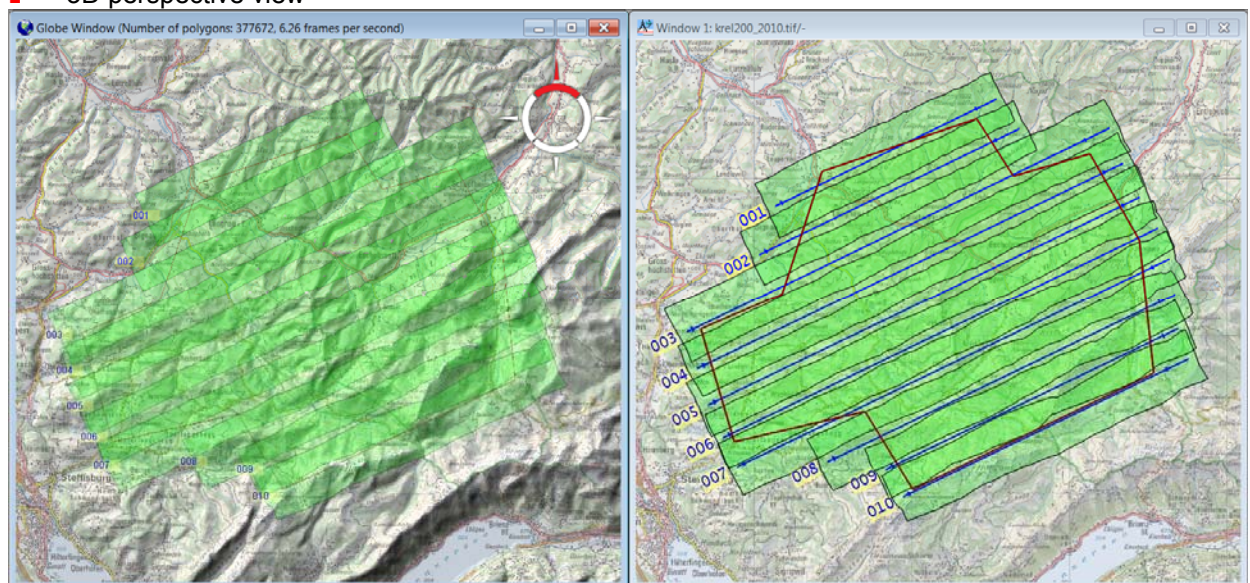


## The Globe Window and the Map Window

- Digital raster maps, Images
- DTM as image
- Graphical information like GCP, location of GNSS ground reference stations, restricted airspace, vector data and vector maps as overlays

The Globe Window additionally features

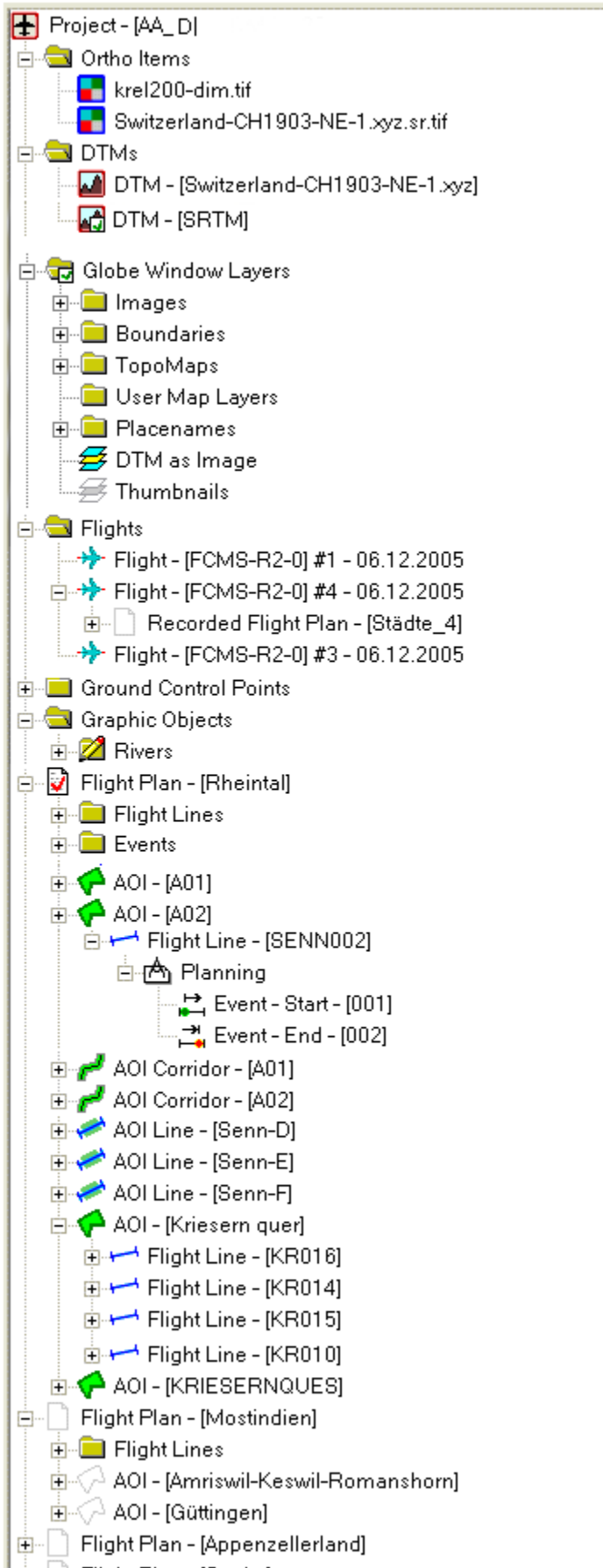
- Display of raster data and vector data from WMS Server
- Automatic display of SRTM/ASTER DTM data as image
- Display of thumbnails
- Display of maps with 3D relief effect
- 3D perspective view



Globe Window

Map Window

## Project Explorer



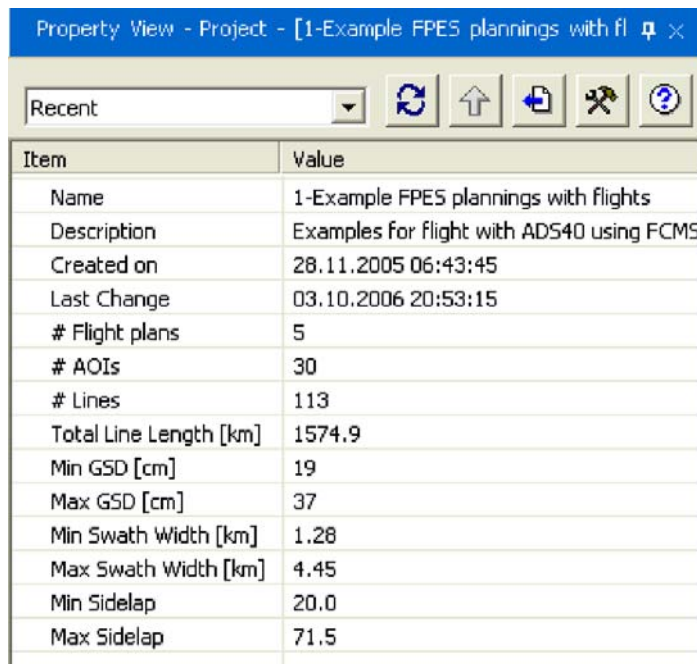
The Project Explorer shows the project in a directory-like tree. The tree can be expanded or collapsed to show or hide information.

**In Leica MissionPro, a project is a container.**

It holds:

- **Ortho Item** – Links to maps, images of any coordinate system
    - The maps/images can be displayed as backdrop in the Map Window
  - **DTMs**
    - Links to (local) Digital Terrain Models
    - World wide SRTM/ASTER - DTM data which are handled by MissionPro automatically.
  - **Globe Window Layers**
    - Links to WMS data servers. Data are handled and loaded to the Globe Window automatically
    - User Map layers to link maps/images for display as backdrop in the Globe Window
  - **Flights**
    - All flights imported for evaluation are listed here
    - A flight plan or parts of it can be executed several times
  - **Ground control points**
    - GCP or GNNS reference stations are either imported, drawn or entered numerically
  - **Graphic objects**
    - Vector data can either be imported or drawn in Leica MissionPro
    - Can be organized in sub-folders
  - **Flight plans**
    - Amount not limited
    - Each flight plan can have a different coordinate system and or different sensor definition
    - One flight plan is active and can be edited at a time
    - A non-active flight plan is hidden by default. However, elements can be selected to be shown if the coordinate system is the same as the active flight plan
- A flight plan can be:
- Duplicated within the project
  - Deleted from the project
  - Made active or inactive
  - Exported

## Property View



Property View - Project - [1-Example FPES plannings with flights]

Recent

Item	Value
Name	1-Example FPES plannings with flights
Description	Examples for flight with ADS40 using FCMS
Created on	28.11.2005 06:43:45
Last Change	03.10.2006 20:53:15
# Flight plans	5
# AOIs	30
# Lines	113
Total Line Length [km]	1574.9
Min GSD [cm]	19
Max GSD [cm]	37
Min Swath Width [km]	1.28
Max Swath Width [km]	4.45
Min Sidelap	20.0
Max Sidelap	71.5

This panel is typically displayed on the lower left side. But it can be undocked, resized and placed anywhere on the screen.

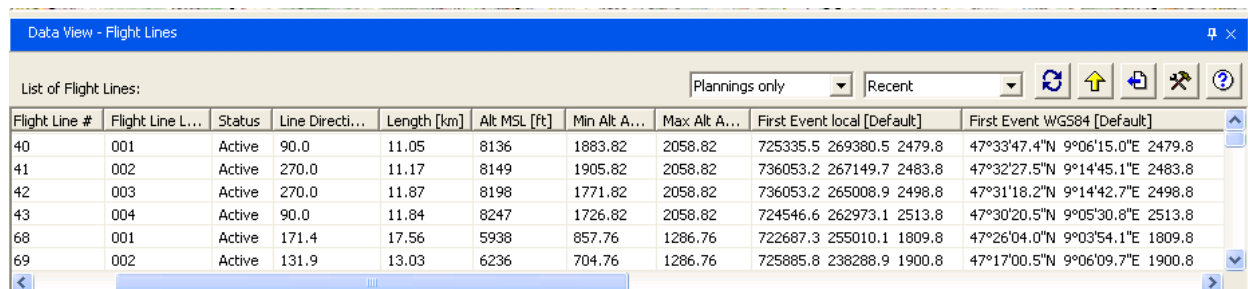
Property View shows a large number of various summarized project data. The items displayed can be freely configured. The data displayed depends also on the node which is selected in the Project Explorer. E.g.:

- If the 'Project' node is selected, data about the project is displayed
- If a 'Flight plan node' is selected data about the flight plan is displayed

The example on the left shows an overview of the project.

Displayed data can be exported in various formats.

## Data View



Data View - Flight Lines

List of Flight Lines: Plannings only Recent

Flight Line #	Flight Line L...	Status	Line Directi...	Length [km]	Alt MSL [ft]	Min Alt A...	Max Alt A...	First Event local [Default]	First Event WGS84 [Default]
40	001	Active	90.0	11.05	8136	1883.82	2058.82	725335.5 269380.5 2479.8	47°33'47.4"N 9°06'15.0"E 2479.8
41	002	Active	270.0	11.17	8149	1905.82	2058.82	736053.2 267149.7 2483.8	47°32'27.5"N 9°14'45.1"E 2483.8
42	003	Active	270.0	11.87	8198	1771.82	2058.82	736053.2 265008.9 2498.8	47°31'18.2"N 9°14'42.7"E 2498.8
43	004	Active	90.0	11.84	8247	1726.82	2058.82	724546.6 262973.1 2513.8	47°30'20.5"N 9°05'30.8"E 2513.8
68	001	Active	171.4	17.56	5938	857.76	1286.76	722687.3 255010.1 1809.8	47°26'04.0"N 9°03'54.1"E 1809.8
69	002	Active	131.9	13.03	6236	704.76	1286.76	725885.8 238288.9 1900.8	47°17'00.5"N 9°06'09.7"E 1900.8

This panel is typically displayed below the graphic window. But it can be undocked, resized and placed anywhere on the screen.

Data View shows a large number of various data items. The items displayed can freely be configured. The data displayed depends also on the node which is selected in the Project Explorer. It always shows the data one level lower than selected in the Project Explorer and displayed in the Property view. E.g.

- If the 'Project' node is selected the Property View shows data about the project and the Data View shows data about the flight plans in the project.
- If a 'Flight plan node' is selected, the Property View shows data about the flight plan and the Data View shows data about the AOI.

The records can be filtered to list

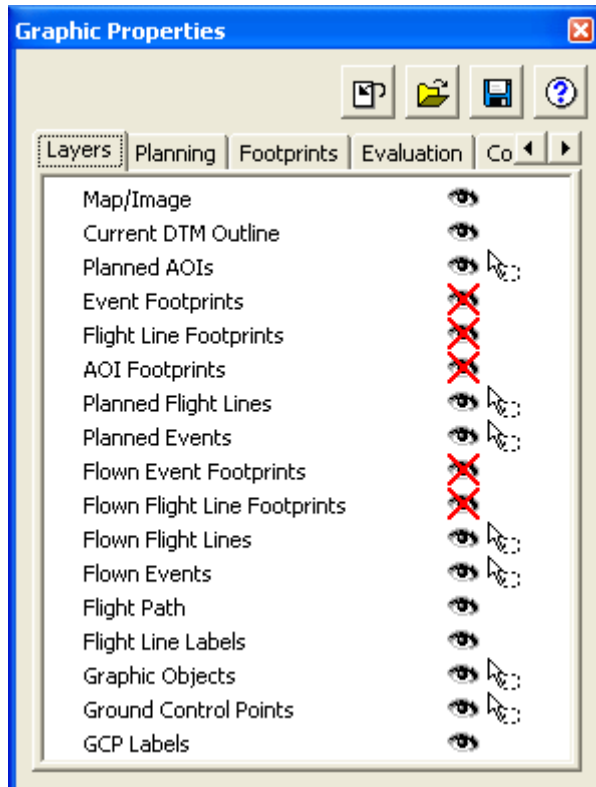
- Planning only
- Flights only
- Planning and Flights
- Planning or Flights

The example above shows an overview of all planned flight lines of a flight plan. That is, the 'Flight Line' node was selected for the flight plan in the Project Explorer.

Displayed data can be exported in various formats.



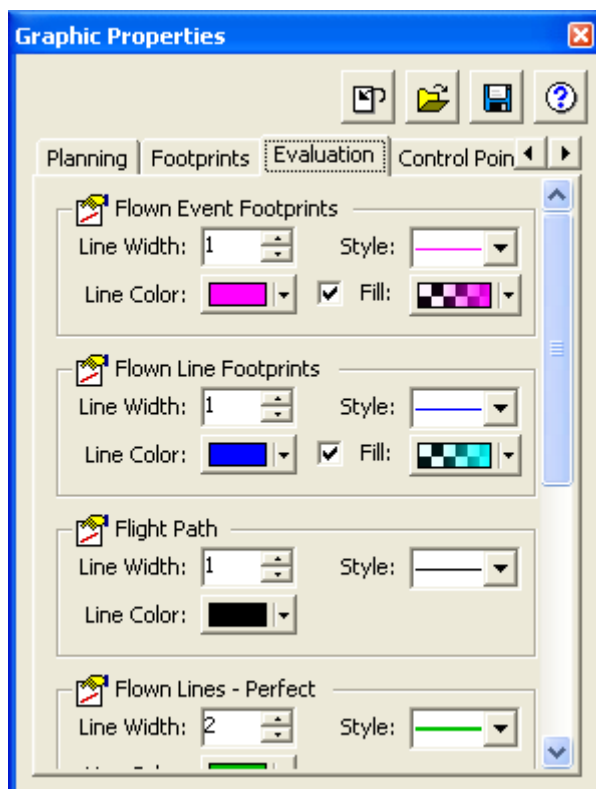
## Graphic Properties



The 'Layers' TAB allows showing or hiding the following layers:

- Map/Image
- Current DTM Outline
- Planned AOIs
- Event Footprints
- Flight Line Footprints
- AOI Footprints
- Planned Flight Lines
- Planned Events
- Flown Event Footprints
- Flown Flight Line Footprints
- Flown Flight Lines
- Flown Events
- Flight Path
- Flight Line Labels
- Graphic Objects
- GCP Labels

The order of the layers can also be rearranged.



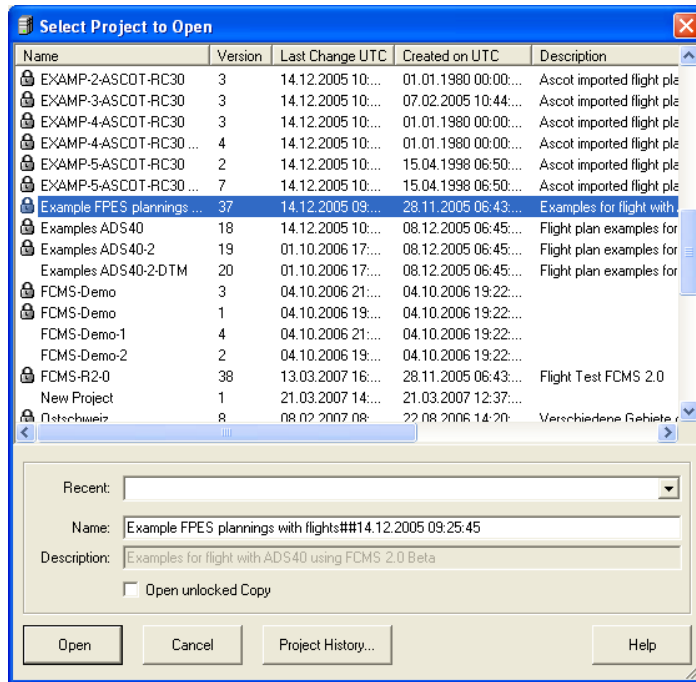
The properties can be freely defined for all graphic elements like:

- Line width
- Line color
- Line style
- Fill color and transparency
- Font style and size

For convenient access, the elements are grouped and the groups are selectable in Tabs.

The settings can be saved and reloaded.

## Flight plan database



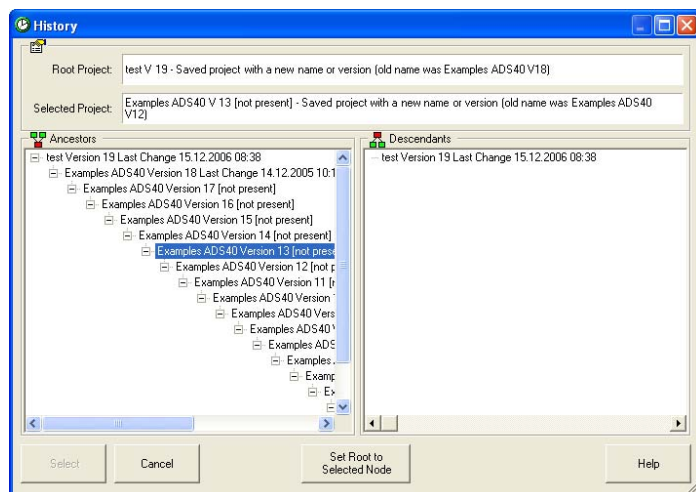
The flight plan database is a relational database. The SQL database server comes with the Leica MissionPro software.

This powerful database ensures data storage in a logical structure with fast access and secure and flexible data management.

The flight plan database is the same database as used for Leica FCMS. This simplifies data handling and project management, because the status of a project is easy to monitor.

Leica MissionPro database utilities allow a user to:

- Restore database
- Backup database
- Delete Projects, Flights from database



A version number is used to identify different versions of a project in the database. Older versions of a project can be retrieved.

For convenient access to the flight plan database across the organization the flight plan database can also be installed on an Enterprise version of a SQL server.

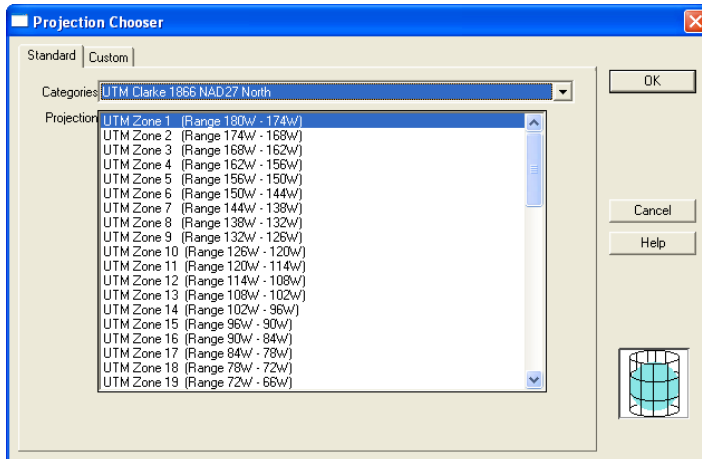


# Highlights of Leica MissionPro

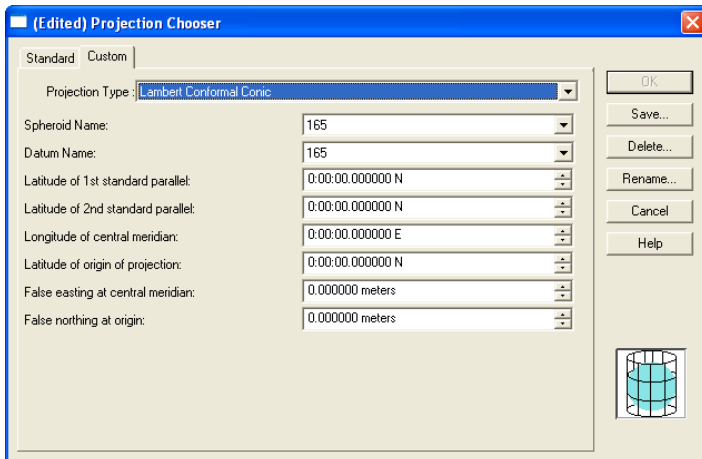
## Flight planning

### Flight planning on all common types of geographic and grid systems

GNSS-supported flight execution with Leica FCMS and Z/I Inflight is based on the WGS84 Reference System (World Geodetic System 1984). This reference system differs from local datum used for flight planning in several respects. To plan flights in local geographic systems or in national grid systems, the proper conversion to and from WGS84 is essential.



Leica MissionPro supports flight planning on all common types of geographic and grid systems. During flight plan setup, a coordinate system is selected and assigned to a flight plan. A large number of projections are predefined in Leica MissionPro.

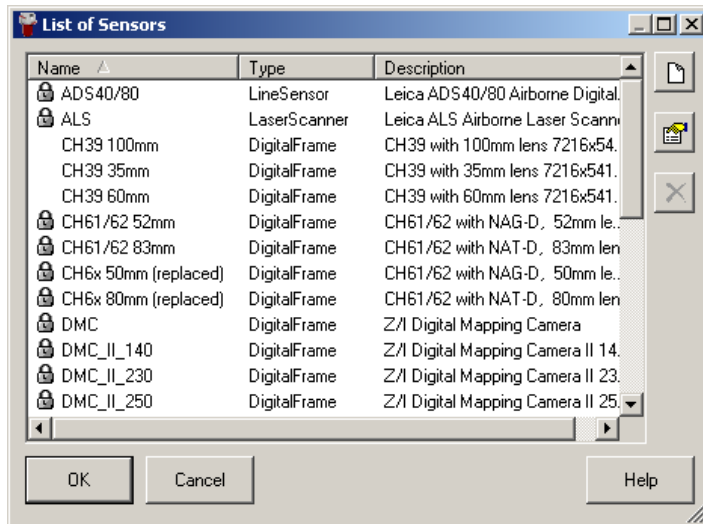


Projections can also be easily defined by the user. A large number of projection types, spheroids and datums are predefined in Leica MissionPro and can be used to define a customized projection system. Also, custom spheroid and datums can also be defined.

Leica MissionPro handling of the coordinate systems is extremely powerful:

- The flight plan can have a coordinate system different than the backdrop map shown in the graphic view
- At the same time several graphic views can be displayed. Each graphic view can have a different backdrop map where each map can have a different coordinate system
- All flight plan data are also converted into WGS84 coordinates for flight execution

## Efficient flight planning for any type of sensor including multi-sensor systems



Leica MissionPro supports flight planning for single sensor and multi-sensors. The sensor type for flight planning is selected out of a list. All Leica Geosystems and Z/I Imaging sensors are pre-defined.

The user can define any sensor of the following types:

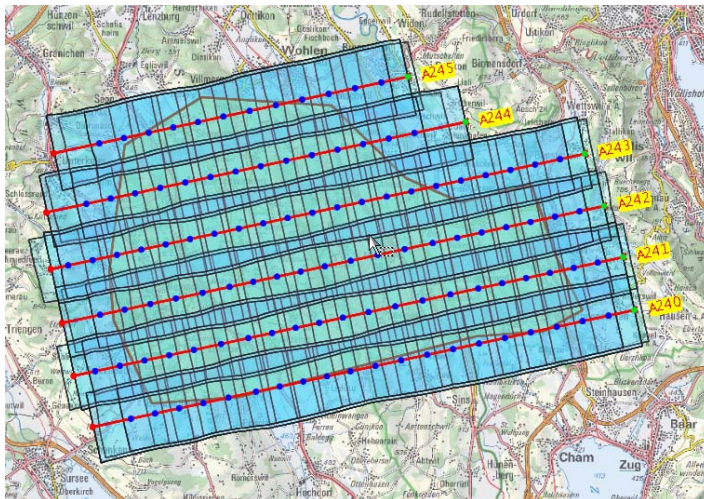
- Film Frame
- Digital Frame
- Digital Line
- Laser Scanner (LIDAR)

- **Film Frame**, for example, Leica RC30 or Z/I RMK TOP  
Defined by image width, length and focal length  
Image scale is one of the key input parameters for flight planning
- **Digital Frame**, for example, Z/I DMC II 230 or Leica RCD30  
Defined by pixel size, pixel count along and across track and focal length  
GSD (Ground Sample Distance) is one of the key input parameters for flight planning
- **Digital Line**, for example, Leica ADS80  
Defined by pixel size, pixel count across track and focal length  
GSD (Ground Sample Distance) is one of the key input parameters for flight planning
- **LIDAR**, for example, Leica ALS70  
FOV (Field of View) and swath width are key input parameters for flight planning

### Multi-sensor flight planning

Flight planning for multi-sensor systems is another powerful feature of Leica MissionPro. Two options are available to create a flight plans:

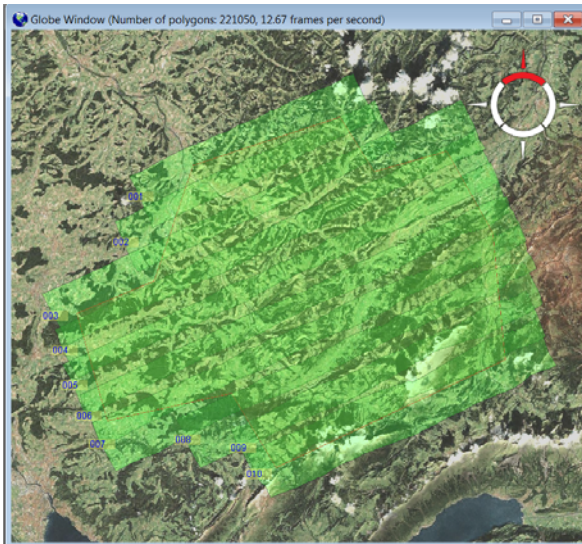
- **'Duplicate'** used if the flight plans are executed independently for each sensor.
- **'Duplicate for different sensor'** used if the flight plans are executed simultaneously.



The example shows a flight planning for a multi sensor system  
Leica ALS70 + Leica RCD30  
For simultaneously execution



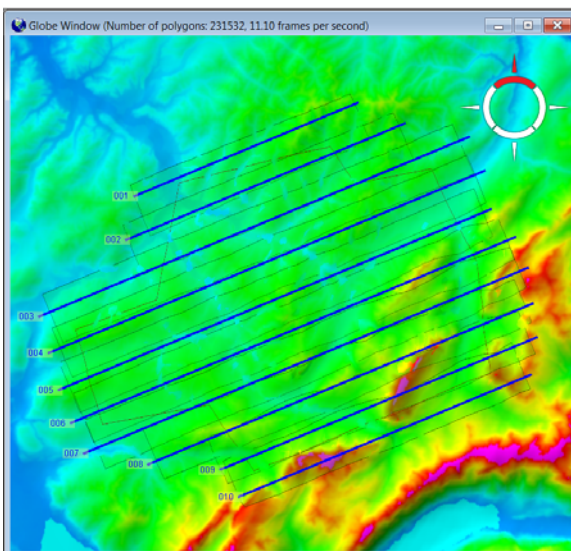
## Globe Window



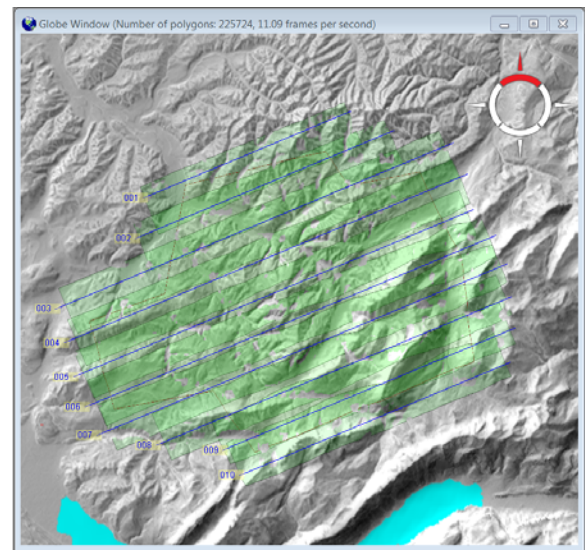
WMS service

In the Globe Window the following can be displayed as backdrop for the flight planning:

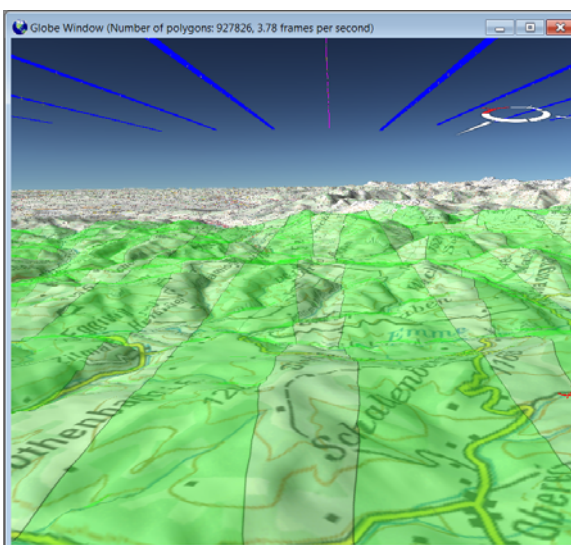
- Display of raster data and vector data from WMS Servers
- Automatic display of SRTM/ASTER DTM data as image in various types
- Display of thumbnails
- Display of maps
- 3D perspective view
- Digital raster maps, Images
- Graphical information like GCP, location of GNSS ground reference stations, restricted airspace, vector data and vector maps as overlays



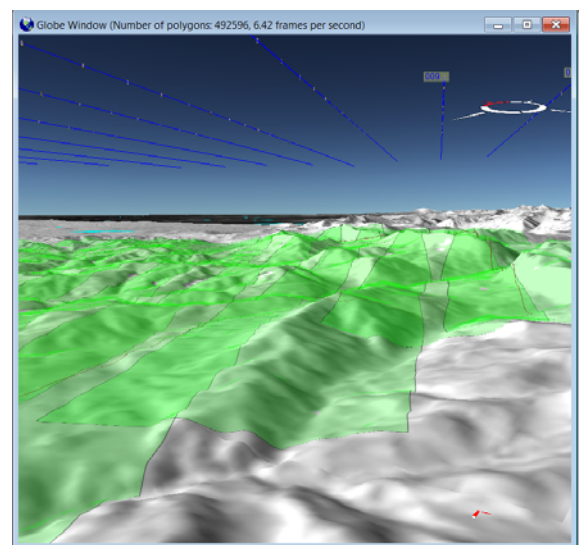
DTM as elevation encoded color image



DTM as shaded relief image



Map with relief effect



DTM as shaded relief image



## Map Window

### Digital raster maps for flight planning



All formats supported by ERDAS LPS and IMAGINE can be used as backdrops for flight planning in Leica MissionPro. This includes the following formats:

- GeoTIFF
- TIFF with TFW-file
- \*.IMG image

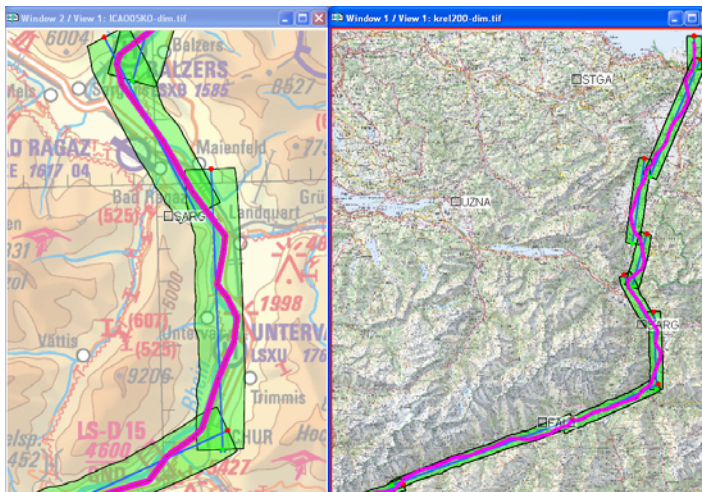
The coordinate system can be assigned during flight planning in Leica MissionPro.

The best performance is obtained if:

- Map is in 24-bit color or 8-bit grey

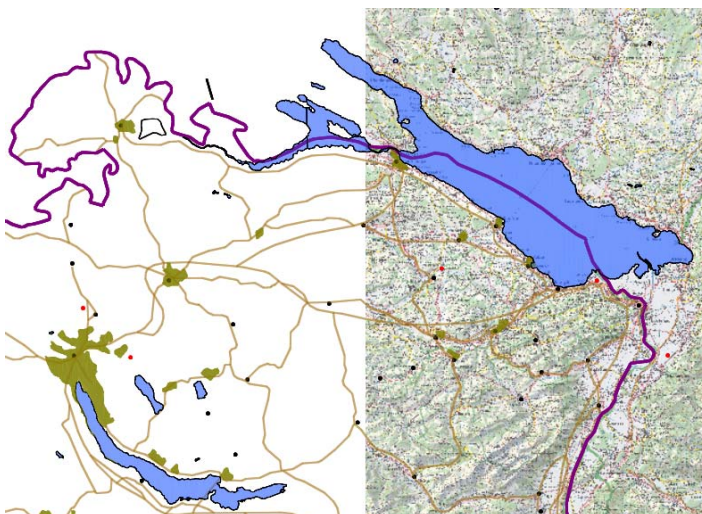
Leica MissionPro creates automatically image pyramids if not already available.

### Multiple Map Windows



Leica MissionPro allows display of multiple graphic windows at the same time. The same map or different maps, even with different projections, can be loaded into the various graphic windows. This is very powerful because the zoom factor and area can be different in each graphic window. This allows very accurate and detailed planning on a map at a large zoom scale in one window. At the same time, the planning can appear in another graphic window on a map at a smaller zoom scale showing a good overview of the flight plan.

### Digital vector maps for flight planning



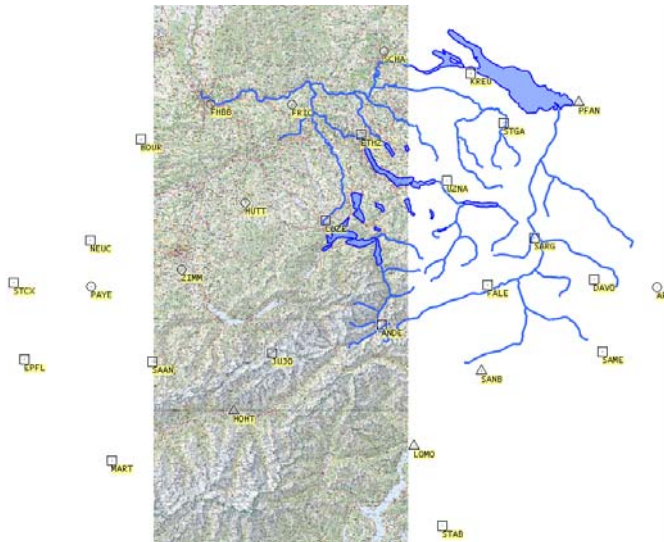
Vector maps can be imported to the 'Graphic objects' layer in Leica MissionPro. The following formats are supported:

- Shapefiles (\*.shp)
- DGN V7 format (\*.DGN)
- DGN V8 format (\*.DGN)

Leica MissionPro is able to display vector data on top of a raster map.



## Ground control points

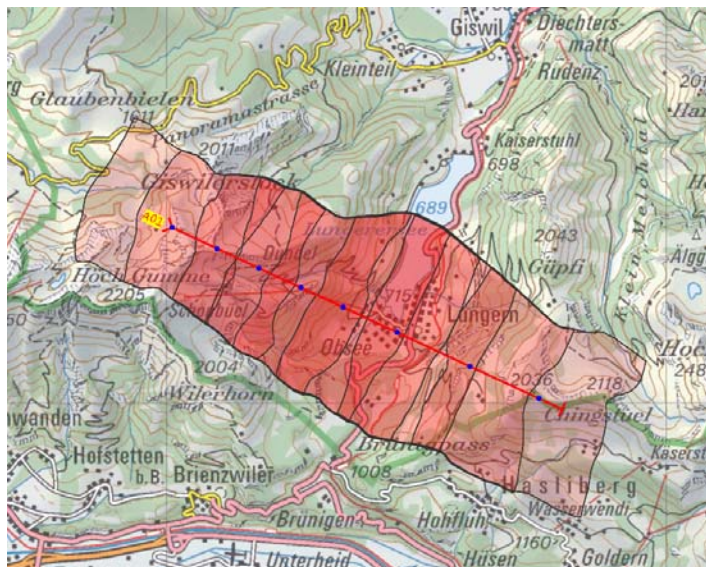


Leica MissionPro displays ground control points. Three different types can be displayed:

- 2D
- 3D
- GNSS ground reference station
- Points can be entered as coordinates, digitized by the user in the graphic window or imported.)

Leica MissionPro is able to display ground control points on top of vector data and raster maps.

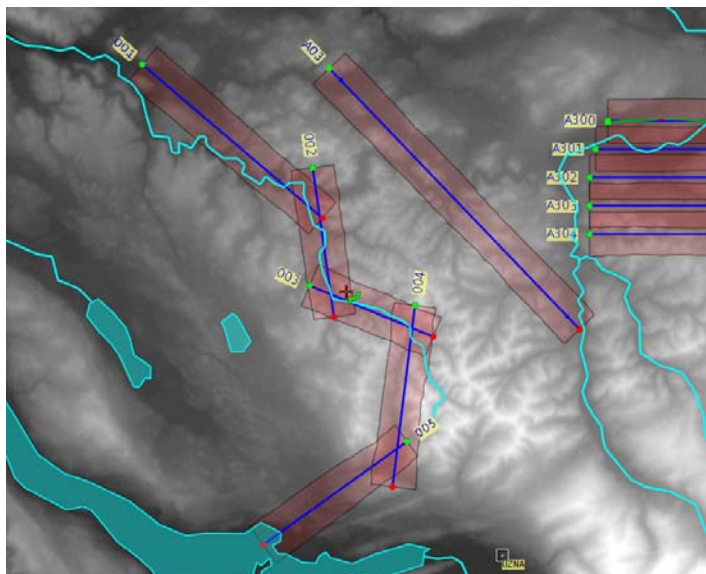
## DTM for flight planning



Leica MissionPro loads automatically and dynamically uses SRTM/ASTER DTM data covering the area of the flight plan. The flight plan can be in any coordinate system. Transformation of the WGS84 SRTM-DTM data is handled by Leica Mission Pro automatically.

All DTM formats supported by LPS and IMAGINE can be used for flight planning in Leica MissionPro. This includes the following most common formats:

- ASCII XYZ (\*.xyz)
- IMAGINE (\*.img)
- TerraModel TIN (\*.pro)
- ArcInfoGrid (\*.agr)



Leica MissionPro has also a tool to convert DTMs to georeferenced bitmaps which are stored in files and can be used like maps in the Map Window or Globe Window.

In the Globe Window Leica MissionPro displays automatically and dynamically SRTM/ASTER DTM data as image in all available formats

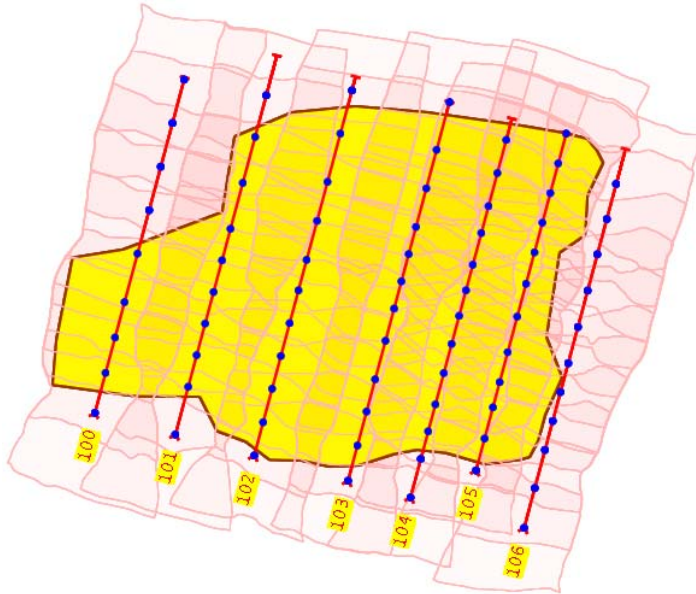
Example Shaded relief



## Planning types

Leica MissionPro supports for all sensor types the different planning types:

- AOI (Area Of Interest) – block defined by a polygon of any shape
- Corridor – defined by a polyline of any shape
- Individual single line – defined by start and end point

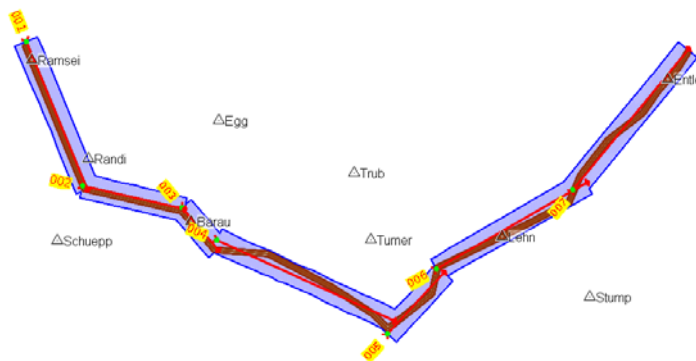


### AOI

**Area Of Interest** – also called a block

- The AOI is defined by a polygon of any shape
- The polygon can be edited
- An AOI record in the database holds the lines required to cover the AOI stereoscopically by parallel lines
- For computation, the AOI area can be extended by safety factors
- DTM can be taken into account
- Each line can be individually edited

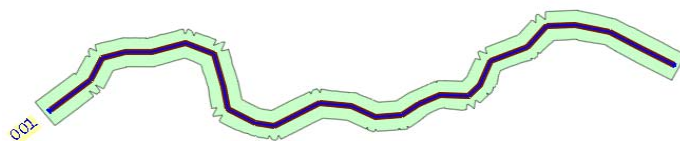
The example on the left side shows the planning for a Frame Camera on mountainous terrain. DTM was taken into account during computation.



### Corridor

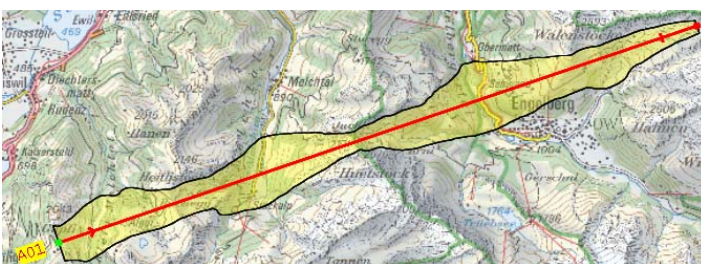
A corridor is defined by a polyline of any shape. The width of the corridor can be specified.

- The corridor polyline can be edited
- An AOI-Corridor record in the database holds the lines required to cover the corridor stereoscopically
- For computation, the corridor area can be extended by safety factors
- Each line can be individually edited



### Corridor – Route mode

- The computation option 'Route mode' generates a winding flight line for helicopter flights.



### Individual single line

Defined by start and end point.

The example on the left side shows the planning of a profile across the mountains for a Line Sensor.

DTM was taken into account.

## Sophisticated algorithm for flight plan computation

Leica MissionPro computes flight lines to ensure gap-free stereoscopic coverage of areas. This is either an AOI of any shape, a corridor or an individual single line. Various parameters can be pre-set and tuned to adapt the flight plan layout according to preferences or to fit the exposures to a given map-sheet layout. Edge and Side safety factors extend the AOI. This simplifies flight plan optimization.

Item	Computed	Planned
GSD	31 - 40 cm	40 cm
Max Forward Overlap	69 %	60 %
Min Base Length	1665 m	0 m
Flying Height AGL	5090 - 6571 m	
Altitude AMSL	6983 m / 22912ft	(Minimum)
Max Side Overlap	48.2 %	30 %
Line Spacing	At least 3216 m	10 m
Number of Events	423	
Number of Lines	14	
Total Length of Lines	857276 m	
Line Direction	95 deg	

### Input parameters for computation

- Image scale (film frame)
- GSD (for digital frame or line)
- FOV and swath width (LiDAR)
- Along track
  - overlap in % (frame only)
  - base length (frame only)
- Across track
  - sidelap in %
  - line spacing
- Corridor width

### Options to compute the lines to cover an AOI stereoscopically

- Line direction
- Maximum number of lines
- Lock at coordinate

### Options to compute the lines to cover a corridor

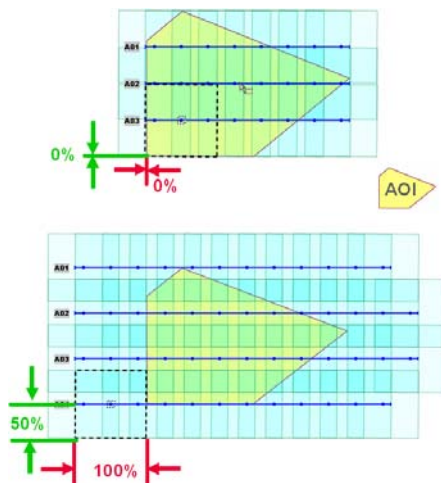
- Auto Split
- Route mode

### Elevation

- User entered reference height
- DTM
  - Allow different flying heights
  - Auto split lines (step lines)
  - Terrain offset (to all DTM data)
  - Surface offset (to peak in AOI)

## Safety factors during computation

Safety factors allow the user convenient optimization of the flight planning without editing the polygon points of an AOI. For computation, the AOI is extended according to the safety factors. The safety factors are entered as a % of an event footprint on the ground. For a line sensor, the swath width also defines the 'footprint' in flight line direction.



The example on the left side shows the flight line coverage for an AOI computed with the following safety margins:

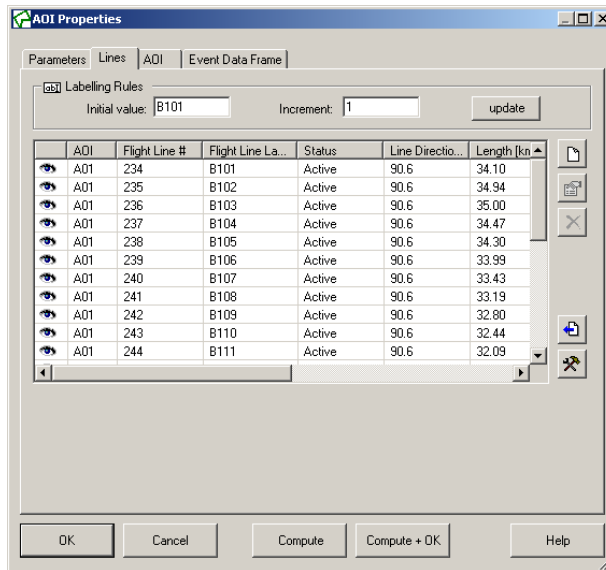
- Along Track 0%
- Across Track 0%

The example on the right side shows the flight line coverage for an AOI computed with the following safety margins:

- Along Track 100%
- Across Track 50%

For computation, the AOI is extended by the safety margins.

## Easy line and event labelling (labelling might also called user numbering)



The line label can be numbers, letters or an alphanumeric. The user can individually edit each line label. Leica MissionPro label generator automates individual line labeling. The user defines the initial value and the increment.

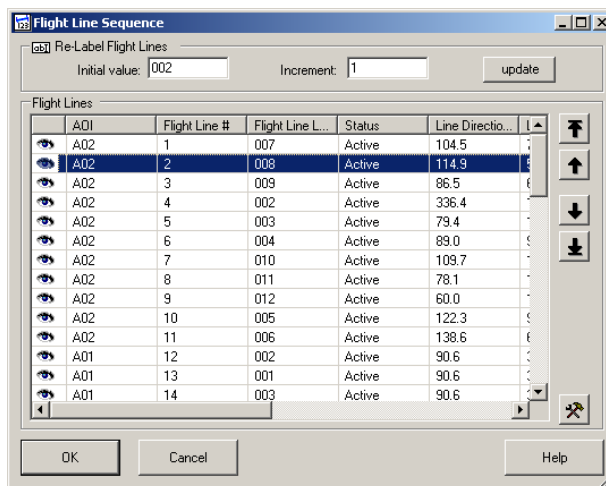
Examples of line labels:

- 001, 002, 003, ...
- A100, A101, A102, ....
- BA200, BA220, BA240, ....
- AAA, AAB, AAC, AAD, ...

Each line can be labeled individually. The lines of an AOI or of the whole flight plan can be labeled automatic.

In addition user event numbering can be done per line, per AOI or per flight plan.

## Definition of flight line sequence and direction of approach during flight planning



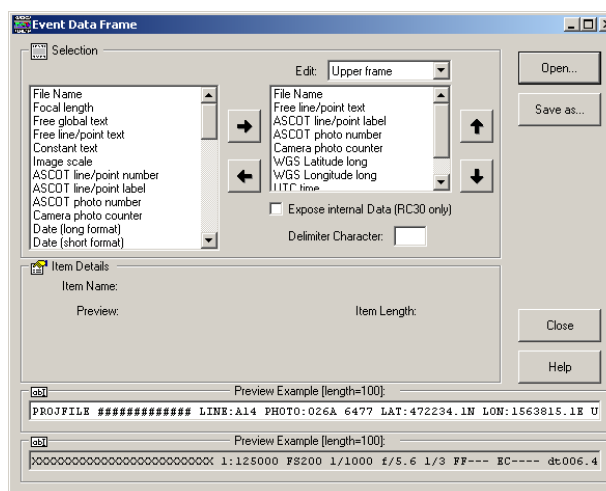
During flight execution with Leica FCMS, the flight lines can be executed in any sequence. For special needs such as corridor mapping, the sequence in which the lines should be flown can be defined in the flight plan.

The planning sequence of the lines is not relevant. A dialog in Leica MissionPro allows the line sequence to be rearranged.

Also, the direction of approach can be defined.

The user's line labeling (numbering) is not affected if the line sequence is redefined.

## Simple definition and flexible Event Data annotation

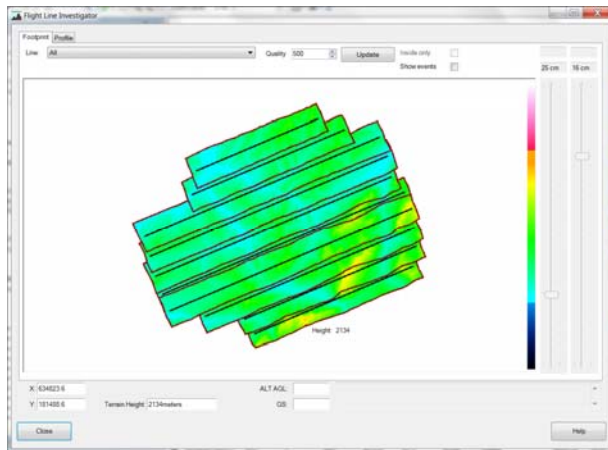


Defining of data for e.g. Leica RC30 film images annotation or to store it in TIFF headers of Leica RCD30 images is a simple task. The user defines in a dialog the data frame template with two strings of up to 100 characters. A template contains freely selectable parameters. Each parameter can have a preceding text. Text fields can be included in the template. 'Global text fields' contain text valid for the whole Flight Plan. 'Free Line text fields' can contain text individual for each Line.

The template is assigned to the flight plan. A preview allows easy editing and convenient entering of individual line texts.

During flight execution, all parameters in the template will be replaced with its actual values.

## Tools to optimize flight planning



### Investigate AOI

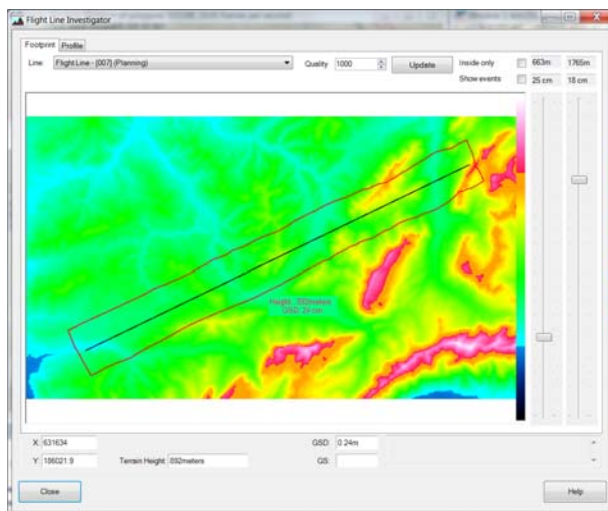
The Investigate dialog provides for an AOI in plan view a color coded graphical presentation of:

- GSD for digital imaging sensors
- Point density for Leica LiDAR
- Image scale for film cameras.

Information provided beneath the cursor.

- Coordinates
- Terrain height

Lines can be selected and investigated as described below



### Investigate flight line

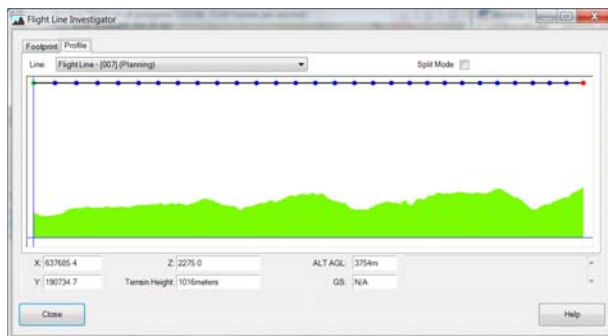
The Investigate dialog provides for a flight line in plan view a color coded graphical presentation of:

- GSD for digital imaging sensor
- Point density for Leica LiDAR
- Image scale for film cameras.

Minimum and maximum values can be adjusted with sliders to define the range of desired data resolution for the flight line.

Information provided beneath the cursor.

- Coordinates
- Terrain height
- Image scale (Film Sensors)
- GSD (Digital Sensors)



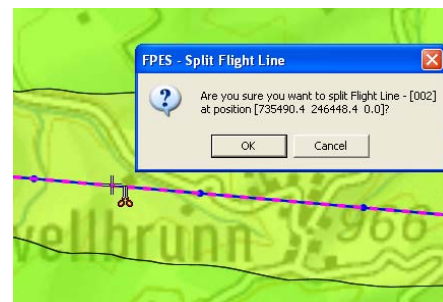
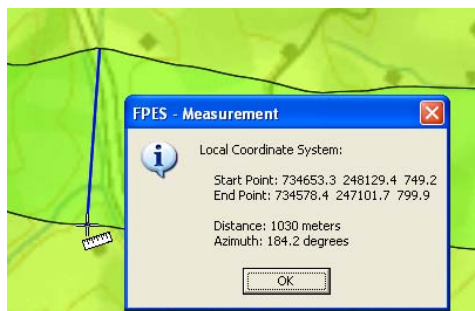
The profile view provides interactive information beneath the cursor.

- Coordinates of the cursor
- Terrain height
- Flying height
- Measured GS on flown lines

Split line function available in profile view

For Leica ALS70 horizontal lines display the minimum and the maximum range gate respectively.

## Measure tool and Split flight line

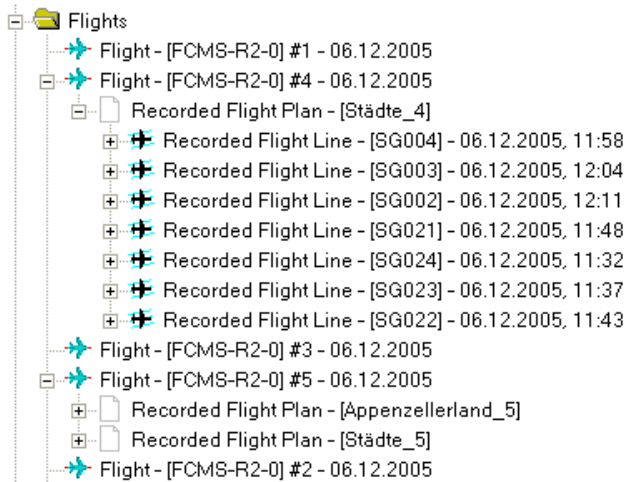




## Flight evaluation

A flight plan, or parts of it, can be executed during several flights in Leica FCMS. During the flight, a large amount of data are stored to the flight plan database. Flown projects are transferred from the airborne system to the office. All this data can be jointly evaluated in Leica MissionPro.

### Flight Evaluation of multiple flights to manage projects of all sizes



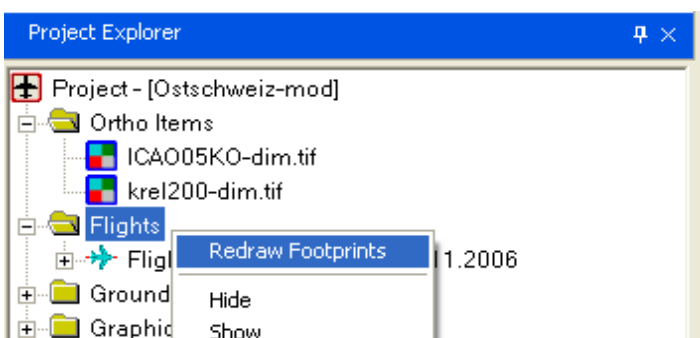
Leica MissionPro flight evaluation is straightforward and powerful. It allows analyses of survey flights. It performs the graphical and numerical presentation of the flights.

If a project can only be completed by multiple flights, all flights can be selected for joint evaluation.

The flights which are added for evaluation to the project are listed in the Project Explorer in the 'Flights' node.

Flights can be either shown or hidden. Also, the flight path can be displayed.

### Display footprints of flown data

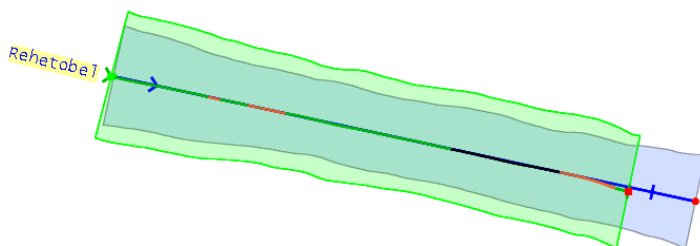


The user can select at which level footprints of recorded data shall be displayed:

- Flights
- Flight
- Recorded flight plan
- Recorded flight line
- Event

A DTM is taken into account.

### Graphic evaluation



Example on the left shows a flight line which was:

- Flown (Green footprint) at higher altitude than planned
- Flown partly with Warnings (Orange) or Errors (Red) Sensor inactive (Black)
- Not completed

### Display of georeferenced thumbnails



This option is available for:

- DMC
- DMC II
- RCD30

Option to take DTM into account



## Numeric evaluation – Data view

AOI	Flight Line Label	Flight Status	Flown Errors	Flown Warnings	% completed	Acceptance	Length flown
AO1	005	FullRecorded	None	PAV out of limits	100.0	Pending	5.64
AO3	003	FullRecorded	None	None	100.0	Pending	5.62
Walldt_Me...	000	FullRecorded	None	None	100.0	Pending	8.71
Walldt_Me...	001	FullRecorded	None	None	100.0	Pending	8.72
Walldt_Me...	002	FullRecorded	None	None	100.0	Pending	8.73
Walldt_Me...	003	FullRecorded	None	None	100.0	Pending	8.70

The Data View presents freely definable flight information. The example on the left side lists a number of recorded flight lines. One line was flown with the mount (PAV) out of limits.

## Numeric evaluation – Property view

Item	Value
Flight Plan	Städte_5
AOI	St. Gallen Ost
Flight Line Label	SG002
Date	Dienstag, 6. Dezember 2005
Aircraft	HB-FKL PC-6 Sitterdorf
Status	Active
Sensor	ADS40
Flight Status	FullRecorded
Flown Errors	Horizontal deviation exceeded
Flown Warnings	PAV out of limits, Image Overexposur
% completed	100.0
Acceptance	Pending
Length flown Line [km]	10.33
Length not flown on Line [km]	0.00
Max dev across [m]	43
Max dev along [m]	38
Max dev height [m]	-7
Flown Line Direction	232.8
Line begin time UTC	12:38:40
Line end time UTC	12:43:20
First flown Event Local [Def...	750419.7 258047.8 1920.8
First flown Event WGS84 [D...	47°27'21.6"N 9°26'00.7"E 1967.1
Last flown Event Local [Def...	742192.4 251797.7 2005.5
Last flown Event WGS84 [D...	47°24'05.9"N 9°19'20.9"E 2052.1

The Property View and the Data View present freely definable flight information.

On the left side, an example of the Property View is shown for a recorded flight line.

Similar data can be displayed for the entire Project, for a Flight Plan or for an AOI.

Displayed data can be exported in various formats.

## Manage projects – generate modified flight plans

	Flight Line	Flown Errors	Flown Warnings	% complet.	Acceptance	Length flown
	1	None	None	100.0	Pending	Hide Show Accept Reject
	2	None	None	100.0	Pending	
	3	None	None	100.0	Pending	
	4	None	None	100.0	Pending	
	5	None	None	100.0	Pending	
	6	None	None	100.0	Pending	
	7	None	None	100.0	Pending	

Evaluation Options	
Safety Factor (Swath Widths):	1.0
Consider flown elements as good, which are:	
<input checked="" type="radio"/>	Explicitly accepted
<input type="radio"/>	Not rejected
<input type="button" value="OK"/> <input type="button" value="Cancel"/> <input type="button" value="Help"/>	

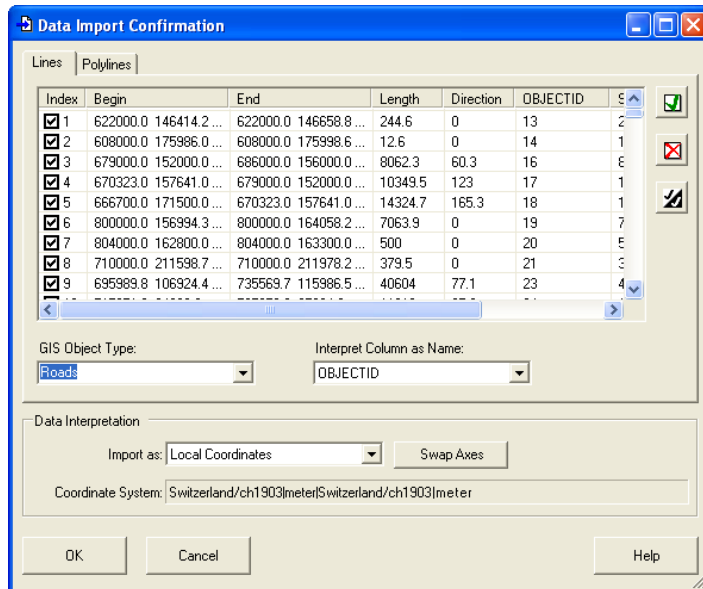
Leica MissionPro automatically generates flight plans of remaining plan parts depending on the flight execution progress.

Leica MissionPro compares flight data with the plan and creates a modified plan that contains the whole flight plan. Only "not-flown" plan parts or parts which have to be repeated are set active.

To ensure correct overlap, either a safety factor (line sensor) or additional events (frame camera) are taken into account. Also the user's 'Acceptance' settings are taken into account.

# Data import

## Data import for flight planning



The following formats are supported:

- **Ground control points:**
  - Shapefiles (\*.shp)
  - DGN V7,V8 format (\*.DGN)
  - ASCII XYZ (\*.txt)
- **Graphic objects** (Polygon, Polyline, Line, Points)
  - Shapefiles (\*.shp)
  - DGN V7,V8 format (\*.DGN)
- **AOI border points as polygon**
  - Google Earth (\*.kml)
  - Shapefiles (\*.shp)
  - DGN V7,V8 format (\*.DGN)
  - ASCII XYZ (\*.txt)
- **Single flight lines**
  - Shapefiles (\*.shp)
  - DGN V7,V8 format (\*.DGN)
  - ASCII XYZ (\*.txt)

## Import of flight plannings

- Leica FPES (\*.fpd)
- Z/I Mission (\*.zim)

## Import of flight plans computed by 3<sup>rd</sup> party software

```
153 228 228
[Dataframe]
EXAMP-1
Userdef txt1
[Coordinate_System]
GEO : WGS84
[Lines]
I 2500 450.00 * * * * * AAA
ZS  N 47 12  0.00  E 9 19  0.00  A
ZE  N 47 15 11.00  E 9 18 32.00  A
S   N 47 12  7.96  E 9 18 58.83  A
P   N 47 12 15.92  E 9 18 57.67  A
P   N 47 12 23.88  E 9 18 56.50  A
P   N 47 12 31.83  E 9 18 55.33  A
P   N 47 12 39.79  E 9 18 54.17  A
P   N 47 12 47.75  E 9 18 53.00  A
P   N 47 12 55.71  E 9 18 51.83  A
P   N 47 13  3.67  E 9 18 50.67  A
P   N 47 13 11.62  E 9 18 49.50  A
P   N 47 13 19.58  E 9 18 48.33  A
P   N 47 13 27.54  E 9 18 47.17  A
```

Additionally to the data import formats listed in section 'Data import for flight planning', 'Leica MissionPro supports import of flight plans made with 3<sup>rd</sup> party flight planning software

The imported flight planning can be either a complete or a non-complete external flight plan.

An example of the ASCII import format is shown at left.

## Data import for flight evaluation

- Leica FCMS flights (\*.fpd)
- Z/I Inflight flights (\*.mdb)
- Leica ASCOT flights (\*.fd0 ...9)

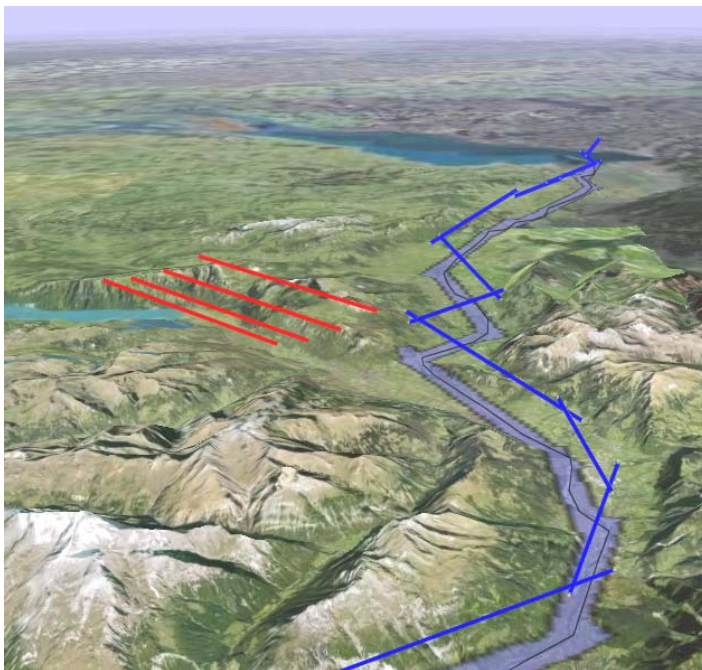
## Data export

Data export is very powerful in Leica MissionPro. This simplifies creation of proposals, reports, and invoices.

Data format	File Suffix	Purpose
ASCII	*.txt *.raw	Output for reports, for import to Track'Air, CCNS4 or UNS Output to 3 <sup>rd</sup> party databases
HTML	*.htm	Output of reports
EXCEL	*.xls	Further use of data for reporting and planning
Shapefiles	*.shp	Further use of graphical data in 3 <sup>rd</sup> party packages
DGN V7,V8 format	*.dgn	Further use of graphical data in 3 <sup>rd</sup> party packages
Google Earth	*.kml	Visualization in Google Earth
MissionPro/FCMS	*.fpd	To FCMS for flight execution or to MissionPro for flight evaluation
Z/I Inflight	*.afl + *.apf	Transfer to Z/I Inflight for flight execution
ASCOT	*.fda	Transfer to ASCOT for flight execution

The following data can be exported:

- AOI border point coordinates
- Flight line coordinates
- All data which can be displayed in the Data View and in the Property View
- Graphical data
- Flight planning data for TrackAir or CCNS4
- Flight planning data for UNS systems
- Projects for flight execution with FCMS
  - FCMS flight plans. Format \*.fpd
- Flight plans for flight execution with Z/I Inflight or ASCOT
  - Z/I Inflight flight plans. Format \*.afl + \*.apf
  - ASCOT flight plans. Format \*.fda



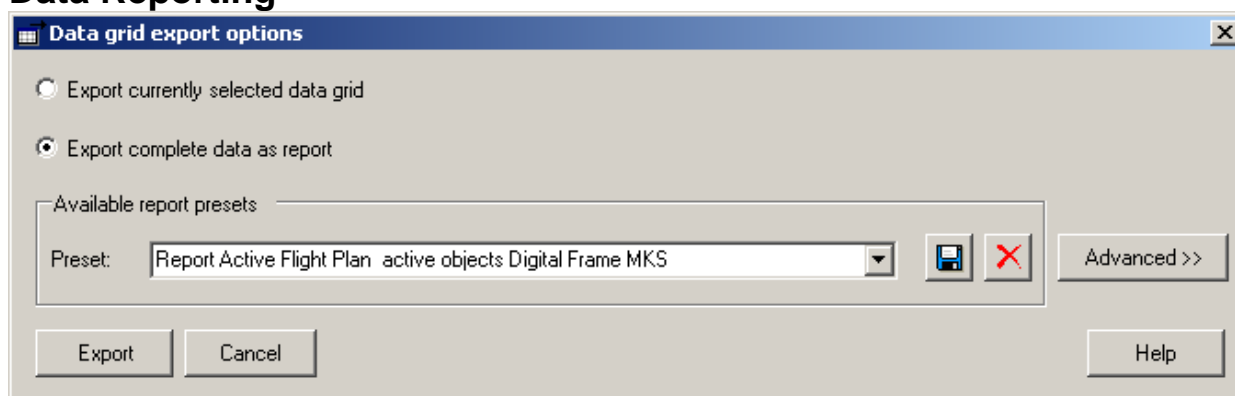
### Flight plan data for graphical use

The following formats are supported:

- Shapefiles (\*.shp)
- DGN V7, V8 format (\*.DGN)
- Google Earth (\*.kml)

The example at left shows flight lines for Leica ALS70 exported and displayed in Google Earth.

# Data Reporting



Leica MissionPro provides 'one-click' export of complete data as reports into files in the format either \*.txt, \*.html, \*.xls, \*.xml and \*.raw.

The content of the reports can be defined very flexible by the user and stored as report-preset.

## Example

```
Item Value
Name Nordostschweiz
Created on 19.01.2012 10:51:55
Last Change 23.01.2012 17:28:01
# Flight plans 3
# AOIs 15
# Lines 251
# Events 8079
Total Line Length [km] 16230.2
Min GSD [cm] 11
Max GSD [cm] 50

List of AOIs from Flight Plan - [Toggenburg]
Name Type AOI Area [km^2] # Active Lines # Active Events Line Direction [deg] Active Line Length [km] Min GSD [cm] Max GSD [cm]
A01 AOI 319.0 25 737 90.0 653.79 11 25
A02 Corridor 21.5 11 92 95.6 105.64 22 25
A04 AOI 395.6 4 58 92.8 141.23 45 50
A03 AOI 482.0 7 142 90.0 206.72 27 30
A05 AOI 344.2 4 50 61.1 122.78 47 50

List of Flight Lines from AOI - [A01]
AOI Flight Line Label Status Line Direction [deg] Length [km] Alt MSL [ft] Min Alt AGL [m] Max Alt AGL [m] Min GSD [cm] Max GSD [cm]
A01 001 Active 90.6 34.10 14886 3003.14 4107.14 18 25
A01 002 Active 90.6 34.94 14872 3091.14 4107.14 19 25
A01 003 Active 90.6 35.00 14872 3000.14 4107.14 18 25
A01 004 Active 90.6 34.47 14872 2629.14 4107.14 16 25
A01 005 Active 90.6 34.30 14872 2628.14 4107.14 16 25
A01 006 Active 90.6 33.99 14872 2628.14 4107.14 16 25
A01 007 Active 90.6 33.43 14872 2628.14 4107.14 16 25
A01 008 Active 90.6 33.19 14872 2628.14 4107.14 16 25
.
.

List of Flight Lines from AOI - [A02]
AOI Flight Line Label Status Line Direction [deg] Length [km] Alt MSL [ft] Min Alt AGL [m] Max Alt AGL [m] Min GSD [cm] Max GSD [cm]
A02 002 Active 336.4 10.22 14800 3846.17 4107.17 23 25
A02 003 Active 79.4 11.71 14800 3929.17 4107.17 24 25
A02 004 Active 89.0 9.33 14834 3852.42 4107.42 23 25
A02 005 Active 122.3 9.33 14867 3854.46 4107.46 23 25
A02 006 Active 138.6 6.65 15001 3873.41 4107.41 24 25
A02 007 Active 104.5 7.91 15077 3899.43 4107.43 24 25
.
.

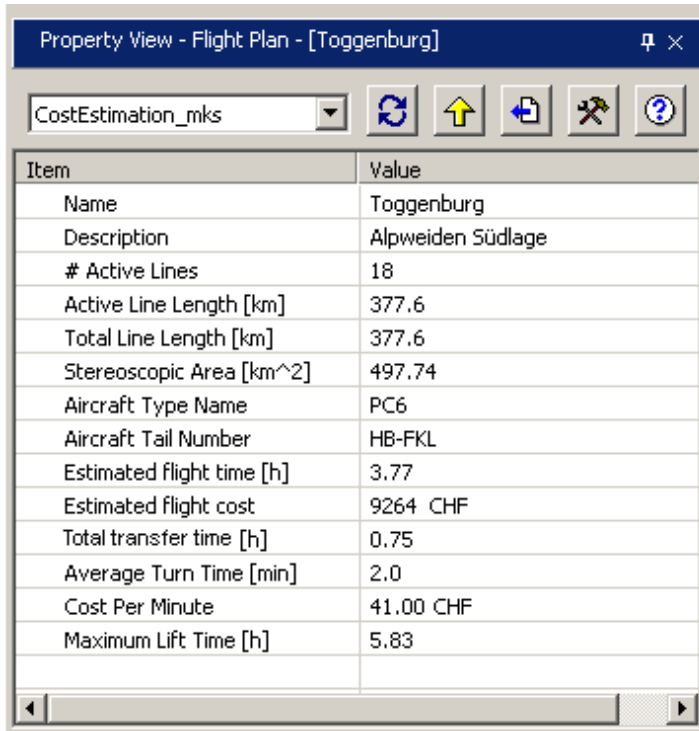
List of Flight Lines from AOI - [A04]
AOI Flight Line Label Status Line Direction [deg] Length [km] Alt MSL [ft] Min Alt AGL [m] Max Alt AGL [m] Min GSD [cm] Max GSD [cm]
A04 002 Active 92.9 35.49 28239 7381.29 8214.29 45 50
A04 003 Active 92.9 35.43 28269 7390.29 8214.29 45 50
.
.

List of Flight Lines from AOI - [A03]
AOI Flight Line Label Status Line Direction [deg] Length [km] Alt MSL [ft] Min Alt AGL [m] Max Alt AGL [m] Min GSD [cm] Max GSD [cm]
A03 A03 Active 90.6 29.71 17298 4558.57 4928.57 28 30
A03 A04 Active 90.6 29.26 17302 4476.57 4928.57 27 30
A03 A05 Active 90.6 28.90 17331 4416.57 4928.57 27 30
A03 A06 Active 90.6 28.94 17354 4423.57 4928.57 27 30
A03 A09 Active 90.6 30.30 17417 4406.57 4928.57 27 30
.
.
```

## Creating Image Station Project out of Leica Mission Pro

Leica MissionPro features creating the ImageStation Photogrammetric Manager (ISPM) files used by Intergraph's orientation, compilation, and orthophoto software.

## Flying cost and flying time estimation



Item	Value
Name	Toggenburg
Description	Alpweiden Südlage
# Active Lines	18
Active Line Length [km]	377.6
Total Line Length [km]	377.6
Stereoscopic Area [km <sup>2</sup> ]	497.74
Aircraft Type Name	PC6
Aircraft Tail Number	HB-FKL
Estimated flight time [h]	3.77
Estimated flight cost	9264 CHF
Total transfer time [h]	0.75
Average Turn Time [min]	2.0
Cost Per Minute	41.00 CHF
Maximum Lift Time [h]	5.83

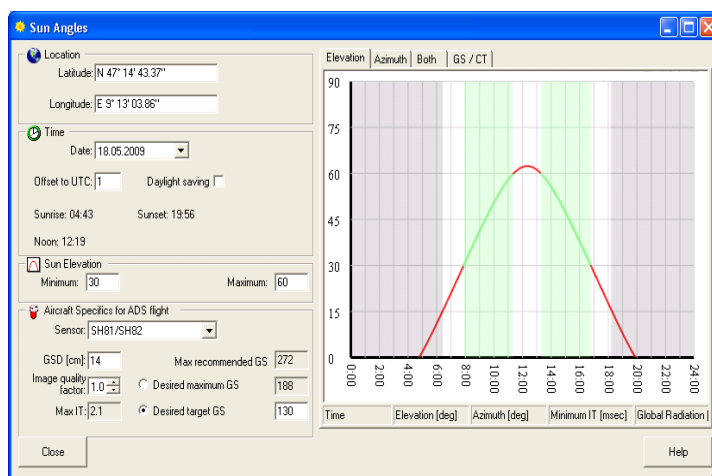
From the MissionPro database select the aircraft and assign it to the flight plan. Leica MissionPro calculates the estimated flying time and cost to fly by taking the aircraft data as well as flight plan data into account.

## Integrated utilities

Several useful utilities are integrated in Leica MissionPro:

- Sun Angles
- AeroPlan70
- Georeferencing Tool
- Leica FCMS In-flight map transformation editor
- Projection Chooser
- SRTM Converter
- RINEX Conversion

### SunAngles



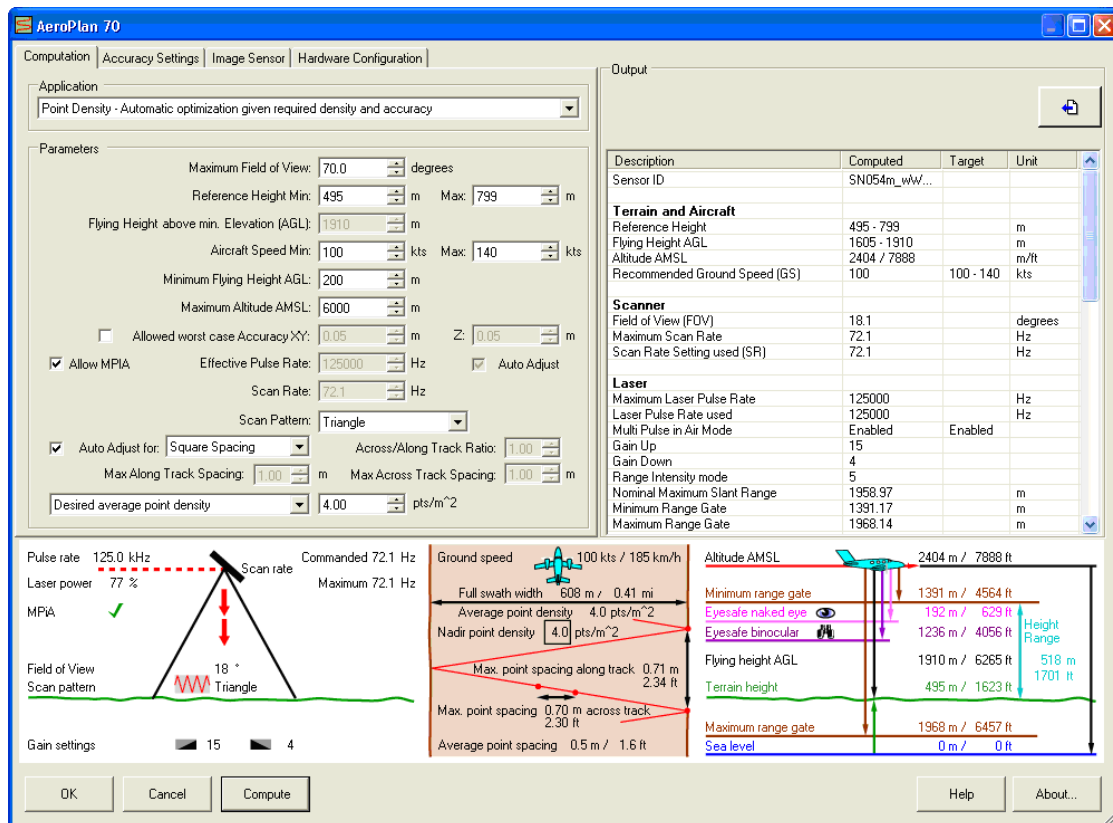
Determination of the flight window in advance is important when flying in northern countries, or during days of the year where the sun angle is critical for aerial photography.

The Sun Angles tool integrated in Leica MissionPro displays sun elevation, azimuth and flight window for the location of the flight line at the desired flying date.

A prediction of the flight window and expected Integration Time for image data acquisition with Leica ADS80 or RCD30 is also implemented.



## AeroPlan70



AeroPlan70 is used in the flight planning to determine the operation settings needed for an ALS LiDAR acquisition mission. In AeroPlan70 the user chooses the type of LiDAR application for automatic setup:

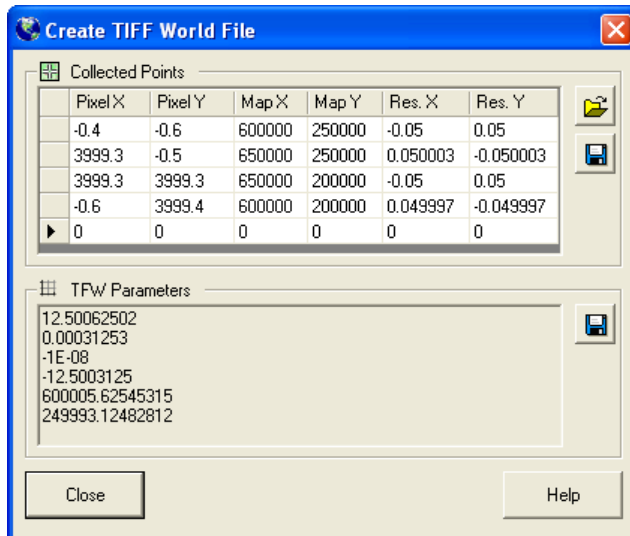
- Point Spacing - Automatic optimization given required spacing and accuracy
  - Useful for large regional projects
- Point Density - Automatic optimization given required density and accuracy
  - Useful for large regional projects
- Point Spacing / fix FOV – Optimization for point spacing with fixed FOV
  - Useful for city mapping to ensure coverage of “urban canyon” floor or for dual sensor flight planning to ensure coordinated coverage when using an attached frame camera
- Point Density / fix FOV - Optimization for Point Density with fixed FOV
  - Useful for forest mapping, where limiting off-nadir angle maximizes forest canopy penetration or for dual sensor flight planning to ensure coordinated coverage when using an attached frame camera

Also manual setup is selectable.

If AeroPlan70 is started within Leica MissionPro, input parameters are taken over to AeroPlan70 and the ALS settings are then passed back to Leica MissionPro. Then, the planning in Leica MissionPro continues with the flight line layout design. Leica MissionPro features automatic computation of the LiDAR settings (FOV, swath) individually for each line of an AOI. Depending on the terrain, using individual line settings can result in 20% fewer flight lines.

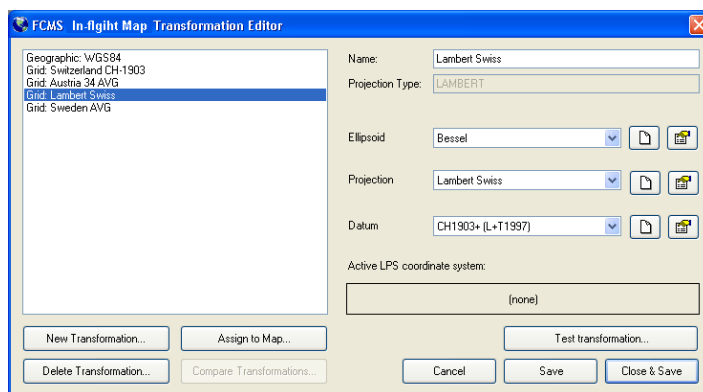
All Leica ALS settings are stored in the MissionPro/FCMS flight plan file (\*.fpd). During flight execution with the Flight & Sensor Control Management System Leica FCMS 3.1x or higher, the ALS is automatically configured and released according to the flight plan.

## Georeferencing Tool



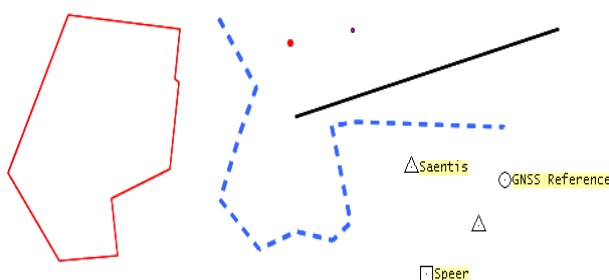
The Georeferencing Tool is used to georeference a map in TIFF format and create the corresponding TFW file.

## In-flight map transformation editor



The In-flight map transformation editor is used to create a transformation information file. This file is required during flight execution with Leica FCMS to display on the map layer georeferenced maps.

## Drawing tools



The drawing tools in Leica MissionPro allows the drawing of graphic objects like

- Polygon
- Polyline
- Line
- Point
- Ground Control Point of various types

The object appearance can be freely defined. The objects are stored with the project.

It is also possible to load objects from a project stored in the flight plan database.