

# Planning complex flight plans for drones using gvSIG

**Cálculo de plans de vuelo complejos para  
aviones no tripulados**

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# DRONES – Unmanned Aerial Vehicles

- remotely controlled flying vehicles
- drones fly autonomously through software-controlled flight plans integrated in the system and communicating with the mounted GPS
- often associated with military use, but have many other applications:

environment  
monitoring

search &  
rescue

precision  
agriculture

forest  
fires

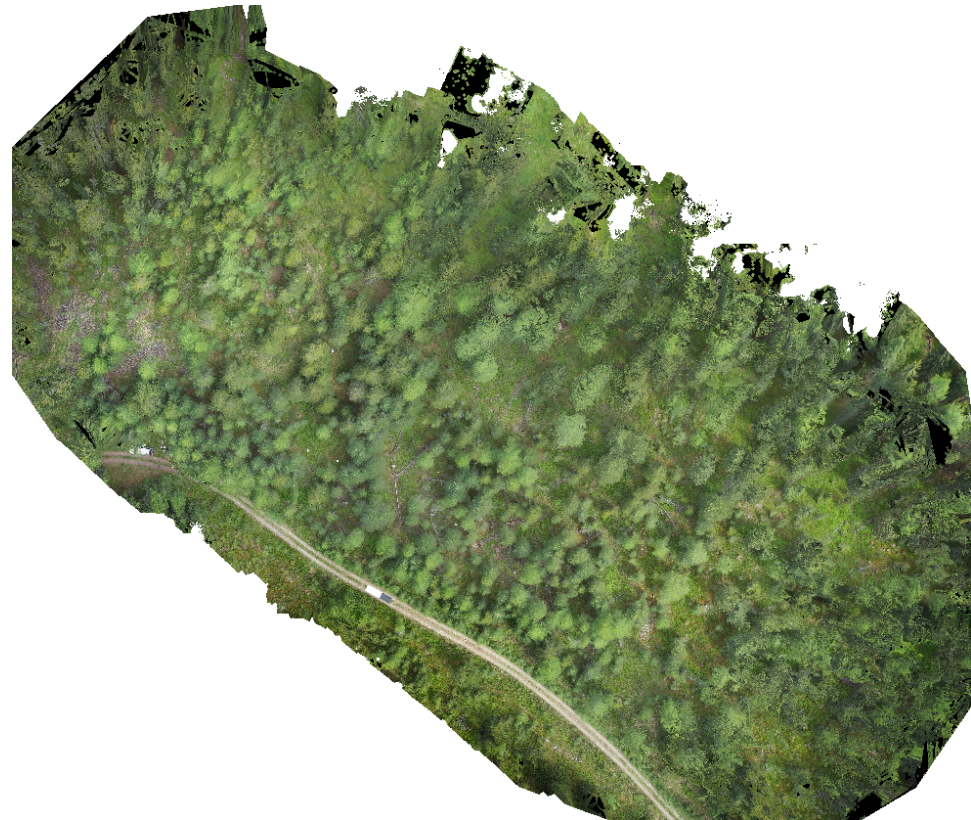
traffic  
monitoring



# MONITORING WITH DRONES

- install a camera for aerial photography or videography
- install more than one camera or use of ground control points for generating point clouds (with elevation) from images (DSM+DTM)

# MONITORING WITH DRONES



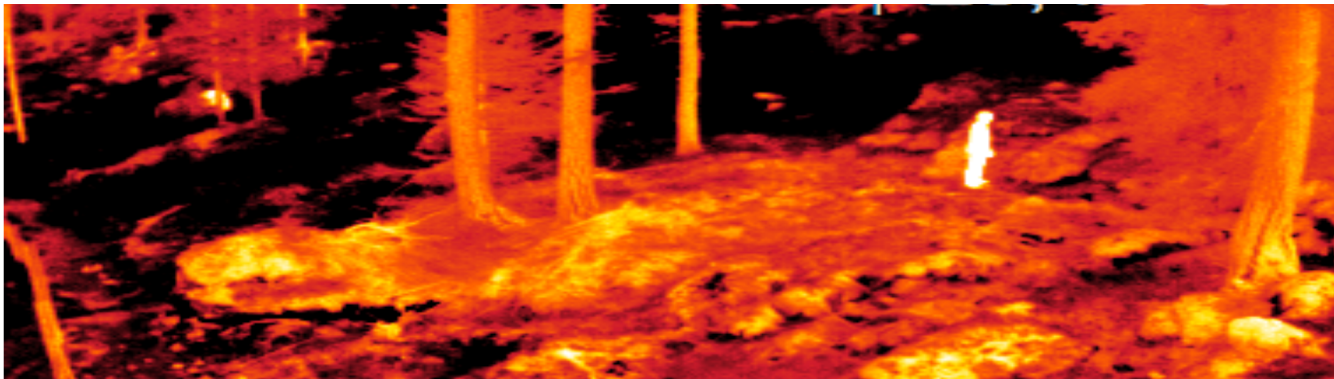




# MONITORING WITH DRONES

- install a camera for aerial photography or videography
- install more than one camera or use of ground control points for generating point clouds (with elevation) from images (DSM+DTM)
- install a thermal camera to discover objects – persons - animals in forests, solar panel surveys, loss of energy in buildings, fire-maps
- install special sensors (limited dimensions and weight):
  - LiDAR
  - magnetometer
  - special instruments to carry and distribute things

# MONITORING WITH DRONES





# REGULATION ON DRONES

- must stay within the operator's line of sight or at a maximum fixed distance (500 m)
- can not fly over a maximum height from the terrain (150 m)
- more than 5 km away from airports and air traffic
- prohibit to fly over defined areas (populated zones, zone with privacy restrictions, zone with particular emissions)



# FLIGHT PLANS FOR DRONES

- the piloting control can be:
  - fully automatic
  - partially automatic
  - manual
- flight plans are generated with external software and must consider:
  - legislation rules
  - morphology of the terrain (slope)
  - presence of obstacles
  - specific sensors or survey needs



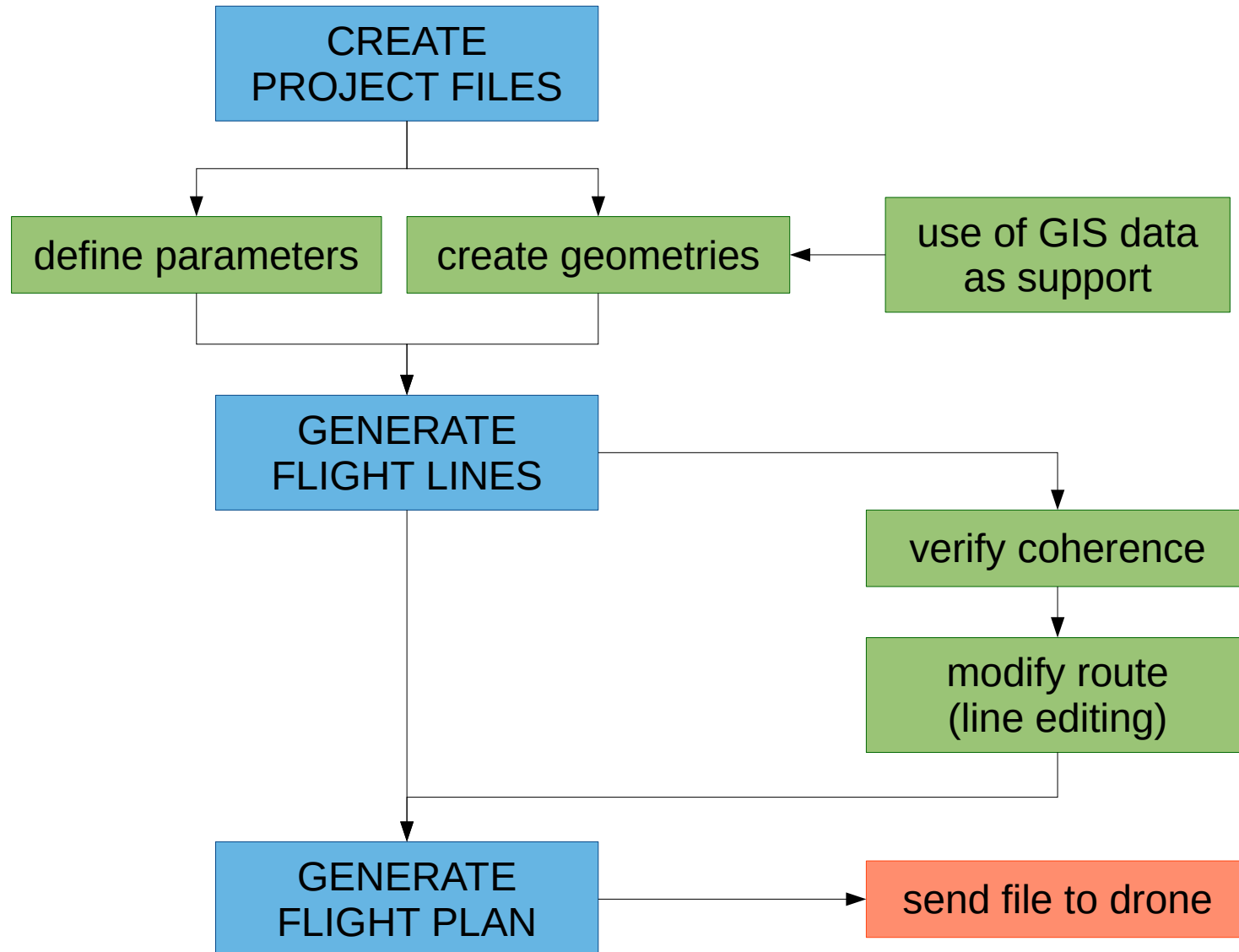


# JGRASSTOOLS: DRONEPLANNER

- GIS tools to generate flight plans for drones
  - photogrammetry and magnetism
- GUI is integrated in gvSIG2.3
  - use of geospatial supported data types
  - possibility to edit and define elements
  - interaction between the tools and the layers loaded in the view
  - results are automatically visualized in the map, possibility to check and verify them
  - generate the flight plan ready to be sent to the drone (file format)

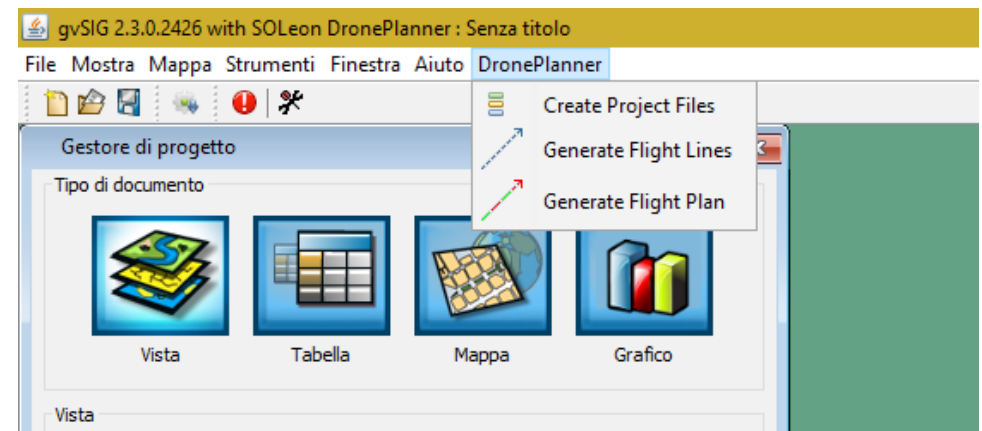
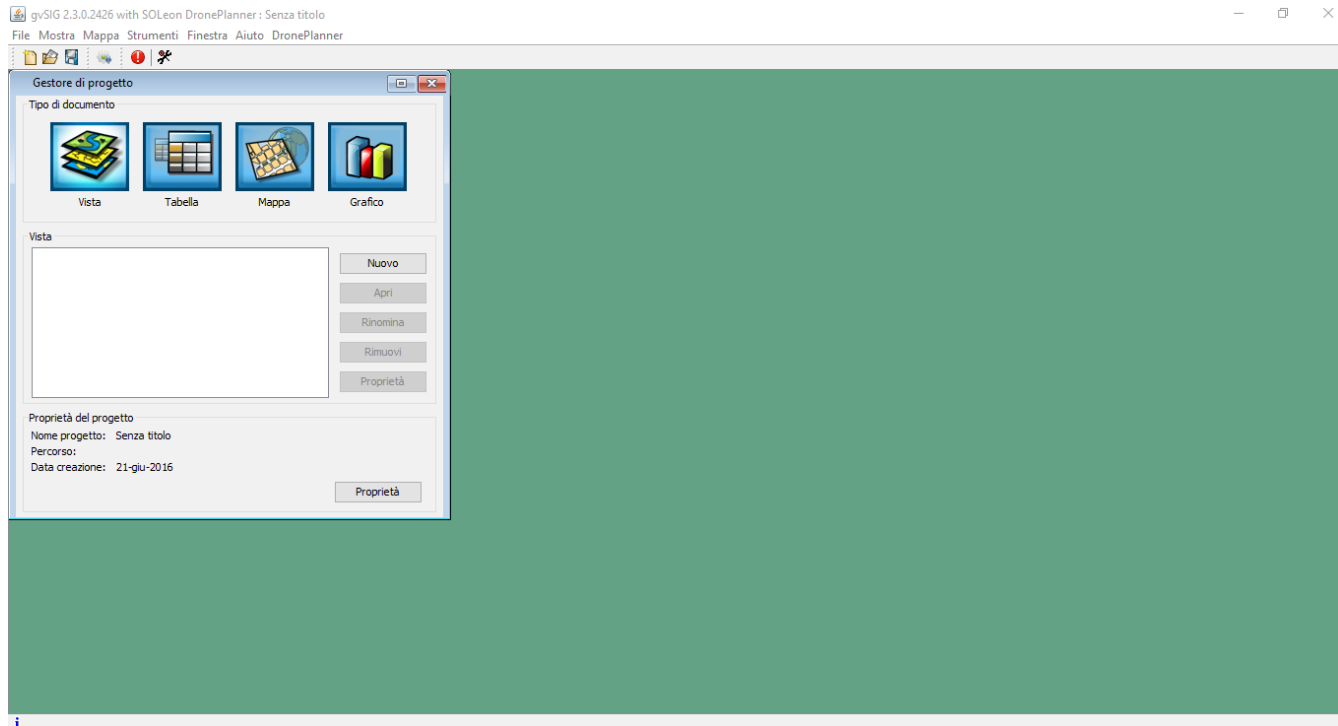
# JGRASSTOOLS: DRONEPLANNER

## WORKFLOW





# JGRASSTOOLS: DRONEPLANNER





# DronePlanner: CREATE PROJECT FILES

- create a new project and a new view for the data
- create and save spatial layers with specific geometries and attributes
- 5 step procedure:





# JGRASSTOOLS FOR DRONES

1)define the path where to store the data

Create Project Files

Output Path

Projection

Project Type: Photogrammetry

Ok Cancel

2)define the spatial projection

Select a projection.

CRS e trasformazioni

Tipo: EPSG

Criterio di ricerca: ☐ Per codice ☐ Per nome ☒ Per area

Cerca: italy

Codice	Nome	Tipo	Area	Descrizione
4230	ED50	geographic 2D	Europe - ED50 by country	Europe - west: Andorra; Cyprus; Denmark
23032	ED50 / UTM zone 32N	projected	Europe - 6°E to 12°E and ...	Europe - between 6°E and 12°E - Denmark
23033	ED50 / UTM zone 33N	projected	Europe - 12°E to 18°E an...	Europe - between 12°E and 18°E onshore
23034	ED50 / UTM zone 34N	projected	Europe - 18°E to 24°E an...	Europe - between 18°E and 24°E - Greece
4258	ETRS89	geographic 2D	Europe - ETRS89	Europe - onshore and offshore: Albania; A
3035	ETRS89 / LAEA Europe	projected	Europe - ETRS89	Europe - onshore and offshore: Albania; A
3034	ETRS89 / LCC Europe	projected	Europe - ETRS89	Europe - onshore and offshore: Albania; A
4670	IGM95	geographic 2D	Italy - including San Marin...	Italy - onshore and offshore; San Marino,
3064	IGM95 / UTM zone 32N	projected	Italy - west of 12°E	Italy - onshore and offshore - west of 12°
3065	IGM95 / UTM zone 33N	projected	Italy - east of 12°E	Italy - onshore and offshore - east of 12°
4265	Monte Mario	geographic 2D	Italy - including San Marin...	Italy - onshore and offshore; San Marino,
4806	Monte Mario (Rome)	geographic 2D	Italy - including San Marin...	Italy - onshore and offshore; San Marino,
3003	Monte Mario / Italy zone 1	projected	Italy - west of 12°E	Italy - onshore and offshore - west of 12°
3004	Monte Mario / Italy zone 2	projected	Italy - east of 12°E	Italy - onshore and offshore - east of 12°
5659	Monte Mario / TM Emilia-R...	projected	Italy - Emilia-Romagna	Italy - Emilia-Romagna region.
6706	RDN2008	geographic 2D	Italy - including San Marin...	Italy - onshore and offshore; San Marino,

Selezione trasformazione: Senza trasformazione

Annulla Indietro Avanti Fine

3)select project type

Create Project Files

Output Path: D:\lavori\_tmp\soleon\_test01

Projection: EPSG:32632

Project Type: Photogrammetry

Ok Cancel



# DronePlanner: CREATE PROJECT FILES

## 4) define general parameters for the flight

**Magnetism Project Parameters**

General Parameters of Flight Plan		Magnetism Parameters	
Radius [m]	10	Altitude [m]	25
Follow Terrain	yes	Flight direction border distance [m]	-10
ClimbRate [m/s]	3	Start/Stop distance from border [m]	-10
Delay Time [s]	0	Flight lines distance [m]	18
WP Event Channel Value	100		
Heading [degrees]	-1		
Speed [m/s]	5		
CAM-Nick	0		
Autotriggering	yes		
Flight Time [min]	12		
RTL Point	yes		
Autopilot Type	mikrokopter		
Delta H [m]	30		

Ok Cancel



# DronePlanner: CREATE PROJECT FILES

5) define specific parameters for the project type

The screenshot displays two overlapping dialog boxes from the DronePlanner software. The background dialog is titled "Magnetism Project Parameters" and contains two sections: "General Parameters of Flight Plan" and "Magnetism Parameters". The foreground dialog is titled "Photogrammetry Parameters" and contains "Camera Parameters".

**Magnetism Project Parameters**

**General Parameters of Flight Plan**

Parameter	Value
Radius [m]	10
Follow Terrain	yes
ClimbRate [m/s]	3
Delay Time [s]	0
WP Event Channel Value	100
Heading [degrees]	-1
Speed [m/s]	5
CAM-Nick	0
Autotriggering	yes
Flight Time [min]	12
RTL Point	yes
Autopilot Type	mikrokopter
Delta H [m]	30

**Magnetism Parameters**

Parameter	Value
Altitude [m]	25
Flight direction border distance [m]	-10
Start/Stop distance from border [m]	-10
Flight lines distance [m]	18

**Photogrammetry Parameters**

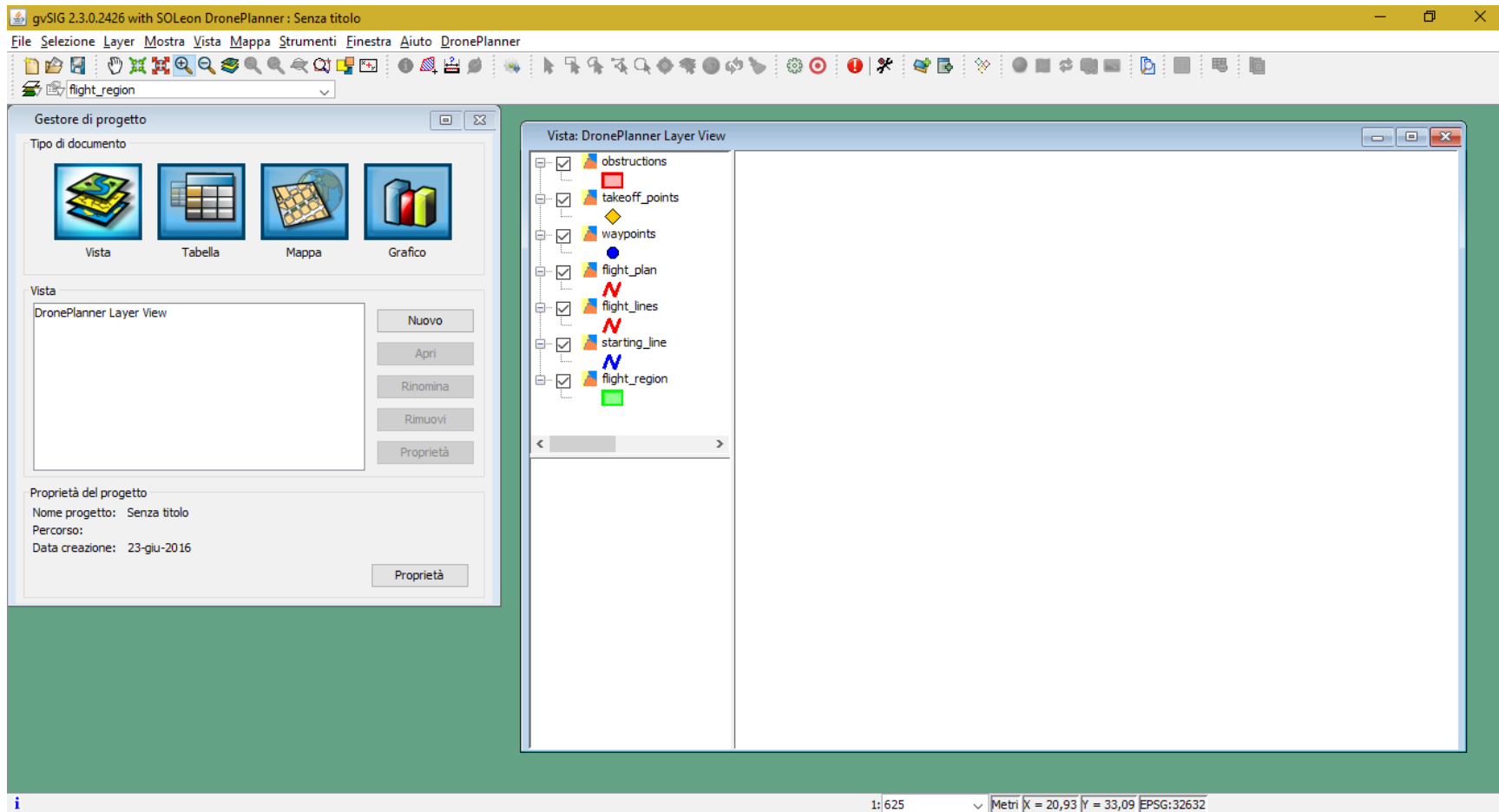
**Camera Parameters**

Parameter	Value
Altitude [m]	
Overlap [%]	80
Sidelap [%]	80
Desired Precision [cm]	
camera	Alpa Aptus75
Focal Length [mm]	
Image Width [pixels]	6666.0
Image height [pixels]	4992.0
Sensor Width [mm]	47.995
Sensor Height [mm]	35.942

Precision [x, y, z] = []



# DronePlanner: CREATE PROJECT FILES







## i





# CreateProjectFiles: FLIGHT\_REGION

gvSIG 2.3.0.2426 with SOLeon DronePlanner: Senza titolo

File Modifica Selezione Mostra Tabella Vista Mappa Strumenti Finestra Aiuto DronePlanner

Gestore di progetto

Tipo di documento

Vista

DronePlanner Layer View

Nuovo  
Apri  
Rinomina  
Rimuovi  
Proprietà

Proprietà del progetto

Nome progetto: Senza titolo  
Percorso:  
Data creazione: 23-giu-2016

Proprietà

Tabella degli attributi: flight\_region

	descr	area	perimeter	note
1		18.934,132	585,239	

0 / 1 righe selezionate.

Vista: DronePlanner Layer View

- ☒ obstructions
- ☒ takeoff\_points
- ☒ waypoints
- ☒ flight\_lines
- ☒ starting\_line
- ☒ flight\_region
- ☒ testarea\_small
- ☒ dtm50m

Metri X = 703.326,82 Y = 5.181.440,95 EPSG:32632



# CreateProjectFiles: STARTING\_LINE

gvSIG 2.3.0.2426 with SOLeon DronePlanner : soleon01.gvsproj

File Modifica Selezione Mostra Tabella Vista Mappa Strumenti Finestra Aiuto DronePlanner

Gestore di progetto

Tipo di documento

Vista

DronePlanner Layer View

Nuovo  
Apri  
Rinomina  
Rimuovi  
Proprietà

Proprietà del progetto

Nome progetto: Senza titolo  
Percorso: D:\lavori\_tmp\gvSIG\_projects\soleon01.gvsproj  
Data creazione: 23-giu-2016

Proprietà

Tabella degli attributi: flight\_region

	descr	area	perimeter	note
1		18.833,164	602,934	

0 / 1 righe selezionate.

Vista: DronePlanner Layer View

- obstructions
- takeoff\_points
- waypoints
- flight\_lines
- starting\_line
- flight\_region
- testarea\_small

Tabella degli attributi: starting\_line

sta	radius	flterrain	climb	delayt	heading	fspeed	camnick	flightt	rtpoint	autopilot	deltah	altitude	distbord	diststart	distines
1	10	yes	3,000	0	-1	5,000	0	12	yes	mikrokopter	30	25	-10,000	-10,000	18,000

0 / 1 righe selezionate.

Metri X = 703.223,2 Y = 5.181.486,27 EPSG:32632





# CreateProjectFiles: OBSTRUCTIONS

gvSIG 2.3.0.2426 with SOLeon DronePlanner : Senza titolo

File Selezione Layer Mostra Vista Mappa Strumenti Finestra Aiuto DronePlanner

obstructions

Gestore di progetto

Tipo di documento

Vista

DronePlanner Layer View

Nuovo

Apri

Rinomina

Rimuovi

Proprietà

Proprietà del progetto

Nome progetto: Senza titolo

Percorso:

Data creazione: 24-giu-2016

Proprietà

Tabella degli attributi: obstructions

obst	height	notes
1	100,000	
2	30,000	

0 / 2 righe selezionate.

Vista: DronePlanner Layer View

obstructions

takeoff\_points

waypoints

flight\_lines

starting\_line

flight\_region

testarea\_small

dtmSp0m

1: 1.765

0/2 Metri X = 703.217,57 Y = 5.181.616,2 EPSG:32632





# DronePlanner: GENERATE FLIGHT LINE

gvSIG 2.3.0.2426 with SOLeon DronePlanner : soleon01.gvsproj

File Modifica Selezione Mostra Tabella Vista Mappa Strumenti Finestra Aiuto DronePlanner

**Gestore di progetto**

Tipo di documento

Vista

DronePlanner Layer View

Nuovo  
Apri  
Rinomina  
Rimuovi  
Proprietà

Proprietà del progetto

Nome progetto: Senza titolo  
Percorso: D:\lavori\_tmp\gvSIG\_projects\soleon01.gvsproj  
Data creazione: 23-giu-2016

Proprietà

**Tabella degli attributi: flight\_region**

	descr	area	perimeter	note
1		18.833,164	602,934	

0 / 1 righe selezionate.

**Vista: DronePlanner Layer View**

- ☒ obstructions
- ☒ takeoff\_points
- ☒ waypoints
- ☒ flight\_lines
- ☒ starting\_line
- ☒ flight\_region
- ☒ testarea\_small

**Tabella degli attributi: starting\_line**

sta	radius	flterrain	climb	delayt	heading	fspeed	camnick	flightt	rtpoint	autopilot	deltah	altitude	distbord	diststart	distines
1	10	yes	3,000	0	-1	5,000	0	12	yes	mikrokopter	30	25	-10,000	-10,000	18,000

0 / 1 righe selezionate.

Metri X = 703.190,76 Y = 5.181.905,54 EPSG:32632



# DronePlanner: **GENERATE FLIGHT PLANS**

- modify starting line and flight line before generating the flight plans
- takeoff\_points:
  - if no takeoff points are specified in the layer → unique takeoff point for all the flights at the first point of the flight line
  - if one or more takeoff points are specified in the layer → for each takeoff point the program generates two flights in the two opposite directions from the points on the flight line



# DronePlanner: GENERATE FLIGHT PLANS

gvSIG 2.3.0.2426 with SOLeon DronePlanner: Senza titolo

File Selezione Layer Mostra Vista Mappa Strumenti Finestra Aiuto DronePlanner

Gestore di progetto

Tipo di documento

Vista

DronePlanner Layer View

Nuovo

Tabella degli attributi: waypoints

way	id	flightid	latitude	longitude	altitude	dtm_elev	progtme	distance	azimuth
1	10_F	5.181.719,041	703.299,355	23,820	862,510	5	12,200	223	
2	20_F	5.181.676,388	703.258,480	24,190	862,880	17	59,000	118	
3	30_F	5.181.667,466	703.274,861	23,560	862,250	21	18,600	43	
4	40_F	5.181.714,779	703.320,202	23,340	862,030	34	65,500	101	
5	50_F	5.181.710,518	703.341,050	23,140	861,830	38	21,200	223	
6	60_F	5.181.658,945	703.291,242	23,310	862,000	52	71,900	118	
7	70_F	5.181.649,623	703.307,623	23,250	861,940	56	18,600	43	
8	80_F	5.181.706,256	703.361,897	22,450	861,140	72	78,400	99	
9	90_F	5.181.702,811	703.383,527	21,760	860,450	76	21,900	223	
10	100_F	5.181.640,701	703.324,004	22,440	861,130	93	86,000	118	
11	110_F	5.181.631,779	703.340,385	20,640	859,330	97	18,700	43	
12	120_F	5.181.695,730	703.401,672	20,900	859,590	115	88,500	111	
13	130_F	5.181.688,649	703.419,817	20,560	859,250	119	19,400	223	
14	140_F	5.181.622,857	703.356,766	19,940	858,630	137	91,100	118	
15	150_F	5.181.613,936	703.373,147	18,590	857,280	141	18,700	43	
16	160_F	5.181.681,568	703.437,962	20,220	859,910	160	93,600	128	
17	170_F	5.181.670,246	703.452,043	20,330	859,020	164	18,000	223	
18	180_F	5.181.605,014	703.389,528	17,500	856,190	182	90,300	118	
19	190_F	5.181.596,092	703.405,910	16,660	855,350	186	18,600	43	
20	200_F	5.181.640,005	703.447,993	19,590	858,280	198	60,800	187	
21	210_F	5.181.609,764	703.443,943	18,140	856,830	204	30,500	223	
22	220_F	5.181.587,170	703.422,291	16,010	854,700	210	31,300	318	
23	230_F	5.181.730,379	703.295,005	25,000	863,690	248	191,800	138	

1 / 23 righe selezionate.

Vista: DronePlanner Layer View

- obstructions
- takeoff\_points
- waypoints
- flight\_lines
- starting\_line
- flight\_region
- testarea\_small
- dtmSp0m

1: 1.324 1/23 Metri X = 703.355,25 Y = 5.181.529,31 EPSG:32632



# DronePlanner: GENERATE FLIGHT PLANS

gvSIG 2.3.0.2426 with SOLeon DronePlanner: Senza titolo

File Selezione Layer Mostra Vista Mappa Strumenti Finestra Aiuto DronePlanner

Gestore di progetto

Tipo di documento

Vista

DronePlanner Layer View

Nuovo

Tabella degli attributi: waypoints

	id	flightid	latitude	longitude	altitude	dtm_elev	proptime	distance	azimuth
1	110_F	5.181.702,811	703.383,527	23,750	860,450	6	19,800	223	
2	210_F	5.181.640,701	703.324,004	24,430	861,130	23	86,000	118	
3	310_F	5.181.631,779	703.340,385	22,630	859,330	27	18,700	43	
4	410_F	5.181.695,730	703.401,672	22,890	859,590	45	88,500	111	
5	510_F	5.181.688,649	703.419,817	22,550	859,250	49	19,400	223	
6	610_F	5.181.622,857	703.356,766	21,930	858,630	67	91,100	118	
7	710_F	5.181.613,936	703.373,147	20,580	857,280	71	18,700	43	
8	810_F	5.181.681,568	703.437,962	22,210	858,910	90	93,600	128	
9	910_F	5.181.670,246	703.452,043	22,320	859,020	94	18,000	223	
10	1010_F	5.181.605,014	703.389,528	19,490	856,190	112	90,300	118	
11	1110_F	5.181.596,092	703.405,910	18,650	855,350	116	18,600	43	
12	1210_F	5.181.640,005	703.447,993	21,580	858,280	128	60,800	187	
13	1310_F	5.181.609,764	703.443,943	20,130	856,830	134	30,500	223	
14	1410_F	5.181.587,170	703.422,291	18,000	854,700	140	31,300	341	
15	1510_F	5.181.721,622	703.377,323	25,000	861,700	168	141,900	161	
16	110_B	5.181.702,811	703.383,527	23,750	860,450	6	19,800	229	
17	210_B	5.181.706,256	703.361,897	24,440	861,140	10	21,900	223	
18	310_B	5.181.649,623	703.307,623	25,240	861,940	26	78,400	298	
19	410_B	5.181.658,545	703.291,242	25,300	862,000	30	18,600	43	
20	510_B	5.181.710,518	703.341,050	25,130	861,830	44	71,900	281	
21	610_B	5.181.714,779	703.320,202	25,330	862,030	48	21,200	223	
22	710_B	5.181.667,466	703.274,861	25,550	862,250	61	65,500	298	
23	810_B	5.181.676,388	703.258,480	26,180	862,880	65	18,600	43	
24	910_B	5.181.719,041	703.299,355	25,810	862,510	77	59,000	88	
25	1010_B	5.181.721,622	703.377,323	25,000	861,700	93	78,000	268	

2 / 25 righe selezionate.

Vista: DronePlanner Layer View

- obstructions
- takeoff\_points
- waypoints
- flight\_lines
- starting\_line
- flight\_region
- testarea\_small
- dtmSp0m

1: 1.324 2/25 Metri X = 703.357,36 Y = 5.181.536,67 EPSG:32632





# DronePlanner: GENERATE FLIGHT PLANS

gvSIG 2.3.0.2426 with SOLeon DronePlanner : Senza titolo

File Selezione Layer Mostra Vista Mappa Strumenti Finestra Aiuto DronePlanner

Gestore di progetto

Tipo di documento

Vista

DronePlanner Layer View

Nuovo

Tabella degli attributi: waypoints

way	id	flightid	latitude	longitude	altitude	dtm_elev	progrtime	distance	azimuth	type	notes
1	11	1	5.181.719...	703.299,355	23,760	862,510	7	24,400	223	0	
2	21	1	5.181.676...	703.258,480	24,130	862,880	19	59,000	118	0	
3	31	1	5.181.667...	703.274,861	23,500	862,250	23	18,600	43	0	
4	41	1	5.181.714...	703.320,202	23,280	862,030	36	65,500	101	0	
5	51	1	5.181.710...	703.341,050	23,080	861,830	40	21,200	223	0	
6	61	1	5.181.658...	703.291,242	23,250	862,000	54	71,900	118	0	
7	71	1	5.181.649...	703.307,623	23,190	861,940	58	18,600	43	0	
8	81	1	5.181.705...	703.361,897	22,390	861,140	74	78,400	99	0	
9	91	1	5.181.702...	703.383,527	21,700	860,450	78	21,900	223	0	
10	101	1	5.181.640...	703.324,004	22,380	861,130	95	86,000	118	0	
11	111	1	5.181.631...	703.340,385	20,580	859,330	99	18,700	43	0	
12	121	1	5.181.695...	703.401,672	20,840	859,590	117	88,500	111	0	
13	131	1	5.181.688...	703.419,817	20,500	859,250	121	19,400	223	0	
14	141	1	5.181.622...	703.356,766	19,880	858,630	139	91,100	118	0	
15	151	1	5.181.613...	703.373,147	18,530	857,280	143	18,700	43	0	
16	161	1	5.181.630...	703.389,750	48,780	887,330	156	37,700	43	0	
17	171	1	5.181.681...	703.437,962	20,160	858,910	174	76,600	128	0	
18	181	1	5.181.670...	703.452,043	20,270	859,020	178	18,000	223	0	
19	191	1	5.181.630...	703.413,681	48,460	887,210	194	62,100	223	0	
20	201	1	5.181.614...	703.398,462	47,850	886,600	198	22,000	223	0	
21	211	1	5.181.605...	703.389,528	17,440	856,190	210	33,000	118	0	
22	221	1	5.181.596...	703.405,910	16,600	855,350	214	18,600	43	0	
23	231	1	5.181.640...	703.447,993	19,530	858,280	226	60,800	187	0	
24	241	1	5.181.609...	703.443,943	18,080	856,830	232	30,500	223	0	
25	251	1	5.181.587...	703.422,291	15,950	854,700	238	31,300	318	0	
26	261	1	5.181.614...	703.398,523	47,850	886,600	253	48,100	318	0	
27	271	1	5.181.625...	703.388,522	48,540	887,290	256	15,200	318	0	
28	281	1	5.181.659...	703.359,322	120,960	959,710	286	84,900	318	0	
29	291	1	5.181.665...	703.353,959	121,640	960,390	288	8,100	318	0	
30	301	1	5.181.740...	703.287,972	25,000	863,750	332	139,200	138	5	
31	12	2	5.181.609...	703.443,943	18,080	856,830	41	203,700	223	0	
32	22	2	5.181.587...	703.422,291	15,950	854,700	47	31,300	318	0	
33	32	2	5.181.614...	703.398,523	47,850	886,600	62	48,100	318	0	
34	42	2	5.181.625...	703.388,522	48,540	887,290	65	15,200	318	0	
35	52	2	5.181.659...	703.359,322	120,960	959,710	95	84,900	318	0	
36	62	2	5.181.665...	703.353,959	121,640	960,390	97	8,100	318	0	
37	72	2	5.181.740...	703.287,972	25,000	863,750	141	139,200	138	5	

0 / 37 righe selezionate.

1: 1.765 0/37 Metri X = 703.141,44 Y = 5.181.501,3 EPSG:32632



# DronePlanner: GENERATE FLIGHT PLANS

gvSIG 2.3.0.2426 with SOLeon DronePlanner: Senza titolo

File Selezione Layer Mostra Vista Mappa Strumenti Finestra Aiuto DronePlanner

Gestore di progetto

Tipo di documento

Vista

DronePlanner Layer View

Nuovo

Tabella degli attributi: waypoints

way	id	flightid	latitude	longitude	altitude	dtm_elev	proptime	distance	azimuth
1	110_F	5.181.702,811	703.383,527	23,750	860,450	6	19,800	223	
2	210_F	5.181.640,701	703.324,004	24,430	861,130	23	86,000	118	
3	310_F	5.181.631,779	703.340,385	22,630	859,330	27	18,700	43	
4	410_F	5.181.662,963	703.370,270	122,760	959,460	68	109,000	43	
5	510_F	5.181.695,730	703.401,672	22,890	859,590	109	109,600	111	
6	610_F	5.181.688,649	703.419,817	22,550	859,250	113	19,400	223	
7	710_F	5.181.622,857	703.356,766	21,930	858,630	131	91,100	118	
8	810_F	5.181.613,936	703.373,147	20,580	857,280	135	18,700	43	
9	910_F	5.181.637,480	703.395,711	51,060	887,760	149	44,600	43	
10	1010_F	5.181.642,249	703.400,281	51,080	887,780	150	6,600	43	
11	1110_F	5.181.681,568	703.437,962	22,210	858,910	166	61,600	128	
12	1210_F	5.181.670,246	703.452,043	22,320	859,020	170	18,000	223	
13	1310_F	5.181.639,733	703.422,802	50,840	887,540	184	50,900	223	
14	1410_F	5.181.626,368	703.409,993	50,330	887,030	188	18,500	223	
15	1510_F	5.181.605,014	703.389,528	19,490	856,190	202	42,700	118	
16	1610_F	5.181.596,092	703.405,910	18,650	855,350	206	18,600	43	
17	1710_F	5.181.640,005	703.447,993	21,580	858,280	218	60,800	187	
18	1810_F	5.181.609,764	703.443,943	20,130	856,830	224	30,500	223	
19	1910_F	5.181.587,170	703.422,291	18,000	854,700	230	31,300	341	
20	2010_F	5.181.626,368	703.409,181	50,330	887,030	245	52,400	341	
21	2110_F	5.181.642,249	703.403,869	51,080	887,780	248	16,700	341	
22	2210_F	5.181.721,622	703.377,323	25,000	861,700	268	87,600	161	
23	110_B	5.181.702,811	703.383,527	23,750	860,450	6	19,800	279	
24	210_B	5.181.706,256	703.361,897	24,440	861,140	10	21,900	223	
25	310_B	5.181.649,623	703.307,623	25,240	861,940	26	78,400	298	
26	410_B	5.181.658,945	703.291,242	25,300	862,000	30	18,600	43	
27	510_B	5.181.710,518	703.341,050	25,130	861,830	44	71,900	281	
28	610_B	5.181.714,779	703.330,202	25,330	862,030	48	21,200	223	
29	710_B	5.181.667,466	703.274,861	25,550	862,250	61	65,500	298	
30	810_B	5.181.676,388	703.258,480	26,180	862,880	65	18,600	43	
31	910_B	5.181.719,041	703.299,355	25,810	862,510	77	59,000	88	
32	1010_B	5.181.721,622	703.377,323	25,000	861,700	93	78,000	268	

2 / 32 righe selezionate.

Vista: DronePlanner Layer View

- obstructions
- takeoff\_points
- waypoints
  - 0\_B
  - 0\_F
- flight\_lines
- starting\_line
- flight\_region
- testarea\_small
- dtmSp0m

1: 1.765 2/32 Metri X = 703.419,55 Y = 5.181.484,83 EPSG:32632



# JGRASSTOOLS FOR DRONES

- the waypoints layer contain the points of:
  - change direction
  - change elevation for terrain morphology or obstacles
  - if specified also the triggering points
- the tool automatically creates also a **WPL** file for each flight ready to be sent to the drone



# THANKS FOR THE ATTENTION!

Homepage: <http://www.jgrasstools.org>

Need help? **Join the Mailinglist.**

<http://groups.google.com/group/jgrasstools>

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