



Geomatics and UAV Systems



Geomatics at the Politecnico di Torino

Politecnico di Torino is composed by Engineering and Architecture faculties.



In both faculties, there is a Geomatics research group, because it is an important topic for future engineers and architects.

Geomatics research group at the faculty of engineering



Ambrogio Manzino
Full Professor



Alberto Cina
Associate Professor



Andrea Lingua
Associate Professor



Tamara Bellone
Associate Professor



Paolo Maschio
Technician



Horea Bendea
Technician



Marco Piras
Research Associate

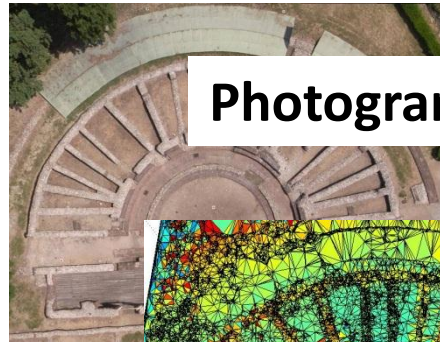


Paolo Dabove
Ph.D student

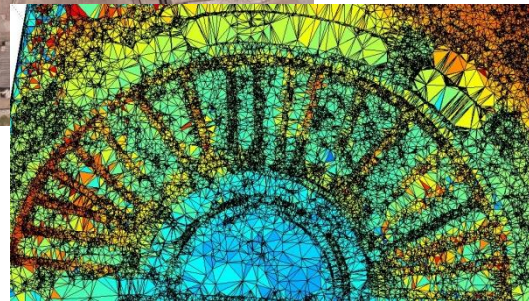
Geomatics research group : activities



**Satellite positioning
And Geodesy**



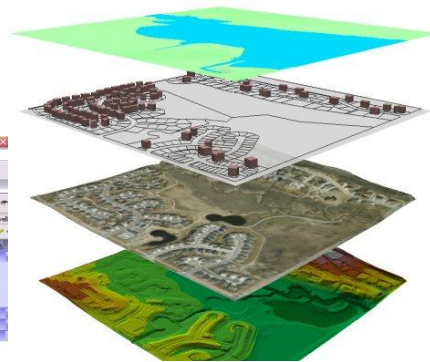
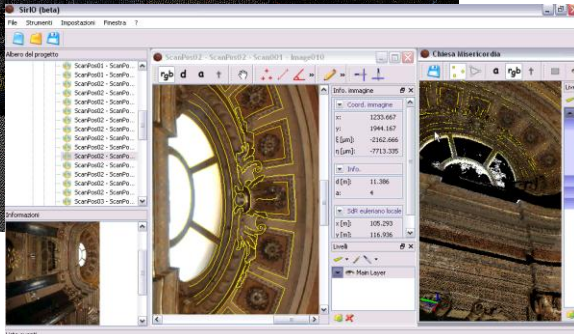
Photogrammetry



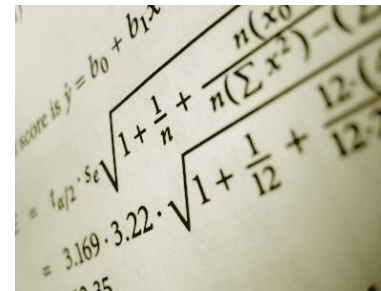
**Mobile mapping system
and navigation**



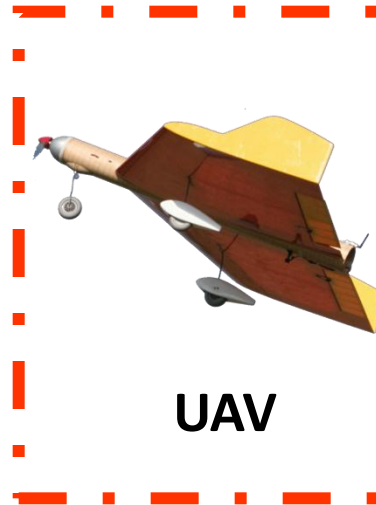
LiDAR



GIS



**Processing of
observations**



UAV

UAV – Hexacopter experience

Our UAV experience was started in 2008 and a low cost Hexacopter UAV system, but with a different structure was bought in 2010.



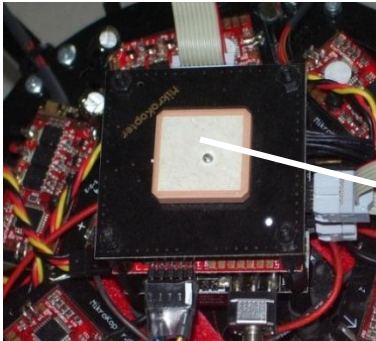
**GPS-board Mikrocopter
KGPS ver1.0 equipped with
the u-blox 6H sensor**

This is a commercial solution, where the single parts will be mounted by a ourselves. Engines and some electronic parts have been modified.

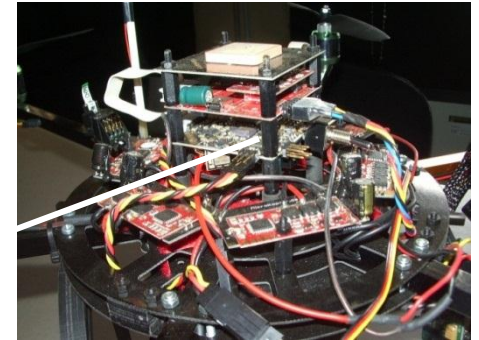
- low cost (< 2500€)
- transportability
- no expert pilot is required
- no runways are required
- vertical and standing flight are allowed
- time of flight (5-20 mins)

<http://www.mikrocopter.de>

UAV – Hexacopter experience

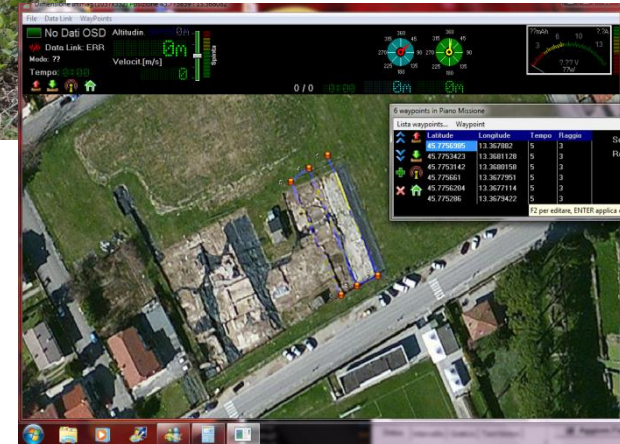


GPS antenna



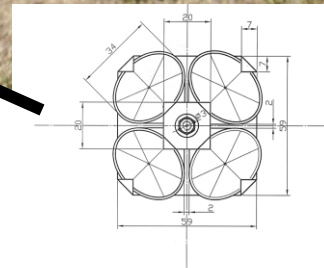
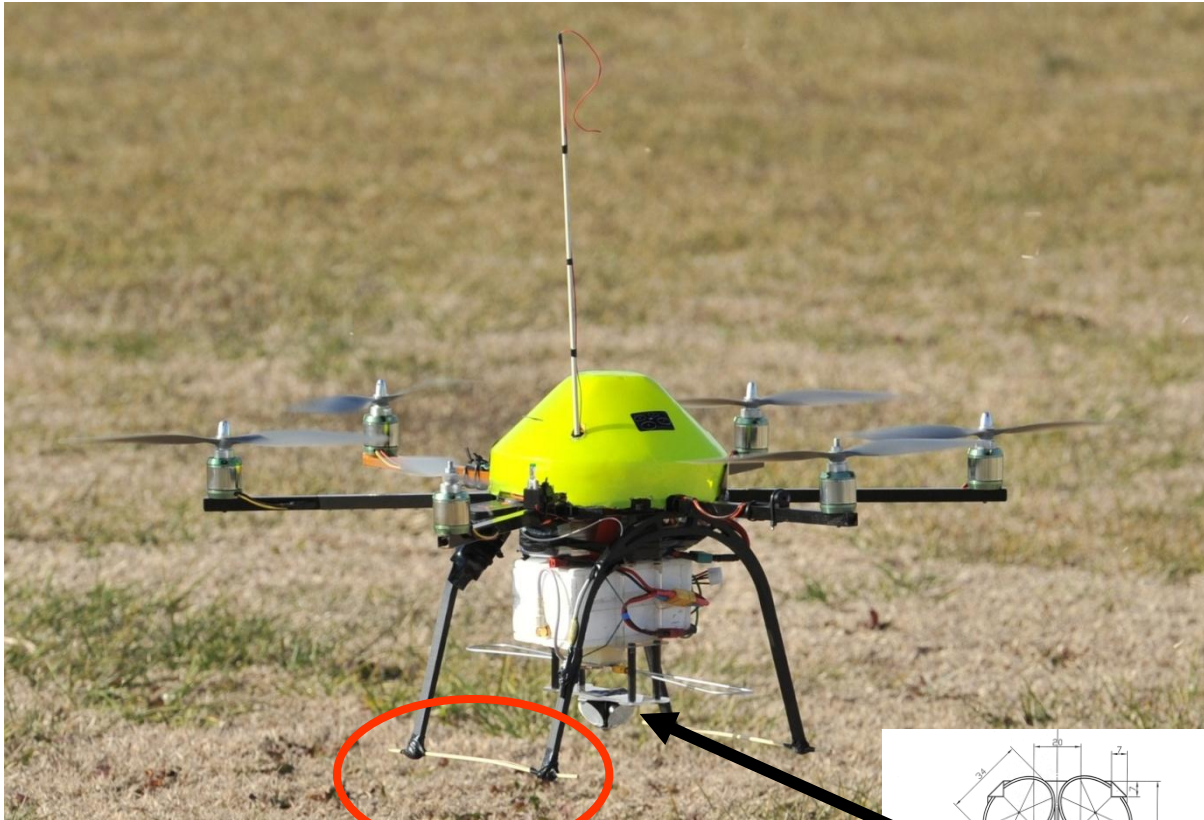
Navi control
(gyro, accelometers)

The UAV is able to do an autonomous fly, but the landing and take off have to be manually realized.



This system has a payload up to 1 kg, and an autonomy about 5-20 minutes (depends on the battery). **↑ payload** **↓ duration of fly**

Hexacopter: adapted version

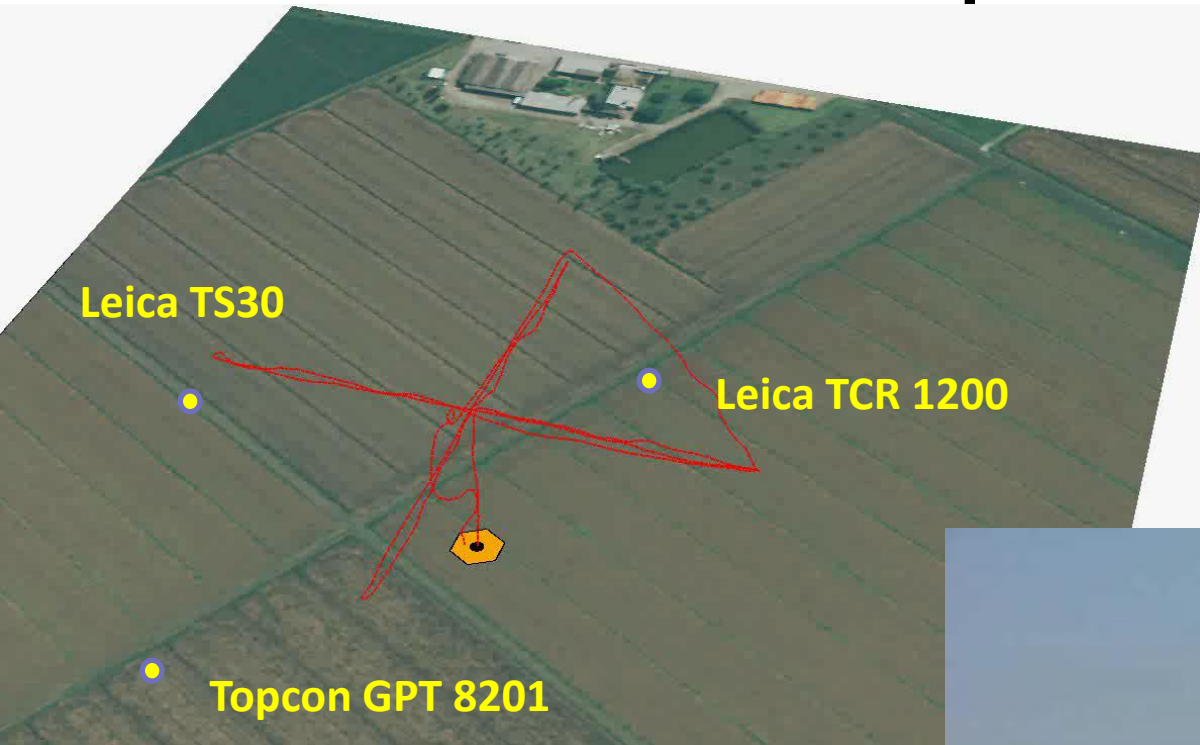


Skids: the metallic parts were removed to avoid interference, and they were substituted with wooden skewers.

Antenna TX: special antenna was housed in the middle of UAV (VIRONE).

Special retro-reflector

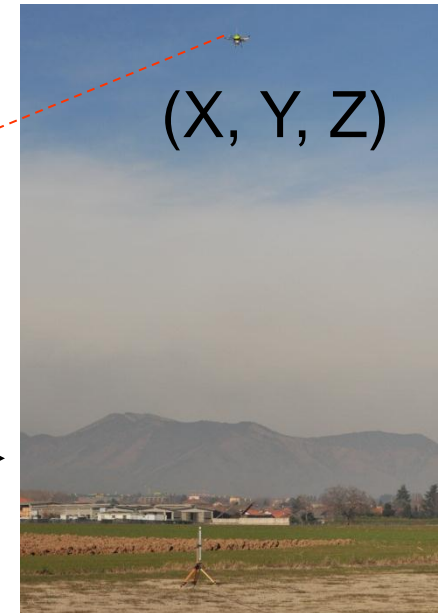
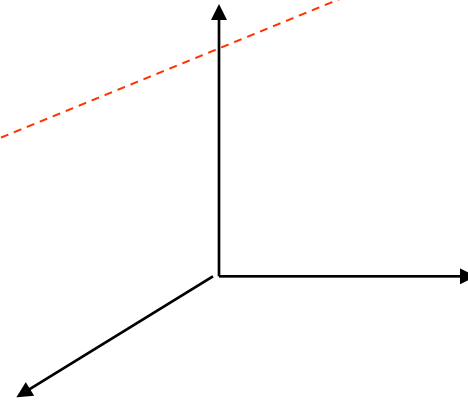
HexaKopter test



HexaKopter test

In order to define the absolute position of the UAV, a topographic tracking has been realized using a motorized total station (MTS). It was possible thanks to a dedicated retroreflector installed on the bottom of the UAV.

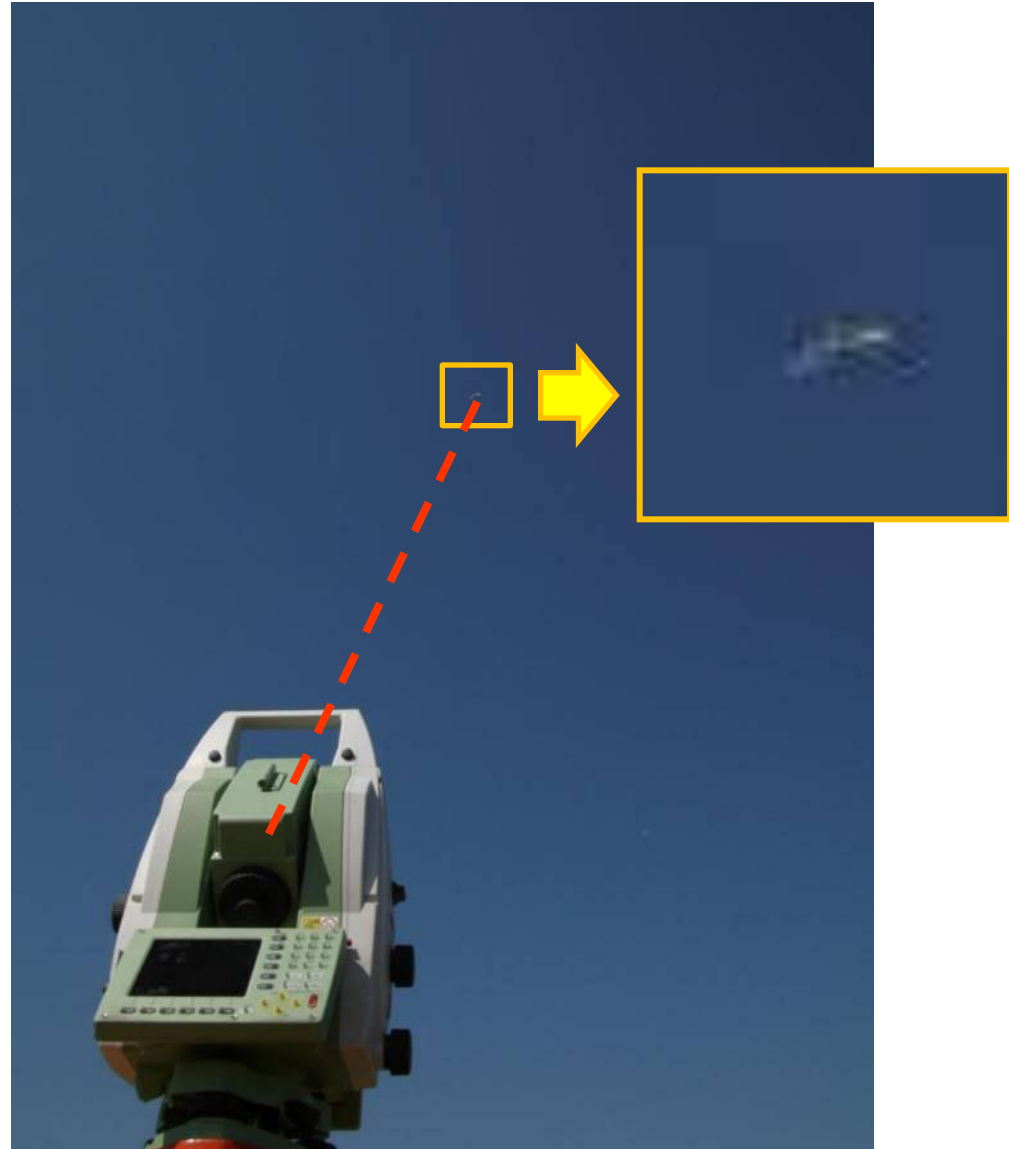
The real position is defined by means MTS with a rate $\cong 3-6$ Hz.



Leica TPS 1200+, TCRP 1201 - R300

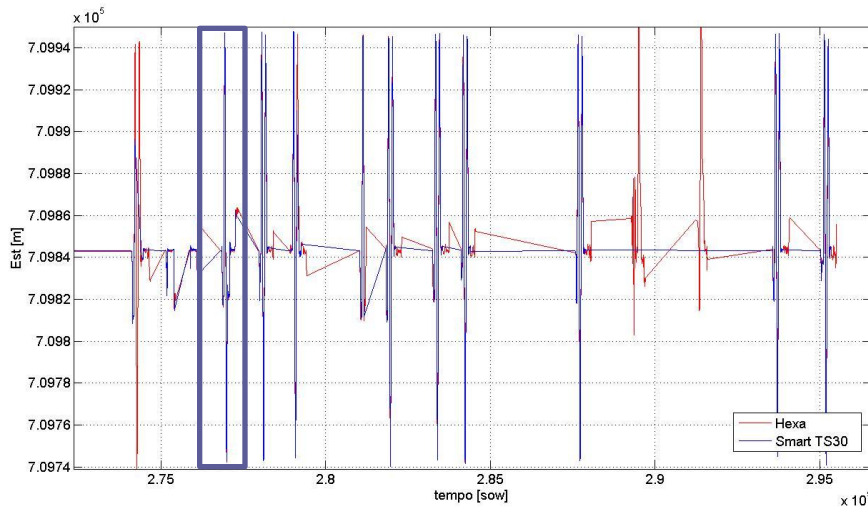
nominal distance and angle accuracies of $3\text{mm} + 1.5\text{ppm}$ and 1 arcsec, respectively, within a 1 km operative range

HexaKopter test



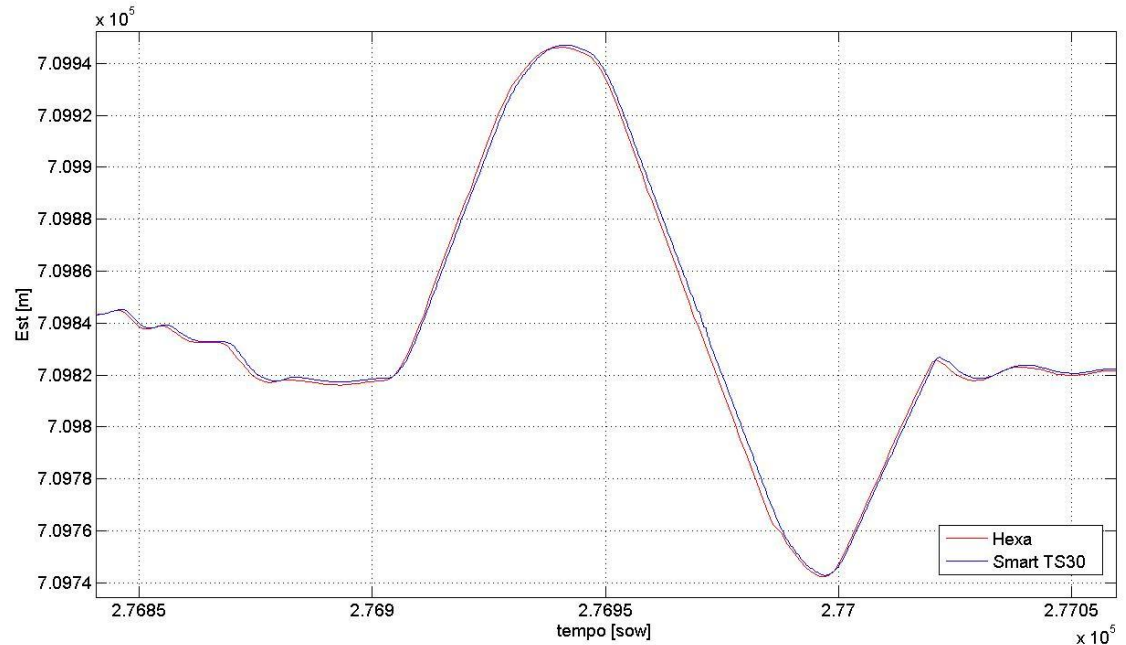
HexaKopter accuracy

Horizontal component comparison



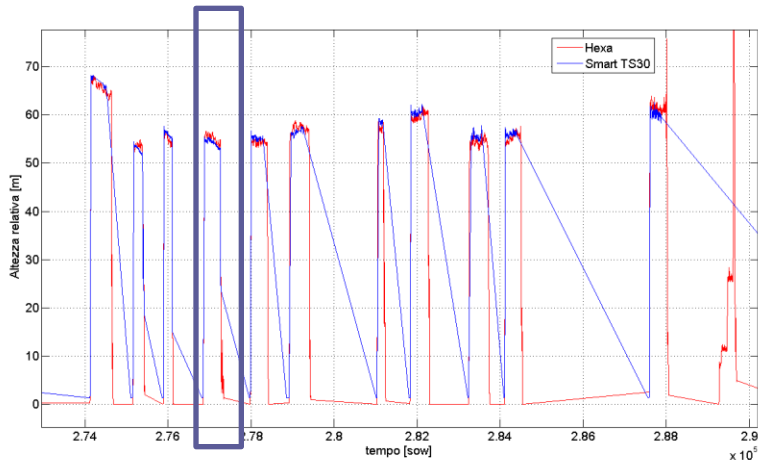
	ΔE [m]	ΔN [m]
m	-0.034	0.890
σ	2.420	1.744
min	-9.841	-6.977
max	7.906	11.402

> 20000 points



HexaKopter accuracy

Relative height comparison



	ΔH [m]
m	0.277
σ	1.465
min	-8.794
max	9.352

> 20000 points

