FIG Working Week 2012
Rome, Italy 6–10 May
Knowing to: Manage the territory · Protect the environment · Evaluate the cultural heritage

GEO SURVEY

aerRobotix

Autonomous Unmanned Surface Vessels for Hydrographic Measurement and Environmental Monitoring

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1 - aerRobotix and Geo Survey

Two different expertise meet for a common goal

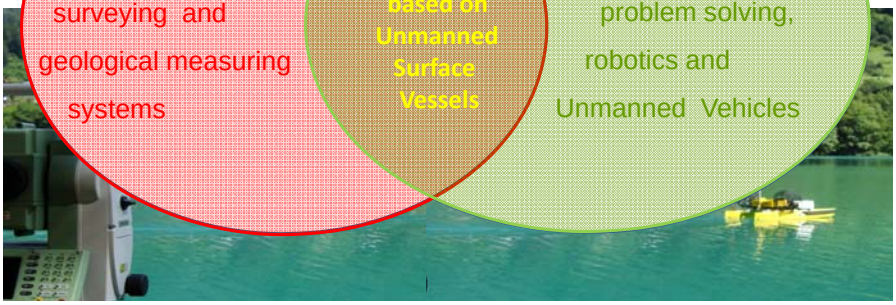
GEO SURVEY

aerRobotix

a company specialized in topography, surveying and geological measuring systems

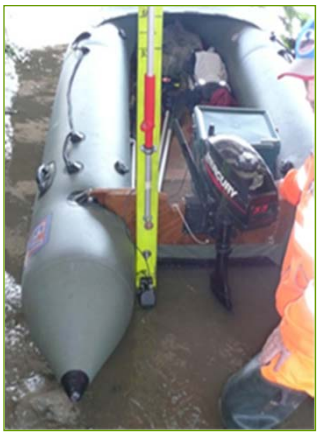
Advanced solutions based on Unmanned Surface Vessels

high tech company specialized in engineering problem solving, robotics and Unmanned Vehicles

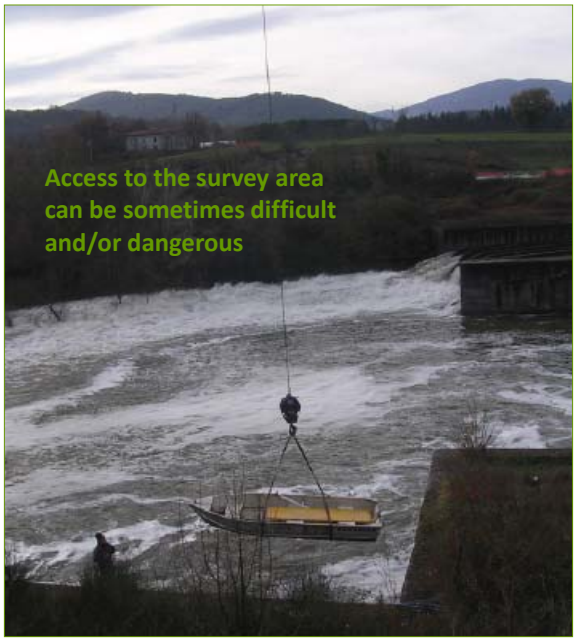


2 – Fresh water bathymetry – the traditional approach

Craft of a certain dimension is generally used today. It must accommodate the helmsman as well as an operator of the measuring system, plus the relevant equipment



2 – Fresh water bathymetry – the traditional approach



2 – Fresh water bathymetry – the traditional approach

The same boat does not suit all different and sometime difficult situations
(source Sam DeBow, NOAA)

3 - The Unmanned Surface Vessels (USV)

- not a new concept. Examples even earlier than WWar II
- U.S. Navy collected radio-active water samples after the atomic tests on Bikini Atoll in 1946.

- continuous development in the field of GPS, electrical energy storage and microelectronics allow for small, handy and efficient military solutions

- a consequent growth of a USV civil market
- a large range of **maritime solutions**, of different performance, shape and sizes.

- somewhat less developed are the **fresh water** applications

4 - The family of USV " aerRobotix CatOne"

multi-purpose catamaran-robots especially effective in shallow water, in situations that require recurring, very repetitive, long endurance activities or in those to be carried out in dangerous and hazardous environment and in sensitive ecosystems.

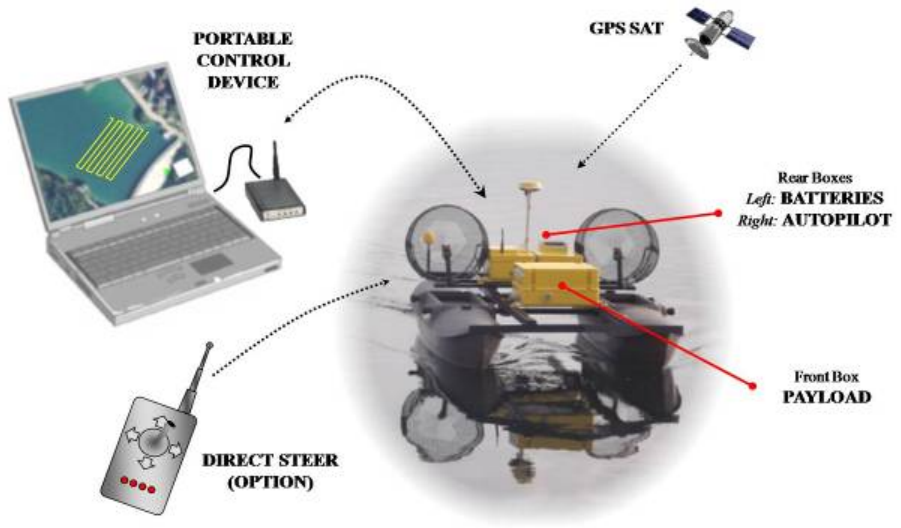
4 - The family of USV " aerRobotix CatOne"

Several specific characteristics make CatOne unique (patented) capable of operating in very shallow water, in presence of algae and in sensitive ecosystems, namely :

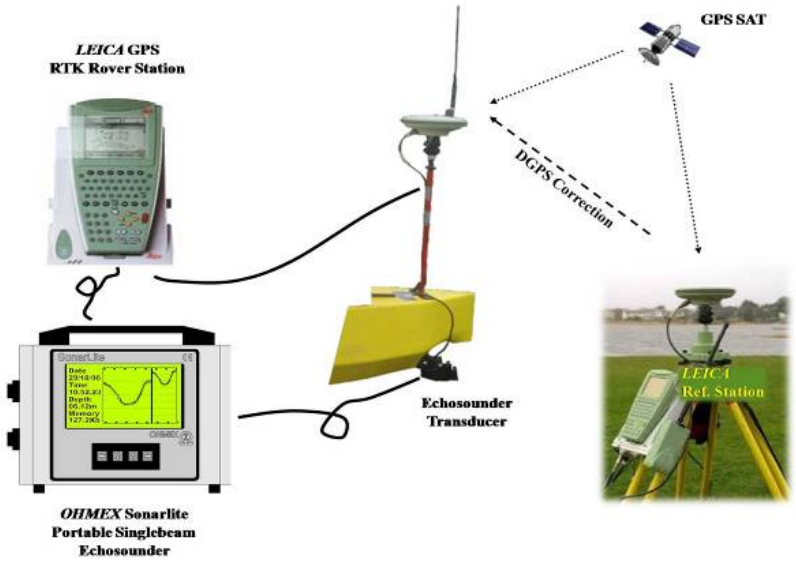
- very low draft
- absence of propellers and rudders in the water
- zero pollution emission (electric propulsion)
- low noise
- no disturbance to the depth contour of shallow water and to the flora and fauna.

Length	1.6 - 1.9 m
Width	1.0 - 1.2 m
Weight (empty)	12 - 20 kg
Pay load	up to 12 - 50 kg
Propulsion	Electrical
Energy	High energy density LiPo rechargeable batteries
Operational speed	5 km/h
CO2 emission	zero
Navigation modes	Fully automatic (pre-defined), remotely controlled or mixed
Endurance	8 hours (prolongable by additional battery packages)
Operators	One person can supervise up to three units
Transportation	Station wagon, monovolume car or car roof carrier

CatOne's system architecture



System Configuration for operation in presence of good GPS coverage



System Configuration for operation with laser tracking

5 - Our experience for hydrographic measurement. Lessons learned

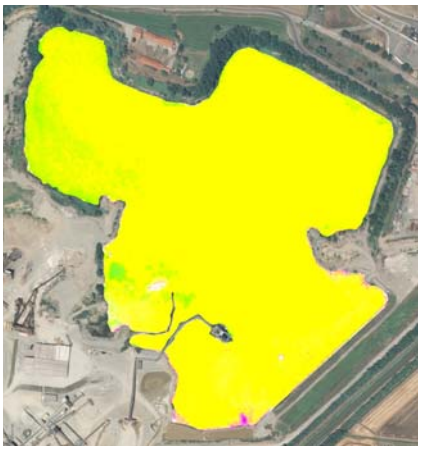
- Simple and effective management
- Easy transportation
- Single operator
- Optimized navigation pattern
- Optimized operational and post processing procedures
- “sense and (possibly) avoid” capability in progress
- Etremely useful and effective the user involvment

Typical example of shallow water : Quarry lake batymetric scanning process

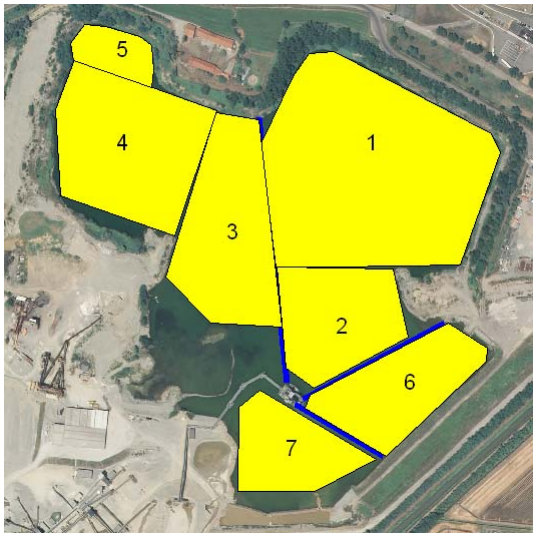
Perimeter and Area calculation
through **automatic Image Processing tool**

➔ Rough estimation of mission duration ➔cost estimate

Perimeter: 3.37 km



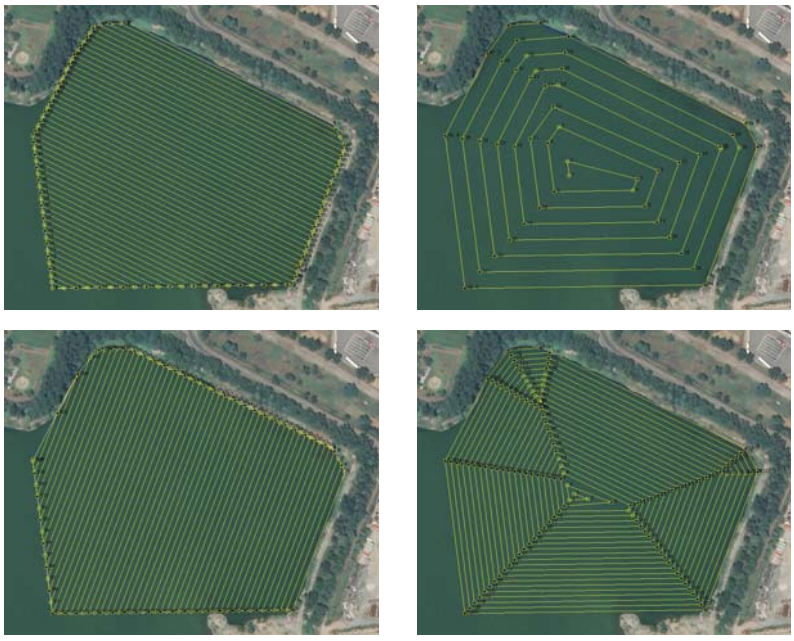
Surface: 17.42 10^4 m^2



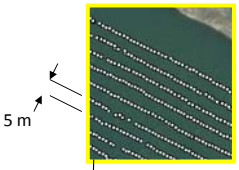
#	km	time
1	10.8	2h 44 min
2	3.44	52 min
3	4.71	1h 11 min
4	5.4	1h 22 min
5	1.02	15 min
6	3.32	50 min
7	2.55	39 min
	31.3	7h 53 min

• Partitioning into smaller areas with regular contours, taking into account obstacles, visibility (e.g. total station tracking coverage), accessibility, logistics, etc
• Definition of detailed scanning routes for each partition allows precise estimation of mission time and day plan

Automatic definition of best scanning routes, depending also on customer requirements and shape/regularity of the basin coast

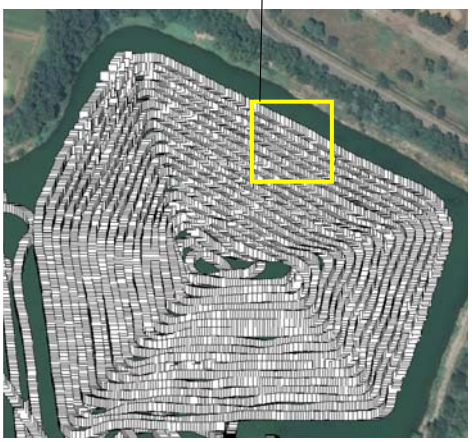


Example



As planned…

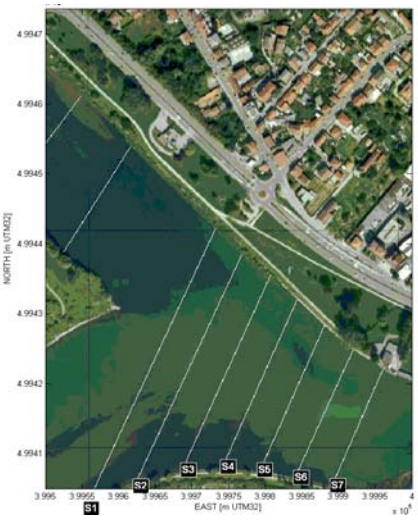
… as executed

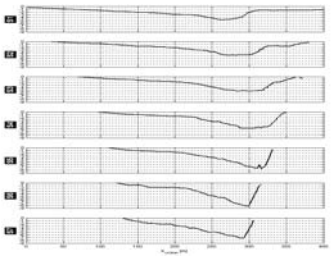


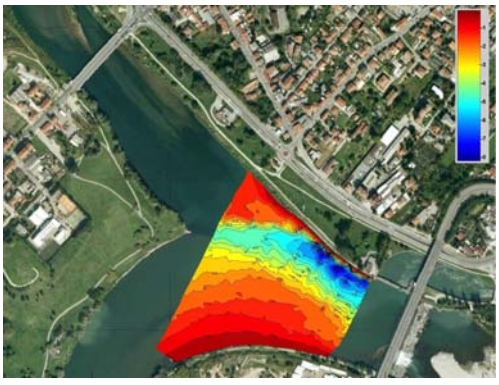
… and the typical result of the data processing

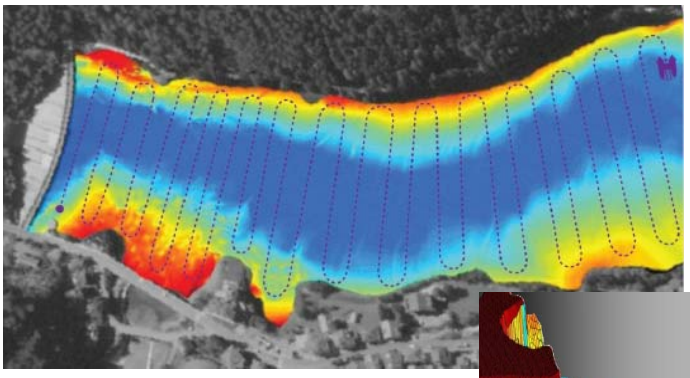
Other typical applications :

River sections depth measurement



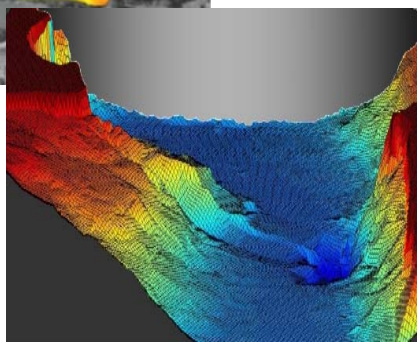






Other typical applications :

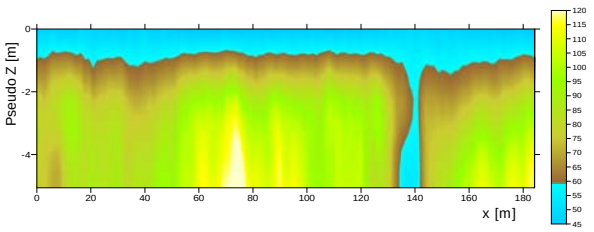
Hydroelectric dams bathymetric scanning



6 - Other promising applications of CatOne
Seepage detection in water canals

The aerRobotix CatOne robot boat tows the electrode array during tests in a canal.

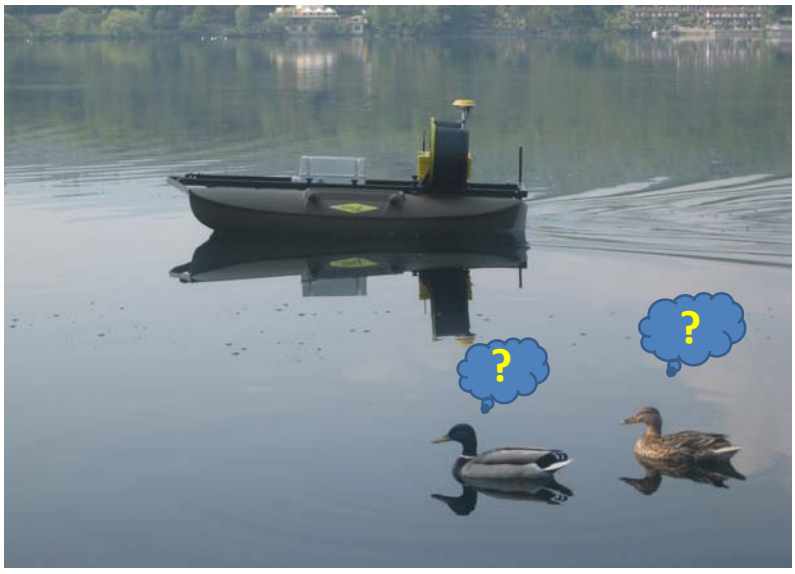
A detected strong resistivity decrease points out a flow variation in the canal



6 - Other promising applications of CatOne

- **Discharge measurements** via ADCP Doppler systems
- **Water quality measurement/monitoring**
- **Surveillance of the water surface**
- **Search of objects, persons and/or animals**
- Precisely localized **distribution of colouring water markers** on the surface
- **Dispersion of chemical products** (fertilizers, pesticides etc.)
- Detection and **scaring of birds** over drinkable water basins and fish breeding ponds (non-fatal and environmental-friendly manner)

7 - Questions



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Thanks for your kind attention

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