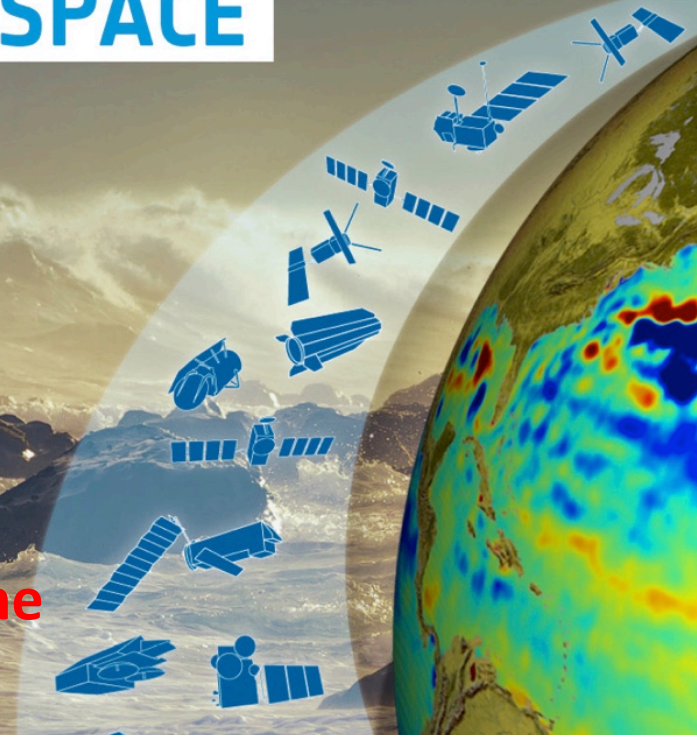
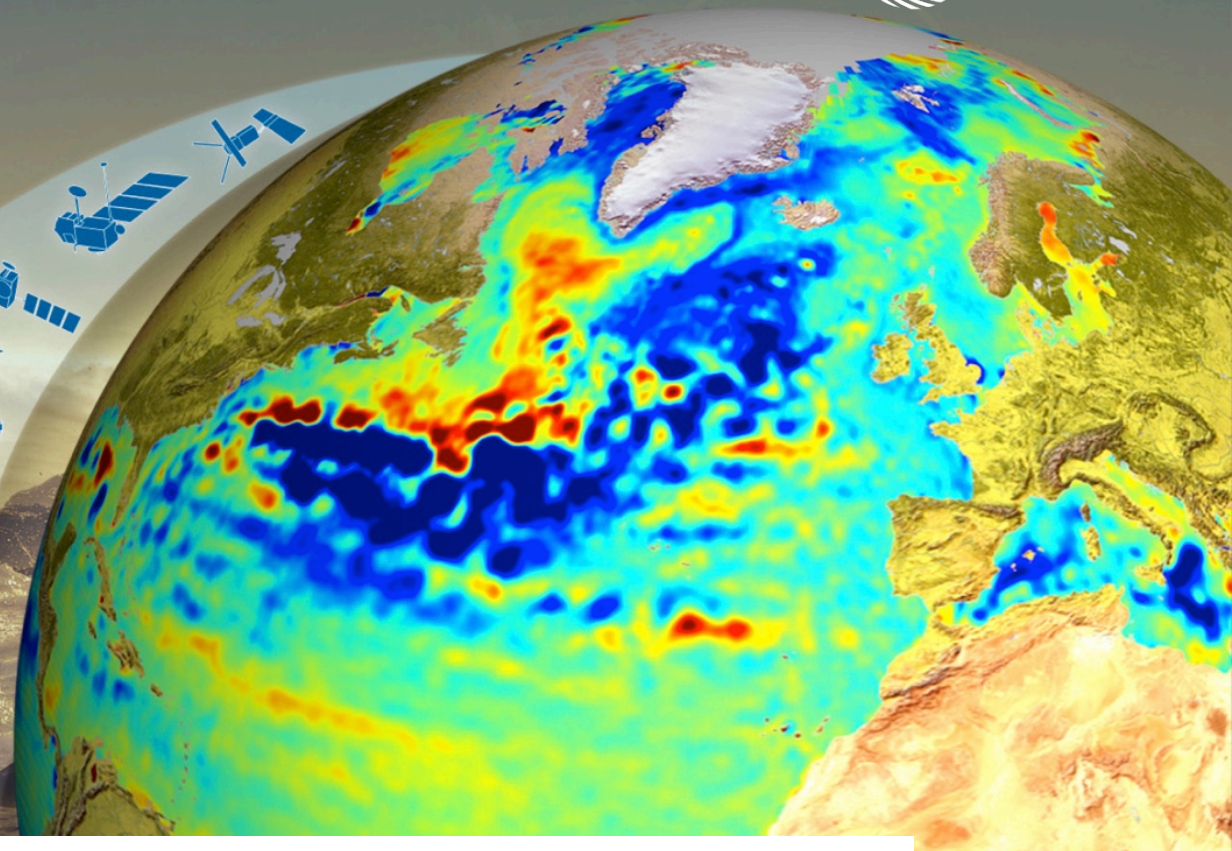
→ ATLANTIC FROM SPACE WORKSHOP

23–25 January 2019
National Oceanography Centre
Southampton, UK

Beach Litter
Monitoring via Drone
Remote Sensing





Universidade Vigo

Grafinta

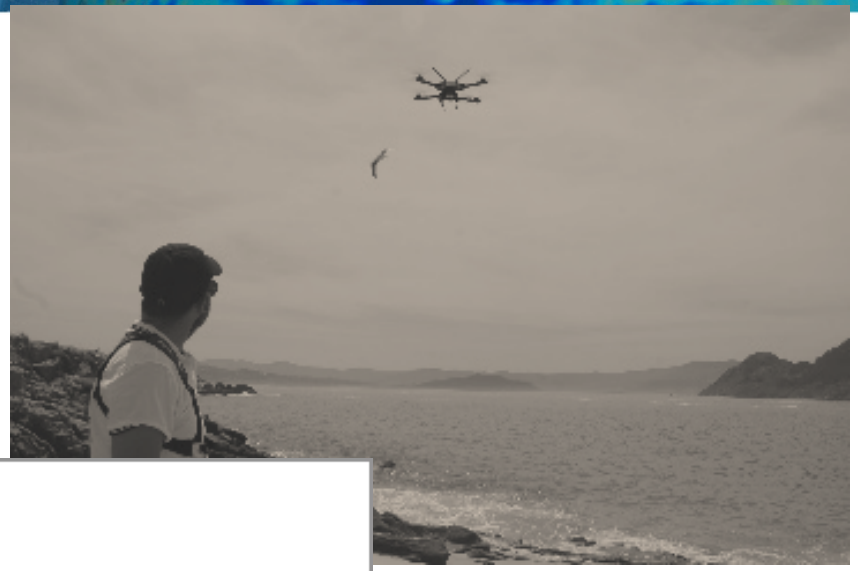
AEBAM
ASOCIACIÓN ESPAÑOLA DE BASURAS MARINAS

Supported by:
ecoembes

With the collaboration of:
PARQUE NACIONAL MARÍTIMO TERRESTRE DE LAS ISLAS ATLÁNTICAS DE GALICIA

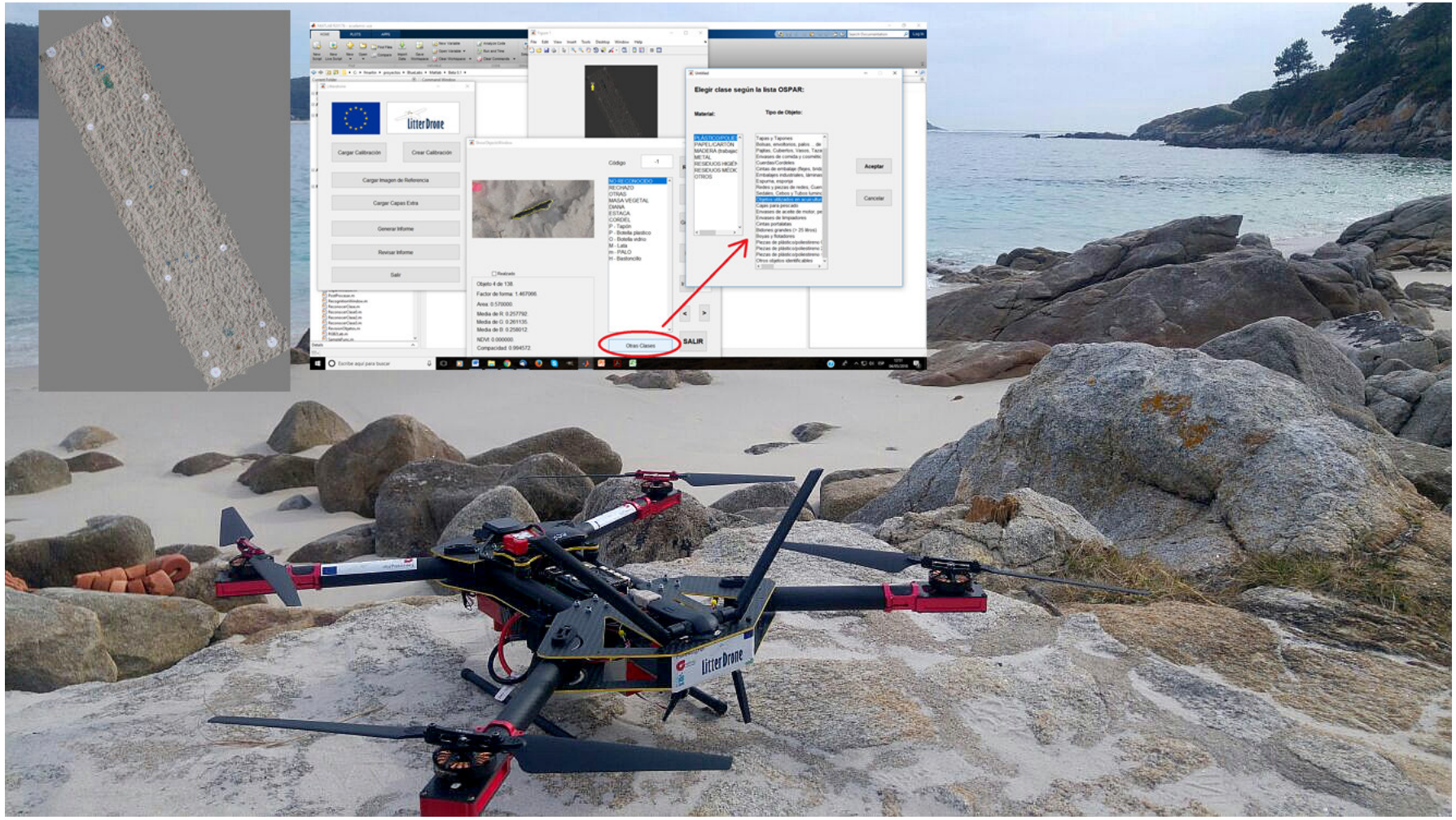
Co-funded by the UE

European Space Agency



LitterDrone

DRONE-BASED IMAGE ACQUISITION
+
COMPUTER BASED IMAGE ANALYSIS



¿WHAT IS MARINE LITTER?

Man made solid waste that, for any cause, are abandoned in marine or coastal environment

SOURCE: PNUMA

LITTERDRONE ORIGIN

- Marine litter **characterization** as a key factor to eradicate them
- Official **monitoring** program for marine litter on beaches (MAPAMA)
- **Standardizatio**n and **automation** of marine litter characterization

SOURCE: Surfrider España

FUNDED BY EU (BLU-LABS PROGRAM)

Litter Drone

- **EASME/EMFF/2016/1.2.1.4**

  Blue Labs

  Innovative Solutions for Maritime Challenges

- **Supported by:**

ecoembes
El poder de la colaboración

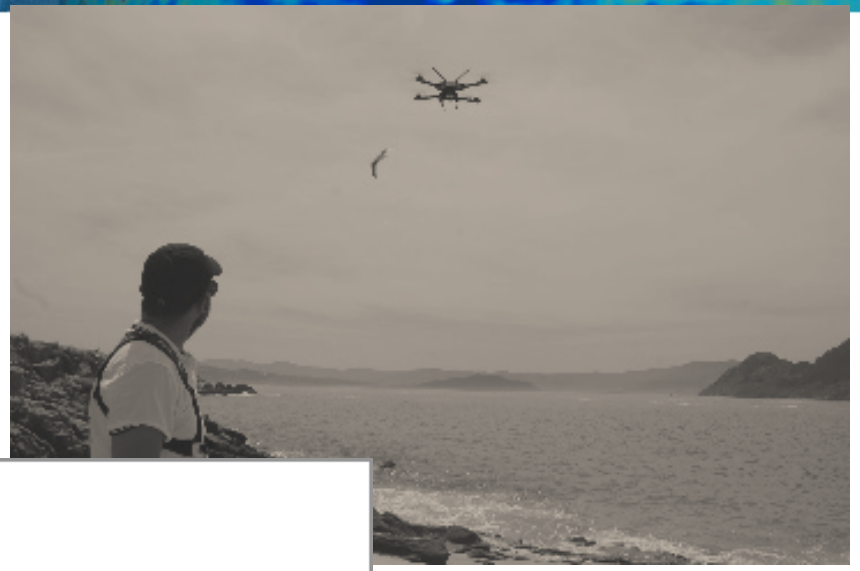
- **With Collaboration of:**

PARQUE NACIONAL MARÍTIMO TERRESTRE
DAS ILLAS ATLÁNTICAS
DE GALICIA

- **Partners:**

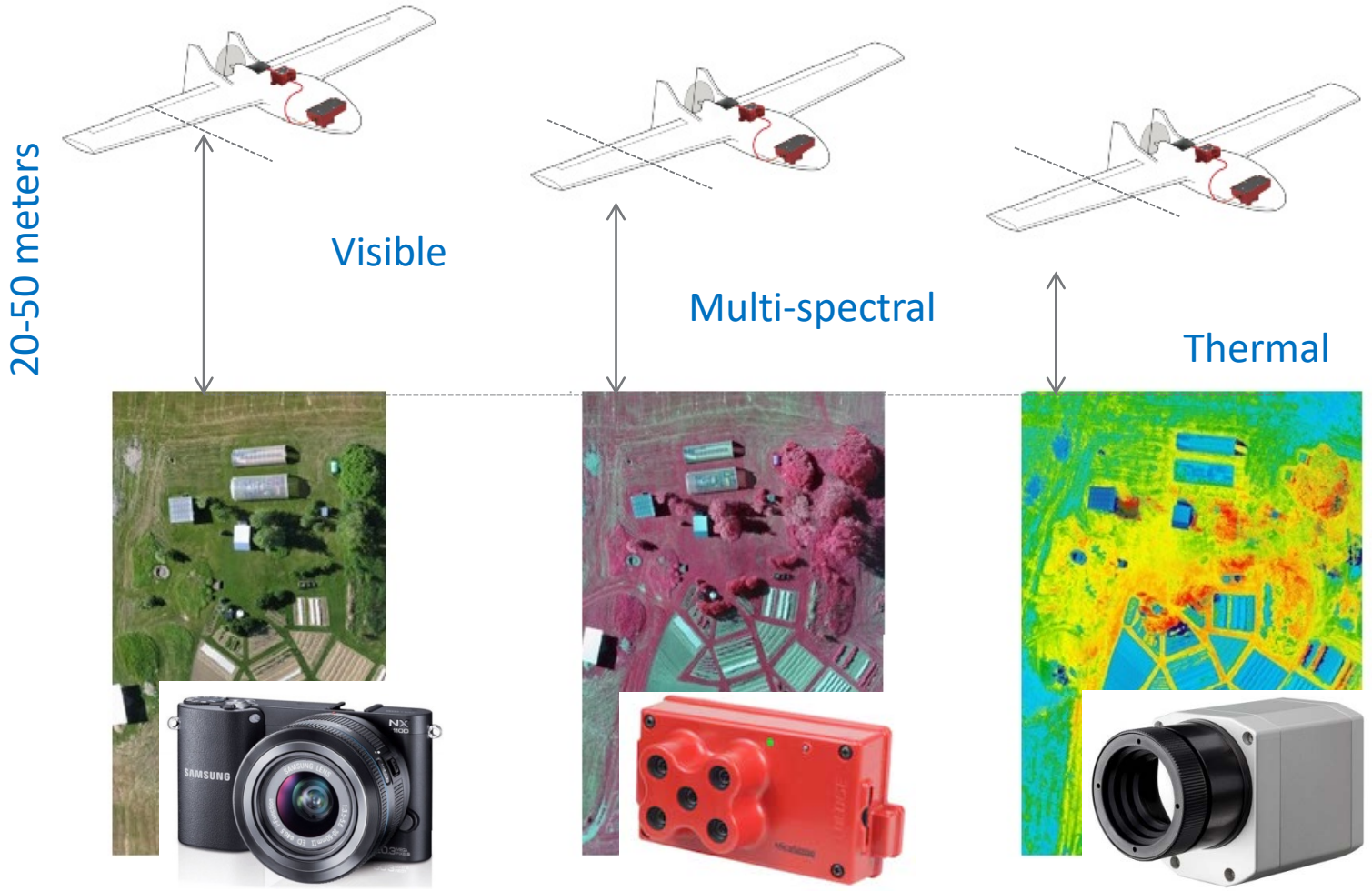
Universidade Vigo

AEBAM
ASOCIACIÓN ESPAÑOLA
DE BASURAS MARINAS



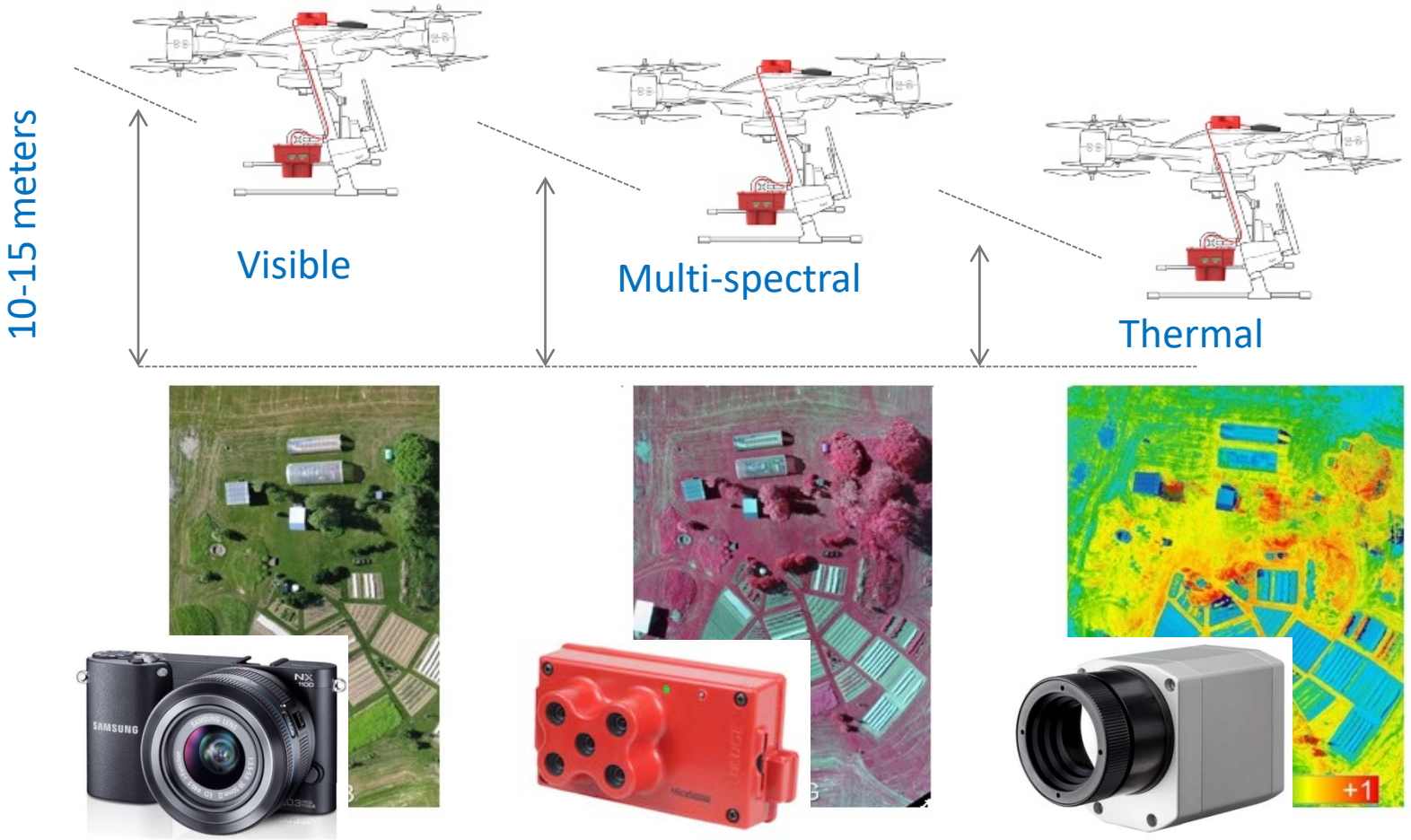
LitterDrone

UAV'S & CAMERAS



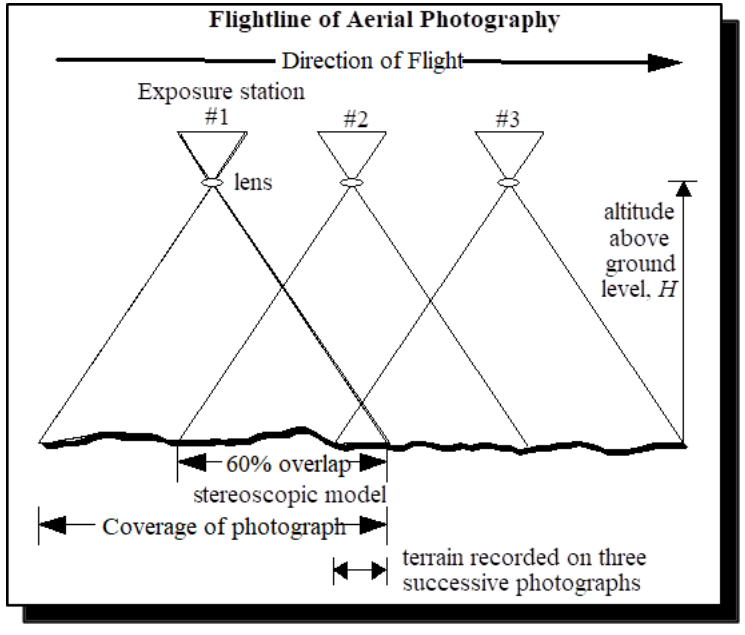
UAV'S & CAMERAS

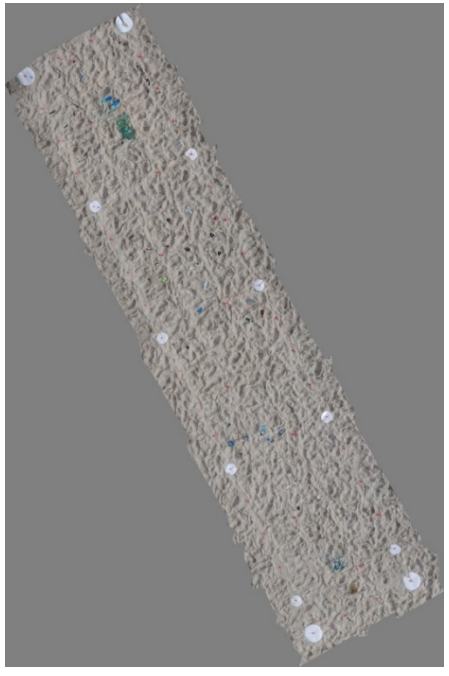
Litter Drone



REAL FLIGHTS

IMAGE ACQUISITION: ORTHO-PHOTO





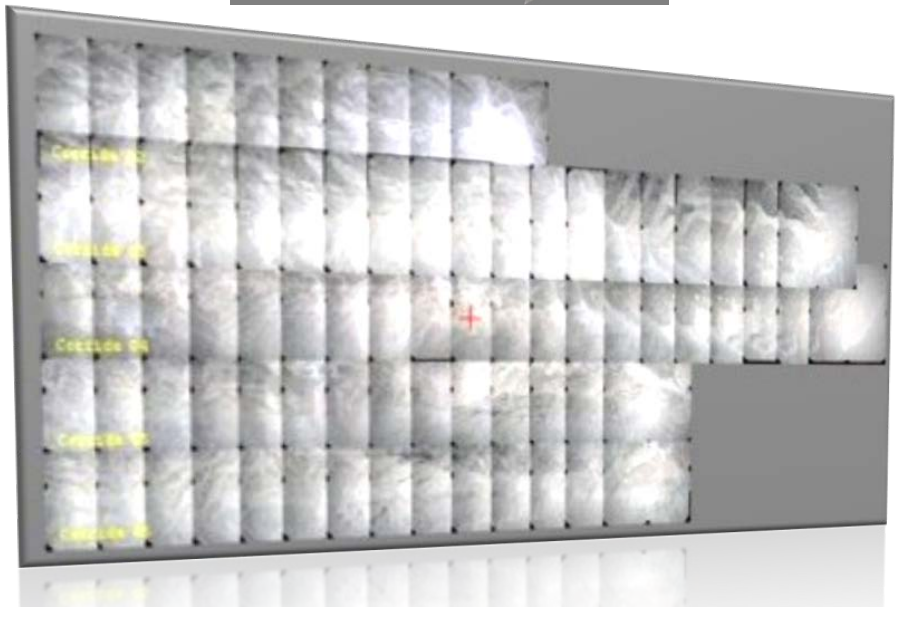


IMAGE ACQUISITION: ORTHO-PHOTO

Photomodeler: from photos to Ortho-photo (geo-referenced, exact)

TEST ZONE

- Flying on one of the monitored beaches: “playa de Rodas” (Galician Atlantic Islands Maritime-Terrestrial National Park)
- Detection of true marine litter and comparison with official data
- Flying on another (non monitored) beach

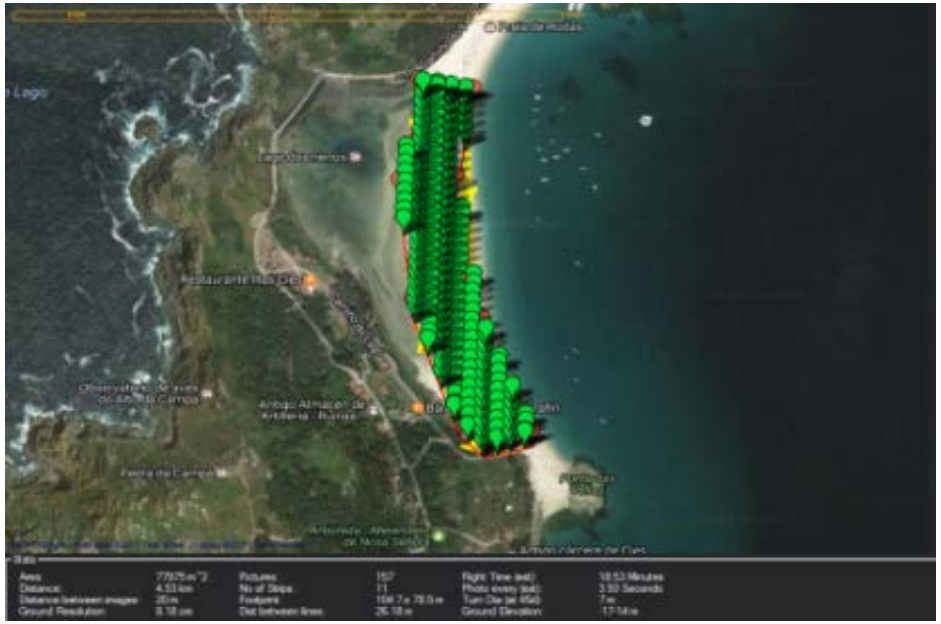
With the collaboration of

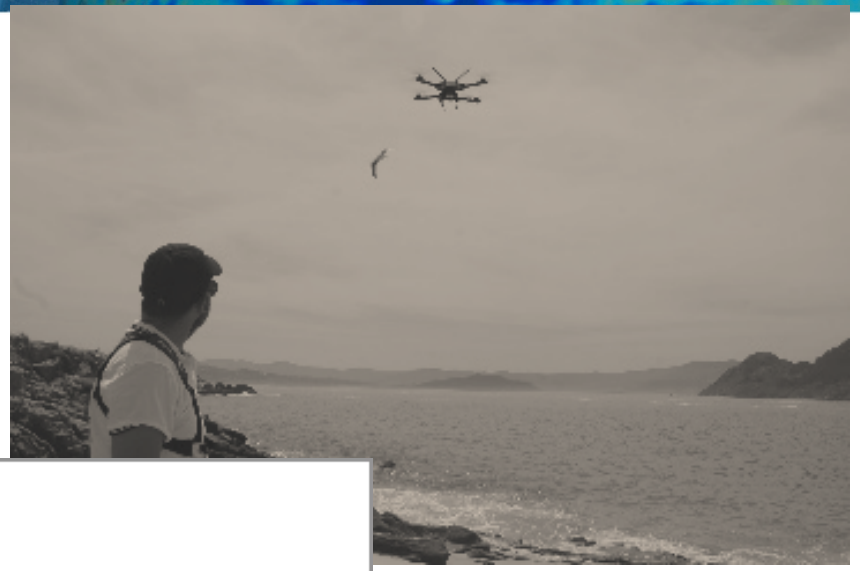
PARQUE NACIONAL MARÍTIMO TERRESTRE DAS ILLAS ATLÁNTICAS DE GALICIA

REAL FLIGHTS

Flight transects

Flight with individual photo shots labelled






LitterDrone

IMAGE PROCESSING

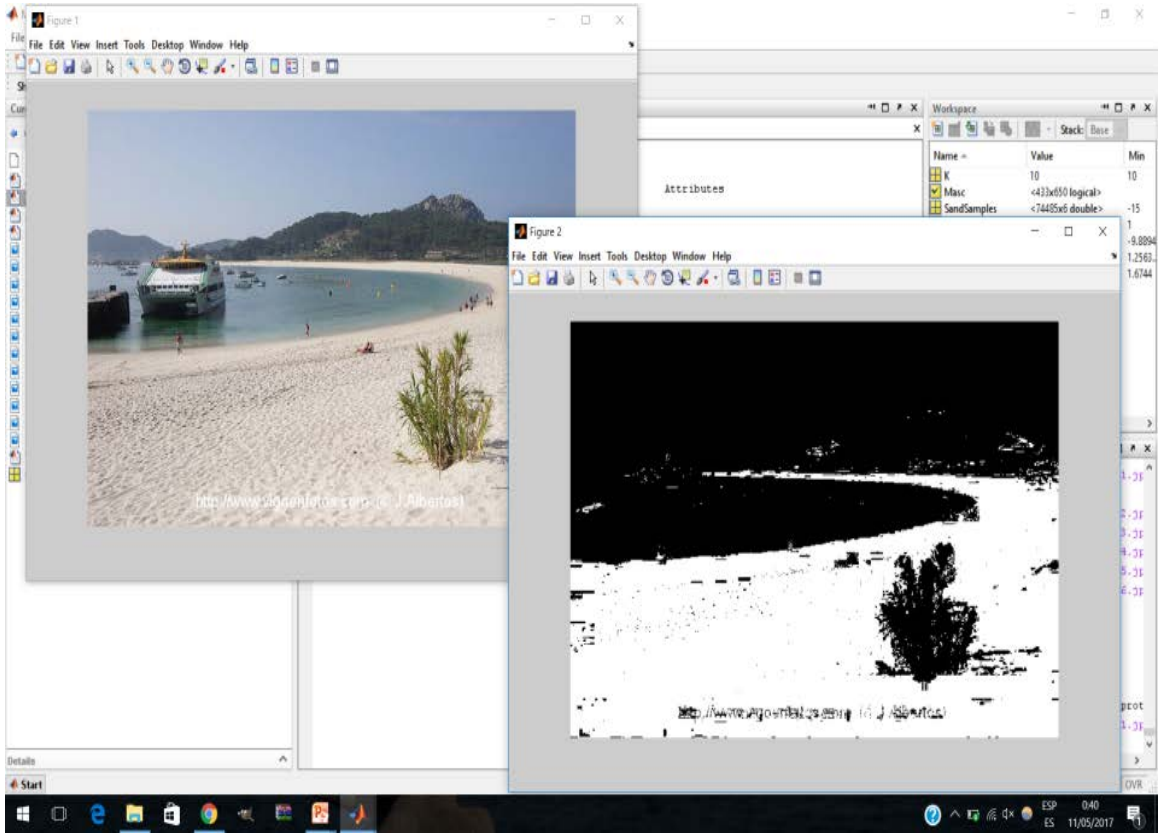
Objects detection with beta version:

sand characterization

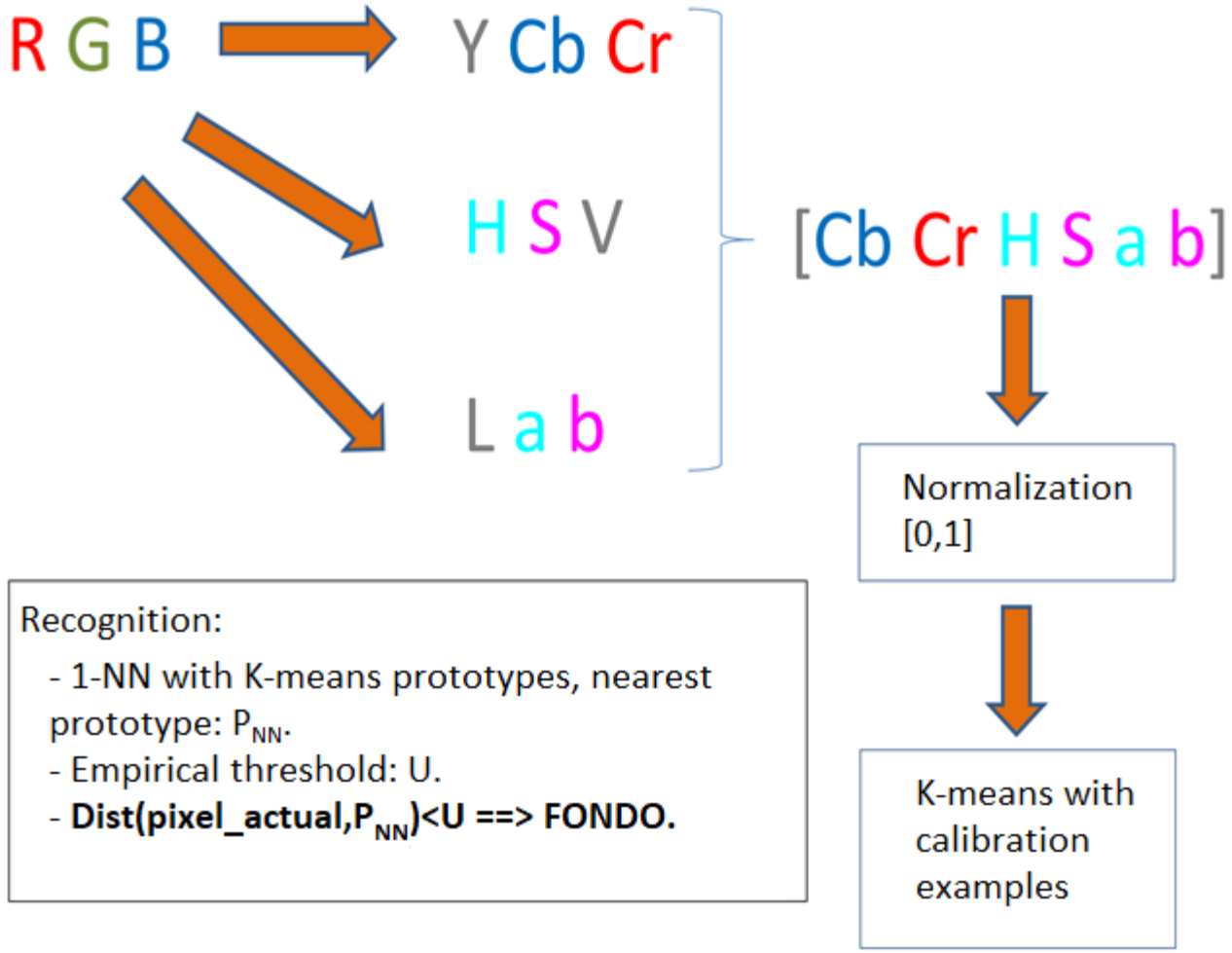
IMAGE TYPE: RGB

VISIBLE

CONVENTIONAL CAMERA



SAND CHARACTERIZATION



SAND CHARACTERIZATION (method II)

Use of differential components (R-G, R-B, G-B).

Future Lines:

Use of normalized differential indexes: (C2-C1)/(C1+C2)

OBJECT DETECTION

Litter Drone

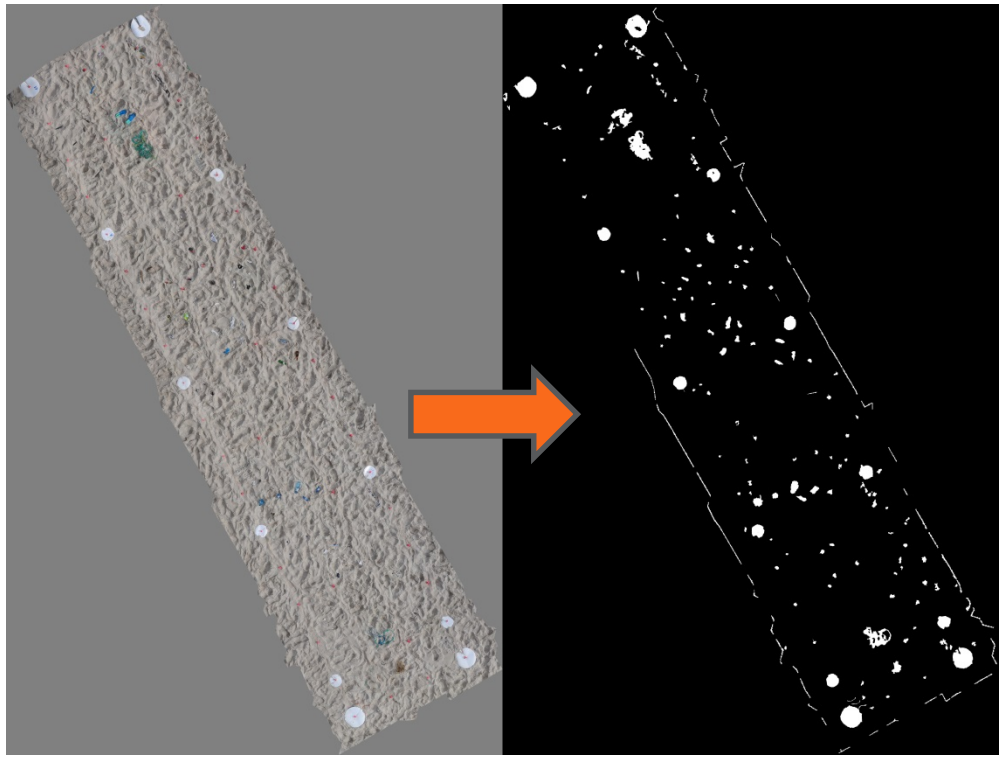
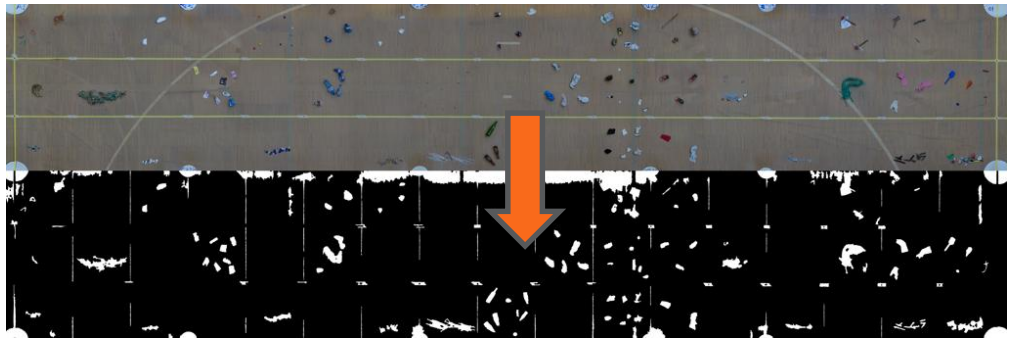
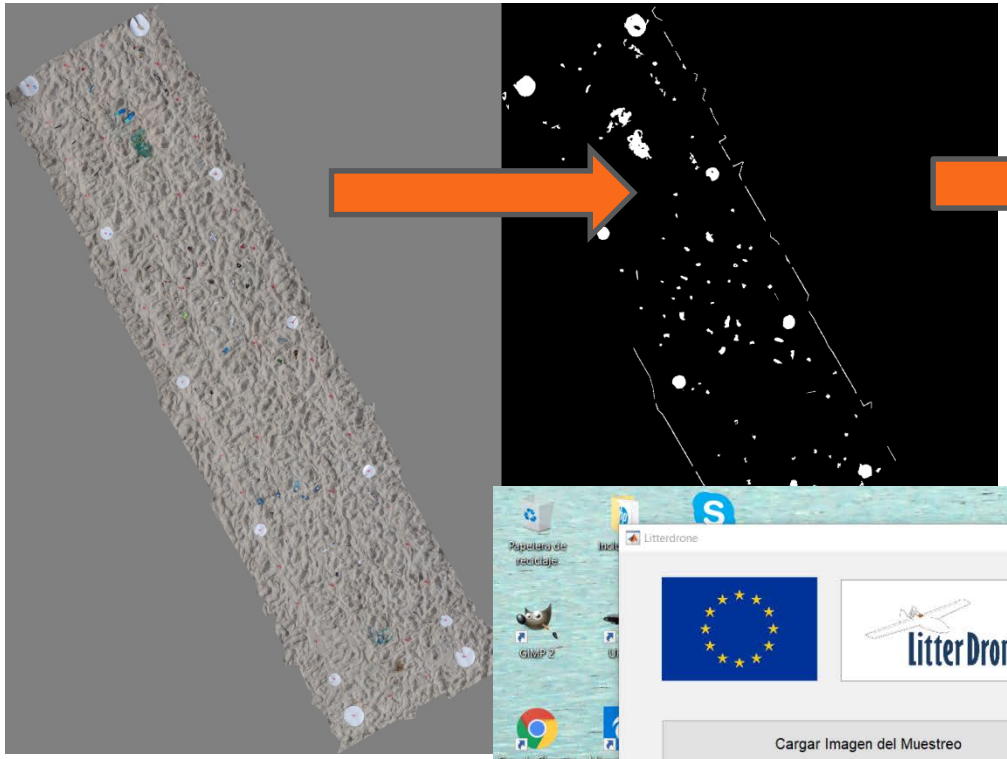


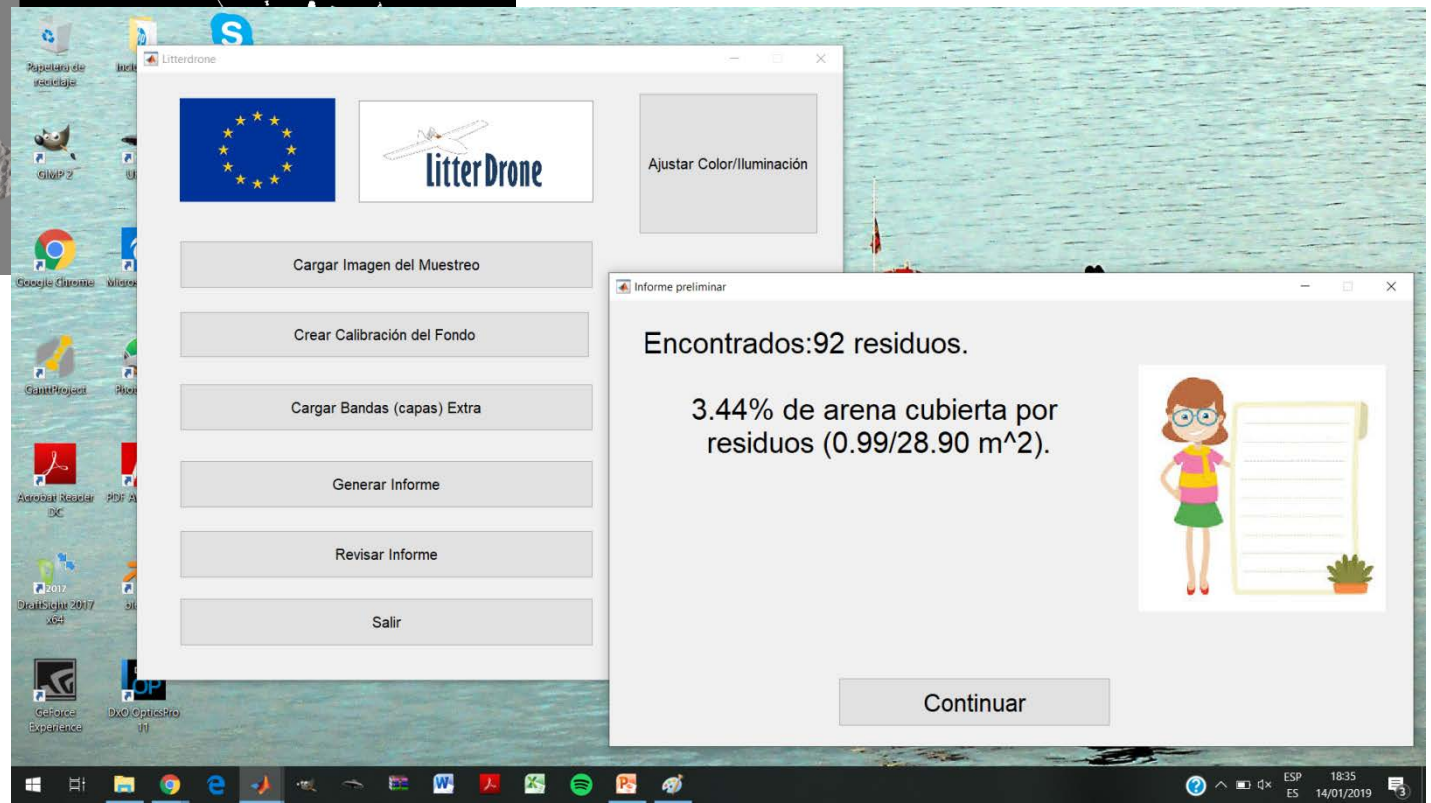
IMAGE TYPE: RGB

VISIBLE,
CONVENTIONAL CAMERA



GLOBAL REPORT





FAST & AUTOMATIC

IMAGE SUPERPOSITION

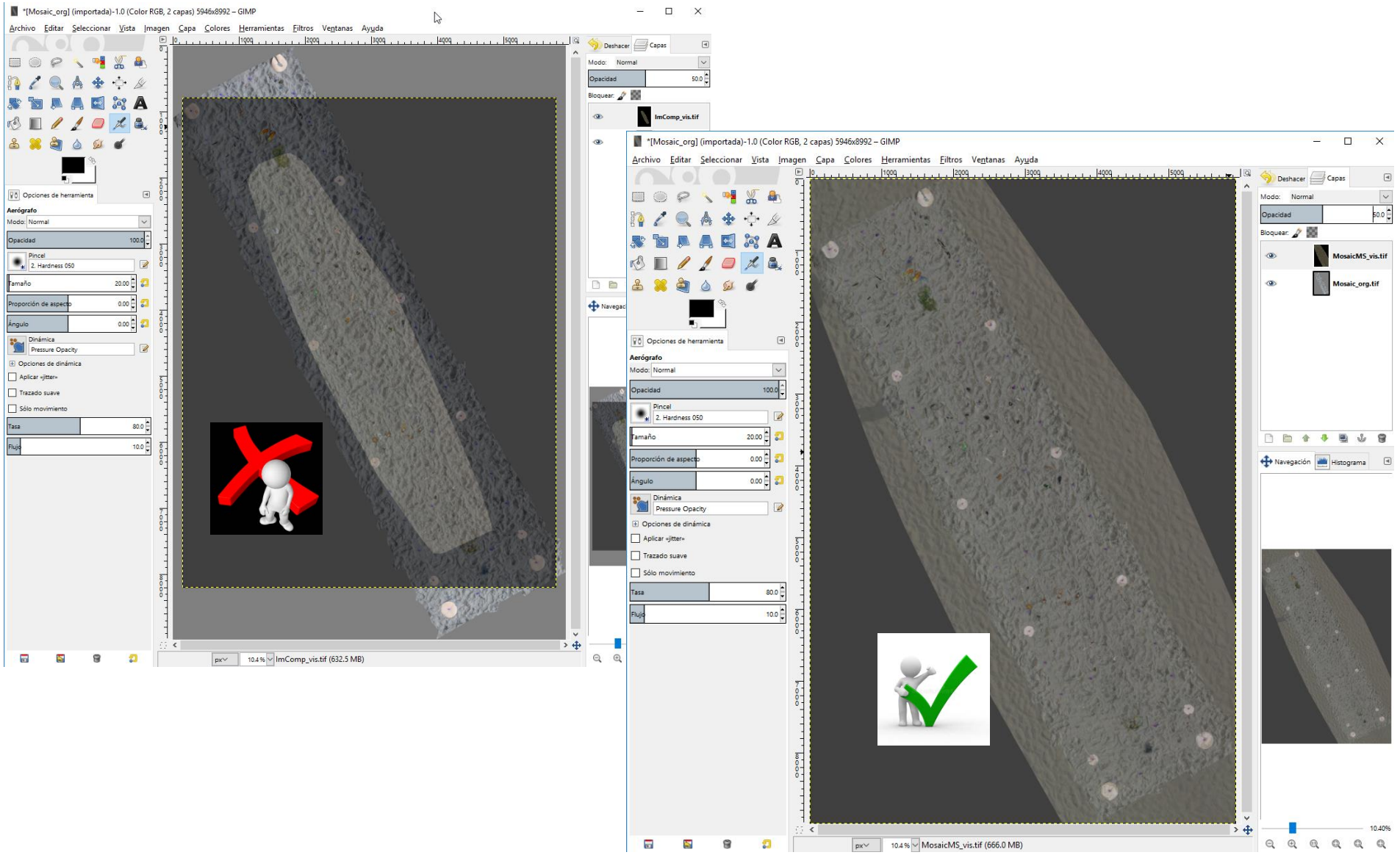


IMAGE SUPERPOSITION: methods

- Manual selection of (at least three control points) and affine transformation.
- Use of geo-referentiation files: scale info + one control point from image origins.
- Manual introduction of scale info + one control point (for displacement).

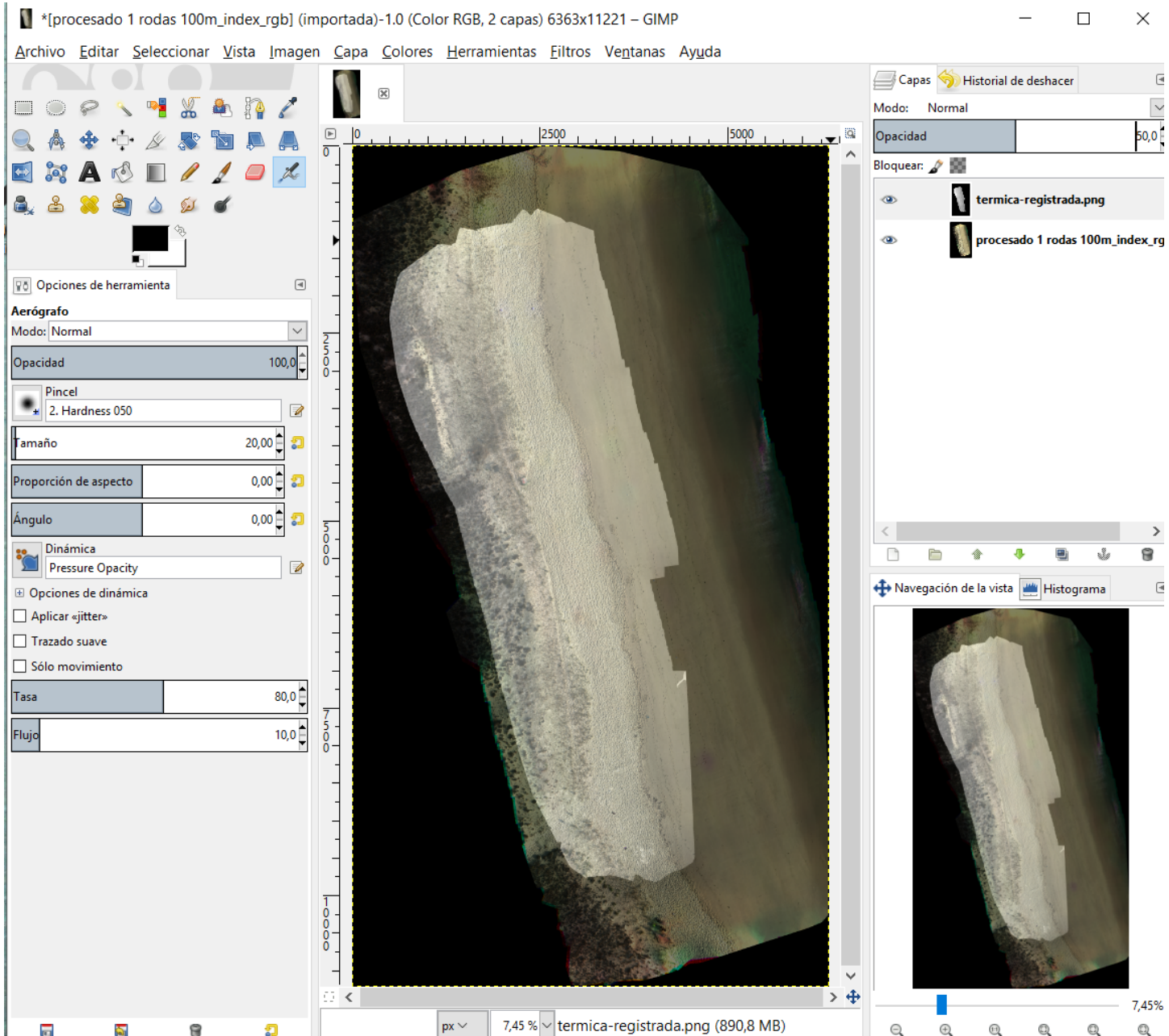
Future Lines:

- Two control points ➔ definition of two “control vectors” ➔ enough to deduce scale info and displacement).

IMAGE SUPERPOSITION:

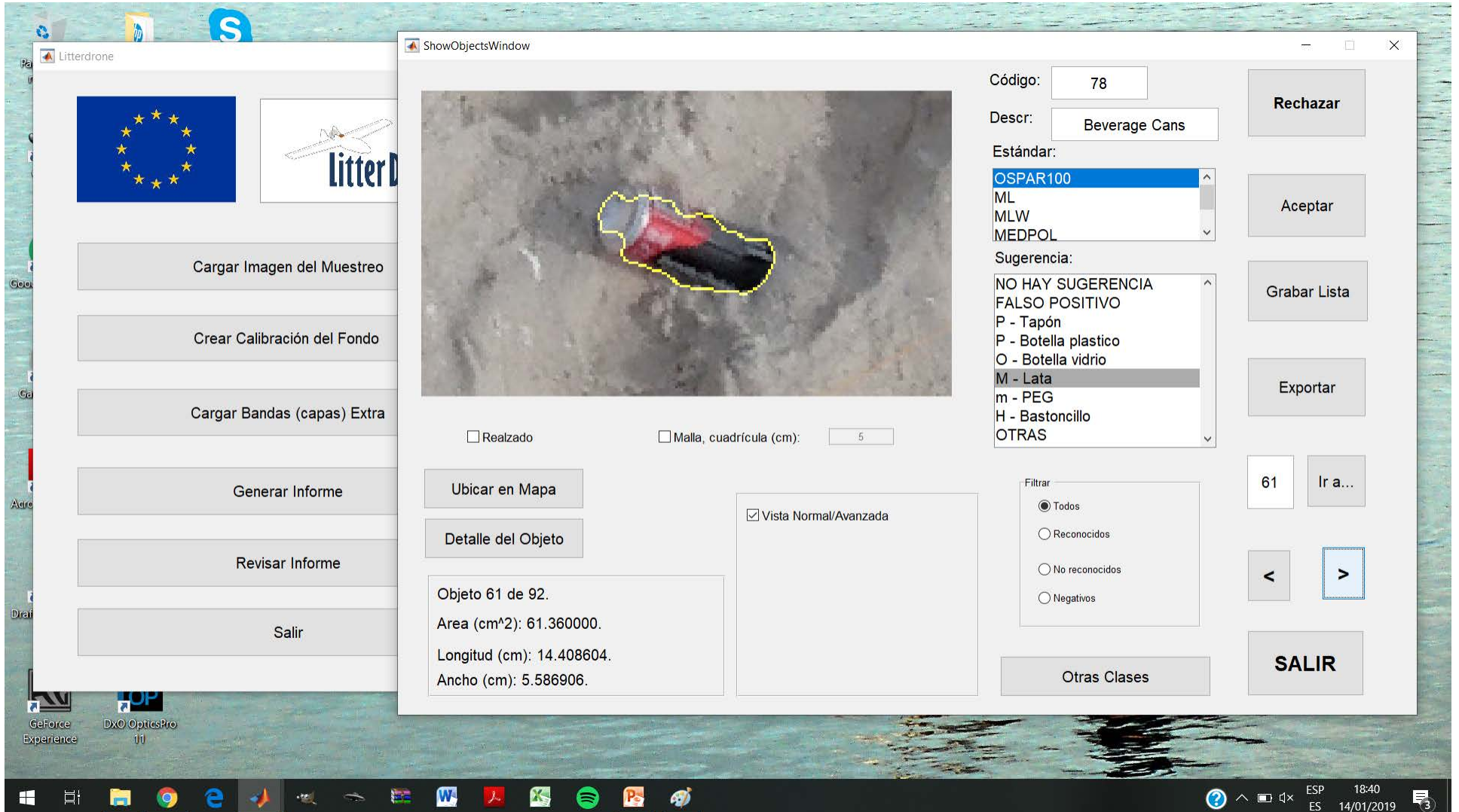
Litter Drone

e x a m p l e

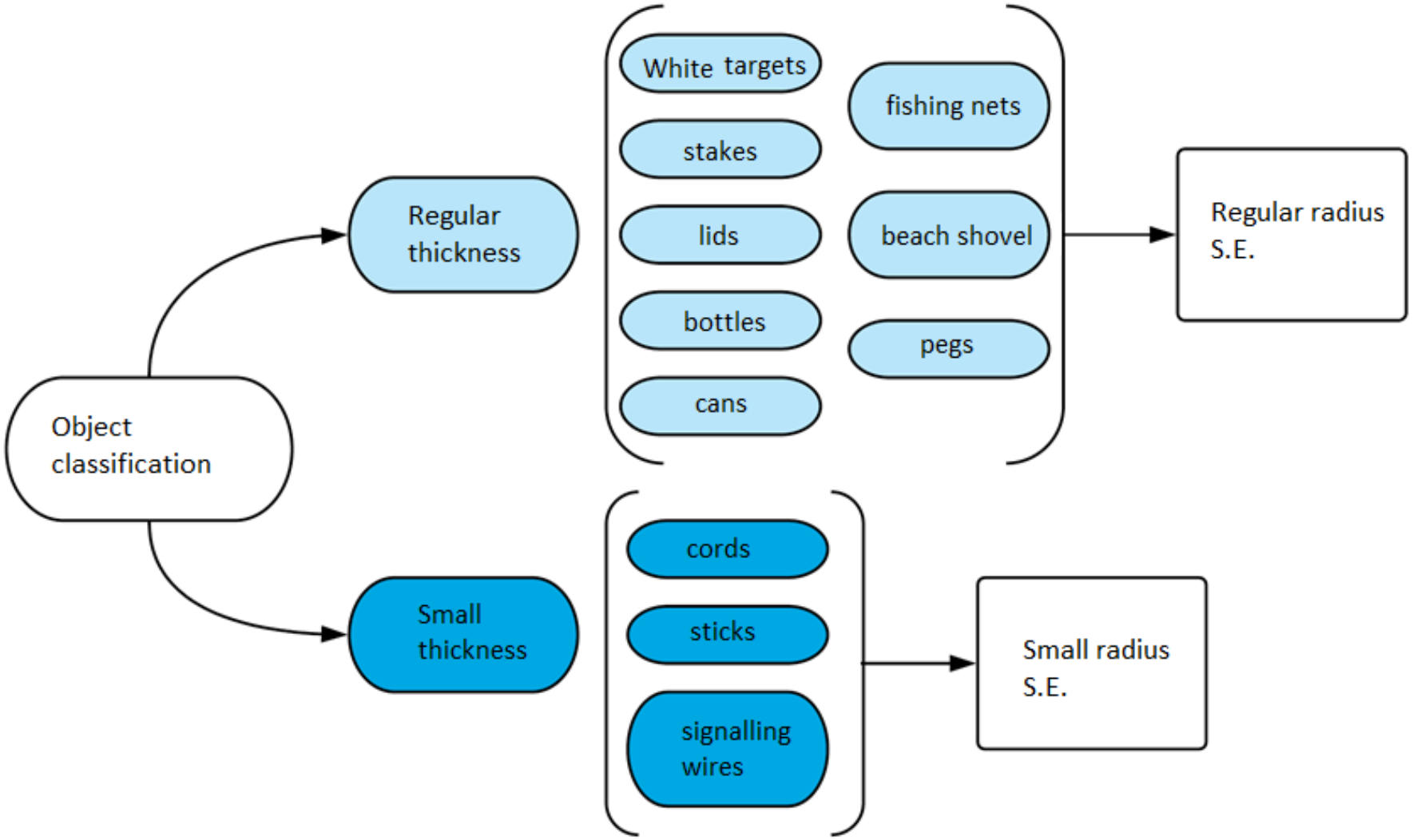


OBJECT RECOGNITION

Automatic recognition of more common objects: lids, bottles, cans, sticks…
and also auxiliary objects (white targets)



OBJECT RECOGNITION



OBJECT RECOGNITION

Litter Drone

Decision tree is implemented computing discriminant functions.
For class i, at stage n, we take into account feature value x:

$$D_i^{n+1} = D_i^n . d_i(x)$$

$$d_i(x) = \begin{cases} 0, x > x_{max} \cup x < x_{min} \\ \exp\left[-\frac{1}{2}\left(\frac{x - x_{med}}{x_{desv}}\right)^2\right] \end{cases}$$

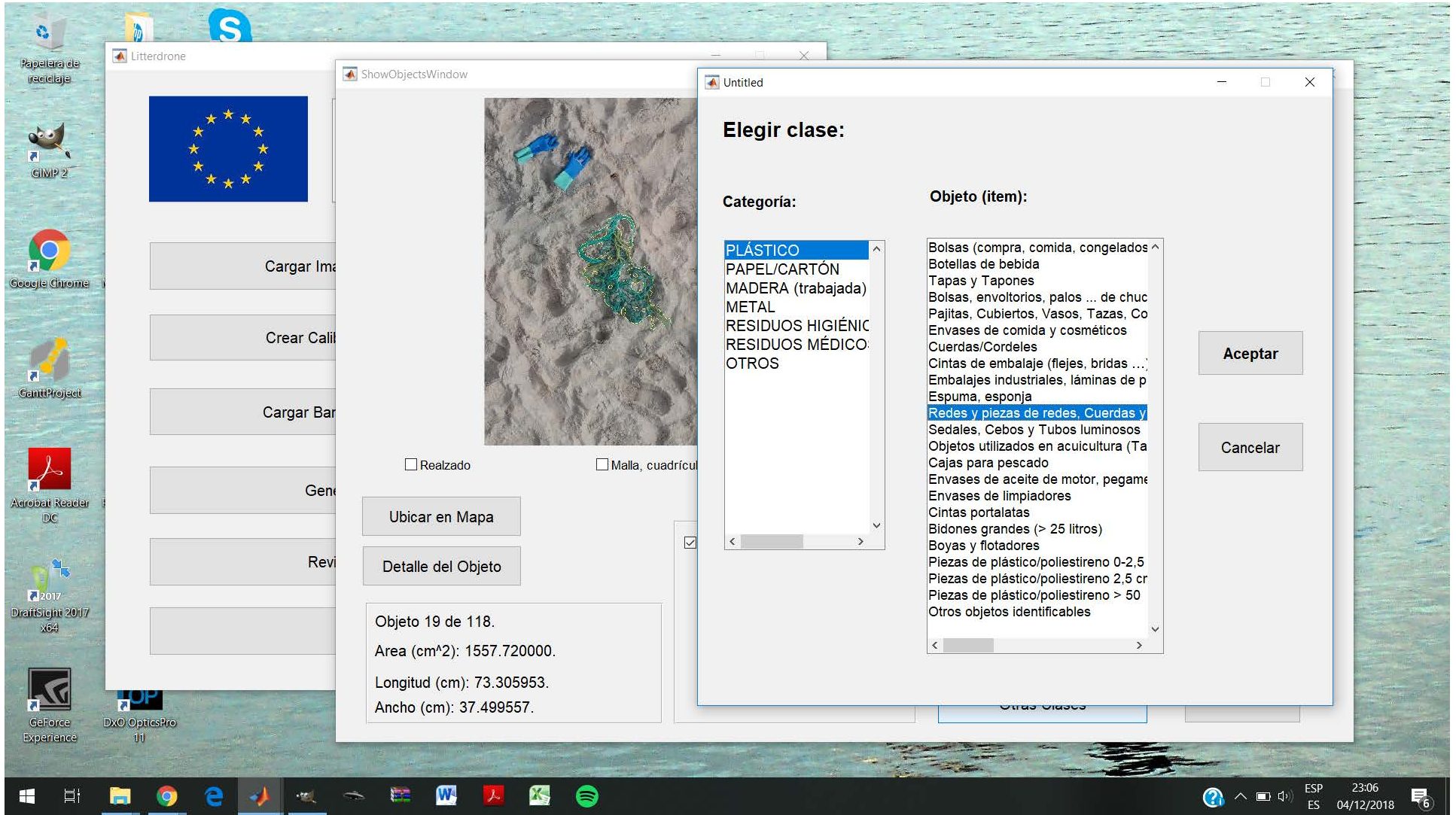
Empirical equations inspired by Bayes rule and gaussian distribution.

Minimum, Maximum, Median & Deviation are computed from real samples and manually revised.

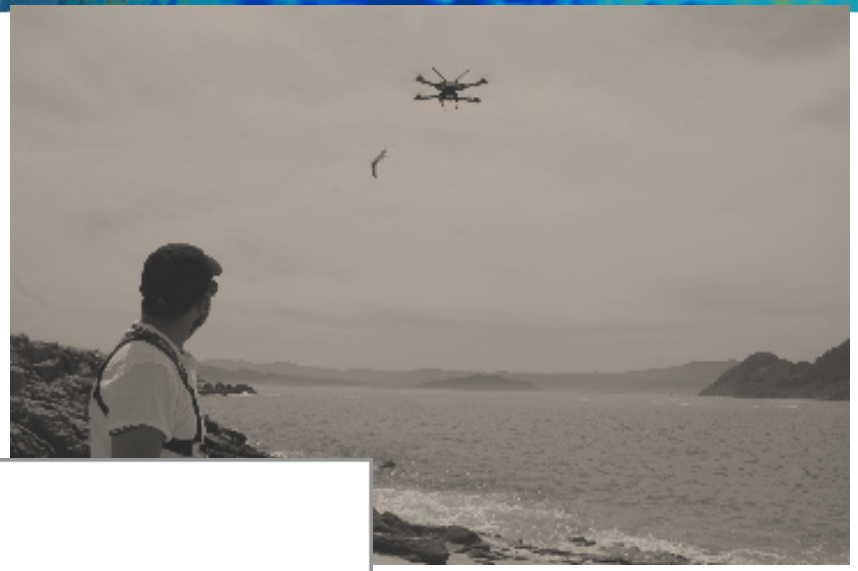
OBJECT RECOGNITION

Litter Drone

Human correction of non recognized objects



CONCLUSIONS



LitterDrone

CONCLUSIONS

Litter Drone

- **Interesting project ending at January 2019.**

- **Future Lines:**
  - ✓ Testing New Cameras.
  - ✓ Improving Object Recognition.
  - ✓ Jump to Market.

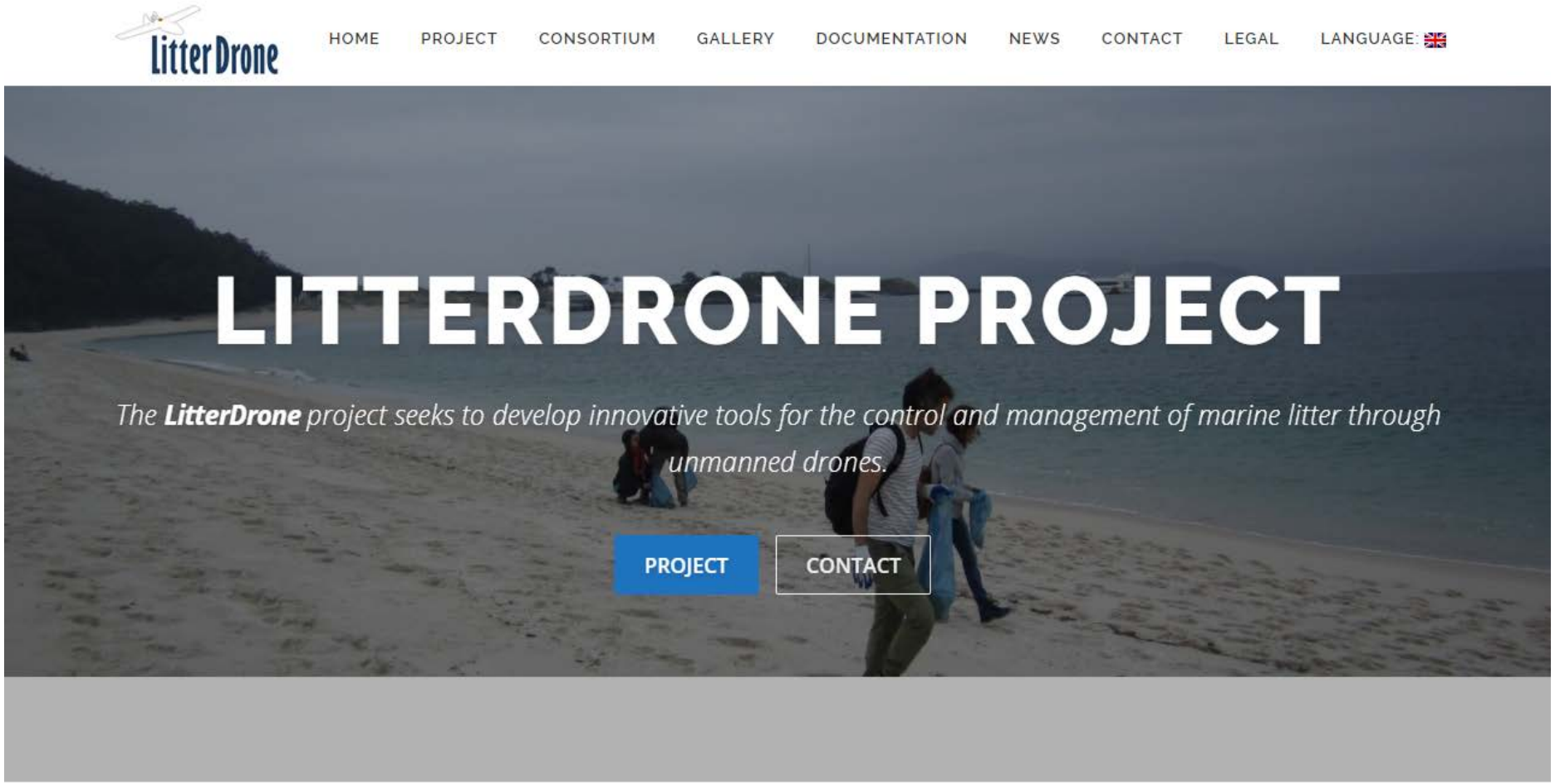
MEETING OF DRONE TECNONOLOGY, REMOTE SENSING AND COMPUTER VISION,

MORE PROJECTS OF THIS KIND ARE EXPECTED IN THE FUTURE

RECOMMENDATIONS

- Pay attention to drone technology & computer vision.
- Drone technology & hyperspectral sensors (or new hyperspectral sensors for drones).
- Drone imaging over the sea (near to coastline and/or drones launched from ships).
- Projects trying to integrate drone and satellite images.

THANK YOU !



www.litterdrone.eu