



Context

- **Who ?** The ecologists engineers of EGIS
- **What ?** Falco subbuteo's artificial nest occupancy survey
- **Where ?** Notre Dame Forest in the South of Paris, ecological compensation site for line 15 of Paris Suburban train
- **When ?** Years 2018-2019, regular monitoring after construction
- **Why ?** Mitigate disturbance on breeding birds and reduce the risk of falling (while tree climbing)



Gear-box of a tunnel boring head – SGP Line 15



Falco Subbuteo - © Jonas Landolt

Traditionnal methods used in 2018

Ornithological inventories : watch points, listening points, *identification of nests and their occupancy*

Height elevation 10 to 25 meters

Time 1 hour / 1 tree - nest

Nests occupancy monitoring

Risk fall / birds disturbance

Skills Special training – specific license for works-at-height



Test with measures

Target species : Hobby Falcon (Falco subbuteo), a protected species

Target location : Ten artificial nests

Goal : Check presence of clues proving attendance in the nest (feather, droppings, remains of eggshell ...)

Protocol

To improve efficiency of drone's nest monitoring both in terms of time and personnel security, the use of drones, also called Unmanned Aerial Vehicles (UAVs), has been tested and proven as part of a project.

A first experience has been conducted to test the capacity of UAVs to hover at different distances of the nest.

Several parameters have been measured: distance to the nest, image resolution, noise level (DB) and sound frequency.

The steps:

- Install an artificial nest in a tree with dense foliage. We put an hard-boiled egg and a baby bird's size plush !
- Install a sonometer close to the nest
- Perform a timed and measured UAV's flight with nest's shooting to defined quality pictures and noises in function of UAV-Nest distance



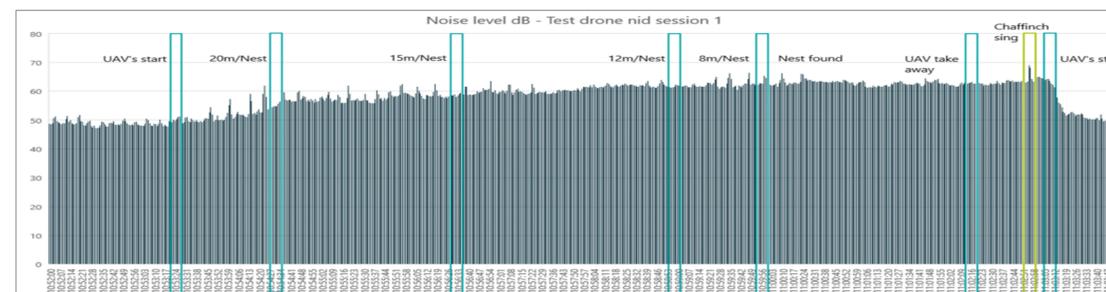
Results

We have defined an optimal distance that responds to the following criteria :

- reduce the disturbance linked to the noise emitted by UAVs (pitch and frequency)
- Acquire pictures with a quality and resolution sufficient for us to be able to interpret the different clues collected.

With this equipment, it has been shown that the optimal distance was around 8 meters, depending on the zoom power and the noise generate by the UAVs motors and blades.

Thanks to the UAV maneuverability, the nest occupancy results obtained are satisfactory even at this quite long distance and with a dense foliage.



Real application : Survey 2019

In application, a monitoring campaign has been carried out to survey nest occupancy on site

For the first campaign, the drone pilot was accompanied by the ecologist to localize the nests.

The survey duration was very efficient : 1 hour of preparation and 1 hour UAV flight for ten nests as opposed to 1 hour per nest with the traditional method.

The characteristics of the UAV – smaller than the one used for the test - and the features of the camera – more powerfull zoom - have allowed corrects shots with greater distance.



The pictures are geolocated making the monitoring easier and more relevant as well as the surveillance of the artificial nest (durability and occupancy).

As a conclusion, using drone presented an interest to save time and in terms of safety.

Limits of using drones : If any damage is observed on artificial nest, the ecologist will still have to climb to fix it. It is not possible to operate maintenance with these equipment.