FLYABILITY

# ELIOS 2
# Training Exercises

The objective of the training is to offer all the knowledge and the piloting skills needed to perform inspections with the Elios 2 drone. The training exercises have been inspired by the real-life inspections that our drone pilots are doing daily. The exercises will be performed during the training day and will allow you to further improve your skills as an Elios 2 pilot when used as regular practise routine.

## Risk evaluation of the flight area

This is the most important aspect of any mission. You always need to identify what the main risks are and where they are in the flight area. Elios 2 is collision resistant, however, you will be able to gather better footage more efficiently if you fly with a minimum of collisions. You should always identify, ideally before taking-off, the areas and objects to be avoided. All these aspects are part of the knowledge you will get during the introductory training. Do not forget to **always wear ears and eyes protection** when flying Elios 2.

## Flight plan.

Before every mission (or training session) you need to define a flight plan. You always need to know why you are flying and what is the objective of your flight. Most incidents occur when no flight plan has been defined. If you don't know where you are going to fly, you won't be able to identify the risks in the area and the object you need to avoid. During the Introductory training, we will give you some hints on how to define Flight plans.

## How the Exercises are Organized.

**The exercises 1-3** will be done exclusively in Line of Sign (LOS). The objective of these exercises is to learn how to control the drone and to understand how the drone reacts to the inputs you give on the remote control.

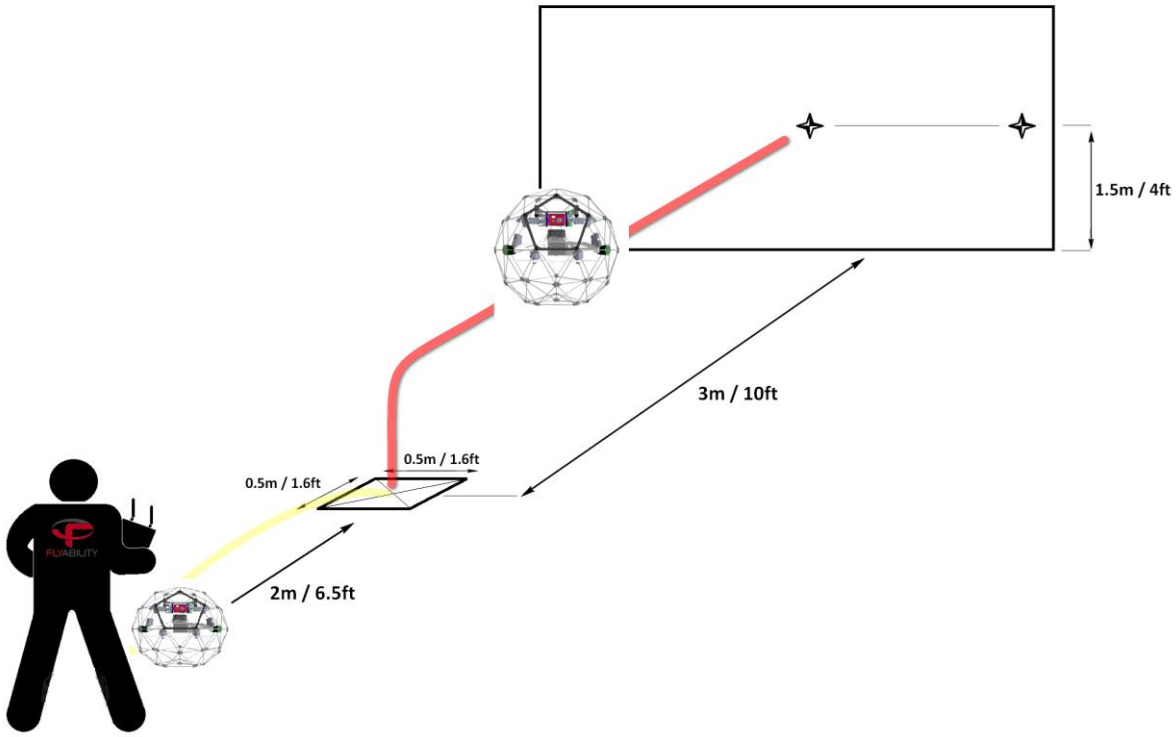
**The exercises 4-8** must be done in First Person View (FPV). You will see on the illustration of each exercises the sign 

. For those exercises you must go through the Check-list of the tablet before each flight and only rely on the video on the tablet to fly the drone

# Exercise 1: The shuttle run

## Objective:

In this exercise, you will take-off and fly in a straight-line forward and backwards, with a slight wall contact.
During an inspection, you need this skill to be able to fly to your target and look at it more closely.




## Risk evaluation of the flight area.

Make a proper evaluation of the risks you will encounter from the take-off location to your target and back.
Questions you need to ask yourself before a flight:

- Is there anything that could enter the cage?
- Can I get stuck somewhere?

## How to get there?

Begin the exercise with the UAV in front of you. Then take off and fly to the square, land on it without turning off the propellers. You will then take off and fly straight to the target. Once in contact with the target, you will fly backward to land on the square. Do the exercise 3 time in a row.

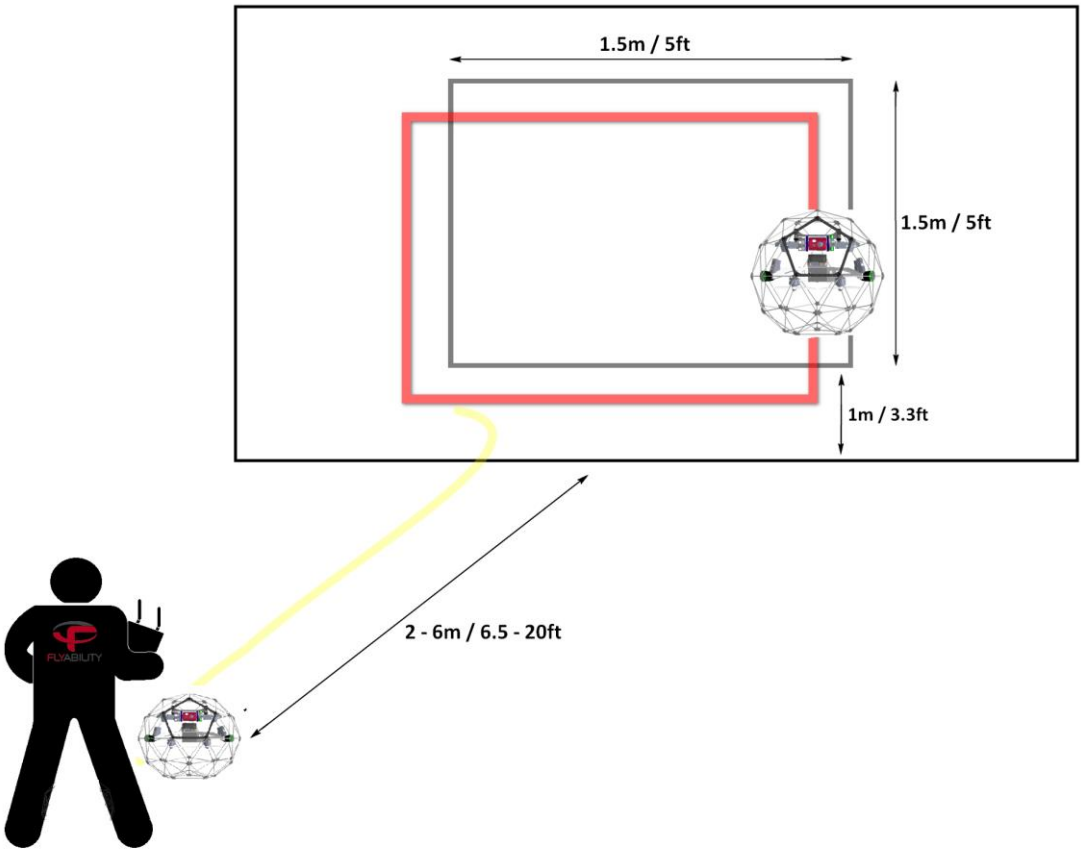
## Tips and tricks:

Do not change the heading (Yaw) unless the drone is no longer aligned with you, only use the left stick to change the altitude and the right stick to go forward and backward. When you are flying in LOS (line of sight) it is easier to fly backwards with the drone facing away from you. For the landing, you should always steady your flight before touching the ground descending vertically.

# Exercise 2: The vertical square

## Objective:

Follow the perimeter of the vertical square while maintaining a distance between 60cm and 30 cm to the wall.
In most inspection, you will need to follow a welding, control a line of bolts or even follow a pipe. During those inspection, you need to follow an exact line without losing sights of it. This exercise will let you practise the coordination required for such inspections.




## Risk evaluation of the flight area.

You may consider the risk around your flight zone in case you drift away from the flight area. It is important to check both sides of your objective before you begin your mission.

## How to get there?

Begin the exercise with the UAV in front of you. Then fly directly to the vertical square. Once you reach it, follow the line while maintaining a distance between 60cm and 30 cm to the wall.

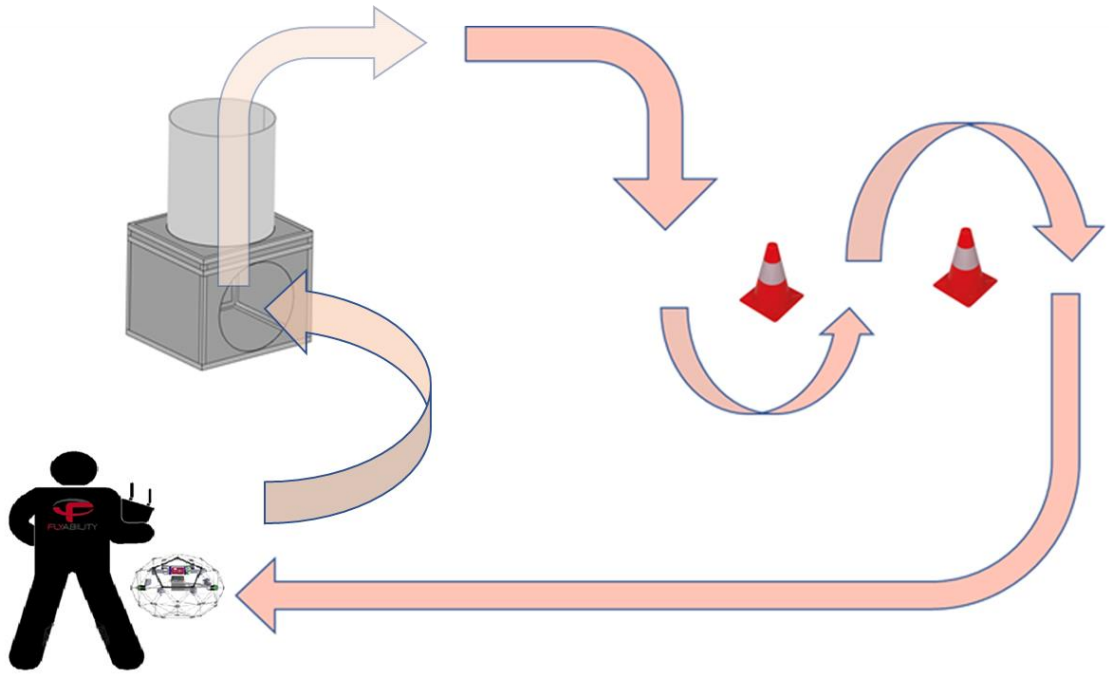
## Tips and tricks:

Don't get in contact with the wall, fly close to the wall but without contact if possible, it will allow you to have a much steadier flight and better footage. The camera provides the highest resolution at 40cm distance from the target.

# Exercise 3: Obstacle course

## Objective:

With this obstacle course, you will learn how to manoeuvre in a complex environment. Most of the places you will need to inspect have difficult access in often narrow places. This exercise will teach you to avoid objects or in some cases even use them to remain steady.



## Risk evaluation of the flight area.

In this exercise, you will fly through narrow pipes. It is very important to pay attention to any protruding objects that could get into the cage. You may bump into an obstacle or one of the cones. That is why you need to gather some information before and during the flight about areas and objects that are best avoided.

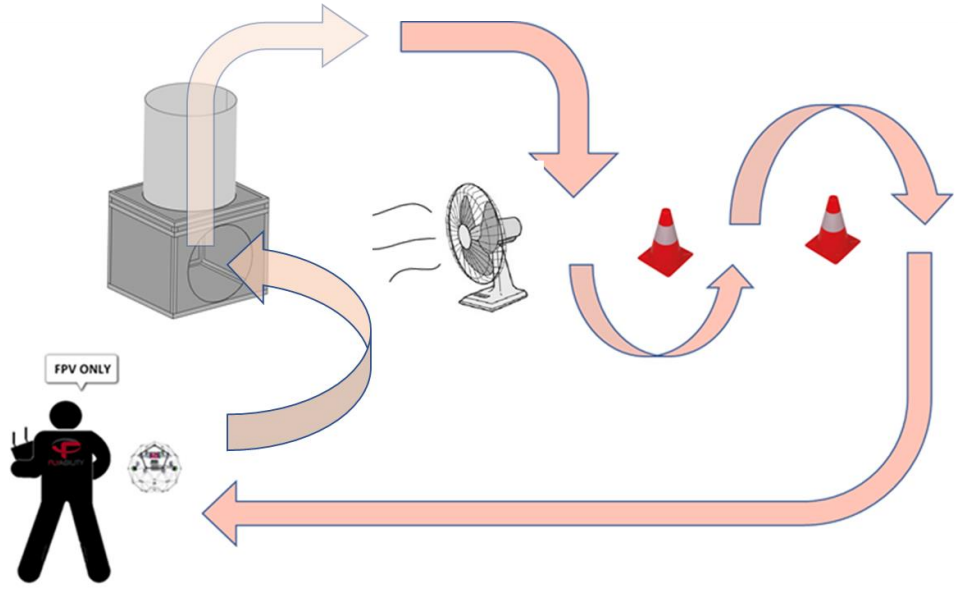
## How to get there?

You can move and follow the drone around if necessary.
Take-off in front of you, then pass through the pipes and slalom between the cones. Do the exercises 3 time in a row.

## Tips and tricks:

The easiest way to pilot the drone in LOS is to have the camera of the drone facing the same direction than your body. It is more logical and easier to control the drone this way.

# Exercise 3B: Do the exercise again with a wind effect and without the stabilisation




## Risk evaluation of the flight area.

Make a proper evaluation of the risks you will encounter from the take-off location to your target and back. You also need to consider the danger of being pushed by an airflow into an obstacle. In a real inspection scenario, it needs to be made based on any information your clients give you, such as the blueprints of the inspection area, or from your own observations.

## Wind effect

The portable fan must have a minimum size of 40 cm or 16 inch in diameter. It must be placed (in the non-oscillation mode) to blow right into the pipe. The purpose of the fan is to reproduce an airflow that would push the drone with a wind speed of 3m/s and destabilize it when he is going through the obstacle course.

## How to get there?

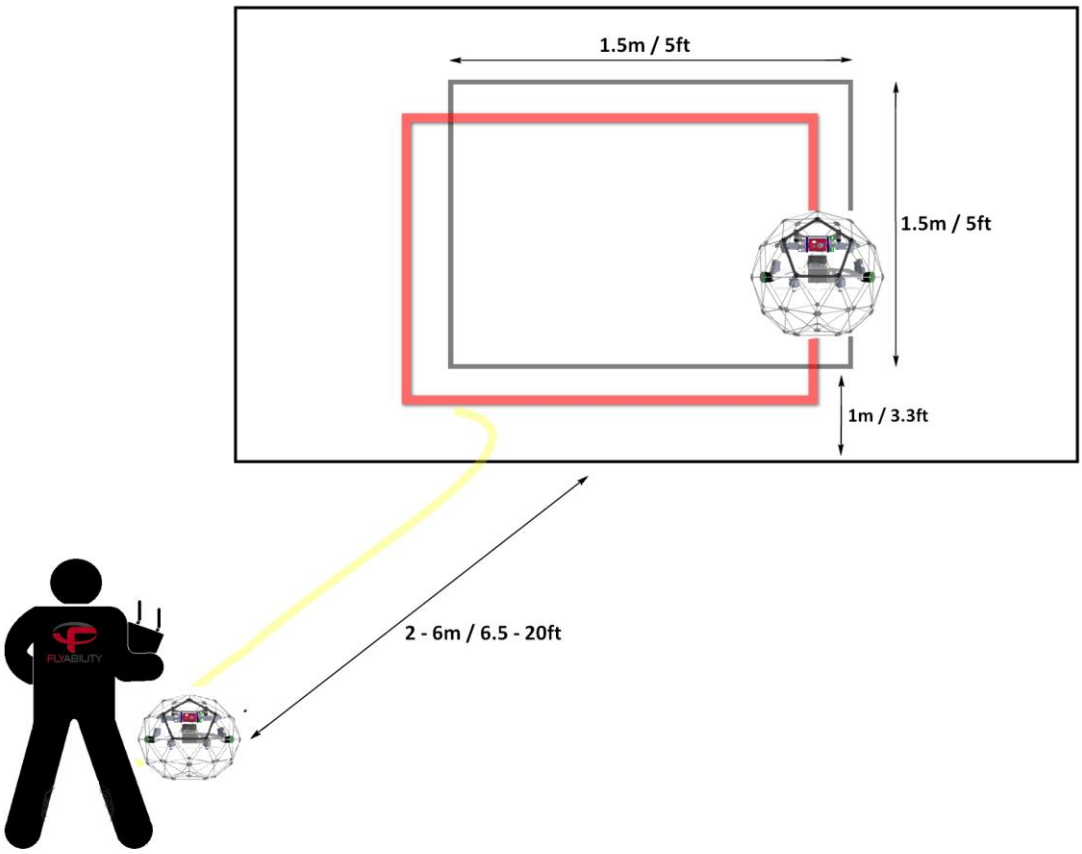
Do the first passage with the stabilisation activated. Pass through the pipe and proceed through the cones. On your second pass deactivate the stabilisation to get a better felling of how the stabilisation works. Do the third pass with the stabilisation.

# From this point, the drone must be piloted in FPV only.

## Exercise 4: The vertical square

### Objective:

Follow the perimeter of the vertical square while maintaining a distance between 60cm and 30 cm to the wall.
You are getting closer to a real inspection. The objective of this exercise is to practise flying with a drone close to your objective while using only the video to locate yourself. You will also discover that you need to fly steadily to have high quality footage.




### Risk evaluation of the flight area.

As you have a limited field of view during the flight you need to be careful to not fly backwards or sideways unless you have done a risk assessment of the entire flight area.

### How to get there?

Begin the exercise with the UAV in front of you. Then fly directly to the vertical square. Once you reach it, follow the line while maintaining a distance between 60cm and 30 cm to the wall.

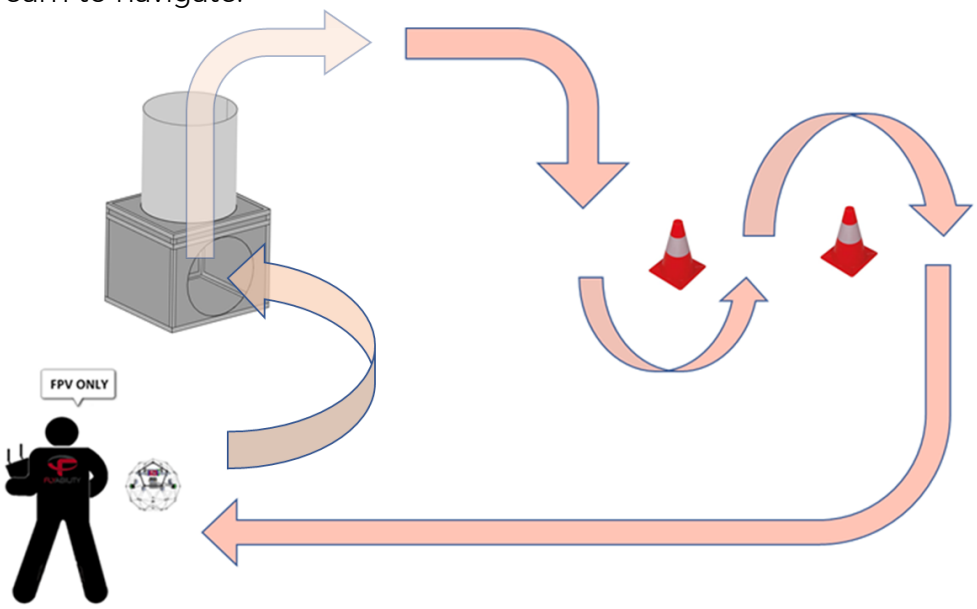
### Tips and tricks:

The best way to inspect a line without losing sight of it is to angle or tilt the camera to have a bigger range of vision. Do not look straight at it as it reduces a lot your field of view and the don't see potential obstacles coming. The camera provides the highest resolution at 40cm distance from the target, as the image will be out of focus at shorter range.

# Exercise 5: Obstacle course

## Objective:

This obstacle course in FPV is a good introduction to a real inspection. In this exercise, you will learn to fly in a cluttered environment and avoid obstacles, while using only the drone's video stream to navigate.




## Risk evaluation of the flight area.

Make a proper evaluation of the risks you will encounter from the take-off location to your target and back. In a real inspection scenario, it needs to be made based on any information your clients give you, such as the blueprints of the inspection area, or from your own observations.

**Questions you need to ask yourself before a flight:**

- Is there anything that could enter the cage?
- Can I get stuck somewhere?
- Will I lose sight of the drone?
- Could there be a major airflow?
- Can I lose connection?
- Can I get lost?
- At what % of the battery do I need to come back?

## Flight plan.

Decide on the path you are going to take, according to the risk assessment.

## How to get there?

This exercise is to be flown in FPV, you can force yourself to use the video display by turning your back to the drone.

Complete the obstacle course by passing through the pipes and then slaloming between the cones. Do this 3 time in a row.

## Tips and tricks:

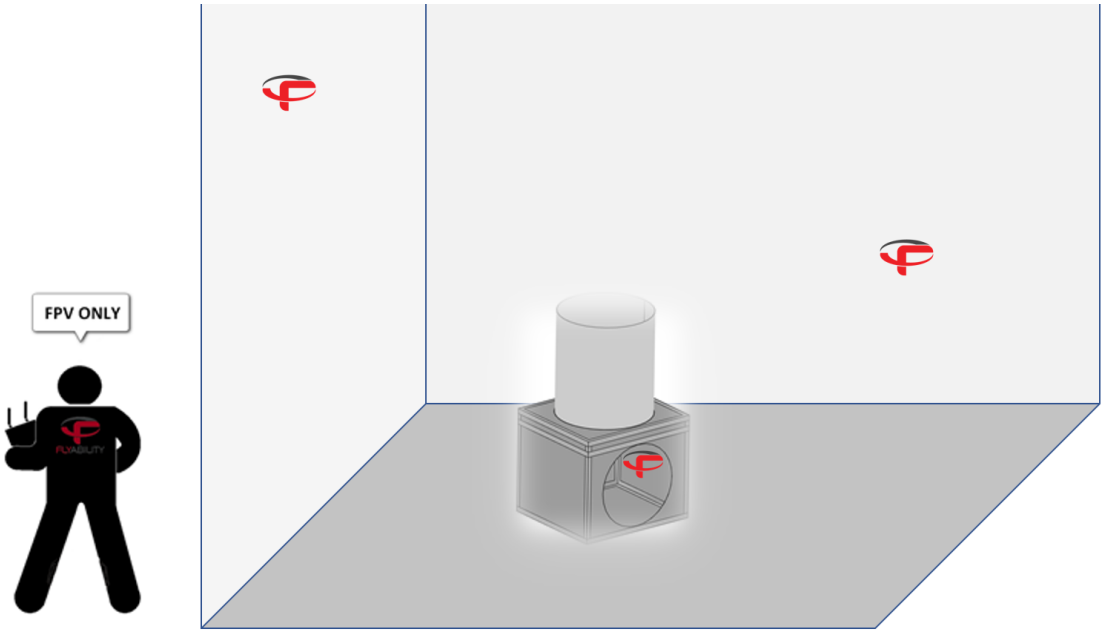
When you are flying in FPV you need to progress slowly for several reasons:

- You need to remember which path you are taking to be able to come back.
- The transmission of the live stream takes a few milliseconds, you will keep a better control if you fly slowly.
- You need to avoid obstacles, if you fly too fast you will bump into obstacles instead of avoiding them.
- Progressing slowly will allow you to do a good visual check of your surroundings.

# Exercise 6: Reconnaissance flight in dark condition.

## Objective:

With most missions, you will begin with a reconnaissance flight. The purpose of this flight is to spot critical objects and places you need to avoid (which may or may not have been identified beforehand), and to get familiar with the flight area.
In this exercise, you will need to control and fly close to the 4 Flyability logos (or other defined targets) which represent dangers. The instructor will tell you where the first 2 are, and you need to find **the 2 others.**




## Risk evaluation of the flight area.

As this is a reconnaissance flight, you need to be extra careful. The only objective of this flight is to assess the feasibility of the mission. Try to stabilize by leaning against safe walls and fly slowly and carefully. Do not forget that you are in FPV and drifting sideways or backwards could be dangerous. Try to get a good look at the inside of the confined space before flying into it.

## Flight plan.

To help you assess the risks, define a flight plan using the information you have gathered before your flight. (Is it an empty room? Can you land on the floor?...)

## How to get there?

This exercise is in FPV, and the drone will be flown into a different room beyond line of sight. Fly into the room trying to avoid as much as possible the obstacles and adjust camera and lighting settings as necessary.

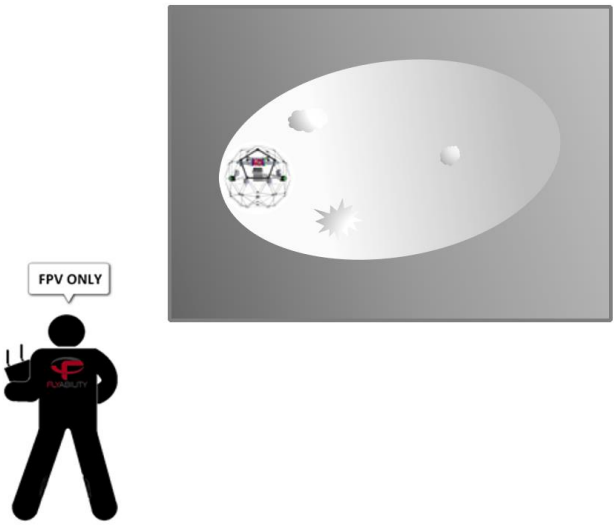
## Tips and tricks:

For this kind of search, you need to fly very slowly and methodically. Define your flight plan and do a reconnaissance accordingly. During the flight, you can also identify a zone where there is no risk, on the floor by example and land on it during the scanning of this area. Your light settings will be important for this kind of flight.

# Exercise 7: Oblique Lighting

## Objective:

This oblique lighting exercise will show you how to use the right camera and lighting settings to see small deformations or holes on a metallic plate.




## Risk evaluation of the flight area.

To be able to find default/holes into these metallic plates, you will need to fly in parallel of the metallic plates. Always check the surrounding of your inspection area. Do not forget to pay attention to small metallic parts on which the drone could get hooked

## Flight plan.

Fly straight to the metallic plates and place the drone in parallel of the plates. Do one plate after the other. Take a few pictures and POI during the flight when you think you have the best positioning.

## How to get there?

This exercise is to be flown in FPV, you can force yourself to use the video display by turning your back to the drone. Fly to the metallic plates, once in position turn on the side lights. Fly past the dented plate while maintaining a sharp angle with the wall.

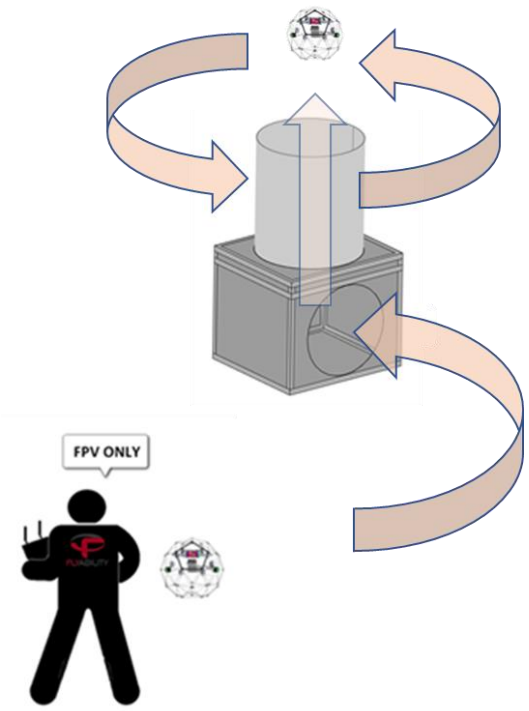
## Tips and tricks:

Try to avoid leaning on the wall. This will help you to have a steady and more progressive flight. Do the exercises a couple of times and experiment with the intensity of the lights.

# Exercise 8: Inspect the top of a pipe with and without stabilisation.

## Objective:

The objective of this inspection is to obtain clear images of all the rivets at the top of the pipe.




## Risk evaluation of the flight area.

During this flight you will point your drone at the top of the vertical pipe. This mean that you will not always see where the drone will drift. You need to make sure before you start your inspection that you have enough room on each side of the pipe to be able to circle around it.

## Flight plan.

Your turn to define your flight plan.

## How to get there?

Plan yourself the best way to do this exercise. Do the exercises 2 times with the stabilisation and the last time without.

## Tips and tricks:

This exercise is about keeping the right distance to the target (+- 30cm/ 1 foot), managing the light settings, and having a slow progression speed. Check the footage from the drone to verify the results.