# ELIOS 3
# Training Exercises

The objective of this training is to share all the knowledge and piloting skills needed to perform easy inspections with the Elios 3 drone. After completing the simulator training, we recommend that you perform at least seven flight exercises to complete your Elios 3 training. This will help you gain full proficiency with your drone and its features.

## Risk evaluation of the flight area

This is the most important aspect of any inspection. You always need to identify what the main risks are and where they are in the flight area. We define three categories of safety around the drone that you should consider before any flight:
- The safety of the people present in the flight area.
- The safety of the drone.
- The safety of the facility.

All these safety considerations are part of the knowledge you got during the introductory training. Do not forget to **always wear protection for your ears and eyes** when flying Elios 3.

## Flight plan.

Before every drone flight 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 flying, 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 tips on how to define flight plans.

## How the Exercises are Organised.

**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.

**Exercises 4-8** must be done in First Person View (FPV). For those exercises you must go through the check-list on 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, fly to two different targets, make a POI of them, and come back and land in the same place where you took off.

During an inspection, you need this skill to be able to fly to your target and look at it more closely.



1.5m / 4ft

3m / 10ft

0.5m / 1.6ft

0.5m / 1.6ft

2m / 6.5ft
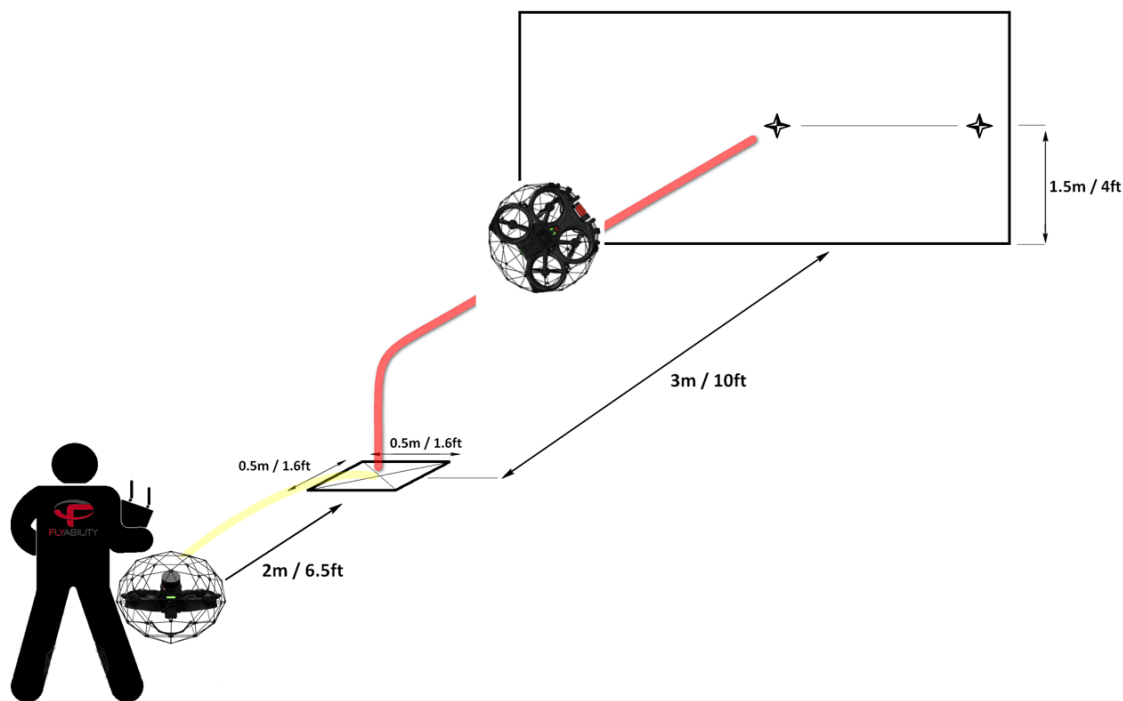
## Risk evaluation of the flight area.

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 your E3 in front of you. Then take off and fly to the square and 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 times 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, and descend vertically.

# Exercise 2: The vertical square

## Objective:

Follow the perimeter of the vertical square while maintaining a distance of 30 cm(1 foot) to the wall.
In most inspections, you will need to follow a welding, control a line of bolts, or even follow a pipe. During inspections like this, you need to follow an exact line without losing sight of it. This exercise will let you practise the coordination required for such inspections.
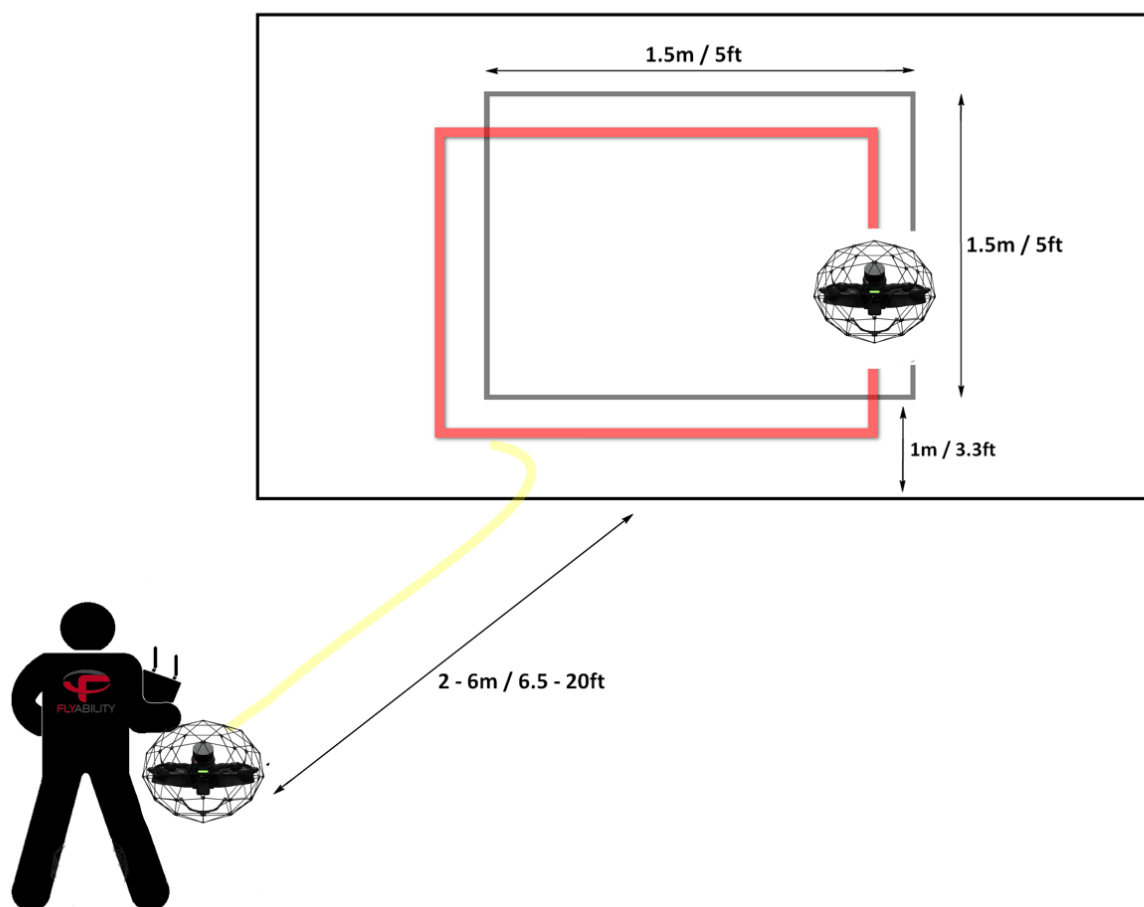


## Risk evaluation of the flight area.

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 of 30 cm (1 foot) to the wall. Do the exercise two times, the first time manually and the second time you can use the distance lock. You can increase or decrease the distance with the right joystick when the distance lock is activated.

## 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.
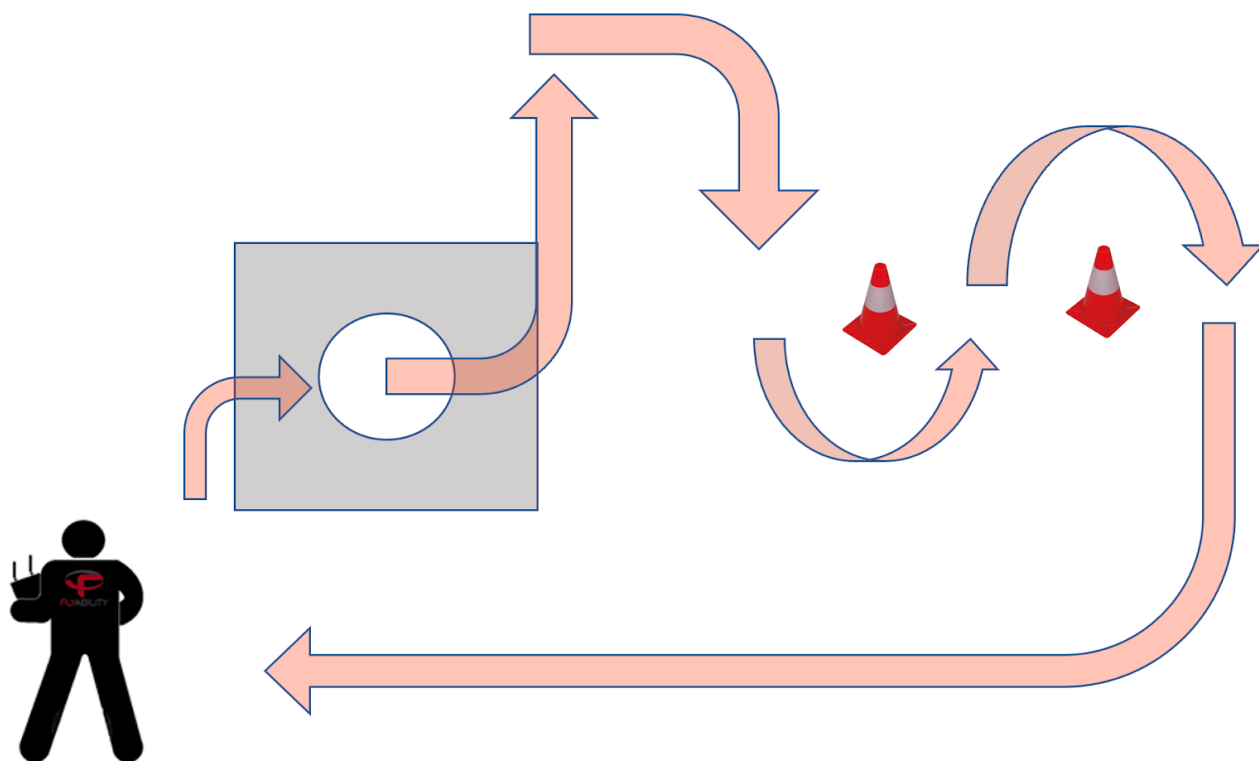


### Risk evaluation of the flight area.

In this exercise, you will fly through manholes. 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.
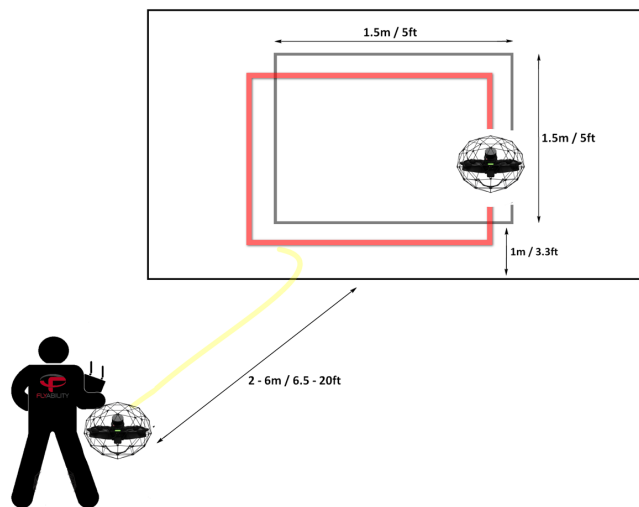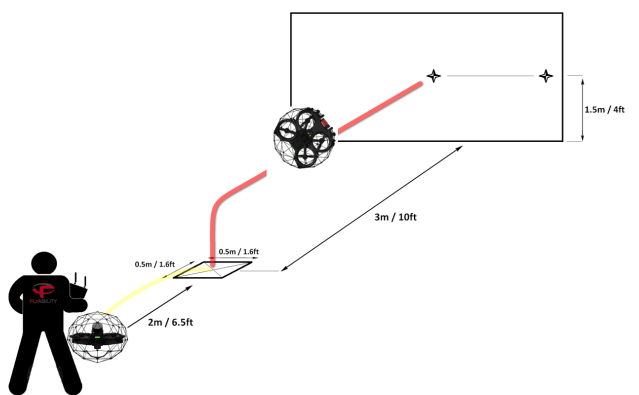
### How to get there?

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

# From this point, the drone must be piloted in First Person View only.

## Exercise 4: The shuttle run + vertical square

### Objective:

In this exercise, you will take-off and fly to two different targets on the wall. When you are at about 30cm (1 foot) to the target, take a POI of each target. Then fly to the vertical square and follow the line of the square while maintaining a distance of 30 cm/1 foot.





### Risk evaluation of the flight area.
As you have a limited field of view during the flight, you need to be careful not to fly backwards or sideways unless you have done a risk assessment of the entire flight area.
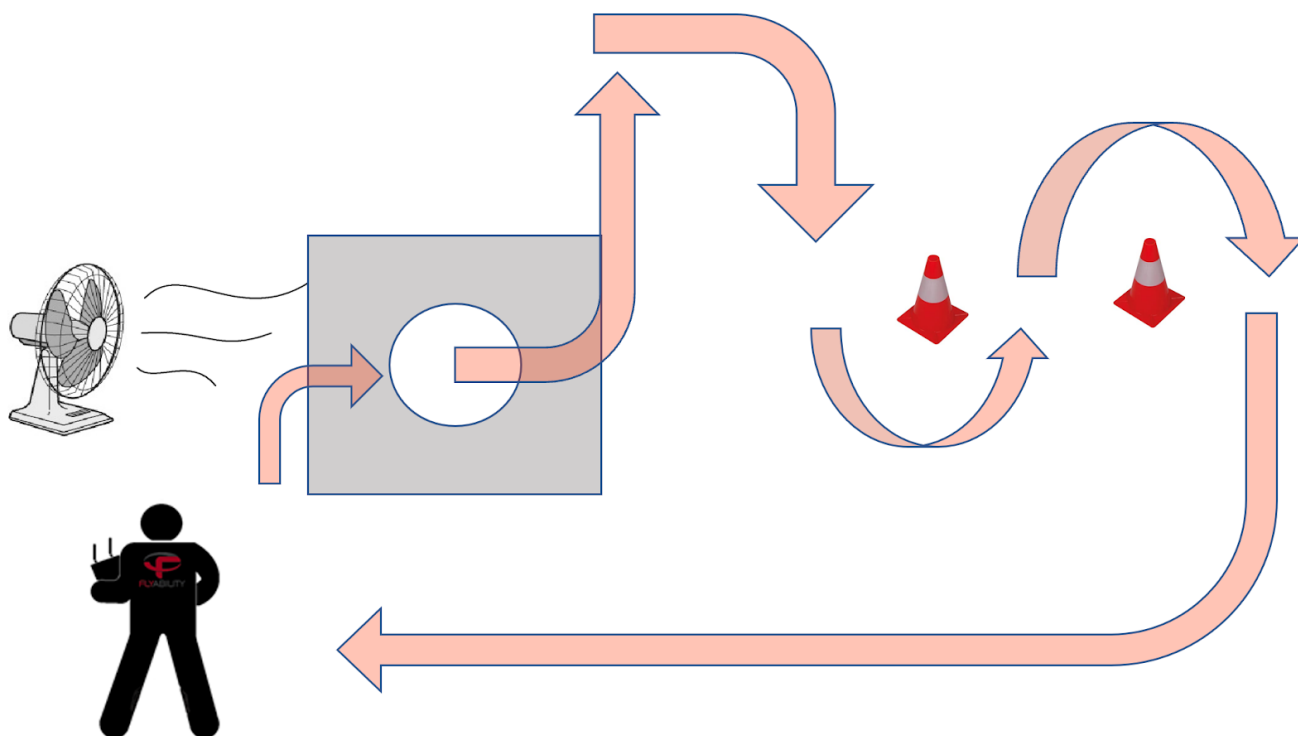
## How to get there?

Begin the exercise with the UAV in front of you. Then fly directly to the two targets and take a POI of each of them. Then fly to the vertical square. Once you reach it, follow the line while maintaining a distance of 30 cm (1-foot) to the wall.

# Exercise 5-6: Obstacle course without the LiDAR and without stability.

## Objective:

The objective of this flight is to use the drone with and without the Visual-Inertial Odometry stabilisation. For this flight, you need to remove the lidar from your Elios 3. To do so, you need to use the T8 screwdriver and remove the Lidar from the drone. Flying without the lidar will increase your flight time but you will lose the benefit of the lidar stability and the live map. It will however increase flight time by a few minutes. During this flight, you will have to redo an exercise as many times as possible by alternating between ASSIST and ATTI mode. Please remove the lidar from the drone as strong collision may damage the Lidar.

## Risk evaluation of the flight area.

Make sure to identify any risks around your flight trajectory.

## Flight plan.

This is like the obstacle course of exercise 3, but do it as many times as possible in ASSIST and ATTI mode.

## How to get there?

First step is to remove the Lidar from the drone. Then place the drone at the take of position and fly through the obstacle course one time. Then switch to ATTI flight mode by using the top left switch or by pressing and holding the back right button on the Remote Control. Do the exercises as many times as possible in ASSIST and ATTI flight mode with one battery.

## Tips and tricks:

Flying in atti doesn't require the same flight techniques as flying in ASSIST flight mode. In ATTI flight mode the drone is only stabilised in altitude by the barometer. So the best way to control the drone is to use the natural drift of the drone and push it in the right direction. Do not give strong impulse on the joystick but prefer small constant impulse.

# 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.
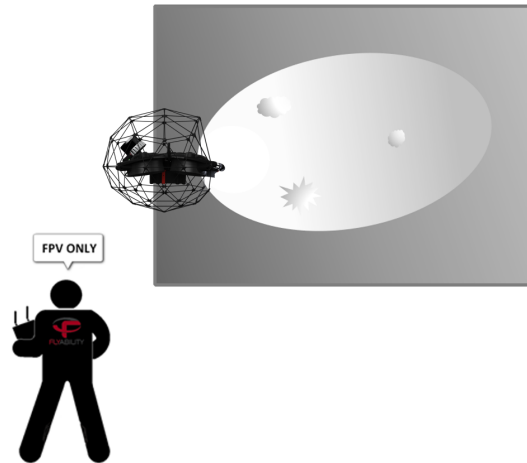


## Risk evaluation of the flight area.

To be able to find default/holes in the metallic plates, you will need to fly in parallel with them. Always check the surroundings 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 with the plates. Do one plate after the other. Take a few pictures and POIs during the flight when you think you have the best positioning.

## How to get there?

This exercise is to be flown in First Person View. 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: Do the obstacle course by following all the best mapping practices.
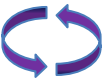
## Objective:

This exercise will help you to put into practice all the good mapping flight practices.
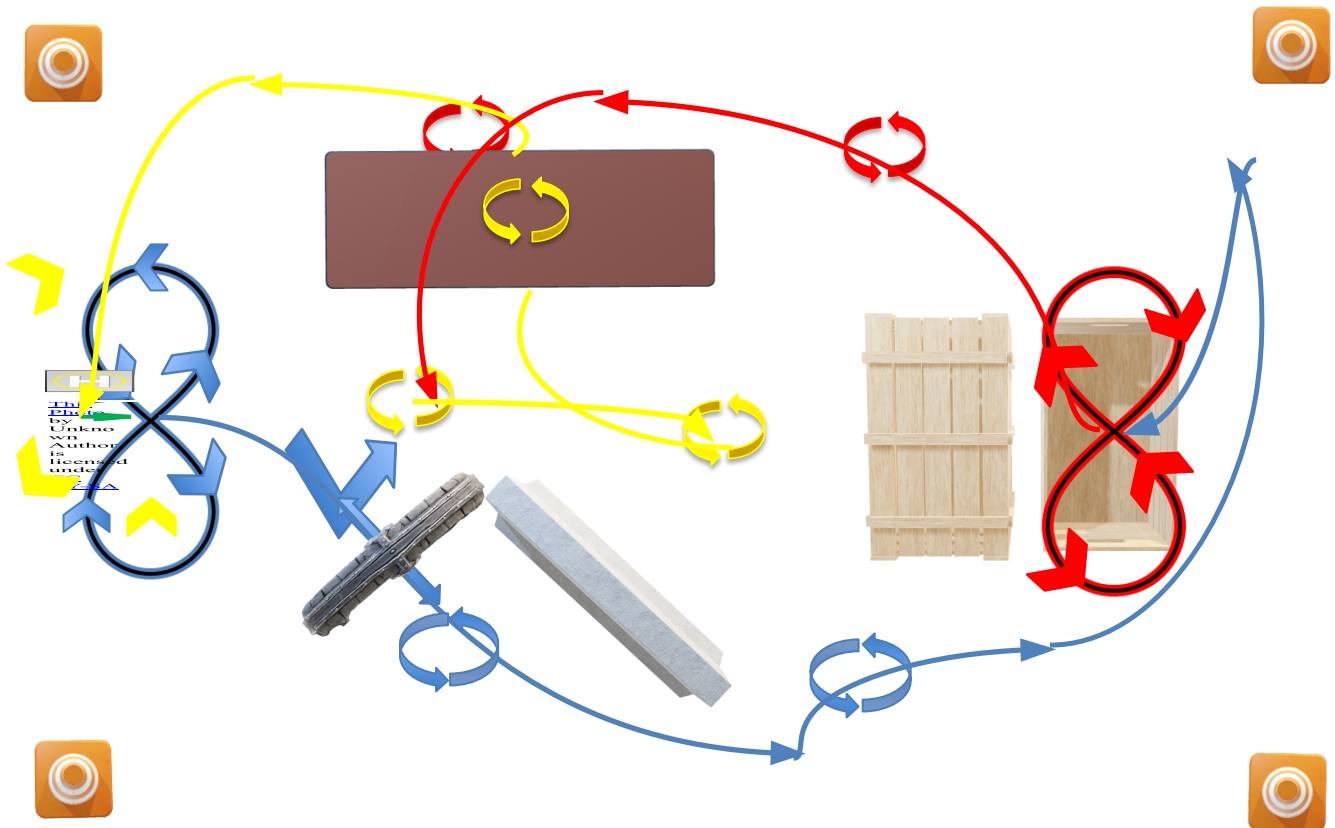


The figure above represents an example of a mapping flight path. It shows the trajectory to be followed and the different manoeuvres to be performed to get the best possible scan of the area.

Please find the legend for the different manoeuvres in the figure below:

Take off and gain altitude (preferably at least 1m above the take off point)

Perform / fly a figure 8 ( this helps to cover 100% of the area)

Drone is pointing in this direction during flight

Turn the drone sideways and fly sideways through the manhole

Perform a 360° turn ( faster than an 8 shape turns and cover well the area)

This is what the defined flight area above looks like from a 3D perspective.
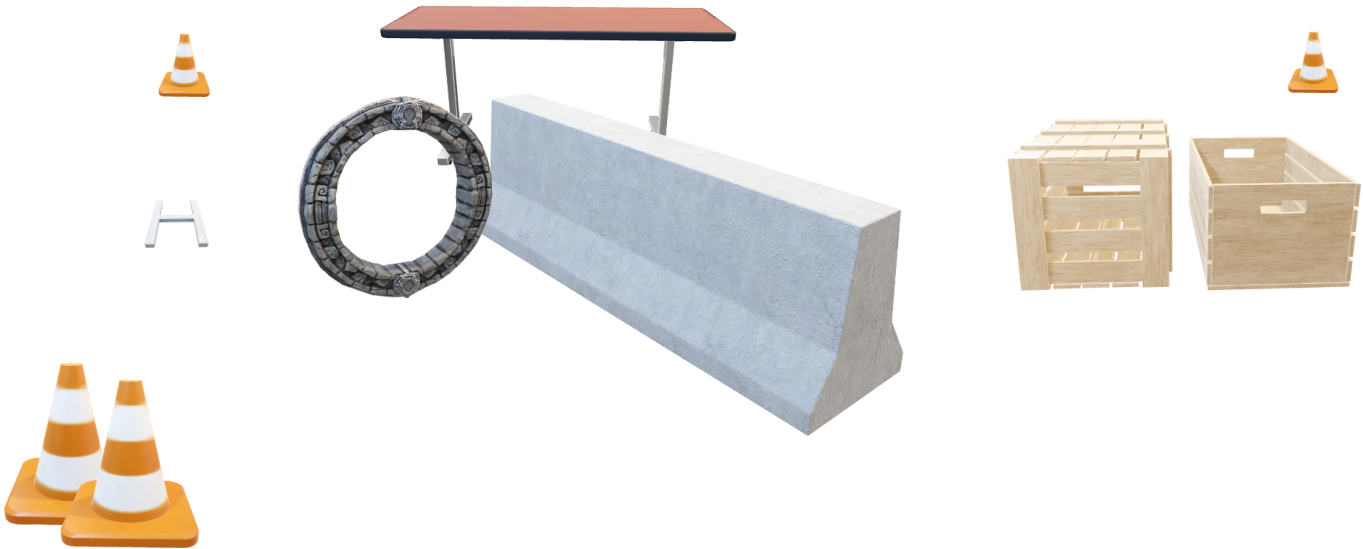


## Risk evaluation of the flight area.

During this flight you will fly your drone using the mapping flight techniques. This means that you must follow all mapping flight techniques you have learned during training. You need to make sure that before you start your mapping flight that the mapping flight mode slider is turned ON in cockpit.

## Flight plan.

For a mapping flight you should always plan your flight in advance.

You need to take the following points into consideration:
- Physically define your take-off spot
- Turn on "Perform a mapping flight" slider in Cockpit and make sure you fly in ASSIST
- Take off and fly to an altitude of 1m (3.3 ft)
- Fly the drone above the take off area and perform a figure 8 to open the loop
- Fly to the manhole
- Look through the manhole to see if there are any dangerous objects on the other side
- Fly sideways into the manhole
- After having flown through the manhole, do a slow 360° turn to scan the area
- Fly slowly through the obstacles
- Perform 360° turns as needed to guarantee proper data capture with the LiDAR
- Gain altitude in the room and do another figure 8
- Fly above AND below the table performing 360° turns on both passes
- Come back to your take off point
- Land on your take off spot