Drone Watch & Rescue

Mission Simulator - User manual

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1. INTRODUCTION

Drone Watch & Rescue is a set of online applications to create and simulate multi-UAV missions, in an environment related to the mission modelling and mission planning developed in the *Open Innovation SAVIER project of Airbus Defence and Space.*

The functionality of this application is divided in three main tools:

1. Mission Designer: Used by a mission operator to create new UAV missions.
2. Scenary Scheduler: Used by an operation trainer to plan the incidents plan and the expected-interactions of a specific mission.
3. Mission Simulator: Execute an specific mission plan. The mission plan is given by the work of *Cristian Ramírez Atencia* in his Thesis *TD-04* of the *Open Innovation SAVIER project of Airbus Defence and Space.*

This document focuses on the Mission Simulator. First we will explain how to access the simulator and how to execute a mission. Then there will be a brief description of the different elements of the simulator interface, and finally, we will detail the different actions that an operator can perform, and how to use them in order to avoid the various incidents that may occur during a simulation execution.

2. GETTING STARTED

The *Drone Watch & Rescue (DWR)* tools do not require any additional software to be executed. It can be accesed via *web browser* through this location [1]:

http://durin.ii.uam.es:8888/

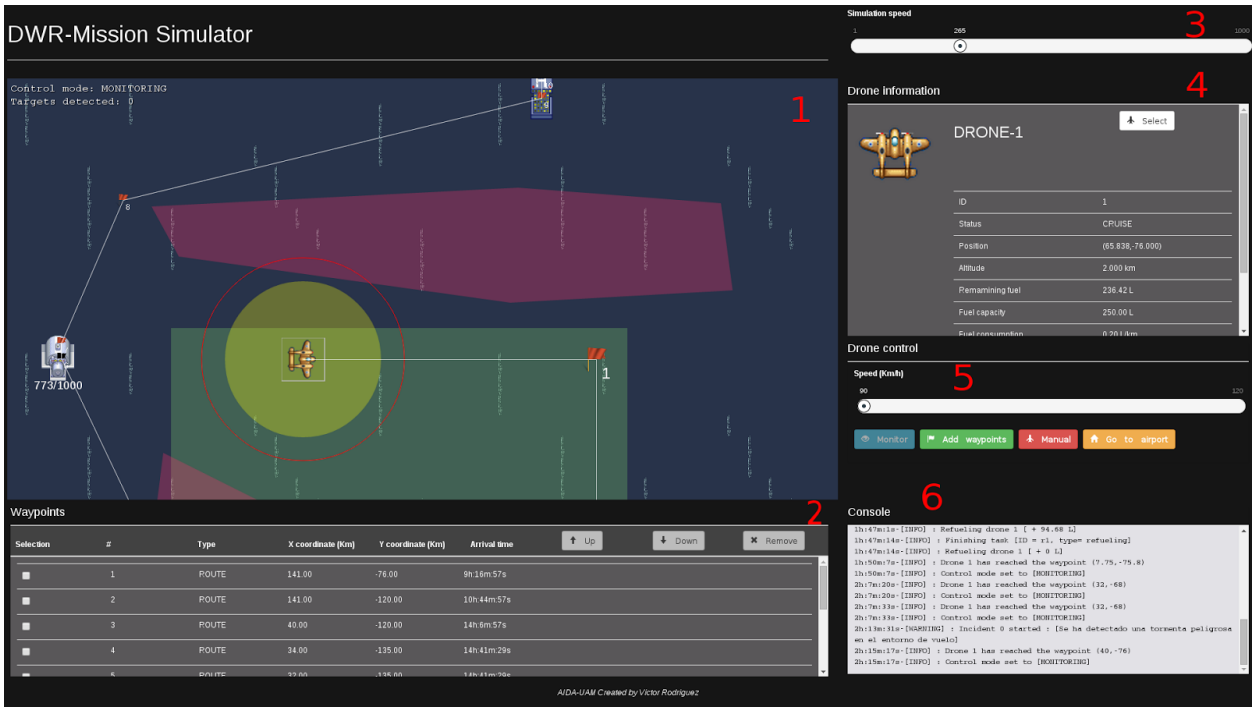
[1] If there is any problem accessing to this location contact to victor.rodriguezf@estudiante.uam.es

To run a mission in *DWR-Mission simulator* please follow these steps:

- Go to the “Mission Simulator” tab.
- Select the mission plan you want to simulate in the Mission plans table.
- Press the button “Simulate this mission plan!” to execute the Mission Simulator.

3. SIMULATOR INTERFACE

This picture shows a screenshot of a mission plan running in *DWR-Mission Simulator*:



The *DWR-Mission Simulator* interface is divided in 6 sections:

1. Simulation screen: It is the most important window of the simulator. It graphically displays the simulation map, the simulation status and all its elements:
    a. Drones: The circles around the drone represent the payload elements:
        i. Radar: Drawn as a filled yellow circle.
        ii. Camera: Drawn as a red circular-line
    b. Waypoints: Drawn as numbered flags. Can be of different types:
        i. Cruise: Red flags
        ii. Refueling: Black flags over a Fuel Station.
        iii. Task: Green flags over a Objective Zone.

iv. Land: Black flags over an airport.

c. No Flight Zones : Red areas
d. Objective Zones (Flight zones): Drawn as green areas.
e. Airports
f. Refueling Stations

2. Waypoints table: Shows the current waypoints of the selected drone in detail.
3. Simulation time panel: Shows the information and control options of the simulation time and speed.
4. Drone information panel: Shows the current information of all the UAVs taking part of this simulation.
5. Drone control panel: If a drone is selected, shows the possible actions that an operator can perform to control the drone.
6. Console: Shows a log of all the events and interactions happened during the simulation.

The next section will explain all possible interactions taht any operator can perform within the Mission Simulator. To explain those interactions there will be references to the panels explained in this section.

4. INTERACTIONS MANUAL

This section explains the different interactions that an operator can perform during the execution of a simulation in *DWR-Mission Simulator*.

Basic interactions

Name	Description	How to perform it
Move Camera	Moves the camera along the simulation screen. This allows the operator to see every point in the mission map.	Arrow keys (Up, Down, Right, Down)
Select a drone	At the beginning of the simulation there is no drone selected. Select a drone allows the operator to monitor and control the drone status and waypoints.	2 modes: - Left click over a drone in the simulation screen. - Left click on the “Select” button of a drone in the

		Drone information panel.
Set simulation speed	Increase or decrease the simulation time speed. Normally, the UAV missions last many hours, so sometimes it is desirable to accelerate the process. The minimum simulation time speed is 1, what means that it is equal to the real time. The maximum value is 1000, which means that it is 1000 times higher.	Left click over the slider on the simulation time panel (panel 3 in the screenshot), in the upper right corner of the screen.

Control mode interactions

In order to manipulate the path that a drone must follow during a mission, we can choose different control modes.

Name	**Description**	**How to perform it**
Set control mode: Monitor	Sets the control mode of the selected drone to 'Monitor'. This is the default control mode and allows the operator to see and edit the drone's waypoints, but not to add new waypoints. When a new drone is selected or when a drone reaches a waypoint, this control mode is set automatically.	Press the 'Monitor' button in the drone control panel. It is necessary to select a drone before performing this interaction.
Set control mode: Add waypoints	Sets the control mode of the selected drone to 'Add waypoints''. This control mode allows the operator to view and edit the drone's waypoints, and also to add new waypoints **at the beginning** of the drone's path, maintaining the **rest of the waypoints unchanged**.	Press the 'Add waypoints' button in the drone control panel. It is necessary to select a drone before performing this interaction.
Set control mode: Manual	Sets the control mode of the selected drone to "Manual". This control mode allows the operator to define a new path, deleting the previous one.	Press the 'Manual' button in the drone control panel. It is necessary to select a drone before performing this interaction.

Waypoint interactions

Name	Description	How to perform it
Add a waypoint	Adds a new waypoint on the current drone's path. It is necessary to select a drone to perform this action. Depending on the control mode selected, this interaction change its behavior: - Control mode "Monitor": It's not possible to add waypoints. - Control mode "Add waypoints": The waypoints added don't change the previous drone's path. - Control mode "Manual": The waypoints added define a new path.	With a drone selected, and the appropriate control mode set, click any point in the simulation screen to add a waypoint in that position. Click over the sea to create "Cruise" waypoints. Click over a refueling station to create "Refueling" waypoints. Click over an airport to create "Land" waypoints.
Set waypoint position	Set a new position for an existing waypoint. It is necessary to select a drone to perform this interaction. All the control modes are valid for this interaction.	With a drone selected, **drag any waypoint** across the simulation screen.
Increase waypoint order	Increase by one the order of a waypoint. It is necessary to select a drone to perform this action. This interaction is not available for the first waypoint.	Select a specific waypoint by clicking its associated row in the *Waypoints table* and press the button "Up" of the same table.
Decrease waypoint order	Decrease by one the order of a waypoint. It is necessary to select a drone to perform this action. This interaction is not available for the last waypoint.	Select a specific waypoint by clicking its associated row in the *Waypoints table* and press the "Down" button of the same table.
Remove waypoint	Remove a waypoint from the current drone's path. It is necessary to select a drone to perform this action	Select a specific waypoint by clicking its associated row in the *Waypoints table* and press the "Remove" button of the same table.

Drone control interactions

Name	Description	How to perform it
Set drone speed	Set the drone speed. The new speed value must be between the drone minimum and maximum speed values. It is necessary to select a drone to perform this action.	Mouse click over the slider on the drone control panel.
Return to airport	Move the drone to its associated airport. This interaction is equivalent to adding a new waypoint in a position where there is an airport.	Press the "Go to airport" button in the *drone control panel*.

5. INCIDENTS MANUAL

During the execution of a mission plan in *DWR-Mission Simulator*, many incidents can affect either to the environment or the drones performing the mission. The goal of introducing incidents is to test the operator ability to avoid them and make a new and safe mission plan. There are different type of incidents defined in *DWR-Mission Simulator*:

Name	Description	How to avoid it
Danger Area	Due to weather troubles or other possible threat, a new *No Flight Area* (See Section 3) appears in the simulation map. If a drone flights over one of these areas, it will be immediately destroyed.	Use some of the possible *waypoint interactions* (See section 4) to change the drone's path or to define a new one.
Payload Breakdown	One of the sensors that compose the drone's payload stops working properly. As a result, the drone becomes unable to watch and rescue any objective.	Guide the drone to any airport in the mission map to fix the drone's payload.

6. TROUBLESHOOTING

Drone Watch & Rescue is still under heavy development. If you experience any problems to use the tools or detect a bug, please send a mail to victor.rodriguezf@estudiante.uam.es