CLAIMS

1. A computer-implemented method, implemented in air traffic control system controlling an airspace, the airspace comprising a set of obstacles, each obstacle being associated with a criticality level, said method accessing to at least one information storage medium storing a definition of a set of fixed and mobile obstacles in the airspace, comprising:

- receiving, through a communication port, a trajectory request from an unmanned aerial vehicle, said request comprising: an initial point; a final point; at least one manoeuvrability parameter of the unmanned aerial vehicle, a manoeuvrability parameter being a parameter that has an impact on the flight capabilities of the unmanned aerial vehicle;
- computing a plurality of optimized 4D trajectories between the initial point and the final point, complying with the at least one manoeuvrability parameter, each 4D trajectory being a succession of 4D waypoints, each defined by a latitude, a longitude, an altitude, and a time, and avoiding obstacles in an airspace, each 4D trajectory being associated with a performance score, said performance score being determined at least by criticality levels associated with the obstacles from said airspace;
- simulating, by a flight simulator, each of said plurality of 4D trajectories by decreasing order of the associated performance scores, until an optimized 4D trajectory is selected by the flight simulator, said simulation of each optimized 4D trajectory comprising determining, by the flight simulator, if said simulated optimized 4D trajectory is flyable, and if so selecting said flyable optimized 4D trajectory;
- sending said selected optimized trajectory to said unmanned aerial vehicle through said at least one communication port, to be followed by the unmanned aerial vehicle.

2. The method according to Claim 1, wherein the trajectory request comprises a series of waypoints defining a target route.

3. The method according to either of the preceding claims, wherein a 4D trajectory is optimized in accordance with one or a combination of the following parameters:

- minimizing a length of the trajectory while passing through a series of waypoints in a predefined order;

- minimizing a number of unmanned aerial vehicle manoeuvres over the trajectory;
- complying with the at least one manoeuvrability parameter;
- avoiding obstacles in accordance with a criticality level of the obstacles;
- complying with a safety corridor around a target route.

4. The method according to one of the preceding claims, comprising adding the selected optimized trajectory to the obstacles in order to compute the trajectory of other aircraft in the airspace.

5. The method according to one of the preceding claims, wherein computing a 4D trajectory of the plurality of optimized 4D trajectories comprises:

- receiving a three-dimensional representation of the airspace at the time when the method is executed;
- encoding the airspace configured so as to determine a smaller representation of the airspace by applying a recurrent autoencoder to said three-dimensional representation of the airspace at said time when the method is executed;
- determining an action to be implemented by said unmanned aerial vehicle, by implementing a deep reinforcement learning algorithm in order to determine said action based on said smaller representation of the airspace and on information relating to said unmanned aerial vehicle and/or to at least one other aircraft in the airspace.

6. The method according to Claim 5, characterized in that said deep reinforcement learning algorithm is trained beforehand to approximate a reward function for a given representation of a scenario in the airspace at the time when the method is executed, said action corresponding to an optimum strategy that maximizes said reward function in the training phase, said reward function defining the performance score associated with the 4D trajectory.

7. The method according to Claim 6, characterized in that said reward function associates a value with each triplet comprising an air situation at a first given time, an action taken at a given time, and an air situation at a second given time, said value being broken down into a plurality of penalties comprising:

- a positive penalty if the action taken at the given time has resolved a conflict, or
- a negative penalty if the action taken at the given time has not made it possible to resolve a conflict or has led to at least one other air conflict;

- a negative penalty if the action taken at the given time leads to a new trajectory that causes a detour;
- a positive penalty if the action taken at the given time leads to a new shorter trajectory;
- a negative penalty if the action taken at the given time makes it possible to resolve said air conflict and the resolution takes place close to the conflict;
- a negative penalty that increases with the number of actions taken to resolve said air conflict.

8. The method according to Claim 7, wherein the sum of the negative penalty if the action taken at the given time has not made it possible to resolve a conflict or has led to at least one other air conflict depends on the criticality of said conflict or of said other air conflict.

9. A system comprising:

- at least one communication port able to communicate with an unmanned aerial vehicle;
- an access point to at least one information storage medium storing a definition of a set of obstacles in an airspace;
- at least one computing unit configured so as to execute a method according to one of Claims 1 to 8.

10. A computer program product comprising program code instructions for executing the steps of the method according to one of Claims 1 to 8 when said program is executed on a computer.