

AUTOMATIC GENERATION OF A FLIGHT PATH FOR TARGET ACQUISITION

CROSS-REFERENCE TO A RELATED APPLICATION

5 The present application claims benefit from IL285486 filed on August 9, 2021.

TECHNOLOGICAL FIELD

The invention is in the field of generating a flight path for an aerial vehicle.

BACKGROUND

A flight path defines the path to be followed by an aerial vehicle. The flight path
10 depends on various constraints of the mission to be performed by the aerial vehicle.

References considered to be relevant as background to the presently disclosed
subject matter are listed below (acknowledgement of the references herein is not to be
inferred as meaning that these are in any way relevant to the patentability of the presently
disclosed subject matter):

- 15 - US2020202115;
 - US8718838;
 - US10618673;
 - WO2018232447.

There is now a need to propose new systems and methods of generating a flight
20 path for an aerial vehicle.

GENERAL DESCRIPTION

In accordance with certain aspects of the presently disclosed subject matter, there
is provided a method comprising, by a processor and memory circuitry (PMC), for an
aerial vehicle comprising a payload operative to perform an interaction with a target: for
25 each target of a plurality of targets, determining an interaction area based on a position of
the target, wherein, for each position of the aerial vehicle located in the interaction area
of the target, the interaction between the payload and the target is enabled according to
an operability criterion, generating a series of connections, wherein each connection

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comprises at least one waypoint located in an interaction area of a target of the plurality of targets and at least one waypoint located in an interaction area of another different target of the plurality of targets, wherein each interaction area comprises a waypoint of at least one connection of the series of connections, and obtaining a flight path for the aerial vehicle using the series of connections.

In addition to the above features, the method according to this aspect of the presently disclosed subject matter can optionally comprise one or more of features (i) to (xxi) below, in any technically possible combination or permutation:

- i. the method comprises, during a flight of the aerial vehicle:
 - (1) for a period of time T_i of the flight of the aerial vehicle:

for each target of a plurality of targets, obtaining an interaction area based on a position of the target at the period of time T_i ,

wherein, for each position of the aerial vehicle located in the interaction area of the target, the interaction between the payload and the target is enabled according to an operability criterion,

wherein at least one target of the plurality of targets is a moving target,

generating a series of connections, wherein each connection comprises at least one waypoint located in an interaction area of a target of the plurality of targets and at least one waypoint located in an interaction area of another different target of the plurality of targets, wherein each interaction area comprises a waypoint of at least one connection of the series of connections,

obtaining a flight path FP_i for the aerial vehicle using the series of connections,
 - (2) repeating (1) at least once for a period of time T_{i+1} different from T_i , wherein the moving target has a position at time T_{i+1} different from time T_i , to generate an updated flight path FP_{i+1} for the aerial vehicle.
- ii. the payload comprises an acquisition device and the interaction with the target comprises an acquisition of the target by the acquisition device;
- iii. the interaction area of each target is determined based on a maximal zoom-in capability of the acquisition device;
- iv. generating the series of connections comprises determining a connection between a waypoint of a given connection of the series of connections and an interaction area of a next target, said determining comprising selecting the connection among one of:

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- a connection which comprises the waypoint and is orthogonal to a tangent to a boundary of the interaction area of the next target;
- a connection which comprises the waypoint and is tangent to the boundary of the interaction area of the next target;
- 5 a connection which intersects an interior area of the interaction area of the next target;
- v. for at least one given target of the plurality of targets associated with a given interaction area, a given connection of the series of connections comprises a waypoint located at a boundary of said given interaction area, said waypoint
- 10 having a position different from a position of the given target;
- vi. generating the series of connections comprises generating a connection from a starting waypoint, said generating comprising:
- determining a first target among the plurality of targets, for which a first candidate connection C_1 meets an optimization criterion, wherein the first candidate
- 15 connection C_1 comprises a first waypoint $W_{1,1}$ corresponding to the starting waypoint, and a second waypoint $C_{1,2}$ located at a boundary of an interaction area of the first target, wherein the first candidate connection C_1 is orthogonal to said boundary;
- vii. the optimization criterion takes into account at least one of:
- 20 (i) a length of the first candidate connection C_1 ; and
- (ii) a level of priority of the first target;
- viii. the method comprises determining a second target among the plurality of targets, for which a second candidate connection C_2 comprising the second waypoint $W_{1,2}$ and a third waypoint $W_{2,1}$ located at a boundary of an interaction area of the second
- 25 target meets an optimization criterion, wherein the second candidate connection C_2 is orthogonal to said boundary;
- ix. the method comprises, after identification of the first target and the second target: performing a comparison between:
- a first series of connections comprising the first candidate connection C_1
- 30 and the second candidate connection C_2 , and
- a second series of connections comprising a first candidate connection C'_1 comprising the first waypoint $C_{1,1}$ and a second waypoint $W'_{1,2}$ located at a boundary of the interaction area of the first target, wherein the first candidate

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connection C'_1 is tangent to the boundary of the interaction area of the first target at said second waypoint $W'_{1,2}$,

generating the series of connections based on the comparison;

- x. generating the series of connections comprises: determining an order among
5 targets of the plurality of targets for generating the series of connections, wherein a second target is consecutive to a first target according to said order, and determining a candidate connection which intersects at least one of: an interior area of an interaction area of the first target, and an interior area of an interaction area of the second target, using said candidate connection for generating the series
10 of connections;
- xi. the method comprises obtaining at least one forbidden area, and generating the series of connections, wherein each connection of the series of connections does not comprise any waypoint located in the forbidden area;
- xii. the method comprises dividing the plurality of targets into a plurality of clusters,
15 wherein at least one cluster comprises at least two targets of the plurality of targets, wherein said dividing is based on a distribution of distance between the targets, determining an order between the plurality of clusters, and generating the flight path, wherein said flight path follows said order between the plurality of clusters;
- xiii. the method comprises determining the order between the plurality of clusters uses
20 at least one of: a distance between a center of mass of each cluster and an initial position from which the flight path is to be generated; a number of targets of each cluster; data informative of a level of priority of the one or more targets of each cluster;
- xiv. the method comprises, for at least one given cluster of the plurality of clusters,
25 determining an order between targets of the given cluster according to a decreasing distance with respect to a next cluster being after said given cluster, and generating the flight path, wherein said flight path follows said order between the targets of the given cluster;
- xv. the method comprises identifying at least one given connection which has a length
30 which differs from a length of other connections of the series of connections according to a criterion, generating an updated series of connections, which does not comprise said given connection, and has a length which is smaller than a length of the series of connections;

- xvi. for each position of the aerial vehicle located in the interaction area of said target, the interaction between the payload and said target is enabled according to the operability criterion, and for each position of the aerial vehicle located outside the given interaction area, the interaction between the payload and the given target is not enabled according to the operability criterion;
- xvii. the method comprises, for at least one target of the plurality of targets: obtaining data informative of a position of the target and data informative of a dimension of the target, using the data informative of a position of the target and the data informative of a dimension of the target to determine the interaction area of the target;
- xviii. the series of connections is generated progressively, wherein generation of said series of connections comprises determining a connection between a current waypoint and an interaction area of a next target, wherein the next area is determined based on at least one of: a distance between the current waypoint and the interaction area of the next target; and a level of priority of the next target indicative of a priority to perform an interaction between the payload and the next target;
- xix. the method comprises, for a given period of time T_1 : determining a given moving target among the plurality of targets for which a distance between a position of the aerial vehicle at time T_1 and a position of the given moving target at time T_1 or an interaction area of the given moving target at time T_1 meets a criterion, estimating a time ΔT_{target} for the aerial vehicle to reach the given moving target or the interaction area of the given moving target, predicting position of one or more moving targets of the plurality of targets at time $T_1 + \Delta T_{\text{target}}$, generating a connection between the position of the aerial vehicle at time T_1 and an interaction area of a given target of the plurality of targets, wherein the interaction area is estimated for a position of the given target at time $T_1 + \Delta T_{\text{target}}$;
- xx. a distance between a position of the aerial vehicle at time T_1 and a position of the given target at time $T_1 + \Delta T_{\text{target}}$ or an interaction area of the given target at time $T_1 + \Delta T_{\text{target}}$ meets the criterion; and
- xxi. the method comprises, for the given period of time T_1 :
(10) determining a given moving target among the plurality of targets for which a distance between a starting waypoint W_i and a position of the given moving target

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at time T_i or an interaction area of the given moving target at time T_i meets a criterion, wherein, at a first iteration of (10), T_i is equal to T_1 and W_i corresponds to a position of the aerial vehicle at time T_1 ,

5 (11) estimating a future time T_{i+1} at which the aerial vehicle, starting from W_i , will reach the given moving target or the interaction area of the given moving target,

(12) predicting position of one or more moving targets of the plurality of targets at time T_i ,

(13) generating a connection between W_i and an interaction area of a given target of the plurality of targets, wherein the interaction area is estimated for a position
10 of the given target at time T_{i+1} , wherein a distance between W_i and a position of the given target at time T_{i+1} or an interaction area of the given target at time T_{i+1} meets the criterion,

(14) repeating (10) to (13) at least once, wherein for said repeating W_i is set equal to an extremity of the connection determined at (13) and T_i is set equal to T_{i+1} .

15 In accordance with other aspects of the presently disclosed subject matter, there is provided a system comprising a processor and memory circuitry (PMC) configured to perform, for an aerial vehicle comprising a payload operative to perform an interaction with a target, the method as described above.

20 In accordance with other aspects of the presently disclosed subject matter, there is provided a non-transitory storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform, for an aerial vehicle comprising a payload operative to perform an interaction with a target, the method as described above.

25 In accordance with other aspects of the presently disclosed subject matter, there is provided an aerial vehicle comprising a payload operative to perform an interaction with a target and a processor and memory circuitry (PMC) configured to perform the method as described above.

According to some embodiments, the proposed solution is able to generate automatically an optimized flight path for an aerial vehicle.

30 According to some embodiments, the proposed solution generates an optimized flight path for an aerial vehicle without requiring intervention of an operator.

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According to some embodiments, the proposed solution generates a flight path for an aerial vehicle which enables acquisition of a plurality of targets by an imaging device of the aerial vehicle.

According to some embodiments, the proposed solution improves operational
5 performance of an aerial vehicle, such as a UAV.

According to some embodiments, the proposed solution optimizes the length of the flight path while taking into account the level of priority of the targets to be acquired.

According to some embodiments, the proposed solution generates the flight path in real time or quasi real time.

10 According to some embodiments, the proposed solution enables the aerial vehicle to perform an acquisition of targets while avoiding forbidden areas.

According to some embodiments, the proposed solution computes an optimized flight path without requiring intensive usage of processing resources.

According to some embodiments, the proposed solution generates an optimized
15 flight path for acquiring targets, even if the targets are mobile.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to better understand the subject matter that is disclosed herein and to exemplify how it may be carried out in practice, embodiments will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in
20 which:

- **Fig. 1** illustrates an architecture of a system according to some embodiments of the invention;
- **Fig. 2** illustrates, at a given period of time, a non-limitative example of a map of a plurality of targets with which the aerial vehicle has to interact;
- 25 - **Fig. 3** illustrates an embodiment of a method of generating a flight path which enables the aerial vehicle to interact with a plurality of targets;
- **Fig. 4** illustrates an embodiment of a method of determining an interaction area of a target;
- **Fig. 5A** illustrates an embodiment of a method of dividing a plurality of targets
30 into a set of ordered clusters;
- **Fig. 5B** illustrates a non-limitative example of the method of **Fig. 5A**;

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- **Fig. 6A** illustrates an embodiment of a method of determining a first target and a connection to this first target;
- **Fig. 6B** illustrates a non-limitative example of the method of **Fig. 6A**;
- **Fig. 6C** illustrates an embodiment of a method of determining a second target and a connection to this second target;
- **Fig. 6D** illustrates a non-limitative example of the method of **Fig. 6C**;
- **Fig. 6E** illustrates an embodiment of a method of testing two candidate series of connections between a first target and a second target;
- **Fig. 6F** illustrates a non-limitative example of the method of **Fig. 6E**;
- **Fig. 6G** illustrates an embodiment of a method of testing connections which intersect an interior area of an interaction area of a first target and/or of a second target;
- **Fig. 6H** illustrates a non-limitative example of the method of **Fig. 6G**;
- **Fig. 7A** illustrates an embodiment of a method of generating connections which avoid a forbidden area;
- **Fig. 7B** illustrates a non-limitative example of the method of **Fig. 7A**;
- **Fig. 8A** illustrates a method of determining irregularity in the length of a connection of a series of connections;
- **Fig. 8B** illustrates a non-limitative example of the method of **Fig. 8A**;
- **Fig. 9A** illustrates an embodiment of a method of generating a flight path which enables the aerial vehicle to interact with a plurality of targets, wherein the method takes into account a motion of at least one moving target;
- **Fig. 9B** illustrates, at a given period of time, a non-limitative example of a map of a plurality of targets with which the aerial vehicle has to interact; and
- **Fig. 9C** illustrates, at a predicted period of time, a non-limitative example of a map of the plurality of targets of **Fig. 9B**.

DETAILED DESCRIPTION OF EMBODIMENTS

In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the invention. However, it will be understood by those skilled in the art that the presently disclosed subject matter may be

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practiced without these specific details. In other instances, well-known methods have not been described in detail so as not to obscure the presently disclosed subject matter.

The term "processor and memory circuitry" (PMC) as disclosed herein should be broadly construed to include any kind of electronic device with data processing circuitry, which includes for example a computer processing device operatively connected to a computer memory (e.g. digital signal processor (DSP), a microcontroller, a field programmable gate array (FPGA), and an application specific integrated circuit (ASIC), etc.) capable of executing various data processing operations.

Unless specifically stated otherwise, as apparent from the following discussions, it is appreciated that throughout the specification discussions utilizing terms such as "using", "generating", "determining", "obtaining", "transmitting", "dividing", "comparing" or the like, refer to the action(s) and/or process(es) of a processor and memory circuitry that manipulates and/or transforms data into other data, said data represented as physical, such as electronic, quantities and/or said data representing the physical objects.

It can encompass a single processor or multiple processors, which may be located in the same geographical zone or may, at least partially, be located in different zones and may be able to communicate together.

Embodiments of the presently disclosed subject matter are not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of the presently disclosed subject matter as described herein.

The invention contemplates a computer program being readable by a computer for executing one or more methods of the invention. The invention further contemplates a machine-readable memory tangibly embodying a program of instructions executable by the machine for executing one or more methods of the invention.

Attention is drawn to **Fig. 1**.

An aerial vehicle **100** includes a payload **105** operative to perform an interaction with at least one target.

The aerial vehicle **100** corresponds e.g. to an aircraft, a helicopter, a UAV (unmanned aerial vehicle), a balloon, etc.

The UAV can be fully autonomous or can be controlled by an operator located at a remote central station, or is both controlled remotely and operates autonomously.

According to some embodiments, payload **105** is operative to acquire a target. In some embodiments, payload **105** includes an imaging device (e.g. a camera), a radar, a LIDAR, etc.

According to some embodiments, payload **105** is operative to perform a physical
5 interaction (e.g. destructive interaction) with the target (and not only a remote acquisition). For example, payload **105** includes a laser operative to remove material from the target, a device enabling launch of a projectile to annihilate the target, etc.

Although reference will be made hereinafter to the acquisition of a target by the payload, it is to be understood that this is not limitative, and other interactions can be
10 performed with the target(s), as explained above.

The aerial vehicle **100** comprises aircraft positioning and sensing utilities **110** such as air speed detector (e.g. Pitot tube), GPS receiver, inertial navigation system (INS), altimeter (e.g. pressure altimeter, sonic altimeter, radar altimeter, GPS based altimeter, etc.), etc. These devices are used for determining aircraft situation data including: current
15 position and attitude (six degrees of freedom), heading, and speed of the aerial vehicle.

The aerial vehicle **100** comprises aerial control devices **120** which include, for example, elevators, ailerons, flaps, rudder, throttle, wheels, and others. Elevators enable the plane to go up and down through the air. The elevators change the horizontal stabilizer's angle of attack, and the resulting lift either raises the rear of the aircraft
20 (pointing the nose down) or lowers it (pointing the nose skyward). Ailerons are horizontal flaps located near the end of an airplane's wings. Ailerons allow one wing to generate more lift than the other, resulting in a rolling motion that allows the plane to bank left or right. A rudder is a flap located on the vertical tail wing. The rudder enables the plane to turn left or right. Throttle enables to increase/decrease thrust. Wheels may be used during
25 landing.

The aerial vehicle **100** comprises a flight computer **120** (including a PMC), which is configured to control and manage the operations of various sub-systems and devices on-board the aerial vehicle **100** during a mission.

Flight computer **101** can control sub-systems related to takeoff and landing,
30 navigation, payload activation, etc. In particular, flight computer **101** controls various aerial control devices **120** for the purpose of controlling the motion of the aerial vehicle **100** along a flight path.

A flight path (also called flight route) defines the path to be followed by the aerial vehicle **100** during its mission. The flight path can comprise a series of points (also called waypoints (WPs)) defining the path of the aerial vehicle. Each waypoint can comprise coordinates (e.g. latitude/longitude – in some embodiments, each waypoint can also
5 comprise an altitude).

In some embodiments, the flight path is defined by a trajectory to be followed by the aerial vehicle, and, in particular, by a series of connections joining a series of waypoints.

According to some embodiments, the flight path is generated by a navigation
10 computer **130** embedded on the aerial vehicle **100**. The navigation computer **130** comprises a processor and memory circuitry.

According to some embodiments, the flight path is generated by another entity communicating with the aerial vehicle **100**. For example, a remote control unit **160** (which comprises a PMC) generates the flight path and communicates the flight path to the aerial
15 vehicle **100**, using remote communication (e.g. radio communication, satellite communication, etc.).

In some embodiments, an operator uses the remote control unit **160** to transmit commands to the aerial vehicle **100**. These commands can include e.g. navigation commands, control of an operation of the payload **105**, etc.

20 According to some embodiments, the flight path is generated both by the navigation computer **130** and by the remote control unit **160**.

According to some embodiments, at least one acquisition and/or tracking device **170** is operative to acquire data informative of a plurality of targets. Device **170** include e.g. a radar, a camera, COMINT (communications intelligence) sensor, ELINT
25 (electronic intelligence) sensor, AIS, a device providing input to the aircraft or to the remote control unit, etc.. As explained hereinafter, device **170** can e.g. determine (or at least estimate) position of the targets (in particular, position over time), velocity of the targets, a dimension of the targets (e.g. a size of the target), etc. In some embodiments, position and/or velocity and/or dimensions of one or more targets are provided
30 automatically by a sensor and/or manually by an operator (e.g. to the aerial vehicle **100** and/or to the remote control unit **160**).

According to some embodiments, device **170** can track one or more targets over time. In some embodiments, device **170** can predict the trajectory of targets over time.

According to some embodiments, device **170** can communicate data with the aerial vehicle **100** and/or with the remote control unit **160**.

Attention is now drawn to **Fig. 2**.

Fig. 2 depicts, at a given period of time, a position (latitude, longitude) of a plurality of targets **200₁** to **200_N**. Targets are spread over an area **250**.

According to some embodiments, at least some of the targets **200₁** to **200_N** are located at sea (in some embodiments, each target includes at least a part which is located above sea level). The targets at sea can include e.g. marine vessels, icebergs, buoys, etc. These examples are not limitative.

According to some embodiments, at least some of the targets **200₁** to **200_N** are located on ground. This can include for example a ground vehicle, a person, a building, etc. These examples are not limitative.

According to some embodiments, at least some of the targets **200₁** to **200_N** are located in the air. This can include for example an aircraft, a UAV, a balloon, a helicopter, etc. These examples are not limitative.

According to some embodiments, at least one of targets **200₁** to **200_N** is a static target (meaning that the position is fixed and does not vary over time).

According to some embodiments, at least one of targets **200₁** to **200_N** is a mobile target (meaning that its position varies over time).

According to some embodiments, the mission of the aerial vehicle **100** comprises acquiring, using its payload **105**, all targets **200₁** to **200_N** (or at least a subset of these targets **200₁** to **200_N**).

In order to perform this mission, a flight path is to be generated for the aerial vehicle **100**. As explained hereinafter, in some embodiments, the flight path is periodically updated, since at least some of the targets are mobile over time.

Attention is now drawn to **Fig. 3**, which depicts a method of generating a flight path for the aerial vehicle **100**.

Assume that the mission requires acquisition of targets **200₁** to **200_N**.

According to some embodiments, a flight path is generated for the aerial vehicle **100** during the flight of the aerial vehicle **100**. Assume that at a period of time T_i (as explained hereinafter, in some embodiments, the method is iterative - at the first iteration, $i=1$), the aerial vehicle **100** has a position $P_{\text{aerial}, i}$.

The method includes, for each target of the plurality of targets **200_i** to **200_N** (or for at least some of them), determining (operation **300**) an interaction area **210_i** to **210_N**.

The interaction area is an area for which, for each position (latitude/longitude) of the aerial vehicle **100** located within the interaction area, the interaction between the payload **105** of the aerial vehicle **100** and the target is enabled according to an operability criterion.

Assume for example that the mission requires acquisition of a target **200_j**. As a consequence, if the aerial vehicle **100** has a position in the interaction area **210_j** (note that the interaction area **210_j** includes both an interior area **211_j** of the interaction area **210_j** and a boundary **212_j** of the interaction area **210_j**), its payload **105** can acquire the target **200_j**. To the contrary, if the aerial vehicle **100** has a position which is outside the interaction area **210_i** (note that a position on the boundary **212_j** is considered as being in the interaction area **210_j**), its payload **105** cannot acquire the target **200_j**.

The operability criterion can define e.g. a quality parameter/a threshold (such as a signal to noise ratio, a resolution, a relative size of the target with respect to the frame, etc.) for which it can be considered that the payload **105** is able to acquire the target. Below this threshold, it can be considered that the payload **105** is not able to acquire the target (e.g. because the resolution and/or the signal to noise ratio and/or the relative size of the target in the image is too low, etc.).

According to some embodiments, the operability criterion can be different for each target. For example, for sensitive targets, a harsher threshold is imposed (meaning that for a given size of a target, the interaction area will be of smaller size), whereas for low sensitive targets, a relaxed threshold is imposed (meaning that for a given size of a target, the interaction area will be of larger size).

According to some embodiments, the size of the interaction area does not depend on the altitude of the aerial vehicle **100** (meaning that for conventional altitudes of the aerial vehicle **100**, the interaction area remains substantially identical). For example, for a target located at sea, since the sea area is generally free of obstacles, the altitude of the aerial vehicle **100** does not substantially impact the size of the interaction area.

In some embodiments, altitude of the aerial vehicle **100** can impact the size of the interaction area. Indeed, in crowded areas (such as in a city), obstacles can be present between the line of sight of the payload **105** of the aerial vehicle flying at a given altitude, and the target. Assume that without any obstacles, the interaction area would have a radius

R_1 . In order to take into account that obstacles are present for an aerial vehicle **100** flying at this altitude, the interaction area can be voluntarily reduced to have a radius R_2 , with $R_2 < R_1$. The coefficient of reduction can be determined e.g. using simulations (a simulation of the payload and of the crowded area including the target to be acquired can be performed), or can be predefined, or can be determined using e.g. heuristics.

According to some embodiments, determination of the interaction area for a target can be performed using the method of **Fig. 4**.

The method can include (operation **400**) obtaining data informative of a position of the target at the period of time T_i .

According to some embodiments, the target itself communicates its position. For example, for a sea target, the target can embed an automatic identification system (AIS). For a ground target, the target can embed e.g. a GPS system and a transponder for communicating its position. These examples are however not limitative.

According to some embodiments, the position of the target can be determined by the acquisition and/or tracking device **170** (e.g. a radar).

Note that position of the target can be either static (and in this case it is sufficient to determine this position once) or can evolve over time (and in this case this position needs to be determined periodically). The period at which this position needs to be determined depends in particular on the relative velocity of the target with respect to the aerial vehicle **100**.

The method includes (operation **410**) obtaining data informative of a dimension of the target. This data can include e.g. an estimated size of the target. In some embodiments, this data can include an estimated height, length and width of the target.

In some embodiments, the data informative of dimension of the target can be determined by the acquisition and/or tracking device **170**. Generally, it is sufficient to acquire this data once. In some specific cases, the size of the target can evolve over time, and this data can be acquired periodically.

The method further includes (operation **420**) using data informative of a position of the target and data informative of a dimension of the target to determine the interaction area of the target at the period of time T_i .

According to some embodiments, the interaction area is a disk (the center of the disk corresponds to the position of the target at the period of time T_i). The radius of the disk defines the maximal distance at which the payload **105** of the aerial vehicle **100** can

be located from the target and can still be able to acquire the target. When the aerial vehicle **100** is located at the boundary of the interaction area (in the case of a disk, this corresponds to the perimeter of the disk), its payload **105** can still acquire the target. When the aerial vehicle **100** is located out of the interaction area, its payload **105** cannot acquire the target (even if some kind of acquisition is possible, even at long range, this acquisition will not meet the operability criterion).

Although the interaction area is depicted as a disk, in some embodiments, it can have another shape (for example because there is a forbidden area, or because of other constraints provided e.g. by an operator).

Note that the ability of the payload **105** to acquire the target depends mainly on the distance between the target and the aerial vehicle **100** and on the size of the target.

According to some embodiments, other parameters (such as weather conditions) which can influence the ability of the payload **105** to acquire the target, are neglected. In other embodiments, a model which models impact of the weather conditions on the ability of the payload to **105** to acquire the target can be used to determine the interaction area.

According to some embodiments, when the payload **105** is an acquisition device, the interaction area of each target is determined based on a maximal zoom-in capability of the acquisition device. The maximal zoom-in capability defines also the minimal field of view of the acquisition device.

For example, assume that the mission requires that each target has to be acquired by the acquisition device such that each target fills 20% of the size of the frame of the acquisition device.

If the target has a length of 100m, a frame covering an area of 500m is required (since $100/0.2 = 500$).

If it is known that the minimal field of view of the acquisition device (as mentioned the minimal field of view and the maximal zoom-in capability are equivalent) is 1 degree (0.017 rad), this means that the radius of the interaction area for this target is 30 km ($500/0.017 \approx 30$ km - the formula which can be used is e.g.: *Length of the target / Field of view = Radius of the interaction area*).

The use of the maximal zoom-in is not mandatory and other parameters can be used.

For example, if the payload **105** is a laser, the maximal effective distance of the laser can be used to determine the radius of the interaction area (the maximal effective

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distance is the maximal distance to the target for which the laser can perform an interaction with the target – above this distance the interaction cannot be performed by the laser, or the interaction does not meet an operability criterion).

Reverting to **Fig. 3**, the method further includes generating (operation **310**) a series of connections. Each connection comprises e.g. one or more segments (which can be in particular straight lines, but this is not mandatory, and they can comprise curved lines which connect the various interaction areas of the targets in order to define a flight path enabling acquisition of the targets by the payload **105** of the aerial vehicle **100**.

In particular, each connection includes at least one waypoint located in an interaction area of a target of the plurality of targets, and at least one waypoint located in an interaction area of another different target of the plurality of targets.

For example, assume that a connection includes at least one waypoint located in an interaction area of a first target, and at least one waypoint located in an interaction area of a second target (different from the first target).

As a consequence, when the trajectory of the aerial vehicle **100** follows a path along this connection, its payload **105** will be able to acquire the first target and the second target.

According to some embodiments, each connection is an oriented connection (that is to say, it comprises a first waypoint corresponding to the starting point, and a second waypoint corresponding to the endpoint of the connection, the connection being oriented from the first waypoint to the second waypoint).

In order to be able to acquire all targets of the plurality of targets, each interaction area of each target of the plurality of targets includes a waypoint of at least one connection of the series of connections. In other words, the series of connections is such that each interaction area is intersected by at least one connection of the series, thereby enabling acquisition of all targets by the payload **105** of the aerial vehicle **100**.

As explained hereinafter, according to some embodiments, the series of connections is generated progressively (by connecting the various targets progressively) by testing various alternatives so as to meet an optimization criterion.

Once the series of connections has been generated, a flight path FPI is obtained (operation **320**), which corresponds to the union of this series of connections.

According to some embodiments, operations **300**, **310** and **320** are performed during a flight of the aerial vehicle.

If at least one target of the plurality of targets is a moving target, then the flight path FP_i can be updated over time, to take into account this evolution.

This is illustrated in **Fig. 3**, in which, for a period of time T_{i+1} (different from the period of time T_i – note that T_{i+1} occurs after T_i), operations **300**, **310** and **320** are repeated,
 5 to generate an updated flight path FP_{i+1} .

At the period of time T_{i+1} , the position of the aerial vehicle **100** and of the one or more moving targets has changed. The position of the static targets has not changed. Therefore, a different series of connections is obtained at iteration $i+1$, which is used to generate a different flight path FP_{i+1} for time T_{i+1} .

10 Note that according to some embodiments, at each iteration “ i ”, generating the series of connections can rely on an assumption that the targets are all static (until update of the flight path at iteration “ $i+1$ ”).

For example, assume that the area **250** in which the targets are located has a dimension of X (e.g. length of X). Assume that during the period of time “ $T_{i+1}-T_i$ ”, the
 15 distance traveled by each moving target **200_j** of the plurality of targets is D_j (this can be calculated using the velocity of each moving target), and D_j can be ignored with respect to X ($|D_j/X| \leq \text{threshold } T$ – the threshold T for which D_j can be selected with respect to X can be set e.g. by an operator). In a non-limitative example, assume that X is equal to 200 km and D is equal to 2km, the threshold can be set as $T=D/X=2/200=0.01$ (this value is
 20 not limitative). In this example, generation of the connections at each iteration “ i ” can rely on the assumption that each target is static.

According to some embodiments, the velocity of the moving target(s) is not known or not measured. At each iteration of the method, each target can be modelled as static. In some embodiments, the frequency of update of the flight path can be increased
 25 to take into account the fact that one or moving target(s) may have a velocity which cannot be ignored with respect to the dimension of the area **250** to be covered by the aerial vehicle **100**.

According to some embodiments, the frequency of update (F) can be determined using the following formula (this formula is not limitative): $F = D / \text{target speed}$. D can
 30 be obtained as follows: $D = T.X$ (with T the threshold as defined above and X the size of the area as defined above). The “*target speed*” corresponds to the speed of the target which is to be handled. In some embodiments, if a plurality of moving targets is to be

handled within the area, the following equation can be used: $F = D / \text{max speed}$, wherein *max speed* is the maximal speed of the plurality of moving targets that need to be handled.

According to some embodiments, at a given period of time, the flight path is
5 determined for all targets (although, in practice, the flight path will be updated before the aerial vehicle will interact with all targets) since this information can be useful to provide indications such as current estimated time to interact with all targets during the mission, amount of fuel required to perform the whole mission, etc. In some embodiments, the flight path is determined only for some of the targets.

10 According to some embodiments, and as explained hereinafter, at each iteration of the method, the velocity of the moving target(s) can be taken into account to generate the flight path.

According to some embodiments, when the aerial vehicle **100** is located in an interaction area of a given target of the plurality of targets, it can automatically provide
15 information on the target which is pertinent for the mission. For example, assume that the payload **105** is an acquisition device and that the target is a marine target (this is not limitative). The aerial vehicle **100** can determine whether data of the marine target (e.g. size, name, flag, which can be determined based on an image of the marine target acquired by the payload **105**) matches data provided by an AIS of the marine target. If the aerial
20 vehicle **100** fails to automatically identify the marine target, the method can include entering a mode in which the aerial vehicle **100** is forced to fly towards the target. Then, an operator, located e.g. at the remote control unit **160**, attempts to manually identify the target based on images acquired by the payload **105** of the aerial vehicle **100**. Once the aerial vehicle **100** has been identified, the aerial vehicle **100** can return to an automatic
25 mode (the flight path can be updated based on the last position of the aerial vehicle **100**, using e.g. the method of **Fig. 3**).

Attention is now drawn to **Figs. 5A and 5B**.

According to some embodiments, in order to generate the series of connections
(see operation **310**), the method comprises a preliminary operation **501** of dividing the
30 plurality of targets into a plurality of clusters (**500₁**, **500₂**, ..., **500_N**). At least one cluster of the plurality of clusters includes at least two targets. The other clusters can include one target or a plurality of targets.

The division into clusters can depend on a distribution of distance between the targets. For example, targets belonging to the same given cluster are such that the distance inter-targets within this given cluster is (e.g. on average) lower than the distance between targets of this given cluster to other targets belonging to other clusters. In some
5 embodiments, a size of the area **250** can be taken into account.

Division into clusters can use e.g. clustering algorithms such as K-means, Mean-Shift Clustering, DBSCAN (Density-Based Spatial Clustering of Applications with Noise), EMGMM (Expectation-Maximization Algorithm for Gaussian mixture model), HAC (hierarchical agglomerative clustering), etc.

10 Once the clusters have been determined, an order (operation **510**) between the clusters can be determined. For example, the order can indicate that the flight path of the aerial vehicle **100** should first go to cluster 2 and then to cluster 1, up to cluster N.

Note that according to some embodiments, the clusters and/or the order between the clusters can evolve over time, since one or more targets can be a moving target.
15 Therefore, at each time T_i , operations **501** and **510** can be repeated.

Various criteria can be used to determine the order between the clusters. In some embodiments, a score can be attributed to each cluster based on the various criteria, and, based on this score, the order between the clusters can be determined (for example, the higher the score of a given cluster, the higher the probability that this given cluster
20 corresponds to the first cluster).

According to some embodiments, a distance between a center of mass of each cluster and an initial position from which the flight path is to be generated (e.g. position of the aerial vehicle **100** at the period of time T_i) is used to determine the order. The center of mass can correspond e.g. to a centroid/center of gravity determined as an average of
25 all positions of the targets within the cluster. In the example of **Fig. 5B**, according to this criterion, a higher score is attributed to cluster **500₂** in order to be considered as the first cluster. The next cluster can be selected by determining the cluster whose center of mass is the closest to the center of mass of the first cluster. The method can be repeated iteratively for all clusters.

30 According to some embodiments, a number of targets in each cluster is taken into account. The larger this number for a cluster, the higher the score attributed to this cluster. Therefore, this cluster will have a higher chance to be among the first clusters in the order. This reflects the fact that a cluster including a larger number of targets is of higher interest

than a cluster with a lower number of targets, and therefore should be located beforehand along the flight path.

According to some embodiments, assume that each target is assigned with a level of priority. The level of priority indicates to which extent acquisition of the target is important in the mission of the aerial vehicle **100** (or, more generally, it reflects importance of interaction with the target). For example, a high level of priority indicates that acquisition of the target is of high importance.

An aggregated level of priority can be computed for each cluster. For example, this aggregated level of priority can be computed as an average of all levels of priority of all targets within the cluster. This is however not limitative.

Therefore, the aggregated level of priority of each cluster can be taken into account when determining the order between the clusters. The higher the aggregated level of priority of a cluster, the higher the score attributed to this cluster. Therefore, this cluster will have a higher chance to be among the first clusters in the order.

Based on one or more of the criteria discussed above (and/or additional/different criteria), the order between the clusters can be determined.

According to some embodiments, the score based on which the order between the clusters is determined can be calculated using the formula (this formula is not limitative):

$$Score_{cluster} = (ClusterAveragePriority * ClusterNumofTargets) / (ClusterDistance)$$

In this formula, $Score_{cluster}$ is the score of a given cluster, $ClusterAveragePriority$ is the aggregated level of priority of the targets of the given cluster (as explained above), $ClusterNumofTargets$ is the number of targets of the given cluster (as explained above) and $ClusterDistance$ is the distance to the given cluster (as explained above).

Note that the order between the clusters can evolve over time. Similarly, division of the targets into clusters can evolve over time. Therefore, according to some embodiments, the division into clusters and the determination of the order between the clusters is repeated at each period of time (T_i , T_{i+1} , etc.).

Attention is now drawn to **Fig. 6A**, which depicts operations which can be performed in order to generate the series of connections (see operation **310** in **Fig. 3**).

The method can include determining (operation **601**), among the plurality of targets, a target which is the first target to be acquired by the aerial vehicle **100** along its flight path.

Operation **601** can include determining a connection which includes the current position of the aerial vehicle **100** (at time T_i) and a waypoint located e.g. at the boundary of an interaction area of a target, such that this connection meets an optimization criterion. According to some embodiments, the connection is selected to be orthogonal to a tangent
 5 of the boundary of the interaction area of the target (at this waypoint).

According to some embodiments, the optimization criterion takes into account the length of the connection. In other words, the target for which the connection has the smallest length has the highest probability to be selected as the first target. Note that the connection can be a straight line. This is however not mandatory, because in some
 10 embodiments, there can be one or more forbidden areas (a forbidden area is an area in which it is forbidden for the aerial vehicle to enter). As a consequence, the connection can include various pieces of connected straight lines, or one or more curved portions enabling bypass of the forbidden area(s).

According to some embodiments, the optimization criterion takes into account (in
 15 addition to, or in place of the length of the connection) the level of priority of each target. In other words, it is possible that a target which is located farther than another target with respect to the current position of the aerial vehicle. will be selected as the first target because it has a higher level of priority, although the length of the connection to reach the interaction area of this target is larger.

20 According to some embodiments, the optimization criterion takes into account both the length of the connection to the target and the level of priority of the target.

An example is provided with reference to **Fig. 6B**.

Assume that the area includes targets **600₁** to **600_N**, associated with interaction areas **610₁** to **610_N** (each interaction area **610₁** to **610_N** has a boundary **612₁** to **612_N**).

25 According to some embodiments, a plurality of candidate connections **613₁** to **613_N** is generated (operation **601** in **Fig. 6A**): each candidate connection is a line (e.g. a straight line, since this enables reducing the length of the flight path – as mentioned above, in some embodiments, a connection can include curved portions to bypass forbidden areas(s)) between the current position of the aerial vehicle **100** at time T_i and a waypoint
 30 located at a boundary (**612₁** to **612_N**) of a given interaction area of a given target. For each given target, the candidate connection (**613₁** to **613_N**) is orthogonal to a tangent (**614₁** to **614_N**) to a boundary (**612₁** to **612_N**) of the given interaction area of the given target.

A plurality of candidate connections 620_1 to 620_N is obtained (in order to simplify presentation of **Fig. 6A**, only two candidate connections 620_1 and 620_N are depicted in **Fig. 6**).

Based on the candidate connections, a first target is selected.

5 Assume for example that the optimization criterion takes into account only the length of the connection. As a consequence, in the example of **Fig. 6A**, target 600_1 is selected as the first target (for time T_i). Therefore, a first connection C_1 is obtained which joins the current position of the aerial vehicle 100 at time T_i to the waypoint $W_{1,2}$ located at the boundary of the interaction area of the first target 600_1 .

10 According to some embodiments, the targets are divided into clusters (see **Fig. 5A**) and an order between the clusters has been determined. In this case, the method of **Fig. 6A** is performed for the first cluster: it is attempted to determine the first target in the first cluster.

According to some embodiments, if the targets have been divided into a plurality of clusters, a flight path can be first generated for the targets of the first cluster. In some embodiments, the order between the targets of the first cluster is selected according to a decreasing distance with respect to the next cluster (e.g. center of mass of the second cluster).

For example, the target which is selected as the first target of the flight path within the first cluster is the target which has the highest distance to the next cluster (in this case the second cluster).

The target which is selected as the second target of the flight path within the first cluster is the target which has the second highest distance to the next cluster (in this case the second cluster).

25 The last target of the flight path within the first cluster is the target which is the closest to the second cluster. This enables to have a transition between each cluster and the consecutive cluster with the smallest travelling distance.

In some embodiments, the level of priority of the targets can be also taken into account to determine the order between the targets within each cluster.

30 This process can be repeated similarly for each cluster.

For the last cluster, since there is no next cluster, the targets are ordered according to the smallest distance with respect to the current position on the flight path.

The method described above is not limitative, and in some embodiments, for each cluster, the targets are ordered according to the smallest distance with respect to the current position on the flight path.

Attention is drawn to **Fig. 6C**.

5 Once the first target has been identified, the method can include determining the second target of the flight path.

According to some embodiments, the method of **Fig. 6C** (see operations **615** and **625**) can rely on the same method as described with reference to **Figs. 6A** and **6C**.

10 The difference is that the starting point is not the current position of the aerial vehicle **100** at time T_i , but rather the waypoint $C_{1,2}$ corresponding to the extremity of the previous connection C_1 (determined in the method of **Fig. 6A**).

The method includes determining a second target, for which a second candidate connection C_2 meets an optimization criterion. The second candidate connection C_2 comprises the waypoint $W_{1,2}$ (determined at the previous iteration of the method) and a
15 waypoint $W_{2,1}$ located at a boundary of the interaction area of the second target. The second candidate connection C_2 is orthogonal to a tangent to the boundary of the interaction area of the second target (at the waypoint $W_{2,1}$).

As explained with reference to **Figs. 6A** and **6B**, a plurality of candidate connections can be “tested” and the candidate connection which meets the best the
20 optimization criterion can be selected as the second candidate connection C_2 .

In the example of **Fig. 6D**, the second target is selected as target **600₂**. The second connection C_2 includes the waypoint $W_{1,2}$ and the waypoint $W_{2,1}$. The second connection C_2 is orthogonal to a tangent **614₂** to the boundary **612₂** of the interaction area **610₂** of the second target **600₂** (at the waypoint $W_{2,1}$).

25 The method of **Fig. 6C** can be repeated to select a third target (a connection is generated between the waypoint located at the extremity of the connection determined at the previous iteration and the interaction area of the third target), etc. until the series of connections (operation **310**) is generated.

According to some embodiments, and as explained hereinafter, different types of
30 connections can be tested (e.g. which are not necessarily orthogonal to a tangent to a boundary of an interaction area of the target), in order to further improve generation of the series of connections.

Attention is now drawn to **Figs. 6E** and **6F**.

According to some embodiments, once at least two consecutive targets (noted as first target and second target – note that these two targets are not necessarily the two first targets within the flight path and can correspond to any of two consecutive targets within the flight path) have been identified (see operation **660**), different types of connections
5 can be tested.

Assume (see operation **665**) that a first series of connections comprising a first connection C_1 and a second connection C_2 have been obtained (as explained above).

The first connection C_1 comprises a waypoint $W_{1,1}$ (corresponding e.g. to the current position of the aerial vehicle **100** at time T_i – or corresponding to the extremity of
10 the previous connection which connects the interaction area of the previous target to the interaction area of the first target), and a waypoint $W_{1,2}$, wherein the first connection C_1 is orthogonal to a tangent to a boundary **612₁** of an interaction area **610₁** of the first target **600₁**.

The second connection C_2 comprises the waypoint $W_{1,2}$ corresponding to the
15 extremity of the previous connection, and a waypoint $W_{2,1}$, wherein the second connection C_2 is orthogonal to a tangent to a boundary **612₂** of an interaction area **610₂** of the second target **600₂**.

The method comprises generating a second series of connections (operation **665**).

The second series of connections comprises a first candidate connection C'_1
20 comprising the waypoint $W_{1,1}$ and a waypoint $W'_{1,2}$ located at a boundary of the interaction area **610₁** of the first target **600₁**, wherein the first candidate connection C'_1 is tangent to the boundary of the interaction area **610₁** of the first target **600₁** at said waypoint $W'_{1,2}$.

The second series of connections comprises a second candidate connection C'_2 ,
25 which comprises the waypoint $W'_{1,2}$ and another waypoint $W'_{2,1}$ located at the boundary of the interaction area **610₂** of the second target **600₂**, wherein the second candidate connection C'_2 is orthogonal to a tangent of the interaction area **610₂** of the second target **600₂**.

In other words, instead of requiring the aerial vehicle **100** to fly along a flight path
30 orthogonal to the boundary of the interaction area of the first target, an approach in which the flight path is tangent to the boundary of the interaction area of the first target is evaluated.

According to some embodiments, the method comprises comparing (operation **670**) the first series of connections with the second series of connections. According to some embodiments, if the length of the second series of connections is smaller than the length of the first series of connections, the method can include using the second series of connections when generating the series of connections, instead of the first series of connections.

In other words, it is tested whether the approach in which the flight path is tangent to the boundary of the interaction area of the first target is more optimal than an approach orthogonal to the tangent to the boundary of the first interaction area.

Attention is now drawn to **Figs. 6G** and **6H**.

Assume that during generation of the series of connections for a given period of time T_i (using e.g. one of the methods described above – as mentioned above, generation of the series of connections is performed progressively, by identifying progressively the next target to be reached), it has been determined that target **600_{j+1}** should be consecutive to target **600_j** in the flight path. In other words, the series of connections requires that the aerial vehicle **100** first interacts with target **600_j** and then with target **600_{j+1}** (operation **680**).

Assume for example that a first series of connections including connections C''_1 and C''_2 have been determined (see **Fig. 6H**): the aerial vehicle **100** is required to first follow connection C''_1 to acquire target **600_j** and then to follow connection C''_2 to acquire target **600_{j+1}**. In this non-limitative example, C''_1 is orthogonal to a tangent to a boundary of the interaction area **610_j** of target **600_j** and C''_2 is orthogonal to a tangent to a boundary of the interaction area **610_{j+1}** of target **600_{j+1}**. This is however not limitative.

The interaction area **610_j** comprises a boundary **612_j** (perimeter of the disk) and an interior area **611_j** (interior of the disk, excluding the perimeter).

Similarly, the interaction area **610_{j+1}** comprises a boundary **612_{j+1}** (perimeter of the disk) and an interior area **611_{j+1}** (interior of the disk, excluding the perimeter).

As mentioned above, various types of connections can be tested (e.g. orthogonal to the boundary of the interaction area, tangent to the boundary of the interaction area, etc.).

The method comprises determining (**681**) a candidate connection which intersects an interior area of the interaction area of the first target and/or an interior area of the interaction area of the second target. In other words, it is tested whether flying directly

through the interior area of the respective interaction areas provides a shorter flight path (than the flight path previously generated).

In the non-limitative example of **Fig. 6H**, candidate connection C''_3 is generated, which intersects both the interior area 611_j of the interaction area 610_j of the first target 600_j and the interior area 611_{j+1} of the interaction area 610_{j+1} of the second target 600_{j+1} . In this example, the candidate connection C''_3 is a straight line, but this is not mandatory, and other types of lines can be used (e.g. two connected straight lines which are not parallel, a curved line, etc.).

The candidate connection is compared to the connection(s) previously determined (in particular, a comparison of their respective length is performed). In the example of **Fig. 6H**, the length of candidate connection C''_3 is compared to the total length of connections C''_1 and C''_2 . In this particular example, it appears that connection C''_3 is shorter than the sum of C''_1 and C''_2 and therefore should be selected for generating the series of connections.

Although the example of **Fig. 6H** has been depicted with two targets, the method can be used for N targets, with $N > 2$. Assume for example that a series of connections has been determined for these N targets (the series of connections follows an order determined between the N targets). It can be tested whether a straight line intersecting the interior area of the interaction of each of the N targets (or of at least a subset of the targets) is shorter than the series of connections previously determined.

Attention is now drawn to **Fig. 7A**.

According to some embodiments, the method includes obtaining (operation **700**) at least one forbidden area **704**. A forbidden area is an area in which it is forbidden for the aerial vehicle **100** to enter (due e.g. to regulations, tactical reasons, etc.). The forbidden area can include e.g. a series of waypoints defined by their latitude and longitude (and, if necessary, altitude).

The method includes generating (operation **710**) a series of connections (using the various embodiments described above), wherein each connection of the series of connections does not comprise any waypoint located in the forbidden area(s) **704**. In other words, a flight path which bypasses the forbidden area(s) is built.

Generating a connection between two interaction areas of two different targets which avoids at least one forbidden area can rely on various methods. In some embodiments, the method described in the patent application US 16/892,726 of the

Applicant (content of this patent application is incorporated hereinafter in its entirety) can be used. This is however not limitative, and other methods can be used.

Fig. 7B illustrates a non-limitative example of the method of **Fig. 7A**. Assume that it is attempted to generate a connection between an interaction area **710_j** of target **700_j** and an interaction area **710_{j+1}** of target **700_{j+1}**.

A first connection **C₁₁** is generated between the current position of the aerial vehicle **100** (at time **T_i**) and a waypoint **C₁₁₁** located at a boundary of the interaction area **710_j** of target **700_j**.

If there is no forbidden area, and the method of **Fig. 6C** and **Fig. 6D** is used, then the second connection should correspond to connection **C₂₂** depicted in **Fig. 7A** (**C₂₂** includes waypoint **W₁₁₁** and is orthogonal to a tangent to a boundary of the interaction area **710_{j+1}** of target **700_{j+1}**). However, since a forbidden area **750** is present, different connections must be generated. In the non-limitative example of **Fig. 7B**, a connection **C₂₂₀** is generated which joins the waypoint **W₁₁₁** to a waypoint **W₂₂₅** located at a vertex of the polygon representative of the forbidden area **750** (as shown, according to some embodiments, the method strives to keep the connections which bypass the forbidden area **750** as close as possible to the forbidden area **750**, in order to minimize the length of the flight path). An additional connection **C₂₂₁** is generated, which joins the endpoint **W₂₂₅** of the connection **C₂₂₀** to a waypoint **W₂₂₆** located at a boundary of the interaction area **710_{j+1}** of the target **700_{j+1}**.

Note that the connection **C₂₂₀** is orthogonal to a tangent to the boundary of the interaction area **710_{j+1}** of the target **700_{j+1}**, in compliance with the method of **Fig. 6C** and **Fig. 6D**. This is however not mandatory.

Although in the example of **Fig. 7B**, two straight lines are generated to bypass the forbidden area, this is not limitative, and in other embodiments, curved lines can be generated.

Attention is now drawn to **Fig. 8A**.

Assume that for given period of time **T_i**, a series of connections have been determined.

The method of **Fig. 8A** includes identifying (operation **800**) at least one given connection which has a length which differs from a length of the other connections of the series of connections according to a criterion. For example, the length of each connection is compared to the average length of all connections, and it is detected whether the

difference between a length of a given connection and this average length is larger than a threshold (the criterion can define e.g. this threshold).

As a consequence, the method includes generating (operation **810**) an updated series of connections. In particular, this updated series of connections does not comprise the given connection (identified as irregular because of its excessive length). In addition, the updated series of connections is selected to have a total length which is smaller than the total length of the original series of connections. In some embodiments, operation **810** comprises reusing the same waypoints, but connected in a different manner (using different connections – the waypoints can be connected in a different order).

10 A non-limitative example is provided in **Fig. 8B**.

Assume that a series of connections have been generated. Each connection defines the flight path between a starting waypoint and an ending waypoint (see waypoints **800₁** to **800_N**). In this non-limitative example, the connections are substantially straight lines. The flight path starts from waypoint **800₁** and ends at waypoint **800₇**.

15 The average length of the connections depicted in the upper part of **Fig. 8A** is determined. The length of the connection which joins waypoint **820₅** to waypoint **820₆** differs from the average length more than the threshold (defined e.g. by an operator).

As a consequence, it is attempted to generate an updated series of connections. According to some embodiments, the updated series of connections (see bottom part of **Fig. 8B**) comprises the same waypoints **820₁** to **820₇** but which are connected in a different manner. In particular, it is checked whether given waypoints belonging to the given connection identified as irregular (and also other waypoints which are in the vicinity of these given waypoints) can be connected to waypoint(s) which is(are) closer to them. In the present example, this induces generation of a new connection between waypoint **820₆** and **820₂** and of a new connection between waypoints **802₁** and **820₇**. The total length of the updated series of connections (see below part of **Fig. 8B**) is reduced with respect to the total length of the original series of connections (see top part of **Fig. 8B**). The order between the waypoints has been changed: the flight path goes successively through waypoints **820₁**, **820₇**, **820₆**, **820₂**, **820₃**, **820₄** and **820₅**.

30 Attention is now drawn to **Figs. 9A** and **9B**.

According to some embodiments, the displacement of one or more moving target(s) can be taken into account to generate the series of connections.

Assume that the position of the aerial vehicle **100** and of the targets is known at the period of time T_1 (see a non-limitative example of a map of the targets **900₁** to **900₇** at time T_1 in **Fig. 9B**). In addition, velocity of the aerial vehicle can be obtained at T_1 . In some embodiments, velocity of the moving target(s) is obtained at T_1 (using e.g. device **170**, or other ways enabling obtaining this velocity).

According to some embodiments, it can be determined (operation **901**) that a given target among the plurality of targets meets a criterion. According to some embodiments, the given target meets the criterion if the distance between the position of the aerial vehicle **100** at time T_1 and the position of the given target at time T_1 is the smallest relative to all other targets. In some embodiments, the criterion can take into account the level of priority of each target, and the given target is the one which has the highest score, wherein the score depends on the distance between the aerial vehicle **100** and the given target (the lower the distance, the higher the score), and the level of priority of the given target (the higher the level of priority, the higher the score).

For example, in **Fig. 9B**, target **900₁** is the target which is the closest to the aerial vehicle **100**.

The method further comprises estimating (operation **902**) the period of time ΔT_{target} required by the aerial vehicle **100** to reach the given target (or to reach the interaction area of the target). According to some embodiments, this estimation can be performed by assuming that the aerial vehicle **100** follows e.g. a straight line (if there is a forbidden area, then the method determines a path which avoids this forbidden area, as explained above). This can be determined since the initial position and the velocity of the aerial vehicle **100** at time T_1 are known (it can be e.g. assumed that there is a constant velocity to reach the target or its interaction area), and the trajectory of each target can be predicted over time. The trajectory of each target can be predicted over time using e.g. tracking information of the device **100** (which is e.g. a radar – since the target is tracked over a period of time, its future motion can be predicted using e.g. Kalman filtering), and/or using velocity information of the target (measured by the device **100**, or provided by the target itself, or by a third party).

Once ΔT_{target} has been determined, the position of all targets is predicted at time $T_1 + \Delta T_{\text{target}}$.

Prediction of the position of the targets at a future time can be performed using various methods.

According to some embodiments, since each target can be tracked by the device **170** (e.g. a radar), a track can be generated for each target, and therefore the future position of each target can be predicted (using e.g. Kalman filters or other techniques of the art). Regarding targets which are static, their positions remain the same between T_1 and $T_1 + \Delta T_{\text{target}}$.

Fig. 9C depicts positions of the targets as predicted at future time $T_1 + \Delta T_{\text{target}}$, and also depicts, in a dotted line, previous positions of the targets at time T_1 .

At operation **904**, it is verified again (at predicted time $T_1 + \Delta T_{\text{target}}$) whether the given target (as identified at operation **901**) is still the target which is the closest to the position of the aerial vehicle **100** at time T_1 (or whether the interaction area of the given target is the closest to the position of the aerial vehicle **100**). Indeed, since some targets are moving towards the aerial vehicle **100**, and some are moving away from the aerial vehicle **100**, it can occur that a different target is the closest target at time $T_1 + \Delta T_{\text{target}}$.

In some embodiments, at time $T_1 + \Delta T_{\text{target}}$, both the distance to the aerial vehicle and the level of priority of each target is taken into account to select the target at operation **904**.

In the example of **Figs. 9B** and **9B**, target **900₁** is the closest target both at time T_1 and at time $T_1 + \Delta T_{\text{target}}$.

The method further includes determining an interaction area of the target selected at operation **904** (in the example of **Figs. 9B** and **9C**, this corresponds to target **900₁**).

Since the position of the selected target at time $T_1 + \Delta T_{\text{target}}$ has been predicted, and the dimension of the selected target is known, the interaction area of the selected target located at its predicted position can be determined (using e.g. the method of **Fig. 4**).

The method further includes determining a connection C_{300} between the position of the aerial vehicle **100** and a waypoint W_{301} located in the interaction area of the selected target (in the example of **Fig. 9C**, this corresponds to target **900₁**).

The method of **Fig. 9A** can be repeated iteratively to generate the flight path covering all targets (for the position of the aerial vehicle at time T_1).

The waypoint W_{301} is considered as the starting point, and it is determined which given target is the closest target to W_{301} .

The time of travel $\Delta T_{\text{target},2}$ from W_{301} to this given target is estimated. The positions of all targets are predicted at time $T_1 + \Delta T_{\text{target}} + \Delta T_{\text{target},2}$. It is verified whether

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the given target is still the closest target to W_{301} . If this is the case, a connection is determined between W_{301} and an interaction area of this given target.

The method can be repeated until the flight path is generated such that it enables acquisition of all targets. Therefore, for time T_1 , a complete flight path FP_1 is obtained.

5 As mentioned, in some embodiments, the flight path is updated before the aerial vehicle manages to cover all targets, but the complete flight path FP_1 is useful to provide indications about estimate time to perform the mission, required fuel, etc.

Over time (e.g. at time T_2 different from T_1), the method of **Fig. 9A** can be repeated (using a map including position of the aerial vehicle **100** and the targets at time
10 T_2), in order to generate an updated flight path at time T_2 .

It is to be noted that the various features described in the various embodiments may be combined according to all possible technical combinations.

It is to be understood that the invention is not limited in its application to the details set forth in the description contained herein or illustrated in the drawings. The
15 invention is capable of other embodiments and of being practiced and carried out in various ways. Hence, it is to be understood that the phraseology and terminology employed herein are for the purpose of description and should not be regarded as limiting. As such, those skilled in the art will appreciate that the conception upon which this disclosure is based may readily be utilized as a basis for designing other structures,
20 methods, and systems for carrying out the several purposes of the presently disclosed subject matter.

Those skilled in the art will readily appreciate that various modifications and changes can be applied to the embodiments of the invention as hereinbefore described without departing from its scope, defined in and by the appended claims.

CLAIMS:

1. A method comprising, by a processor and memory circuitry (PMC), for an aerial vehicle comprising a payload operative to perform an interaction with a target:
- for each target of a plurality of targets, determining an interaction area based on a position of the target,
- wherein, for each position of the aerial vehicle located in the interaction area of the target, the interaction between the payload and the target is enabled according to an operability criterion,
- generating a series of connections, wherein each connection comprises at least one waypoint located in an interaction area of a target of the plurality of targets and at least one waypoint located in an interaction area of another different target of the plurality of targets, wherein each interaction area comprises a waypoint of at least one connection of the series of connections, and
- obtaining a flight path for the aerial vehicle using the series of connections.
2. The method of claim 1, comprising, during a flight of the aerial vehicle:
- (1) for a period of time T_i of the flight of the aerial vehicle:
- for each target of a plurality of targets, obtaining an interaction area based on a position of the target at the period of time T_i ,
- wherein, for each position of the aerial vehicle located in the interaction area of the target, the interaction between the payload and the target is enabled according to an operability criterion,
- wherein at least one target of the plurality of targets is a moving target,
- generating a series of connections, wherein each connection comprises at least one waypoint located in an interaction area of a target of the plurality of targets and at least one waypoint located in an interaction area of another different target of the plurality of targets, wherein each interaction area comprises a waypoint of at least one connection of the series of connections,
- obtaining a flight path FP_i for the aerial vehicle using the series of connections,
- (2) repeating (1) at least once for a period of time T_{i+1} different from T_i , wherein the moving target has a position at time T_{i+1} different from time T_i , to generate an updated flight path FP_{i+1} for the aerial vehicle.

3. The method of claim 1 or of claim 2, wherein the payload comprises an acquisition device and the interaction with the target comprises an acquisition of the target by the acquisition device.
- 5
4. The method of claim 3, wherein the interaction area of each target is determined based on a maximal zoom-in capability of the acquisition device.
5. The method of any of claims 1 to 4, wherein generating the series of connections
- 10 comprises determining a connection between a waypoint of a given connection of the series of connections and an interaction area of a next target, said determining comprising selecting the connection among one of:
- (i) a connection which comprises the waypoint and is orthogonal to a tangent to a boundary of the interaction area of the next target;
- 15 (ii) a connection which comprises the waypoint and is tangent to the boundary of the interaction area of the next target;
- (iii) a connection which intersects an interior area of the interaction area of the next target.
6. The method of any of claims 1 to 5, wherein, for at least one given target of the
- 20 plurality of targets associated with a given interaction area, a given connection of the series of connections comprises a waypoint located at a boundary of said given interaction area, said waypoint having a position different from a position of the given target.
7. The method of any of claims 1 to 6, wherein generating the series of connections
- 25 comprises generating a connection from a starting waypoint, said generating comprising:
- determining a first target among the plurality of targets, for which a first candidate connection C_1 meets an optimization criterion, wherein the first candidate connection C_1 comprises a first waypoint $W_{1,1}$ corresponding to the starting waypoint, and a second waypoint $C_{1,2}$ located at a boundary of an interaction area of the first target, wherein the
- 30 first candidate connection C_1 is orthogonal to said boundary.
8. The method of claim 7, wherein the optimization criterion takes into account at least one of:

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- (i) a length of the first candidate connection C_1 ; and
- (ii) a level of priority of the first target.

9. The method of claim 7 or of claim 8, comprising:
- 5 determining a second target among the plurality of targets, for which a second candidate connection C_2 comprising the second waypoint $W_{1,2}$ and a third waypoint $W_{2,1}$ located at a boundary of an interaction area of the second target meets an optimization criterion, wherein the second candidate connection C_2 is orthogonal to said boundary.
- 10 10. The method of claim 9, comprising, after identification of the first target and the second target:
- performing a comparison between:
- a first series of connections comprising the first candidate connection C_1 and the second candidate connection C_2 , and
 - 15 a second series of connections comprising a first candidate connection C'_1 comprising the first waypoint $C_{1,1}$ and a second waypoint $W'_{1,2}$ located at a boundary of the interaction area of the first target, wherein the first candidate connection C'_1 is tangent to the boundary of the interaction area of the first target at said second waypoint $W'_{1,2}$,
- 20 generating the series of connections based on the comparison.
11. The method of claims 1 to 10, wherein generating the series of connections comprises:
- determining an order among targets of the plurality of targets for generating the
 - 25 series of connections, wherein a second target is consecutive to a first target according to said order, and
 - determining a candidate connection which intersects at least one of:
 - an interior area of an interaction area of the first target, and
 - an interior area of an interaction area of the second target,
 - 30 using said candidate connection for generating the series of connections.
12. The method of any of claims 1 to 11, comprising:
- obtaining at least one forbidden area, and

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generating the series of connections, wherein each connection of the series of connections does not comprise any waypoint located in the forbidden area.

13. The method of any of claims 1 to 12, comprising:
- 5 dividing the plurality of targets into a plurality of clusters, wherein at least one cluster comprises at least two targets of the plurality of targets, wherein said dividing is based on a distribution of distance between the targets,
- determining an order between the plurality of clusters, and
- generating the flight path, wherein said flight path follows said order between the
- 10 plurality of clusters.

14. The method of claim 13, wherein determining the order between the plurality of clusters uses at least one of:
- (i) a distance between a center of mass of each cluster and an initial position from which
- 15 the flight path is to be generated;
- (ii) a number of targets of each cluster;
- (iii) data informative of a level of priority of the one or more targets of each cluster.

15. The method of claim 13 or of claim 14, comprising, for at least one given cluster
- 20 of the plurality of clusters:
- determining an order between targets of the given cluster according to a decreasing distance with respect to a next cluster being after said given cluster, and
- generating the flight path, wherein said flight path follows said order between the targets of the given cluster.

- 25 16. The method of any of claims 1 to 15, comprising:
- identifying at least one given connection which has a length which differs from a length of other connections of the series of connections according to a criterion,
- generating an updated series of connections, which:
- 30 (i) does not comprise said given connection, and
- (ii) has a length which is smaller than a length of the series of connections.

17. The method of any of claims 1 to 16, wherein, for each target:

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(i) for each position of the aerial vehicle located in the interaction area of said target, the interaction between the payload and said target is enabled according to the operability criterion, and

(ii) for each position of the aerial vehicle located outside the given interaction area, the interaction between the payload and the given target is not enabled according to the operability criterion.

18. The method of any of claims 1 to 17, comprising, for at least one target of the plurality of targets:

10 obtaining data informative of a position of the target and data informative of a dimension of the target,

using the data informative of a position of the target and the data informative of a dimension of the target to determine the interaction area of the target.

15 19. The method of any of claims 1 to 18, wherein the series of connections is generated progressively, wherein generation of said series of connections comprises determining a connection between a current waypoint and an interaction area of a next target, wherein the next area is determined based on at least one of:

(i) a distance between the current waypoint and the interaction area of the next target; and

(ii) a level of priority of the next target indicative of a priority to perform an interaction between the payload and the next target.

20. The method of any of claims 1 to 19, comprising:

25 for a given period of time T_1 :

determining a given moving target among the plurality of targets for which a distance between a position of the aerial vehicle at time T_1 and a position of the given moving target at time T_1 or an interaction area of the given moving target at time T_1 meets a criterion,

30 estimating a time ΔT_{target} for the aerial vehicle to reach the given moving target or the interaction area of the given moving target,

predicting position of one or more moving targets of the plurality of targets at time $T_1 + \Delta T_{\text{target}}$,

generating a connection between the position of the aerial vehicle at time T_1 and an interaction area of a given target of the plurality of targets, wherein the interaction area is estimated for a position of the given target at time $T_1 + \Delta T_{\text{target}}$.

5 21. The method of claim 20, wherein a distance between a position of the aerial vehicle at time T_1 and a position of the given target at time $T_1 + \Delta T_{\text{target}}$ or an interaction area of the given target at time $T_1 + \Delta T_{\text{target}}$ meets the criterion.

22. The method of any of claims 1 to 21, comprising:
10 for the given period of time T_1 :
(10) determining a given moving target among the plurality of targets for which a distance between a starting waypoint W_i and a position of the given moving target at time T_i or an interaction area of the given moving target at time T_i meets a criterion, wherein, at a first iteration of (10), T_i is equal to T_1 and W_i corresponds to a position of the aerial
15 vehicle at time T_1 ,
(11) estimating a future time T_{i+1} at which the aerial vehicle, starting from W_i , will reach the given moving target or the interaction area of the given moving target,
(12) predicting position of one or more moving targets of the plurality of targets at time T_i ,
20 (13) generating a connection between W_i and an interaction area of a given target of the plurality of targets, wherein the interaction area is estimated for a position of the given target at time T_{i+1} , wherein a distance between W_i and a position of the given target at time T_{i+1} or an interaction area of the given target at time T_{i+1} meets the criterion,
(14) repeating (10) to (13) at least once, wherein for said repeating W_i is set equal
25 to an extremity of the connection determined at (13) and T_i is set equal to T_{i+1} .

23. A system comprising a processor and memory circuitry (PMC), configured to, for an aerial vehicle comprising a payload operative to perform an interaction with a target:
for each target of a plurality of targets, determine an interaction area based on a
30 position of the target,
wherein, for each position of the aerial vehicle located in the interaction area of the target, the interaction between the payload and the target is enabled according to an operability criterion,

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generate a series of connections, wherein each connection comprises at least one waypoint located in an interaction area of a target of the plurality of targets and at least one waypoint located in an interaction area of another different target of the plurality of targets, wherein each interaction area comprises a waypoint of at least one connection of the series of connections, and
5 obtain a flight path for the aerial vehicle using the series of connections.

24. The system of claim 23, configured to, during a flight of the aerial vehicle:

(1) for a period of time T_i of the flight of the aerial vehicle:

10 for each target of a plurality of targets, obtain an interaction area based on a position of the target at the period of time T_i ,

wherein, for each position of the aerial vehicle located in the interaction area of the target, the interaction between the payload and the target is enabled according to an operability criterion,

15 wherein at least one target of the plurality of targets is a moving target,

generate a series of connections, wherein each connection comprises at least one waypoint located in an interaction area of a target of the plurality of targets and at least one waypoint located in an interaction area of another different target of the plurality of targets, wherein each interaction area comprises a waypoint of at least one connection of the series of connections,
20

obtain a flight path FP_i for the aerial vehicle using the series of connections,

(2) repeating (1) at least once for a period of time T_{i+1} different from T_i , wherein the moving target has a position at time T_{i+1} different from time T_i , to generate an updated flight path FP_{i+1} for the aerial vehicle.

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25. The system of claim 23 or of claim 24, wherein the payload comprises an acquisition device and the interaction with the target comprises an acquisition of the target by the acquisition device.

30 26. The system of claim 25, wherein the interaction area of each target is determined based on a maximal zoom-in capability of the acquisition device.

27. The system of any of claims 23 to 26, wherein generating the series of connections comprises determining a connection between a waypoint of a given connection of the series of connections and an interaction area of a next target, said determining comprising selecting the connection among one of:
- 5 (i) a connection which comprises the waypoint and is orthogonal to a tangent to a boundary of the interaction area of the next target;
- (ii) a connection which comprises the waypoint and is tangent to the boundary of the interaction area of the next target;
- (iii) a connection which intersects an interior area of the interaction area of the next target.
- 10 28. The system of any of claims 23 to 27, wherein, for at least one given target of the plurality of targets associated with a given interaction area, a given connection of the series of connections comprises a waypoint located at a boundary of said given interaction area, said waypoint having a position different from a position of the given target.
- 15 29. The system of any of claims 23 to 28, wherein generating the series of connections comprises generating a connection from a starting waypoint, said generating comprising:
- determining a first target among the plurality of targets, for which a first candidate connection C_1 meets an optimization criterion, wherein the first candidate connection C_1 comprises a first waypoint $W_{1,1}$ corresponding to the starting waypoint, and a second
- 20 waypoint $C_{1,2}$ located at a boundary of an interaction area of the first target, wherein the first candidate connection C_1 is orthogonal to said boundary.
30. The system of claim 29, wherein the optimization criterion takes into account at least one of:
- 25 (i) a length of the first candidate connection C_1 ; and
- (ii) a level of priority of the first target.
31. The system of claim 28 or of claim 29, configured to:
- determine a second target among the plurality of targets, for which a second
- 30 candidate connection C_2 comprising the second waypoint $W_{1,2}$ and a third waypoint $W_{2,1}$ located at a boundary of an interaction area of the second target, meets an optimization criterion, wherein the second candidate connection C_2 is orthogonal to said boundary.

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32. The system of claim 31, configured to, after identification of the first target and the second target:

perform a comparison between:

5 a first series of connections comprising the first candidate connection C_1 and the second candidate connection C_2 , and

a second series of connections comprising a first candidate connection C'_1 comprising the first waypoint $C_{1,1}$ and a second waypoint $W'_{1,2}$ located at a boundary of the interaction area of the first target, wherein the first candidate connection C'_1 is tangent to the boundary of the interaction area of the first target at said second waypoint $W'_{1,2}$,

10 generate the series of connections based on the comparison.

33. The system of any of claims 23 to 32, wherein generating the series of connections comprises:

15 determining an order among targets of the plurality of targets for generating the series of connections, wherein a second target is consecutive to a first target according to said order, and

determining a candidate connection which intersects at least one of:

20 an interior area of an interaction area of the first target, and

an interior area of an interaction area of the second target,

using said candidate connection for generating the series of connections.

34. The system of any of claims 23 to 33, configured to:

obtain at least one forbidden area, and

25 generate the series of connections, wherein each connection of the series of connections does not comprise any waypoint located in the forbidden area.

35. The system of any of claims 23 to 34, configured to:

30 divide the plurality of targets into a plurality of clusters, wherein at least one cluster comprises at least two targets of the plurality of targets, wherein said dividing is based on a distribution of distance between the targets,

determine an order between the plurality of clusters, and

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generate the flight path, wherein said flight path follows said order between the plurality of clusters.

36. The system of claim 35, wherein determining the order between the plurality of clusters uses at least one of:

- (i) a distance between a center of mass of each cluster and an initial position from which the flight path is to be generated;
- (ii) a number of targets of each cluster;
- (iii) data informative of a level of priority of the one or more targets of each cluster.

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37. The system of claim 35 or of claim 36, configured to, for at least one given cluster of the plurality of clusters:

determine an order between targets of the given cluster according to a decreasing distance with respect to a next cluster being after said given cluster,

15 generate the flight path, wherein said flight path follows said order between the targets of the given cluster.

38. The system of any of claims 22 to 35, configured to:

identify at least one given connection which has a length which differs from a length of other connections of the series of connections according to a criterion,

20 generate an updated series of connections, which:

- (i) does not comprise said given connection, and
- (ii) has a length which is smaller than a length of the series of connections.

25 39. The system of any of claims 23 to 38, wherein, for each target:

(i) for each position of the aerial vehicle located in the interaction area of said target, the interaction between the payload and said target is enabled according to the operability criterion, and

30 (ii) for each position of the aerial vehicle located outside the given interaction area, the interaction between the payload and the given target is not enabled according to the operability criterion.

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40. The system of any of claims 23 to 39, configured to, for at least one target of the plurality of targets:

obtain data informative of a position of the target and data informative of a dimension of the target,

5 use the data informative of a position of the target and the data informative of a dimension of the target to determine the interaction area of the target.

41. The system of any of claims 23 to 40, wherein the series of connections is generated progressively, wherein generation of said series of connections comprises
10 determining a connection between a current waypoint and an interaction area of a next target, wherein the next area is determined based on at least one of:

(i) a distance between the current waypoint and the interaction area of the next target; and

(ii) a level of priority of the next target indicative of a priority to perform an
15 interaction between the payload and the next target.

42. The system of any of claims 23 to 41, configured to:
for a given period of time T_1 :

determine a given moving target among the plurality of targets for which
20 a distance between a position of the aerial vehicle at time T_1 and a position of the given moving target at time T_1 or an interaction area of the given moving target at time T_1 meets a criterion,

estimate a time ΔT_{target} for the aerial vehicle to reach the given moving target or the interaction area of the given moving target,

25 predict position of moving targets of the plurality of targets at time $T_1 + \Delta T_{\text{target}}$,

generate a connection between the position of the aerial vehicle at time T_1 and an interaction area of a given target of the plurality of targets, wherein the interaction area is estimated for a position of the given target at time $T_1 + \Delta T_{\text{target}}$.

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43. The system of claim 42, wherein a distance between a position of the aerial vehicle at time T_1 and a position of the given target at time $T_1 + \Delta T_{\text{target}}$ or an interaction area of the given target at time $T_1 + \Delta T_{\text{target}}$ meets the criterion.

44. The system of any of claims 23 to 43, configured to:
for the given period of time T_1 :
- (10) determine a given moving target among the plurality of targets for which a
5 distance between a starting waypoint W_i and a position of the given moving target at time
 T_i or an interaction area of the given moving target at time T_i meets a criterion, wherein,
at a first iteration of (10), T_i is equal to T_1 and W_i corresponds to a position of the aerial
vehicle at time T_1 ,
- (11) estimating a future time T_{i+1} at which the aerial vehicle, starting from W_i , will
10 reach the given moving target or the interaction area of the given moving target,
- (12) predicting position of one or more moving targets of the plurality of targets
at time T_i ,
- (13) generating a connection between W_i and an interaction area of a given target
of the plurality of targets, wherein the interaction area is estimated for a position of the
15 given target at time T_{i+1} , wherein a distance between W_i and a position of the given target
at time T_{i+1} or an interaction area of the given target at time T_{i+1} meets the criterion,
- (14) repeating (10) to (13) at least once, wherein for said repeating W_i is set equal
to an extremity of the connection determined at (13) and T_i is set equal to T_{i+1} .
- 20 45. An aerial vehicle comprising:
a payload operative to perform an interaction with a target,
a processor and memory circuitry (PMC), configured to:
for each target of a plurality of targets, determine an interaction area based on a
position of the target,
- 25 wherein, for each position of the aerial vehicle located in the interaction area of
the target, the interaction between the payload and the target is enabled according to an
operability criterion,
generate a series of connections, wherein each connection comprises at least one
waypoint located in an interaction area of a target of the plurality of targets and at least
30 one waypoint located in an interaction area of another different target of the plurality of
targets, wherein each interaction area comprises a waypoint of at least one connection of
the series of connections,
obtain a flight path for the aerial vehicle using the series of connections.

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46. A non-transitory storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform, for an aerial vehicle comprising a payload operative to perform an interaction with a target:

5 for each target of a plurality of targets, determining an interaction area based on a position of the target,

 wherein, for each position of the aerial vehicle located in the interaction area of the target, the interaction between the payload and the target is enabled according to an operability criterion,

10 wherein at least one target of the plurality of targets is a moving target,

 generating a series of connections, wherein each connection comprises at least one waypoint located in an interaction area of a target of the plurality of targets and at least one waypoint located in an interaction area of another different target of the plurality of targets, wherein each interaction area comprises a waypoint of at least one connection of

15 the series of connections,

 obtaining a flight path for the aerial vehicle using the series of connections.

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