

Handling system, related floating dock, naval platform and handling method

The present invention relates to a handling system comprising:

- a lifting gantry mounted moving on a naval platform,
- 5 - a floating dock for placement in the water and/or recovery of an unmanned surface vehicle configured to house the unmanned surface vehicle, the floating dock comprising, in the lower part, a cradle for receiving the unmanned surface vehicle and, in the upper part, a lifting spreader configured to be attached to the lifting gantry.

10 The present invention also relates to a floating dock for placement in the water and/or recovery of the unmanned surface vehicle configured to house the unmanned surface vehicle, the floating dock comprising, in the lower part, a cradle for receiving the unmanned surface vehicle and, in the upper part, a lifting spreader configured to be attached to a lifting gantry mounted moving on a naval platform.

15 The present invention also relates to a naval platform comprising a handling system of the aforementioned type.

The present invention also relates to a handling method implemented using the aforementioned handling system.

20 For the placement of the water and/or recovery of the unmanned surface vehicle (USV) by the plating of a naval platform, based solutions have been developed. Among these solutions, a solution based on the use of a floating dock as described in application WO 97/39940 is used to house the unmanned surface vehicle during these operations.

25 Such a floating dock has, to that end, two parts that are permanently secured, namely a lower part forming a receiving housing or cradle whose characteristics are such that they allow the unmanned surface vehicle and the floating dock to have substantially identical buoyancy and sea state capability conditions, and an upper part forming a lifting spreader configured to be lifted, for example using sling(s), by a lifting gantry (that is to say, a gantry crane or a davit).

30 However, the floating dock according to application WO 97/39940 has the drawback of preventing the handling of payloads to be loaded/unloaded on the unmanned surface vehicle. Such payloads are in particular bulky and heavy and for example correspond to a towed sonar, an autonomous underwater vehicle (AUV), a remotely operated vehicle (ROV), and their handling for loading/unloading on the unmanned surface vehicle interferes with the upper part forming the lifting spreader of the floating dock according to application
35 WO 97/39940.

One of the aims of the invention is therefore to resolve this problem.

To that end, the invention relates to a handling system comprising:

- a lifting gantry mounted moving on a naval platform,
- a floating dock for placement in the water and/or recovery of an unmanned surface vehicle configured to house the unmanned surface vehicle, the floating dock comprising, in the lower part, a cradle for receiving the unmanned surface vehicle and, in the upper part, a lifting spreader configured to be attached to the lifting gantry, the lifting spreader being detachable from the cradle.

"Detachable" means that the spreader and the cradle form a unit, namely the floating dock, and that the spreader and the cradle are separable, able to be isolated from one another, without any damage, during the establishment of the connection, or during the separation, of these two elements. In other words, the spreader is removably fastened on the cradle.

Thus, the deck of the unmanned surface vehicle is accessible and its loading/unloading is made easier and possible to implement by a single human operator. Indeed, the assembly formed on the one hand by the lifting gantry and on the other hand by the spreader detached from the floating dock but also attached to the lifting gantry, is able to project and no longer interferes with any handling operations seeking to load/unload the deck of the unmanned surface vehicle. In other words, the gantry-spreader assembly, when it projects outside the platform while the floating dock housing the unmanned surface vehicle remains on the platform, frees all of the vertical space located above the deck of the unmanned surface vehicle, which makes it accessible and facilitates the handling operations in particular using one or several bridge crane(s) fastened to the ceiling of a handling hanger located on the deck of the naval platform.

The handling system according to the invention may include one or more of the following features, considered alone or according to any technically achievable combination(s):

- the cradle comprises at least one element for locking/unlocking the lifting spreader;
- the locking/unlocking element is a bolting/unbolting element;
- the floating dock comprises at least one centering element associated with each locking/unlocking element;
- the gantry and the lifting spreader are secured by at least one rigid link configured to stabilize the spreader in the projecting position, the rigid link being formed at least by a cable and a jack;
- the handling system further comprises at least two transverse guide arms for the placement in the water and/or recovery of the floating dock, each having an end secured to the plating of the platform, each transverse guide arm being able to come into contact with

the plating of the floating dock, and each being able to be activated by hydraulic jack(s) between a retracted position substantially collinear to the plating of the platform and a deployed position where each transverse guide arm forms a predetermined offset angle relative to the plating of the platform.

5 The present invention also relates to a floating dock for placement in the water and/or recovery of the unmanned surface vehicle configured to house the unmanned surface vehicle, the floating dock comprising, in the lower part, a cradle for receiving the unmanned surface vehicle and, in the upper part, a lifting spreader configured to be attached to a lifting gantry mounted moving on a naval platform, the lifting spreader being
10 detachable from the cradle.

 The present invention also relates to a handling method, implemented by a handling system comprising:

- a lifting gantry mounted moving on a naval platform,
- a floating dock for placement in the water and/or recovery of a unmanned surface vehicle
15 configured to house the unmanned surface vehicle, the floating dock comprising, in the lower part, a cradle for receiving the unmanned surface vehicle and, in the upper part, a lifting spreader configured to be attached to the lifting gantry, the lifting spreader being detachable from the cradle,

 the method comprising at least:

20 - the detachment, from the cradle of the floating dock, of the lifting spreader secured to the lifting gantry,

 - the projection, outside the platform, of the assembly formed by the lifting spreader and the lifting gantry to which the lifting spreader is secured, by moving the lifting gantry into a projecting position, the cradle of the floating dock remaining on board the naval
25 platform,

 - the handling of a payload intended to be loaded/unloaded onto/from the unmanned surface vehicle,

 - the loading/unloading of the payload onto/from the unmanned surface vehicle,
 - the retraction on board the platform, opposite the projection, of the assembly
30 formed by the lifting spreader and the lifting gantry, by moving the lifting gantry into an on board position, the cradle of the floating dock remaining on board the naval platform,

 - the reattachment, to the cradle of the floating dock, of the lifting spreader secured to the lifting gantry,

 - the placement in the water and/or recovery of the floating dock housing the
35 unmanned surface vehicle on which the payload is loaded by moving the lifting gantry into the projecting position.

The handling system according to the invention may include one or more of the following features, considered alone or according to any technically achievable combination(s):

5 - the placement in the water of the floating dock housing the unmanned surface vehicle on which the payload is loaded comprises, simultaneously with the action to place the lifting spreader in the water, the deployment of transverse guide arms for the placement in the water and/or recovery of the floating dock, each having an end secured to the plating of the platform, each transverse guide arm being able to come into contact with the plating of the floating dock, and each being able to be activated between a retracted position
10 substantially collinear to the plating of the platform and a deployed position where each transverse guide arm forms a predetermined offset angle relative to the plating of the platform;

 - the recovery of the floating dock housing the unmanned surface vehicle on which the payload is loaded comprises, simultaneously with the action to raise the lifting spreader,
15 the retraction of transverse guide arms for the placement in the water and/or recovery of the floating dock, each having an end secured to the plating of the platform, each transverse guide arm being able to come into contact with the plating of the floating dock, between a deployed position where each transverse guide arm forms a predetermined offset angle relative to the plating of the platform and a retracted position substantially collinear to the
20 plating of the platform.

The invention will be better understood upon reading the following description, provided solely as an example and done in reference to the appended drawings, in which:

- figure 1 and figure 2 show a perspective view of two distinct positions of the handling system according to the present invention;
- 25 - figures 3 to 9 are schematic illustrations, seen from the back of the naval platform, showing different successive positions of the handling system to load an unmanned surface vehicle housed within a floating dock;
- figure 10 is a schematic illustration of the lifting gantry;
- figure 11 is an illustration of the different positions of the handling system for the
30 placement in the water or conversely for the recovery of an unmanned surface vehicle;
- figure 12 is a flowchart of a handling method according to the present invention.

In the remainder of the description, the expressions "substantially" or "on the order of" refer to an equality relationship to within plus or minus 10%, i.e., with a variation of no
35 more than 10%, also preferably to an equality relationship to within plus or minus 5%, i.e., with a variation of no more than 5%.

The naval platform 12 of figure 1 is shown in the navigation phase on the water 14 and comprises, on the port side and the starboard side, a lifting gantry 16 mounted moving on the naval platform 12 between an on board position as illustrated by the lifting gantry 16 on the port side, and a projecting position as illustrated by the lifting gantry 16 on the starboard side.

In particular, the lifting gantry 16 is used for the placement in the water and/or the recovery of a floating dock comprising a lower part forming a receiving cradle 18 for an unmanned surface vehicle 20. The receiving cradle 18 in particular comprises risers 21 able to be secured to the upper part of the floating dock corresponding to a lifting spreader 22. The lifting spreader 22 is configured to be attached, for example using sling(s), to the lifting gantry 16.

The lifting gantry 16 moves from the on board position to the projecting position for example by rotation using hydraulic jacks 24. Such hydraulic jacks 24 are for example controlled remotely by an operator using a centralized control system, not shown in figure 1.

In figure 2, the handling system on the starboard side of the naval platform 12 according to the present invention formed by the lifting gantry and by the floating dock comprising, in the lower part, the receiving cradle 18 for the unmanned surface vehicle 20 and, in the upper part, the lifting spreader 22 is shown in the position for loading a payload 26.

In this loading position of the handling system, the lifting spreader 22 is both secured to the lifting gantry 16 and detached from the risers 21 of the receiving cradle 18, and the assembly formed by the lifting gantry 16 and the spreader 22 is projected to the outside of the naval platform 12, here on the starboard side, while the rest of the floating dock, namely the receiving cradle 18 housing the unmanned surface vehicle 20, remains on the naval platform 12 for loading/unloading of the payload 26, for example using a lifting tool 28 (for example, a crane).

In figure 3, an operator O_1 commands the hydraulic jack 24, which actuates the movement of the lifting gantry 16 to come to a position on board the naval platform 12 in order to bring the floating dock housing the unmanned surface vehicle 20 back on board the naval platform 12 in order to subsequently load the payload 26 onto the deck of the unmanned surface vehicle 20, in particular using a loading tool 28 corresponding to a bridge crane suspended from the ceiling of a hangar, not shown.

In this position prior to any handling of the payload 26, the spreader 22 is simultaneously secured on the one hand to the lifting gantry 16 and on the other hand to the cradle 18 for receiving the unmanned surface vehicle 20.

In particular, figure 3 shows two fastening points 30_A and 30_B for two parts of the floating dock that are detachable from one another, namely the upper part corresponding to the spreader 22 on the one hand, and the lower part corresponding to the cradle 18 on the other hand.

5 According to one optional aspect, the gantry 16 and the lifting spreader 22 are secured by at least one rigid link configured to stabilize (that is to say, preventing rocking of) the spreader 22 in the projecting position, the rigid link being formed at least by a jack 32 and a cable 34.

10 In figure 4, the spreader 22 of the floating dock is configured to be detached from the cradle 18 manually by an operator O₂ tasked with loading and unloading operations, while remaining attached to the lifting gantry 16.

15 To that end, at each of the two fastening points 30_A and 30_B, the cradle 18 comprises a locking/unlocking element (not shown) for the lifting spreader 22. In particular, the locking/unlocking element is a bolting/unbolting element, the manual manipulation of which is quick and easy.

 Furthermore, according to one variant that is not shown, the floating dock comprises at least one centering element (for example, a pin) associated with each locking/unlocking element.

20 Such an association makes it possible to quickly and easily manually detach/reattach the spreader 22 and the floating dock, the spreader also remaining secured to the lifting gantry 16.

25 In figure 5, the lifting gantry 16 secured only to the spreader 22 projects outside the naval platform 12, the cradle 18 of the floating dock remains on board. The deck of the unmanned surface vehicle 20 housed on the cradle 18 is then accessible by the handling tool 28 for the payload 26, any interference between the spreader 22 and/or the gantry 16 in the position of figure 3 being eliminated.

 In other words, the use of the lifting gantry 16 is enhanced by an additional function on top of placement in the water and recovery, namely a function of freeing the deck of the unmanned surface vehicle 20.

30 Furthermore, the vertical volume thus freed allows vertical handling operations, in particular when the handling tool 28 is a bridge crane suspended from the ceiling of a hangar. Such vertical handling operations in particular make it possible to avoid any contact (or even damage), with vertical vents arranged on the deck of the unmanned surface vehicle 20 passing above the payload 26.

In figure 6, the payload 26 is placed effectively on the deck of the unmanned surface vehicle 20, in particular after having passed vertical vents of the unmanned surface vehicle 20, the mission of the operator O_2 is then complete.

5 In figure 7, the assembly formed by the lifting gantry 16 and the spreader 22 is positioned on board such that the spreader 22 is attached to the uprights 21 of the cradle 18 of the floating dock at the fastening points 30_A and 30_B .

In figure 8, the attachment to the cradle 18 of the assembly formed by the lifting gantry 16 and the spreader 22 at the fastening points 30_A and 30_B by locking (for example bolting) of the locking/unlocking element (not shown) is effective.

10 In figure 9, the lifting gantry 16 of the handling system according to the invention, configured to be actuated by the operator O_1 , is in the projecting position, for example by rotation 36 of the gantry 16, to place the unmanned surface vehicle 20 on which the payload 26 is loaded (not shown) in the water.

15 The handling system, according to an optional aspect illustrated by figure 10, further comprises at least one transverse guide arm 38 for placement in the water and/or recovery of the floating dock, having one end secured to the plating of the platform 12.

Each transverse guide arm is able to come into contact with the plating of the cradle 18 of the floating dock, and can be activated by hydraulic jack(s) between a retracted position substantially collinear to the plating of the platform and a deployed position where
20 each transverse guide arm forms a predetermined offset angle 40 relative to the plating of the platform as illustrated hereinafter by figure 11.

In figure 11, the transverse guide arms 38 are deployed by the plating of the naval platform 12. These transverse guide arms 38 are configured to be active once the cables for placing the floating dock in the water are partially slackened. The transverse guide arms
25 38 come into contact with the placement of the floating dock (rubber fenders), so as to limit its relative sway and roll movements, for the phases where the floating dock is not yet in the water.

The handling method 50 according to the invention for an unmanned surface vehicle configured to be housed throughout the entire handling method within a floating dock will
30 now be explained in light of figure 12 showing a flowchart of such a method.

During a first step 52, the detachment of the cradle 18 of the unmanned surface vehicle, from the lifting spreader 22 secured to the lifting gantry 16, is done by the operator $O_{2,}$, which corresponds to the position of the handling system according to the invention illustrated by figure 4.

35 During a step 54, the projection, outside the platform 12, of the assembly formed by the lifting spreader 22 and the lifting gantry 16 to which the lifting spreader 22 is secured,

by moving the lifting gantry 22 into a projecting position, the cradle 18 of the floating dock remaining on board the naval platform is for example carried out by the operator O_1 of figure 5.

5 During a step 56, the handling (which is to say, the movement before loading) of a payload 56 suitable for being loaded onto/from the unmanned surface vehicle 20 is carried out, in particular by the operator O_2 as illustrated in figure 5.

During a step 58, the loading/unloading of the payload onto/from the unmanned surface vehicle is done in particular by the operator O_2 as illustrated in figure 6.

10 During a step 60, the retraction on board the platform, opposite the projection, of the assembly formed by the lifting spreader 22 and the lifting gantry 10, by moving the lifting gantry 16 into an on board position, the cradle 18 of the floating dock remaining on board the naval platform is done, in particular by the operator O_1 as illustrated in figure 7.

15 During a step 62, the reattachment, to the cradle 18 of the floating dock, of the lifting spreader 22 secured to the lifting gantry 16, is done by the operator O_2 as illustrated in figure 8.

During a step 64, the placement in the water and/or recovery of the floating dock housing the unmanned surface vehicle 20 on which the payload 26 is loaded by moving the lifting gantry 16 into the projecting position is done, in particular by the operator O_1 as illustrated in figure 8.

20 Such a handling method allowing loading, then placement in the water when the detachment 52, projection 54, handling 56, loading 58, retraction 60, reattachment 62 and placement in the water 64 steps follow one another as illustrated by figure 12, or (in a manner not shown) allows a recovery, then unloading when the recovery step 64 is followed by the detachment 52, projection 54, handling 56, unloading 58, retraction 60 and
25 reattachment 62 steps are done successively.

Other technically achievable combinations of these steps can also be done according to the inventive method 50 in order to produce desired handling kinematics.

30 According to one optional aspect, the step 64 for placement in the water and/or recovery of the floating dock housing the unmanned surface vehicle 20 on which the payload 26 is loaded comprises a step 66 for respectively deploying and/or retracting the transverse guide arms 38.

35 According to this optional aspect, the placement in the water 64 of the floating dock housing the unmanned surface vehicle 20 on which the payload 26 is loaded comprises, simultaneously with the action of placing the lifting gantry 16 in the water, a step 66 for deploying the transverse guide arms 38 for placement in the water and/or recovery of the floating dock, each having an end secured to the plating of the platform 12, each transverse

guide arm being able to come into contact with the plating of the floating dock, and being able to be actuated between a retracted position substantially collinear with the plating of the platform 12 and a deployed position where each transverse guide arm forms a predetermined projection angle relative to the plating of the platform 12.

5 According to this optional aspect, the recovery 64 of the floating dock housing the unmanned surface vehicle on which the payload is loaded comprises, simultaneously with the action to raise the lifting spreader, a step 66 for retraction of transverse guide arms for the placement in the water and/or recovery of the floating dock, each having an end secured to the plating of the platform, each transverse guide arm being able to come into contact
10 with the plating of the floating dock, between a deployed position where each transverse guide arm forms a predetermined offset angle relative to the plating of the platform and a retracted position substantially collinear to the plating of the platform. Alternatively, the activation by deployment and/or retraction of the transverse guide arms 38 is only implemented for the operation for placement in the water or respectively for the recovery
15 operation.

 One can thus see that the handling system formed at least by the gantry 16 and the floating dock comprising two parts, namely the cradle 18 for receiving the unmanned surface vehicle 20 and the spreader 22 allows quick and easy clearing by a single operator of the vertical space necessary for the payload handling intended to be loaded on the
20 unmanned surface vehicle.

 Furthermore, the handling during the placement in the water and/or recovery of the unmanned surface vehicle is optimized by a system of transverse guide arms that make it possible to best accompany the handling for placement in the water and/or recovery by limiting the relative movements between the naval platform 12 and the floating dock.

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CLAIMS

1.- A handling system comprising:

- a lifting gantry (16) mounted moving on a naval platform (12),
- a floating dock for placement in the water and/or recovery of an unmanned surface vehicle (20) configured to house the unmanned surface vehicle (20), the floating dock comprising, in the lower part, a cradle (18) for receiving the unmanned surface vehicle (20) and, in the upper part, a lifting spreader (22) configured to be attached to the lifting gantry (16),

characterized in that the lifting spreader (22) is detachable from the cradle (18), and in that the assembly formed on the one hand by the lifting gantry and on the other hand by the spreader, detached from the floating dock, but also attached to the lifting gantry, being able to project and to no longer interfere with any handling operations seeking to load/unload the deck of the unmanned surface vehicle.

2.- The system for handling an unmanned surface vehicle (20) according to claim 1, wherein the cradle (18) comprises at least one element for locking/unlocking the lifting spreader (22).

3.- The system for handling an unmanned surface vehicle (20) according to claim 2, wherein the locking/unlocking element is a bolting/unbolting element.

4.- The system for handling an unmanned surface vehicle (20) according to claim 2 or 3, wherein the floating dock comprises at least one centering element associated with each locking/unlocking element.

5.- The system for handling an unmanned surface vehicle (20) according to any one of the preceding claims, wherein the gantry (16) and the lifting spreader (22) are secured by at least one rigid link configured to stabilize the spreader (22) in the projecting position, the rigid link being formed at least by a cable (34) and a jack (32).

6.- A floating dock for placement in the water and/or recovery of the unmanned surface vehicle (20) configured to housing the unmanned surface vehicle (20), the floating dock comprising, in the lower part, a cradle (18) for receiving the unmanned surface vehicle (20) and, in the upper part, a lifting spreader (22) configured to be attached to a

lifting gantry (16) mounted moving on a naval platform (12), characterized in that the lifting spreader (22) is detachable from the cradle (18).

7.- A naval platform (12) comprising a handling system according to any one of claims 1 to 5.

8.- A handling method (50) implemented by a handling system comprising:

- a lifting gantry (16) mounted moving on a naval platform (12),
- a floating dock for placement in the water and/or recovery of an unmanned surface vehicle (20) configured to house the unmanned surface vehicle (20), the floating dock comprising, in the lower part, a cradle (18) for receiving the unmanned surface vehicle (20) and, in the upper part, a lifting spreader (22) configured to be attached to the lifting gantry (16), the lifting spreader (22) being detachable from the cradle (18), the assembly formed on the one hand by the lifting gantry and on the other hand by the spreader, detached from the floating dock, but also attached to the lifting gantry, being able to project and to no longer interfere with any handling operations seeking to load/unload the deck of the unmanned surface vehicle,

the method comprising at least:

- the detachment (52), from the cradle (18) of the floating dock, of the lifting spreader (22) secured to the lifting gantry (16),
- the projection (54), outside the platform (12), of the assembly formed by the lifting spreader (22) and the lifting gantry (16) to which the lifting spreader (22) is secured, by moving the lifting gantry (16) into a projecting position, the cradle (18) of the floating dock remaining on board the naval platform (12),
- the handling (56) of a payload (26) intended to be loaded/unloaded onto/from the unmanned surface vehicle (20),
- the loading/unloading (58) of the payload (26) onto/from the unmanned surface vehicle (20),
- the retraction (60) on board the platform (12), opposite the projection, of the assembly formed by the lifting spreader (22) and the lifting gantry (16), by moving the lifting gantry (16) into an on board position, the cradle (18) of the floating dock remaining on board the naval platform (22),
- the reattachment (62), to the cradle (18) of the floating dock, of the lifting spreader secured to the lifting gantry (16),

- the placement in the water (64) and/or recovery (64) of the floating dock housing the unmanned surface vehicle (18) on which the payload (26) is loaded by moving the lifting gantry into the projecting position.

9.- The method for handling an unmanned surface vehicle according to claim 8, wherein the placement in the water (64) of the floating dock housing the unmanned surface vehicle (20) on which the payload (26) is loaded comprises, simultaneously with the action to place the lifting spreader (16) in the water, the deployment (66) of transverse guide arms (38) for the placement in the water and/or recovery of the floating dock, each having an end secured to the plating of the platform (12), each transverse guide arm (38) being able to come into contact with the plating of the floating dock, and each being able to be activated between a retracted position substantially collinear to the plating of the platform (12) and a deployed position where each transverse guide arm (38) forms a predetermined offset angle relative to the plating of the platform (12).

10.- The method for handling an unmanned surface vehicle according to claim 8 or 9, wherein the recovery (64) of the floating dock housing the unmanned surface vehicle (20) on which the payload (26) is loaded comprises, simultaneously with the action to raise the lifting spreader, the retraction (66) of transverse guide arms (38) for the placement in the water and/or recovery of the floating dock, each having an end secured to the plating of the platform (22), each transverse guide arm (38) being able to come into contact with the plating of the floating dock, between a deployed position where each transverse guide arm forms a predetermined offset angle relative to the plating of the platform and a retracted position substantially collinear to the plating of the platform (12).