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IN REPLY REFER TO:

Attorney Docket No. 82767
Date: 21 May 2002

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Serial Number 09/853,934

Filing Date 5/11/01

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20020528 084

SUBMARINE LAUNCHED UNMANNED COMBAT VEHICLE REPLENISHMENT

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT (1) JOHN E. SIRMALIS and (2) PAMELA J. LISIEWICZ, citizens of the United States of America, employees of the United States Government and residents of (1) Barrington, County of Bristol, State of Rhode Island, and (2) Tiverton, County of Newport, State of Rhode Island, have invented certain new and useful improvements entitled as set forth above of which the following is a specification:

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5 STATEMENT OF GOVERNMENT INTEREST

6 The invention described herein may be manufactured and used
7 by or for the Government of the United States of America for
8 governmental purposes without the payment of any royalties
9 thereon or therefore.

10

11 CROSS-REFERENCE TO RELATED APPLICATIONS

12 There are no related patent applications.

13

14 BACKGROUND OF THE INVENTION

15 (1) Field of the Invention

16 The present invention relates generally to unmanned
17 underwater vehicles, and more particularly to a method using an
18 unmanned underwater vehicle to provide in-situ replenishment of a
19 submarine's tactical capabilities.

20 (2) Description of the Prior Art

21 Recent testing using scale models have demonstrated the
22 potential of programmable, or mission reconfigurable, unmanned
23 underwater vehicles operating in concert with a submarine. Such
24 underwater unmanned vehicles, referred to as Unmanned Combat

1 Vehicles (UCV's) are hydrodynamically and stealth shaped, and
2 provide an extended sphere of influence for the submarine.
3 Current battle scenarios call for submarine operation in the
4 littoral area. With the shallow depth and generally heavy
5 surface ship traffic in littoral areas, the submarine becomes
6 extremely vulnerable to hostile attack. The UCV can provide
7 detailed intelligence, surveillance and environmental data to the
8 submarine without the need for the submarine to enter the
9 littoral area. The initial concept for UCV use was recited in
10 U.S. Patent No. 6,118,066 entitled AUTONOMOUS UNDERSEA PLATFORM,
11 by the current inventors and incorporated herein by reference.

12 Advanced weapons systems on contemplated UCV's make the
13 platform an excellent standoff weapon system. Artificial
14 intelligence and neural network processing capabilities allow the
15 platform to operate autonomously when provided with general
16 mission requirements and boundaries. In terms of submarine use,
17 a number of UCV's may be attached to the submarine, each
18 independently launched on a mission and returned to the sub at
19 the completion of the mission. However, in a hostile engagement
20 scenario, the weapons systems aboard the platforms may be
21 depleted. No method or system exists to replenish or reload
22 fully equipped UCV's at the submarine. Such a method and system
23 for replenishing the weapons systems during such an engagement

would greatly enhance survivability of the submarine and its crew.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a method and system for replenishing a submarine's tactical capabilities in situ.

Another object of the present invention is to provide a method and system to replenish a submarine's depleted Underwater Combat Vehicles.

Other objects and advantages of the present invention will become more obvious hereinafter in the specification and drawings.

In accordance with the present invention, the method consists of providing one or more UCV's in addition to those attached, or dedicated, to one particular submarine. These additional UCV's are either pre-positioned, surface launched, or air launched to rendezvous with a submarine in need of additional tactical capabilities. In the pre-positioned mode, the additional UCV's are placed at strategic locations in the general vicinity of a potential conflict. As an example, UCV's may be located at U.S. overseas military bases or friendly ports about the Persian Gulf. If a conflict is imminent, the UCV's may also be positioned in well-concealed underwater locations near the

1 conflict area. In the pre-positioned mode, the UCV's are in a
2 standby status awaiting instructions or programming. However,
3 the sensor suites aboard the UCV's may remain active to provide a
4 sensor network near or within the conflict area. This network
5 may be used by surface, airborne, or other platforms to provide
6 increased surveillance in the area.

7 Surface or air launches of the UCV's may be accomplished
8 during a conflict, or at other times when pre-positioning the
9 UCV's near or within the conflict area would present too great a
10 risk. A launch from a surface ship may be accomplished from a
11 position well removed from the conflict area. The launch can
12 easily be accomplished in a covert manner and the UCV can travel
13 virtually undetected to the conflict site. A launch from an
14 aircraft would not be as covert, but may be necessary where time
15 for replenishment is critical.

16 The additional UCV's are programmed to search for and locate
17 the submarine to be resupplied. This can either be accomplished
18 using signals broadcast from the submarine, communications
19 between the submarine and the UCV's, or using UCV internal
20 navigation systems and a last known position for the submarine.
21 Signals and communications may include electromagnetic or
22 acoustic singles and communications. Once located, communication
23 between the submarine and UCV allows docking of the UCV onto the
24 submarine. To initiate resupply, a submarine may broadcast a

1 signal either to one of the UCV's on standby, or to a central
2 command. In a battle space environment, such external
3 communication may not be possible. Thus, instead of returning to
4 the submarine, depleted sub-launched UCV's may be programmed to
5 proceed to a site where they can rendezvous or make contact with
6 a standby UCV, central command, or other platform. Once contact
7 is made, the replenishment UCV can be launched. In a still
8 further scenario, a depleted UCV returning to the submarine may
9 be reprogrammed at the submarine to search for and locate a
10 specific UCV having the ordnance (torpedoes, missiles),
11 countermeasures, sensors, or communications hardware most needed
12 by the submarine. The submarine can also dispatch the UCV to
13 proceed to the contact site as noted above. It can be seen that
14 the method envisioned in the disclosure requires a system of
15 UCV's traveling in and out of the battle space as required,
16 rather than UCV's confined to operation in concert with a single
17 submarine.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the invention and many of the attendant advantages thereto will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in conjunction with the

accompanying drawings wherein like reference numerals refer to like parts and wherein:

FIG. 1 is a schematic representation of the vicinity near a conflict area illustrating the use of the method of the present invention; and

FIG. 2 is a block diagram for the implementation of the method of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, there is shown a schematic representation of the system of the present invention. Submarine 10 is depicted within a battle space environment 12. Submarine 10 has at least one Unmanned Combat Vehicle (UCV) 14 that it can launch as a standoff weapon system. Each UCV 14 has a suite of sensors, communications equipment and weapons that serve as adjunct to submarine 10's own tactical systems. In FIG. 1, UCV 14a and UCV 14b are depicted as having been launched from submarine 10. During a combat or reconnaissance mission, a UCV 14 may be required to expend its weapons or sensors in the performance of its mission. In the prior art, an expended UCV 14 would return to and dock with submarine 10. When replenishment of its tactical capabilities was required, submarine 10 would leave environment 12 and proceed to a facility having the logistics necessary to replenish submarine 10.

1 In the system depicted in FIG. 1, UCV 14a has depleted its
2 weapons and sensor stores and requires replenishment. UCV 14c
3 has been pre-positioned at a location 16 somewhat remote from
4 battle environment 12. Location 16 is chosen for strategic
5 reasons, such as ease of concealment and ease of establishing
6 communications. UCV 14c may have been brought to location 16 by
7 another submarine, by a surface ship or other platform. In a
8 preferred embodiment, UCV 14c has been programmed to make its way
9 to location 16 once launched from a platform. Preferably, UCV
10 14c is one of many such UCV 14's pre-positioned about environment
11 12, each having a full suite of tactical capabilities, e.g.,
12 weapons, sensors and communications equipment. UCV 14a is
13 programmed to make contact with pre-positioned UCV 14c,
14 illustrated by lines 18, once UCV 14a is depleted.
15 Alternatively, a depleted UCV 14d can also be programmed to rise
16 to the surface 20 or proceed to a specific rendezvous point 20a,
17 so as to make contact, illustrated by lines 22, with a nearby
18 platform, such as airborne platform 24 or surface ship platform
19 26. Platform 24 or 26 can then contact UCV 14c, as shown by
20 lines 28. In a further alternate scenario, platform 24 or 26 may
21 launch a replenishment UCV 14e, or 14f, respectively.

22 Each replenishment UCV 14c, 14e, or 14f, is programmed such
23 that, once contacted or launched, UCV 14c, 14e, or 14f, searches
24 for and locates submarine 10 that originally launched the

1 depleted UCV 14's. Depending on the specific scenario, UCV 14c
2 may navigate to submarine 10 by using signals 10a broadcast from
3 submarine 10, by two-way communication 10b between the submarine
4 10 and UCV 14c, or by using inertial navigation systems onboard
5 UCV 14c and a last known position of the submarine 10. It is
6 noted that signals 10a and communication 10b may be
7 electromagnetic or acoustic in nature. In an alternative
8 scenario, depleted UCV 14b returns to submarine 10 and is
9 reprogrammed at submarine 10 to search for, or otherwise make
10 contact with, replenishment UCV 14c, as previously described.
11 Further, submarine 10 may reprogram UCV 14b to search for and
12 locate a specific replenishment UCV 14 having the mix of weapons,
13 sensors, countermeasures, etc., most needed by submarine 10.

14 Referring now to FIG. 2, there is shown a block diagram for
15 implementing the system of FIG. 1. For those scenarios where
16 appropriate locations can be found, at least one replenishment
17 UCV 14c is pre-positioned at strategic location 16 (100). After
18 UCV 14a, 14b, or 14d is depleted (102), their internal
19 programming has them contact replenishment UCV 14c directly
20 (104), proceed to the surface 20 or a rendezvous site 20a to
21 contact platform 24 or 26 (106), or return to submarine 10 to be
22 reprogrammed (108), respectively. If platform 24 or 26 is
23 contacted (106), platform 24, 26 may then contact the
24 replenishment UCV 14c (104) or launch a replenishment UCV 14e,

1 14f of its own (110). Depleted UCV 14b returning to submarine 10
2 may be programmed (108) to either contact UCV 14c (104) or
3 contact one of the platforms 24, 26 (106). Once the
4 replenishment UCV is contacted (14c) or launched (14e, 14f), it
5 searches for and locates submarine 10 (112). Once submarine 10
6 is located (112), UCV 14c, 14e, 14f docks with submarine 10 to
7 replenish its tactical capabilities (114).

8 The invention thus described provides a system and method to
9 replenish a submarine's tactical capabilities without requiring
10 the submarine to leave the battle environment. The system and
11 method is utilized in conjunction with a submarine equipped with
12 UCV's having full suites of tactical equipment and serving as
13 adjuncts to the submarine's tactical capabilities. When one or
14 more of the tactical equipment suites of a UCV launched from the
15 submarine has been depleted, a replenishment UCV is contacted.
16 The UCV with the depleted suite may either contact a pre-
17 positioned replenishment UCV directly, or may be programmed to
18 rise to the surface at a rendezvous site and contact a nearby
19 control platform, such as a surface ship. The control platform
20 may contact the pre-positioned UCV or may launch a replenishment
21 UCV. The replenishment UCV is programmed to search for, locate
22 and dock with the submarine and thus provide the submarine with
23 its full complement of tactical capabilities.

1 Although the present invention has been described relative
2 to a specific embodiment thereof, it is not so limited. There
3 are a large number of scenarios in which such a system of UCV
4 14's can be utilized. As an example, submarine 10 and surface
5 ship 30 may be operating in the same environment 12, or in nearby
6 environments. In order to optimize their payloads for their
7 theatre of operation, submarine 10 and ship 30 may swap UCV 14g
8 and UCV 14h. Further, once UCV 14c is pre-positioned, UCV 14c
9 may be placed in a standby mode, awaiting contact so as to begin
10 its search for submarine 10. Additionally, while in the standby
11 mode, UCV 14c may have its sensor suite active to form a sensor
12 net with other UCV 14c's pre-positioned about environment 12.

13 Thus, it will be understood that many additional changes in
14 the details, steps and scenarios, which have been herein
15 described and illustrated in order to explain the nature of the
16 invention, may be made by those skilled in the art within the
17 principle and scope of the invention

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5 ABSTRACT OF THE DISCLOSURE

6 A system and method is provided to replenish a submarine's
7 tactical capabilities, e.g., weapons, sensors and communications,
8 while the submarine remains within a hostile environment. One or
9 more Underwater Combat Vehicles (UCV's) are pre-positioned at
10 strategic locations or are launched from a surface and/or
11 airborne platform. The UCV's include full tactical capabilities,
12 which can attach to and be integrated with a submarine's
13 capabilities. To initiate replenishment, a submarine broadcasts
14 a signal, or dispatches one of the UCV's under its direct
15 control, to make contact with one of the pre-positioned UCV's or
16 with a central command platform. The pre-positioned UCV's are
17 programmed to search for and locate the submarine. This can
18 either be accomplished using signals broadcast from the
19 submarine, or using UCV internal navigation systems and a last
20 known position for the submarine. Once located, communication
21 between the submarine and UCV allows docking of the UCV onto the
22 submarine.

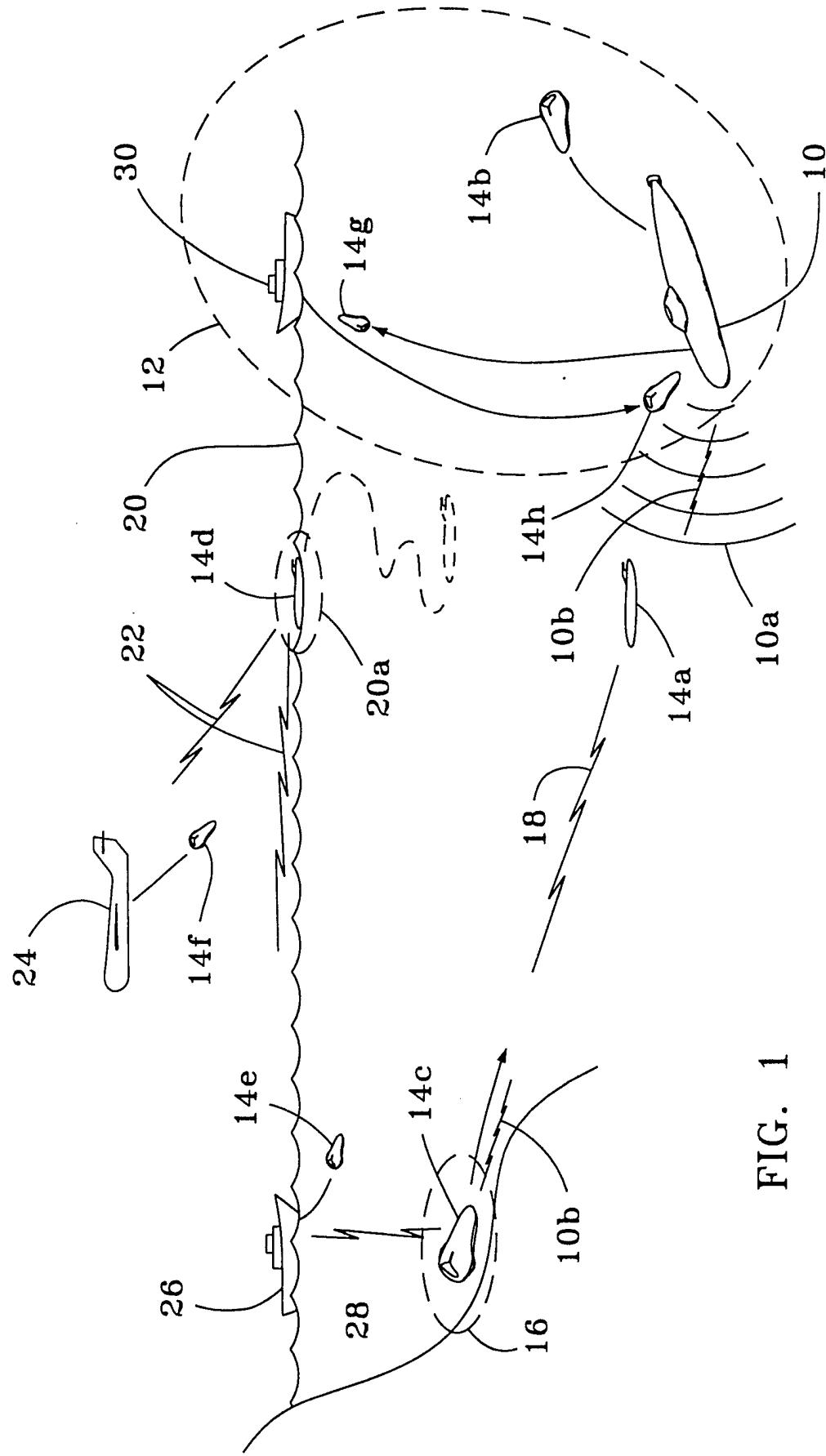


FIG. 1

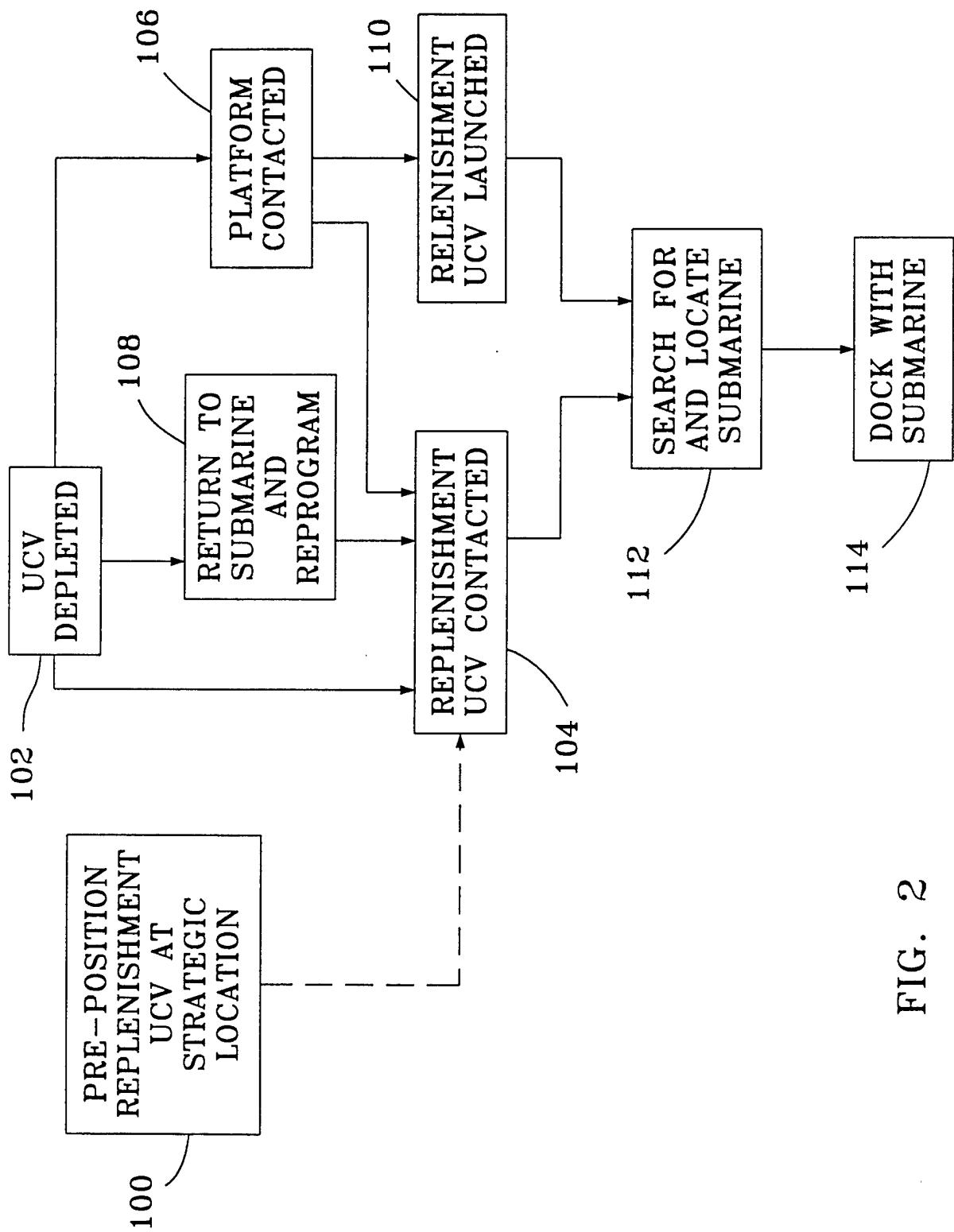


FIG. 2