(19) Europäisches Patentamt / European Patent Office / Office européen des brevets

(11) **EP 4 242 096 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
13.09.2023 Bulletin 2023/37

(21) Application number: **23181517.6**

(22) Date of filing: **25.04.2017**

(51) International Patent Classification (IPC):
B63G 8/00 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B63B 35/00; B63G 8/001; B63B 2003/147; B63B 2027/165; B63B 2035/007; B63B 2035/008; B63G 2008/007; B63G 2008/008

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **27.04.2016 NO 20160706**

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
20198858.1 / 3 778 373
17727736.5 / 3 448 748

(71) Applicant: **Kongsberg Maritime AS**
3183 Horten (NO)

(72) Inventors:
- **Levander, Oskar**
  26101 Rauma (FI)
- **Sipilä, Sauli Petteri**
  26101 Rauma (FI)
- **Callaway, Mark**
  3183 Horten (NO)

(74) Representative: **Bryn Aarflot AS**
Patent
Stortingsgata 8
0161 Oslo (NO)

Remarks:
This application was filed on 26-06-2023 as a divisional application to the application mentioned under INID code 62.

(54) **UNMANNED SURFACE VESSEL FOR REMOTELY OPERATED UNDERWATER VEHICLE OPERATIONS**

(57) The invention relates to an unmanned surface vessel for remotely operated underwater vehicle (ROV) operations, comprising an ROV, a deployment and recovery device to deploy an ROV from the vessel to water and recover the ROV from the water to the vessel, and a vessel control unit controlling the deployment and recovery of the ROV, the operation of the ROV, and movements of the vessel.

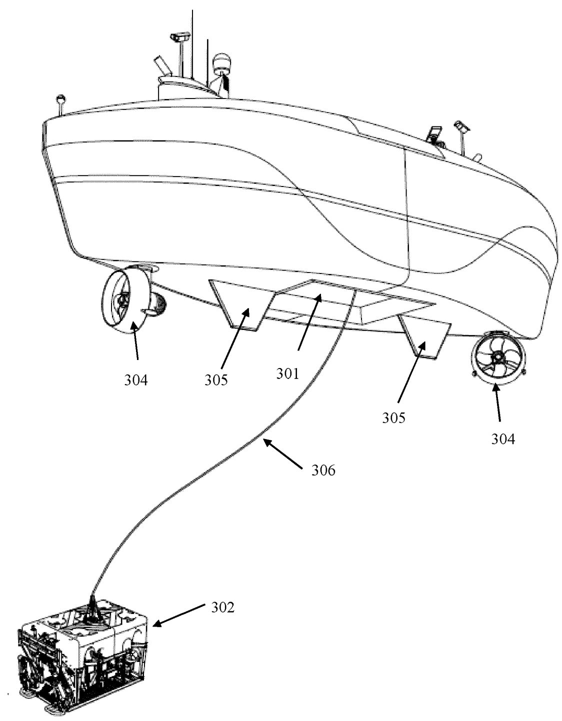

Fig.3a

EP 4 242 096 A2

Description

INTRODUCTION

BACKGROUND

[0001] A remotely operated underwater vehicle (ROV) is a tethered underwater mobile device. ROVs are unoccupied, highly maneuverable, and operated by a crew aboard a vessel. The ROVs are typically deployed by a Launch and Recovery System (LARS) onboard the vessel. The ROVs are connected to the vessel by a neutrally buoyant tether, or when working in rough conditions or in deeper water, a load-carrying umbilical cable is used along with a Tether Management System (TMS). The TMS may be a separate assembly, top hat, connected to the top of the ROV. The top hat goes with the ROV down to the working depth and discharges the ROV. The top hat is equipped with a winch and umbilical connected to the ROV. Alternatively, the TMS may be a garage system that contains the ROV during lowering to the working depth. The garage cage is equipped with an umbilical connected to the ROV. The TMS decouples the ROV from vessel movements and provides a larger working radius.

[0002] Remote operated vehicle operations are typically performed from large manned multipurpose vessels as shown in Fig. 1. The chartering of these large vessels can be expensive and the vessel is limited to perform other types of work while ROV operations are ongoing. It is also costly and cumbersome that the ROV crew is required to stay and work onboard the vessel. The large vessels may also pose a threat to offshore rigs.

SUMMARY OF THE INVENTION

[0003] According to a first aspect the invention provides an unmanned surface vessel for remotely operated underwater vehicle (ROV) operations, the unmanned surface vessel comprising an ROV, a deployment and recovery device to deploy an ROV from the vessel to water and recover the ROV from the water to the vessel, and a vessel control unit controlling the deployment and recovery of the ROV, the operation of the ROV, and movements of the vessel.

[0004] The vessel may comprise a dynamic positioning control system controlling the position of the vessel based on a plurality of input parameters. The plurality of input parameters may comprise parameters relating to the ROV during ROV operations, the parameters relating to the ROV comprises at least one of paid out length of a tether, tension on a tether between the vessel and the ROV, paid out length of an umbilical cable between the ROV and a tether management system, tension on the umbilical cable between the ROV and a tether management system, and working position of the ROV. The dynamic positioning control system may be configured to prioritize maintaining a working position of the ROV when controlling the position of the vessel. The plurality of input parameters controlling the position of the vessel may comprise at least one of surface traffic, meteorological data, environmental data, movement of the vessel, location of the vessel, and electronic navigational charts. The dynamic positioning control system may further comprises a database comprising navigational rules, and evaluates the surface traffic parameters in view of the navigational rules. The vessel may deploy and recover the ROV through at least one of a base of the vessel below the waterline, a side of the vessel, and a top side of the vessel. The vessel may further comprise an enclosed space for storage of the ROV. When the deployment and recovery device is in a resting position, it may be located within the enclosed space. The vessel may deploy the ROV using a load-carrying umbilical cable connected to a Tether Management System. The ROV may be deployed using a neutrally buoyant tether. The deployment and recovery device may be an automated Launch and Recovery System (LARS). The vessel may further comprise a redundant propulsion and steering system. The operation of the vessel may be carried out autonomously by the vessel control unit, or may be controlled from a land based control station. The vessel may further comprise connection means configured for connection to a launch and recovery system on a second vessel or shore installation.

[0005] According to a second aspect the invention provides an unmanned surface vessel controller, comprising a propulsion controller module to control movements of the vessel, a deployment and recovery module to control deployment of an ROV from the vessel to water and recover the ROV from the water to the vessel, and a ROV operation module to control operation of the ROV. The controller may further comprise a dynamic positioning control system controlling the position of the vessel based on a plurality of input parameters. The plurality of input parameters may comprise parameters relating to the ROV during ROV operations, the plurality of input parameters relating to the operation of the ROV comprises at least one of paid out length of a tether, tension on the tether between the vessel and the ROV, paid out length of an umbilical cable between the ROV and a tether management system, tension on the umbilical cable between the ROV and a tether management system, and working position of the ROV. When controlling the position of the vessel the controller may prioritize maintaining a working position of the ROV. The plurality of input parameters controlling the position of the may comprise at least one of meteorological data, environmental data, movement of the vessel, electronic navigational charts, position of the vessel relative to land, rocks and other fixed hazards, and position of the vessel relative to other surface traffic. The dynamic positioning control system may further comprise a database comprising navigational rules, and evaluates the surface traffic parameters in view of the navigational rules. The dynamic positioning control system may further comprise a docking module to position the vessel for a vessel-to-vessel connection or a vessel-to-dock connection. The operation of the vessel may be carried out autonomously by the vessel control unit, or the vessel may be controlled from a land based control station.

[0006] According to a third aspect the invention provides an unmanned surface vessel for remotely operated underwater vehicle (ROV) operations, the unmanned surface vessel comprising a hull comprising an enclosed space, the enclosed space accommodating at least one ROV, and a deployment and recovery device to deploy an ROV from the vessel to water and recover the ROV from the water to the vessel. The deployment and recovery device may in a resting position be located within the enclosed space. The deployment and recovery device may be configured to deploy and recover the ROV through at least one of a base of the hull below the waterline, in a side of the hull, and in a top side of the enclosed space. The deployment and recovery device may be an automated Launch and Recovery System (LARS). The enclosed space of the vessel may be watertight. The enclosed space may further be located in a midship section of the vessel. The deployment and recovery device may be positioned on a side of the enclosed space. The vessel may further comprise a redundant propulsion and steering system. The hull of the vessel may be provided with two symmetrically positioned fin keels. The vessel may further comprise at least one of a redundant vessel control unit controlling the deployment and recovery of an ROV, the operation of the ROV, and movements of the vessel, redundant fuel tanks or battery banks, redundant communication systems, and redundant sensors. The vessel may further comprise connection means provided on the hull configured for connection to a launch and recovery system on a second vessel or onshore installation. The hull and top section of the vessel may be essentially symmetrical both along the vessel and along a midship section of the vessel. The redundant and steering system may comprise azimuth thrusters located on opposite ends of the vessel.

BRIEF DESCRIPTION OF DRAWINGS

[0007] Embodiments of the invention will now be described with reference to the followings drawings, where:

Fig. 1 shows a large manned multipurpose vessels of prior art.

Fig. 2 shows a top perspective view of an exemplary independent unmanned ROV surface vessel.

Fig. 3b shows a bottom perspective view of an exemplary independent unmanned ROV surface vessel.

Fig. 3b shows a side view of an exemplary independent unmanned ROV surface vessel.

Fig. 4 shows a top view of an enclosed space of an exemplary independent unmanned ROV surface vessel.

Fig. 5 illustrates an exemplary unmanned surface vessel controller.

Fig. 6 illustrates an exemplary arrangement of a dynamic positioning control system.

DETAILED DESCRIPTION

[0008] The present invention will be described with reference to the drawings.

Vessel

[0009] Referring now to Fig. 2, an exemplary embodiment of the independent unmanned ROV surface vessel comprising a hull 201 and a top section 202 is shown in perspective view on a water surface 206. The vessel is further provided with a hatch 204 in the top section for access through the top section to an enclosed space. The enclosed space may accommodate at least one ROV. The vessel also comprises a deployment and recovery device to deploy an ROV from the vessel to water and recover the ROV from the water to the vessel. The deployment and recovery device may in a resting position be located within the enclosed space. The deployment and recovery device may be positioned on the a side of the enclosed space. The enclosed space is watertight. In this manner is the interior of the enclosed space against rough weather and sea conditions. The watertightness of the enclosed space may be provided by the top section. The enclosed space may be located in a midship section of the vessel. The vessel may also be provided with at least one tower 205. The towers may be provided with antennas, communication units, radars, sensors etc. as will be described in further detail below. However, the antennas, communication units, radars, sensors etc. may also be positioned in other positions of the vessel. The vessel may be provided with redundant antennas, communication units, radars and sensors. The redundant antennas, communication units, radars and sensors may provide additional safety for the vessel. In the embodiment illustrated in Fig. 2, the towers are positioned symmetrically on each end of the vessel. The hull and top section are essentially symmetrical both along the length of the vessel and along the midship section of the vessel. The essentially symmetrical layout of the vessel comprise two mirrored bow sections back to back. In an alternative embodiment, the vessel may have a traditional layout with a bow section and a stern section.

[0010] Fig. 3a illustrates an exemplary embodiment of the vessel seen in perspective view from below the water surface. The hull is amidships provided with an opening in the floor or base of the hull, known as a moon pool 301 to deploy an ROV 302 under the water surface. In another embodiment, the hull may be provided with an opening in the side of the hull above the waterline, or partially above and below the waterline. The ROV are connected to the vessel by a tether 306. The tether may be a neutrally buoyant tether, or a load-carrying umbilical cable used along with a Tether Management System (TMS). To move the vessel, the vessel is provided with a redundant propulsion and steering system. The redundant propulsion and steering system comprises in the embodiment illustrated in Fig. 3 two propulsion systems 304. Each propulsion system is located on opposite ends of the vessel. At least one of the propulsion units 304 comprise an azimuth thruster. Azimuth thrusters provides high maneuverability of the vessel. The vessel may be provided with two symmetrically positioned fin keels 305. In Fig. 3 the two symmetrically positioned fin keels are illustrated as positioned between two azimuth thrusters. In other embodiments, the vessel may be provided with other combinations of propulsion units, such as a propeller and rudder configuration, bow thruster, stern thruster etc. Fig. 3b illustrates the exemplary embodiments of Fig. 2 and Fig. 3 in side view, and shows an exemplary waterline 307.

[0011] Fig. 4 illustrates the inside of the hull according to an embodiment of the vessel. The vessel includes a ROV 401, a deployment and recovery device 402, such as an automated Launch and Recovery System (LARS), propulsion motors 403, azimuth thruster connectors 404, a spool winch 405 for an umbilical cable and an energy source 406. The propulsion motors 403 may be a diesel-mechanic arrangement wherein a diesel engine connects mechanically to the thrusters e.g. by gearing. Alternatively, the propulsion motors 403 may be a diesel-electric arrangement where a diesel engine connects mechanically to an electrical generator, creating electricity that powers electric motors positioned inside the vessel or in the thruster itself. In the cases where the propulsion motor is a diesel-mechanic or diesel-electric arrangement, the energy source 406 comprises at least one fuel tank. Although the engines are described as diesel engines, engines running on other fuels such as petrol or gas may be used. In yet another alternative embodiment, the propulsion motors 403 may be a battery-electric arrangement wherein electric motors, positioned inside the vessel or in the thruster itself, are powered directly from at least one battery bank 406.

[0012] In one embodiment as illustrated in Fig. 3, the ROV is deployed through an opening in the floor or base of the hull, known as a moon pool. In another embodiment, the ROV is deployed through an opening above the waterline, or partially above and below the waterline, in the side of the hull. The ROV may also be deployed by a deployment and recovery device positioned on the top section of the vessel. In this case the ROV may be lifted from the enclosed space through an opening or the hatch in the top section. Alternatively, the ROV may be stored on the top section of the vessel and deployed therefrom.

[0013] Fig. 4 illustrates an embodiment where the vessel is provided with redundant fuel tanks or battery banks 406. The ROV 401 is housed in an enclosed space centrally positioned in the vessel. The enclosed space may also comprise an deployment and recovery device 402, such as an automated Launch and Recovery System (LARS). The deployment and recovery device may be positioned on one side of the enclosed space mounted on ribs transversal to the length direction of the hull. Alternatively, enclosed space may comprise a winch to deploy and recover the ROV. The vessel may be designed such that the trim of the vessel should be unaffected by the presence of a ROV. In the exemplary embodiment of Fig. 4, the vessel is provided with four symmetrically positioned fuel tanks or battery banks 406. The symmetrical positioning to optimize weight distribution and balance of the vessel.

[0014] The unmanned ROV surface vessel may comprise connection means provided on the hull configured for connection to a launch and recovery system on a second vessel or onshore installation. This connection means allows the vessel to be deployed from onshore installations or another support vessel.

Vessel controller unit

[0015] The unmanned ROV surface vessel is provided with a unmanned surface vessel controller 500 as illustrated in Fig. 5. The vessel controller 500 controls the deployment and recovery of the ROV from the vessel to water and recover the ROV from the water to the vessel by a deployment and recovery module 503. The vessel controller also controls the operation of the ROV by an ROV operation module 504. The vessel controller 500 also controls movements of the vessel by a propulsion controller module 505. The vessel controller may receive communication, by a communication module 501, from land based operators comprising instructions to control the vessel. The vessel controller 500 may transmit data to the land based operators comprising data including at least one as location of the vessel, location of the ROV, meteorological data, environmental conditions, surface traffic, umbilical parameters and status parameters for the vessel. The umbilical parameters may include at least one of paid out length of a tether, tension on the tether between the vessel and the ROV, paid out length of an umbilical cable between the ROV and a tether management system and tension on the umbilical cable between the ROV and a tether management system This provides a land based control station control of the ROV surface vessel from a land based control station. Alternatively, the land based control may provide predetermined instructions to the vessel control unit that autonomously carries out the operation of the vessel after receiving the instructions. The vessel may send continuous feedback to land based operators during autonomous operation.

[0016] The vessel controller 500 receives instructions from land based operators through the communication unit 501. The instructions are stored in a memory 502. The instructions may be predetermined operation plans that the vessel controller 500 carries out autonomously after receiving the instructions, or may be real time instructions provided by the land based operators. The vessel controller 500 reads the instructions from the memory 501. When instructed to move the vessel, e.g. to move from a first location to a second location following a predetermined path, the vessel controller 500 instructs the propulsion controller module 505. The propulsion controller unit then instructs the propulsion system of the vessel to move according to the movement instructions, i.e. speed and direction of the vessel. When instructed to launch or recover an ROV, the vessel controller 500 instructs the deployment and recovery module 503 to launch or recover the ROV. When the ROV is launched the vessel controller unit instructs the ROV operation module 504 to operate the ROV according to instructions in the memory 502.

[0017] Whether or not the vessel is instructed to stay in one desired location, move from a first location to a second location following a predetermined path and/or is operating an ROV, the vessel is acted on by wind, waves and sea currents. In addition, the vessel and ROV may face other hazards such as other surface traffic, land, rocks and other fixed hazards. The vessel controller 500 may therefore comprise a dynamic positioning (DP) control system 506 that receives a plurality of input parameters from sensors 507 and navigational systems 508. Based on the plurality of input parameters the DP control system 506 is controlling the position of the vessel. The DP control system 506 determines when and where the vessel should be moved. When the DP control system 506 determines that the vessel should move, the DP control system 506 outputs movement instructions including speed and direction to the propulsion control unit 505.

[0018] The vessel may be deployed and recovered from a second vessel or onshore installations. To position the vessel for a vessel-to-vessel connection or a vessel-to-dock connection, the DP control system 506 may further comprise a docking module 509 to position the vessel for a vessel-to-vessel connection or a vessel-to-dock connection. The docking module 509 may determine the docking movement based on the plurality of input parameters from sensors 507 and navigational systems 508. The docking module 509 may also receive input parameters from a plurality of docking sensors 510. The docking sensor 510 may be distance sensors such as a short-range radar.

[0019] In one embodiment, the communication module 501 providing communication to and from the land based operators is a wireless communication unit. The wireless communication unit may transmit and receive wireless data communication. The wireless data communication transmission to and from the vessel may be a direct link between the vessel and the land based control. Alternatively, the data communication transmission may be relayed via a larger vessel or structure such as an offshore platform. The wireless communication unit may utilize any suitable wireless data communication protocol for cellular data services, mobile satellite communication, wireless sensor network protocols or Wi-Fi. Exemplary cellular data service protocols includes, but is not limited to, Global System for Mobile Communications (GSM), Code division multiple access (CDMA), General Packet Radio Service (GPRS), Universal Mobile Telecommunications System (UMTS), CDMA2000, Enhanced Data rates for GSM Evolution (EDGE), Mobile WiMAX, Long Term Evolution (LTE).

[0020] The vessel may be provided with a redundant vessel controller 500 controlling the deployment and recovery of an ROV, the operation of the ROV, and movements of the vessel. The redundant vessel controller 500 includes a redundant propulsion controller module 505, a deployment and recovery module 503 and a ROV operation module 504. The redundant vessel controller 500 may also include a redundant docking module 509. Further, the vessel may be provided with a redundant communication module 501, including redundant antennas and communication units.

Dynamic positioning control system

[0021] As explained above, the dynamic positioning control system 506 autonomously controls the position of the vessel based on a plurality of input parameters obtained from plurality of sensors 507 and navigational systems 508. The vessel may be provided with a redundant dynamic positioning control system 506. The redundant DP control system may include a redundant navigational system 508. The redundant DP control system may also include redundant sensors 507, including redundant antennas and communication units.

[0022] Fig. 6 illustrates an exemplary arrangement 600 for the dynamic positioning control system 506. The DP control system checks current operating instructions 601, e.g. if the vessel is to stay in one desired location, move from move from a first location to a second location following a predetermined path and/or is operating an ROV.

[0023] The DP control system 506 checks parameters relating meteorological input parameters 602, environmental input parameters 603 and movement of the vessel 604 as described in further detail below. If the vessel has drifted away, or is likely to drift away, from the desired location or path, the DP control system outputs movement instructions to counteract the drift. The DP control system 506 may also check parameters relating to the actual position of the vessel relative to land, rocks and other fixed hazards 605 as described in further detail below. If the DP control system 506 determines that the vessel is too close to any fixed hazards, the DP control system outputs movement instructions to move the vessel safely away from the fixed hazards. The DP control system 506 may also check parameters relating to the position of the vessel relative to other surface traffic 606, evaluates the surface traffic parameters in view of relevant navigational rules. If the DP control system 506 determines that the vessel should move away from other surface traffic, the DP control system outputs movement instructions to move the vessel accordingly.

[0024] During ROV operations, the DP control system 506 also checks parameters relating to the operation of the ROV 607 when determining when and where the vessel should be moved. In the case the ROV is deployed using a neutrally buoyant tether the DP-control system may make the determination based on input parameters such as the paid out length of the tether and the tension on the tether between the vessel and the ROV. In the cases the ROV is deployed using a load-carrying umbilical cable connected to a Tether Management System, such as a top hat or a garage, the DP-control system may make the determination based on input parameters such as paid out length of the umbilical cable, the tension of the umbilical cable between the vessel and the TMS, the paid out length of the umbilical between the ROV and TMS, and the tension of the umbilical between the ROV and TMS. When any of these parameters are found to be above a predetermined threshold, the DP control system 506 outputs movement instructions to move the vessel following the ROV, hence reducing the distance to the ROV. Another important input parameter during ROV operations is the working position of the ROV. The DP control system 506 may be configured to prioritise maintaining the working position of the ROV when determining when and where the vessel should be moved.

[0025] When positioning the vessel for a vessel-to-vessel connection or a vessel-to-dock connection, the docking module 509 checks parameters relating to the docking of the vessel 608 when determining where the vessel should be moved. The docking module may make the determination based on input parameters such as distance to second vessel or dock, and position of the second vessel or dock.

[0026] Wind, waves and sea currents will act on the ship and cause the vessel to move from the desired location or path. The DP control system may calculate the movement from the desired location or path, e.g. the drift, based on meteorological parameters and environmental input parameters such as wind direction, wind strength, water temperature, air temperature, barometric pressure, wave height etc. The input parameters are provided by relevant sensors connected to DP control system such as a wind meter, thermometer, barometer etc. When the DP-control system has calculated the drift, the system output movement instructions to counteract the drift. Other input parameters to calculate the drift may include data from movement sensors such as a gyro, an accelerometer, a gyrocompass and a turn-rate indicator.

[0027] Movement of the vessel may also be calculated from actual position parameters of the vessel relative to the desired location. The actual position parameters may be obtained from navigation systems connected to the DP control system. The navigation system may be a ground based radio navigation system, such as DECCA, LORAN, GEE and Omega, or a satellite navigation systems, such as GPS, GLONASS, Galileo and BeiDou. In the case of satellite navigation systems, the accuracy of the actual location may be improved by input to the CP control system from a Differential Global Positioning System (DGPS).

[0028] The DP-control system may also receive input parameters from electronic navigational charts. Combined with input parameters from the navigation systems, this allows the DP control system to determine movement instructions that safely controls the vessel from colliding with land, rocks and other fixed hazards. For this purpose, the DP-control system may also receive input parameters from other sensors such as a sonar, marine radar, and/or an optical system using a camera. The sonar may provide information about underwater hazards such as land, rocks, underwater vessel etc. The marine radar and/or optical system may provide information about overwater hazards such as land and other surface vessels. The marine radar and/or optical system may also provide navigation information from sea marks such as beacons, buoys, racons, cairns and lighthouses.

[0029] In national and international waters, the vessel will have to comply with respective national and international navigational rules for preventing collision with other ships or vessels. A database comprising the relevant navigational rules for an operation location of the vessel may be included in the DP control system. In one embodiment, the DP control system receives input parameters relating to other surface traffic, evaluates the surface traffic parameters in view of the relevant navigational rules, when determining when and where the vessel should be moved. The input parameters relating to surface traffic may be provided by sensors and systems connected to the vessel controller unit such as a marine radar, an Automatic Identification System (AIS) and an automatic radar plotting aid (ARPA). In one embodiment, the input parameters relating to surface traffic may be provided by optical sensors such as a camera. The optical sensors may observe and recognize other surface vessels and provide navigation information from sea marks such as beacons, buoys, cairns and lighthouses.

[0030] When the DP control system determines that the vessel should be moved due to other surface traffic, the DP control system may optionally alert the land based control station through the wireless communication unit. When alerting the land based control station the DP control unit may transmit data from the marine radar, the Automatic Identification System (AIS), the automatic radar plotting aid (ARPA) or the camera. The land based control station may then make a decision to overrun the DP control system when determining how and when the vessel should be moved.

[0031] In one embodiment, the unmanned ROV surface vessel is provided with a Global Maritime Distress and Safety System (GMDSS).

[0032] Input parameters as described above may be received by the DP control system by wired connections or any suitable wireless data communication protocol, such as wireless sensor network protocols or Wi-Fi.

[0033] The vessel controller unit, the dynamic positioning control system and the propulsion control unit may be implemented in a computer having at least one processor and at least one memory. An operating system runs on the at least one processor. Custom programs, controlled by the system, are moved into and out of memory. These programs include at least the vessel controller unit, the dynamic positioning control system and the propulsion control unit as described above. The system may further contain a removable memory component for transferring images, maps, instructions or programs.

[0034] Having described preferred embodiments of the invention it will be apparent to those skilled in the art that other embodiments incorporating the concepts may be used. These and other examples of the invention illustrated above are intended by way of example only and the actual scope of the invention is to be determined from the following claims.

Claims

1. Unmanned surface vessel for remotely operated underwater vehicle (ROV) operations, the unmanned surface vessel comprising:

- a ROV,
- a deployment and recovery device (402) to deploy the ROV from the unmanned surface vessel to water and recover the ROV from the water to the unmanned surface vessel, and
- a vessel control unit (500) controlling the deployment and recovery of the ROV, the operation of the ROV, and movements of the unmanned vessel, **characterized by**
- a dynamic positioning control system controlling the position of the unmanned surface vessel based on a plurality of input parameters comprising surface traffic parameters,
- wherein the dynamic positioning control system is configured to prioritize maintaining a working position of the ROV when controlling the position of the unmanned surface vessel,
- wherein the dynamic positioning control system further comprises a database comprising navigational rules and evaluates the surface traffic parameters in view of the navigational rules.

2. Unmanned surface vessel according to claim 1, wherein the plurality of input parameters comprises parameters relating to the ROV during ROV operations, the parameters relating to the ROV comprises at least one of:

- paid out length of a tether,
- tension on a tether between the unmanned surface vessel and the ROV,
- paid out length of an umbilical cable between the ROV and a tether management system,
- tension on the umbilical cable between the ROV and a tether management system, and
- working position of the ROV.

3. Unmanned surface vessel according to claim 1, wherein the plurality of input parameters comprise at least one of

- meteorological data,
- environmental data,
- movement of the unmanned surface vessel,
- location of the unmanned surface vessel, and
- electronic navigational charts.

4. Unmanned surface vessel according to claim 1, wherein the ROV is deployed and recovered through at least one of:

- a base of the unmanned surface vessel below the waterline,
- a side of the unmanned surface vessel, and
- a top side of the unmanned surface vessel.

5. Unmanned surface vessel according to claim 1, further comprising an enclosed space for storage of the ROV.

6. Unmanned surface vessel according to claim 5, wherein the deployment and recovery device in a resting position is located within the enclosed space.

7. Unmanned surface vessel according to claim 1, wherein the ROV is deployed using a load- carrying umbilical cable connected to a Tether Management System.

8. Unmanned surface vessel according to claim 1, wherein the ROV is deployed using a neutrally buoyant tether.

9. Unmanned surface vessel according to claim 1, wherein the deployment and recovery device is an automated Launch and Recovery System (LARS).

10. Unmanned surface vessel according to claim 1, further comprising a redundant propulsion and steering system.

11. Unmanned surface vessel according to claim 1, wherein the operation of the unmanned surface vessel is carried out autonomously by the unmanned surface vessel control unit.

12. Unmanned surface vessel according to claim 1, wherein the unmanned surface vessel is controlled from a land based control station.

13. Unmanned surface vessel according to claim 1, further comprising connection means configured for connection to a launch and recovery system on a second vessel or shore installation.

14. Unmanned surface vessel controller (500), comprising

- a propulsion controller module (505) to control movements of the unmanned surface vessel,
- a deployment and recovery module (503) to control deployment of an ROV from the unmanned surface vessel to water and recover the ROV from the water to the unmanned surface vessel, and
- a ROV operation module (504) to control operation of the ROV, **characterized by**

  a dynamic positioning control system (506) controlling the position of the unmanned surface vessel based on a plurality of input parameters comprising surface traffic parameters,
  wherein controlling the position of the unmanned surface vessel comprises to prioritize maintaining a working position of the ROV,
  wherein the dynamic positioning control system further comprises a database comprising navigational rules, and evaluates the surface traffic parameters in view of the navigational rules.

15. Controller according to claim 14, wherein the plurality of input parameters comprises parameters relating to the ROV during ROV operations, the plurality of input parameters relating to the operation of the ROV comprises at least one of:

- paid out length of a tether,
- tension on the tether between the unmanned surface vessel and the ROV,
- paid out length of an umbilical cable between the ROV and a tether management system,
- tension on the umbilical cable between the ROV and a tether management system, and
- working position of the ROV.

16. Controller according to claim 14, wherein the plurality of input parameters comprises at least one of:

- meteorological data,
- environmental data,
- movement of the unmanned surface vessel,
- electronic navigational charts,
- position of the unmanned surface vessel relative to land, rocks and other fixed hazards.

17. Controller according to claim 14, wherein the dynamic positioning control system further comprises a docking module to position the unmanned surface vessel for a vessel-to-vessel connection or a vessel-to-dock connection.

18. Controller according to claim 14, wherein the operation of the unmanned surface vessel is carried out autonomously by the unmanned surface vessel control unit.

19. Controller according to claim 14, wherein the unmanned surface vessel is controlled from a land based control station.

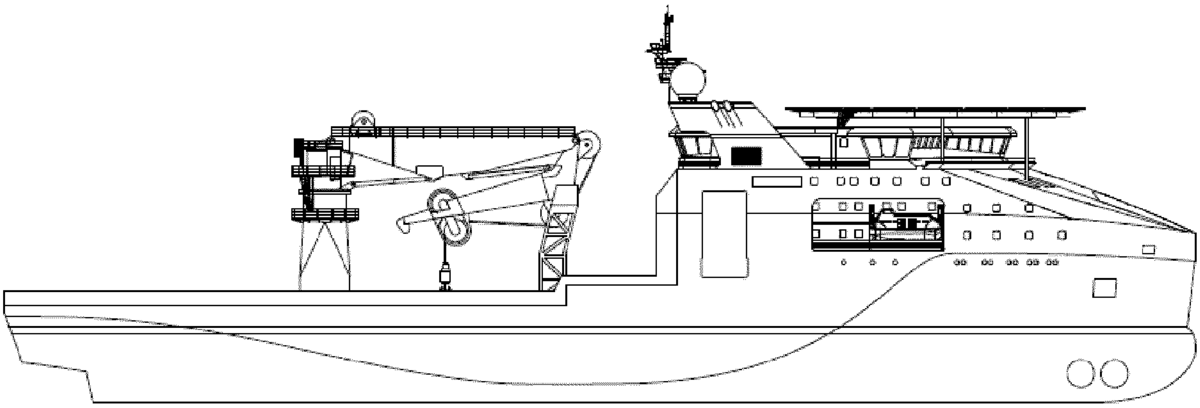

Fig. 1 Prior Art

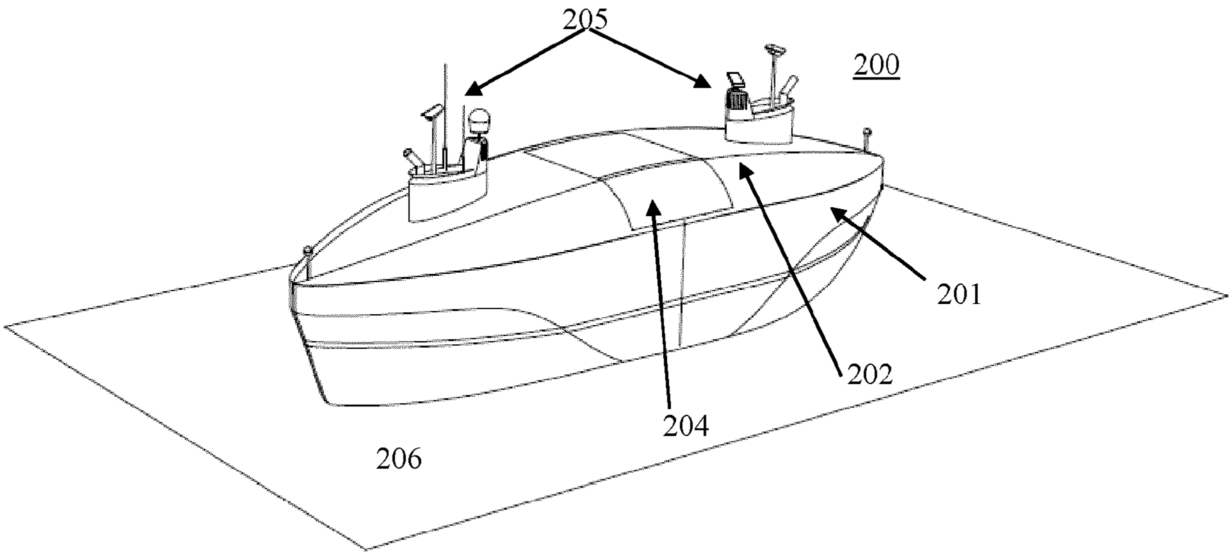

Fig. 2

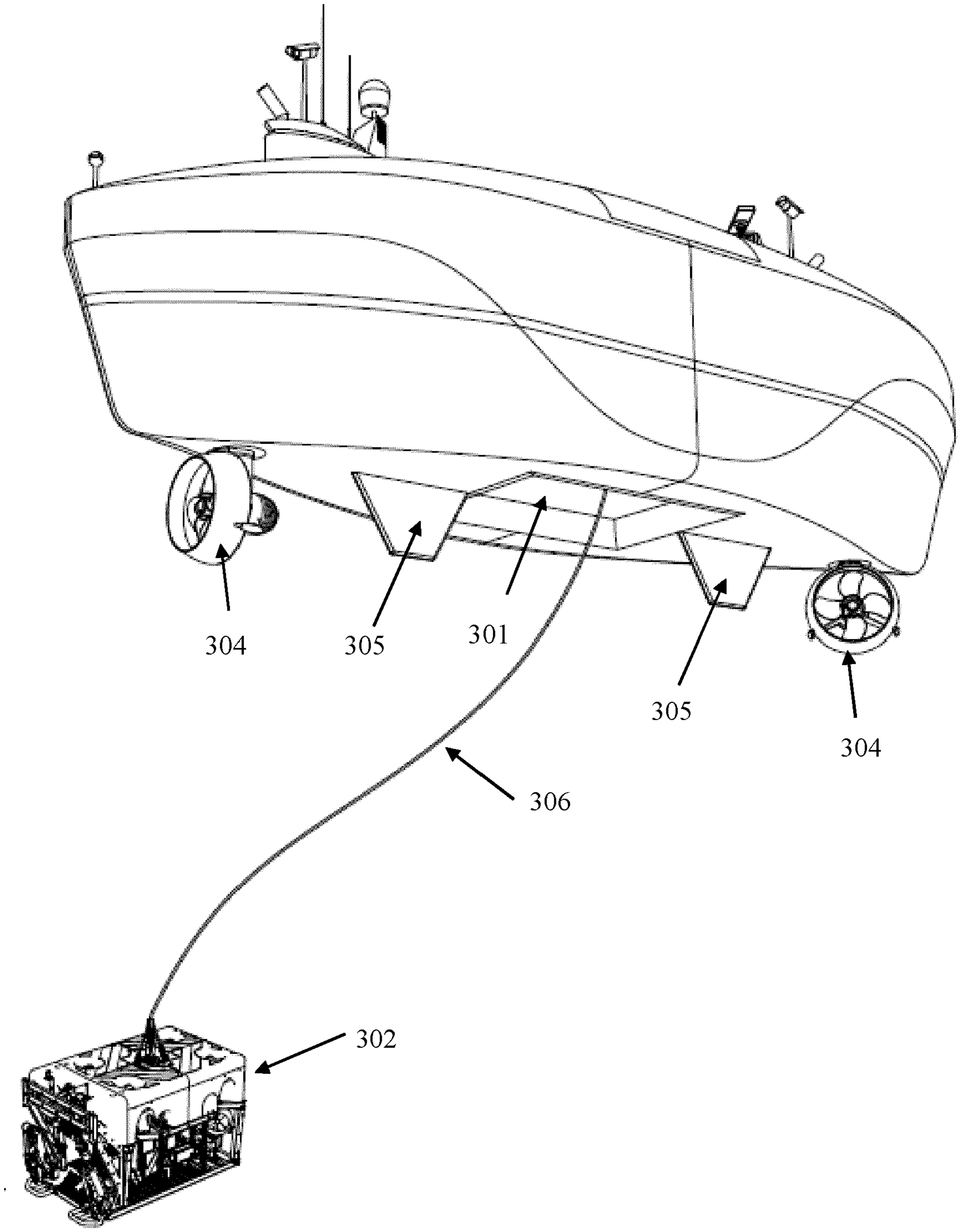

Fig.3a

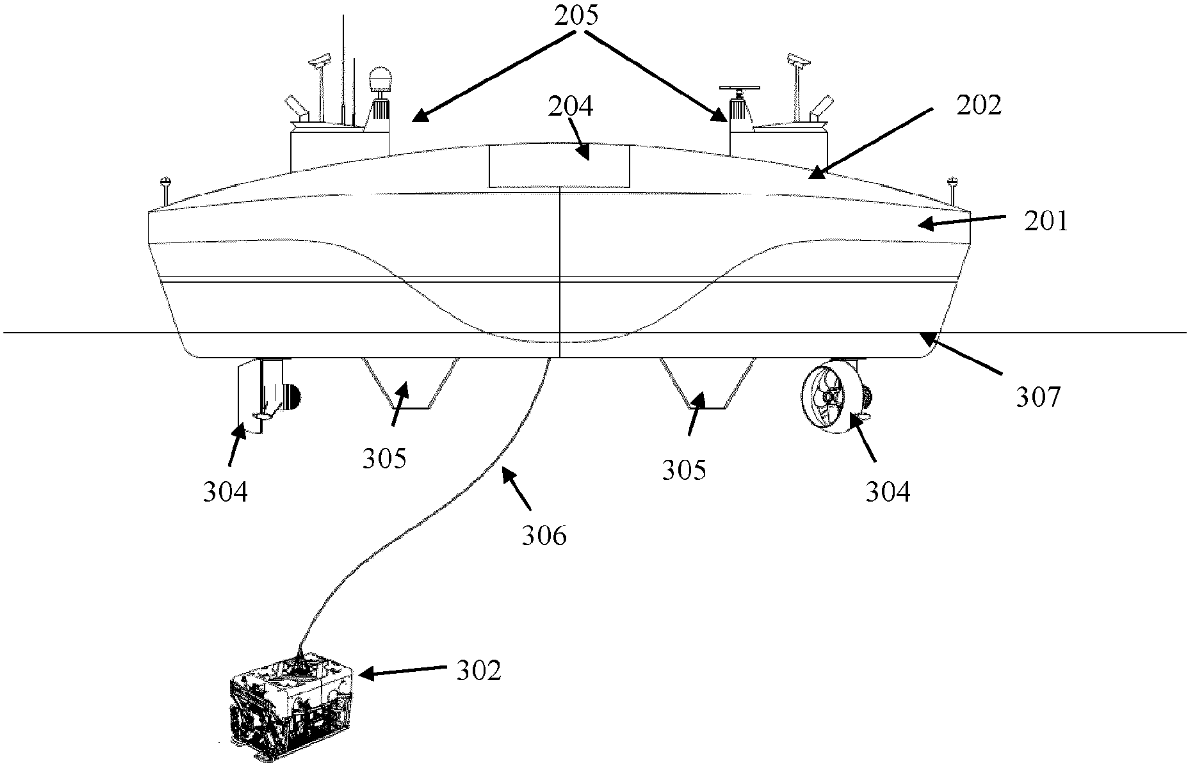
205
204
202
201
307
304
305
305
304
306
302

Fig. 3b

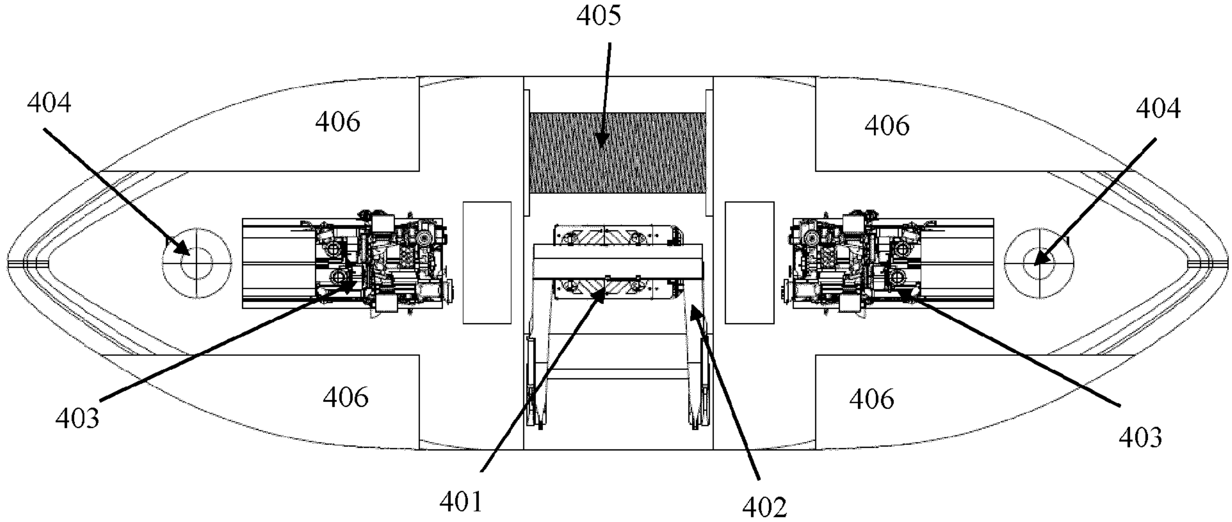
405
404
406
406
404
406
406
403
403
401
402

Fig. 4

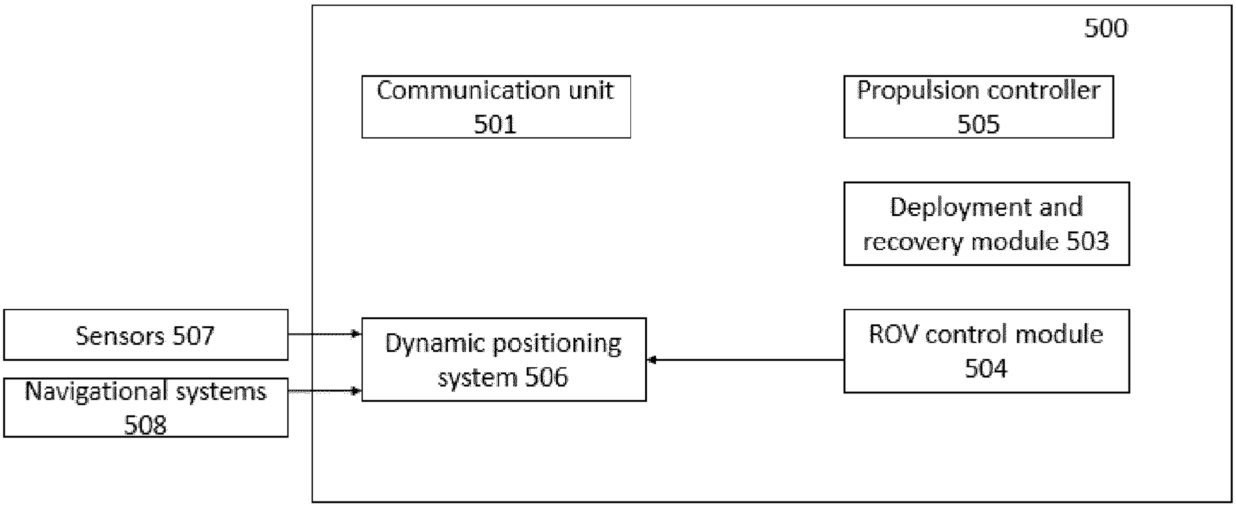
500
Communication unit 501
Propulsion controller 505
Deployment and recovery module 503
Sensors 507
Dynamic positioning system 506
ROV control module 504
Navigational systems 508

Fig. 5

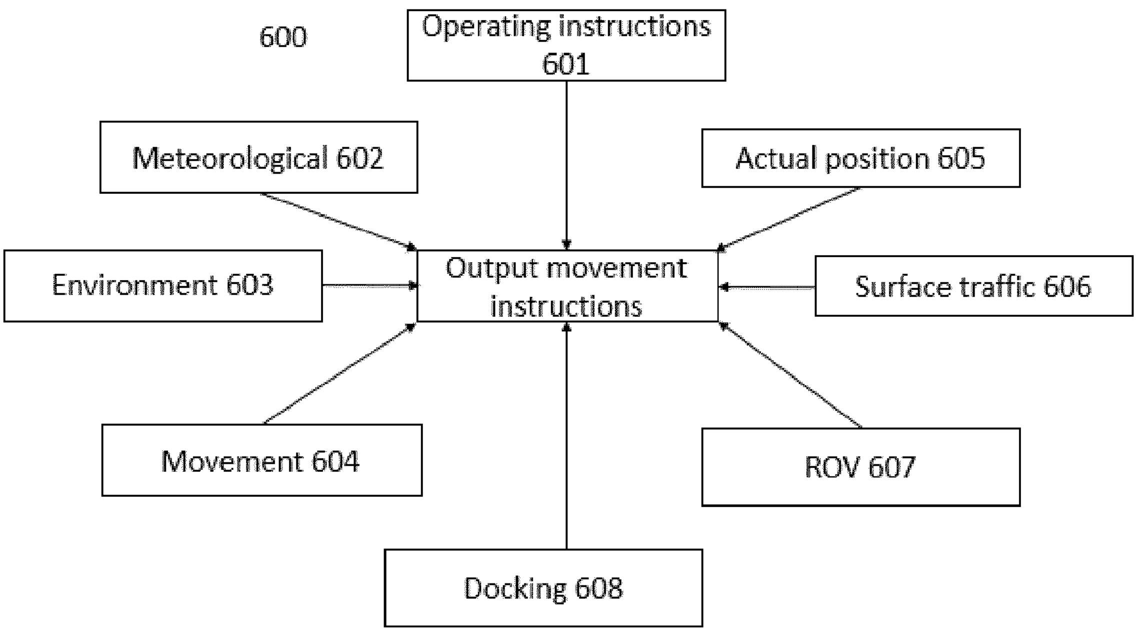
600
Operating instructions 601
Meteorological 602
Actual position 605
Environment 603
Output movement instructions
Surface traffic 606
Movement 604
ROV 607
Docking 608

Fig. 6