

A SHIP AND A METHOD OF LOADING AND UNLOADING A SHIP

INTRODUCTION

The invention relates to a ship defining a longitudinal direction and a transverse direction, and comprising a freeboard, an upper deck, and at least one sheltered deck below the upper
5 deck. A hatch structure is provided for access to one of the at least one sheltered decks.

The invention further relates to a method of handling cargo, particularly what is referred to herein as utility modules on the ship.

BACKGROUND

In loading and unloading ships, hatches in different locations and different shapes have been
10 used as a safe way of establishing large and yet sealable openings for cargo and passengers.

In traditional cargo ships, hatches are positioned in or on the deck above the cargo area and can protect the cargo from water intrusion. The opening to the sky can be established or covered by folding or unfolding one or more covers, by arranging covers from a storage in a telescopic way, or by simply moving the covers by a crane.

15 In a traditional ferry or a so-called roll-on roll-off (RORO) ferry, the fore and/or aft end, or alternatively the side of the ship, comprises a relatively large opening which is closed by a hatch. When the hatch is moved to an open position, it forms a ramp on which rolling vehicles such as cars, trucks, and fork lifters etc, can drive onto an internal deck in the ferry. Sometimes such constructions are combined with an additional hatch inside the ferry. The
20 additional hatch serves to prevent intrusion of water should the outer hatch become damaged e.g., in heavy sea.

Often, the hatch makes close contact with a periphery of the opening and forms a solid shield against intrusion of water on the deck, this is called weather- or watertight closing. In alternative configurations, the covers only serve as a shield to prevent spray or rain on the
25 cargo and to prevent 'green water' to cover the cargo area. This could arise by the combination of waves and movement of the ship in the sea which can result in submerging of the covers. Due to the covers, the amount of intruded water will be limited and will be drained when the cargo deck is above water line.

The freeboard is herein defined as a side of the ship extending height-wise between a waterline and the uppermost deck and extending circumferentially around the ship, i.e. longitudinally between a fore end and an aft end of the ship and if the ship has a flat bow and/or stern, the freeboard additionally extends transversely between starboard and port sides of the ship at the bow and/or stern.

SUMMARY

It is objects of embodiments of the disclosure to improve flexibility in cargo handling in a ship, to enable better access to storage space, to enable a more flexible operation of the ship, and to improve safety in cargo handling.

According to these and other objects, the disclosure, in a first aspect, provides a ship comprising at least one hatch structure. The hatch structure comprises a first opening in the freeboard providing access to one of the at least one sheltered decks. The first opening could e.g., be in a port or starboard side of the ship to provide sideways access to the sheltered deck, or it could be in a bow or stern of the ship to provide longitudinal access to the sheltered deck.

The hatch structure further comprises a hatch element, herein referred to as "*second hatch element*". The second hatch element is slidable between at least one open position providing vertical access to one of the at least one sheltered decks through a second opening in the upper deck and a closed position where the second hatch element covers the second opening.

The second hatch element is arranged and dimensioned such that it protrudes sideways over the freeboard and over the first opening in the open position.

Accordingly, the second hatch element may be moved to open the second opening. This allows access to a sheltered deck in a vertical direction, and since it protrudes over the first opening, it may additionally be used for lifting cargo into and out of one or more sheltered decks or be used for protecting the entrance through the first opening.

Accordingly, the ship provides a double function of the second hatch element.

By the term *slidable* is herein meant that the second hatch element is movable in a translatory movement e.g. rolling on rails, or otherwise guided in a linear or curved path by a sliding bearing structure. As opposed to a rotational suspension of the second hatch element

for pivoting about a rotational axis, the slidable movement of the second hatch element allows the hatch element to stay in close vicinity to a plane defined by the upper deck. This provides the feature that the second hatch element can form an extension of the upper deck when it is in the open position and thereby shield the work of loading and unloading via the first opening.

The second hatch element may be slidable along an upper surface of the upper deck, e.g. parallel to the upper deck. This may reduce the needed space required above the upper deck. Additionally, the second hatch could be carried by the upper deck during the sliding. This allows forces to be exchanged through the second hatch to the upper deck, e.g. forces arising from objects which are carried by the second hatch.

Moreover, the second hatch element may cover the cargo while it moves the cargo from the sheltered deck through the first opening. This allows improved handling of moisture sensitive cargo, or cargo which otherwise needs shielding for sun-light, dust, or handling of cargo which is to be handled in a confidential manner without the ability for non-authorised personnel to observe the handling, e.g., from above, e.g., from a satellite.

Cargo could e.g. be containerized or non-containerized modules intended for cargo transportation or intended as utility modules for use in open sea, both within a sheltered compartment or through openings to a sheltered compartment.

Hatches in different sizes and shapes are commercially available both for vertical access through decks and sideways access through the freeboard. The hatch elements referred to herein may be in different materials like e.g., steel, aluminium, or composite elements made according to existing standards for hatches for ships and they may include normally used gaskets, linear guides, e.g., using linear bearings and standard actuation structures, e.g., including electric or hydraulic actuators. Such equipment is readily available in standard or customer specific shapes and sizes.

As mentioned above, the cargo may include modules intended for cargo transport, and/or what herein is referred to as utility modules. The first opening and the second opening may provide access to a utility section of one of the at least one sheltered decks.

The ship may comprise a number of utility modules releasably arrangeable on the sheltered deck, e.g., attachable to, the utility section. The utility modules may e.g. include standard containers for transportation, or modules configured to provide or increase the capability of the ship to carry out a specific mission. Herein, such modules are referred to as utility modules. The utility modules may e.g. be a weapon system module, a hospital module, a

detention module, an accommodation module, an office module, a workshop module, a laboratory module, an oil spill or a chemical spill recovery module, a fishery research module, a seismic research module, or a module containing and/or hosting a vehicle, e.g. an amphibious vehicle such as an unmanned aerial vehicle (UAV), an assault amphibious vehicle (AAV), or a remote operated underwater vehicle (ROV).

The modules handled by the specific hatch structure may therefore support predefined tasks, e.g., a laboratory setup, mine counter measures, specific weapon capabilities e.g., for subsea activities or for above water activities etc.

- 10 The utility module may be configured for removal through the first opening, and optionally for removal through the second opening, or for operation through the first opening or through the second opening. By means of an example, the utility module may comprise a weapon launch system which is loaded into the sheltered deck via the first opening, and which can launch missiles through the second opening. Similar may be considered for e.g., flying vehicles and helicopters etc.
- 15 The second hatch element may be movable in the transverse direction, and in one embodiment, it is exclusively movable in the transverse direction. The second hatch element may be movable between two extreme locations, one in which it extends over the port side of the ship and one where it extends over the starboard side of the ship, thereby enabling cargo handling on both sides of the ship.
- 20 The second hatch element may also be movable in the longitudinal direction, and in one embodiment, it is exclusively movable in the longitudinal direction. The second hatch element may be movable between two extreme locations, one in which it extends over the bow or stern ends of the ship and one where it covers the second opening.

- 25 An open transition between the first opening and the second opening may define one single unitary opening constituted by the first and the second opening. This may allow movement of cargo freely between the first opening and the second opening, e.g., in a procedure where the cargo is suspended from a lifting structure, e.g., in the form of a cable hoist which is moved across the transition.

- The ship may include a first lifting structure which is attached to the second hatch element.
- 30 The first lifting structure may be configured for lifting objects from one of the at least one sheltered decks. The first lifting structure may be configured to move across the open transition upon movement of the second hatch element between the open and closed

positions. This enables the second hatch to work as a crane arm which can move the cargo in and out through the first opening while shielding the cargo from above.

The first lifting structure could be any kind of crane-like arrangement, e.g., including a pulley block or winch system, or including a crane arm, e.g. with a hydraulic or mechanical lifting motor. Such crane-constructions are known in the art and will not be discussed in detail herein.

To allow longitudinal adjustment and precise pickup and delivery of the cargo, the ship may comprise a lifting motion structure between the first lifting structure and the second hatch element. By this lifting motion structure, the lifting structure can be movable in the longitudinal direction and/or in the transverse direction relative to the second hatch element.

The adjustment may e.g., be within fixed longitudinal or transverse positions or the first lifting structure may be slidable along an inner surface of the second hatch element between different positions.

The longitudinal and/or transverse movability of the first lifting structure relative to the second hatch element can be provided by a trolley system between the lifting structure and the second hatch element.

This lifting structure may allow different ways of handling cargo.

a) in one procedure, the lifting structure is moved to the cargo by moving the lifting structure relative to the second hatch element. When the lifting element is attached to the cargo, the cargo is lifted from the sheltered deck. At this point, the lifting motion structure may be used for moving the cargo from one position on the sheltered deck to another position on the sheltered deck. Should the cargo be moved out of the ship, the second hatch structure may be moved to the open position and used as a crane arm extending over the first opening and thereby allowing movement of the cargo through the first opening. The movement of the cargo through the first opening may either be a result of the movement of the second hatch element, or the second hatch element may be moved to the open position and the lifting motion structure may subsequently be used for moving the lifting structure relative to the second hatch element and thereby for moving the cargo out of the ship while it is carried by the second hatch element.

b) in another procedure, the second hatch element is exclusively used for transverse or longitudinal movement of the cargo. According to this procedure, the lifting structure is attached to an inner surface of the second hatch element at a position above the cargo to be

moved. By use of the lifting structure, the cargo is lifted from the sheltered deck, and the second hatch element is moved to thereby move the cargo over the deck, e.g., out through the first opening while the lifting structure is in a fixed position relative to the second hatch element.

- 5 The first lifting structure may be constituted e.g., by a container lifting lug or a lifting lug of a specific shape and size and fitted with a number of lifting points, e.g., provided by one or more winches. The first lifting structure may also include a lifting lug for a specific purpose, e.g., for lifting life rafts, boats, sub marine equipment, or weapon etc.

- 10 The ship may comprise a first hatch element movable between an open position providing sideways access to one of the at least one sheltered decks through the first opening and a closed position where the first hatch element covers the first opening.

The first hatch element may be separate from the second hatch element, meaning that the first and second hatch elements are individually movable relative to the first and second openings.

- 15 The first hatch element may be configured to border on the second hatch element along a border between the first and the second opening. Border, in this respect, means that the first hatch element is in direct contact with the second hatch element, and they may even support each other. This may be ensured by a connection between the two hatch elements. The bordering of the hatch elements against each other may increase the rigidity and strength of
20 the combined hatch structure, and since the first and second hatches are individual elements, they are still allowed to move individually, i.e. the first opening could be opened or closed independently on the second hatch element

- Accordingly, the first hatch element could be joined to the second hatch element. In one example, the first hatch element is slidingly received in the second hatch element, and in
25 another example, the first hatch element is hinged to the second hatch element such that it can pivot about a rotation axis relative to the second hatch element.

- The slidingly received first hatch element may e.g., be caused by a linear guide on the edge of the second hatch element and by allowing the first hatch element to be guided by that linear guide. The linear guide may e.g., be in the form of a C-shaped profile in which
30 carriages are allowed to roll, like a construction of a sliding door. The linear guide may particularly extend in the transition between the first and second opening when the first and second hatch elements are in the closed positions.

The hinged suspension of the first hatch element on the second hatch element may e.g. allow pivoting about a rotation axis extending along an edge of the second hatch element. In this embodiment, the second hatch element can slide to a position where it extends over the first opening. This may simultaneously move the first hatch element away from the first opening and depending on the need for access to the first opening, the first hatch element may eventually be swung further away from the first opening.

The first hatch element may be movable in the longitudinal direction along the freeboard between an open position and a closed position. Alternatively, it could be hinged to the freeboard and allowed to rotate about a hinge axis or hinge point between the open and closed positions.

The first hatch element may comprise a first element section and a second element section, the first and second element sections being separately movable relative to each other and relative to the first opening – e.g., like a double door construction, or like two sliding doors.

The second hatch element may comprise several elements. However, to improve the ability to reach far out from the side of the ship, it may particularly comprise only a single element, e.g., a large plate shaped element.

The hatch structure may comprise a third opening in the freeboard providing sideways access to one of the at least one sheltered decks.

The second hatch element may be movable between a first open position in which it protrudes sideways over the first opening and a second open position in which it protrudes sideways over the third opening. If the second hatch element is movable in the transverse direction, it will imply the third opening to be on the opposite side of the ship.

The ship may comprise a third hatch element movable between an open position providing sideways access to one of the at least one sheltered decks and a closed position where the third hatch element covers the third opening.

The hatch structure may comprise a fourth hatch elements movable between an open position providing sideways access to one of the at least one sheltered decks through a corresponding fourth opening in the upper deck and a closed position where the fourth hatch element covers the fourth opening.

The fourth hatch element may be movable by sliding, i.e. movable in a translatory movement e.g. rolling on rails, or otherwise guided in a linear or curved path by a sliding bearing

structure. As opposed to a rotational suspension of the fourth hatch element for pivoting about a rotational axis, the slidable movement of the fourth hatch element allows the hatch element to stay in close vicinity to a plane defined by the upper deck. This provides the feature that the fourth hatch element can form an extension of the upper deck when it is in the open position and thereby shield the work of loading and unloading via the third opening.

The fourth hatch element may, in the open position, protrude over the third opening.

At least one of the first and third opening may be in a port or a starboard side of the freeboard, or the first opening may be in the port side of the freeboard and the third opening may be in the starboard side of the freeboard. At least one of the first and third opening may be in a bow part or a stern part of the freeboard, or at least one of the first and third opening may be in a bow part or a stern part of the freeboard and the other one of the first and third opening is in the starboard or port side of the freeboard.

In one embodiment, at least one of the second and fourth hatch elements is herein defined as a "longitudinal" hatch element since it protrudes over a corresponding one of the first and third openings being in the bow part or stern part of the freeboard when it is in the open position. Additionally, it moves longitudinally between the closed and the open position.

In one embodiment, at least one of the second and fourth hatch elements is herein defined as a "transverse" hatch element since it protrudes over one of the first and third openings being in the starboard or port side of the freeboard in the open position. Additionally, it moves transversely between the closed and the open position.

Both the second and fourth hatch elements could be longitudinal hatch elements, both the second and fourth hatch elements could be transverse hatch elements, or one of second and fourth hatch elements could be a longitudinal hatch element while the other one is a transverse hatch element.

The second and fourth hatch element could be shifted relative to each other in the longitudinal direction and thereby provide access to the sheltered deck through the upper deck at a number of locations along the length of the ship.

The second and/or fourth hatch element could be flush with the upper deck. This may improve the usefulness of the upper deck e.g. as a heli-platform etc.

The ship may comprise a second lifting structure attached to the fourth hatch element and being essentially similar to the first lifting structure, and potentially attached to the fourth

hatch element via a lifting motion structure allowing the second lifting structure to move transversely and/or longitudinally relative to the fourth hatch element.

The third and the fourth opening could be in open connection, i.e. essentially forming one unitary opening into the sheltered deck. This may allow the second lifting structure to move
5 across the open transition.

The fourth hatch element may project over the third opening in the open position, and the second lifting structure may allow lifting of cargo such as utility modules while they are carried by the fourth hatch element.

The second lifting structure may be configured for lifting objects from one of the at least one
10 sheltered decks. The second lifting structure may be configured to move across the open transition upon movement of the fourth hatch element between the open and closed positions. This enables the fourth hatch to work as a crane arm which can move the cargo in and out through the fifth opening while shielding the cargo from above.

To allow longitudinal adjustment and precise pickup and delivery of the cargo, the second
15 lifting structure may be movable in the transverse direction relative to the fourth hatch element. The adjustment may e.g., be within fixed transverse positions or the second lifting structure may be slidable along an inner surface of the fourth hatch element.

The second lifting structure may be constituted e.g., by a container lifting lug or a lifting lug of a specific shape and size and fitted with a number of lifting points, e.g., provided by one or
20 more winches. The second lifting structure may also include a lifting lug for a specific purpose, e.g., for lifting life rafts, boats, sub marine equipment, or weapon etc.

A fifth hatch element may be movable between a closed position covering at least a part of a fifth opening in the upper deck and an open position in which the fifth opening is uncovered. The fifth hatch element may be configured to border on at least one of the second and fourth
25 hatch elements.

In a second aspect, the disclosure provides a method of loading or unloading cargo from one of the at least one sheltered decks of a ship. The second hatch structure is moved to the open position, and the cargo is loaded into the sheltered deck via at least one of the first and the second openings.

30 The ship may be moored to a quay or otherwise be arranged for loading and unloading at one of its starboard or port sides and the second hatch structure could be moved to the open

position towards the other one of the ships starboard or port sides. I.e. if the ship is moored to the quay at its starboard side, and the second hatch structure is moved towards the port side. If the ship has an open transition between the first opening and the second opening, this way of opening the second hatch structure makes it possible to utilise the combination of the first and second openings for loading and unloading the cargo into or out of the sheltered deck which may improve the ability to handle the cargo quickly and efficiently.

The method may comprise one or more of the following steps:

- moving the first hatch structure to an open position to open the first opening;
- using the first lifting structure attached to the second hatch structure to move the utility module relative to one of the at least one sheltered decks.

The cargo could be a utility module, and the cargo may be moved from one location one of the at least one sheltered decks to another location on the same or another one of the at least one sheltered decks, or alternatively, it may be moved out through the first, third or fifth opening and delivered outside, vice versa.

- The utility module may be moved from one location on one of the at least one sheltered decks to a location outside the ship via the first or third opening, e.g., for moving cargo from the ship to another ship or to a quay or to the sea etc.

The method may comprise moving one of the second and fourth hatch element to the open position and subsequently moving the fifth hatch structure to an open position where it is located at least partly over one of the second and fourth openings, and/or comprise moving at least one of the second hatch element, the fourth hatch element, and the fifth hatch element to the closed position and using an upper surface of that hatch element as a landing field for receiving an airborne vehicle such as a helicopter or a drone etc.

In a third aspect, the disclosure provides a method of utilising a utility module on a ship according to the first aspect of the disclosure. The utility module is loaded into the sheltered deck via the first opening and/or via the second opening and has an operational state requiring access from the sheltered deck to an ambient space, wherein the access to the ambient space is established through the second opening. Alternatively, the utility module may have an operational state requiring access from the sheltered deck to an ambient space, wherein the access to the ambient space is established through the first opening.

Definitions

When used herein, the term *below* means arranged at a lower height taken relative to gravity in an orientation considered for normal use of the ship. Y below x would therefore be considered as y is at a lower position than x but not necessarily located underneath x.

- 5 When used herein, the term y *underneath* x means that y is arranged within a vertical projection underneath x. I.e. the term *underneath* is a subset of the term *below*. One of the first openings is thus located underneath the second hatch structure, when the second hatch structure is in one of the at least one open positions.

- 10 The terms *first*, *second*, *third*, *fourth*, and *fifth*, e.g. *first hatch structure* and *second hatch structure*, or *first opening* and *second opening* should not be understood as a way of numerically ranking the entities. The numbering is essentially names of the entities. The *first opening* could also be referred to as a freeboard opening, and the *second opening* could be referred to as the upper deck opening.

- 15 The term *freeboard* is herein defined as a side of the ship extending height-wise between a waterline and the uppermost deck and extending circumferentially around the ship, i.e. longitudinally between a fore end and an aft end of the ship and if the ship has a flat bow and/or stern, the freeboard additionally extends transversely between starboard and port sides of the ship at the bow and/or stern.

- 20 The term *longitudinal direction* refers to the lengthwise direction of the ship, i.e. the intended sailing direction.

The term *transverse direction* refers to the direction perpendicular to the longitudinal direction, between starboard and port sides of the ship.

The term *waterline* refers to the intended waterline in a normal use situation for the ship.

The term *cargo* refers broadly to items being transported by the ship.

- 25 The term *utility module* refers to a module which is releasably mounted or carried by the ship and which can be used for a specific mission during which it typically interacts with the ship and uses certain features of the ship, e.g. openings through the freeboard or deck or other features of the ship.

BRIEF DESCRIPTION OF THE DRAWING

The accompanying drawings are included to provide a further understanding of embodiments and are incorporated into and a part of this specification. The drawings illustrate embodiments and together with the description explain principles of embodiments. Other
5 embodiments and many of the intended advantages of embodiments will be readily appreciated as they become better understood by reference to the following detailed description. The elements of the drawings are not necessarily to scale relative to each other. Like reference numerals designate corresponding similar parts.

Figs. 1 and 2 illustrate an aft part of a ship;

10 Fig. 3 illustrates a transverse cross section of the ship;

Figs. 4-7 illustrate in perspective views a procedure of unloading cargo through the first opening in the freeboard;

Figs. 8-10 illustrate in perspective views a procedure of unloading cargo through the fifth opening in the aft end;

15 Figs 11-12 illustrate details of unloading utility modules;

Figs. 13-15 illustrate different combinations of hatches; and

Fig. 16 illustrates a method of loading cargo onto a sheltered deck via both the first and the second opening.

DETAILED DESCRIPTION

20 Fig. 1 illustrates a longitudinal side view of an aft part of a ship and Fig. 2 illustrates a transverse cross section of the aft part of the ship.

The ship 1 defines a longitudinal direction 2 and a transverse direction 3. The freeboard 4 of the ship is defined as the area 5 between the waterline 6 and the upper deck 7.

The upper deck is above a number of lower decks 8, 9 which are sheltered by the upper deck
25 7. Herein, the lower decks are referred to as sheltered decks.

Fig. 3 illustrates that the ship comprises a first opening 30 allowing sideways access to an upper one 8 of the at least one sheltered deck. The ship further comprises a second opening 31 providing vertical access to the same upper one 8 of the sheltered decks.

5 A plurality of utility modules 32 are releasably attachable to a utility area of the upper one of the sheltered decks. The utility area may be predefined with features facilitating use of the utility module, e.g., power, compressed air, wastewater handling, or other necessary features.

10 The utility modules could be weapon modules, transport containers or generally modules enabling the ship to carry out a certain mission. The ship is configured for removal of these utility modules, or for operating them in open sea, either through the first opening or through the second opening.

The illustrated ship further comprises a third opening 33 in the freeboard of the ship. The third opening provides sideways access to the same upper one sheltered deck 8. The first opening and the third opening are on opposite sides of the centre line 34 of the ship.

15 The arrows 35, 36, 37 indicate the vertical and horizontal passageways from the sheltered deck through the first, second, or third opening.

Figs. 4-7 illustrate in a sequence of illustrations, a procedure for unloading utility modules 32 from the sheltered deck.

20 In Fig. 4, the first hatch element 40 covers the first opening 30, and the second hatch element 41 covers the second opening 31. In this, closed, position of the first and second hatch elements, the first hatch element borders on the second hatch element along a border between the first and the second opening. The first hatch element may e.g., slide into a C-shaped track of the second hatch element and the second hatch element thereby supports the first hatch element. Alternatively, the first hatch element can be self-supported.

25 The illustrated first and second hatch elements are configured to provide a sealing connection with the freeboard and upper deck and thereby prevent intrusion of water. In alternative implementations, the second hatch element, and optionally also the first hatch element may essentially prevent spray water from entering, however without providing a sealing barrier against water intrusion.

30 In the closed position, the first hatch element is flush with the freeboard. The illustrated first hatch element is a single element which slides in the longitudinal direction. In an alternative

embodiment, the first hatch element comprises two separate elements: a first element section and a second element section slidable towards or away from each other and e.g., being on opposite sides of the first opening in the open position.

In the illustrated embodiment, the second hatch element is a single element. The second
5 hatch element may particularly be translationally slidable in the transverse direction, and in the embodiments of Figs. 3 and 4, it can slide both in port and starboard directions and thereby extend over one or the other of the first 30 and third 33 openings. In the closed position, the second hatch element is flush with the upper deck 7.

In Fig. 5, the first hatch element 40 has shifted longitudinally in a rearward direction thereby
10 opening the first opening 30 and revealing the utility modules. The first hatch element 40 can alternatively open forwards. The second hatch element is still in the closed position.

Fig. 6 illustrates that the ship comprises a first lifting structure 70 (illustrated in Fig. 7) which can be used for lifting cargo, e.g. the utility modules. The first lifting structure is attached to the second hatch element. It may be constituted by a crane structure of a kind known per se,
15 e.g., comprising one or more motorised winches e.g., being movably attached to the second hatch element by a trolley. Such a lifting structure may be useful for lifting objects from one of the sheltered decks.

In Fig. 6, four utility modules are lifted by the first lifting structure, and the second hatch element is moved in the transverse direction and thereby utilised as a crane component for
20 moving the utility modules sideways through the first opening.

The first opening is in open connection with the second opening, and the first lifting structure is configured to move across the open transition between the two openings. This allows the first lifting structure to move itself and/or the utility modules across the transition upon movement of the second hatch element between the open and closed positions.

25 The arrow 60 indicates that the first lifting structure is movable in the longitudinal direction relative to the second hatch element. This allows longitudinal adjustment of the position of the utility modules on the sheltered deck and or longitudinal adjustment of the delivery position of the utility modules, e.g., on a quay or on another ship or e.g., boat launch and recovery.

30 Fig. 7 illustrates lowering of the utility modules 32 by use of the first lifting structure 70.

Figs. 8-10 illustrate in a sequence of illustrations, a procedure for loading and unloading utility modules through an opening in the aft end of the ship. In this case, the first opening is in a flat transom forming the aft of the ship, and the second opening is at the upper deck at the aft end of the ship.

- 5 The second opening is closable by the second hatch element 41. In the illustration, the second hatch element forms a heli-platform marked with an H. The fourth hatch element is movable longitudinally between a closed position covering at least a part of a second opening and an open position in which it protrudes longitudinal over the aft end of the ship.

- 10 In Fig. 8, the first opening is sealed by a first hatch element constituted by a first and a second hinged door 81, 82. Alternatively, any other kind of sealing or non-sealing hatch structure may be provided, or the first opening may simply stay open without any hatch structure.

- 15 Fig. 9 illustrates a compartment 90 behind the doors 81, 82. The compartment is upwardly shielded by the second hatch element 41. In the compartment, the utility module is constituted by a boat 91 suspended from a crane 92 fixed to the second hatch element and constituting the second lifting structure.

In Fig. 10, the second hatch element is moved to the open position where it extends over the transom of the ship, and this brings the second lifting structure and the boat 91 out of the compartment 91 and ready to be launched in the sea.

- 20 Fig. 11 illustrates lowering of the utility modules 32 by use of the first lifting structure 70 in an embodiment, where a shield 110 is fixed to the second hatch element and thereby blocks the view to the utility modules.

Fig. 12 illustrates use of the second hatch element for lifting cargo from the sheltered deck to a quay 120 at land or to a barge or to another ship at sea or for launch and recovery of boats

- 25 Fig. 13 illustrates a side view and Figs. 14-15 illustrate top views of different embodiments.

- 30 Figs. 13 and 14 illustrate a ship comprising a plurality of hatch elements. Two of the three hatch elements in the upper deck are in the open position and one is in the closed position. One projects over the stern part of the freeboard, and one projects over the port side of the freeboard. In the closed position, they are flush with the surrounding fixed part of the upper deck, and two of the second hatch elements constitute a coherent flight deck.

Referring to one of the hatch elements 41, 41', they could, as an example, be seen as the second hatch element being movable to project over the first opening 40, 40'.

Referring to the hatch element 141, this could be seen as the fourth hatch element being movable over the third opening 140. The third opening is an opening in the stern of the ship
5 and the first opening is an opening in the port side of the ship.

The second hatch elements are both movable to project over the first openings and the fourth hatch element is movable to project over the third opening in the stern. Accordingly, this ship combines the openings in the port of starboard sides of the ship with an opening in the stern of the ship. The ship may further have openings in the bow, and a corresponding
10 hatch on the upper deck may be arranged to project over that opening.

Fig. 15 illustrates a ship which further comprises a fifth hatch element 150 movable between a closed position covering at least a part of a fifth opening in the upper deck and an open position in which the fifth opening is uncovered. The fifth hatch element is configured to slide longitudinally and to border on at least one of the second hatch element 41 and fourth hatch
15 element 141 – in this case the fourth hatch element 141.

Fig. 16 illustrates a method of loading or unloading cargo 160 from one of the at least one sheltered decks of the ship. In this method, the ship is moored to a quay at one of its starboard or port sides and the second hatch structure is moved to the open position towards the other one of the ships starboard or port sides. In this way, the second hatch structure
20 extends over the freeboard away from the quay.

In the disclosed embodiment, the ship has an open transition between the first or third opening and the second opening such that a single unitary opening is formed when the second hatch structure moves to an open position.

When the second hatch structure extends away from the quay, it improves access for loading
25 machines, in this case a telescopic wheel loader 161, which can utilise the full opening of the first and second openings for placing the cargo 160 on the sheltered deck. In Fig. 16, the cargo is lifted transversely over the transition between the first and the second opening which makes loading and unloading very efficient.

The cargo could be constituted by utility modules which, while being placed on the sheltered
30 deck, operates through the second opening in the upper deck.

CLAIMS

1. A ship (1) defining a longitudinal direction (2) and a transverse direction (3) and comprising a freeboard (4), an upper deck (7), and at least one sheltered deck (8, 9) below the upper deck, where the freeboard (4) is defined as an outer surface between a waterline and the upper deck (7) and extending circumferentially about the ship, the ship comprising at least one hatch structure comprising:
- a first opening (30) in the freeboard (4) providing access to one of the at least one sheltered decks,
 - a second hatch element (41) slidable between at least one open position providing vertical access to one of the at least one sheltered decks through a second opening (31) in the upper deck (7) and a closed position where the second hatch element (41) covers the second opening (31),
- wherein the second hatch element (41) protrudes over the first opening (30) in one of the at least one open positions.
2. The ship according to claim 1, comprising an open transition between the first opening (30) and the second opening (31), the first opening and the second opening (30, 31) thereby forming one unitary opening.
3. The ship according to any of the preceding claims, wherein the second hatch element (41) extends from a starboard side of the ship to a port side of the ship, and the second hatch element (41) is movable to selectively protrude over the freeboard on a starboard or a port side of the ship to thereby define two open positions.
4. The ship according to any of the preceding claims, comprising a first lifting structure (70) carried by the second hatch element (41) and configured for lifting objects from one of the at least one sheltered decks such that the lifted objects are carried by the second hatch element (41).
5. The ship according to claim 2 and 4, wherein the first lifting structure (70) is configured to move across the open transition between the first opening (30) and the second opening (31).

6. The ship according to claim 5, wherein the first lifting structure (70) is arranged to move across the transition upon movement of the second hatch element (41) between one of the at least one open positions and the closed position.
7. The ship according to claim 6, wherein the first lifting structure (70) is arranged to move across the transition upon movement of the first lifting structure (70) relative to the second hatch element (41).
8. The ship according to any of claims 3-7, wherein the first lifting structure (70) is movable in the longitudinal direction and/or in the transverse direction relative to the second hatch element (41).
9. The ship according to any of the preceding claims, further comprising a first hatch element (40) movable between an open position providing sideways access to one of the at least one sheltered decks (8, 9) through the first opening (30) and a closed position where the first hatch element (40) covers the first opening (30).
10. The ship according to claim 9, wherein the first hatch element (40) is configured to border on the second hatch element (41) along a border between the first and the second opening (30, 31).
11. The ship according to any of claims 9-10, wherein the first hatch element (40) is joined to the second hatch element (41) in the closed positions of the first hatch element (40) and second hatch element (41).
12. The ship according to any of claims 9-11, wherein the first hatch element (40) is movable in the longitudinal direction along the freeboard between at least one open position and a closed position.
13. The ship according to any of claims 9-12, wherein the first hatch element (40) comprises a first element section and a second element section, the first and second element sections being separately movable relative to each other and relative to the first opening.
14. The ship according to any of the preceding claims, comprising a utility module (32) insertable into and removable from one of the sheltered decks (8, 9) through the first opening.

15. The ship according to any of the preceding claims wherein the second hatch element (41) is movable in the transverse direction, and the first opening (30) is in a port side or a starboard side of the freeboard.
16. The ship according to any of the preceding claims, wherein the second hatch element (41) is movable in the longitudinal direction, and the first opening (30) is in a bow part or stern part of the freeboard.
17. The ship according to any of the preceding claims, wherein the second hatch element (41) comprises only a single element.
18. The ship according to any of the preceding claims, wherein the hatch structure comprises a third opening (140) in the freeboard (4) providing access to one of the at least one sheltered decks (8, 9).
19. The ship according to claims 18, wherein the second hatch element (41) is movable between a first open position in which it protrudes over the first opening (30) and a second open position in which it protrudes over the third opening (140).
20. The ship according to claim 18-19, comprising a third hatch element movable between an open position providing sideways access to one of the at least one sheltered decks through the third opening (140) and a closed position where the third hatch element covers the third opening (140).
21. The ship according to any of the preceding claims, wherein the hatch structure comprises a fourth hatch element (141) movable between an open position providing access to one of the at least one sheltered decks (8, 9) through a fourth opening in the upper deck and a closed position where the fourth hatch element (141) covers the fourth opening.
22. The ship according to claim 21, wherein the fourth hatch element (141) is movable by sliding between the open and the closed positions.
23. The ship according to claims 18 and 22, wherein the fourth hatch element (141) in the open position protrudes over the third opening (140).
24. The ship according to any of claims 18-23, wherein at least one of the first and third opening (30, 140) is in a port or a starboard side of the freeboard (4).

25. The ship according to claim 24, wherein the first opening (30) is in the port side of the freeboard and the third opening (140) is in the starboard side of the freeboard.

26. The ship according to any of claims 18-24, wherein at least one of the first and third opening (30, 140) is in bow part or stern part of the freeboard (4).

- 5 27. The ship according to any of claims 18-26, wherein at least one of the first and third opening (30, 140) is in a bow part or stern part of the freeboard and the other one of the first and third opening (30, 140) is in the starboard or port side of the freeboard (4).

- 10 28. The ship according to claim 27, wherein a longitudinal one of the second and fourth hatch elements protrudes over one of the first and third openings being in the bow part or stern part of the freeboard in the open position and moves longitudinally between the closed and the open position.

- 15 29. The ship according to claim 27 or 28, wherein a transverse one of the second and fourth hatch elements protrudes over one of the first and third openings being in the starboard or port side of the freeboard in the open position and moves transversely between the closed and the open position.

30. The ship according to any of claims 21-29, comprising a second lifting structure attached to the fourth hatch element.

31. The ship according to claims 21-30, comprising an open transition between the third opening and the fourth opening.

- 20 32. The ship according to claim 29 and 31, wherein the second lifting structure is configured to move across the open transition.

33. The ship according to any of the preceding claims, comprising at least two hatch structures shifted relative to each other in the longitudinal direction.

- 25 34. The ship according to any of the preceding claims, comprising a fifth hatch element (150) movable between a closed position covering at least a part of a fifth opening in the upper deck and an open position in which the fifth opening is uncovered.

35. The ship according to claim 34, wherein the fifth hatch element (150) is configured to border on at least one of the second and fourth hatch element.

36. A method of loading or unloading cargo from one of the at least one sheltered decks of a ship according to any of the preceding claims, the method comprising moving the second hatch structure to the open position and loading the cargo (160) into the sheltered deck via at least one of the first and the second openings.

- 5 37. The method according to claim 36, wherein the ship is moored to a quay at one of its starboard or port sides and the second hatch structure is moved to the open position towards the other one of the ships starboard or port sides.

38. The method according to claim 37, wherein an open transition between the first opening and the second opening is utilised as improved access for loading cargo (160) into or out of
10 the sheltered deck.

39. The method according to claim 36, comprising:

-moving the first hatch structure to an open position to open the first opening;

- using the first lifting structure attached to the second hatch structure to move the utility module relative to one of the at least one sheltered decks.

- 15 40. The method according to claim 39, wherein the utility module is moved from one location on one of the at least one sheltered decks to another location on the same or another one of the at least one sheltered decks.

41. The method according to claim 39, wherein the utility module is moved from one location on one of the at least one sheltered decks to a location outside the ship via the first or third
20 opening.

42. The method according to any of claims 36-39 wherein the ship is according to claim 32, comprising moving one of the second and fourth hatch element to the open position and subsequently moving the fifth hatch structure to an open position where it is located at least partly over one of the second and fourth openings.

- 25 43. The method according to any of the claims 36-42, comprising moving at least one of the second hatch element, the fourth hatch element, and the fifth hatch element to the closed position and using an upper surface of that hatch element as a landing field for receiving an airborne vehicle.

44. A method of utilising a utility module on a ship according to any of claims 1-35, wherein the utility module is loaded into the sheltered deck via the first opening and has an operational state requiring access from the sheltered deck to an ambient space, wherein the access to the ambient space is established through the second opening.
- 5 45. A method of utilising a utility module on a ship according to any of claims 1-35, wherein the utility module is loaded into the sheltered deck via the second opening and has an operational state requiring access from the sheltered deck to an ambient space, wherein the access to the ambient space is established through the first opening.