

Part VII – Technical Specifications

Supply of Three (3) Aluminium Alloy Harbour Patrol Vessels for the Marine Department

Table of Contents

Chapter 1 General Provisions

- 1.1 Introduction
- 1.2 Statement of Purposes of the Vessel
- 1.3 Authorities
- 1.4 Shipyard
- 1.5 Design and Construction Responsibility
- 1.6 Survey and Inspection
- 1.7 Official Sea Trial and Speed Requirements
- 1.8 Acceptance and Delivery
- 1.9 Warranty Services During the Warranty Period
- 1.10 Support Services
- 1.11 Asbestos Free

Chapter 2 General Technical Requirements

- 2.1 Conceptual General Arrangement Plan
- 2.2 General Provisions
- 2.3 Rules and Regulations
- 2.4 Contract Speed
- 2.5 Principal Dimensions
- 2.6 Material of the Structure
- 2.7 Vessel Operating Profile and Environment
- 2.8 Arrangement of Deckhouse and Compartments
- 2.9 Markings and Colour Scheme
- 2.10 Tally Plates
- 2.11 Other Design Features

Chapter 3 Hull and Deckhouse

- 3.1 General Provisions
- 3.2 Hull and Deckhouse Structural Requirements
- 3.3 Stability and Subdivision
- 3.4 Paint

Chapter 4 General Arrangement

- 4.1 Arrangement on Main Deck and Under-deck
- 4.2 Bridge
- 4.3 High Command Office
- 4.4 Ship Office
- 4.5 Meeting Room
- 4.6 Fore Peak
- 4.7 Crew space
- 4.8 Fuel Oil Tanks
- 4.9 Tank Space
- 4.10 Steering Gear room
- 4.11 Side Deck
- 4.12 Mast and Open Deck
- 4.13 Seating
- 4.14 Bow and Stern
- 4.15 Ancillary boat
- 4.16 Anchoring, Mooring and Towing
- 4.17 Fenders
- 4.18 Cathodic and Hull Surface Protection
- 4.19 Lightning Protection

4.20 Special Equipment

4.21 Miscellaneous

Chapter 5 Safety Equipment

5.1 General Provisions

5.2 Fire Detection System

5.3 Portable Fire Extinguishers

5.4 Fire Pumps

5.5 Safety Plan

5.6 Additional Protection

Chapter 6 Lifesaving Appliances (LSA) and Arrangements

6.1 General Provisions

Chapter 7 Machinery

7.1 General Requirements

7.2 Main Propulsion Engines

7.3 Main Engines Control

7.4 Electric Generator Sets

7.5 Electric Engine Control

7.6 Instrumentation and Control

7.7 Reduction Gearboxes

7.8 Propeller Shafts, Stern Tubes, Propellers

7.9 Steering Gear System

7.10 Rudders and Rudder Socks

7.11 Engine Room Ventilation

7.12 Air-Conditioning System

7.13 Piping System

7.14 Fuel Oil System and Fuel Oil Tank

7.15 Fresh Water System

7.16 Bilge System

7.17 Seawater System

7.18 Sanitary, Grey and Black Water System

7.19 Open deck drainage system

7.20 Floor Plates, Handrails and Guards

Chapter 8 Electrical System

8.1 General Requirements

8.2 Electricity Distribution Network

8.3 Main Switchboard

8.4 D.C. Power Source

8.5 Arrangement of Emergency Power

8.6 Shore Power Supply and Connection

8.7 Circuit Breaker

8.8 Motor and Control Gear

8.9 Unmanned Duty Alarm System

8.10 Level Alarm and Indicator Panel

8.11 Cable, Wiring and Fuse

8.12 Lighting Fixtures

8.13 Navigational Light

8.14 Searchlight

8.15 Floodlight

8.16 Power Receptacles / Sockets

8.17 Waterproof Vessel Side LED Panels

8.18 The solar systems

Chapter 9 Electronic Navigation Equipment

- 9.1 Description of Electronic Equipment System
- 9.2 Loudhailer / Siren System and Public Address System with USB Player
- 9.3 Magnetic Compass
- 9.4 Fiber-Optic Gyrocompass
- 9.5 Satellite Compass
- 9.6 Marine Radar (x-band) for navigation
- 9.7 Marine Radar (x-band) for officer operated
- 9.8 Electronic Chart Display and Information System (ECDIS) for navigation
- 9.9 Electronic Chart Display and Information System (ECDIS) for officer operated
- 9.10 International Maritime Mobile (IMM) VHF Radio with GMDSS
- 9.11 Marine Band Hand-Held Waterproof Radio Transceiver
- 9.12 Secure Automatic Identification System (S-AIS) Transponder
- 9.13 CCTV System
- 9.14 Voyage Data Recorder (VDR)
- 9.15 Speed and Distance Through Water
- 9.16 Direction Finder System
- 9.17 Windshield wiper
- 9.18 Wired and Wireless Intercom (Talkback) System
- 9.19 Wind Speed and Direction System
- 9.20 Echo sounder
- 9.21 32" multi vision display with computer
- 9.22 Integrated navigation system for command
- 9.23 Laptop
- 9.24 Installation/Space/Cabling for the Existing or Free Issue Marine Department Harbour Patrol Section (HPS) Survey Equipment
- 9.25 Acceptance Test
- 9.26 Documentation for the Proposed Equipment
- 9.27 Installation Requirements

Chapter 10 Services Support

- 10.1 General Philosophy
- 10.2 Information to be Provided Prior to and at Delivery Acceptance

Chapter 11 Training

- 11.1 Training on Electronic Navigational Equipment (ENE)
- 11.2 Training on Operation and Maintenance of the Vessel

Chapter 12 Abbreviations

Annexes

- Annex 1 Warranty Services and Guarantee Slipping
- Annex 2 Implementation Timetable
- Annex 3 Drawings Submission Timetable
- Annex 4 Main Items Inspection Timetable
- Annex 5 Official Sea Trial
- Annex 6 Endurance and Performance Test
- Annex 7 As-fitted Drawings and Machinery/Equipment documents and information literature to be delivered to the Government after Delivery Acceptance
- Annex 8 Definitions of Wave and Sea

Chapter 1 – General Provisions

1.1 Introduction

- 1.1.1 This document (or “Technical Specifications” (TS)) sets out the requirements of the Government in relation to **three (3) aluminium alloy Harbour Patrol Vessels for the Marine Department** (viz., “Vessel”) for use by the Harbour Patrol Section (the “user department”).
- 1.1.2 Unless otherwise specified in the Technical Specifications, all the specifications stated in this Part VII of the Tender Documents are classified and labelled as follows:
- (a) Essential Requirements [E];
 - (b) Desirable Specifications [D]; and
 - (c) Those specifications which are without any label (viz., [E] or [D]) shall equally form part of the Contract like the specifications labelled as [E], but the Government will not conduct checks at the tendering stage whether the products offered comply with those specifications not labelled with [E] or [D].
- 1.1.3 All this Part VII shall form part of the Contract. As part of the tender evaluation during the tendering stage (viz., completeness check), the Tenderer shall submit all the information sufficiently detailed to substantiate that the product and the services offered meet the Essential Requirements as stipulated in Annex C to the Conditions of Tender, failing which its tender will not be considered further.
- 1.1.4 The whole of this Part VII, including all Essential Requirements, those without any label (viz., [E] or [D]) and the Desirable Specifications labelled with [D] (if and to the extent the Contractor has indicated compliance in its tender), shall also form part of the Contract and be of equal materiality and importance upon the award of the Contract. The non-compliance with any specifications set out in these TS shall have the same consequences as specified in the Contract. Save during the tendering stage in the manner as mentioned in Paragraph 1.1.2 (c) above, no differentiation shall be made based on the classification unless otherwise expressly specified.
- 1.1.5 The Vessel shall be Ready for Use before the Delivery Date and delivered by the Delivery Date as per the schedule stipulated under Schedule 2 – Delivery Schedule.
- 1.1.6 Unless otherwise expressly defined in the Contract, all technical terms and expressions used in this Part VII shall be interpreted in accordance with the professional or common usage in naval architecture, marine engineering, nautical navigation and the shipbuilding industry.
- 1.1.7 For the avoidance of doubt, references to “tests” throughout the Tender Documents and the Contract shall include all inspections, surveys, assessments, trials and experiments.

1.2 Statement of Purposes of the Vessel

- 1.2.1 This new harbour patrol vessels shall be used by MD to conduct patrols, search and rescue and others; anywhere within Hong Kong waters and coastal waters off Hong Kong to a maximum of 20 nautical miles to a safe refuge, and as specified within the endurance range of the Vessel:
- (a) To perform patrol duties, to conduct special operations, and law enforcement including actions against drink and drug boating;
 - (b) To operate in coastal waters off Hong Kong including South Lamma, Po Toi, Ninepin Island and Soko Islands;
 - (c) To act as command vessels in maritime events, operations and marine emergencies.
- 1.2.2 The Vessel shall be designed and constructed for a service life of at least 15 years under reasonable maintenance.

1.3 Authorities

- 1.3.1 The Government New Construction Section (GNC) of the Marine Department (MD) is the section responsible for the procurement of the Vessel for the Government of the Hong Kong Special Administrative Region (HKSAR) of the People's Republic of China (hereinafter referred to as the Government).
- 1.3.2 GNC may delegate a private consulting firm in relation to the management of the shipbuilding contract for the construction of the Vessel.
- 1.3.3 The Electrical and Mechanical Services Department (EMSD) is the Department which will oversee the Communication Equipment and Electronic Navigation Equipment ("ENE") technical acceptance.

1.4 Shipyard

- 1.4.1 The Contractor's nominated shipyard must have the essential shipbuilding and workshop facilities such as lifting gear, hull construction and calibration equipment, machinery installation and calibration equipment and vessel launching or slipping facilities.
- 1.4.2 The Contractor shall employ a team of professional staff to carry out the design of the Vessel and also carry out supervision and quality control work in the course of the Vessel construction.

1.5 Design and Construction Responsibility

- 1.5.1 The Vessel shall be designed and constructed for a service life of at least fifteen (15) years under reasonable maintenance.
- 1.5.2 It is the SOLE responsibility of the Contractor to supply a Vessel which is safe, fit and suitable for the operation of the user department and which meets all the relevant regulations and all specifications in this Part VII, which include without limitation requirements for safety, health, environmental protection, hull form design features, structure, method and materials for construction and fitting out, stability, sub-division and operational efficiency.
- 1.5.3 The Vessel shall be designed and constructed in accordance with the latest edition of the rules and regulations of the Recognised Organisation (RO) specified in Schedule 9. Unless otherwise expressly stipulated in this Part VII, **(a) references to "RO" in this Part VII shall mean the RO as specified in Schedule 9; and (b) references to "RO Requirements" shall mean the requirement of the rules and regulations of the RO as specified in Schedule 9.** Notwithstanding the foregoing, where it is expressly permitted in this Part VII that in relation to a particular requirement, instead of the RO specified in Schedule 9, another RO which is any one of the ROs listed in Paragraph 2.3.4 (a) to (i) may be designated for compliance with the relevant requirement, references to "RO" shall mean such other RO.
- 1.5.4 The Vessel is required to be issued with a certificate of class (without conditions) with notation by the RO as specified in Schedule 9. All plans, particulars and documentations which are required for the classification of the Vessel by the RO, in addition to those listed in Annex 3 to this Part shall be approved by the RO before submission to MD for endorsement and final approval prior to commencement of work. Any subsequent modifications or additions shall be treated in the same manner. Those drawings which are not required under ship classification approval shall be submitted to MD for approval before work is carried out.
- 1.5.5 Notwithstanding the submission of the preliminary plans and drawings by the Contractor then as part of its tender for the Contract, all plans and drawings of the Vessel except the design stresses and scantling, shall be submitted to GNC for approval before completion of the Vessel design. The design stresses and scantling including internal structural members shall be determined according to the rules of RO.
- 1.5.6 The Contractor shall design, build and supply the Vessel in full compliance with the requirements given in this Part VII which, to that extent, may be over and above what is normally required by any statutory and RO's rules and regulations. Should there be any contradiction between the rules and regulations of the RO and this Part VII, this Part VII shall prevail unless GNC stipulates or agrees otherwise.

- 1.5.7 Even if the Contractor may appoint a sub-contractor to design the Vessel with the prior written consent of the Government, the Contractor shall not be relieved of its obligations under the Contract through such appointment, and the Contractor shall be responsible for all acts, defaults and omissions of the sub-contractor as if they were its own.

1.6 Survey and Inspection

- 1.6.1 Tenderers shall note that the unit price per Vessel quoted in Schedule 1 – Price Schedule in Part V shall be deemed to have included the cost of surveys to be carried out by the relevant RO in respect of that Vessel (if required to be arranged by the Contractor under the Contract).
- 1.6.2 All electronic items and their installations shall be approved and inspected by EMSD or EMSD representatives as part of the Technical Acceptance.
- 1.6.3 Subject to Paragraph 1.6.7 of this Chapter, an advance written notice of not less than 5 working days (if the Vessel is located in Asia), and 10 working days (if the Vessel is located other than Asia) must be given to GNC before the representatives of GNC and other government officers are invited to conduct a survey visit of the Vessel. The Contractor shall be fully responsible for any delay if the Contractor fails to give adequate notice as aforesaid.
- 1.6.4 The Contractor shall provide:
- (a) an Implementation Timetable, in the form set out in Annex 2 to this Part VII, setting out the major milestones and their scheduled completion dates and incorporating the Delivery Dates specified in Schedule 2;
 - (b) the Drawing Submissions Timetable in the form set out in Annex 3 to this Part VII; and
 - (c) the Main Items Inspection Timetable in the form set out in Annex 4 to this Part VII.

Each one of the above shall be submitted to GNC for approval upon commencement of the Contract Period.

The Delivery Date(s) for the Vessel as stated in the Implementation Timetable shall be no later than those set out in Schedule 2 of Part V. Notwithstanding anything in the Contract to the contrary, the Government may suspend payment of any of the instalment specified in Schedule 3 of Part V of the Contract if any of the timetables required herein has not been submitted for GNC's approval or GNC does not approve any of them or if the progress of work does not comply with any of them as approved by GNC.

- 1.6.5 A weekly work progress report with photos evidencing the progress is required to be submitted to MD during the construction of the Vessel. The weekly report shall be submitted before noon of every Monday.
- 1.6.6 MD may designate consultant(s) from private sector who will be authorised to represent the GNC in all technical matters including plan approval related to the construction of the Vessel. The Contractor shall cooperate with the consultant(s) and afford them unhindered access to the Vessel at all times during working hours, and shall furnish them with current copies including but not limited to all drawings, sketches, correspondence, change notices, change orders, test agendas and schedules.
- 1.6.7 After arriving at the site for a survey visit, if MD officer / consultant considers it is unsafe to carry out the test or inspection, the test/inspection will not be carried out. The Contractor shall arrange another additional survey visit at the Contractor's expenses. The Government shall not be responsible for any delay arising from any postponement in conducting the survey visit due to any safety issue as specified in this Paragraph.
- 1.6.8 Where any fee charge and associated expense are payable for the services of the RO which are necessary in order to fulfil any obligation of the Contractor under the Contract, the Contractor is responsible for paying the RO all such fees, charges and associated expenses. Such fees shall include charges for drawing approval, surveys (if deemed necessary), issue of certificates, and any other expenses payable to the RO.
- 1.6.9 The Contractor shall provide offices' space for MD officers and consultants during their survey visits and construction progress visits to the Vessel at the shipyard where the Vessel is constructed. The office space shall include, but not be limited to, two (2) desks, four (4) chairs, one (1) telephone,

one (1) conference table, drinking facilities and one (1) cupboard for storage of documents and working clothes. The space provided by the Contractor shall also be fitted with air conditioning, have Internet access, a copying and a printer machine. Cleaning of the space shall be carried out in each working day.

- 1.6.10 The hours of work of MD officers or consultants will be arranged to coincide with those of the shipyard, in so far as it is practicable to do so. It is intended that all reasonable steps be taken so that the duties of the MD officers and consultants can be carried out with a maximum of efficiency and a minimum of interference with the Contractor's work.

1.7 Official Sea Trial and Speed Requirements

- 1.7.1 The Contractor shall submit for MD approval, an Official Sea Trial programme 14 working days in advance of the Official Sea Trial, which shall include details of proposed procedures for carrying out the Official Speed Trial, endurance, ship handling at sea and performance tests, manoeuvring test, crash stop test, astern running test / emergency steering test, anchoring tests and other tests as stated in this Paragraph. This programme must be submitted to MD in not less than 14 working days before the trials commence. The notification for Official Sea Trial shall include documentary evidence acceptable to the Government that the Vessel is safe to go to sea for the intended tests and trials specified in the Contract (including the inclining experiment report as mentioned in Paragraph 3.3.5 of this Part and approved by the RO).
- 1.7.2 Like all other tests and trials to be conducted as part of the Technical Acceptance, the Contractor is required to carry out the full Official Sea Trial in Hong Kong at its own expense (including the expense of fuel, lubrication oil, crew and other necessary expenses), in the presence of MD officer(s) and the consultant. The Contractor shall observe the local requirements on navigation before the sea trial, including the third party insurance in accordance with the laws of Hong Kong.
- 1.7.3 The Contractor shall provide to MD or GNC officers, the name, post, duty and experience of each one of the Contractor's staff on board the Vessel during the Official Sea Trial to ensure the safe operation of the trial. The number of persons on board during a particular test or trial has to be agreed by the MD/GNC officers. The location of each person on board (which can affect the centre of gravity of the Vessel under trial) will need to be first agreed by the GNC.
- 1.7.4 The Contractor shall provide a trial report to GNC after completion of the above tests. The report shall contain information regarding the method of test, engine(s) running condition, sea, weather and wind conditions, Vessel loading condition, the heeling angles (steady or varying as the case may be) during each forward turning manoeuvre, and any other relevant information as required by GNC or GNC appointed consultant during the tests; and such information shall be prepared in a format agreed by GNC.
- 1.7.5 Official Speed Trial
- (a) The Official Speed Trial shall be carried out in the Hong Kong Waters.
 - (b) As part of the Technical Acceptance, the Contractor shall carry out the Official Speed Trial in the presence of GNC officers or their appointed agents.
 - (c) The actual mean speed of the Vessel (i.e. NOT theoretical) shall be measured during the Official Speed Trial runs to determine if the Contract Speed can be achieved. The speed calculations must NOT be corrected by wind, wave, tidal current, shallow water effects and weather condition.
 - (d) The actual mean speed shall be calculated as the arithmetic mean of not less than FOUR continuous runs, i.e. TWO runs in each direction. The speed for each run shall be taken by measuring the time of the Vessel running for one nautical mile between two poles or other measuring method acceptable to MD.
 - (e) The Contract Speed is considered not achieved if the Contract Speed cannot be attained during the Official Speed Trial after a total of FIVE runs in each direction.
 - (f) The Contract Speed to be achieved by the Vessel in the Official Speed Trial shall be at speed of not less than **24** knots with the engine power at **100%** Maximum Continuous Rating (MCR) and the Vessel under Official Speed Trial Conditions as stated in Annex 5 to this Part. If the

Vessel fails to achieve the speed of **24** knots under the aforesaid conditions, the Government will deem that the Vessel has failed to pass the Official Speed Trial and therefore fails Technical Acceptance.

- (g) The instrument use in measuring the Contract Speed for the Official Speed Trial shall be provided either by:
 - (i) the Contractor provided that the speed measuring device has been calibrated by a certified body in Hong Kong acceptable to GNC; or
 - (ii) Global Positioning System (GPS) supplied by the Government.
The GPS or Differential Global Positioning System (DGPS) which is properly calibrated (with supporting calibration documents) and installed on board the Vessel and is acceptable to GNC; or other speed measuring methods acceptable to GNC.
- (h) The Vessel must be in the trial conditions (see Annex 5 to this Part for the conditions of the trials) during the Official Speed Trial. All Equipment shall also have been passed the Technical Acceptance and be in operation during the Official Sea Trial.
- (i) The information including but not limited to the speed, time of the day, engine running conditions and sea condition shall be properly recorded by the Contractor, and signed as witnessed by GNC surveyor (or GNC representatives) during the Official Sea Trial. A copy of the Official Sea Trial Report as required in Paragraph 1.7.6 below shall be given to GNC before Delivery Acceptance.
- (j) Upon successful completion of the Official Speed Trial in Hong Kong, the Contractor shall arrange GNC officers to carry out hull bottom inspection on the Vessel to check for any hull damage before delivery.

1.7.6 The following tests shall be conducted as part of the Technical Acceptance and the testing results shall be recorded and form part of the Official Sea Trial Report:

- (a) Endurance Test
The Endurance Test shall be carried out for different engine loading and speeds to obtain the speed/fuel consumption curves (or data) for the Vessel, with the engine(s) operating within the manufacturer recommended engine operating conditions. The test results shall be recorded in accordance with the requirements stipulated in Annex 5 to this Part. The report submitted shall include a curve or curves showing ship speed versus propulsion engine(s) rpm and power, with particulars of the vessel loading and displacement in the test(s).
- (b) Manoeuvrability Test
Forward turning circle tests to port and starboard sides shall be carried out with
 - (i) **both** engines running, and
 - (ii) **single** engine running.The minimum time for turning to both sides at 15°, 90°, 180°, 270° and 360° shall be recorded.
- (c) Crash Stop Test
The minimum time and distance achievable by the Vessel when running from full ahead to stop, and then to full astern shall be determined at the Crash Stop Test.
- (d) Astern Running Test / Emergency Steering Test
The maximum astern running speed achievable by the Vessel shall be determined by the test. Also an emergency steering test shall be carried out to ascertain satisfactory emergency steering operations.
- (e) Starting Tests for Main Engines and Electric Generator Engines
- (f) Anchoring Test
- (g) Noise level test as per the requirements in Paragraph 4.1.2(i)(i)(3) of Chapter 4 of this Part.
- (h) Megger test as mentioned in Paragraph 8.3.6 of Chapter 8 of this Part.
- (i) Performance test to check if the percentage of roll reduction achieved by the gyro stabilizer is in compliance with that stated in the Paragraph 4.20.3.

1.8 Acceptance and Delivery

1.8.1 Acceptance of the Vessel (including all Equipment) is to be carried out in two parts:

Part 1: Technical Acceptance

Part 2: Delivery Acceptance

1.8.2 Technical Acceptance

- (a) All tests trials and experiment as required in this Part VII shall be conducted as part of the Technical Acceptance including the Official Sea Trial as mentioned in Paragraph 1.7.5 of this Part, all tests and trials as listed in Paragraph 1.7.6 of this Part, the inclining experiment as mentioned in Paragraph 3.3.5 of this Part, the bench acceptance test and on-site commissioning test for ENE as mentioned in Chapter 9 of this Part, and all other inspections, tests and trials to determine whether or not the Vessel including the Equipment has been supplied in accordance with all the specifications set out in these Technical Specifications.
- (b) All electronic items and their installations shall be approved and inspected by EMSD as part of the Technical Acceptance.
- (c) The Contractor shall supply all necessary equipment and labour at its own cost for carrying out the tests and trials stated in Paragraph 1.8.2(a) above.
- (d) If the Vessel cannot pass all of the tests comprised in the Technical Acceptance by the Delivery Date specified in the Contract, the options available to the Government are set out in Clause 12 of the Conditions of Contract and other applicable provisions of the Contract.

1.8.3 Delivery Acceptance

- (a) The Vessel, after its successful completion of Technical Acceptance, shall be delivered at the Contractor's expense to the Government Dockyard.
- (b) Certificate of class (without conditions) for the Vessel with notations as specified in Schedule 9 shall be issued by the RO before the Acceptance Certificate is issued by the Government.
- (c) The Delivery Acceptance of the Vessel shall be carried out by GNC in accordance with the terms stipulated in the Contract. The Delivery Acceptance is only completed when the Acceptance Certificate is issued by the Director of Marine.
- (d) The Contractor must demonstrate to MD that all hull construction, outfitting, vessel stability, machinery, electrical and electronic equipment are in good working order; and must hand over the Vessel, its fixtures and Equipment to MD in good and complete condition.
- (e) Not later than six weeks before the Delivery Acceptance of the Vessel, the Contractor is required to submit to GNC four copies of the Inventory List covering all items of or relating to the Vessel including all Equipment, Spare Parts, Deliverables, manuals, documentation, stores, and equipment for testing in respect of the entire Vessel. The Inventory List shall be approved by MD seven days before the day of Delivery Acceptance and covers everything which the Contractor is required to deliver under the Contract. At the Delivery Acceptance of the Vessel, the approved Inventory List will be used to check that all the items have been delivered to MD in a satisfactory state. Details of each inventory item shall include: item name, description, type, quantity, manufacture's name and contact details, part reference number and/or serial number, and the items' locations in the Vessel.
- (f) The items specified in Paragraph 10.2 of Chapter 10, and all items set out in the Inventory List in the form as approved or stipulated by the Government shall be delivered to MD at the Delivery Acceptance of the Vessel. The Contractor must provide 14 days advance notice in writing for Vessel delivery when the Vessel is considered to be completed in accordance with the Contract and Ready for Use and to be delivered for the Delivery Acceptance. The Government will not accept delivery if after undergoing the tests and trials in the Technical Acceptance, the Government does not consider that the Vessel is in Ready to Use condition.
- (g) On delivery, the Vessel must be in a clean, tidy and fully fitted and operational condition.

1.9 Warranty Services During the Warranty Period

- 1.9.1 Notwithstanding and without prejudice to the Contractor's obligation to provide the Warranty Services for the Vessel under the Conditions of Contract, the original copy of the manufacturer's warranty certificates and all related manuals and documents in respect of all the Equipment valid for 12 months from the date of Acceptance Certificate of the Vessel, shall be delivered to MD upon Delivery Acceptance.
- 1.9.2 The full scope of the Warranty Services is set out in Annex 1 to this Part.
- 1.9.3 The Contractor is responsible for arranging the Vessel for Guaranteed Slipping at the end of the 12-month Warranty Period. In addition to any defects which the Contractor may be required to fix under Clause 18 of the Part IV (Conditions of Contract), the Contractor shall also be responsible for the rectification of any defects found in the course of Guaranteed Slipping. The full scope of the Services to be provided as part of the Guaranteed Slipping is set out in Annex 1 to this Part.

1.10 Support Services

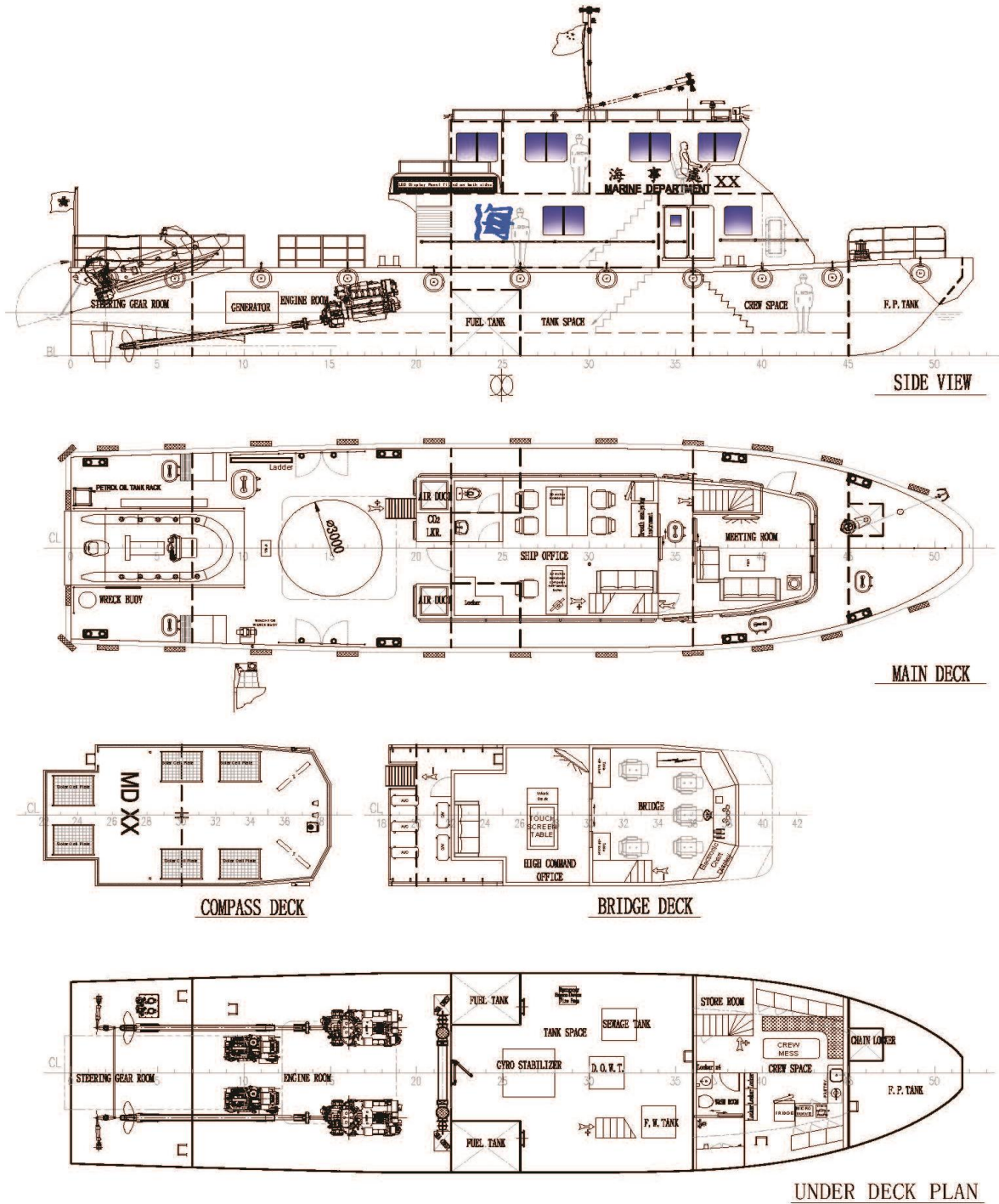
- 1.10.1 The Vessel must be designed for through life support and easy maintenance in Hong Kong based on an operation profile and minimum life expectancy as mentioned in this Part VII.
- 1.10.2 The above applies not only to main engines but also to all other Equipment installed in the Vessel. Support and maintenance services/agents must be available (i.e. serviceable) in Hong Kong in respect of all Equipment installed in the Vessel and return of the whole or part of the Equipment to the original place of manufacturer or supplier shall not be necessary in order to carry out any repair work.

1.11 Asbestos Free

- 1.11.1 The Vessel must not contain any asbestos or asbestos containing materials. The Contractor must comply with the Hong Kong Air Pollution Control Ordinance (Cap. 311), Part X. The Contractor shall engage a service supplier approved by one of the ROs or other entities acceptable by MD to verify that there is no asbestos on the Vessel. An asbestos free certificate or a statement of compliance issued by the service supplier to this effect shall be provided upon delivery of the Vessel.

Chapter 2 - General Technical Requirements

2.1 Conceptual General Arrangement Plan



2.2 General Provisions

- 2.2.1 Without prejudice to the generality of Chapter 1, this Chapter contains the more particular technical specification for the Vessel. The significance of Essential Requirements is explained in Paragraph 1.1 of Chapter 1 above.
- 2.2.2 The work to be done under this Contract consists of the design, construction, outfit, testing and delivery of three (3) aluminium alloy Harbour Patrol Vessels for the Marine Department. Workmanship, functions, characteristics and performance shall be in accordance with this Part VII, best marine construction practices, and the regulatory standards herein specified or otherwise applicable.
- 2.2.3 The Contractor is required to exercise its professional expertise and knowledge to come up with an appropriate design for the Vessel which can comply with all requirements of the Contract. The Conceptual General Arrangement Plan shown above only serves as guidance and is a reference drawing to help to explain the requirements stated in this Part VII.
- 2.2.4 During the design and construction of the Vessel, the Contractor is required to submit a detailed General Arrangement Plan (GA Plan) for GNC approval and acceptance. Where the Contractor has submitted a preliminary General Arrangement Plan during the tendering stage in Schedule 7 (“Preliminary GA Plan”), unless the Government otherwise directs, the GA Plan to be submitted after the Contract award shall incorporate those features set out in the Preliminary GA Plan. Requirements in these Technical Specifications that the GA Plan shall follow the “Conceptual General Arrangement Plan” in these Technical Specification shall be changed to follow the Preliminary GA Plan instead if in the opinion of the Government, the relevant aspect of the Preliminary GA Plan submitted by the Contractor is better than the Conceptual General Arrangement Plan, but not otherwise.
- 2.2.5 For all other plans and information to be submitted including those specified in Annex C to these Technical Specifications, the Contractor shall ensure that they incorporate the plans and information submitted as Excess Proposals in Schedule 7 and accepted by the Government including those design features specified in the Preliminary Construction Plan and the Preliminary Control Console Design, if any.
- 2.2.6 ALL the machinery, equipment and facilities, furniture, fixtures and fittings, including outfitting of the Vessel that are described in this Part VII, together with their requirements for design and installation standards that are stipulated in this Chapter and in any other parts of this Part VII, are the items that must be included in the complete “As-built” Vessel delivered to the Government.

2.3 Rules and Regulations

- 2.3.1 The Vessel shall be designed and constructed in accordance with the latest edition of the rules and regulations of the RO. The Tenderer shall state in Schedule 9 of Part V which Recognised Organisation and its rules and regulations and class notation shall be used in the design and construction of the Vessel. [E]
- 2.3.2 The Vessel shall be classed with one of the RO in 2.3.5 (a) to (i) with class notations as follows or equivalent:
- | | |
|-------|--------------------------------------------------|
| ABS | ✘A1 ✘AMS Circle E HSC CREWBOAT |
| DNVGL | ✘1A, HSLC, PATROL R3, EO |
| LR | ✘100A1 SSC PATROL MONO HSC ✘LMC HONG KONG WATERS |
| RINA | PC ✘ PATROL INSHORE NAVIGATION |
- 2.3.3 The Vessel is required to be issued with certificate of class (without conditions) with notation by the relevant RO. All plans, particulars and documentations which are required for the classification of the Vessel, in addition to those listed in Annex 3 to this Part shall be approved by the relevant RO before submission to GNC for endorsement and final approval prior to commencement of work. Any subsequent modifications or additions shall be treated in the same manner.
- 2.3.4 The Contractor shall design, build and supply the Vessel in full compliance with the requirements given in this Part VII which, to that extent, may be over and above what is normally required by any statutory and RO’s rules and regulations. Should there be any contradiction between the rules and regulations of

the RO and this Part VII, the final decision shall rest with GNC.

2.3.5 Without prejudice to the general requirements that the Contractor shall perform all Work in full compliance with all applicable laws and regulations, and in full compliance with the requirements of the Contract including this Part VII, the construction of the Vessel must comply with the requirements of the RO specified in Schedule 9 or the requirements of any of the RO listed below (where it is expressly specified in this Part VII in relation to a particular requirement, another RO which is any one of the ROs listed in sub-Paragraphs (a) to (i) below may be designated for compliance with the relevant requirement), and also the requirements further specified in sub-Paragraphs (j) to (o) below:

(a)	American Bureau of Shipping	ABS
(b)	Bureau Veritas	BV
(c)	China Classification Society	CCS
(d)	Det Norske Veritas Germanischer Lloyd	DNVGL
(e)	Korean Register of Shipping	KR
(f)	Lloyd's Register	LR
(g)	Nippon Kaiji Kyokai	NK
(h)	Registro Italiano Navale	RINA
(i)	Russian Maritime Register of Shipping	RS

and other entities as specified below:

- (j) International Electrotechnical Commission (IEC) Regulations for the Electrical and Electronic Equipment.
- (k) International Telecommunications Union recommendations in the International Radio Regulations (ITU-R).
- (l) Quality and standards of the welding shall comply with the rules of one of the ROs listed in sub-Paragraphs (a) to (i) above or American Welding Society (AWS) or other applicable international standards or rules
- (m) International Regulations for Preventing Collisions at Sea 1972, as amended by International Maritime Organization (IMO) Resolution as applicable to Hong Kong.
- (n) ISO 12215-4 “Small craft – Hull construction and scantlings – Part 4 Workshop and manufacturing”.
- (o) All equipment/fittings shall be designed and manufactured to at least the standards as specified in these Technical Specifications. When none of the rules and regulations in Paragraphs 2.3.4 (j) to (n) above are applicable, then the applicable standards specified by the applicable organisations below shall be complied with:

BSI	British Standards Institute
GB	Standardization Administration of the People’s Republic of China
IEEE	Institute of Electrical and Electronic Engineers
ISO	International Organization for Standardization
JIS	Japanese Industrial Standards

In the event of any inconsistency amongst the above requirements, rules and standards, those mentioned in sub-Paragraphs (j) to (o) shall prevail over the requirements of the relevant RO as listed in sub-Paragraphs (a) to (i) above.

2.4 Contract Speed

- 2.4.1 The Contract Speed shall not less than **24** knots when both of the main engines running with the output power at **100%** of Maximum Continuous Rating (MCR) under the Official Speed Trial Conditions as stated in Annex 5 to this Part. [E]
- 2.4.2 The Contract Speed prescribed above shall be achieved without porpoising, or other dynamic instabilities. The propeller selected shall match the engine profile and avoid cavitations as far as possible.
- 2.4.3 The Vessel shall also be designed for loitering operations, at Vessel speeds of 5 knots maximum with both port and starboard engines in running condition. [E]

Official Speed Trial Condition	Requirement (continuous operation)
Contract Speed	Not less than 24 knots @ 100% MCR
Loitering speed	5 knots maximum (maintain for 15 minutes)

2.5 Principal Dimensions

General Requirements	Mono-hull	[E]
Length Overall (LOA):	24 metres – 26 metres (Fenders included)	[E]
	It is desirable specification that the LOA (Fenders included) is within the following range: 26 metres < LOA ≤ 26.4 metres	
Maximum Breadth:	5.5 metres – 6.5 metres (Fenders excluded)	[E]
Depth:	Design to suit (Freeboard equal to or smaller than 1.4 metres)	
Extreme Draught:	Not more than 1.7 metres	[E]
Restricted dimensions:	Nil	

2.6 Material of the Structure

Material of Hull & Superstructure:	Marine Aluminium Alloy	[E]
------------------------------------	------------------------	-----

2.7 Vessel Operating Profile and Environment

- 2.7.1 The Vessel shall be designed for deployment on at least 320 days per year with provisions for overnight voyages for the use by the Harbour Patrol Section (HPS) of the Marine Department. The Vessel shall be designed and built to operate in Hong Kong Waters. Typical service areas include: South of Lamma, Po Toi, Ninepin Island and Soko Island etc.

Summary of Operational Hours / Range

Number of hours/day:	24 hours/day	
Number of days/year:	320 days/year	
Endurance for fuel capacity:	at least 12 hours at 24 knots and 36 hours at 5 knots with 10% margin or 6,000 litres in total capacity	[E]

- 2.7.2 The Vessel shall be able to operate safely within the Hong Kong Waters in weather conditions up to and including the conditions equivalent to Beaufort wind force scale (“Beaufort scale”) number **7** and Sea State **6** set out in Annex 7 to this Part.

- 2.7.3 Total carrying capacity of the Vessel is 22 persons including 6 crew to operate the Vessel. [E]

- 2.7.4 Ambient Conditions - All machinery, equipment, systems shall still be capable of operating at their full design performance under the following environmental conditions:

External air	: + 40 °C	
Internal air	: + 20 °C	
Machinery space	: ≤45 °C	(All equipment at full rated power)
Maximum seawater temperature	: + 30 °C	

2.8 Arrangement of Deckhouse and Compartments

- 2.8.1 The Conceptual General Arrangement Plan in Paragraph 2.1 above gives a conceptual layout of the desirable deckhouse and compartments arrangement on main deck and under-deck of the Vessel for reference. The Contractor is required to submit its own design in details for MD’s approval.

The deckhouse compartment consists of four parts.

- (a) Bridge
- (b) High Command Office
- (b) Ship office
- (c) Meeting Room

2.8.2 Hand rails and grab rails shall be provided with to secure the persons in position safely while the Vessel is at the Contract Speed.

2.9 Markings and Colour Scheme

- 2.9.1 Markings and colour scheme for the Vessel shall be provided by the Contractor. Colour scheme shall be approved to GNC before application. All painting colour scheme for fittings shall be agreed by GNC.
- 2.9.2 All labelling shall be both in Chinese and English and as per applicable rules and regulations. The user department logo shall also be displayed on both sides of the deckhouse or elsewhere as directed by MD officers.
- 2.9.3 The Vessel's name shall be permanently marked on both sides of the bow and the transom centre to MD and user department's satisfaction. Draught marks at bow & stern and Plimsoll Disc shall also be marked at both sides of the vessel in the same manner as the vessel name. Vessel's identification shall be marked as large as possible at the deckhouse top for helicopter viewing.
- 2.9.4 All labelling, stencilling and marking (not limited to the hull but including all aspects of the Vessel) shall be made on separate plaques, boards or labels attached to the structure. By default all displays, control actuators, electric switches, valves, and other equipment shall be labelled to indicate their type and function as appropriate.
- 2.9.5 Exits shall be identified and labelled. Stowage locations for life jackets and quantities of life jackets contained therein shall be identified.
- 2.9.6 Safety markings for the prevention of person tripping in the Vessel shall be provided where necessary.

2.10 Tally Plates

- 2.10.1 The following information shall be displayed on the builder's plate.
- (a) Builder's name;
 - (b) Vessel's name;
 - (c) Year of build; and
 - (d) Maximum number of persons including the crew that the Vessel is designed to carry.
- 2.10.2 Tally plates in both English and Chinese characters shall be fitted for all spaces and all equipment as required by MD including but not limited to:
- (a) Equipment in the console;
 - (b) Electrical and communication equipment;
 - (c) Air vents and filling pipes for the fuel oil tanks;
 - (d) All valves, equipment on deck;
 - (e) Control panels, switchboards, distribution boxes and electrical circuits; and
 - (f) Any other equipment/fitting as required.
- Information engraved on the tally plates shall include: service, function, mode of operation, source of power, fuse rating, voltage and warning and other information as required by MD.
- 2.10.3 Tally plates exposed to weather shall be made of durable and weatherproof material and be securely fastened.
- 2.10.4 List of tally plates shall be provided as directed by MD.

2.11 Other Design Features

- 2.11.1 Berthing requirement of the Vessel shall match with the designated point of berth at Government Dockyard.
- 2.11.2 Permanent list is not allowed, and where it is not practical to achieve this requirement, the maximum permanent list of the Vessel in its lightship condition must not be greater than 0.5 degree.
- 2.11.3 Permanent ballasts can only be used as agreed by GNC. The contractor should note that it shall be under a very exceptional case that GNC would agree for the Vessel to have ballast installed.
- 2.11.4 The Vessel shall be free of unacceptable structural vibrations and free of excessive pitching at all speeds so that there is no loss of directional control.

Chapter 3 - Hull and Deckhouse

3.1 General Provisions

- 3.1.1 The strength of the hull structure shall be calculated based on the vertical acceleration at the longitudinal centre of gravity (LCG) being approved by RO while fulfilling the Contract Speed specified in Paragraph 2.4.1 of this Part VII with a mono-hull form and the hull structure shall be constructed in marine aluminium alloy.
- 3.1.2 The Vessel's design stresses and load (wave height versus speed), maximum acceleration considered and scantlings calculation including internal structural members shall be designed according to the rules as stipulated in Paragraph 2.3.4 of this Part VII. It shall be capable of withstanding stress coming from wave impact and operation environment conditions.
- 3.1.3 Any openings in hull and deck shall comply with the applicable RO's rules for watertight integrity if not otherwise specified by MD at or prior to the kick-off meeting.
- 3.1.4 Hull construction materials shall be new and of a type which has been certified by the RO or other entities acceptable to GNC for shipbuilding purposes.
- 3.1.5 All material and build processes for marine aluminium alloy shall comply with an approved standard. This shall recognise the vessel through life cycle and service conditions for ease of repair in the event of hull damage.
- 3.1.6 Records of the structural materials used for vessel construction and up-to-date copies shall be provided to RO surveyor and GNC's site representative for inspection during the construction stage of the Vessel. Materials for composite structures construction shall be traceable to ensure quality, and follow good materials handling procedures, for example: workshop conditions, material storage and handling, and requirements for the manufacturing of the craft.
- 3.1.7 Major penetrations or access openings through the transverse hull bulkheads below the main weather deck level shall be avoided as far as possible. Cable penetrations shall be located as high and as far inboard as possible. Any and all penetrations through bulkheads below the main deck shall be fitted with RO approved devices and be so arranged to ensure the bulkhead to be entirely watertight and strength maintained.
- 3.1.8 Weather-tight deckhouse located above the main deck shall, in their outside boundaries, have means of closing the openings, and such means shall be of sufficient strength and be of a design to maintain weather-tight integrity in all operational conditions.
- 3.1.9 Close attention shall be paid to the fabrication and installation of machinery foundations to insure rigidity of the foundations and their structural continuity with adjacent structure.
- 3.1.10 Strength shall be maintained by ensuring hull structural continuity of main members including bottom and deck girders and transverse web frames. Where the strength of a main structural member is impaired by cuts or interruptions in continuity, efficient means of compensation shall be fitted. Special care shall be given to reinforcing the hull in way of the fenders and areas likely to experience slamming.
- 3.1.11 The keel structure shall be arranged to accommodate Vessel's dry docking and lifting requirements in the Government Dockyard in Hong Kong
- 3.1.12 All welding and fabrication shall be carried out according to the rules of an RO to be appointed to overseeing the construction work for example, "Lloyd's Register Rules and Regulations for the Classification of Special Service Craft Part 7 – Hull Construction in Aluminium" or American Welding Society (AWS) or other international standards acceptable to MD. Welding scheme shall be approved by the RO before work is carried out.
- 3.1.13 Welded joints shall be carefully designed and constructed to conform to the latest established standards to prevent fatigue failure. Cutting for edge preparation shall be performed by qualified person to achieve correct angle, shape and smooth finish of the edges. Only qualified welders shall perform the welding work.
- 3.1.14 Certification of the qualifications of each individual welder and inspector shall be submitted to GNC by the Contractor. Welds carried out by unqualified procedures or welding performed by non-certified

welders shall be removed by the Contractor at his own expense. The structural fabrication shall include but not be limited to the following:

- (a) Inventory of incoming material, consumables components and machinery;
- (b) Traceability procedures for materials together with traceability identification codes which shall be serial and indexed to the controlled manufacturing procedures;
- (c) Lofting, cutting, fitting, welding, forming and dimensions of structural components, measures shall be taken to avoid deformation of structure during fabrication and welding;
- (d) Welding and inspection procedures identifying clearly the type and extent of Non-Destructive Test (NDT) inspection carried out on the Vessel structure as per relevant RO Rule. GNC may extend the NDT deemed to be necessary subject to the quality of the welding. The Contractor shall submit a NDT inspection plan to GNC for approval before inspection. NDT shall be carried out by an agent approved by the national authority or RO and the agent shall submit an inspection report to GNC via the Contractor on their findings;
- (e) Welding, machining, measuring and inspection equipment maintenance and calibration;
- (f) Machining, finish surfaces, bolting;
- (g) Procedures for work quality non-conformance reporting and records of rectification of defects;
- (h) The design and manufacturing drawing control procedures, including any of its revisions and updates, and records for any re-issue of drawings.

3.2 Hull and Deckhouse Structural Requirements

3.2.1 General for Hull Structure Material and Build Process

- (a) All materials used in the construction shall be agreed by GNC prior to construction.
- (b) The keel structure shall be arranged to accommodate vessel's dry docking and lifting requirements in the Government Dockyard in Hong Kong.

3.2.2 Workmanship

- (a) Trunks, coamings, and deck cuts where applicable shall have radius corners as large as possible.
- (b) Fittings and openings through decks and bulkheads for pipes and cables shall be properly designed to maintain watertight integrity, reduce transmission of heat, and to minimise transfer of machinery vibration and noise to the hull structure.
- (c) Limber and vent holes shall be cut as necessary to ensure proper venting and drainage of all tanks, compartments, pockets, and voids. All tanks shall have limber holes and vent holes of adequate size for full capacity flow to suction and vent lines. There shall be no pockets where water or other liquids can be trapped at any normal list or trim to be encountered in service.
- (d) Sharp corners shall be avoided.

3.2.3 Tightness

- (a) Tanks shall be tested by pressurizing to the equivalent of a head of water from the tank bottom to one metre above the top of the vent loop subject to RO requirements. If pressurized by air, all fittings and welding shall be checked by application of a soap solution. No leakage is permitted. During testing, tanks shall hold their pressure without leakage for six hours.
- (b) The weather-tightness of any fittings on the weather deck and deckhouse shall be demonstrated by directing a water stream from a 12 mm diameter nozzle at all parts of the exterior including all windows, doors, and hatches. The nozzle shall be 1.5 metres or less from the fitting being tested, and the water pressure at the nozzle shall be at least 4 bar. Any leakage will be considered to be a failure of the test and corrective measures shall be taken.
- (c) Chalk tests to be carried out if the above two methods are not applicable.

- (d) All structures and fittings shall withstand the tests described above, without deflection greater than 10 mm per metre of span or any permanent set. Any weakness shall be rectified at the expense by the Contractor.

3.2.4 Fairing

The hull and deckhouse side wall shall be fair, and shall be free from objectionable buckles or uneven sight edges. Special care shall be used in aligning and fairing of surfaces which shall be joined.

3.2.5 Hull Decks and Stiffness

All decks, platforms and walking flats shall be sufficiently reinforced to prevent deflection that might be caused by an individual walking or standing on the deck and/or by structural flexure of the hull and/or deckhouse. Structures under or behind fittings shall be adequately strengthened to withstand the load exerted by or on the fittings.

3.2.6 Main Deck

The main deck (and where relevant cabin roof) shall be fitted with watertight hatches for removal of main engines and generators.

The deck area shall have a camber at 1/50~1/80 of the beam of the deck edge and may slope up towards the bow at forward part.

3.2.7 Hull Platforms and Flats

- (a) Adequately secured grating shall be provided as required and to GNC's satisfaction. Removable grating shall be provided where required for access to valves, equipment, bilge pickups, and to other systems below.

3.2.8 Through-Hull Fittings

- (a) Through-hull fittings shall be located in convenient locations for maintenance purposes, as required for equipment listed in this specification. The number of through-hull fittings shall be kept to minimum.
- (b) If required, all through-hull fittings located below the waterline shall be fitted with shut-off valves fabricated of metal and having suitable corrosion protection, such as cathodic protection. All shut-off valves shall be RO approved type.
- (c) The hull external shell surface below the waterline where through-hull fittings are located shall be fitted with external fairings/screens to minimise drag.

3.2.9 Hull Structural Closures

- (a) Inspection hatch shall be provided on each fuel oil tank. The inspection hatch shall be sized to allow proper inspection of the entire tank interior. The inspection hatch shall have gasket covers secured by stainless steel bolts and self-locking nuts.
- (b) Access to hull compartments from the main deck shall be provided by watertight deck hatches. All access closings shall be able to be opened and closed at both sides.
- (c) Emergency escape access shall be provided for hull compartments for RO and GNC approval.
- (d) Flush deck hatches fitted with waterproof soft patch or gasket shall be provided for engine and equipment removal or maintenance purposes. Soft patches shall be secured properly and to GNC's satisfaction.
- (e) Flush watertight deck hatches shall be installed for the access to fore peak/after peak tank/ Oil-water tank from main deck.
- (f) Hinged hatch covers shall be provided with means to hold them in the fully opened position. A protective device should be installed to prevent the crew from accidentally dropping into the opening after opening the hatch.

3.2.10 Deckhouse Closures

- (a) The weather-tight door (with a minimum 700 mm x 1750mm clear opening) complied with the requirements of RO shall be provided for access into the deckhouse.
- (b) The door giving access to the deckhouse shall have a coaming as per RO's regulation above the finished main deck surface.
- (c) Appropriate locking devices shall be provided for all access doors.

- (d) Opening on deck and closing hatches shall be provided and maintaining the structural strength of the deck structure. Deckhouse shall be so designed to facilitate the removal of engines and equipments to shore for maintenance and repair.
- (e) The door in the deckhouse shall have clear toughened safety glass windows.
- (g) A weather-tight door (with a minimum 650 mm x 1750mm clear opening) shall be installed for ship office to provide access to aft deck space.

3.2.11 Freeboard Area

- (a) Exterior surfaces of the Vessel above the fully loaded draught shall be painted and prepared to a satin finish/appearance/texture.
- (b) Antifouling paint shall be applied by the Contractor to paint manufacturer and GNC satisfaction.
- (c) Wherever paint is used, the Contractor shall propose a suitable paint specification in conjunction with a preferred paint manufacturer for GNC's approval. Painting report prepared by the paint supplier should be submitted to GNC for record.
- (d) All coatings shall be applied as specified by the manufacturer including temperature and humidity at time of application, coverage/rate, wet and dry film thickness, recoat time and application equipment and rate, etc.

3.2.12 Hull Preservation

- (a) The Vessel shall be painted externally with a paint process which can be guaranteed for a minimum of two years' service life by the paint manufacturer. Paint shall be used on surfaces as directed by GNC.
- (b) Painting Schedule shall be proposed by the Contractor in consultation with the paint suppliers/manufacturers and submitted for GNC agreement and approval.
- (c) All materials used for painting of the Vessel internally and externally shall be agreed by GNC and shall not have adverse effects to the environment and the health of persons onboard.
- (d) Painting report for the complete Vessel on delivery and after warranty slipping shall be prepared by the paint supplier and submitted to GNC.

3.3 Stability and Subdivision

3.3.1 The Tenderer shall before the Tender Closing Date submit with its tender a Vessel proposal engineering and stability package that clearly defines the Vessel's performance, structural and operational capabilities. This package shall contain:

- (a) The Preliminary Lines Plan of the Vessel and the preliminary stability information and calculation with the curves of stability, including damaged stability for each compartment of the Vessel shall be submitted with the tender by the Tender Closing Date. All calculations shall be carried out by using a proven computer system, with evidence (viz. recognised by a Government Authority or Recognised Organisation). [E]
- (b) Weight and Center of Gravity prediction calculations with breakdown for the Vessel. All calculations shall be carried out by using a proven computer system, with evidence (viz. recognised by a Government Authority or Recognised Organisation). [E]
- (c) The Preliminary Construction plan - midship, deckhouse, profile and deck, bulkhead and stern of the Vessel. All calculations shall be carried out by using a proven computer system, with evidence (viz. recognised by a Government Authority or Recognised Organisation). [E]
- (d) A Preliminary estimate of the fore and aft draught and the position of the centre of gravity (longitudinal, transverse and vertical) of the proposed design for the Vessel in its lightship, sea trial and full loaded conditions, noting the importance of the vessel remaining trim and heel free during operation. All calculations shall be carried out by using a proven computer system, with evidence (viz. recognised by a Government Authority or Recognised Organisation). [E]

The calculations shall be carried out by using a proven computer system, with evidence (viz. recognised by a government authority or a RO). The Contractor shall further develop and refine the above package upon commencement of the Contract and seek the written approval of the Government of such revised package. All calculations and drawings must be in metric units.

3.3.2 The Vessel is required to comply with the intact and damaged stability requirements stated in this Part.

3.3.3 A final stability assessment of the sea trial loading condition using final lightship data shall be delivered to MD prior to the Official Speed Trial mentioned in Paragraph 1.7.5 of this Part VII.

3.3.4 Inclining Experiment

- (a) An inclining experiment shall be carried out, with the attendance of MD officer(s) and/or appointed consultant, according to the guidance of Annex I of IMO Resolution MSC.267(85) in conducting such an inclining experiment, to determine the lightship weight and the position of the centre of gravity of the Vessel.
- (b) At least 7 working days in advance of the inclining experiment, the "Scheme of Inclining Experiment" ("Scheme") shall be approved by the RO and submit to GNC for reference. The Scheme shall include:

- (i) the Vessels' intended condition during the inclining experiment with intact stability results, including surplus and missing weights, and their centre of gravity;
- (ii) the proposed locations and movements of inclining weights;
- (iii) the calculation of estimated metacentric height, heel and trim of the Vessel before and during the inclining experiment;
- (iv) the proposed number, location and lengths of pendulum used or other methods of measuring heel angles;
- (v) hydrostatic table, and tank capacity tables; and
- (vi) the list of data to be measured (i.e. draughts, specific gravity of floating water).

- (c) The inclining experiment shall only be conducted:

- (i) after the "Scheme of Inclining Experiment" has been approved by the RO surveyors and the MD officers; and
- (ii) in the presence of RO surveyors and MD officer(s) and/or appointed consultant.

The lightship weight and centres of gravity shall be calculated and presented in the inclining experiment report. The metacentric height of the Vessel after each and every shift of inclining weight shall be preliminarily determined. Free surface effects of all liquids on board shall be taken into account in all calculations.

- (d) The inclining experiment report shall be produced and has obtained the RO's approval before submitting to MD for further comments. The report shall include a statement from the Contractor stating that the Vessel is safe to go to sea for the intended tests and trials specified in the Contract. The Vessel must not carry any operational limitations with respect to its stability capability within the operational requirements stipulated in this Part VII. No Official Speed Trials shall be conducted until MD, based on the information given in the inclining experiment report, agrees it is safe to carry out such tests and trials.

3.3.5 Stability Information Booklet

- (a) The Contractor shall supply to MD four (4) copies of the Stability Information Booklet. The Stability Information Booklet must be given to MD at the time of Delivery Acceptance.
- (b) The Vessel shall comply with the stability criteria mentioned in this Part or other applicable IMO regulations (International Code on Intact Stability, 2008). Furthermore, stability due to wind and ship rolling for the required service environment of the Vessel shall be calculated. In addition to the requirements stated above, the booklet in its final version shall include:

- (i) The Vessel's particulars, sketch of general arrangement drawing showing different compartment and tank positions, hydrostatic curves, and cross curves;
 - (ii) Tank calibration/sounding tables include but not limited to fuel oil tank and freshwater tank. These tables shall consist of the locations of tanks (in terms of frame numbers), levels from tank bottom, capacity, VCG/LCG/TCG and free surface moments, and the location of the sounding points. The trim and heel of the Vessel for which these tables are applicable shall be stated clearly;
 - (iii) Stability calculations for each loading condition shall include but not be limited to a profile drawing of the Vessel and items of deadweight, lightship, displacement, drafts, trim, VCG, GM (solid & fluid), LCG, down-flooding angle and maximum static stability - GZ curves;
 - (iv) Any other information as reasonably required by the RO and/or GNC; and
 - (v) The RO approved inclining experiment report shall.
- (c) In the preliminary stability information booklet and in the final stability calculations, the estimated and the final (obtained after conducting an inclining experiment) lightship data shall be used respectively. Both the preliminary and final Stability Information Booklet shall include the following loading conditions (and any other conditions as may be required by MD during the construction of the Vessel) and their stability results shall be presented as per on Intact Stability mentioned in 3.3.6.

Loading Conditions		Fuel oil	Fresh water	Black water	Dirty oil water	Persons & Effects
1	Full Load Departure Condition	98%	98%	10%	10%	22 persons, plus effects
2	Full Load Arrival Condition	10%	10%	98%	98%	22 persons, plus effects
3	Light Load Departure Condition	50%	50%	10%	10%	6 persons, plus effects
4	Light Load Arrival Condition	10%	10%	98%	98%	6 persons, plus effects

- (i) The weight of each person shall be assumed to be 75 kg, and effects per person to be 10 kg.
 - (ii) The VCG of each person shall be assumed to be 300 mm above the seat when seated, and 1000 mm above the deck when standing. The seated or standing position, and LCG of each person, shall be in their most likely position on board.
 - (iii) The maximum free surface moments shall be used for calculating the stability of the Vessel in all the above conditions.
 - (iv) Wind moments in various loading conditions due to Beaufort scale number not less than 7 shall also be considered in the stability calculations.
- (d) The Stability Information Booklet shall be approved by the RO before submitting to MD for comments. The Contractor shall provide MD with four (4) copies of Stability Information Booklet (as built) at no extra cost, which must be given to MD at Delivery Acceptance.

3.3.6 Intact Stability Criteria

Stability and freeboard will be considered satisfactory if the following criteria are complied with, after taking into account of free surface effects and wind moment, for loading conditions as specified above.

$$K = \frac{l_g}{l_f} \geq 1$$

- (a) The weather criterion $K = \frac{l_g}{l_f} \geq 1$;
- (b) The initial transverse metacentric height shall not be less than 0.15 metre.
- (c) Full load state, when the persons are concentrated on one side, the inclination angle should not exceed 12 degrees.
- (d) The permitted speed and rudder angle should be measured when the return angle is less than 12 degrees.
- (e) The maximum righting lever (GZ) occurs at an angle of heel of not less than 25 degrees; If the water inlet angle is less than the corresponding inclination angle of the maximum righting lever, the inlet angle is the corresponding inclination angle of the maximum righting lever.
- (f) The righting lever GZ shall be at least 200 mm an angle of heel equal to or greater than 30 degrees; If the inlet angle of the ship is less than 30 degrees, the righting lever at the inlet angle should not be less than the specified value.

3.3.7 **Tonnage measurement** – The Vessel shall be measured as per International Convention on Tonnage Measurement of Ships (ITC) 1969. Tonnage measurement to be endorsed and approved by RO. RO to issue Certificate of Compliance. (Tonnage certificate is not required)

3.3.8 **Freeboard assignment** - In accordance with RO requirement or International Convention on Load Lines (ICLL) 1966. RO to issue Certificate of Compliance.

3.3.9 Damaged Stability Criteria

- (a) Suitable watertight transverse bulkheads shall be arranged to maintain the stability of the Vessel when any one watertight compartment under deck damaged and flooded, and when there is asymmetric flooding to any one of the under deck compartments. The residual stability of the Vessel shall be considered satisfactory if the following criteria are complied with, after taking into account of free surface effects and wind moment, for loading conditions as specified above.
 - (i) The residual transverse metacentric height shall not be less than 0.05 metre.
 - (ii) The inclination angle should not exceed 10 degrees.
 - (iii) The final water line is located below any inlet opening.

N.B. The inlet opening means an opening through which progressive flooding may take place is immersed. This would not be an opening closed by a watertight manhole cover or a vent fitted with an automatic closure.
- (b) The opening(s) to determine the down-flooding angle(s) shall first be agreed by GNC before carrying out the damaged stability calculations.
- (c) The Damage stability calculation shall be produced and has obtained the RO's approval before submitting to GNC for further comments.

3.4 Paint

- 3.4.1 Paints shall be of a fire-retardant marine quality and applied in accordance with the manufacturer's specification.
- 3.4.2 The Contractor shall propose a suitable paint specification in conjunction with a preferred paint manufacturer for GNC's approval.
- 3.4.3 Volatile Organic Compounds (VOC) content limits of the paints shall comply with the Controls and Requirements of the VOC Regulation (VOC content limits for regulated vessel paints and regulated pleasure craft paints) of the Regulation of Hong Kong Air Pollution Control Ordinance.

- 3.4.4 Painting schedule shall be submitted for MD's approval before commencement of work. The proposal shall contain a list and the detailed specification of the paint intended to be used. Thickness of each coating shall be specified.
- 3.4.5 All painting work shall carry a one-year guarantee provided by the Contractor against defects in material and workmanship. The Contractor shall provide MD at Delivery Acceptance a letter of certification from the paint manufacturer to certify the application of the paint is under the paint manufacturer's quality control and in accordance with the manufacturer's requirements including but not limited to the surface preparation, control of the temperature of the surfaces, atmospheric conditions, paint thickness, and method of application.
- 3.4.6 A Tributyltin (TBT) free fouling-release/anti-fouling paint complies with actual operating profiles of this working vessel shall be applied on the following areas below the water line to provide at least two years protection against the marine growth.
 - (a) Exterior of the hull; and
 - (b) Sea chest, sea chest grate and sea suction pipe.
- 3.4.7 A TBT free certificate issued by the paint manufacturer shall be submitted before the Delivery Acceptance. The fluoropolymer foul release coating/antifouling paint (e.g. Intersleek 1100SR or equivalent) shall comply with the International Convention on the Control of Harmful Anti-fouling Systems on Ships as adopted by the IMO.
- 3.4.8 All deck areas shall be covered with hard wearing and anti-slip epoxy paint.
- 3.4.9 A painting report shall be submitted to MD upon completion of work.
- 3.4.10 Surfaces that require painting shall be fully prepared to meet with paint maker's requirement prior to painting.
- 3.4.11 All fastening preparation and other penetrations shall be completed before painting of any surface.
- 3.4.12 All surfaces and any parts of the hull, deck or machinery, fittings that may cause glare or reflection must be matte powder-coated.

Chapter 4 - General Arrangement

4.1 Arrangement on Main Deck and Under-deck

- 4.1.1 The Conceptual General Arrangement Plan in Paragraph 2.1 of Chapter 2 to this Part only serves as guidance and is a reference drawing to help to explain the tender requirements. It shows a desirable layout of the accommodation and compartment arrangement of the Vessel with following maximum and minimum dimensional guidance considered:

Dimension	Guidance
Side deck walkway width	Minimum 0.7 metre
Clear headroom for bridge, High Command Office, ship office, meeting room and crew space	Minimum 2.0 metre

During the design and construction of the Vessel, the Contractor is required to submit a detailed General Arrangement Plan for GNC's written approval and acceptance.

It is a contractual requirement that ALL the furniture, equipment and facilities, fixtures and fittings, including outfitting of the Vessel that are described in this Part VII, together with their requirements for design and installation standards that are stipulated in this Chapter and in any other parts of this Part VII must be included in the complete "As-built" Vessel delivered to the Government.

The deckhouse comprised of four sections:

- (a) Bridge
- (b) High Command Office
- (c) Ship office
- (d) Meeting room

4.1.2 General Provisions

- (a) External deck spaces shall include:
 - (i) Clean and simple bow deck area for efficient boarding and mooring operation.
 - (ii) Clean and simple aft deck area for efficient boarding and mooring operation.
 - (iii) (1) Walk around deck facility which provides easy access to fore deck or aft deck.
(2) The walking area on deck should be well illuminated in dark environments.
 - (iv) The fore deck geometry of the Vessel shall be carefully designed to facilitate safe boarding/mooring to MD's satisfaction. Adequate geometry can be achieved with the addition of fender mouldings adequately fitted to the Vessel.
 - (v) The fore deck should exhibit a flush deck free of anchoring/mooring equipment.
 - (vi) All exterior deck areas shall be covered by an appropriate anti-slip surface for boarding / landing and deck covering requirements. The anti-slip paint shall not be made of a mix of paint and added grit material ("sand") and shall be to GNC's satisfaction.
 - (vii) The main deck and the top deck external spaces shall be provided with railings along the sides.
- (b) All cabins shall be designed and arranged so as to protect the occupants from weather and sea conditions, and aim to minimise risk of injury.
- (c) Natural light should be allowed as far as possible in the crew space.
- (d) All interior decks shall be vinyl composition tile or sheet, colour to be selected by MD.
- (e) All controls, electrical equipment, high-temperature parts and pipelines, rotating assemblies or any other items in cabins and compartments shall be properly placed not to cause injury.
- (f) Windows
 - (i) All windows shall be manufactured from clear toughened safety glass, secured to the structure and be of any one of the ROs listed in Paragraph 2.3.4(a) to (i) approved type which is suitable and safe for marine use.

- (ii) All bridge front windows and forward part of the side windows and meeting room front window shall be provided with wipers with fresh water washing facilities.
- (iii) Windows shall be strong and suitable for the worst intended operating conditions. Window glass and the frame shall be made of materials which will not break into dangerous fragments when fractured/shattered.
- (iv) All windows of the bridge, High Command Office, meeting room and ship office shall be fitted with curtain.
- (v) A basic layout of the windows is shown in the Conceptual General Arrangement Plan. Details of all windows shall be submitted to GNC for approval. Weather-tight test shall be carried out after windows installation.
- (g) Equipment on board shall be fitted properly to avoid injury to persons at all times either during normal or failure-mode operation, especially when the Vessel moves off quickly or during emergency crash stops, and during ship manoeuvres.
- (h) Furniture and Fittings
 - (i) Built-in furniture shall be adequately secured against ship impacts in case of ship collision or bad weather and sea conditions. All seats shall be strongly secured against 45 degrees of inclination in all directions when all seats are occupied by seated persons. All furniture and seats shall be lightweight, tough and robust. Upholstery such as seat cushion, back rests and settees shall be fire retardant, e.g. urethane foam to BS 3379 or equivalent, and be of thickness not less than 100 mm; and be covered with imitation leather.
 - (ii) Lockers located on the aft part of the deckhouse (one port and one starboard), shall be provided with built-in locks and keys. They shall be designed and fitted to the satisfaction of MD officers.
 - (iii) Drawers shall be provided for storage of charts.
 - (iv) All hardware including but not limited to screws, hooks, hasps, hinges, handles and sliding bolts shall be made of brass with chrome plated finish, or in stainless steel.
 - (v) All fittings and hardware fitted on board the Vessel such as coat hooks, ceiling lights and bulkhead mounted lights shall be of a high quality chrome finish. They shall be properly fitted in the accommodation spaces and any other spaces as appropriate and as directed by GNC officers.
 - (vi) Colour and decoration schemes (or a furnishing sample board showing materials and colour to be used) for furniture and fittings shall be submitted to MD for approval before installation/fitting.
 - (vii) All furniture should be fitted as to allow easy removal of the under-deck machineries and tanks.
 - (viii) Rails, Stanchions
 - (1) Hand rails shall be provided where necessary.
 - (2) Grab rails shall be positioned internally and externally throughout the Vessel to MD satisfaction.
 - (3) Hand rails and grab rails shall be made of high quality stainless steel with SS316.
- (i) Insulation and Lining
 - (i) Insulation:
 - (1) Boundaries and ceilings around the inside of the deckhouse shall be insulated against heat and change of weather temperature, to be fitted with glass-fibre wool of appropriate thickness (minimum **50** millimetres) or equal; and be lined with protective/decorative panel linings of hard wearing surface and water sealing.
 - (2) Boundary of machinery space shall be effectively fire and sound insulated with asbestos-free materials of adequate thickness, pinned and wire-mesh secured, and lined with incombustible sheathing in accordance with requirements of any one of the ROs listed in Paragraph 2.3.4(a) to (i) and acceptable to GNC.

- (3) The noise level in the bridge and High Command Office should not be greater than **75 dB** whereas the noise level for the Meeting room and Ship office shall not exceed **80 dB** when the Vessel is operating at all speeds. The Contractor shall make all reasonable efforts to minimise noise and vibration in the Vessel.
- (ii) Lining:
 - (1) Panels for wall, ceiling and their joint materials shall be readily removable. The joining method shall provide long-lasting firm and strong attachments between the adjoining members and parts against excessive vibration, and withstand temperature changes and wear and tear within the life expectancy of the Vessel. The panels shall be fitted to avoid noise generation due to its own vibration or in resonance response to the overall vibratory mode of the Vessel. This requirement applies to all operational speeds of the Vessel. Within reason, if the noise level is considered unacceptable to GNC, the Contractor shall improve the design and fitting methods of the panel/ceilings. Colour of the lining material shall also be agreed by MD.
 - (2) The deck or floor of bridge, ship office, High Command Office, meeting room and crew space shall be covered with non-skid, wear resistant and fire retardant vinyl PVC sheets that are acceptable to GNC. Colour of the floor covering shall be agreed by MD.
 - (j) Access, Doors, Ladders and Hatches
 - (i) Design of all outfitting including but not limited to doors, hatches, ladders and ventilation heads shall be of a type approved by RO for this type of vessel, or other entities acceptable to GNC.
 - (ii) Detailed specifications of these items shall be provided. They shall include the structural arrangement, scantlings, material and welding procedures. These shall be in accordance with requirements of any one of the ROs listed in Paragraph 2.3.4(a) to (i) or other international standards.
 - (iii) The coaming heights of access hatches shall be a minimum of 300 mm. Where the use of a hatch is not practical, a flush type hatch/manhole approved by RO shall be used.
 - (iv) Where the hatches and doors are used for the purpose of escape, they shall be operable from both sides. All hatches and doors shall be fitted with a hold back device. Hatches for access to the watertight compartments below the main deck level shall be type approved by the RO. Watertight and weather-tight deck hatches shall be of hinged type as far as practical.
 - (v) All deck hatches shall be fitted with a high quality stainless steel or bronze commercial-grade marine-type lock. Three sets of keys shall be provided. All keys shall be tagged for identification.
 - (vi) Hatches and doors shall be fitted with manual means of locking; and shall be able to be quick opened from both inside and outside of compartment.
 - (vii) Door to aft deck shall be RO approved outwardly opening weather-tight type. Doors opening to the side deck shall be of a sliding type with width acceptable to GNC. All doors shall be fitted with hooks or other means to hold them in the fully open position if required.
 - (viii) All exterior doors shall be fitted with high quality stainless steel or bronze commercial-grade marine lever-type locksets. Three sets of keys shall be provided. All keys shall be tagged for identification and all locks shall all be keyed alike.
 - (ix) Stairway slopes shall be acceptable to MD and shall be fitted with handrails on each side. A minimum width of 600 mm shall be provided between the handrails.
 - (x) All hand rails shall be of stainless steel strongly secured to the deckhouse side to provide support for persons on board, to prevent them from falling or being thrown on deck or overboard in deteriorated weather and sea conditions, the design to consider the circumstances when all persons on board are lined up together on one side of the deck in case of an emergency situation at sea.
 - (xi) Vertical ladders, if provided, shall be constructed with non-slip purpose with suitable step space intervals including but not limited to adequate footsteps and handholds for safe

access to the compartments and locations of equipment.

(k) Ventilation

- (i) The requirements for ventilators and the ventilation system shall comply with the requirements of any one of the ROs listed in Paragraph 2.3.4(a) to (i).
- (ii) Bridge, High Command Office, meeting room, ship office and crew space shall be protected from gas or vapour fumes from machinery, engine-exhaust gas and smells from the fuel system.
- (iii) The toilet shall be fitted with an exhaust fan of not less than 36 air changes per hour; and a louver at the lower portion of the toiler door shall be provided. There shall be covers for the exhaust fans capable of being closed to prevent rain water and seawater spray.
- (iv) Air pipes shall be fitted to all tanks, void spaces, and all spaces and compartments which are not fitted with other types of ventilation arrangement.
- (v) The lower edge of openings in all exterior air pipes and trunks shall be at least 650 mm above the main deck.
- (vi) All ventilators shall be provided with weather-tight covers.
- (vii) Natural ventilation for all the compartments of Paragraph 4.1.1 of this Chapter shall be provided.

4.2 Bridge

- 4.2.1 The outside configuration of the deckhouse shall be of a design that reduces air resistance, to deflect rain and seawater during heavy weather; and to provide practically all-round visibility at the steering/helm position of the console area. Pillars are not allowed to be fitted inside the bridge.
- 4.2.2 The bridge shall be designed with a bridge control station for one-man operation comprising controls and instruments for navigation, manoeuvring, communication and machinery operation.
- 4.2.3
 - (a) Five heavy duty pedestal seats for the navigators are required.
 - (b) The seats should have high density foam cushions, adjustable back rest, folding arms, lumbar support and adjustable footrest.
 - (c) Height and direction of these seats shall be adjustable.
- 4.2.4 The Contractor shall build a preliminary mock-up and a final mock-up of the bridge console including all the navigation equipment arrangement, seats and other fittings as required under this Part VII. The mock up shall be of FULL SIZE dimensions and agreed by GNC. The bridge mock up inspection shall also include the visibility requirements in para 4.2.14.
- 4.2.5 The bridge control station shall be at a forward position in the deckhouse. Controls for the steering shall be easily reachable by a person of normal Asian stature in the seated position without needing to extend his arms, and without obstructing the coxswain and the patrolling officer all-round field of view.
- 4.2.6 The equipment and means for navigation, manoeuvring, control, communication and other essential instruments shall be located sufficiently close together to enable the coxswain and the assisting officer to read/receive all the necessary information, and be able to use the equipment and controls while they are seated.
- 4.2.7 Instruments, instrument panels and controls shall be permanently mounted in the consoles, taking into account operational, maintenance and environmental needs.
- 4.2.8 All instruments shall be logically grouped according to their functions. In order to reduce to minimise the risk of confusion, instruments shall not be rationalised by sharing functions or by inter-switching.
- 4.2.9 Instruments required for use by any member of the operating crew shall be plainly visible and easily read with minimum practicable disposition from his normal seating position and deviation from line of vision; i.e. they will cause minimum risk of confusion under all likely operating conditions.
- 4.2.10 The instrument panels for the emergency controls and the monitoring of the fire-fighting systems shall be in a separate position, and shall be in clearly defined locations agreed by GNC officers.
- 4.2.11 The instruments and controls shall be provided with screen and dimming facilities to minimise glare and reflections and prevent them from being obscured by strong light.

- 4.2.12 The surfaces of console tops and instruments shall have dark glare-free colours. Surface finishing and interior linings of the deckhouse should be of a matt non-reflecting finish to facilitate night operation.
- 4.2.13 The following controls, displays and equipment are required to be incorporated into the bridge control station so that all relevant controls can be reached from a fixed working position (e.g. sitting, standing or both):
- (a) Steering is controlled by a quick action lever control (Joystick) AND a traditional steering wheel (both required);
 - (b) Engine speed and clutch controls;
 - (c) Electronic navigation equipment and displays;
 - (d) Speed log;
 - (e) Echo sounder;
 - (f) Lighting control panel incorporating controls for navigation lights, alarms, search lights and flood lights;
 - (g) Main and auxiliary engines monitoring indicators and tachometers;
 - (h) Instrument & control and alarming system for major machinery containing start/stop switches;
 - (i) Exhaust temperature gauges;
 - (j) Gear box oil pressure indicators alarms;
 - (k) Fire detection system and CO₂ flooding system control panel;
 - (l) Emergency stop switch for accommodation ventilation fans;
 - (m) Meter/Gauge indicating the quantity of fuel remained in the fuel tank;
 - (n) One colour LED monitors of CCTV for engine room;
 - (o) Public address system and intercom system to engine room;
 - (p) VHF radio receivers stowage position and power sockets;
 - (q) Electric horn, siren, and flashing beacon control panel;
 - (r) Gyro Stabilizer panel; and
 - (s) Gyrocompass Repeater.
- 4.2.14 Visibility
- (a) The visibility check shall also be carried out during the bridge mock up inspection.
 - (b) The visibility from the bridge shall not be obstructed.
 - (c) Side mirrors shall be provided at locations to allow the coxswain to safely manoeuvre the craft to a berth and have a clear rear view during operation.
 - (d) One each large sliding window shall be fitted at port and starboard side to facilitate direct downward viewing to the side of the Vessel.
 - (e) Vision blind spots or sectors shall be as few and small as possible, and in any case they must not adversely affect the keeping of a safe look-out from the helm position in the bridge.
 - (f) All equipment fitted in the vicinity of the control console shall not obstruct the view of the coxswain and the commander.
- 4.2.15 Windows
- (a) Frames at the bridge window separations shall be kept to a minimum, and of adequate structural strength and stiffness. They shall not be installed immediately in front of any workstation.
 - (b) All bridge windows shall be provided with sunscreens of the readily adjustable type. Forward facing windows shall be inclined forward and provide visibility free of any glare under all operating condition. The bridge front windows shall be inclined from a vertical plane topside out to reduce unwanted reflection, at an angle of not less than 10° and not more than 25°.
 - (c) Windows shall be provided at the bridge to allow the vision as wide as practical.
 - (d)
 - (i) At all times, regardless of the weather conditions, all bridge front windows shall be provided a clear view without obstruction.
 - (ii) Where practical, depending on the design of the bridge configuration, more windows are preferred to provide a wider clear view.

- (e) Bridge side windows shall be of RO approved sliding type to provide ventilation while the air-conditioning system is not operating excluding the forward section of the side windows fitted with heavy duty wipers. The sliding windows shall be able to maintain weather-tight integrity in rainy weather.
- (f) Throughout the vessel polarized and tinted windows are not to be fitted. All windows shall be manufactured from clear toughened safety glass and secured to the structure and be of a type suitable and safe for marine use. Details of the all windows should be submitted to GNC for approval and window glass thickness should be verified in accordance with the submitted information before installation.
- (g) The following items/requirements shall be provided:
 - (i) Marine type wide span and large area wipers with fresh water window washing systems shall be fitted for ALL the meeting room front windows and bridge front windows as well as the forward section of the port and starboard side windows. Heavy-duty marine type wipers shall be provided. They shall have an interval operating function with electrical fresh water window/wiper washing systems. These wipers shall be capable of operating independently of each other.
 - (ii) Two sets of spare wiper blades shall be provided for each window wiper installed for the Vessel.
 - (iii) Retractable transparent solar blind (American Standard Window Film ASWF, Sunny-Kool or equivalent) shall be installed inside of all bridge front windows.
 - (iv) Retractable transparent solar UV roller blinds shall be installed on all side windows throughout the Vessel. Dual sidewinder chains with cable guides shall be provided in the ship's office, screen one shall be solar film and screen two shall be blackout fabric. The blinds shall be capable of being retained in position either partially lowered or fully lowered, without swinging due to vessel motions at sea.
 - (v) The height of the lower edge of the bridge front windows above the main weather-deck shall be, where practical, kept as low as possible for a better view forward. Care should be given to ensure the lower edge will not present an obstruction to the forward view.

4.2.16 Lighting

- (a) Adequate lighting intensity and lighting arrangement, as well as any necessary lighting segregation by means of blinds or through the use of other means, shall be provided inside the bridge, ship office, and other compartments to enable the operating personnel to perform their task at all times and places. Only limited (and suitably reduced) illumination of the essential gauges, instruments and controls for monitoring likely system fault situations is allowed.
- (b) Care shall be taken to avoid large shadows as well as glare and stray image reflections in the operating area environment. High contrast in brightness between work area and surroundings shall be avoided. Non-reflective or matt surfaces shall be used to reduce indirect glare to a minimum.
- (c) A suitable degree of flexibility within the lighting system shall be available to enable the operating personnel to adjust lighting intensity and direction in different areas of the compartment, and such arrangements shall also be available for individual instruments and controls.

4.2.17 The following fittings and equipment are required to be provided in the bridge:

- (a) Two wall mounted fans of dia. 300 mm;
- (b) Two fixed office deck at the port side and starboard;
- (c) One set of pigeon holes for stowage of international code flags;
- (d) One set of international code flags suitable for the mast;
- (e) One shelf for the stowage of log books and files;
- (f) One dial type inclinometer and one thermometer for marine use;
- (g) Five cup holders;
- (h) One metal rubbish bin with cover shall be stored inside a cabinet/locker;
- (i) One metal box for keys shall be provided and fitted inside the bridge;
- (j) One wooden box with locks for the storage of binoculars, and it shall be fitted within the vicinity

of the forward high seats. One waterproof and fog proof 7x50 Marine binoculars for day time use shall be provided;

- (k) Five coat-hooks;
- (l) A number of storage lockers;
- (m) One framed safety plan of appropriate size;
- (n) One magnetic compass;
- (o) Air conditioning unit;
- (p) Non-skid handholds at suitable locations for crew movement in rough sea conditions; and
- (q) One approved type first aid box.

4.2.18 Two sliding doors (with a minimum 1000 mm x 1800 mm clear opening) shall be installed for the bridge to provide access to the High Command Office. One of the door leaves slides to the left and the other to the right.

4.3 High Command Office

4.3.1 The High Command Office shall be located abaft of the bridge.

4.3.2 The fitting of all the facilities in the High Command Office and ship office shall facilitate the removal of equipment from the compartment for maintenance and repair work.

4.3.3 A basic layout of all the facilities in the High Command Office is shown in the Conceptual General Arrangement Plan. Final layout and details of all facilities shall be submitted to the user department designated officers for approval.

4.3.4 Notwithstanding anything in this Part VII to the contrary, the High Command Office shall have the following features:

- (a) A table with 55 inches 4K interactive touch screen flat panel display for computer connection and the handrail along 4 sides of this flat panel;
- (b) A multi-function 4K UHD TV set with 49 inches, which can be used as a VGA/HDMI monitor
- (c) Storage space for inflatable life jackets;
- (d) One electric powered marine wall-mounted clock;
- (e) Two wall mounted fans of dia. 300 mm;
- (f) One display board including but not limited to posting plans, maps and notices;
- (g) Weather-tight sliding door with handrail located at P & S side wall of the deckhouse and one weather-tight door at the aft of the office for access to open deck shall be provided;
- (h) Wall-mounted electrical sockets for facilities including but not limited to photocopier, computer, notebook computer and mobile station shall be provided. The number of and the location of sockets shall be proposed by the Contractor and be subject to MD approval; and
- (i) Spare sockets for 220VAC and 24VDC to be supplied for operation need. Numbers of spare sockets shall be agreed with MD.
- (j) Six coat hooks fitted on the wall.
- (k) Windows with roller blinds (fabric type not acceptable) at port and starboard side; there shall be arrangement to prevent the roller blinds swinging due to ship motion.

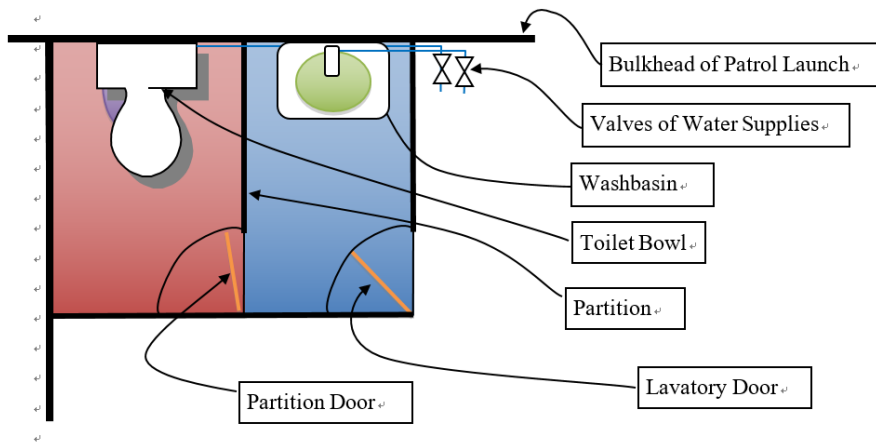
4.3.5 AA weather-tight door (with a minimum 650 mm x 1750 mm clear opening) shall be installed for the High Command Office to provide access to the open deck.

4.4 Ship Office

4.4.1 The ship office shall be located on the main deck of the deckhouse.

4.4.2 The fitting of all the facilities in the ship office shall facilitate the removal of equipment from the compartment for maintenance and repair work.

- 4.4.3 A basic layout of all the facilities in the ship office is shown in the Conceptual General Arrangement Plan. Final layout and details of all facilities shall be submitted to the user department designated officers for approval.
- 4.4.4 Notwithstanding anything in this Part VII to the contrary, the ship office shall have the following features:
- (a) A working table for four persons with a 20 inches Notebook computer. This table must be built with tailor made rack and cabinet. Storage spaces underneath the table shall be agreed with GNC.
 - (b) Another working table with a 20 inches Notebook/Desktop computer and secure at the starboard;
 - (c) A working platform for breath analyzing instrument;
 - (d) A fridge with positive latches (total net capacity not less than 110 litres) but doesn't need the function of freezing. It shall be possible to prevent the door of the fridge from being opened with authorization by means of a lock. (storage urine specimen for evidence after drink and drug operation)
 - (e) A closet that reaches the ceiling above the fridge;
 - (f) A 'L' shape locker as show in the GA;
 - (g) Storage space for inflatable life jackets;
 - (h) One multi-tray cabinet for duty officers;
 - (i) Six drawers for storage of documents;
 - (j) Luggage / cabinets for officer bag storage;
 - (k) One electric powered marine wall-mounted clock;
 - (l) Two wall mounted fans of dia. 300 mm;
 - (m) One display board including but not limited to posting plans, maps and notices;
 - (n) Wall-mounted electrical sockets for facilities including but not limited to photocopier, computer, notebook computer and mobile station shall be provided. The number of and the location of sockets shall be proposed by the Contractor and be subject to MD approval; and
 - (o) Spare sockets for 220VAC and 24VDC to be supplied for operation need. Numbers of spare sockets shall be agreed with MD.
 - (p) Ten coat hooks fitted on the wall.
 - (q) Windows with roller blinds (fabric type not acceptable) at port and starboard side; there shall be arrangement to prevent the roller blinds swinging due to ship motion.
- 4.4.5 A weather-tight door (with a minimum 650 mm x 1750 mm clear opening) shall be installed for ship office to provide access to aft deck space.
- 4.4.6 Stairways Located at the starboard of the ship office shall be provided for access to the bridge and to the tank space below.
- 4.4.7 There is a washroom at the back of the ship office and shall be divided into two individual chamber i.e inner and outer.
- 4.4.8 The washroom shall be well ventilated. One electric exhaust fan shall be provided and the exhaust air shall be routed to outside of the Vessel.
- 4.4.9 Two Aluminium toilet doors shall be fitted with louvre and opened inward and the toilet door fitted with locks which could be released from outside.
- 4.4.10 Flush toilet shall be fitted in the inner chamber and the washbasin shall be located in the outer chamber . Non-slip flooring and waterproof grating shall be provided.
- 4.4.11 The valves of water supplies to the flush toilet shall be fitted outside the inner chamber and easily operated by hand.



4.4.12 Sewage flushed from toilet shall be stored in grey water tank and/or discharge direct overboard.

4.4.13 The washroom shall be provided with following installations and fittings:

- (a) One stainless steel wash basin with a spring loaded cold freshwater supply tap in the outer chamber,
- (b) One water delivery point under basin with a plastic hose for toilet cleaning,
- (c) One cabinet with mirror with vanity lights,
- (d) One toilet paper holder,
- (e) Sufficient lighting,
- (f) One liquid soap dispenser,
- (g) Drain(s) shall be provided to avoid water accumulation on the toilet floor and floor covering shall pitch to a floor drain piped to the grey water collection tank,
- (h) Stainless steel hand rails as appropriate to allow safe use of the facilities while at sea, and
- (i) Matt-glass window with curtain blind
- (j) Three coat hooks.
- (k) One paper towel waste bin;

4.5 Meeting Room

4.5.1 The meeting room shall be located on the main deck at the forepart of the deckhouse.

4.5.2 Aluminium weather-tight door shall be fitted and opened outward which could be released from both inside and outside.

4.5.3 The meeting room shall be provided with the following installations and fittings:

- (a) A table with suitable size. Storage spaces underneath the table shall be agreed with GNC.
- (b) A bottled water dispenser with hot and cold water supply function;
- (c) A multi-function 4K TV set with 49 inches, which can be used as a VGA/HDMI monitor;
- (d) Locker, multi-tray cabinet and storage space;
- (e) One electric powered marine wall-mounted clock;
- (f) Two wall mounted fans of dia. 300 mm;
- (g) One display board including but not limited to posting plans, maps and notices;
- (h) Wall-mounted electrical sockets for facilities including but not limited to photocopier, computer, notebook computer and mobile station shall be provided. The number of and the location of sockets shall be proposed by the Contractor and be subject to MD approval; and
- (i) Spare sockets for 220VAC and 24VDC to be supplied for operation need. Numbers of spare sockets shall be agreed with MD.
- (j) Six coat hooks fitted on the wall.
- (k) Windows with roller blinds (fabric type not acceptable) at front bulkhead and starboard side; there shall be arrangement to prevent the roller blinds swinging due to ship motion.
- (l) Windows of the Meeting Room shall be fitted with heavy duty wipers as per para 4.2.15 g.

4.6 Fore Peak

- 4.6.1 The fore peak shall be watertight and located at the foremost end of the hull, separated with a watertight collision bulkhead.
- 4.6.2 A hinged flush type watertight hatch cover shall be provided on the main deck for access to the Fore peak. Access ladder shall be provided.
- 4.6.3 A store space shall be arranged inside the Fore peak. Suitable sparred wooden shelves and perforated marine ply wood flooring shall be provided for storing the anchor chains.
- 4.6.4 Sparred wooden shelves for stowage of mooring ropes and navigational equipment shall be provided inside this compartment.
- 4.6.5 Racks for stowage of other equipment shall be provided inside this compartment.
- 4.6.6 Racks for shapes and spare fire extinguishers shall be provided inside this compartment.

4.7 Crew space

- 4.7.1 The crew space shall be located under-deck (or partially under-deck) aft the fore peak.
- 4.7.2 There is a washroom at the back of the crew space.
- 4.7.3 The washroom shall be well ventilated. One electric exhaust fan shall be provided and the exhaust air shall be routed to outside of the Vessel.
- 4.7.4 Aluminium toilet door shall be fitted with louvre and opened inward and the toilet door fitted with locks which could be released from outside.
- 4.7.5 Flush toilet shall be provided. Non-slip flooring and waterproof grating shall be provided.
- 4.7.6 Sewage flushed from toilet shall be stored in grey water tank and/or discharge direct overboard
- 4.7.7 The washroom shall be provided with following installations and fittings:
 - (a) One stainless steel wash basin with a cold and hot freshwater supply tap,
 - (b) One water delivery point under basin with a plastic hose for toilet cleaning,
 - (c) One cabinet with mirror with vanity lights,
 - (d) One toilet paper holder,
 - (e) Sufficient lighting,
 - (f) One liquid soap dispenser,
 - (g) Drain(s) shall be provided to avoid water accumulation on the toilet floor and floor covering shall pitch to a floor drain piped to the grey water collection tank,
 - (h) Stainless steel hand rails as appropriate to allow safe use of the facilities while at sea,
 - (i) Three coat hooks.
 - (j) One paper towel waste bin;
 - (k) An electric water heater with a capacity of not less than 50L, and
- 4.7.8 Shower Room
 - Hot and cold water shower spray;
- 4.7.9 A pantry shall be provided at the front end of the crew space. The pantry shall be fitted with the following facilities:
 - (a) One large rubbish bin with cover,
 - (b) One microwave oven,
 - (c) One induction cooker,
 - (a) One refrigerator with positive latches (total net capacity not less than 110 litres)
 - (b) One stainless steel kitchen sink with a spring loaded cold freshwater supply tap;
 - (c) One 240VAC electric tea kettles securely fixed in a position;
- 4.7.10 Notwithstanding requirements specified in other sections, the crew space shall include the following:
 - (a) A stairway with handrail shall lead directly from the upper deck to the crew space.
 - (b) One emergency escape hatch to the exterior deck with a fixed escape ladder as a means of escape to the main deck from crew space.

- (c) Enough storage lockers (not less than 22) with lock. Each locker shall be able to fit standard Marine Department bags (approximate 500 mm x 300 mm x 300 mm)
- (d) One 240VAC wall mounted 300mm diameter fan
- (e) One 240 VAC electric tea kettle securely fixed in location
- (f) The crew space shall be ventilated by a split-type air-conditioning
- (g) Grab rails shall be provided where necessary
- (h) Appropriate number of electric sockets should be provided.
- (i) One electric exhaust fan shall be provided.

4.8 Fuel Oil Tanks

- 4.8.1 Individual components of the system, and the system as a whole, shall be designed to withstand the combined conditions of pressure, vibration, shocks, corrosion and movement encountered under normal operating conditions and storage.
- 4.8.2 All materials used in fuel systems shall be resistant to deterioration by its designated fuel and to other liquids or compounds with which it may come into contact under normal operating conditions, e.g. grease, lubricating oil, bilge solvents and sea water. All seals such as gaskets, O-rings and joint-rings shall be of non-wicking, i.e. non-fuel absorbent, material.
- 4.8.3 The only outlets for drawing fuel from the fuel system [do not understand, please elaborate.] shall be the plugs in petrol filter bowls intended solely for the purpose of servicing the filter;
- 4.8.4 Earthing device shall be provided for fuel filling system.
- 4.8.5 Grounding wires shall not be clamped between a hose and its pipe or spud.
- 4.8.6 Fuel filling systems shall be designed to avoid blowback of fuel through the fill fitting when filling at a rate of 30 litres/min at between 1/4 and 3/4 full of the tank capacity.
- 4.8.7 Quick closing valves (control from above the main deck) shall be fitted to the fuel oil tanks outlets.
- 4.8.8 Fuel filters shall be mounted near the fuel tank on the suction side of the fuel pump. The system design and filtration systems shall be approved by the engine manufacturer.
- 4.8.9 The tanks shall be hydrostatically tested as required by an approved standard and connections shall be proven tight.
- 4.8.10 The Contractor shall provide the initial fills of fuel oil, lube oil, coolant, and hydraulic fluids using fluids and additives prescribed by engine manufacturer. The Contractor shall provide a summary listing of all fluids and quantities used.
- 4.8.11 Provisions to the fuel oil tank
 - (a) A tank content gauge and low level alarm shall be fitted in the console. A level gauge in litres shall be provided for each tank;
 - (b) Rigid fuel suction pipes near the tank bottom shall be provided;
 - (c) An inspection hole, air vent with flame trap on deck and discharge valve with remote operated quick closing device shall be provided. Fuel tank inspection hatch shall be sized to allow proper inspection of the entire tank interior. The inspection hatch shall have gasket covers secured by stainless steel bolts and self-locking nuts;
 - (d) Suitable provision such as drip trap shall be made for collecting the oil discharge;
 - (e) Baffle openings shall be designed so that they do not prevent the fuel flow across the bottom or trap vapour across the top of the tank;
 - (f) The fuel oil tank shall be tested by a head of water equal to the maximum to which the tank may be subject, but not less than one metres above the top of the tank subject to RO requirements;
 - (g) The tanks shall be designed and installed to prevent water from being trapped on the exterior surface;
 - (h) Tank drain shall be provided; and
 - (i) The compartment or space containing the fuel oil tank shall be fitted with two ventilating pipes of arrangement acceptable to GNC.

4.8.12 Structures and Design

- (a) Two separate fuel oil tanks shall be provided. The tanks must be built in or integrated to the hull. The fuel oil tanks shall be symmetrical, one at portside and the other at starboard to minimize the tank beam and to reduce free surface effect.
- (b) Diesel tank(s) shall be mounted at under deck position. The tanks shall be installed so that the loads due to the mass of the full tank are safely induced into the structure, with due consideration given to upward and downward acceleration due to the Vessel's movements at maximum speed in the sea. The design and tests shall comply with the requirements of RO or other international standards acceptable to MD.
- (c) Except the electric wires for the fuel oil tank level sensor(s), no other should pass through any fuel tank compartment(s). Ventilation for the fuel tank compartment(s) shall comply with national or other acceptable industrial standards.
- (d) The total capacity of the diesel oil tank shall be provided. Fuel supplied shall be not less than requirement of the Vessel's operation as Paragraph 2.7.1 of Part VII of the Tender Documents with 10% margin. The unpumpable capacity of the each tank shall not be more than 10% of the capacity of that tank. If the fuel oil capacity calculated as per Paragraph 2.7.1 is more than 6000 litres, then the total capacity of 6000 litres shall be used.
- (e) Internal surfaces of the diesel tank shall be left unpainted and the diesel tank internal shall be cleaned thoroughly to the satisfaction of MD.

4.9 Tank Space

- 4.9.1 Flush watertight hatch shall be provided for access to this compartment.
- 4.9.2 Aluminium chequer plate floor shall be fitted.
- 4.9.3 Adequate ventilation shall be provided in this space in accordance with RO requirements.

4.10 Steering Gear Room

- 4.10.1 The layout of the steering gear compartment shall be arranged for easy and convenient installing, operating and access for maintenance/repairs to the steering gear system. Flush access manhole with hinged cover shall be provided for access to this compartment.
- 4.10.2 Readily accessible space shall be provided for the operation of an emergency manual hydraulic pump with independent piping.
- 4.10.3 The floor of this compartment shall be covered with unpainted aluminium chequer plate.
- 4.10.4 Aluminium chequer plates adjacent to valves, shafts, etc., shall be easily removable for ease of maintenance.
- 4.10.5 Hinged access plates shall be fitted in way of valves. Suitable arrangements shall be provided for hinged plates to avoid/minimise rattling noise.

4.11 Side Deck

- 4.11.1 The width of the passage deck on both sides should be at least 700 mm for providing safe passages for crew/other persons to walk.
- 4.11.2 Accesses shall be provided on each port and starboard sides. The width of each accesses door shall be at least in 0.70 metre.
- 4.11.3 (a) Components including but not limited to air vents and pipes are preferably recessed into the deckhouse side.
(b) Excessive protrusion of components including but not limited to air vents and pipes shall be avoided to prevent obstructions.

- 4.11.4 All hand rails shall be secured to provide support for persons on board, to prevent them from falling or being thrown on deck or overboard in deteriorated weather and sea conditions, the design to consider the circumstances when all persons on board are lined up together on one side of the deck in case of an emergency situation at sea.
- 4.11.5 Where necessary, the rails of the railings are made of detachable marine stainless steel chain. A basic layout of the railings is shown in the Conceptual General Arrangement Plan.
- 4.11.6 (a) Sufficient illumination lights shall be provided at each side.
(b) Illumination lights should not obstruct the passages

4.12 Mast and Open Deck

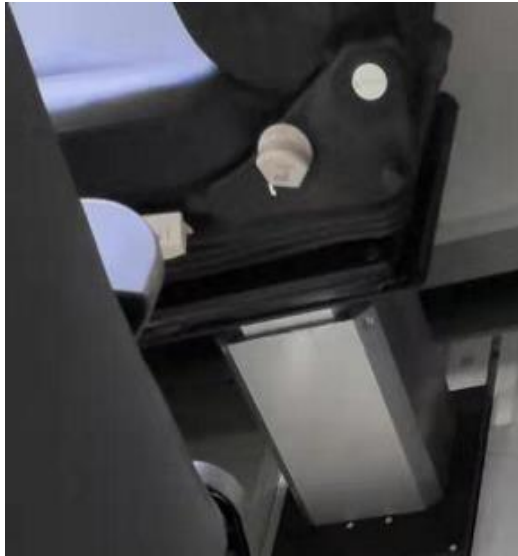
- 4.12.1 Open decks, shall be fitted with guard railings at their perimeter for the safety of persons on board, except where the convenience of crew operation (e.g. at the mooring operation area) requires otherwise.
- 4.12.2 Permanent stanchion with chains for safe embarkation and disembarkation shall be provided.
- 4.12.3 All guard rails shall comply with the RO Requirements for protection of persons on board.
- 4.12.4 A stair/ladder fitted with handrails on each side is located at the back of the deckhouse for access to the upper open deck from the weather deck. The inclined angle of the ladder should be to GNC's satisfaction. Vessel identification shall be marked on the compass deck as large as possible.
- 4.12.5 Open decks shall be covered with non-slip material or paint.
- 4.12.6 One collapse mast operated by hydraulic system shall be fitted on the deckhouse top with navigational lights, sound signals, radar scanner and other electronic and navigational equipment, including the lightning arrestor, ensign hoist, two signal hoists, the antennas, GPS and UHF mobile transceiver (as indicated in the Conceptual General Arrangement Plan). There shall be an all-round flashing red light on the top of the mast
- 4.12.7 The structure of the mast associated with its mountings and fixtures shall be designed so that all the equipment as stated in this Part VII and can operate in all weather conditions, with general provisions as follows:
 - (a) The mast shall have streamline shape and permits navigation light bulbs to be changed by an individual standing on the deckhouse top and to permit the servicing of any equipment it carries. Facilities for access to high location shall be provided where necessary;
 - (b) The mast shall be constructed such that no vibration is experienced in any operating condition including at harbour. The mast design shall be of appropriate size/strength to suit its purpose.
 - (c) The mast is so designed to accommodate all the navigation lights and lights indicating types of operation. Arrangement shall also be provided for hoisting of navigational shapes.
- 4.12.8 Access for maintenance and servicing of Equipment and its fittings shall be provided. Manhole cover of the engine room should be enlarged appropriately and to the satisfaction of the user department.
- 4.12.9 The arrangement shall be such that the Equipment on the mast shall not interfere with each other.
- 4.12.10 All Equipment and their components including but not limited to cables, conduits, connectors, junction boxes, glands and fittings etc. shall be water proof and be able to function in all weather conditions at sea.
- 4.12.11 (a) Two ensign staffs of length and size to be confirmed by GNC, for flags, shall be supplied.
(b) One ensign staff should be placed at the mast and the other one to be placed at the top of the main deck aft. [D]
(c) All hardware for them, such as screws, hooks, hasps, hinges, handles and sliding bolts shall be made of stainless steel.
- 4.12.12 The solar panel systems
The solar panel system shall be fitted on the monkey island as shown in the Conceptual General Arrangement Plan. The number of solar panels shall be agreed by GNC.
- 4.12.13 Two pieces of boat hooks to be provided.

4.13 Seating

4.13.1 Five (5) upholstery seats shall be provided in front of the bridge console for the coxswain and crew. Requirements of the seats shall be:

- (a) Seats shall be of a hydraulically damped, shock reducing and comfortable type
- (b) Adjustable seat height with foot rest
- (c) Backrest angle adjustment
- (d) Fore and aft adjustment
- (e) Safety belt to be provided
- (f) Adjustable armrests
- (g) Turntable/Mounting pedestal 0° - 180°

Samples of these seats is shown below:



- 4.13.2 One three (3) persons high-density black colour leather settees with storage space underneath, shall be provided in the ship office.
- 4.13.3 One three (3) persons and one two (2) persons high-density black colour leather settees shall be provided in the meeting room.
- 4.13.4 One three (3) persons high-density black colour leather settees shall be provided in the High Command Office as indicated in the Conceptual General Arrangement Plan.
- 4.13.5 A locker with cushion top shall be fitted in the crew space which could be served as seats for crews.
- 4.13.6 The seat structures shall be permanently fitted to the structure of the Vessel by means of an attachment system which could be dismantled easily. The seat and the attachment system shall be acceptable by GNC.
- 4.13.7 Seating and handholds shall provide support for spinal neutral alignment and postural stability for each person and also to prevent them from falling or being thrown on deck.
- 4.13.8 Seat materials of upholstery shall be of water resistant materials such as fire retardant foam/reinforced nylon laminated neoprene/heavy duty cordura laminate.

4.14 Bow and Stern

- 4.14.1 The fore deck geometry of the Vessel shall be carefully designed to facilitate safe boarding/ mooring. Adequate geometry can be achieved with the addition of fender mouldings adequately fitted to the Vessel.
- 4.14.2 As part of the boarding frame, a permanent forward deck railing for safe embarkation and disembarkation shall be provided.

- 4.14.3 The deck floor shall be covered with anti-slip material.
- 4.14.4 There shall be a drone platform with area of not less than 3.0 metres in diameter on the main deck aft for unmanned aerial vehicle takeoff and landing. [E]
- 4.14.5 Notwithstanding requirements specified in other sections, the aft deck shall have the following fittings:
- (a) one 24VDC waterproof power socket,
 - (b) one 240VAC waterproof power socket, and
 - (c) one waterproof shore connection.
- 4.14.6 All stanchions and railings on deck shall be of stainless steel in SS316.

4.15 Ancillary Boat

- 4.15.1 One rigid hull inflatable boat (RHIB) shall be provided in the middle of the stern. The hull of the RHIB shall be deep-V hull shape and made of Glass Reinforced Plastic (GRP). The RHIB shall be of length overall between 4.1 metre and 4.2 metre, width overall between 1.8 metre and 1.9 metre. Weight of bare boat without outboard engine shall not exceed 165kg. The RHIB shall be designed and built according to the requirements of the design category C of Directive 2013/53/EU, a declaration of conformity to the requirement of Directive 2013/53/EU shall be provided.
- 4.15.2 The RHIB shall be deployed and retrieved via a stern slipway by means of an electric winch or other design acceptable to the GNC.
- 4.15.3 The stern slipway shall be designed to enable the ancillary boat to be deployed and retrieved without difficulty in consideration of the variation of freeboard of the Vessel. A stern door or other suitable arrangement such as guide rail etc to assist the deployment and retrieval of the daughter may be required if necessary. In case of a stern door is fitted, the power supply mechanism for the opening and closing of the stern door must include both normal power supply and emergency supply.
- 4.15.4 The RHIB shall be equipped with one outboard petrol engine. The outboard engine shall be four stroke, electric start, at least 30 HP in power and comply with “three star label of California’s Air Resources Board” for emission standard. The outboard engine shall be manually controlled by a hydraulic steering system with a helm operating at console. Steering system shall remain operable in case of power failure. The outboard engine shall be fitted with engine shut-off lanyard and a stainless steel propeller guard.
- 4.15.5 The fuel oil tank shall be manufacturer approved type of 70 litres in capacity. It shall be located within the jockey seat with proper ventilation.
- 4.15.6 The capacity of the RHIB shall not be less than 4 persons, up to 6 persons.
- 4.15.7 Besides the deployment and retrieval of the RHIB by stern ramp, The RHIB shall also be designed to lift out of water by overhead crane. A vessel fitted with a single point hoisting system with off-load release hook will NOT be accepted. The stern ramp may be operated by hydraulic system. There should be securing means to shut the ramp in case the hydraulic system is out of order.
- 4.15.8 The following equipment shall be supplied together with the ancillary boat:
- (a) GRP control console with jockey-styled seat;
 - (b) torsional tow bar;
 - (c) heavy duty rubbing strakes;
 - (d) hailer/fog horn;
 - (e) gunwale lifting eyes and sling c/w quick release hook;
 - (f) mast for navigation lights, red beacon lamp and diver's flag;
 - (g) power sockets and portable watertight search lights c/w 20m cable (24V);
 - (h) auto draining device;
 - (i) 12 or 24V sealed type maintenance free battery minimum capacity 70 ampere-hours;
 - (j) and one water resistant locker at bow with drain;
 - (k) first aid kit, vessel repair kit and foot pump;

- (l) mooring cleat at bow;
- (m) two paddles with retainers;
- (n) lightning arrestor and;
- (o) one small fire extinguisher.

- 4.15.9 A petrol oil tank rack to be fitted on the main deck aft platform in the vicinity of the ancillary boat. A quick release mechanism to be fitted to the rack for the instantaneous release of the approved type portable petrol oil tanks to the sea in case of fire or emergency. The number of portable petrol oil tanks to be stored to be agreed by GNC.
- 4.15.10 An aluminium ladder to be provided for embarking and disembarking of persons when the ancillary boat is alongside the Vessel when needed. The aluminium ladder is to be secured on the handrail of port quarter as indicated in the Conceptual General Arrangement Plan.

4.16 Anchoring, Mooring and Towing

4.16.1 Anchor

- (a) At least one high holding power type anchor approved by the RO for this type of vessel and acceptable to GNC shall be provided with its associated swivel, shackles, stowage cable or cable and warp and means of recovery.
- (b) The Vessel shall be provided with adequate and safe means for releasing the anchor and its cable and warp.
- (c) The means of release shall be capable of safe operation even when the anchor cable or warp is under load.
- (d) Adequate means and arrangements shall be provided to secure the anchor under all operational conditions.
- (e) Adequate stainless steel chain with shackle and terylene line shall be provided. All Equipment to be sized as per the RO Requirements.
- (f) The anchor shall be handled by use of a windlass and associated fittings. A watertight hatch shall be fitted on the deck leading down to chain and lines locker.
- (g) Cover plate shall be set at the upper end of the hawse pipe to the satisfaction of the user department.

4.16.2 Windlass

- (a) A windlass with its associated gypsy and warping drum, cable stopper, hawse pipe, bollards and fairleads shall be provided to give an easy run for anchor chain cables and mooring lines. The windlass shall be fitted with an emergency manual operating mechanism.
- (b) The windlass shall be capable of lifting one anchor with sufficient length of chain, at a speed of at least 9m/min.
- (c) Control of the windlass shall be located in the vicinity of the windlass through a starter control unit enclosed in the watertight cabinet. There should be another control unit in the bridge, that it can be controlled in rough weather.
- (d) Emergency stop button for the windlass shall be provided at bridge control station and locally.
- (e) Windlass cover shall be provided.

4.16.3 The Vessel shall be protected so as to minimise the possibility of the anchor and cable damaging the hull structure during operation (including in bad weather and sea conditions).

4.16.4 Where necessary, suitable fairleads, bitts and mooring ropes shall be provided and fitted according to the requirements of any one of the ROs listed in Paragraph 2.3.4(a) to (i).

4.16.5 Enclosed lockers or bins for storing mooring lines shall be provided on deck such that they are readily available and are secured against the high wind and ship motion accelerations.

4.16.6 Two stainless steel boat hooks with 3-metre staves and stowage arrangement shall be provided.

4.16.7 Mooring - As a minimum eight bollards on deck shall be provided with four terylene 20 metres long (minimum) mooring ropes. Size of the deck cleats shall be agreed by GNC.

4.16.8 All the bollards shall be double bits and suitable for towing small vessel from side and rear. The structure associated with these bollards should be strengthened as per the RO Requirements.

4.17 Fenders

4.17.1 Fender system shall be provided on the gunwale and diagonally on the hull as shown on the Conceptual General Arrangement Plan. Internal stiffeners shall be suitably provided to strengthen the hull structures. The fender arrangement shall be to MD's satisfaction. The base plates of fender installation shall be widened properly.

4.17.2 Side, stern and Stem Fenders:

Fixed hollow D shape rubber fenders of suitable size (e.g. 200 mm high x 100 mm depth or other size) for deck edge mounting shall be fitted continuously along the ship sides and stern at main deck level.

Thickened fenders of sufficient height to protect the bow shall be installed samples of this fender is shown in the Conceptual General Arrangement Plan.

4.17.3 Additional Rubber Tyre Fenders at bow, stern and ship's sides:.

Sufficient numbers of rubber tyre fenders of appropriate size, each with a stainless steel securing ring shall be provided. Two (2) of them shall be fitted at the Intersection of ship's stern plate and side plate.

4.17.4 At least eight units of portable air filled fenders at diameter not smaller than 450mm shall be provided.

4.17.5 The arrangement shall be submitted to MD for approval prior to installation.

4.18 Cathodic and Hull Surface Protection

4.18.1 The propellers, stern tubes and the lightning protection system underwater etc shall be protected by a cathodic protection system for two years life.

4.18.2 Service life expectancy of anti-fouling systems shall be provided according to the requirements of any one of the ROs listed in Paragraph 2.3.4(a) to (i) or other equivalent international standards.

4.18.3 Service life expectancy of surfaces coating and protection system shall be provided according to the requirements of any one of the ROs listed in Paragraph 2.3.4(a) to (i) or other equivalent international standards.

4.19 Lightning Protection

4.19.1 The Vessel shall be fitted with a lightning protection system acceptable to one of the ROs listed in Paragraph 2.3.4(a) to (i) to protect the Vessel, persons on board and the electronic equipment installed.

4.19.2 Methods and working principles of protection shall be submitted for MD approval before the installation of the protection system.

4.20 Special Equipment

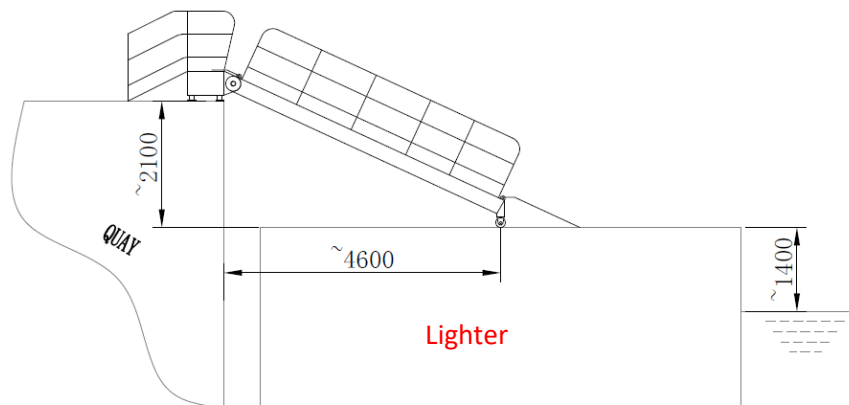
4.20.1 Stern slipway - an electric winch shall be installed on the aft deck for the deployment and retrieval of the ancillary boat using a suitable stern slipway. The electric winch shall be of sufficient power and torque acceptable to GNC for the above purpose. The electric winch shall be both controlled in the bridge and locally. In case of failure of the electric winch, an emergency portable equipment shall be provided and used to deploy and retrieve the ancillary boat.

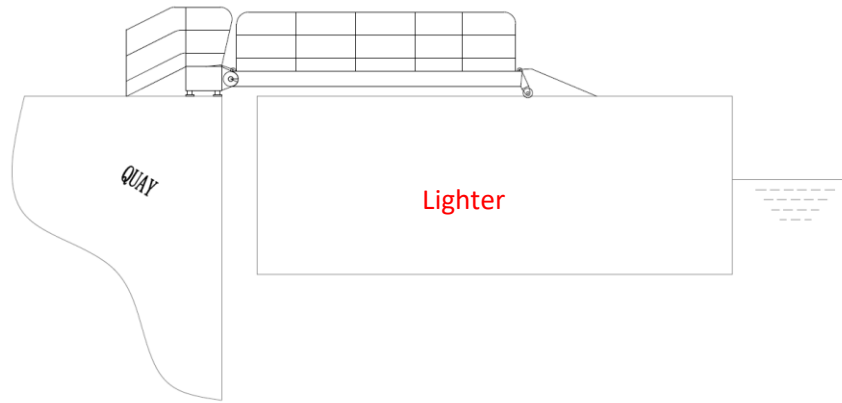
4.20.2 Wreck buoy - an electric winch shall be installed near the ship side of aft deck for the recovering of a wreck buoy, chain and anchor for the wreck buoy. Sample of the electric winch is shown in the following photograph:



Fixed pulley or other equipment shall be used to prevent the chain from rubbing against the metal of the ship side when recovering the wreck buoy.

- 4.20.3 Gyro stabilizer - a gyro stabilizer is required on board to reduce transverse rolling of the Vessel in particular during idling speed and patrol operation.
 - 4.20.3.1 The gyro stabilizer must be compact and self-contained. It is to be positioned such that it can be overhauled without removing other major equipment such as main propulsion engine or generator set.
 - 4.20.3.2 The noise steady state output measured in the factory at 1 metre distance shall be 72-74 dBC.
 - 4.20.3.3 The expected percentage of roll reduction by the gyro stabilizer should be not less than 60% and 80% when the vessel in a static zero forward speed and the waves approaching in a direction perpendicular to the heading, under the maximum wave height not less than 1.0 metre and 0.5 metre respectively. Testing of the gyro stabilizer under idle speed and 24 knots full speed at different areas of the Hong Kong harbour and the test data to be recorded for future reference.
- 4.20.4 Gangway – An aluminium gangway to facilitate safe boarding and disembarking access should be provided from quayside to a lighter or vice versa. The above lighter shall be used for berthing of the Vessels after delivery and the lighter will be purchased in another tender exercise. The gangway should be able to adapt to the fluctuation of the tide. Sample of the gangway is shown in the following photograph:





- 4.20.4.1 Each vessel shall be equipped with a light aluminium gangplank. The gangplank shall be about 2.5m (long) x 0.6m (wide) fitted with handrail on at least one side. The handrail shall be able to fold quickly and stand firmly.
- 4.20.5 Detailed design of the Special Equipment will be discussed at the kick-off meeting and shall be approved by RO and GNC.

4.21 Miscellaneous

- 4.21.1 Navigational shapes shall be provided and properly stowed in the Vessel.
- 4.21.2 The keel shall allow installation of sonar head intruding through the hull together with the protective fairing.

Chapter 5 - Safety Equipment

5.1 General Provisions

- 5.1.1 The Safety Equipment shall be provided as per Hong Kong Shipping Ordinance CAP 548G and the Code of Practice issued by the Hong Kong Government (HKSARG) regarding the Vessel of this type.
- 5.1.2 The Vessel shall be enclosed by fire-resisting divisions complying with the requirements of the International Code for the Application of Fire Test Procedures (FTP Code), as defined in Chapter II-2 of SOLAS.
- 5.1.3 Fire-resisting bulkheads and decks shall be constructed to resist exposure to the fire as per the RO Requirements for that specific location. The main load-carrying structures shall be arranged to distribute load such that there will be no collapse of the construction of the hull and deckhouse when it is exposed to fire.
- 5.1.4 The hull, structural stiffeners, bulkheads, decks, deckhouses and pillars shall be constructed of approved non-combustible materials as required in the FTP Code and having adequate structural properties.
- 5.1.5 The arrangement of components including but not limited to pipes, ducts and electrical cables penetrating into fire-resisting divisions shall be made to ensure that the fire-resisting integrity of the division is not impaired, and necessary testing shall be carried out in accordance with the FTP Code.
- 5.1.6 All furniture shall be constructed entirely of approved non-combustible or fire-restricting materials, except that a combustible veneer with a calorific value not exceeding 45 MJ/m² may be used on the exposed surface of such articles.
- 5.1.7 All upholstered furniture, draperies, curtains, suspended textile materials shall have the qualities of resistance to the propagation of flame in accordance with the FTP Code.
- 5.1.8 All deck finish materials shall comply with the FTP Code.
- 5.1.9 All the exposed surfaces and surfaces in concealed or inaccessible spaces in corridors and stairway enclosures, and of bulkheads (including windows), wall and ceiling linings in all compartments shall be constructed of materials having low flame-spread characteristics as required in FTP Code.
- 5.1.10 Any thermal and acoustic insulation shall be of non-combustible or of fire-restricting material. Vapour barriers and adhesives used in conjunction with insulation, as well as insulation of pipe fittings for cold service systems need not be non-combustible or fire restricting, but they shall be kept to the minimum quantity practicable and their exposed surfaces shall have low flame spread characteristics.
- 5.1.11 Exposed surfaces in corridors and stairway enclosures, and of bulkheads (including windows), wall and ceiling linings, in all compartments shall be constructed of materials which, when exposed to fire, are not capable of producing excessive quantities of smoke or toxic products, this being determined in accordance with the FTP Code.

5.2 Fire Detection System

- 5.2.1 An approved automatic fire detection system shall be provided in the Vessel at appropriate locations in accordance with the RO Requirements. The fire detection system shall comply with the rules of the RO or international standard.
- 5.2.2 The fire detection panel shall be installed in the bridge.
- 5.2.3 The detection system shall initiate audible and visual alarms distinct in both respects from the alarms of any other system not indicating fire, in sufficient places to ensure that the alarms are heard and observed on the bridge control station.
- 5.2.4 Fire detectors to be installed in the engine room, tank space, bridge, high command office, meeting room, ship office, crew space, steering gear compartment etc. in addition to meeting RO requirements. Detection system using only thermal detectors shall not be permitted unless in spaces of restricted height and where their use is especially appropriate.

5.3 Portable Fire Extinguishers

- 5.3.1 Adequate number of portable fire extinguishers shall be provided to serve all compartments in the Vessel and so positioned, as to be readily available for immediate use. In addition, at least one extinguisher suitable for machinery space fires shall be positioned outside each machinery space entrance.
- 5.3.2 Fire extinguishers shall be Type-Approved by the RO or other international standards. Certificates shall be submitted to GNC before Delivery Acceptance.
- 5.3.3 Carbon dioxide fire extinguishers should not be placed in the bridge, ship office and Crew Space.
- 5.3.4 In the spaces where containing electrical or electronic equipment or appliances necessary for the safety of the Vessel, fire extinguishers should be provided with extinguishing media which are neither electrically conductive nor harmful to the equipment and appliances.
- 5.3.5 Fire extinguishers shall be ready for use and located in easily visible places such that they can be reached quickly and easily at any time in the event of a fire. Portable fire extinguishers shall be properly secured in place.
- 5.3.6 Portable fire extinguishers should be provided with devices to identify whether they have been used.

5.4 Fire Pumps

- 5.4.1 The fire main and electric fire pump design shall meet the RO Requirements.
- 5.4.2 A deck washing pipe line shall be branched off from a fire main line.

5.5 Safety Plan

- 5.5.1 A RO approved safety plan in frame shall be permanently exhibited for the guidance of the ship's crew at the ship office, using graphical symbols in accordance with IMO Resolution A.654(16).
- 5.5.2 The contents of the safety plan should meet the relevant regulations of MD.
- 5.5.3 The text of such plan shall be in the languages of English and traditional Chinese.

5.6 Additional Protection

- 5.6.1 When the Vessel is afloat and unmanned, the fire detection system and the bilge alarm system shall continue to function, when the audible and visual alarm is not acknowledged after a time period of 5 minutes (to be adjusted), the audible and visual alarm shall be extended externally to an audible and visual alarm fitted on the top of the deckhouse to bring the attention of the persons ashore or the guard of the Government Dockyard.
- 5.6.2 The additional protection should be able to be turned on and off when required.

Chapter 6 - Lifesaving Appliances (LSA) and Arrangements

6.1 General Provisions

- 6.1.1 Lifesaving appliances and arrangements shall be provided as per Hong Kong Shipping Ordinance CAP 548G and the Code of Practice issued by the Hong Kong Government HKSARG regarding the Vessel of this type.
- 6.1.2 Lifesaving appliances shall be provided in the Vessel at appropriate locations in accordance with the RO Requirements. All the required Life jackets should be Inflatable Life jackets
- 6.1.3 Lifesaving appliances shall be of approved types conforming to the latest International Life-Saving Appliance Code (LSA Code) adopted by the Maritime Safety Committee of the Organization and approved by the RO.
- 6.1.4 Life jackets shall be so placed as to be readily accessible and their positions shall be clearly indicated. Donning instructions should be posted at suitable positions in the Vessel.
- 6.1.5 Adequate number of lifebuoys shall be provided as per the RO Requirements. Lifebuoys shall be marked with ship names on both sides.
- 6.1.6 Approved LSA Plan by RO in frame shall be posted on the wall of the Ship Office or the corridor in front of the Ship Office.

Chapter 7 - Machinery

7.1 General Requirements

- 7.1.1 The Tenderer should note that the Vessel is for use in Hong Kong and it is desirable that the main engines and any other machinery offered by the Contractor are those at present commonly used by ships operating in Hong Kong Waters, and that they have good support and after sale services locally in Hong Kong.
- 7.1.2 The Spare Parts and Warranty Spare Parts to be provided shall be of the same model as supplied for the Vessel and shall equally comply with all specifications set out in this Chapter.
- 7.1.3 The estimated engine propulsive power from both engines required for attaining the Contract Speed of the Vessel (viz., not less than 24 knots) under the Official Speed Trial conditions as stated in Annex 5 to Part VII, together with a descriptive account of the philosophy and methodology employed for such propulsive power estimate and evaluation shall be provided. [E]
- 7.1.4 The Vessel shall be equipped and fitted with all machineries described each complying with the specifications set out in this Chapter for such machinery.
- 7.1.5 Sufficient space and headroom in the vicinity of the machinery for local operation, inspection and routine maintenance for all the machinery shall be provided. Procedures and sequences for complete removal of the major items such as the main engines, generator set shall be carefully designed to enable their removal from ships for maintenance in a practicable manner so to avoid the need for dismantle of built-in furniture or deckhouse structure.
- 7.1.6 Two accesses with reasonable separation shall be provided for the engine room. The design of the engine room layout shall be agreed by GNC. The machinery, associated piping systems and fittings relating to the main engines and electric generator sets shall be of a design and construction adequate for the service for which they are intended and shall be so installed and protected as to reduce to a minimum any danger to persons on board, due regard being paid to moving parts, hot surfaces and other hazards. The design shall have regard to materials used in construction, the purpose for which the equipment is intended, the working conditions to which it will be subjected and the environmental conditions on board. Cushion/protection on the overhead cable trunk for preventing head injury of crew shall be provided.
- 7.1.7 All parts of machinery, piping, control and other systems and their associated fittings which are under internal pressure shall be subjected to appropriate tests including a pressure test before being put into service for the first time.
- 7.1.8 Provision shall be made to facilitate cleaning, inspection and maintenance of components including but not limited to main engines, electric generator set and fire pumps and their associated piping and equipment. Lifting brackets for moving heavy equipment shall be provided under the head of the engine room, the engine room entrance and other locations as deemed necessary. The lifting capacity shall be marked with its maximum load after a load test satisfactory to GNC.
- 7.1.9 The machinery installation shall be suitable for operation as in an unmanned machinery space. The monitoring and control, including automatic fire detection system, bilge alarm system, remote machinery instrumentation and alarm system shall be centralised in the control station of the wheelhouse.

7.2 Main Propulsion Engines

- 7.2.1 The Vessel shall be equipped with two (2) electrically started, fresh water cooled marine diesel engines of adequate power for the Contract Speed. The rating of the engines shall be required for the Vessel on the Contract Speed with annual operation of 3,840 hours. The diesel engines shall meet IMO Tier 2 emission requirements or such higher standards the Contractor may have committed in its tender for the Contract. [E]
- 7.2.2 Type approved certificates issued by an RO or other entities acceptable by GNC in compliance to meet IMO Tier 2 shall be provided.

- 7.2.3 The aggregate propulsive power of the main engines shall be not less than 1,500 kW. [E]
- 7.2.4 The main engines shall drive the propellers through reduction gears.
- 7.2.5 The main engine's exhausts and silencers shall be protected according to RO requirements to avoid the hot surface danger to the personnel and minimise the heat transfer into the machinery space. All components of exhaust system shall be mounted or suspended by the hangers which will not transmit heat, noise or vibration to the Vessel's structure.
- 7.2.6 The main engine's shall be resilient-mounted to the ship's structure.

7.3 Main Engines Control

- 7.3.1 The controls and instrumentation of the main engines are to be designed for one-man operation in the wheelhouse, they shall be ergonomically laid out and grouped around the steering position in the wheelhouse control console,
- 7.3.2 Instrumentation and controls in the control console shall be comprehensive and shall include:
- (a) Starting and stopping of main engines from the wheelhouse;
 - (b) Emergency stop button with guard cover;
 - (c) Wheelhouse /local control change over switch and indicator;
 - (d) Speed control device;
 - (e) Rudder angle indicator;
 - (f) Engine tachometers with running hour meter;
 - (g) Sea water cooling pressure;
 - (h) Coolant water temperature and pressure;
 - (i) Engine lubricating oil temperature and pressure gauges;
 - (j) High cooling water temperature alarm and de-rate function;
 - (k) Engine low lubricating oil pressure alarm and trip;
 - (l) Gearbox lubricating oil low pressure gauge;
 - (m) Gearbox lubricating oil low pressure alarm and trip;
 - (n) Ammeter for each engine;
 - (o) Engine exhaust gas pyrometer;
 - (p) Fresh water tank content gauge;
 - (q) Fuel oil tanks content gauge;
 - (r) Overspeed alarm and trip;
 - (s) Main engine expansion tank low level alarm;
 - (t) Battery charging control lamps;
 - (u) D.C. power on light;
 - (v) Central illumination dimmer for all light in the control console;
 - (w) Lamp test;
 - (x) Alarm test and reset;
 - (y) A standard engine maker's engine control panel to be provided in the engine room; and
 - (z) Any other instrumentation recommended by the engine maker and GNC.

7.4 Electric Generator Sets

- 7.4.1 Two (2) electrically started, fresh water cooled diesel engines integrated with alternating current alternator, of self-excited, brushless and ventilated type, shall be installed. [E]
- 7.4.2 The capacity of these generating sets shall be such that either one of the two generator sets shall be able to supply all electricity necessary to ensure normal operation conditions of propulsions and safety can be achieved. Synchronization of the generators are not required.
- 7.4.3 Each electric generator sets at its continuous service rating, shall have sufficient capacity for supplying:
- (h) all full operational electrical load of the whole vessel including air conditioning running at full capacity plus not less than a 15% reserve margin and,
 - (i) to permit the starting of the largest motor without causing any motor to stall or any other device to fail due to excessive voltage drop of the system when the electric generating sets is

supplying full operational electrical load including air conditioning running at full capacity of the whole Vessel.

7.4.4 Normal shore supply voltages on the Vessel are 220V for essential electric apparatus. One 220V single phase power supply to the electric equipment from the distribution board shall be through circuit breakers. The distribution system for 220V AC shall be insulated with two wires.

7.4.5 Electrical load analysis and calculations shall be approved by the RO before submission to GNC.

7.5 Electric Generator Engine Control

7.5.1 The controls and instrumentation of the generator engine shall be designed for one man operation in the wheelhouse, the instrumentation and controls in the control console shall be comprehensive and include:

- (a) Remote start and stop
- (b) Tachometer with running hour meter
- (c) Cooling water temperature gauge
- (d) Exhaust gas temperature gauge
- (e) Lubricating oil pressure gauge
- (f) Battery charger ammeter
- (g) Fault indicating lights and alarms
- (h) Protective devices such as overspeed and low lubricating oil pressure trip as recommended by the engine builder
- (i) A standard manufacturer's local control panel to be fitted in the engine room.

7.6 Instrumentation and Control

7.6.1 A control station in the wheelhouse shall be provided with comprehensive instrumentation and controls for remote operation and monitoring of the main engines, electric generator sets and other auxiliaries to facilitate for unattended engine room operation.

7.6.2 One fire detector panel and one engine room carbon dioxide fire fighting panel shall be installed in the vicinity of the control station.

7.6.3 Additional controls and monitoring devices shall also be provided locally in the vicinity of that machinery or equipment.

7.6.4 All the instruments such as temperature sensors, pressure sensors, level gauges, etc. shall have obtained type approval certificates by a RO or the manufacturer's certificate complying with the national standards of the place of manufacture of the relevant instrument. The Contractor shall provide copies of the type approval certificates or the manufacturer's certificate to GNC on or before the Delivery Acceptance.

7.6.5 All indication lights, illumination of instrumentation gauges fitted on the consoles of the wheelhouse control station shall be fitted with dimmers for day and night operation.

7.6.6 At least two independent means of stopping the main engines from the wheelhouse control station under any operating conditions shall be available

7.7 Reduction Gearboxes

7.7.1 The reversing reduction gearboxes shall be resilient-mounted to the ship's structure. Gearboxes shall be provided with clutches, alarm senders, and switches.

- (a) Gear oil heat exchangers shall be piped to the engine cooling circuits as specified by the manufacturer. Gearbox oil coolers shall be sized to accommodate the heat generated by the clutches at less than full engagement.
- (b) Reduction gear shall be sized to provide both low and high speed performance, shafts shall rotate outboard when the Vessel is moving forward.
- (c) In order to operate at the loitering speed of maximum 5 knots, repeated cycling of the clutches in and out of gear is not permitted in any case to obtain low speed operation. If required the Vessel shall be fitted with a gearbox configured with a trolling clutch to permit low-speed operation.

7.7.2 The gearbox shall be provided with alarms for low oil level and oil temperature. Alarms shall be repeated both locally and at the wheelhouse.

7.8 Propeller Shafts, Stern Tubes, Propellers

7.8.1 All the components of the shafting system shall be in accordance with the requirements of the rules of an RO.

7.8.2 All the components of the shafting system shall be of adequate strength and stiffness to enable it to withstand the most adverse combination of the loads without exceeding acceptable stress levels for the material concerned

7.8.3 stern tubes

(a) Water lubricated stern tubes with packing type glands shall be of type approved by a RO or other organisations acceptable to GNC. Propeller shaft bearings shall be RO approved water-lubricated cutlass rubber/composite type. Forward and after ends of stern tubes shall be bored for bearings and a dripless shaft seal system shall be fitted to the inboard side of each stern tube.

(b) The material of the stern tube should be AL5083, bronze, stainless steel 316L with antifouling protection.

7.8.4 The propeller shafts exposed to sea-water shall be manufactured from corrosion resistant material, such as 316L (austenitic) stainless steel or equivalent material.

7.8.5 The propellers shall be a fixed pitch type with the design to minimise the vibration in shell plating and hull girder.

7.8.6 Propellers shall turn outboard at their tops when the Vessel is moving ahead.

7.8.7 Propellers shall be selected to achieve the Contract speed when 100% of Maximum Continuous Rating (MCR) engine power.

7.8.8 The propeller shaft brackets shall be of stainless steel construction. The materials for shaft brackets, shafts, keys, locking nuts, etc. shall be compatible for use with the propeller material.

7.8.9 Grease or packing containing graphite shall not be used with these shafts.

7.8.10 Each propeller shaft shall be fitted with a rope-cutting device.

7.8.11 The propellers and stern tubes shall be protected by a cathodic protection system for 2 years service life from the date of Delivery Acceptance.

7.8.12 Torsional vibration analysis of the shafting system shall be submitted to a RO for approval.

7.9 Steering Gear System

7.9.1 The steering gear system shall be a twin rudders arrangement and shall comply with the requirements of RO.

7.9.2 Electro-hydraulic steering gear with two independent power units, each running unit is capable of providing the maximum torque operating on twin rudders from 35 degrees on either side to 30 degrees on the other sides within 28 seconds.

7.9.3 The system should include motor driven pumps, reservoir/filter units, emergency manual helm pump, rudder transmitter limit switch, rudder angle indicators, actuating cylinders, master helm control and one non-follow-up controller.

7.9.4 Due to the arrangement of the ancillary boat at the stern, the Contractor shall design a suitable lever linking the port and starboard rudder stock or design/using electrical means to provide the synchronous feedback from port and starboard rudder to ensure the proper operation of the steering wheel and the joystick.

7.9.5 Rudders are controlled by steering wheel or joystick (both steering wheel and joystick are required) in the control station of the wheelhouse. Coxswain shall be able to use steering helm wheel or joystick at the same time. Steering helm wheel may also function as emergency manual helm pump in case of emergency. The power hydraulic pump could be started and stopped both in wheelhouse and in steering gear room. Steering wheel type shall be non-skid type of appropriate size acceptable to GNC.

- 7.9.6 When all electro-hydraulic steering fails, the control of the rudder shall be automatically switched from the electro-hydraulic steering to the emergency hydraulic helming via a automatically hydraulic lock in the wheelhouse.
- 7.9.7 Separated illuminated rudder angle indicator with dimmer switch, running and overload alarm should be provided in the wheelhouse.

7.10 Rudders and Rudder Stocks

- 7.10.1 The rudders shall be designed to meet the RO Requirements.
- 7.10.2 Rudder angle indicators shall be provided in the steering gear. The port and starboard degree markings in intervals not greater than one degree shall be permanently marked and distinguished by red (port) and green (starboard) in English and traditional Chinese.
- 7.10.3 Extremes of rudder travel shall be provided by mechanical stoppers.
- 7.10.4 Lower bearings of rudder stock shall be water-lubricated
- 7.10.5 The rudders and rudder Stocks exposed to sea-water shall be manufactured from corrosion resistant material, such as 316L (austenitic) stainless steel or equivalent material.

7.11 Engine Room Ventilation

- 7.11.1 There shall be four sets of marine axial type a.c. ventilating fans with silencers in the engine room. 2 sets of supply fans and 2 sets of exhaust fans. All air inlet and outlet shall be equipped with fire dampers.
- 7.11.2 Arrangements shall provide sufficient air to the engine and shall give adequate protection against damage, as distinct from deterioration, due to ingress of foreign matter.
- 7.11.3 The air supply inlet vents shall be connected to louvers of efficient design in preventing ingress of water during extreme weather conditions. All vents shall be provided with weather-tight covers, fire dampers and coaming of adequate height (Trunks shall be at least 600 mm above the main deck.).
- 7.11.4 Engine room compartment shall be adequately ventilated so as to ensure that when machinery therein is operating at full power in all weather conditions, including heavy weather, an adequate supply of air is maintained to the compartment for the safety of personnel and the operation of the machinery.
 - (a) All spaces containing machinery shall be provided with forced ventilation for combustion and ventilation air to meet the requirements of the prime movers and other heat sources with a minimum 50 air changes per hour for the machinery space. The ventilation design shall be such to avoid any hot spot or “dead air” area.
 - (b) All ventilation ducts, intakes, and outlets shall be sized to minimise pressure drops and flow noise. For design purpose, air flow rates in ducting shall be kept at 10 m/s or less. Airflow rates at vents and louvers shall be as low as is required to avoid flow noise (Typically 5 m/s depending on vent or louver design)
- 7.11.5 Steering gear compartment and tank space shall be adequately mechanically ventilated for the purpose of those compartments. The ventilation arrangements shall be adequate to ensure that the safe operation of the Vessel is not put at risk.
- 7.11.6 For guidance, the ventilation air to the compartment as stated should:
 - limit the temperature rise in a machinery space to 10°C above ambient temperature;
 - As the prime movers draw combustion air from within the compartment, the total ventilation air be based on ISO 7547 “Standard for Shipbuilding - Air-conditioning and ventilation of accommodation spaces” as a minimum but should not be less than that required for combustion plus 50%.
- 7.11.7 Automatic shut-off device shall be provided according to RO Requirements when CO₂ system activated.
- 7.11.8 Calculation for the capacity of the fans to meet the minimum air changes requirements should be submitted to the RO for approval.

7.12 Air-conditioning System

- 7.12.1 A Proprietary make cold and warm split-type Air Duct Air-conditioner system including indoor and outdoor units for each of the following compartments shall be provided. The Contractor shall propose specific equipment for approval by GNC prior to purchasing.
- a) Bridge
 - b) High Command Office
 - c) Meeting room
 - d) Ship office
 - e) Crew space

Air-cooled type air-conditioning units shall be used. The supply/exhaust of the circulation air through the air duct installing under the ceiling or side wall is required.



- 7.12.2 The temperature of the compartments as stated in paragraph 7.12.1 shall be maintained at 22°C for 60% relative humidity when the external ambient air temperature is 38°C at 85% relative humidity with full crew and full carrying capacity on board. An acceptance test of the complete air-conditioning system of the Vessel shall be carried out by GNC to verify the system is effective and complying to the requirements given here. The Contractor shall provide GNC a copy of this test report upon completion of the test.
- 7.12.3 The design of the cooling air capacity shall be evenly distributed. An individual control shall be provided in each compartment.
- 7.12.4 The air-conditioner shall be of a proprietary make with local control in wheelhouse.
- 7.12.5 The heat exchange coils shall be provided with anti-corrosion treatment.
- 7.12.6 The refrigerant shall be CFC and HCFC free.
- 7.12.7 Remote emergency stop buttons in the wheelhouse shall be provided to stop the air-conditioning units in an emergency.
- 7.12.8 The supporter rack for each outdoor unit shall be provided. Removable covers shall be provided for protection the external unit of the air-conditioner from sunlight / rain.
- 7.12.9 Sufficient fresh air induced to the air-conditioned area shall be based on ISO 7547 “Standard for Shipbuilding - Air-conditioning and ventilation of accommodation spaces”, All compartment; and there shall be not less than 25 m³/hour per person so as to keep the CO₂ level low enough for health reasons. Sufficient ventilation shall be provided in case of air-conditioning breakdown
- 7.12.10 Mould and bacteria resistant replaceable filters shall be fitted at air inlets.

7.13 Piping System

7.13.1 Pipes connection and bending

- (a) Piping connections and joints shall be constructed and designed in accordance with the rules and regulations of the RO.
- (b) Pipe bends should be kept to a minimum and have sufficient radius to facilitate smoothness of flow.

7.13.2 The piping material shall be copper chrome plated or stainless steel 316L.

7.13.3 All pipes for essential services shall be secured in position to prevent chafing or lateral movement. Long or heavy lengths of pipe shall be supported by bearers so that no undue load is carried by pipe connections or pumps and fittings to which they are attached.

7.13.4 Suitable provision for expansion shall be made, where necessary, in each range of pipes.

7.13.5 Where expansion pieces are fitted, arrangements shall be provided to protect against over extension and compression. The adjoining pipes shall be suitably aligned, supported, guided and anchored, where necessary, expansion pieces of the bellows type shall be protected against mechanical damage.

7.13.6 So far as practicable, pipelines, including exhaust pipes from engines, shall not be routed in the vicinity of switchboards or other electrical appliances in positions where the drip or escape of fluids or gas from joints or fittings could cause damage to the electrical installation. Where it is not practicable to comply with these requirements, drip trays or shields shall be provided as found necessary.

7.13.7 Watertight bulkheads, decks or structural members having pipeline penetration shall be designed and compensated in accordance with the RO Requirements.

7.13.8 The material of the gaskets shall be capable of resisting chemical attack of the fluid being conveyed. Galvanic corrosion shall be avoided if different materials are used in the system.

7.13.9 Machinery and piping designation and marking.

- (a) All piping and equipment shall be labelled and colour-coded. And each pipe running through each compartment shall be colour coded, labelled, and have the direction of flow marked in at least two places.
- (b) Colour coding of machinery and piping shall be in accordance with the following:

Fire main	:	Red
Sea Water	:	Dark Green
Fuel Oil	:	Dark Brown
Lube Oil	:	Striped Black/Yellow
Fresh Water	:	Blue
Hydraulic Oil	:	Orange

7.14 Fuel Oil System and Fuel Oil Tank

7.14.1 As Government vessels are committed to utilize sustainable / renewable fuel blends, the propulsion engines and the electric generators of the Vessel shall be able to use ASTM D975-08a B5 blends diesel fuel (5% bio-diesel, 95% diesel labeled B5) and approved by the engine makers.

7.14.2 The fuel oil of the main engines and generators shall be supplied from two fuel oil tanks. The Contractor is free to design the location of the fuel oil tank to fulfil the specification requirement.

7.14.3 Quick closing valves (control from above the main deck) shall be fitted to the fuel oil tanks outlets.

7.14.4 Boost pumps shall be arranged to lift fuel to the engines through coalescing filters.

7.14.5 Fuel filters shall be mounted near the fuel tank on the suction side of the fuel pump. The system design and filtration systems shall be approved by the engine and generator system manufacturer.

7.14.6 The tanks shall be hydro-statically tested as required by an approved standard and connections shall be proven tight.

7.14.7 An electric motor-driven pump shall be provided for transferring the fuel.

- 7.14.8 The Contractor shall provide the initial fills of fuel oil, lube oil, coolant, and hydraulic fluids using fluids and additives prescribed by engine manufacturer. The Contractor shall provide a summary listing of all fluids and quantities used.
- 7.14.9 All materials used in fuel systems shall be resistant to deterioration by its designated fuel and to other liquids or compounds with which it may come into contact under normal operating conditions, e.g. grease, lubricating oil, bilge solvents and sea water.
- 7.14.10 The filling pipe shall be of metallic construction and a permanent fixture led from the deck and secured to the tank by an approved connection. A screwed cap and name plate inscribed 'Fuel Oil' shall be provided at the filling point. Flexible hoses are not permitted as filling pipes. The diameter of the filling head shall be large enough to be inserted by the filling gun.
- 7.14.11 An easily removable coarse strainer shall be built into the filling line.
- 7.14.12 Two duplex filters are to be fitted in the oil fuel supply lines to the main and auxiliary engines, and the arrangements are to be such that any filter can be cleaned without interrupting the supply of filtered fuel oil to the engines.
- 7.14.13 Where necessary, flexible pipes of approved type may be used as short joining lengths to the engine.
- 7.14.14 Water separators should be fitted to the fuel supply line, if required.
- 7.14.15 Fuel piping material shall be 316L stainless steel. The thickness accords with RO requirement.
- 7.14.16 Fuel Oil Tank(s).
- (a) Fuel oil tank(s) shall be arranged to allow Vessel operation at acceptable trim in all conditions of loading and with consideration for the requirements for good static and running trim, the Vessel shall be built with two fuel tank to service the Vessel's main propulsion engines and ship service electric generators. The tanks shall be interconnected to permit fuel transfer between the tanks.
 - (b) The fuel oil tank(s) shall be fitted / installed in the tank space, actual location to be designed and approved by an RO and accepted by GNC.
 - (c) The thickness shall sustain the loads due to the mass of the full tank with due consideration given to accelerated forces due to the Vessel's movements at all speeds at sea, without damaging the tank and ship structure.
 - (d) Internal surfaces of the fuel oil tank shall be left unpainted and shall be cleaned thoroughly to the satisfaction of GNC.
 - (e) Provisions to the fuel oil tank
 - (i) A tank content level gauge in liters and low level alarm shall be fitted on the wheelhouse control station. The level gauge of each fuel oil tank shall be marked with markings of level;
 - (ii) Rigid fuel suction pipes near the tank bottom shall be provided;
 - (iii) An inspection hole, air vent with flame trap on deck and discharge valve with remote operated quick closing device shall be provided;
 - (iv) Suitable provision such as drip trap shall be made for collecting the oil discharge;
 - (v) Baffles shall be provided, the total open area provided in the baffles shall be not greater than 30% of the tank cross section in the plane of the baffle;
 - (vi) Baffle openings shall be designed so that they do not prevent the fuel flow across the bottom or trap vapour across the top of the tank;
 - (vii) The fuel oil tank shall be tested by a head of water equal to the maximum to which the tank may be subject, but not less than 2.5 m above the top of the tank. The static test pressure shall be applied for 5 minutes without pressure drop. After the test, the test fuel tank shall not show any leakage;
 - (viii) Sounding pipes with chained cap shall be provided;
 - (ix) Tank drain shall be provided; and
- The compartment or space containing the fuel oil tank shall be fitted with two ventilating pipes of arrangement acceptable to GNC.

7.15 Fresh Water System

- 7.15.1 One independent stainless steel fresh water tank with a total capacity of not less than 1000 litres shall be arranged in the Vessel to supply fresh water to the main deck and crew space.
- 7.15.2 The fresh water shall be supplied by a fresh water pump to achieve a pressure at the tap located at main deck and crew space to GNC's satisfaction. This system act as the potable fresh water system and a hose which freely reaches all parts of the Vessel shall also be provided.
- 7.15.3 Marine grade stainless steel 316 shall be used. The fresh water tank shall be flushed clean before installation and delivery of Vessel.
- 7.15.4 The fresh water tank shall be designed to easily accessible for maintenance. It shall also be arranged with its own fill and vent pipes with gauze to prevent ingress of material / bugs to the tank. The freshwater tank shall be fitted with the following:
- (a) Inspection / cleaning access cover
 - (b) Filling / sounding pipe
 - (c) Air pipe
 - (d) A tank content level gauge in liters and low level alarm shall be fitted on the wheelhouse control station.
- 7.15.5 The tanks shall not be integral with the hull and shall be installed so that the loads due to the mass of the full tank are safely induced into the structure.
- 7.15.6 The thickness shall sustain the loads due to the mass of the full tank with due consideration given to upward and downward acceleration due to the Vessel's movements at maximum speed in the sea without damaging the integrity of the tank and ship's structure.
- 7.15.7 The freshwater tank shall not be directly adjacent to any other tanks carrying liquid of any kind.
- 7.15.8 The freshwater tank shall be tested without leakage by a head of water equal to the maximum to which the tank may be subjected, but not less than 2.5 m above the top of the tank. The static test pressure shall be applied for five minutes without pressure drop.
- 7.15.9 A capacity indicator calibrated in litres shall be provided.
- 7.15.10 The pressurised unit shall be provided with a starter, pressure switch, pressure gauge, relief valve and suction valves. The freshwater pump shall maintain the pressure automatically.
- 7.15.11 Domestic freshwater piping shall be made of copper. Certificate of piping material shall be submitted before the delivery of Vessels. The welding joints of the domestic fresh water pipings shall be free from lead. The domestic fresh water from the fresh water tank shall be free from any substance harmful to health and shall comply with the Government requirements for domestic water.
- 7.15.12 Stainless steel cold freshwater taps completed with 15m PVC braided / reinforced transparent hoses should be fitted on the main deck aft/front and wheelhouse top to provide a rinse off facility for cleansing purposes.
- 7.15.13 Electric water heater with sufficient capacity provides hot water for one showering heads at a time with flow rate of not less than 9L/min.
- 7.15.14 Wipers with fresh water window washing systems shall be supplied with fresh water.
- 7.15.15 Two fresh water pipes with nozzles and plastic pipes about 22 metres installed in the forward deck and aft deck respectively for cleaning the ship and windows.

7.16 Bilge System

- 7.16.1 An electric bilge pump shall be provided for all compartment.
- 7.16.2 The Vessel shall be fitted with a bilge system conforming to the requirements of the RO.
- 7.16.3 A bilge audible and visual alarm panel shall be fitted in the wheelhouse control station for all compartments, such as, engine room, crew space, steering gear room, fore peak and tank space, etc.

- 7.16.4 When the Vessel is afloat and unmanned, the bilge audible and visual alarm system shall continue to function, when the audible and visual alarm is not acknowledged after a time period such as five minutes (to be adjusted), the audible and visual alarm shall be extended externally to an audible and visual alarm fitted on the top of the deckhouse to bring the attention of the persons ashore or the guard of the Government Dockyard. The additional protection shall be able to be turned on and off when required.
- 7.16.5 A bilge water holding tank of minimum of 500 litres in capacity shall be provided in the tank space. Marine grade stainless steel 316L shall be used for bilge water holding tank. [In the general arrangement plan, no bilge holding tank was indicated. Please consider to illustrate in the plan accordingly.]
- 7.16.6 The bilge shall lead to the bilge water holding tank. An electric motor-driven pump with associated piping shall be provided in pumping out the bilge water ashore. A direct overboard shall be provided in case of emergency affecting the safety of the Vessel.
- 7.16.7 Bilge piping shall be made of stainless steel 316L.

7.17 Seawater System

- 7.17.1 The piping system of sea-water pumping shall be protected from overpressure. The piping system shall also be suitably protected from corrosion and capable of draining thoroughly during operation
- 7.17.2 The piping system of sea-water pump shall be designed to avoid water hammer and similar hydraulic shocks within the system and providing the means to purge air from the piping system at low flow velocities.
- 7.17.3 All sea valves shall be compatible with the hull material, connected to the sea chests shall be tested according to the RO Requirements.
- 7.17.4 Sea chests provided for the main and auxiliary machineries should be installed in the vicinity of their respective seawater pump suction but with adequate distance between each other to avoid water flow disturbance.
- 7.17.5 The sea water inlet at sea chest shall be fitted with strainer plates at the Vessel's shell. The strainer plates shall possess a clear area at least twice that of the sea valves. The edges of strainer plate slots or holes shall be rounded to prevent the cavitation. Compressed air or other effective means shall be provided for clearing off debris from the strainer plates.
- 7.17.6 (a) Seawater piping shall be constructed of stainless steel pipe SS316L with sufficient thickness.
(b) A suitable strainer with isolation valves and air vent should be fitted to each seawater system.
(c) Due consideration shall also be given for quick and easy access to the seawater strainers.
- 7.17.7 Sea water inlet and sea chest shall be arranged and located at position as low as practical to avoid clogging due to debris from sea.
- 7.17.8 The suction arrangement for the fire pump shall include a sea chest with screened inlet, a valve near the sea chest outlet and a valve vent to atmosphere shall be provided.
- 7.17.9 Cathodic protection shall be provided for sea chests.

7.18 Sanitary, Grey and Black Water System

- 7.18.1 There are two toilets in the Vessel. One located in the ship office and the other in the crew space. Both toilets shall use pressured sea water for flushing.
- 7.18.2 An isolating sea water valve for the toilet flushing in the ship office shall be installed outside the toilet, under the washing basin inside the room adjacent to the toilet.
- 7.18.3 One stainless steel grey/black water holding tank with capacity of not less than 500 litres shall be installed in the tank space.
- 7.18.4 A sanitary/sea water pump shall be installed in the engine room to supply sea water for sanitary service. Pressurised seawater shall be distributed to the toilets through pressure reducing valves or for flushing

by direct pressure via flushing valves.

- 7.18.5 Toilet and basin shall be designed to discharge into the grey / black water holding tank and ashore. Alternative pipings shall be arranged for the wash basins/toilets to be discharged directly overboard through a non-return shipside valve if necessary.
- 7.18.6 The tank shall be fitted with a level gauge and a “Tank Full” indicator installed in a highly visible location in the wheelhouse.
- 7.18.7 The design of the toilet shall be agreed and acceptable to GNC before installation. Alternative piping to be provided to discharge the toilet directly overboard in emergency.
- 7.18.8 A discharge macerator electric pump shall be provided for pumping out the contents of the holding tank. This shall be primarily lead to the shore connection, but shall also be arranged with a backup direct overboard discharge via non-return valve. The shore connection shall be arranged with an international shore connection.
- 7.18.9 Sanitary, Grey and Black Water piping shall be made of stainless steel 316L

7.19 Open deck drainage system

- 7.19.1 The Vessel shall be fitted with an Open deck drainage system to the requirements of the RO.
- 7.19.2 Upper deck lines are constructed by AL5083 tubes.

7.20 Floor Plates, Handrails and Guards

- 7.20.1 The floor in compartments under main deck shall be covered with unpainted aluminium chequer plate for safe operational use.
- 7.20.2 All boundary bars, handrails, gratings, ladders, platforms, stanchions and vertical supports in the compartments shall be of lightweight construction. Aluminium chequer floor plates shall be secured by fixing with sections but shall be readily removable for access to the components including but not limited to bilges, pumps, shaft, pipe work and strainers for ease of maintenance.
- 7.20.3 Hinged access plates shall be fitted in way of valves. Suitable arrangements shall be provided for hinged plates to avoid rattling noise.
- 7.20.4 Removable guards for the protection of personnel and machinery shall be provided over exposed moving parts of the components including but not limited to machinery and hot pipe work.
- 7.20.5 Components including but not limited to splash plates, casings, fenders and screens shall be provided for the protection of personnel and machinery.

Chapter 8 - Requirements for Electrical System

8.1 General Requirements

- 8.1.1 All the electrical equipment and installation on the Vessel shall comply with the requirements of the RO.
- 8.1.2 Contractor shall design a solar panel system to convert solar energy to power shipboard lightings and other equipment with the backup from the switch board power supply during gloomy days. The number of solar panel to be agreed by GNC.
- 8.1.3 All electrical equipment, fittings, instruments, switches, cables, insulation, sheathing, circuit breakers, rating standards and their installations shall comply with the latest Regulations of the International Electro technical Commission (hereinafter referred to as IEC), Electrical Installations in Ships.
- 8.1.4 Protective devices such as circuit breakers or fuses shall be provided at the source of power, e.g. the switchboard, to interrupt any overload current in the circuit conductors before heat can damage the conductor insulation, connections or wiring-system terminals.
- 8.1.5 Switches and controls shall be marked to indicate their use, unless the purpose of the switch is obvious and its mistaken operation will not cause a hazardous condition. Each cable shall be clearly labelled and carry its own unique identification code.
- 8.1.6 The Contractor shall submit a layout plan showing the exact locations of the Equipment. All Equipment shall be accessed easily and safely for inspection and maintenance.
- 8.1.7 All Equipment installed shall be provided with manuals for operation and maintenance.
- 8.1.8 The standard of installation shall enhance the Equipment's safety features of not presenting any hazards to the operator, e.g. all metal panels exposed to the operator shall be grounded properly. Warnings of any potential hazards shall be displayed in both English and Chinese, or with universally recognised labels.
- 8.1.9 Essential drawings and detailed particulars (such as the rating and capacity, type of all electrical Equipment as well as the wiring, circuit breakers, lighting and sockets, etc.) shall be submitted to RO approval and MD endorsement before installation.
- 8.1.10 Detailed wiring diagrams of the complete supply and distribution network, including wire size, insulation and sheathing shall be submitted for RO approval and MD endorsement before commencement of the installation.
- 8.1.11 If electrical fittings, not of aluminium, are connected to aluminium, suitable means is to be taken to prevent electrolytic corrosion.

8.2 Electricity Distribution Network

- 8.2.1 The main electrical AC power supply shall be provided by two diesel generators (220V AC, 50 Hz, single phase, 2-wire insulated system). The generators shall have unrestricted continuous rating. The generators shall be located in the engine room, positioned port and starboard.
- 8.2.2 Each generator shall be sized based on a 15% growth margin above the predicted maximum load condition. The vessel's electrical load calculation shall include summer and winter, static and transient, loads on AC, DC, shore power, and ship service systems. The vessel's electrical load calculation is to be approved by the RO / Classification Society and to MD's satisfaction.
- 8.2.3 The generator set will maintain an output voltage within ± 5 percent over the entire load range and frequency within ± 1.5 Hz.
- 8.2.4 The generator starting circuit shall be 24 VDC. Starting and normal shutdown controls shall be mounted on the generator along with generator oil pressure and water temperature gauges; AC voltmeter and ammeter shall be directly connected to existing wiring systems with the use of a double-pole, double-throw (DPDT) transfer switch / centre-off switch for an ammeter to read both legs (AC Volts readings).

- 8.2.5 The generator shall be protected against short-circuits and overloads by multipole circuit breakers (overload protector).
- 8.2.6 The distribution of the electricity to the equipment is through circuit breakers fitted on an electrical distribution board.
- 8.2.7 Power distribution panels / electrical distribution boards shall be positioned in the wheelhouse.
- 8.2.8 Circuit breakers shall be provided for each circuit. Circuit breakers shall be of the proper voltage rating, manual reset type, designed for inverse time delay, instantaneous short circuit protection, and capable of repeatedly opening the circuit in which it shall be used without damage to the circuit breaker. Circuit breakers shall indicate whether they are in the open or closed position. All circuit breakers shall be labelled to identify the circuit being protected.
- 8.2.9 Twenty percent (minimum of three) spare circuit breakers shall be provided in each distribution panel, both AC and D.C. The Vessel's electronic navigation equipment shall be supplied from an independent distribution panel, which shall in turn be supplied from a single breaker in the main D.C. panel.
- 8.2.10 Twenty percent (minimum of two) spare wiring penetrations shall be provided through each bulkhead except the forward collision bulkhead. Spare penetrations shall be plugged watertight with rubber plugs.
- 8.2.11 All single-phase loads shall be balanced on each light feeder. Loads of one type such as heaters or receptacles shall not be concentrated on a single branch or leg.
- 8.2.12 All supply panels shall be fitted with a miniature circuit breaker of double-pole type with over-current and short circuit trips. All junction boxes shall be readily accessible and the prime supply panel shall be positioned inside the wheelhouse. A special arrangement is required for the navigational lights supplied from this prime panel.

8.3 Main Switchboard

- 8.3.1 Switchboards for main and emergency power supplies shall be installed such that the control elements, indicating instruments, circuit breakers and fuses are readily accessible. The terminal side shall be accessible.
- 8.3.2 Under all normal conditions of operation, power is distributed from the main switchboard and the distribution system shall be designed to keep cable costs to a minimum by distributing to power panels located close to the user services and in general located in the engine room. Connections and components on panel-boards shall be in locations protected from the expected conditions in conformity with IEC 60529:
 - (a) IP 67 as a minimum, if exposed to short-term immersion;
 - (b) IP 55 as a minimum, if exposed to splashing water;
 - (c) IP 20 as a minimum, if located in protected locations inside the Vessel.
- 8.3.3 Switchboards shall be permanently marked with the nominal system voltage.
- 8.3.4 A self-standing dead front marine type main switchboard of aluminium construction with adequate ventilation louvres shall be fitted in an accessible and well ventilated position in the wheelhouse and shall contain the following:
 - (a) Sector for electric generator set 220V AC
 - (b) Sector for 24 V & 12V D.C.
 - (c) Sector for shore power
 - (d) Sector for solar power
- 8.3.5 Due consideration shall be given in respect of the switchboard location to avoid any risk of damage resulting from oil and water spray or other mechanical hazards. Adequate guardrail(s) and insulated mat(s) shall also be provided.
- 8.3.6 Megger test and other relevant tests shall be carried out and witnessed by GNC. The results for these tests shall form part of Sea Trial Report that shall be submitted to GNC before Delivery Acceptance.
- 8.3.7 An appropriate laminated electrical diagram shall be attached on each switchboard.

- 8.3.8 All switchboard instruments, controls, and all circuit breakers, both on external panels and inside the switchboard, shall be provided with labels of durable flame-retardant material bearing clear and indelible indications. The appropriate ratings of fuses, the setting of adjustable protective devices and the full load current of electric generator shall be indicated.
- 8.3.9 Apart from the spare feeder breakers, the switchboard shall contain but not be limited to the following:
- (a) Electric Generator Set Sector with the following:
 - (i) Circuit breaker of adequate capacity with over-current trip and short circuit trip;
 - (ii) Interlock device to ensure only one electric generator is connected to the busbar;
 - (iii) Voltmeter, ammeter, wattmeter and frequency meter;
 - (iv) Indication lights for "Power Available", "Breaker Opened" & "Breaker Closed";
 - (v) All necessary fittings and any other protective devices.
 - (b) 220V Single Phase Sector with the following:
 - (i) Meters or earth lamps to indicate the state of insulation;
 - (ii) Moulded case circuit breakers with over-current and short circuit trips for the distribution of 220V AC power supply to their components including but not limited to lighting services, fans and motors;
 - (iii) Any other necessary fittings and protective devices.
 - (c) 24V and 12V D.C. Feeders Sector:
 - (i) Transformer / rectifier of adequate capacity for converting AC power to D.C. power. The rectifier shall be of 1-phase full wave regulated type with voltage regulation $\pm 5\%$ and ripple factor 4% at 100 Hz;
 - (ii) Magnetic automatic relay switch for activating emergency 24V D.C. supply in event of AC power failure;
 - (iii) Supply source indicator lamp for transformer / rectifier;
 - (iv) Ammeter for charging unit;
 - (v) Voltmeter with selector switch (charging voltage and battery voltage);
 - (vi) Metres or earth lamps to indicate the state of insulation;
 - (vii) Moulded case circuit breakers with over-current and short circuit trips for 24V D.C. bus and feeder circuits; and
 - (viii) Any other necessary fittings and protective devices.
 - (d) Shore Power Connection Sector:
 - (i) Moulded case circuit breaker for shore connection box shall be provided on the main switchboard.
 - (ii) The shore connection box shall be capable of receiving 220V single phase 50 Hz 50 Amp current on a 2-wire system and the cables between the connection box and the main switchboard shall be of sufficient capacity to supply the necessary electrical equipment.
 - (iii) An earth terminal shall be provided for connection of the Vessel's earth to the shore earth.
 - (iv) An instruction shall be provided at the connection box to give full information of the system and the procedures for carrying out the connection.
 - (e) Solar power Sector
 - (i) Ammeter for solar power
 - (ii) Voltmeter for solar power
 - (iii) A multipole switch locate in wheelhouse which can sent the solar power to charge all the DC24V batteries, this multipole switch must interlock with other battery charger.

8.4 D.C. Power Source

8.4.1 Batteries for Main Engines and Electric Generator Set Starting

- (a) Independent bank of 24V batteries shall be provided for starting of each of the two main engines

- and the electric generator set.
- (b) The capacity of the batteries shall be sufficient to provide at least six consecutive starts of each one of the main engines, and at least three consecutive starts of each one of the electric generator set from cold, without recharging.
 - (c) Electrical connections shall be arranged so that the batteries can be used to start either main engine or generator engine by operating a manual change-over switch in the engine room.
 - (d) The batteries shall be charged by engine driven alternators with backup service provided by an automatic battery charger. Interlock or protective devices shall be provided to prevent simultaneous charging from the charger and the alternator. The battery charger shall also be prevented from charging the batteries during main engine starting.
 - (e) Batteries to be of maintenance-free type
 - (i) There will be five sets of 24V batteries charged directly from engine driven alternators, generator set and/or the solar panel system. There shall be one battery set allocated to each engine.
 - (ii) Power supply batteries shall be portable, maintenance free, heavy duty, deep cycle and produced from environmentally friendly materials. They shall have a minimum life expectancy of five years, or 200 full discharge cycles at full load, rated in accordance with cognizant regulatory body requirements.
 - (f) Each engine driven alternator shall have its own built-in voltage regulators, automatic cut-off, and any other required protective devices.
 - (g) The batteries shall be located as close as practicable to the engines in order to minimise the voltage drop. The battery bank shall be housed in a separate GRP or GRP lined storage box. Each box shall be provided with a removable cover with locking clips for ease of maintenance.

8.4.2 Batteries for Routine and Emergency Supply

- (a) 24V battery shall be provided for routine and emergency supply, all emergency equipment shall operate from a dedicated 24V D.C. power supply.
- (b) In event of main electrical AC power failure, 24V D.C. batteries shall act as an emergency supply for all communication equipment, navigation and emergency lighting, fire monitoring and control system, and other vital instrumentation and control systems for the Vessel to return to base.
- (c) This emergency supply shall come into operation automatically in the event of main electrical power supply failure. The capacities of these sets of batteries shall be sufficient to maintain the emergency supply for a period not less than 6 hours.
- (d) The batteries shall be installed in a separate compartment located outside of the engine room above deck. The compartment shall be well ventilated and prevent ingress of water.

8.4.3 Independent batteries for Electronic Equipment

- (a) A maintenance-free type battery shall be provided solely for the electronic equipment:
 - (i) VDR
 - (ii) VHF
- (b) The battery bank shall be housed in a separate GRP or GRP lined storage box, that the box should be located outside of the engine room above deck. The box shall be well ventilated and prevent stagnant of water.

8.4.4 12/24V D.C. services shall be supplied from the switchboard in the wheelhouse through a 2-wire insulated system to the following items:

- (a) Navigational light control panel and navigational lights
- (b) Horn
- (c) General lighting (DC24V if applicable)
- (d) Compass light
- (e) Instrument panel in control console
- (f) One hand-held searchlight and one fixed searchlight
- (g) Siren

- (h) Fire detecting system
 - (i) Watertight door indicating and alarm system
 - (j) ECDIS for navigation
 - (k) Radar for navigation (If the radar does not have a DC24V power input port, another inverter shall be provided. The input power of the inverter is DC24V)
 - (l) Unmanned duty alarm system
 - (m) Satellite Gyrocompass
 - (n) /Fiber-Optic Gyrocompass
 - (o) Any other navigational and electronic equipment (if applicable).
- 8.4.5 The batteries as required in Paragraphs 8.4.1 and 8.4.2 shall be subjected to continuous trickle charge under normal operation of the Vessel by an automatic battery charger. Under the battery fully discharged condition, the charger shall be able to perform a quick charge function.
- 8.4.6 Apart from the charger, a provision shall also be made to allow the batteries to be charged by an engine driven alternator. The battery chargers shall provide automatic control between float and boost charges. Each charger shall also be provided with a voltmeter, voltage regulator, selector switch, blocking rectifier, and the required devices for protecting the chargers against short circuit, reverse connection, excessive temperature and overloading. The capacity of each battery charger shall be sufficient for charging one set of completely discharged starting batteries to fully charged condition within 10 hours.
- 8.4.7 Battery charger installations shall meet all cognizant regulatory body requirements including:
- (a) One (1) set of charging and discharging board charger for Routine and Emergency battery shall be located in engine room. Charging method shall be float-charging type and boosting charge type with manual voltage adjuster.
 - (b) The charger is equipped with rectifying device. When the main power supply is normal, the rectifying device provides DC24V power. When the main power failure, it automatically switches to battery for power supply. The character of battery charger shall be: Input (AC)220V, 2Ph, 50Hz. Output(DC) Max. Voltage: abt. 28V.
 - (c) The chargers shall be sized such that a completely discharged battery bank can be recharged to 80% capacity within 8 hours (100% at 10 hours). At the end of the charge, the charge shall be tapered to a trickle value.
 - (d) The chargers shall be fitted with a pilot lamp, a charging adjustment, a voltmeter and an ammeter indicating charging current.
 - (e) Discharge protection shall be provided to prevent a failed charger component from discharging the battery bank.
 - (f) Battery charging facilities will be available via the main propulsion engines and the 220V AC generator. Battery chargers shall not be mounted directly over batteries.
 - (g) The battery systems must have the ability to be charged from the solar panels. The solar panel system shall be fitted to the roof of the deckhouse where utilisation of the physical roof space shall be optimized for maximum solar collection.
 - (h) Battery selector/isolator switches shall be provided between battery chargers and the battery banks they serve.
 - (i) Provisions shall be made to allow either main engine to be started by the other engine's starting batteries.
- 8.4.8 An instruction plate with a schematic wiring diagram illustrating the operating procedures and precautions for the selection of battery banks and charging of batteries shall be provided in the vicinity of the charger, battery selection switchboard and charging distribution board. All charging control shall be conducted in the wheelhouse.
- 8.4.9 Batteries shall be permanently installed in a dry, ventilated location above the anticipated bilge-water level.
- (a) Battery compartment shall be actively ventilated whenever batteries are charging.
 - (b) Batteries shall be located in areas so as to avoid heat soak. Emergency batteries shall be located in the area outside the engine room such as wheelhouse.

- (c) All battery storage boxes shall be provided with removable covers and locking clips for ease of maintenance.
 - (d) Drainage shall also be provided to avoid accumulation of moisture.
- 8.4.10 Batteries shall not be installed directly above or below a fuel tank or fuel filter.
- 8.4.11 Any metallic component of the fuel system within 300 mm above the battery top, as installed, shall be electrically insulated.
- 8.4.12 Battery cable terminals shall not depend on spring tension for mechanical connection to them.
- 8.4.13 A battery-disconnect switch shall be installed in the positive conductor from the battery, or group of batteries, connected to the supply system voltage in a readily accessible location, as close as practical to the battery or group of batteries except the circuits for engine starting and navigation lighting and electronic devices with protected memory and protective devices such as bilge-pumps and alarms, if individually protected by a circuit breaker or fuse as close as practical to the battery terminal.
- 8.4.14 Local information plates showing the voltage, ampere-hour rating, group number and application shall be provided for each battery set.

8.5 Arrangement of Emergency Power

- 8.5.1 The back-up control panels and the indication panel for manoeuvring shall always be supplied by the DC24V switchboard refers to paragraph 8.3.4 (b).

8.6 Shore Power Supply and Connection

- 8.6.1 The electrical system shall include the provision for shore power supply (220 VAC, 50 Hz 50A) designed to an approved standard.
- 8.6.2 The shore power system shall be interlocked to prevent the Vessel's generator from providing power to the shore. Indicating lights for "shore power available", "shore power breaker on" and "shore power breaker closed" to be fitted.
- 8.6.3 The Contractor shall provide a 1:1 isolation transformer for the shore power supply. The earth wire of the shore power cable shall be connected to the shielded core of the isolation transformer. The core of the isolation transformer shall be completely insulated from the case. It shall be convection cooled and shall have no moving parts. The transformer enclosure shall be drip-proof and the isolation transformer shall be rated for continuous operation at full capacity of the shore power connection.
- 8.6.4 The watertight connection box shall be designed with a quick release receptacle.
- 8.6.5 Not less than 20 metres long shore connection power cable of adequate rating with quick release watertight plug shall be provided.
- 8.6.6 The 20-metre shore connection power cable terminating at compatible connections to mate with existing facilities on Government Dockyard, to be identified by GNC. Suitable stowage on board shall be provided for the cable.

8.7 Circuit Breaker

- 8.7.1 All circuit breakers shall have time delay thermal overload trip and instantaneous short circuit current trip. The overload trip shall be set at 110% of the maximum circuit load current. The cable rating shall be in excess of the circuit breaker overload tripping current.
- 8.7.2 Circuit breaker shall act as a protective device only and shall not use for switching purposes. An individual On/Off switch shall be installed for each electrical fitting.

8.8 Motor and Control Gear

- (a) Where a starter is situated remotely from the motor, stop and start buttons should be provided near the motor for local operation.
- (b) All electric motors of essential services shall have separate start and stop push buttons plus running indication lights (with dimmer control) inside the wheelhouse.

- 8.8.1 Motors installed in the engine room and other enclosed spaces shall be of semi-enclosed drip-proof type. Motors installed in locations exposed to weather or moisture shall be of waterproof construction. Insulation of motors shall not be less than Class B standard.
- 8.8.2 A circuit diagram shall be placed in the local control box of each electrical installation.

8.9 Unmanned duty alarm system

- 8.9.1 When the Vessel is afloat and unmanned, if the bilge-alarm or fire detecting system trigger, nobody acknowledged after 5 minutes (to be adjustable), the audible and visual alarm shall be extended to another audible and visual alarm fitted on the top of the deckhouse mast to bring the attention of the persons ashore/nearby or the guard of the Government Dockyard. The additional protection should be able to be turned on and off when required.
- 8.9.2 DC24V power supply from routine battery.

8.10 Level alarm and indicator panel

- 8.10.1 Supply a level alarm and indicator panel in wheelhouse. DC24V power supply from routine battery. The level alarm and indicator panel includes the following functions:
- (a) High level alarm:
 - (vi) Steering gear room bilge
 - (vii) Engine room bilge
 - (viii) Tank space bilge
 - (ix) Crew space bilge
 - (x) Fuel oil tanks
 - (xi) Fresh water tank
 - (xii) Sewage tank
 - (b) Low level alarm:
 - (i) Fuel oil tank
 - (ii) Fresh water tank
 - (c) Level indicator panel in wheelhouse:
 - (i) Fuel oil tank
 - (ii) Fresh water tank
 - (d) Alarm signal to Voyage Data Recorder(VDR) & Unmanned duty alarm system

8.11 Cable, Wiring and Fuse

- 8.11.1 Cables which may be exposed to physical damage shall be protected by sheaths, conduits or other equivalent means. Cables passing through bulkheads or structural members shall be protected against damage to insulation by chafing.
- 8.11.2 Where cables are protected by pipe conduits, the space factors of the pipe conduit shall conform to IEC regulations in order to prevent bunching of wires and to minimise earth faults.
- 8.11.3 Cables shall have minimum dimensions in accordance with IEC regulations or other equivalent international standard, or the conductor manufacturer's rated current-carrying capacity, based on the load to be supplied and allowable voltage drop for the load to be carried.
- 8.11.4 Cables in voltage-critical circuits, such as starter motor circuits and navigation light circuits, whose output may vary with system voltage, shall be sized in compliance with the component manufacturer's requirements.
- 8.11.5 The metallic sheathing, armour or braid of cable shall be properly earthed at both ends. All bare terminals shall be properly insulated by approved cable insulators.
- 8.11.6 Cables that are not sheathed shall be supported throughout their length in conduits, cable trunking, or trays, or by individual supports at maximum intervals of 300 mm.

- 8.11.7 Sheathed cables and battery cables to the battery disconnect switch shall be supported at maximum intervals of 300 mm, with the first support not more than 1 m from the terminal. Other sheathed conductors shall be supported at maximum intervals of 450 mm. Sheathed engine starter conductors constitute an exception to this requirement.
- 8.11.8 Wiring shall be run along perforated metal trays and shall be secured in such positions as to allow easy maintenance.
- 8.11.9 In principle Wiring shall not be installed below the engine room floor plates. If it is unavoidable, it must be laid through galvanized pipes.
- 8.11.10 Cables and wiring inside accommodation areas shall run behind linings which shall have removable panels for inspection and maintenance.
- 8.11.11 Where electric cables have to be fitted on the decorative surface of bulkheads, they shall be enclosed in conduits.
- 8.11.12 (a) RO approved watertight, fire resistant and gastight cable transit system shall be provided in way of watertight bulkhead or deck penetrations (Hilti, RISE or equivalent).



- (b) The penetration should be located as high as practicable and well clear from the ship side.
- 8.11.13 Each electrical cable that is part of the electrical system shall have a means to identify its function in the system, except for conductors integral with engines as supplied by their manufacturers.
- 8.11.14 Cables and the wiring terminals of different AC and D.C. power supply voltages in the junction box, fuse box as well as the equipment terminal box shall be laid separately and shall have a distinctive code and labelling system for easy identification to facilitate tracing.
- 8.11.15 Tally plates showing the cable size and the number of cores shall be provided for each of the main power cables.
- 8.11.16 All fuses are preferably of cartridge type and rated adequately for the protected circuits.
- 8.11.17 Electric wiring (whether single core or multi-core type) shall use approved (by an authority acceptable to GNC) type of bulkhead/deck penetration gland/fitting when they pass through watertight bulkheads or the weather deck.

8.12 Lighting Fixtures

- 8.12.1 General lighting shall be provided for all compartments and shall be arranged to give sufficient illumination to all working areas for normal operation. All lighting shall be equipped with LED bulbs including the navigation lights.
- 8.12.2 Lighting shall be in accordance with the recommended practices for marine lighting and to MD's satisfaction, particular attention will be paid to the level of brightness provided in all areas.
- 8.12.3 The general lighting system described herein shall be composed of fixtures permanently installed as necessary to provide the levels of illumination required to an approved standard. The system shall include fixtures, switches, panels, boxes, and cabling for the distribution system supplying the lighting fixtures. Fixtures shall be accessible for re-lamping and cleaning.
- 8.12.4 General lighting shall have individual or group switches to conserve power, unless agreed with GNC, all light sources, including signalling, shall be of LED type. The LED colour temperature is to be to MD's satisfaction.
- 8.12.5 All lighting in the Wheelhouse and the High Command Office shall be fitted with a dimmer control. Red lighting with dimmers and switches shall be provided for operation at night. Lighting from the

engine room shall not be seen through the ventilation louvres during operation at night. Emergency lighting of 24V D.C. supply shall be provided for all compartments, emergency embarkation stations, open decks as per the RO Requirements.

- 8.12.6 Emergency exit routes shall be identified and illuminated as required by RO Requirements.
- 8.12.7 For the wheelhouse (forward port and starboard, for the aft port and starboard tables) , High Command Office, ship's office and crew space, small red and daylight lighting shall be provided above all desks and working areas including the touch screen table and the adjunction work table inside the High Command Office. Red and daylight can be changed by switch, and it can be adjusted by dimmer.
- 8.12.8 Controls shall be provided within each compartment for the illumination therein. Each light shall have a manually controlled switch located at the primary entrance to that compartment and switches for this purpose shall be installed near the access and located so as not to be obscured when the door is open. A separate switch shall be provided in each compartment to control each group of lights. Switches shall break both sides of the circuit. Fixtures shall be installed so that illumination therefrom will not be obstructed by the components including but not limited to fixed pipes, ducts, bins and berths.
- 8.12.9 Fixtures shall be mounted so as not to vibrate in any operating condition and so that the vessel vibration will not harm the fixture. Fixtures shall be selected and mounted to maintain the maximum possible headroom.
- 8.12.10 All sockets, terminal blocks, and switch and receptacle interiors shall be made of non-flammable phenolic material.

8.13 Navigational Lights

- 8.13.1 All navigational and signal lights to be provided shall be in compliance with the International Regulations for Preventing Collisions at Sea 1972 as amended by IMO Resolution A. 464 (XII) and A. 626 (XV). Type approved certificate in respect of each model of the navigational and signal lights issued by any one of the ROs listed in Paragraph 2.3.4(a) to (i) shall be provided on or before the Delivery Acceptance at the latest.
- 8.13.2 The lightings shall be controlled from a control and alarm signal panel in the wheelhouse. Each - circuit shall be provided with a switch, protection fuse, indicating lamp and alarm. A dimmer for the panel indication lights, buzzer stop and lamp test buttons shall be fitted. The navigation light control panel alarm and it's communication interface must be suitable to VDR.
- 8.13.3 Navigational light circuits shall be independent of any other circuit. There shall be two essentially separate power supply systems to the distribution board: one from the main AC power source and one from the emergency D.C. power source.
- 8.13.4 The following navigational and signal lights (with double-pole circuit breakers) and shapes shall be provided:
 - (a) Port-side light;
 - (b) Starboard-side light;
 - (c) Stern light;
 - (d) Masthead light;
 - (e) Anchor light;
 - (f) Combined NUC and diving lights as follows: three all-round lights in a vertical line where they can best be seen. The highest and lowest of these lights shall be red and the middle light shall be white, all lights shall be independently operated for different use;
 - (g) One all round flashing red light on top of mast without restriction, indicating the vessel is on duty; (All the above lights from items d-g should be installed on the main mast)
 - (h) Black ball (three numbers);
 - (i) Black diamond;
 - (j) Whistle;
 - (k) Bell; and
 - (l) Any other navigational lights as required.

8.13.5 Three sets of spare bulbs (one per light) shall be provided for the navigational and signal lights.

8.14 Searchlight

8.14.1 Two (2) proprietary make 220V AC LED (with luminosity equivalent to not less than 600 W conventional type) adjustable remote control searchlights are required for forward operation. -Two switches for the searchlight shall be mounted adjacent to the searchlight control joysticks on wheelhouse console. Additional an IP56 remote control joystick fix beside this searchlight, this joystick must be installed in a watertight box. It can be easily taken out of the watertight box during operation.

8.14.2 One (1) proprietary make 220V AC LED (with luminosity equivalent to not less than 600 W conventional type) adjustable remote control searchlights are required for stern operation. A switch for the searchlight shall be mounted adjacent to the searchlight control joystick.

Another one (1) proprietary make 220V AC LED (with luminosity equivalent to not less than 600 W conventional type) adjustable remote control searchlight is installed on the aft flag pole for the operation of RHIB at night. A switch for the searchlight shall be mounted adjacent to the searchlight control joystick.

8.14.3 The searchlights shall be installed on the top of the wheelhouse forward and aft. The searchlights shall be remotely controlled by electric joystick located in the wheelhouse control station for turning and tilting.

8.14.4 Tarpaulin covers shall be provided for the searchlights.

8.14.5 One 24V D.C. LED portable search lights (with luminosity equivalent to not less than 150 W conventional type) with 30 meters water proof cable reels and plugs shall be provided in the wheelhouse.

8.15 Floodlight

8.15.1 Ten (10) Proprietary Made 220V AC LED remote power-operated floodlights (with luminosity equivalent to not less than 300W conventional type) shall be installed on the top of the wheelhouse.

8.15.2 The floodlights shall be used on the Vessel for boarding, landing, forward deck space operation and aft deck space operation including drone platform The orientation of this floodlight shall be manually adjustable.

8.15.3 The floodlights shall be for marine use, and capable of withstanding a corrosive environment. The floodlights arrangement should be like below figure 1

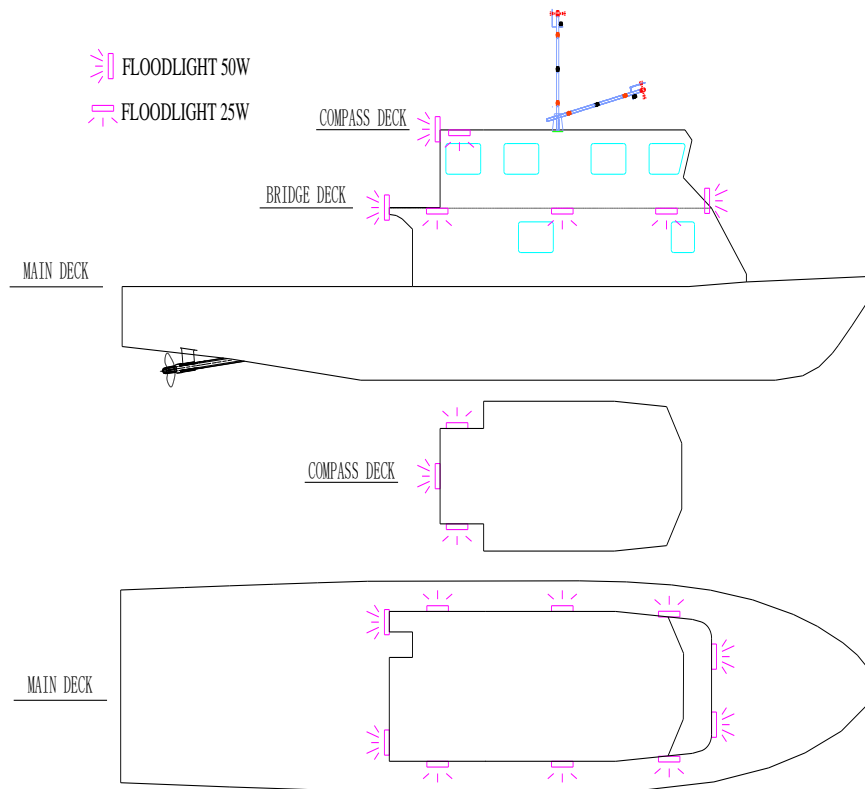


Figure 1

The floodlight control panel should be install on wheelhouse console.

8.16 Power Receptacles / Sockets

- 8.16.1 Receptacles/sockets installed in locations subject to rain, spray or splashing shall have a minimum protection of IP55, in accordance with IEC60529 when not in use, e.g. protected by a cover with an effective weatherproof seal.
- 8.16.2 A system of 220V AC 13A and 24V D.C. 5A socket outlets shall be provided in the engine room, fore and aft ends of the Vessel on the main deck and in the fore peak of the Vessel.
- 8.16.3 Socket outlets for 220V AC(with USB charging socket), 24V D.C. and 12V D.C. shall be provided in the wheelhouse.
- 8.16.4 Sockets shall be provided in ship office for hardware including but not limited to printer, personal computers, charger for portable VHF, charger for digital camera, charger for mobile phone, desk lamp and spare.
- 8.16.5 The crew space and pantry require 220V AC power sockets (with USB charging socket) for the Equipment including but not limited to portable apparatus and the domestic equipment.
- 8.16.6 Each socket outlet shall be integrated with an 'On/Off' switch to facilitate local switching of the electrical equipment. The 220V AC socket outlets shall be supplied with 13A 3-square-pin fused plugs. The 24V D.C. socket outlets shall be supplied with fused plugs.
- 8.16.7 Sockets for different voltage systems shall be clearly labelled and with different pin sizes so that one system cannot plug into the other.
- 8.16.8 Power sockets on the weather deck, in the engine room and other damp locations shall be watertight and be provided with watertight covers and switches. All power plugs provided for the portable equipment intended to be used in these areas shall also be of weatherproof marine type.

8.17 Waterproof LED Display System at Vessel Side

8.17.1 Two (2) Waterproof Externally Mounted LED Panels (minimum size 3000 by 450 mm, IP56) shall be provided and situated both port and starboard on the passenger cabin roof. The LED panel shall be provided with a control on the bridge deck allowing for predefined or custom message to be displayed.

8.17.2 Two LED Panels, Display control (optional) and the desktop computer (mentioned in the paragraph 9.21 are interconnected to form IP network (Local Area Network) by network hub and network cable.

8.17.3 Performance Requirements

- (a) The minimum technical requirements are as follows:
 - (i) LED modules with display three colors White, Red and Green
 - (ii) Pitch: 10 mm or better
 - (iii) Panel size at least 3000 mm x 450 mm (WxH)
 - (iv) Resolution: 300 dots x 45 dots (horizontal x vertical) or better
 - (v) Brightness: 5000 cd/m² or better
 - (vi) Built-in automatic intensity control
 - (vii) Viewing angle: 110°horizontal, 45°vertical or better
 - (viii) 220V AC single phase, 50 Hz+- 1 Hz with timer ON/OFF control
 - (ix) Enclosure: IP51 standard, made of aluminium
 - (x) Operating temperature: from 10° C to 50° C or better
 - (xi) Environmental humidity: 10% - 90% RH (non-condensing)
- (b) The Display Content Software must support two operation modes:
 - (i) Synchronous mode: Two LED modules show the same content.
 - (ii) Asynchronous mode: Two LED modules show the different contents
- (c) Key locks shall be provided with the enclosure.
- (d) The window of the enclosure shall be made of anti-vandal shatter proof.
- (e) The enclosure shall be so designed to prevent overheating.
- (f) Display Content Software Requirement
 - (i) The Display Content Software shall be installed and configured in the Desktop Computer at the ship office (mentioned in paragraph 9.21).
 - (ii) The System shall allow the operator to assemble several image files into a sequence and play the recorded sequence on the display as configured.
 - (iii) The System shall run on the latest version of Traditional Chinese Windows, with well-designed user-friendly software interfaces as per the comments from the Engineer and other relevant parties, such as the users.
 - (iv) Installation disc and licenses for the Display Content Software shall be provided.
 - (v) Allow the user to input/edit any free- form text message in Chinese and English and draw graphics picture. All master software and all licenses shall be included in the supply.
 - (vi) After initiation of the send command in the display controller/LED panel, the display information shall be loaded into the signage unit and to the display within three (3) seconds.
 - (vii) The software shall have the following facilities: Character font/size selection, pause, right shift, left shift, scroll up, scroll down, flash, jump, wipe, inverse color, rolling messages and graphic display.
 - (viii) Simplified and Traditional Chinese (hereafter Chinese), English or Alphanumeric messages should be input through the Desktop Computer in the ship officer desk and then be displayed in the display. A mix of Chinese, English and Alphanumeric could also be input and displayed in the same picture.
 - (ix) The operator shall be able to set via the display controller the period and duration for displaying graphic, Chinese message, English message or alphanumeric message.
 - (x) The system shall support, but not be limited to, the following message display features.
 - Message Scheduling – release message at predefined time

- Message Chaining – to link message together
- (xi) There shall be a time schedule display function so that the operator shall be able to pre-set files of graphics, messages and sources for display at the specified time.
- (xii) The system shall have facilities to create, edit, save, rename, copy, delete, preview, import, open and close files of graphics, messages, animation and video.
- (xiii) The duration of display time of each file shall be adjustable (for animation display, the input duration shall be integral multiples of the time length of the animation so that the animation shall be able to be displayed several times consecutively. The software shall automatically check the input duration. If the input duration is wrong or in conflict, warning signal in audible and visual format shall be generated). The display style described above shall also be selectable.
- (xiv) There shall be a preview function so that the display information can be previewed before actually sent out for display.

The display content software shall have an integral text and graphics editor.

8.18 The solar systems

8.18.1 The solar panel system shall be fitted on the top of the deckhouse as indicated on the Conceptual General Arrangement Plan. The solar battery systems must be capable to be charged from the solar panels.

8.18.2 The solar panel system converts solar energy to electrical power for equipment such as cabin lighting, fans, portable apparatus and domestic equipments.

8.18.3 A multipole switch shall be located in wheelhouse using solar power to charge all the DC24V batteries, this multipole switch must interlock with the other battery charger.

Chapter 9 - Electronic Navigation Equipment

9.1 Description of Electronic Equipment System

9.1.1 The Contractor shall supply and be responsible for the supply, delivery, testing, installation, commissioning and warranty (12 months from the date of the Acceptance Certificate) and provision of operational and maintenance service manual and training of the following equipment/systems to be fitted onboard the Vessel for MD:

- (a) Loudhailer/Siren and public address system with USB player,
- (b) Magnetic compass,
- (c) Fiber-Optic Gyrocompass
- (d) Satellite Gyrocompass
- (e) Marine daylight viewing colour radar with Differential Global Positioning System (DGPS),
- (f) Marine Radar (x-band) for navigation
- (g) Marine Radar (x-band) for officer operated
- (h) Electronic Chart Display and Information System (ECDIS) for navigation on the bridge
- (i) Electronic Chart Display and Information System (ECDIS) for officers operated in Ship Office and the High Command Office
- (j) International Maritime Mobile (IMM) VHF radio with Global Maritime Distress Safety System (GMDSS), installed on the bridge, High Command Office and the Ship Office
- (k) Secure Automatic Identification System (AIS) transponder (Include the receiver and transmitter modules).
- (l) CCTV System
- (m) VDR
- (n) Wind Speed and Direction Indicator
- (o) Precision Direction Finder
- (p) Integrated navigation system for command
- (q) Desktop computer with 32 inches multi vision display, Electronic chart software, Document Processing Software and IT Peripheral
- (r) Laptop Computer
- (s) Audio and Video System in the Meeting Room

The Contractor shall provide all labour, material, transportation, installation calibration, testing and commissioning, Warranty Services in Warranty Period, test equipment and all other tools and equipment which are necessary to complete the work required in this Chapter. References to "Equipment" in this Chapter 9 shall mean the above-mentioned Equipment in (a) to (f). References to "Electronic Navigation Equipment" or "ENE" or "Electronic Navigational Equipment" throughout the Tender Documents or Contract shall mean each set of the above-mentioned Equipment in (a) to (q).

- 9.1.2 An integrated system covering all ENE is preferred, so that information and also the display monitors of different systems, such as colour plotter system, radar system, can be shared in order to utilise the limited space available in coxswain operation area and to provide users a better displaying interface.
- 9.1.3 All ENE offered shall be designed for marine applications and shall allow effective operation under most arduous condition such as poor weather, strong winds and heavy rains and severe vibration. Exposed components shall be weather-proof and adequate protection against splash and water shall be provided for all electronic equipment fitted on board.
- 9.1.4 All components of the Equipment exposed to the weather shall be water resistance. Internal components shall be fully enclosed with heavy duty seals and sufficient heat dissipation mechanism such as ventilation and conduction to protect the Equipment.
- 9.1.5 The Contractor shall pay attention to the compass safe distance of the Equipment and the radiation hazard zone of the radar scanner in the Vessel design.
- 9.1.6 All radar and radio equipment shall be of a type approved by the Office of the Communications Authority of Hong Kong.

- 9.1.7 All sitting, installation and cabling in respect of components including but not limited to compass, VHF and radar shall comply with the relevant rules and regulations of Hong Kong.
- 9.1.8 All ENE shall have warranty support services in Hong Kong and on-site maintenance shall be available in Hong Kong.
- 9.1.9 When the generation / use of calendars are employed for logging of reports, activation off equipment, or as any essential part of logic for the proper functioning of the system, then the calendar generation shall function without any error or manual intervention for all leap years.
- 9.1.10 The circuit breaker for the ENE shall equip with lockout device so that the breaker can be locked during the equipment maintenance.
- 9.1.11 Lightning protection shall be provided and installed wherever applicable. The lightning arresters for all outdoor antennas shall be installed at the antenna ends.
- 9.1.12 Equipment supplied shall complete with all standard and/or maker recommended accessories as required for normal operation.
- 9.1.13 All the (ENE) control system on wheelhouse console do not use touch screen (Except for ECDIS)

9.2 Loudhailer / Siren System and Public Address System with USB Player

- 9.2.1 The system shall function as a loudhailer/siren system for external broadcast specially designed for maritime purposes. The system shall also consist of a public address system for internal broadcast in the crew area. The whole system must be marine type.
- 9.2.2 Loudhailer/Siren
 - (a) The system shall comprise three master control units (included two fixed forward and aft loudhailers control units on the console installed on the port and starboard of the bridge, another one control unit for the Directional Loudhailer should be with joystick in the wheelhouse. There should be three weather proof horn type loudspeakers, in conformance to IPX5 or better, located at forward and aft of the Vessel respectively. One controllable loudhailer located at middle top of wheelhouse with an electrical remote control platform which can 360 degree rotation, and it was controlled by a joystick on the wheelhouse console with angle indicator. The remote control platform and it's joystick must be provided by the loudhailer system.
 - (b) The system shall have the capacity to generate a "Yelp" siren and a horn signal sound in manual mode. It shall also have a selection of at least six warning signal sounds in automatic mode for general marine navigational uses, namely Underway, Stopped, Sail, Tow, Anchored, and Aground.
 - (c) There shall be a volume control on external broadcasting speaker so it shall be adjustable to full power for messages to be heard 0.5 km away from the Vessel and down to minimum for night operations.
 - (d) Two master control units, which shall be completed with fist microphone and microphone hanger, shall be recessed mounted in the wheelhouse with the following facilities provided at the front panel:
 - (i) Power ON/OFF
 - (ii) Hail volume control
 - (iii) Function control
 - (iv) One joystick with 360 degree rotation angle indicator
 - (e) Speech shall be delivered through a fist microphone hanging on the console. The fist microphone shall be splash-proof, and preferably water-proof.
 - (f) The amplifier shall be with a rated power output of not less than 30 watts per speaker and shall have the following characteristics:
 - (i) Mic in (hail) sensitivity: Not greater than 30 mV for 30 watts output at 1 kHz
 - (ii) Hail distortion : Not greater than 10% at 30 watts output at 1 kHz
 - (g) The horn type loudspeaker shall be weatherproof reflex type, and with an impedance compatible with the amplifier and with power rating not less than 30 watts.
 - (h) A USB player shall be provided with the system in such a configuration that the audio signal from the USB player can be broadcasted through the loudhailer system.

9.2.3 Public Address System

- (a) There shall be at least two speakers installed around the crew area for a one-way internal broadcast to the crew from the microphone at either of two control panel units. There shall be volume control for these internal broadcast speakers for adjusting acoustic levels to comfortable levels for the crew and at the same time avoid excessive acoustic feedback to the microphone. These internal broadcast speakers shall be waterproof to IPX5 or better and suitable for the location of installation.
- (b) The positions of two master control units of loudhailer/siren system, control panel and both the position and quantity of speakers of public address system shall be finalised in the detailed design stage.

9.3 Magnetic Compass

- 9.3.1 The Contractor shall provide one magnetic compass, built-in.
- 9.3.2 The power of the equipment shall be supplied from the 24V DC system of the vessel by switch on wheelhouse console.
- 9.3.3 The Contractor shall provide a magnetic compass deviations table by professional magnetic compass adjuster.
- 9.3.4 The magnetic compass shall have a direct-read dial with dial size of at least 2 inches.
- 9.3.5 The magnetic compass shall have a green night lighting function.
- 9.3.6 The magnetic compass shall have a built-in compensator to adjust for deviation.
- 9.3.7 The compass dome shall be constructed of heavy duty, optically clear polymer, and shall provide clear and accurate magnification of the dial.
- 9.3.8 Performance requirements of magnetic compass:
 - (a) Resolution: 2° or better
 - (b) Mounting option Binnacle or flush or bulkhead mount
 - (c) Waterproofing IPX5 or better

9.4 Fiber-Optic Gyrocompass

The technical specifications meet the follow:

Heading accuracy :	<0.5° secant latitude RMS
Roll & pitch accuracy:	0.05° RMS
Heave accuracy :	5cm or 5% (delayed heave)
Alignment time:	<10 minutes
Angular rate:	>500°/s
Operating latitude:	± 80°
Power supply:	18 - 36Vdc
Interface:	4 x configurable bi-directional RS-232 / RS-422 4 x configurable transmit only RS-232 / RS-422 1 x Ethernet Status / Alarm relay contacts
Data formats:	Signal Outputs VDR 1 x IEC 61162-1(include the roll, pitch signal) NMEA 0183 / IEC61162, TSS proprietary and industry standard
Rating:	IP31
Operating temperature:	-20°C to +55°C
Storage temperature:	-30°C to +70°C

Environmental:	Meets or exceeds IEC 60945
EMC:	Meets or exceeds IEC 60945
MTBF:	30,000 hours
Standards:	IMO A424(XI), IMO A821(19), IMO A694(17), MSC 191(79), ISO 8728, ISO 16328, IEC 60945, IEC 62288, IEC 61162, US Coast Guard MRA
Control & Display Unit Capabilities:	Heading, roll, pitch, latitude, longitude, speed, status and alarms

9.5 Satellite Gyrocompass

- 9.5.1 The Contractor shall supply and install one complete satellite compass set. The satellite compass shall consist of at least a sensor unit and an electronic digital display unit. The unit shall be compact and recessed in the console.
- 9.5.2 The satellite compass sensor unit shall be connected to the radar, ECDIS, and other equipment as necessary via a NMEA 0183 or NMEA 2000 standard interface.
- 9.5.3 The sensor unit shall incorporate two or more satellite receivers from at least two types of satellite positioning systems.
- 9.5.4 The satellite compass shall incorporate integrated 3-axis rate gyro and acceleration sensors to deliver fast start-up times and shall be capable of providing heading updates during temporary loss of satellite signals (i.e. during navigation under bridges).
- 9.5.5 Performance:
- (a) Reference: Either Magnetic North or True North
 - (b) Warm-up Time: Less than one second
 - (c) Accuracy: +1.0° typical
 - (d) Resolution: 0.1°
 - (e) Deviation Compensation: Automatic
 - (f) Operating Temperatures: Sensor unit: 0 °C to 50°C
 - (g) Waterproofing: Sensor unit: IPX5, Display unit: IPX6.

9.6 Marine Radar (x-band) for navigation in the bridge

9.6.1 General Requirements

- (a) The equipment shall be a relative motion high performance radar suitable for small vessels and comprise a transceiver, an antenna and a colour display unit, suitable for bright daylight and night viewing.
- (b) The radar shall be able to track high speed small crafts easily.
- (c) The radar shall be equipped with a collision avoidance system that is an Automatic Radar Plotting Aid – ARPA or other equivalent function capable of tracking at least 10 targets.
- (d) The transceiver shall be housed in the scanner unit and shall be designed for aloft mounted construction and capable of satisfactory operation at high wind speeds. The scanner assembly shall be housed in a weatherproof housing.
- (e) The radar scanner unit shall be installed well clear of obstructions to minimise undue interference and Non-Ionizing Radiation (NIR hazards). Care shall also be taken to ensure the scanner mounting does not give excessive shadow sectors for navigation lights.
- (f) Complete interface kit shall be provided to interface the radar for the fluxgate compass, GPS/DGPS, colour plotter and AIS. The Marine Radar have the interface kit to output the radar signal to ECDIS. The radar shall have interface to accept and display navigation data such as

- latitude and longitude positions of the Vessel given by the GPS/DGPS receiver.
- (g) There shall be interface provided to the radar for AIS. The radar shall have interface to accept and display AIS information such as Vessel names, call signs, heading, destination, maritime mobile service identity (MMSI), latitude, and longitude and other navigation data given by the AIS.
 - (h) The Contractor shall pay special attention to any possible radar blind zone, and shall address this during the design stage and verify it after installation, and rectify it if required. The Contractor shall pay special attention to the Equipment installed before the radar scanner like flood lights and/or horn speakers. Care shall also be taken to ensure the mounting does not obstruct the navigation lights.
 - (i) The radar shall have standard NMEA 0183 OR NMEA 2000 interface ports, i.e. National Marine Electronics Association (NMEA) Standard, capable of accepting navigational data from a wide selection of GPS/DGPS Receivers and Electronic Compasses, AIS and to output comprehensive data on all tracked targets in the form of a track table to a wide selection of electronic chart plotters. However, connection of the radar system to the other systems supplied under this Contract via other standard or proprietary interface types equivalent to NMEA 0183 OR NMEA 2000 is acceptable.
 - (j) The power for the equipment shall be supplied from the D.C. 24V system of the Vessel.
 - (k) The radar transceiver shall be housed in a radome antenna/scanner unit of maritime type. It shall be designed for aloft mounted construction and capable of satisfactory operation at high relative wind speeds of not less than 70 knots.
 - (l) Guard zones and alarm functions shall be provided in the radar. The zone shall be set and shown on the display screen. Audible alarm shall be activated if other vessels enter the zones set.
 - (m) The display unit shall be of table top mounting type providing clear and clutter free picture in all weather conditions and suitable for bright daylight and night viewing. It shall indicate clearly the important parameters such as radar targets, range marker, bearing line, heading marker, range rings, guard zone and background.
 - (n) On the viewing side of the display unit, the following controls shall be provided:
 - (i) Power ON/OFF
 - (ii) Standby/Transmit
 - (iii) Automatic adjustment of gain, sea clutter and tune keeps targets clearly in view
 - (iv) True motion display the Vessel's movements relative to fixed targets
 - (v) Bearing cursor rotation
 - (vi) Electronic bearing line (EBL)
 - (vii) Variable range marker (VRM)
 - (viii) Range scale selection
 - (ix) Display brilliance & illumination
 - (x) Selection of background colour and target colour
 - (xi) Tuning
 - (xii) Heading marker ON/OFF
 - (xiii) Change over switch to use the radar which is for the High Command Office, in case the bridge radar was out of order in restricted visibility at sea.

9.6.2 Performance Requirements

- (a) The marine radar shall perform at least or better than the following requirements in this Paragraph.
- (b) Display Unit
 - (i) Display : Flat panel colour LCD
 - (ii) Screen size : 15 inches (381 mm) or larger
 - (iii) Resolution : 1280 x 1024 pixels or better
 - (iv) Display mode : Head up, course up, north up and true bearing modes (with inputs of compass and speed data)
 - (v) Range scale : 0.125 nm to 24 nm

- (vi) Range units : Selectable from nautical miles, kilometres, and kilo yards
- (vii) Minimum range : 30 m or less
- (viii) Range ring accuracy : 1.5% or less of the maximum range of the scale in use; or 30 m, whichever is the greater
- (ix) Radar bearing accuracy : 1.5 degree or less
- (x) Display language : English Bilingual (English and Chinese) is preferred [D]
- (xi) Others : With adjustable electronic bearing lines and variable range markers features
- (xii) Operating temperature : -15°C to +55°C or better
- (xiii) Relative humidity : 90% or better
- (c) Transceiver
 - (i) Operating frequency : 9410±30 MHz (X-band)
 - (ii) Peak power output : At least 6 kW
 - (iii) Pulse length : Equipped with long, medium and short pulse modes for close, medium and long range operation
 - (iv) Overall noise figure : 6 dB or better
- (d) Antenna
 - (i) Operating frequency : 9410±30 MHz (X-band)
 - (ii) Aerial type : Open array radar antenna
 - (iii) Horizontal beam width : 2.0 degrees or less
 - (iv) Vertical beam width : 26.0 degrees or less
 - (v) Polarization : Horizontal
 - (vi) Rotation speed : Not less than 24 rpm within satisfactory operation at relative wind speed up to 70 knots. Manual and automatic selection of antenna rotation speed such as 24 rpm, 36 rpm and 48 rpm shall be available according to detection range.
 - (vii) Operating temperature : -15°C to +55°C or better
 - (viii) Relative humidity : 90% or better
- (e) Heading Marker, Bearing Measurement and Display
 - (i) The thickness of heading marker shall not be greater than 0.5 degree with an accuracy of not greater than 1 degree.
 - (ii) Arrangements shall be provided for bearing measurement with an accuracy of better than 1.5 degree. Bearing discrimination shall be better than 2.0 degrees.
- (f) ARPA (Automatic Radar Plotting Aid) Requirement
 - (i) Target acquisition : 10 targets (manual)
 - (ii) Tracking : Automatic
 - (iii) ARPA range scales : From 0.75 to 12 nautical miles or better
 - (iv) Readout of selected target : Range, bearing, course, speed, CPA (Closest Point of Approach), TCPA (Time to Closest Point of Approach)
 - (v) Target vector : Relative, true
 - (vi) Intercept mode : Automatically calculate intercept course and Time to Go (TTG) to tracked target
 - (vii) Adjustable warning limit : warning for CPA to a desired adjustable limit
- (g) The crew operator shall be able to select the following modes of presentation at the radar display:
 - (i) radar image only,
 - (ii) plotter image only, or
 - (iii) plotter image overlaid with radar image.

9.7 Marine Radar (x-band) for officer in High Command Office

- 9.7.1 The contractor shall provide an independent marine radar apart from the radar provided in paragraph 9.6 for officer operated. Each Marine Radar have the independent antenna. If two antenna of two Marine Radars can be failover with each other.
- 9.7.2 This radar shall meet the general requirements set in 9.6.1 and 9.6.2, excluding the requirement for display unit.
- 9.7.3 A radar display shall be installed in High Command Office. Performance requirement of this display are shown below:
- (i) 55" table display with **tempered** screen, table tilt range is 30°, lift range is 29.92" to 41.72" and install the handrail along 4 sides of this flat panel;
 - (ii) 4K UHD - DisplayPort (DP), 2 HDMI inputs
 - (iii) LED Backlight Technology
 - (iv) Full Dimming 100%
 - (v) Glass Display Control
 - (vi) Multi-Touch
 - (vii) Superior Optical Bonding Option
 - (viii) Resolution at 3840 x 2160 (4K)
 - (ix) ECDIS & Radar Compliant
 - (x) EN60945 Tested and Type Approved
 - (xi) Adjustable Floor Stand Option w/integrated HT C02 Computer in which connect to the IP network (mentioned in paragraph 9.24)
- 9.7.4 This radar display shall be installed with screen protector.
- 9.7.5 An UPS shall be provided for this display with back-up time no less than 30 minutes.
- 9.7.6 The contractor shall provide one 55" table display for spare , this spare display shall meet the same requirement as at paragraph 9.7.2 including install all necessary software.

9.8 Electronic Chart Display and Information System (ECDIS) for navigation in the bridge

- 9.8.1 The ECDIS shall show the radar, AIS, depth of water by echo sounder and ENC information in one picture.
- (a) General Requirements
 - (i) One set of Electronic Chart Display and Information System (ECDIS) with DGPS receiver, AIS and echo sounder installed **in the bridge**, must provide the following functions:
 - (1) Navigational calculation
 - (2) Chart updating
 - (3) Piloting
 - (4) Voyage monitoring.
 - (5) Create User Charts and Route Plan.
 - (ii) . It shall consist of DGPS, display control units, a remote GPS antenna and differential beacon receiver, colour chart plotter with electronic chart cartridges for Hong Kong Waters, and echo sounder.
 - (iii) The information received by the DGPS receiver shall be input to the marine radar and display on the marine radar and the screen of colour plotter. The output of the receiver shall give the Vessel position in a format compatible to marine radar in the "American Standard for Interfacing Marine Electronic Navigational Devices" NMEA 0183 or NMEA 2000 format. However, connection of the radar system to the other systems supplied under this Contract via other standard or proprietary interface types equivalent to NMEA 0183 OR NMEA 2000 is acceptable.
 - (iv) The GPSD/GPS/plotter system shall be provided with "speed logs and electronic compass interface" or "gyro and its interface" to support the "dead reckoning" mode operation, if GPS satellite signal is absent for a period greater than 10 minutes

- (v) The system shall be equipped with navigational sea charts in details covering the entire Hong Kong Waters. The system must read, show and update the Electronic Chart in the IHO/S-57 format from Hydrographic Office of Hong Kong Marine Department.
- (vi) For ENC charts update purpose, the ECDIS have at least one external USB port which is installed at Bridge.
- (vii) The ECDIS have the control unit have have keyboard, trackball, scrollwheel and left/right click button. The control unit is installed at Bridge.
- (viii) The information received by the AIS and Marine Radar shall be able to display on the screen monitors of ECDIS.
- (ix) Complete interface kit shall be provided to interface with the colour chart plotter for the radar, echo sounder and GPS/DGPS. The colour chart plotter shall accept and display information given by the radar, echo sounder and GPS/DGPS receiver.

9.8.2 Performance requirements

- (a) Display Unit
 - Size : At least 23 inches
 - Touch screen : Yes
 - Panel: : TFT LCDs with a special anti-reflective glass filter
 - Resolution : UXGA and at least 1600 x 1200
 - Viewing Area : left/right and up/down: 80 degree or more
 - Interface : At least 1 Analog RGB port, At least 2 DVI ports
 - Waterproof : At least IP22
- (b) Navigational Features
 - (i) Total waypoints : 2000 or more
 - (ii) Routes : 50 route plans or more
 - (iii) Alarms : Including but not limited to, proximity alert, cross-track error, and arrival /anchor watch
- (c) Electrical and Physical
 - (i) Power source : 12 - 24V D.C. (external)
 - (ii) Display (screen type) : At least 23 inches or greater diagonal high resolution colour display, resolution 1280 x 1024 pixels or better for 4:3 aspect ratio
- (d) Environment
 - (i) Operating temperature : -10 °C to +50 °C
 - (ii) Storage temperature : -20 °C to +60 °C
- (e) GPS Receiver
 - (i) GPS receiver type : Equipped with 8 channel parallel receiver or better
 - (ii) Frequency range (GPS) : 1575.42±1MHz (C/A code), L1
 - (iii) Sensitivity (GPS) : -130 dBm or better
 - (iv) Dynamic range (GPS) : 25 dB or better
 - (v) Warm start fix time : Less than 30 seconds
 - (vi) Cold start fix time : Less than 3 minutes
 - (vii) Position accuracy : no greater than 15 m
 - (viii) Tracking velocity : 999 knots
- (f) Differential Beacon Receiver
 - (i) Frequency range : 283.5-325 kHz
 - (ii) Frequency step : 500 Hz
 - (iii) Position accuracy : No greater than 5 m

- (g) Data Display
 - (i) Lat/Lon : N or S plus 7 digits E or W plus 8 digits
 - (ii) Speed and course : 0.1 Kt/h or 0.1 Km/h resolution digit 1-degree resolution
 - (iii) Cross track error : Graphic or direction indication
 - (iv) Bearing : 3 digits, 1-degree resolution
 - (v) Range : 4 digits, 0.01-nm resolution
 - (vi) CDI : Active perspective view, selectable scale (0.1, 0.3 or 0.5 nm)
 - (vii) Time : Selectable as GMT or local mode
 - (viii) Mapping : Resident world map in memory (reversible video)
 - (ix) Language for system : English operation and display
Bilingual (English and Chinese) is preferred [D]
- (h) Echo Sounder & Depth Indicator
 - (i) The equipment shall consist of a transducer and a digital depth indicator which is recessed mounted at the steering console and capable of providing readout of sea depth in feet, fathoms and meters.
 - (ii) The measuring depth shall be from 3 feet to 999 feet or equivalent fathom or metre with at least three selectable ranges to indicate shallow, mid and deep ranges. The unit of measurement shall be selected at the front panel of the equipment.
 - (iii) Shallow water audible alarms shall be provided. Setting of the alarm depth shall be at the front panel of the equipment.
 - (iv) The electronic accuracy of depth reading shall be better than + 5% of full scale range.
 - (v) The peak to peak transmitting pulse power of the transducer shall not be less than 200 watts and the nominal operating frequency shall be 200 kHz.

9.9 Electronic Chart Display and Information System (ECDIS) for officer operated in Ship Office and High Command Office (Two Sets)

- 9.9.1 These ECDISs shall meet the general requirements stated in paragraph 9.8, except for display unit.
- 9.9.2 One set is installed in the ship office and the other set is installed in the High Command Office.
- 9.9.3 The display signal of ECDIS in the Ship Office will be connected to 32 inches monitor of desktop computer, it shall meet the requirements in paragraph 9.21.
- 9.9.4 One set of touch screen table of 55 inches display unit inside the High Command Office. The ECDIS and Radar information can be shown on the display unit. for officer operated and refer paragraph 9.7.3

9.10 International Maritime Mobile (IMM) VHF Radio with GMDSS (two sets)

9.10.1 General Requirements

- (a) Three sets of the IMM VHF radio shall be a type approved make by the Office of the Communications Authority of Hong Kong.
- (b) One set on the wheelhouse console for navigation. One set should be installed in the Ship Office. The other one should be installed in High Command Office (behind wheelhouse) for the operation of the senior officer.
- (c) The radio shall be fully compatible with Global Maritime Distress Safety System (GMDSS) and equipped with a lithium battery with a lifetime of at least five years.
- (d) The radio shall be fully compatible with GMDSS, which is a class A Digital Selective Calling (DSC) transceiver fully compatible with the International Maritime Organization (IMO) GMDSS carriage requirements.

- (e) The radio shall be equipped with all the international maritime VHF channels complete with fist microphone with press-to-talk switch or telephone handset, mic/handset hanger, mounting bracket and loud speaker.
- (f) The radio shall have an independent dual watch mode selection switch that incorporate with Channel 16 and shall be able to dual watch on any other selective channel.
- (g) The radio shall be completed with electrical components including but not limited to antenna and integrated microphone, loudspeaker, control knobs/keys, display screen and re-chargeable battery, necessary for a stand-alone portable radio. The radio shall be equipped with a 220 VAC battery charger (for battery charging on shore) and one extra set of spare re-chargeable battery. The Contractor shall provide proper stowing space and facilities for keeping of the portable radio and the spare battery such that the crew can take the portable radio out for use when necessary.
- (h) The operating temperature shall be -5°C to $+55^{\circ}\text{C}$ or better. The water ingress protection shall be IPX7 or better.
- (i) The radio shall be supplied with a belt clip and a shoulder carrying case.
- (j) The Contractor shall also supply a D.C. battery charger (one for each Vessel extra to the 220 VAC battery charger) which can be readily and directly connected to a D.C. power outlet at each Vessel such that the portable radio can be charged on the Vessel if necessary. Normally the D.C. battery charger shall be not in use and shall be stowed on the Vessel with stowing space and facilities provided by the Contractor.
- (k) The following facilities shall be provided at the front panel of the radio:
 - (i) Power ON/OFF
 - (ii) Transmit indicator, volume and squelch controls
 - (iii) Socket for plug for microphone and external speaker
 - (iv) Quick selection of Channel 16
 - (v) Channel selection and indicator
 - (vi) Independent dual watch mode selection switch
 - (vii) Transmission power selector for HIGH and LOW Power (25 W/ 1 W)

9.10.2 Performance Requirements

- (a) Transmitter Characteristics
 - (i) Spurious and harmonics : -70 dB or better emissions
 - (ii) RF output power : 25 W / 1 W (High / Low)
- (b) Receiver Characteristics
 - (i) Sensitivity : Less than 1 uV for 20 dB SINAD or equivalent
 - (ii) Adjacent channel selectivity : 60 dB or better
 - (iii) Spurious image rejection : 65 dB or better
 - (iv) Intermodulation : 65 dB or better
 - (v) Audio output : Not less than 1 Watt at rated audio power output with less than 10% distortion
- (c) Aerial and Feeder
 - (i) The aerial provided shall be a marine type aerial with at least 3 dBi gain, vertically polarised, omni-directional and suitable for mounting on the launch.
 - (ii) The V.S.W.R. of the aerial installed shall be less than 1.5 : 1.
 - (iii) The aerial feeder shall be RG58U type or equivalent.
 - (iv) Coaxial cable lightning suppresser with appropriate earthing connection shall be provided for protecting the radio equipment. All outdoor connector joints shall be properly covered by waterproof tape or material.

9.11 Marine Band Hand-held Waterproof Radio Transceiver

9.11.1 General Requirements

- (a) The Contractor shall provide four (4) GMDSS IMM VHF waterproof handheld transceivers.
- (b) Each portable IMM VHF transceiver shall be of proprietary make and completed with two sets of rechargeable batteries, batteries charger, helical antenna with V.S.W.R. not exceeding 1.5:1 and carrying case (with shoulder strap or belt clip).
- (c) The operation period of each fully charged battery shall not be less than eight hours per charge (10% transmit, 10% receive, 80% stand-by). The charger shall be designed for 220V AC input power supply and equipped with a BS 1363 type 13A power plug.
- (d) The portable transceiver shall, as a minimum, be capable of transmitting and receiving on all 55 International Maritime VHF channels, together with the private maritime VHF single frequency channels 96 (157.925MHz) and/or 99 (157.975MHz).
- (e) The transceiver shall be of robust, waterproof, light weight design and made with shock proof material suitable for hand held radio communications both on the Vessel and ashore.
- (f) The transceiver shall be fully solid state and of software programmable carrier frequency type. Add-on crystal for carrier frequency will not be acceptable.
- (g) The unit shall be a type approved model accepted by OFCA for maritime frequency band application.

9.11.2 Performance Requirements

- (a) The transceiver shall, as a minimum, incorporate the following controls/switches/functions:
 - (i) Power on/off button;
 - (ii) Volume control;
 - (iii) High/low transmitting power switch;
 - (iv) Press to talk switch;
 - (v) Built-in microphone and loudspeaker;
 - (vi) Channel selector operating channel display; and
 - (vii) Sockets for external microphone, press to talk and loudspeaker
- (b) The transceiver shall comply with the following:
 - (i) Operating frequency range: International Maritime VHF Band
 - (ii) No. of Operating Channels: 99 (programmable)
 - (iii) Channel spacing: 25kHz
 - (iv) Frequency stability: ± 8 ppm between 0 and 50°C
 - (v) Housing IP Category: IP 57

9.12 Secure Automatic Identification System (S-AIS) Transponder

9.12.1 General Requirements: Since the SAIS onboard should be cooperated with the system (SAAB) already installed in VTC, therefore, the SAIS should be SAAB R 5 or latest type by SAAB.

- (a) The equipment shall receive information from AIS-equipped vessels.
- (b) The equipment shall be a Class A universal AIS complying with IMO MSC. 74(69) Annex 3, IEC 61993-2, ITU-R M.1371-3, ITU-R M.493-13, ITU-R M.825(DSC), IEC60945, IEC61162-1/2.
- (c) The AIS transponder (receiver module) shall be capable of receiving AIS information from AIS equipped vessels that includes: dynamic data (vessel position, coordinated universal time (UTC), course over ground (COG), speed over ground (SOG), rate of turn (ROT), heading), static data (maritime mobile service identity (MMSI), vessel name, type of ship, call sign, length and beam, heading, destination, latitude and longitude, location of position-fixing antenna on the ship), short safety-related messages and other navigational data.

- (d) The AIS supplied shall be compatible with all systems using NMEA 2000 standard and be capable of interfacing with the navigation radar, surveillance radar, multi-function displays, ECDIS, compass, and DGPS and the INS.
- (e) The AIS shall be capable of operating in at least four (4) modes, including but not limited to:
 - (i) Normal mode – function as a normal SOLAS Class A AIS broadcasting and receiving without encryption;
 - (ii) Secure mode – only encrypted AIS data will be broadcasted, both encrypted and non-encrypted AIS messages will be received;
 - (iii) Passive mode - no AIS will be broadcasted, both encrypted and nonencrypted AIS messages will be received; and
 - (iv) Pseudo mode – receives both encrypted and non-encrypted AIS messages, broadcasts correct encrypted AIS data and virtual unencrypted AIS data for AIS spoofing.
- (f) It shall be possible to edit AIS message information relating to navigation and ship information.
- (g) The AIS shall be easy to identify other ship’s status by providing electronic chart data.
- (h) The AIS shall have a self-restoring function to enhance stability.
- (i) The AIS shall have a user-friendly one touch keypad (or equivalent).
- (j) Each set of AIS shall include:
 - (i) A display with minimum dimensions of 250mm x 130mm;
 - (ii) An AIS transponder unit;
 - (iii) A VHF antenna;
 - (iv) A GPS antenna; and
 - (v) Installation/operation handbook.

9.12.2 The AIS shall be capable of the following performance requirements:

- (a) General Requirements
 - (i) Power Supply : 24V DC
 - (ii) Default Frequencies:
 - AIS1 (CH 87B) : 161.975MHz
 - AIS2 (CH 88B) : 162.025MHz
 - DSC (CH70) : 156.525MHz
 - (iii) Frequency Range : 155-163MHz
 - (iv) Transponder Size/Weight (+2%) : 237mm W x 79mm H x 170mm D,
1.7kg
- (v) The initial setting of the SAIS, should be protected with password that it will not be easily deleted by the normal operator.
- (a) AIS Transmitter
 - (i) Power Output: 12.5W or 1.0W (¡ó 1.5dB)

9.13 CCTV System

The contractor shall supply and install two CCTV Systems on board.

9.13.1 One CCTV System to provide a 360° view of the exterior of the vessel to assist with navigation and in particular berthing of the vessel as well as the rear and front deck for view of operations being carried out at those locations. Interior views to include the Unmanned Machine Spaces in accordance with [GNC to provide relevant standard], the arms locker, and the Wheelhouse. The other one independent CCTV System for the law enforcement process.

- (a) The locations of the CCTV cameras shall be determined with the GNC either in the kick-off meeting after the Contract is awarded or during the design phase of the Vessel.

- (b) Unless otherwise specified, all CCTV cameras shall comply with the following technical requirements:
- (i) All cameras shall be IP based, high definition camera (1920 x 1080p), water-proof, vandal-resistant type, Infrared Cut Filter (ICR) day and night dome pan-tilt-zoom cameras. They shall be marine type and shall be suitable for operation in a rough sea environment. Ingress protection: Outside door must IP56 or better, inside of up-deck may be IP20 or better, and under-deck may be IP44 or better.
 - (ii) All cameras shall have an image stabilization function to accommodate the rough sea conditions.
 - (iii) All cameras shall be capable of covering diagonal view by wide angle lens or standard lens according to the actual condition.
 - (iv) All camera images shall be recorded within a Digital Video Recorder (DVR).
 - (v) The DVR shall have sufficient disk space to archive sixty (60) days of video images from all cameras in high definition format at 30 frames per second.
 - (vi) CCTV images shall be displayed relevant multi-function display on the Wheelhouse Control Station and the INS. Exterior CCTV views of the port / starboard / aft shall be permanently displayed on the overhead monitors. Interior CCTV images of the UMS shall be displayed at the Engineering Officer's Console.
 - (vii) An Uninterruptible Power System (UPS) shall be designed, supplied and installed to sustain the operation of the CCTV system for a minimum of sixty (60) minutes.
 - (viii) The CCTV system shall be equipped with a control panel or virtual control panel, installed in the Wheelhouse to allow the operator to control pan-tilt-zoom of the selected camera. These requirements will be discussed further during the design phase.
 - (ix) The CCTV system shall be capable of providing an instant playback function from the video file recorded in the DVR.
 - (x) The CCTV system shall be provided with time from the DGPS for clock synchronization, which will be displayed on the recorded images.
 - (xi) All cameras shall be powered by Power over Ethernet (PoE) as part of the CCTV system.

9.13.2 CCTV for view of the exterior and internal of the vessel:

The CCTV system shall consist of sixteen (16) channels covering including but not limited to the following areas:

- (i) one (1) camera on the port side, view the boarding ladder location;
- (ii) one (1) camera on the starboard side, view the boarding ladder location;
- (iii) one (1) camera facing aft for navigation purposes;
- (iv) one (1) camera looking at the helicopter winching area;
- (v) one (1) camera looking at the daughter craft LARS system;
- (vi) one (1) camera facing forward to view operations on the bow;
- (vii) one (1) camera facing forward for navigation purposes, just for record not need on monitor;
- (viii) At least two (2) cameras in the engine room;
- (ix) At least one (1) camera in the steering gear room; and
- (x) At least one (1) camera in the wheelhouse.

9.13.3 CCTV for the law enforcement process:

The CCTV system shall consist of at least six (6) channels covering including but not limited to the following areas:

- (i) two (2) cameras facing the tested person boarding on both port side and starboard side. (refer to paragraph 9.12.2 (i)&(ii), no need to add more)
- (ii) At least two (2) cameras in the ship office of main deck. Two (2) independent high definition microphones located on the interrogate table and near the breath analyzing

area and, when conducting drink and drug test. The video and audio to be recorded in one computer in the ship's office, this two cameras must toward the officer's face and the tested person's face;

- (iii) two (2) cameras looking at the inner corridor when the tested person pass.
- (iv) two (2) cameras looking at the ship's office space. One toward aft can view tested person out and in the restroom, and other one toward front.

9.13.4 Camera shall be a fixed camera with a wide field of view of at least 100° and with Infra-Red (IR) Light Emitted Diodes (LEDs) enabling operation in poorly illuminated areas or conditions. The camera shall be installed in the location that that covers the area in front of the Vessel.

9.13.5 The control and monitoring of the CCTV system shall be from the Wheelhouse.

9.14 Voyage Data Recorder (VDR)

9.14.1 A VDR meeting the specifications listed in IMO IEC 61996-1 and MSC. 333 (90) shall be fitted to the Vessel for the purposes of post incident review.

9.14.2 The Contractor shall install the play back software for playing back the recorded files in the desktop computer in the ship office (mentioned in paragraph 9.21). The software program that can download the saved data and playback information. The software shall be compatible with the commercial off the shelf notebook computer provided by the operating system. When using non-standard or proprietary format to save data in VDR, the software shall convert the saved data into open industry standard format.

9.14.3 The VDR shall satisfy the following performance requirements:

- (a) Data collection unit (DCU)
 - (i) Recording period : 720 hours or better
 - (ii) Recorded media : Removable CF Solid State Drive
 - (iii) Built in UPS : Two (2) hours or above
 - (iv) Number of audio interface input : Ten (10) or above
 - (v) Number of serial data input : Twelve (12) or above
 - (vi) Number of Ethernet data input : Seven (7) or above
 - (vii) Interface : Support NMEA 0183 or NMEA 2000 (Ethernet base)
 - (viii) Remote Alarm Display Panel : 4.3 inches colour LCD or better

9.14.4 Following are the minimum items that the VDR shall need to record:

- (a) Bridge microphones
- (b) VHF;
- (c) ECDIS for navigation;
- (d) Radar for navigation;
- (e) DGPS including information of position, speed over ground;
- (f) Satellite compass;
- (g) Fiber-Optic Gyrocompass
- (h) Echo sounder;
- (i) Secure AIS;
- (j) Wind Speed and Direction System;
- (k) Speed and Distance Through Water from the speed log installed.
- (l) Main engine and generator detection and alarm
- (m) Bilge alarm system
- (n) Fire detecting and alarm system

- (o) Navigational light control panel alarm
- (p) Steering gear system
- (q) Watertight door status indication (if any)
- (r) CO2 pre-release alarm system

9.14.5 Extraction of data from the VDR shall be possible via USB.

9.15 Speed and Distance Through Water

- 9.15.1 A device shall be fitted to measure speed and distance through the water and be integrated with the INS for display at the Wheelhouse Control Station.
- 9.15.2 The speed and distance measuring device should be type approved by the RO.
- 9.15.3 A transducer is to be fitted to the hull, such that the system will operate without disturbance when the Vessel is operating at full speed in all sea conditions.
- 9.15.4 The transducer is to be located away from any sea water inlets or hull appendages so as not to disturb the flow of water across the transducer.

9.16 Direction Finder System

The contractor shall supply a Direction Finder System. DC24V power from general batteries.

9.16.1 Technical data

Method of bearing

Method of bearing:	Doppler principle (3 kHz rotational frequency, right/left rotation)
Bearing indication:	Relative bearing and true bearing (if external heading data available)
Bearing accuracy ¹ :	±5°
Internal resolution:	1 °
Sensitivity:	RF voltage at receiver input (50 Ω): VHF, UHF: < 1 00 nV, Cospas-Sarsat: < 1 50 nV
Frequency stability:	±2.0 ppm ($\Delta f/f = \pm 2 \times 10^{-6}$) (in temperature range -30 °C to +80 °C)
Reception bands:	4 (VHF air band, VHF marine band, UHF air band, Cospas-Sarsat)
Reception frequency:	VHF air band: 1 1 8.000 to 1 21 .500 to 1 22.975 MHz
Frequency ranges:	VHF marine band: 1 56.000 to 1 56.800 to 1 62.025 MHz (channels 0 to 28 / 60 to 88 / sea + coast) UHF air band: 240.000 to 243.000 to 245.975 MHz Cospas-Sarsat: 406.022 to 406.076 MHz (channels A to S)
Channel pattern:	25 kHz (depends on frequency band)
Scanning /Monitoring mode:	Monitoring: Four additional frequencies (emergency frequencies 1 21 .500 MHz, 243.000 MHz and two free selectable frequencies) are monitored during normal operation. Standby: The Cospas/Sarsat and one free selectable frequency is monitored at all times in standby mode.
Signal filtering:	Optional, all emergency frequencies can be filtered for ELT modulation (false alarms disabled).
Cospas-Sarsat analysis:	Reception and analysis of Cospas-Sarsat data signal (112 or 144 bit, 400 baud, biphasic L-phase modulated, with Bose-Chaudhuri-Hocquenghem error test, specified according Cospas-Sarsat C/S T.001 October 1 999) Indication of data content (mode, country, GPS coordinates)
Bearable modulation:	A3E, F3E, A3X (PLB modulation), bearing largely independent of modulation.
Polarization:	Vertical
Polarization error:	< 5° at 60° field vector rotation
Garbling cone:	approx. 30° to the vertical

Response time ² :	< 50 ms (with sufficient reception field strength)
Keyboard:	Foil on the front with integrated keyboard matrix and EL background illumination
TFT display:	320 x 240 pixels with max. brightness of approx. 450 cd/m ² , continuously variable brightness
Operating voltage:	12 V to 30 V DC
Current consumption:	Max. 2.5 A
Audio out:	External speaker 4 W (4 Ω, 8 Ω) Line out (adjustable from 1 00 mV pp to 2000 mV pp)
Interfaces:	NMEA I/O (RS-422 and RS-232) Ethernet LAN Test port (RS-232) optional customer-specific Alarm relay output (1.0 A, 30 V DC / 0.3 A, 125 VAC) PTT input for self-bearing suppression Squelch output for external audio control

¹ With undisturbed wave field and sufficient field strength. Measured by changing the angle of incidence with the antenna rotating on a revolving table in order to eliminate environmental influences on the results.

² Very weak signals can increase response time considerably!

9.16.2

9.17 Wired and Wireless Intercom (Talkback) System

9.17.1 The Talkback System shall be robust, ergonomic and suitable for using in sea environment.

9.17.2 The Talkback System shall comprise of the following components:

- (a) The Talkback System shall be operating on 24V DC power or nominal AC Power, 220V±10%, 50Hz. The supplier shall be responsible for connecting the Talkback System to the 24V DC and 220V AC supply on the Vessel.
- (b) The operator panel in the Wheelhouse shall be capable of initiating an intercommunication call to any talkback station. Each of the talkback stations shall be capable of initiating an intercommunication call to the operator panel in the Wheelhouse.
- (c) One (1) gooseneck microphone shall be installed at the operator panel.

9.17.3 The Talkback System shall be capable of making a single call, group call and all call to twenty (20) or more talkback stations. The locations of operator panel and talkback stations shall be determined in the kick-off meeting or during the design phase after Contract is awarded.

9.17.4 The operator panel of Talkback System shall comprise of the following functions:

- (a) Dimmable panel backlight;
- (b) Buzzer indicator of incoming calls;
- (c) Step volume control;
- (d) Push-to-talk button; and
- (e) Call signal button.

9.17.5 The talkback stations to be installed on the exterior or covered exterior of the vessel shall be of at least IP 66 rated and include a speaker of at least 10W or more.

9.17.6 The talkback stations to be installed internally shall include an indoor speaker that is suitable for using in a marine environment.

9.17.7 Talkback stations to be installed in the following locations shall be at least IP 66 standard waterproof talkback stations including speakers of 10W or more, which associated with Combined Audible devices (Call Alert with Flashing Light & Ringer) and Portable Headsets for the use in noise areas (with 10 metres long cable, plug and headset holder).

- (a) Steering gear room x1
- (b) Engine room x1
- (c) Tank space x1

9.18 Wind Speed and Direction System

The contractor provided a Wind Speed and Direction System.

9.18.1 System Parameters

The sensor converts wind speed and direction into serial digital data. Data is displayed by the P1249 Indicator in digital format and also in analogue for wind direction. The instrument interfaces in NMEA 0183/RS422 to other ship systems. Sentence – MWV

Input voltage: 24v DC 40mA

Wind Speed Measurement:

Range: 0–120 knots

Accuracy: +/- 2% (@ 24kts)

Resolution: 0.01 knots

Wind Direction measurement

Range: 0°–359°

Accuracy: +/- 3° (@ 40 kts)

Resolution: 0.1°

Environmental

Operating Temperature:

Sensor: -35 °C to +70 °C

Indicator: 0 °C to +55 °C

Storage Temperature

Sensor: -40 °C to +90 °C

Humidity: <5% to 100%

9.18.2 Indicator

Standard DIN 43700 case; 144 x 144 mm – depth 110mm

Mounted by panel clips or drilled frame supplied.

Controls: Illumination

Lamp Test

Select Units, Knots, Metres/Sec and Kilometres/Hour.

Front panel splash proof when installed correctly.

9.19 Echo sounder

9.19.1 The Contractor shall supply and install an Echo Sounder System with the sonar unit securely installed on the body of the vessel. The Echo Sounder shall be as follows:

- (a) The equipment shall consist of a transducer and a digital depth indicator front panel which is flushed mounted at the steering console and capable of displaying depth information in feet, fathoms and meters.

- (b) The measured depth shall be between 0m and 5000m with at least three selectable ranges to indicate shallow, mid and deep ranges. The unit of measurement shall be selected at the front panel of the equipment.
- (c) Shallow water audible and visual alarms shall be provided when entering an area with a depth shallower than the pre-set depth. Setting of the alarm depth shall be capable on the front panel of the equipment.
- (d) The measuring accuracy of depth reading shall be better than + 5% of full scale range.
- (e) The peak to peak transmitting pulse power of the transducer shall not be less than 200 Watts and the nominal operating frequency shall be 200kHz.
- (f) There shall be an isolating switch to switch off the recorder in case of shortage of recording paper but the equipment for sensing and indicating the depth shall still be operating and functioning as in normal working condition.
- (g) The transducer shall not interfere or be interfered with by other equipment on the vessel.
- (h) The echo sounder supplied shall be completely compatible with all systems using the NMEA 0183 or 2000 standard and be capable of interfacing through the INS with the navigational radar, surveillance radar, multi-function displays, ECDIS, compass, DGPS and other equipment as necessary. The echo sounder supplied shall be connected to the navigation radar display.

9.19.2 Echo sounder display shall be:

- (a) 10.4” colour LCD with adjustable backlight and full dimming capability with day/night pre-sets;
- (b) Either 24 V DC or 220-240V AC Power Supply;
- (c) Provide data Output in NMEA 0183 and / or NMEA 2000 format;
- (d) Provide output for external VGA;
- (e) Provide output for printer and
- (f) Type approved in accordance with IMO Requirements.

9.20 Desktop computer with 32 inches multi vision display, electronic charts software and IT peripheral (2 sets)

9.21.1 A Windows-Intel-based desktop computer in which the Electron Chart Software is installed on the starboard side table inside the Ship Office. Two sets of the desktop computers are required. One is installed in the table the Ship Office and the other one is used for spare purpose.

9.21.2 It provides the interface kit to connect for the radar, echo sounder, GPS/DGPS, Secure AIS and Fiber-Optic Gyrocompass. (mentioned in paragraph 9.22)

9.21.3 The DVR software of the CCTV system (mentioned in paragraph 9.13.1 b(iv)) and the Display Content software of the Waterproof LED Display System (mentioned in paragraph 8.17.2(f)) shall be installed and configured at the desktop computer. Also all the software (in the software item of paragraph 9.21.5) shall be installed and configured.

9.21.4 This Electronic Chart Software which must read, show and update the IHO/S-57 format electronic chart from Marine Department Hydrographic Office of the ECDIS.

9.21.5 This desktop computer shall meet the following requirement:

(1)	Operating system	Window 10 Professional/Enterprise (Traditional Chinese) 64bits version
(2)	CPU	At least Intel Core i7 Processor 3.1 GHz or higher
(3)	RAM	At least 16 GB
(4)	Display	Up to 1920 x 1080 HDMI, DVI interface, VGA in which the dual displays function which provide display signal to the 23 inches multi-touch monitor of ECDIS (mentioned in paragraph 9.8)
		at the Bridge Deck.
(5)	HDD	At least SSD 480GB or above

(6)	Interface	At least three serial ports, (receive NMEA Data from the navigational equipment e.g AIS, DGPS, echo sounder and gyrocompass At least six USB ports, At least two gigabyte network interfaces cards
(7)	Accessories	DVD-RW/CD-RW Dual Recorder Multi-card reader (SD/MMC+/mini SD, Micro SD)
(8)	Printer	At least 35 pages per minutes and support auto double-sides printing, copying and scanning. The dimension (width,,depth and height) of the printer is equal or less than 494 mm x 430 mm x 448mm Interface: LAN port (RJ45) and USB Port
(9)	Software	Orca Master (ECS Software) with the most up-to-dated Electronic chart of Hong KONG Waters from Marine Department, Microsoft Office Standard 2019 Adobe Reader Java Runtime Environment,Adobe Flash Player for Internet explorer, Chrome and Firefox, Internet Browser (Chrome, Firefox) DVR of the CCTV System Display Content Software of the LED Display System

9.21.6 The contractor shall provide the display unit which is a 32 inches multi vision display with mounting bracket. It is installed in ship office table.

9.21.7 Key features of this display unit:

- 4K UHD - DisplayPort (DP), HDMI inputs
 - LED Backlight Technology
 - Full Dimming 100%
 - Glass Display Control
 - Multi-Touch Option
 - Superior Optical Bonding Option
 - Resolution at 3840 x 2160 (4K)
 - ECDIS & Radar Compliant (the Radar & ECDIS mentioned in 9.7 & 9.9)
 - Integrated with desktop computer (mentioned in paragraph 9.21.5)
 - EN60945 Tested and Type Approved
- 9.21.8 One set of **55 inches 4 K- TV installed inside the port side of the High Command Office, for obtaining the updated information of accident.**

9.21 Integrated navigation system for command

Contractor shall provide an integrated navigation system for command, that combine the radar & ECDIS (mentioned in 9.7&9.9) and Speed and Distance Through Water, DGPS, Echo sounder, Wind Speed and Direction System, CCTV system, Secur AIS, and Fiber-Optic Gyrocompass.

This system have it's own LAN and processor.

Contractor provide integrated navigation system different operation interface to HPS for select.

The integrated navigation system use the display unit, mentioned in 9.7.2 & 9.9.2& 9.20.

Contractor provide the display unit mentioned in 9.7.2 & 9.9.2 & 9.20.

9.22 Notebook Computer

9.22.1 Two notebook computers are required. One is installed in the ship office and the other for spare purpose.

9.22.2 The contractor shall follow the following specification and provide two notebook computers

i7	Features	Requirement
(Processor	■ At least Intel® Core™ i98 MB cache, 4 cores
8	Graphics	■ Discrete AMD Radeon™ RX 540 (2 GB GDDR5 video memory)
t	System Memory	■ At least 16GB (1x16GB) DDR4 2400
h	Display	■ At least 17.3 inches FHD (1920x1080)
g	Display Resolution	■ NVIDIA®Quadro RTX™ 5000 ; 16GB GDDR6
e	Port & Slot	■ At least 1 Thunderbolt™ (USB Type-C™ connector)
n		■ At least 2 USB 3.1 Gen 1 (1 charging)
e		■ At least 1 HDMI 2.0
r		■ 1 RJ-45
a		■ 4 in 1 card reader (include SD card);
t		■ 1 headphone/microphone combo
i		■ 1 USB Adaptor for RJ45
o		■ 1 USB Adaptor for Serial port
n		■ 1 AC power adaptor
)		
4	Battery	■ At least 14 hours of video playback
c	Internal Storage	■ At least 512GB PCIe NVMe Self Encrypted OPAL2 Three Layer Cell Solid State Drive
o	Wireless connectivity	■ Wi-Fi: IEEE 802.11 a/b/g/n/ac compatible
r		■ Bluetooth Wireless 4.2 technology
e	Operation System	■ Windows 10 Professional 64bits (Traditional Chinese)
s		■ Microsoft Office Standard 2016 (Traditional Chinese)
,		■ Adobe Acrobat Reader (Most up-to-date version)
T		■ Java Runtime Environment (Most up-to-date version)
h		■ Adobe Flash Player for Internet explorer, Chrome and Firefox
r		■ Internet Browser (Chrome, Firefox)
e		■ Orac Master
e		■ 7-Zip
l	Others	■ Waterproof
		■ Must be bundled with notebook bag/pocket
e	Reference Model	■ Lenovo ThinkPad P73

9.23 IP Network for Desktop Computer, Notebook Computer, mini desktop computer of Audio and Video System and CCTV System, Voyage Data Recorder, LED Display System and HT CO2 Computer of Marine Radar (x-band) for officer operated.

9.24.1 The desktop computer, the printer (mentioned in paragraph 9.21) notebook computer (mentioned in paragraph 9.23, the built-in mini desktop computer of the Audio and Video System (mentioned in paragraph 9.25.2), the CCTV System (mentioned in paragraph 9.13), the voyage data recorder (mentioned in paragraph 9.14) and Waterproof LED Display System (mentioned in paragraph 8.17) and HTCO2 computer of Marine Radar (x-band) for officer operation (mentioned in paragraph 9.7) are interconnected to form IP network (Local Area Network - LAN) by network hub and network cable.

9.24.2 The contractor shall install the trunk and the socket with RJ45 port.

9.25 Audio and Visual System in the Meeting Room

9.25.1 One Audio and Video System (AVS) shall be installed in the meeting room. The AVS has the following units:

- Display unit – One 49 inches interactive whiteboard and one built-in mini desktop computer
- Audio unit – One amplifier and at least two wall mounted speakers

9.25.2 The general requirement of the 49 inches interactive whiteboard with the built in mini desktop computer:

- Interactive Display with 4k resolution
- High Accuracy Touch Experience
- Intuitive 10 points of touch
- Resistant to optical interference (use as usual under direct sunlight)
- Resistant to shielding
- Durable whiteboard surface
- Multi OS and Multi Modules
- Seamless switching between OS
- Built-in pluggable PC module or External PC module with Microsoft Windows 10 64bits professional.

9.25.3 Amplifier amplifies and sends the audio signal from IW and the other connected device to the wall mounted speakers. The following is the general requirement of the amplifier

Features	Requirement
Channels	At least 2
Stereo Mode	60 Watt
Frequency Response	20 Hz - 20 KHz +/- 0.1 dB
Signal to Noise	>100 dB
Input Impedance	>10k, balanced or unbalanced
Maximum Input Level	12.3V (+24 dBu)
Highpass Filter	80Hz in Bridged 70V & 100V
Power Requirements	Universal Power Supply 100 - 240 VAC, 50 - 60 Hz with active power factor correction

9.25.4 The wall mounted speakers broadcast the audio signal within the meeting room. It has following general requirement:

- Nominal Impedance : At least 8 ohms
- Weather resistant enclosure and transducers
- Overload Protection Circuitry

9.26 Installation/Space/Cabling for the Existing HKSAR 4G LTE Network Equipment

9.26.1 Contractor reserve cable channel from the ship office of main deck to compass deck for installation works of 4G LTE network antenna and the its network equipment.

9.26.2 Contractor shall provide and install two coaxial high frequency cables in the cable channel. Also the

contractor shall provide two coaxial jumper cables and one 12 voltage DC power cable for connecting the 4G LTE network. The following specification of coaxial high frequency cables and the coaxial jumper cable:

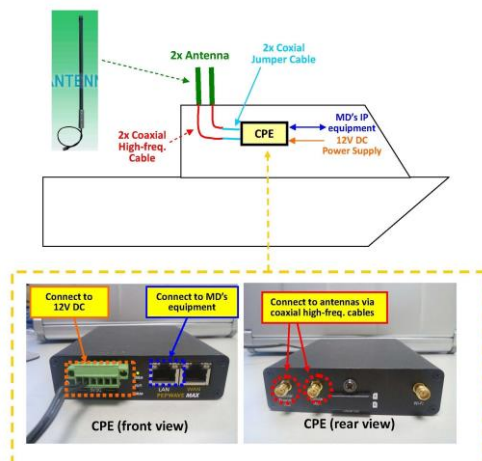
Coaxial High-freq. Cable	Quantity: 2
Cable type:	3/8" High flexible corrugated coaxial cable
Nominal impedance:	50-Ohm
Cable diameter:	Around 11 mm
Connector :	N-type (Male) at both ends

Coaxial Jumper Cable	Quantity: 2
Cable type	SMA to N-type jumper cable
Length	At least 1 meter
Length	End A: SMA(Male) End B: N-type (Female)

12V DC Power cable	Quantity: 1
Cable type:	2.5mm 2-core DC power cable

9.26.3 Contractor shall install two antennae at the compass deck and connect it to the coaxial high frequency cables in the paragraph 9.26.2. The horizontal separation between antennae is at least 1 meter. Two antennae and the 4G LTE network equipment are provided by HKSAR Marine Department.

9.26.4 The following is the overview of the 4G LTE Network system



9.27 Acceptance Test

9.27.1 The acceptance tests shall comprise the following:

- (a) A bench acceptance test which includes functional tests and detailed measurements of the performance of the Equipment to verify that each item of Equipment complies with all the required performance specifications.

- (b) On-site commissioning test shall be carried out by the Contractor in the presence of the EMSD representatives after completion of the installation of each set of Equipment. The overall installation standard and operational features of each set of Equipment shall be evaluated. The test shall be carried out during the Official Sea Trial.
- 9.27.2 The Contractor shall deliver each set of Equipment to the EMSD representatives for bench acceptance test prior to the installation on the Vessel. Where the test is failed (i.e. the Equipment does not comply with any requirements as set out in this Chapter or in other applicable part of the Contract), the Contractor shall provide a brand new replacement to the EMSD for reconduct of the bench acceptance tests.
- 9.27.3 The Contractor shall submit a schedule of commissioning tests of the ENE installed on board of the Vessel at least one month prior to the on-site commissioning test date.
- 9.27.4 The Contractor shall provide all the necessary test equipment and tools for carrying out all tests as mentioned in this Chapter 9 at no extra cost to Government.
- 9.27.5 At least one month before the end of the Warranty Period, the Contractor shall arrange and perform confirmation test in the presence of the representatives from EMSD. Should any defects be found during the confirmation test, the Contractor shall fix the defects as soon as possible and in any event no later than the time prescribed by the EMSD representatives. The Warranty Period shall be extended correspondingly for so long as the defects are not fixed by the Contractor.
- 9.27.6 For defects found during the confirmation test, the Equipment or its parts shall be repaired or replaced, and the Warranty Period of the Equipment shall be extended for one more year.

9.28 Documentation for the Proposed Equipment

- 9.28.1 The Contractor shall supply the following documentation:
- (a) Technical and proposed equipment information including integrated system equipment schematic diagram of all these general electronic equipment and sufficiently detailed to enable a technical appraisal of the Equipment in this Chapter to be made.
 - (b) Lists of Equipment as required in this Chapter.
- 9.28.2 The Contractor shall upon delivery of the Vessel, supply three sets of Operation Manuals, Service Manuals and integrated system/equipment schematic diagram in English or Chinese (at least two sets of which shall be original), giving full details on:
- (a) Operations and working principals;
 - (b) Equipment functional description;
 - (c) Equipment specifications;
 - (d) Schematic block diagrams and circuit diagrams with sufficient information and details for Equipment maintenance and repairing;
 - (e) Calibration procedures;
 - (f) Equipment (adjustment/mounting procedure) and parameter settings;
 - (g) Part list with part numbers and locations (the adjustment/calibration tools/kit/program shall also be included);
 - (h) Maintenance and troubleshooting instructions;
 - (i) Equipment interfacing with wiring diagram with clear signal labelling;
 - (j) Software operation manual for Equipment driven by application software;
 - (k) As fitted conduit/trunking route diagrams for the electronic equipment installed on board for the purpose of future maintenance; and
 - (l) The design conduit/trunking route diagrams submitted to MD and EMSD for approval during construction stage.
- 9.28.3 If some of the above information mentioned in the paragraph above cannot be provided, the Tenderer shall state clearly in the tender. Otherwise, the Contractor shall supply three sets of Equipment handbooks in English (at least two sets of which shall be original) giving the above required information within one month after the delivery of the Vessel.
- 9.28.4 In addition, the Tenderer shall submit with the tender a list to show the unit price and the installation cost for each proposed Equipment and the accessories and recommended maintenance spares for the

first year as stated in this Chapter. The name of the manufacturer and model / type shall also be included in the above list for MD and EMSD's consideration / evaluation.

9.29 Installation Requirements

9.29.1 General

- (a) The control panel of all Equipment shall be installed and flush-mounted in the coxswain operation area unless otherwise specified. The mounting screw shall be detachable from the front of the Equipment and the Equipment shall be taken out at the front for further checking or replacement. The Contractor shall submit a layout plan showing the exact locations of the Equipment before installation.
- (b) Equipment supplied shall be completed with all standard and/or maker recommended accessories as required for normal operation.
- (c) The Equipment supplied shall be completed with all the auxiliary items required for normal operation including connectors, circuit breakers, power sockets, interface device, plugs and cables with conduits. Additional power conditioners, filtering devices, power stabiliser or regulator shall be provided and installed at no extra cost if required.
- (d) RF connectors of suitable impedance shall be provided and used for connections of the RF cables, antennae and radio equipment. Connectors between the feeder cables and antennae shall be protected by weatherproof material to avoid water seepage.
- (e) All wiring shall be finished in a neat and appropriate manner approved by the Government.
- (f) Adequate measures to prevent interference amongst the Equipment shall be taken, which include but not limited to the following:
 - (i) Separate screened conduits or trunkings shall be provided.
 - (ii) Rules, regulations and recommended practices regarding screening of electric wiring must be observed.
 - (iii) Receiving apparatus and other electronic equipment which may be affected by radio frequency induced voltages must be effectively earthed, screened and protected against such voltages.
 - (iv) Lightning protection devices shall be fitted.
- (g) All sitting, installation and cabling work shall be undertaken to the highest standard to ensure:
 - (i) satisfactory performance of the Equipment,
 - (ii) protection from mechanical and water damages,
 - (iii) ease of accessibility for maintenance and repair, and
 - (iv) manufacturers' recommendations shall be strictly observed.
- (h)
 - (i) The power, signal and control cables connecting to the flush-mounted equipment shall be long enough to let the equipment wholly rest on a secure surface with valid cable connections for fault finding and equipment testing. These extended cables shall be properly managed and resided inside the console.
 - (ii) Induced mutual interference should be within an appropriate level which would not affect normal operation. [D]
- (i) Installation location
 - (i) Installation location of the Equipment shall be easily accessible for inspection and maintenance. Exact location shall be subject to the approval of the Government.
 - (ii) Installation location of the Equipment shall not cause interference with other Equipment including any emitted interference.
- (j) Material and Workmanship
 - (i) Material and Equipment shall be of high quality, and shall comply with, where applicable, the appropriate British Standards and Code of Practice, together with any amendments made thereto, suitable for installation in the Vessel.
 - (ii) All the designs shall be subject to the approval of the Government and the respective

works shall be carried out in a first class workman-like manner.

- (iii) The Government reserves the right to reject any part of the installation not compliant with these Specifications. The Contractor shall carry out the necessary remedial work or replacement at its own cost and expense and without delay.
 - (iv) The Contractor shall provide all installation materials including but not limited to cables, casing and mounting accessories which are durable and fire retarding. Where it is impracticable for signal cables for data to be run inside conduits, PVC insulated and sheathed with armoured cable shall be used.
- (k) Equipment Fixing and Interconnection
- (i) All switches, connectors, jacks and receptacles shall be clearly, logically and permanently marked during installation. All wires and cables shall be identified at every termination and connection point with permanent type markers suitable for installation in the Vessel.
 - (ii) Interconnection of various items of Equipment shall be mechanically and electrically connected by multi-pin connectors or terminals.
 - (iii) All cables shall be joined by properly designed connectors or inside joint boxes. Where terminal blocks are used for connection cables, the tip of each conductor shall be crimped with a suitable terminal pin before it is inserted into the terminal block.
 - (iv) The Contractor shall be responsible for providing and installing properly rated power cables from the power points to its own equipment.
- (l) Electricity
- (i) The power supply shall be compatible with Vessel's D.C. electrical system.
 - (ii) The Equipment shall be protected by appropriately rated fuses. The fuses shall be contained in independent fuse holders which are easily accessible.
- (m) Cable
- (i) All exposed cables and wiring shall be sheathed or protected by metal conduits.
 - (ii) Watertight cable glands shall be provided by way of watertight bulkhead or deck penetration.
 - (iii) Signal wiring shall be separated from power supply cables and housed in separate screened conduits or cable trunks.
 - (iv) Cables and wirings shall run behind the compartment lining. Where electric cables are necessary to be fitted on the decorative surface of bulkheads, they shall be enclosed in proper metal conduits.
- (n) Labelling and Marking
- (i) Each cable shall be clearly labelled and carry its own unique identification code.
 - (ii) Polarity of power cables shall be labelled.

Chapter 10 - Services Support

10.1 General Philosophy

- 10.1.1 In determining the appropriate design for the Vessel, all of the following factors shall equally be taken into account without one outweighing another.
- (a) Vessel performance (including engine rating and size of the Vessel).
 - (b) Initial cost.
 - (c) On-going cost (including maintenance cost, petrol consumption, and spare parts).
 - (d) Reliability (frequency and time to repair breakdown).
 - (e) Time between maintenance periods.
 - (f) Time to undertake scheduled maintenance (downtime).
 - (g) All machineries and equipment installed in the Vessel shall be serviceable in the Hong Kong.
- 10.1.2 Allowable Vessel downtime (including scheduled preventive maintenance and unscheduled repair and maintenance) shall not exceed 10% of the total hours of operation per month based on the operation profile as specified in Paragraph 2.7.1 of Chapter 2 of this Part VII.
- 10.1.3 Maintainability – the Vessel shall be easy to maintain by ensuring that there shall be:
- (a) Good access to all installed items for monitoring, service and overhaul.
 - (b) Ease access to in-situ service and maintenance in Hong Kong.

10.2 Information to be Provided Prior to and at Delivery Acceptance

- 10.2.1 Information provided prior to Delivery Acceptance:
- (a) Detailed inventory list for the whole Vessel to be submitted to the Government for approval.
 - (b) The Inventory List shall cover all discrete items down to major component/unit level.
 - (c) Full details of each item including:
 - (i) Item number
 - (ii) Description
 - (iii) Type or model (if applicable)
 - (iv) Quantity
 - (v) Manufacturer
 - (vi) Manufacturer's reference number
 - (vii) Location in Vessel
 - (viii) Local agent/supplier address, telephone and fax numbers
 - (d) **FOUR** paper copies and **ONE** soft copy of the Inventory List shall be provided to MD.
- 10.2.2 "As Fitted" drawings and other information shall be supplied
- The Contractor shall supply the following items upon Delivery Acceptance of the Vessel:
- (a) **FOUR** complete sets of paper print drawings of the Vessel and **ONE** soft copy in Compact Disk (CD-ROM).
 - (b) **FOUR** complete sets of paper print as fitted electrical schematic, cabling, wiring and single line diagrams for electrical equipment installed on board and conduit / trunk route diagram and **ONE** soft copy in CD-ROM as per the Vessel delivered.
 - (c) **FOUR** copies of equipment list for all Equipment. The list shall include:
 - (i) Description
 - (ii) Type or model (if applicable)
 - (iii) Makers part number or equivalent (if applicable)
 - (iv) Location
 - (v) Quantity
 - (vi) Supplier or agent's name and contact address
 - (d) **FOUR** copies (at least one original) of maker operation, maintenance and workshop manuals for each piece of Equipment in English.
 - (e) **FOUR** paper copies and **ONE** soft copy in CD-ROM "Docking Plan" of the Vessel which shall

- include the profile, plan and sections shall be prepared by the Contractor.
- (f) **FOUR** copies of On board Operator's Manual (English and Chinese) covering:
 - (i) Daily user check and operation procedure.
 - (ii) Operating detail of each system.
 - (iii) Emergency operation procedure.

(The precise format and detail required will have to be subject to the GNC's approval when the configuration of the Vessel and outfitting is decided.)
 - (g) The first draft of the On board Operator's Manual (in both English and Chinese) shall be submitted to GNC for approval one month before documentation acceptance.
 - (h) The documentation for all Equipment, Spare Parts, special tools and test equipment shall be provided at the Delivery Acceptance of the Vessel.

10.2.3 Tools & Test Equipment for Electronics

- (a) Delivery of all test and tool equipment for the electronics equipment of the Vessel will be directly to EMSD.
- (b) All items shall be properly documented, preserved and packed.

10.2.4 Photographs

- (a) As-Fitted Photographs
 - (i) Two sets of colour prints (130 mm x 90 mm) from different aspects to give an overall picture of the various parts/areas of the Vessel shall be provided upon Delivery Acceptance.
 - (ii) Each print shall be enclosed in a suitable album and labelled showing the position of the content.
- (b) Official Photographs
 - (i) Four framed colour photographs of picture size not less than 350 mm x 270 mm and frame size not less than 510 mm x 400 mm showing the profile of the Vessel in Hong Kong Waters shall be provided upon Delivery Acceptance.
 - (ii) Four 200 mm x 150 mm colour photographs with specifications of vessel particulars showing the profile of the Vessel in Hong Kong Waters shall be provided upon Delivery Acceptance.
 - (iii) Four 150 mm x 100 mm colour photographs showing the profile of the Vessel in Hong Kong Waters shall be provided upon Delivery Acceptance.
- (c) Softcopy of Photographs

All photographs as required in the sub-paragraphs (a) and (b) above shall be taken by way of digital camera in JPEG format at a resolution of not less than 5.0 M pixel. The photographs shall be stored in Compact Disk (CD-ROM) and forwarded to GNC at the time of Delivery Acceptance.

10.2.5 Certificates and Reports

Copies of the following documents (one original with two copies and one soft copy stored in CD-ROM), filed in clear folders, shall be forwarded to GNC at the time of Delivery Acceptance:

- (a) Associated test certificates.
- (b) Test performance certificates of Equipment as required in this Part VII.
- (c) Main engines performance test certificates.
- (d) Complete record of the trial commissioning tests.
- (e) Original copy of the warranty certificates of all Equipment (valid for 12 months from the date of Acceptance Certificate of the Vessel).
- (f) Certificates issued by the manufacture of light and sound signalling equipment.
- (g) Builder certificates.
- (h) Certificates of building material.
- (i) Deviation card for compass (after adjustment in Hong Kong).
- (j) Hull construction material issued by the RO.

- (k) Undertaking duly signed and sealed by the Contractor's (or its Sub-contractor's) shipyard for providing Warranty Services in relation to all aspects of the Vessel during the Warranty Period in Hong Kong as stipulated in Annex 1 of this Part VII - Technical Specification
- (l) Certificate of Class issued by the relevant RO.
- (m) Any other certificates as appropriate.

10.2.6 Ship Model

- (a) The Contractor shall supply six (6) ship models (scale 1:25) for display and training purpose.
- (b) The purpose of the ship model shall provide a reasonable realistic appreciation to the viewer (who cannot see the actual vessel) about the shape, scale, construction of the Vessel and the machinery installations and fittings therein. Hence the model shall include the position and look of the major external fittings including but not limited to the skeg, appendages, shafts, propeller (propulsion units), rudders, mast, mast fittings and navigation lights and any other external above and under water items; and the Vessel shall be made to an overall exact scale standard relevant to model making. The price for such model shall be INCLUDED in the Total Purchase Price of the Vessel in the Tender Documents.

Chapter 11 - Training

11.1 Training on Electronic Navigational Equipment (ENE)

11.1.1 General Requirements

- (a) All training courses shall be held in Hong Kong.
- (b) The Contractor shall provide two separate days training for two different classes of different trainees, with appropriate classroom as well as on board training to the operational and technical staff to familiarise with the operation and maintenance of the ENE being supplied and installed. The trainers shall be able to communicate with the local trainees effectively, better to use Cantonese if possible, but not must.
- (c) It is anticipated that two distinct types of training shall be required, namely:
 - (i) Operator Training
 - (ii) Equipment Maintenance Training
- (d) The Contractor shall submit a detailed course syllabus and a schedule for conducting the training course.
- (e) Each trainee shall receive one copy of comprehensive training documents before the start of each course.
- (f) Training manual in Chinese and English shall be provided and submitted to MD and EMSD for approval at least one month prior to commencement of the aforementioned two types of training respectively.

11.1.2 Operator Training Course

- (a) This course shall provide training for trainers.
- (b) The course shall provide a full knowledge and appreciation of the day-to-day operation of all ENE. This shall include hands-on demonstrations and operation of all ENE including the necessary routine cleansing requirement.
- (c) The course shall be held immediately before the commissioning of the ENE on the Vessel.
- (d) A total of up to 20 trainees will attend the course. The training course shall accommodate the specified number of trainees.

11.1.3 Equipment Maintenance Training Course

- (a) The equipment maintenance training course shall enable the maintenance staff to:
 - (i) acquire full knowledge and appreciation of all aspects of the design considerations, day-to-day operation, inter-connected system operation, fault breakdown, routine maintenance and fault finding/ repairing procedures of the ENE being offered; and
 - (ii) effectively maintain the ENE. This shall include practical demonstrations and tests.
- (b) The maintenance training course shall include, but not be limited to the following items:
 - (i) Introduction of the ENE locations;
 - (ii) ENE operational, working principle and functional descriptions;
 - (iii) ENE block and schematic functional descriptions;
 - (iv) ENE adjustment/calibration procedure and parameter settings;
 - (v) ENE construction and mounting;
 - (vi) ENE interfacing and signal interfacing;
 - (vii) Preventive maintenance and trouble-shooting
- (c) The course shall be held immediately after the commissioning of the ENE on the Vessel.
- (d) A total of up to 20 trainees will attend the course. The training course shall accommodate the specified number of trainees.

11.2 Training on Operation and Maintenance of the Vessel

- 11.2.1 In addition to the training to be provided for the ENE, the Contractor shall provide training in relation to the operation of the Vessel for the operational staff of the user department, training in relation to maintenance of engine and Equipment on board for the technical staff of the user department and for the Maintenance Section of Government Dockyard.
- 11.2.2 In order to ensure the navigational work-up team of the MD acquires full knowledge and appreciation of all aspects including but not limited to manoeuvrability, vessel handling, turning characteristics and engines, the Contractor shall provide an appropriate training course for 20 officers of the MD in Hong Kong after the Delivery Acceptance of the Vessel. An operation training programme shall be proposed for consideration by GNC which shall include details of depth and duration of the training course. The training instructors must possess suitable qualifications acceptable to MD. A certificate shall also be issued to the trainees by the training instructor or his organisation upon completion of the training course for proof of competence and satisfactory completion of the course.
- 11.2.3 In order to ensure the engineering work-up team and the front-line maintenance teams of the MD and the maintenance personnel of the Government Dockyard acquire full knowledge and appreciation of all aspects of the designs, day to day operation, breakdown, routine maintenance and fault diagnosis of the engine/electrical distribution system, hull structural repair, the Contractor shall provide appropriate train-the-trainer courses for a total of 10 engine operators and 10 maintenance personnel from the Government Dockyard in Hong Kong or overseas after the Delivery Acceptance of the Vessel. A certificate shall also be issued to the trainees by the training instructor or his organisation upon completion of the training course for proof of competence and satisfactory completion of the course.
- 11.2.4 All facilities, venue, and materials necessary for all of the above-mentioned training courses shall be provided by the Contractor unless otherwise specified. The training shall be conducted in Chinese and/or English with relevant training materials to be supplied by the Contractor. The training materials shall be provided before the training, in both paper and CD-ROM format.

Chapter 12 - Abbreviations

AC	Alternating Current
AIS	Automatic Identification System
AML	Additional Military Layers
ARCS	Admiralty Raster Chart Service
ARPA	Automatic Radar Plotting Aid
ASCII	American Standard Code for Information Interchange
ASTM-SAE	American Society for Testing and Materials Safety Standard
ASTM	American Society for Testing and Materials
ASWF	American Standard Window Film
AUX	Auxiliary
AWS	American Welding Society
BER	Bit Error Rate
BS	British Standards
CDI	Course Deviation Indicator
CD	Compact disc
CD-ROM	Compact Disc Read-Only Memory
CFC	Chlorofluorocarbon
CH	Channel
cm	centimetre
CMR	Compact Measurement Record
CO ₂	Carbon Dioxide
COG	Course over ground
CPU	Central Processing Unit
dB	Decibel
dBm	Decibel-milliwatts
D.C.	Direct Current
DGNSS	Differential Global Navigation Satellite System
DGPS	Differential Global Positioning System
dia.	diameter
DNC	Digital Nautical Chart
DSC	Digital Selective Calling
DTM	Digital Terrain Model
DVD	Digital Versatile Disc
DVI	Digital Video Interface
ECDIS	Electronic Chart Display and Information System
ECS	Electronic Chart System
ENC	Electronic Navigational Charts
ENE	Electronic Navigational Equipment
FSK	Frequency-shift keying
ft	feet
FTP	Fire Test Procedures
GB	Gigabyte
GeoTIFF	GeoTIFF Format File
GHz	Gigahertz
GLONASS	Global Navigation Satellite System
GM	Metacentric Height
GMDSS	Global Maritime Distress Safety System
GMSK	Gaussian Minimum Shift Keying
GMT	Greenwich Mean Time
GPS	Global Positioning System
GRP	Glass Reinforced Plastic
GSOF	General Serial Output Format
GZ	Righting Lever
HCFC	Chlorodifluoromethane

HD	Hard Disk
HDPCP	High -bandwidth Digital Content Protection
HDD	Hard Disk Drive
HDMI	High Definition Multimedia Interface
Hz	Hertz
IBSS	International Bibliography of the Social Sciences
ICLL	International Convention on Load Lines
IEC	International Electrotechnical Commission
IEEE	Institution of Electrical and Electronic Incorporated Engineers
IHO	International Hydrographic Organization
IMD	Intermodulation Distortion
IMM	International Maritime Mobile
IMO	International Maritime Organization
INS	Inertial Navigation System
IP	Ingress Protection
IPX	Internet Packet Exchange
IS	Intact Stability
IS Code	International Code on Intact Stability
ISO	International Organization for Standardization
ITC	International Tonnage Certificate
ITU-R	International Telecommunication Union – Radiocommunication Sector
Kg	Kilogram
kHz	Kilohertz
kt	Knot
kW	Kilowatt
kt/hr	Knot per hour
km	kilometre
km/hr	Kilometre per hour
LAN	Local Area Network
LCD	Liquid Crystal Display
LCG	Longitudinal Centre of Gravity
LED	Light-emitting Diode
LSA	Life-Saving Appliance
m	Metre
m/s	Metre per Second
m ³ /hr	Cubic Metre per Hour
MCR	Maximum Continuous Rating
min	Minimum
m/min	Metre per minute
max	Maximum
MHz	Megahertz
MJ/m ²	Megajoule per Square Metre
MKD	Minimum Keyboard Display
mm	Millimetre
MIL-STD	United State Military Standard
MMC	MultiMediaCard
MS PRO	Memory Stick PRO
MS PRO Duo	Memory Stick PRO Duo
MSC	Maritime Safety Committee
MSK	Minimum Shift Keying
mV	millivolt
NAVSEA	Naval Sea Systems Command
NDT	Non-Destructive Test
nm	nautical mile
NMEA	National Marine Electronics Association
NTRIP	Networked Transport of RTCM via Internet Protocol

NUC	Not Under Command
ohms	Unit of Electrical Resistance
P & S	Port and Starboard
ppm	Part per Million
PVC	Polyvinyl Chloride
QZSS	Quasi-Zenith Satellite System
RF	Radio Frequency
RG58U	RG58U Type Coaxial Cable
RO	Recognised Organisation
rpm	Revolutions per Minute
RT	Radioactive Test
RS232	Recommend Standard number 232
RTCM	Radio Technical Commission for Maritime Services
SATA	Serial Advanced Technology Attachment
SBAS	Satellite-based Augmentation System
SD	Secure Digital
Sec	Second
SINAD	Signal-to-noise and Distortion Ratio
SOLAS	Safety of Life at Sea
SSD	Solid-state Drive
SVP	Sound Velocity Profiler
TCG	Transverse Centre of Gravity
TFT	Thin-film Transistor
TNC	Threaded Neill-Concelman connector
TIFF	Tagged Image File Format
TS	Technical Specifications
U	Rack Unit (1U = 44.45mm high)
UHF	Ultra High Frequency
USB	Universal Serial Bus
UT	Ultrasonic Test
UV	Ultraviolet
V	Volt
VAC	Voltage of Alternating Current
VCG	Vertical Centre of Gravity
VDC	Voltage of Direct Current
VGA	Video Graphics Array
VHF	Very High Frequency
VMAP	Vector Map
VRS	Virtual Reference Station
V.S.W.R.	Voltage Standing Wave Ratio
W	Watt
WLED	White Light Emitting Diode
WMS	Web Map Service
XGA	Extended Graphics Array
PPS	Pulse Per Second
2U	Rack Unit (2U = 88.9mm high)
3U	Rack Unit (2U = 133.35mm high)

Annex 1 - Warranty Services and Guarantee Slipping

1. Warranty Services

- 1.1 The Contractor is required to be a Government Recognised Servicing Shipyard (“GRSS”) or appoints a GRSS in Hong Kong for providing Warranty Services in relation to all aspects of the Vessel during the Warranty Period, including Guarantee Slipping as stipulated in this Annex. If the Contractor appoints a GRSS to perform the Warranty Services, the Contractor shall ensure that the GRSS appointed will perform the Warranty Services and Guarantee Slipping in full compliance with the requirements of the Contract including those as set out in this Annex 1 as if references to the Contractor mean such GRSS.
- 1.2 The purposes of requiring GRSS for providing the Warranty Services is to facilitate rectification of defects without causing inconvenience to the Vessel's operation. As such, if the GRSS is a third party but not the Contractor, the Contractor shall give, and shall be deemed to have given, full authorisation to that GRSS in the HKSAR for making decision in relation to all matters arising out of any warranty claims submitted by the Government, but the Government reserves all rights and claims against the Contractor in the event that any warranty claim has not been handled in accordance with the terms of the Contract.
- 1.3 For those Equipment in respect of which the manufacturer/supplier does not offer one-year free warranty on such equipment, the Contractor shall ensure that the GRSS will provide the Warranty Services throughout the Warranty Period at the Contractor’s own cost. For other loose equipment and installation, such as life-saving and fire-fighting equipment, etc., which are required to be serviced, inspected or renewed annually, the GRSS shall provide the servicing, inspection and renewal as per the manufacturer’s requirements of that equipment or installation in the Warranty Period applicable to such items.
- 1.4 During the Warranty Period, when the Vessel is handed over to the GRSS for the Warranty Services and/or Guarantee Slipping, the Contractor shall be responsible for the due return of the Vessel in good order. Should there be any loss or damage of the Vessel or any Warranty Item (as defined in Paragraph 1.5 below) caused by any reason whatsoever while the Vessel is in the possession or control of the Contractor (including even when the Vessel is at the Government Dockyard or a maintenance base of the user department) or at the shipyard of the Contractor or the GRSS appointed by it, the Contractor shall pay for the cost for the loss or damage plus 20% as and for liquidated damages but not as a penalty. Throughout the Warranty Period, notwithstanding anything to the contrary in the Contract, the Vessel and all Warranty Items are deemed to be at the Contractor’s risks, and the Contractor shall insure and keep insured, at his own expense, a property insurance with the Government to be named as the sole payee, for an indemnity amount of not less than the purchase price of the Vessel plus 20% to protect the Government property against all risks. Certificate of Insurance and evidence showing premium being paid shall be available for inspection in advance. The Contractor shall provide this insurance policy before the commencement of the Warranty Services and/or Guarantee Slipping. Any excess payable under the insurance policy shall be borne by the Contractor.
- 1.5 **Total Vessel Warrant**

It is required that the Vessel is covered by free of charge Warranty Services for one year after the date of Acceptance Certificate in respect of the Vessel. The Warranty Services shall cover the entire Vessel and all its Equipment (including all major Equipment specified in Schedule 6 in Part V and ENE), fittings and outfit (including spare parts, and documentation) (collectively, “Warranty Items”) against defects of design, construction, workmanship or materials and against any non-compliance with any of the Product Warranties. The Warranty Services may be backed up by the Contractor using individual equipment

suppliers / manufacturers warranties but the Contractor shall remain solely liable to MD as a primary obligor to provide the Warranty Services. Notwithstanding and without prejudice to the Contract on warranty obligations for the total Vessel, any individual equipment supplier/manufacturers warranty extending beyond the one year total Vessel warranty must be assigned to the Government as appropriate.

1.6 Procedures for Warranty Claim

Without prejudice to the provisions of the Contract, a detailed procedure for dealing with warranty claims must be proposed by the Contractor and agreed by MD before the issuance of the Acceptance Certificate of the Vessel. This shall be based on the following principles:

- (a) Any notification of claimed defect to be sent from MD to the Contractor or the GRSS appointed by it through a defined route.
- (b) There shall be a joint inspection to examine the defect and the Contractor shall propose the appropriate and necessary remedial action to satisfaction of MD.
- (c) The Contractor shall undertake on-site Warranty Services (including provision of all replacement Warranty Item, spare parts, labour, materials, test equipment, and transportation) wherever at the option of the Government, the Vessel is berthed in Government Dockyard or maintenance bases of the user department. Taking the Vessel to the shipyard of the Contractor or of the GRSS appointed by the Contractor should be avoided unless absolutely necessary.
- (d) Rectification of defect must have minimum effect on operation of the Vessel by provision of on loan equipment when the anticipated repair time exceeds the time frame as specified in Paragraph 1.7 below.

1.7 Throughout the Warranty Period, the Contractor shall be responsible for the provision of free of charge corrective maintenance and rectification of all defects in all and any of the Warranty Items including repair and replacement as necessary. This shall, at no cost to MD, include Warranty Services to be performed by the Contractor described in the following sub-paragraphs:

- (a) To attend to the Vessel for inspection and repair within 24 hours (excluding Hong Kong public holidays) of receiving the report of a fault ("fault report") and to take immediate action of rectifying the defect after inspection. Unless otherwise agreed by the Government, all corrective maintenance and rectification must be effected within 48 hours after the fault report is first issued. MD must be informed of what the corrective maintenance and rectification actions have been taken within 72 hours of receiving the relevant fault report.
- (b) To provide all necessary transport, replacements Equipment, spare parts, labour and materials, tools and testing instruments required for the corrective maintenance and rectification.
- (c) Any replacement item or part to be used shall be originated from the manufacturer of the original Warranty Item to be repaired and can be found in latest spare parts list issued by such manufacturer. Alternative components shall not be used without prior approval in writing of MD.

If the Contractor fails to respond to any reported warranty claims within 48 hours, MD may arrange defect corrective maintenance and rectification either on its own or by deploying another third party contractor as deemed appropriate with a view to minimizing any downtime incurred. In such case the Contractor shall compensate the Government for the full cost of such repairs plus 10% as and for liquidated damages but not as a penalty no later than 10 working days after a written demand has been served on the Contractor by MD.

1.8 Extension of Warranty

- (a) The Warranty Period for any Warranty Item shall be suspended whilst and if the Contractor fails to repair and correct satisfactorily the defects in such Warranty Item within seven working days counting from the relevant fault report is first issued.
- (b) Warranty Items which are electronic equipment sub-assemblies, modules or components and which are replaced during the Warranty Period shall have a new warranty period of one year commencing from the date of replacement.
- (c) In relation to a Warranty Item, references to Warranty Period shall be construed to include such extended warranty period as mentioned in (a) and/or (b) above, depending whichever is applicable.
- (d) Equipment which is found defective during the trials at the Guarantee Slipping as mentioned in Paragraph 2.2.3 below shall have an extension of warranty of one year.

1.9 Recurrent Defects

During the Warranty Period, should a second and similar defect arise in relation to a Warranty Item, this shall be construed as conclusive evidence of the Warranty Item's unsuitability for the purpose intended, and the Contractor shall take immediate steps to conduct a thorough investigation jointly with MD at the Contractor's expense, to ascertain the reasons for any such defect and shall forthwith at MD's option and the Contractor's expense, procure and deliver another replacement Warranty Item with a new design suitable for the purpose intended to replace the original defective Warranty Item.

1.10 In the event that the Contractor proposes to modify any Warranty Item or any part of the Vessel in order to repair or replace the same or another Warranty Item, the Contractor shall obtain a written advance consent of the Government to the proposed modification.

1.11 Throughout the Warranty Period, the Contractor shall maintain an inventory of spare parts, which shall be the same items as listed in Schedule 6 in Part V and in the same quantity in the shipyard of the Contractor or of the GRSS appointed by it and which the Contractor (or its GRSS) shall use for performing the Warranty Services. The Government will not provide its own inventory of the Spare Parts listed in Part 2 of Schedule 1 to the Contractor for the provision of the Warranty Services.

1.12 Updated/Upgraded Information

It is expected that during the Warranty Period certain Warranty Item may be modified or changed. All documentation affected by this change must be updated to reflect the new situation. All the support documentation such as the Vessel inventory list, job information and maintenance scheduling in relation to these modification and changes shall be provided at the expiry of the Warranty Period.

1.13 Warranty of Electronic Navigational Equipment

Please refer to the Paragraphs 9.9.5 and 9.9.6 in Chapter 9 of the TS.

2. Guarantee Slipping

2.1 As stated in the section "Warranty" above, Guarantee Slipping shall be carried out at the end of the original Warranty Period regardless of any subsequent extension in relation to any Warranty Item under the terms of the Contract.

2.2 At the Guarantee Slipping, the Contractor shall carry out the following work and provide all necessary materials, spare parts, labour and equipment in order to carry out such work:

2.2.1 Engines and Gearboxes

- (a) Renew the lubricating oil and replace the filters for the main engines and gearboxes as per the manufacturer's recommendations;
- (b) Clean all the engine air filters and change the filter elements as necessary;
- (c) The coolers of the engines shall be cleaned with all zinc anodes renewed if provided;
- (d) All the belts of engines shall be checked and adjusted if necessary;
- (e) Tappet clearances for the inlet and exhaust valves, ignition timing and idle speed shall be checked and adjusted if necessary;
- (f) Function tests for the engines' protection system and their associated sensors, gauges and other measuring devices shall be conducted;
- (g) Any other work required or recommended by the engine manufacturer.

All the above work shall be carried out by the manufacturer's authorised agent.

All the work procedures and the spare parts used shall be in compliance with the specifications and requirements of the manufacturer.

2.2.2 Hull and Deck Items (if applicable)

(a) Paint Under Water Line

- (i) Paint under water line shall be checked by paint manufacturer's representative for the effectiveness of two years protection against marine growth;
- (ii) Hull shall be cleaned;
- (iii) Damaged paint shall be repaired according to paint manufacturer's procedures;
- (iv) After the repairing of the damaged paint in (c), two coats of touch up primer and one coat of touch up shall be applied; and
- (v) One full coat of finishing paint to hull below water line shall be applied at direction of GNC subject to the condition of the bottom inspection before delivery.

(b) All zinc anodes shall be renewed.

(c) Paint Above Water Line

- (i) Hull and deck including deckhouse above waterline shall be cleaned.
- (ii) Damaged paint on the hull above water line shall be properly repaired. After repair, two coats of touch up primer and one coat of touch up shall be applied;
- (iii) All the other areas including interior and exterior of the hull, deckhouse, mast, rails, stanchions, hatches fittings, etc. shall be applied with one full finishing coat.
- (iv) Vessel's name, draft marks and insignia two coats shall be painted; and
- (v) The open and side deck shall be applied with one full coat of anti-slip paint.

(d) Inspect, clean, polish, coated with oil if necessary.

(e) Free, clean, grease and recondition all moving parts of the deck fittings, i.e. WT (Water tight) hatches, vent covers, roller and fairleads and anchor chain stopper, etc.

2.2.3 The following shall be tested at the dock trial / sea trials as part of the Guarantee Slipping:

- (a) Engine control and steering system.
- (b) Engine alarm and shut down function (including emergency stopping of engines).
- (c) Navigational equipment, light and sound signal.
- (d) Ahead and astern running and crash stop test.
- (e) Steering trial.
- (f) Fire pumps.

- (g) CO2 smothering system.
- (h) Fire detection system and manual call points
- (i) Other trials as required by Government Representative.
- (j) Any item or component found defective shall be repaired or replaced.

Annex 2 - Implementation Timetable

	Milestones	Completion Date
1	Issuance of "Notification of Conditional Acceptance"	<i>To be advised after Tender Evaluation</i>
2	Contract Date (the date of the last party signing the Articles of Agreement)	<i>The date when the last party signs the Articles of Agreement. The Government will not sign the Articles of Agreement until and unless the Contractor fulfils all of the conditions precedent as specified in Clause 25.2 of the Conditions of Tender (save to the extent waived by the Government, if any).</i>
3	Kick-Off Meeting	<i>To be held within two months after the Contract Date at Government Dockyard or Contractor's Shipyard</i>
4	Completion of hull structures	<i>The Contractor shall propose the completion dates of Milestones 4-7 for GNC's approval in two months after the Contract Date.</i>
5	Completion of installation of engines, propellers and steering gears	
6	Conduct of all tests, inspections and trials as part of the Technical Acceptance including the Official Sea Trial	
7	Conduct of the on-site commissioning tests for the electronic navigation equipment on the Vessel (as part of the Technical Acceptance)	
8	Vessel Ready for Use (including without limitation the passing of the Technical Acceptance)	On or before the Delivery Date applicable to the same Vessel
9	Delivery Date	The Delivery Date for the Vessel shall be no later than the date set out in Schedule 2 (Delivery Schedule) of Part V

Annex 3 -Drawings Submission Timetable

All the drawings are required to submit to Classification Society for approval and reference within two (2) months after Signing of Articles of Agreement.

Details of the submission have to be discussed in the Kick-Off Meeting

Drawing Title	For Approval (A) or Reference (R) by RO	Submission Date	Completion Date
General Arrangement Plan			
Lines Plan			
Structural Construction Plan in Mid-Ship and Bulkhead Section			
Construction Profile and Deck Plan			
Shell Expansion Plan			
Stem Construction and Stern Construction Plan			
Superstructures Construction Plan			
Tank Capacity Plan			
Fuel Oil Tank Construction and Piping Diagram			
Engine Mounting Arrangement			
Power / Speed Curve			
Details of Navigational / Communication Equipment			
Details of Deck Equipment, Outfitting, Furniture, etc.			
Details of Main Propulsion Engines and Marine Gears			
Details of Electrical Generator Sets and Main Switchboard Diagram			
Engine Exhaust plan			
Engine Room Ventilation and Insulation Plan			
Propellers diagram			
Details of Tailshaft, Stern gear Arrangement and Propellers			
Details of Steering Arrangement			
Details of Galvanic Corrosion Prevention (throughout the			

Drawing Title	For Approval (A) or Reference (R) by RO	Submission Date	Completion Date
vessel)			
Details of Anchoring and Mooring Arrangement Plan			
Control Console Arrangement and Schematic Diagram			
Instrumentation and Control System			
Calculation of Fuel Oil Tank Capacity and Fuel Consumption Curves (Diagrams			
Details of Electrical and Electronic Equipment			
Electrical Load Calculations			
Schematic Layout of Electrical Circuits			
Ship Overall Ventilation, Temperature and Noise Control calculations			
Painting Schedule			
Lightning Protection Arrangement			
Torsional vibration Calculation			
Navigational equipment arrangement drawing			
Life-Saving Appliances arrangement plan			
Fire Safety Plan			
Others as required			

Annex 4 -Main Items Inspection Timetable

All the drawings are required to submit to Classification Society for approval and reference within two (2) months after Signing of Articles of Agreement. Details of the submission have to be discussed in the Kick-Off Meeting

Item No	Items to be Inspected	Completion date		
		1 st vessel	2 nd vessel	3 rd vessel
	HULL			
H-1	Construction material check			
H-2	Keel lay inspection			
H-3	Welding consumables and welders certificates verification			
H-4	Fabrication inspection including alignment, edge preparation, welding, non-destructive tests, plating thickness gauging etc.			
H-5	Superstructure scantling check.			
H-6	Inspection of installation of various items including doors, hatches, windows, mast, etc			
H-7	Function test of various outfitting items			
H-8	Compartment, void space, fuel oil tank, fresh water tank, grey water tank etc			
H-9	Watertightness or weathertightness of openings including manholes, hatches, doors, windows, air pipes, cable gland etc.			
H-10	Painting inspection			
H-11	Installation of zinc anodes and lightning protection			
H-12	Vessel dimension verification			
H-13	Draught marks verification			
H-14	Hull completion survey			
H-15	Deckhouse console mock up			
H-16	Interior furnishings in ships office, crew			

	space etc.			
H-17	Inclining experiment			
	MACHINERY AND ELECTRICAL			
EM-1	Propulsion engines, steering and generators installation and function tests			
EM-2	Function test of all machinery and electrical equipment			
EM-3	Function test of all piping system including fresh water, fuel oil, sea water, bilge, sanitary etc.			
EM-4	Control system installation and testing			
EM-5	Cables layout and installation			
EM-6	Steering system installation and function test			
EM-7	AC and DC power distribution			
EM-8	Main and emergency switchboard, shore power supply			
EM-9	Lightings installation and test			
EM-10	Navigational lights and signals installation and test			
EM-11	Battery system and battery charger function test			
EM-12	Electronic Navigational Equipment installation and testing			
EM-13	Air conditioning system installation and testing			
	FIRE DETECTION AND FIRE FIGHTING AND LIFE SAVING			
F-1	Fire detection system installation and test			
	Fire fighting system installation and test			
-2				
	Lifesaving appliances test			
-3				
	SEATRIAL			
S-1	Dock trial			
S-2	Official sea trial in Hong Kong			
S-3	Inventory check			
S-4	Document check			

S-5	Cleanliness of vessels before acceptance			

Annex 5 – Official Sea Trial (carried out in Hong Kong)

1) Official Speed Trial

Conditions at Speed-Trial		
1	Person on board	22 Persons (at 85 kg per person)
2	Fuel oil tanks	50% fuel tanks capacity
3	Fresh water tank	50% fuel tank capacity
4	Grey water tank	0% fuel tank capacity
5	Other Equipment	100 kg
6	Sea Conditions	Sea state 2 : wave height 0.1 - 0.5 metres

2) Endurance and Performance Test

Conditions at Endurance and Performance Test		
1	Person on board	22 Persons (at 85 kg per person)
2	Fuel oil tanks	50% fuel tanks capacity
3	Fresh water tank	50% fuel tank capacity
4	Grey water tank	0% fuel tank capacity
5	Other Equipment	100 kg
6	Sea Conditions	Sea state 2 : wave height 0.1 - 0.5 metres

3) Manoeuvrability Test

Conditions at Endurance and Performance Test		
1	Person on board	22 Persons (at 85 kg per person)
2	Fuel oil tanks	50% fuel tanks capacity
3	Fresh water tank	50% fuel tank capacity
4	Grey water tank	0% fuel tank capacity
5	Other Equipment	100 kg
6	Sea Conditions	Sea state 2 : wave height 0.1 - 0.5 metres

4) Crash Stop Test / Astern Running Test / Emergency Steering Test

Conditions at Endurance and Performance Test		
1	Person on board	22 Persons (at 85 kg per person)
2	Fuel oil tanks	50% fuel tanks capacity
3	Fresh water tank	50% fuel tank capacity
4	Grey water tank	0% fuel tank capacity
5	Other Equipment	100 kg
6	Sea Conditions	Sea state 2 : wave height 0.1 - 0.5 metres

Annex 6 - Endurance and Performance Tests

Date of Test:		Place of Test:							
Vessel's Identification:		Vessel's Name:							
Conditions at Endurance and Performance Test									
Person On board	22 Persons		Dummy Weight	85 kg/Persons					
Fuel (Petrol)	50% of Fuel Tank capacity		Other Equipment	100 kg					
Sea Conditions	Sea state 2: wave height 0.1 to 0.5 metre								
Engines:	Port Side		Starboard Side		Propellers:	Port Side		Starboard. Side	
Maker					Maker				
Type					Type				
Serial Number					Diameter				
Rated Power					Pitch				
Rated Speed					Direction of Rotation				
Engine Load	Engine Speed (rpm)	Vessel Speed (Knots)	Time (Start)	Time (Finish)	Fuel Consumption (litres/minutes)	Engine Oil Pressure (Bar)	Engine cooling water Temp. (°C)	Others	Others
___% of rated Power	At Minimum Cruising Speed		Not less 15 minutes						
50% of rated Power			Not less 15 minutes						
60% of rated Power			Not less 15 minutes						
70% of rated Power			Not less 15 minutes						
80% of rated Power			Not less 30 minutes						
90% of rated Power			Not less 30 minutes						
100% of rated Power (Endurance Test)			Not less 120 minutes						
Remarks:									
Witness by:	GNC Representative			Contractor Representative			User Representative		

Annex 7 - As-fitted Drawings and Machinery/Equipment Documents and information literature to be delivered to the Government after Delivery Acceptance

1 “As-Fitted” Plans and Drawings

- 1.1 After the Vessel is delivered to the Government, the Contractor shall deliver to the Government four (4) hard copies and four (4) soft copies of the following plans and drawings that contain the technical information of the Vessel and its machinery and Equipment as they are upon the Delivery Acceptance. These are termed the **final version** of the “As-Fitted” Plans and Drawings, and they must consist of those specified in paragraph 1.2 below as well as any other additional ones that may be required by GNC during the design and construction of the Vessel and before the delivery of the Vessel is accepted by the Government.
- 1.2 The “As-Fitted” Plans and Drawings shall be prepared by professional ship draughtsmen and they shall be prepared in a professional manner, scale, size and style normally required of in the ship design and construction industry. All “As-Fitted” Plans and Drawings shall show and be clearly marked for the profile, plan, and section views of the layout, arrangement details, and construction details in a manner required by GNC/MD.
- (a) General Arrangement Plan.
 - (b) Lines Plan and Offsets Data.
 - (c) Stability information booklet and the inclining experiment report.
 - (d) Hydrostatics, Cross Curves and intact and damage stability calculations for all ship loading conditions specified in the Technical Specifications.
 - (e) Vessel subdivision drawings and stability calculations
 - (f) Painting scheme of the whole Vessel.
 - (g) Draught mark diagram.
 - (h) Detailed arrangement and layout plan of the wheelhouse, cabins, decks showing the disposition of all main equipment, fittings and fixtures, furniture, doors, windows, hatches, manholes and access openings.
 - (i) Structural Construction plan, including Profile and Deck, Frame Construction, Shell Expansion, Bulkhead Construction, Deckhouse Construction, Superstructures to deck connection detailed construction, Bow construction, Engine girder and seatings etc
 - (j) Deck Edge and Bulwark (if any) details and construction plan, including detailed structural arrangement drawings of hull to deck connection.
 - (k) Closing appliances. The down-flooding openings (points) shall be clearly indicated on the drawings.
 - (l) Detailed cathodic corrosion prevention and arrangement plans and drawings for the Vessel throughout.
 - (m) Mast construction Plan and Mast Arrangement Plan.
 - (n) Vessel lighting arrangement and light control plan.
 - (o) Docking Plan.
 - (p) Fuel oil tank drawing and its associated piping, filling, overflow and ventilation system
 - (q) Drawings for anchor, windlass and the anchoring system
 - (r) Equipment layout diagram
 - (s) Sound and heat insulation system diagram
 - (t) Lifesaving and Firefighting
 - (u) Engine Room Layout
 - (v) Main propulsion and auxiliary machineries
 - (w) Air-conditioning load calculation

- (x) Refrigerant piping layout drawing of the air-conditioning system
- (y) Shafting arrangement and torsional vibration analysis.
- (z) Main engine and gearbox control and monitoring systems.
- (aa) Main engines and generator sets arrangement and sitting plans and drawings of their fuel lines and exhaust gas piping and arrangement.
- (bb) Steering system and steering arrangement diagrams.
- (cc) Propeller drawings.
- (dd) Main fuel oil tank drawing and its associated piping and manifold(s), and filling, overflow and ventilation system.
- (ee) Pumping and piping diagrams for fuel oil, lubricating oil, freshwater, sea water, bilge, fire fighting, scuppers and drains, sewage system, air pipes and ventilation pipings etc.
- (ff) Engine room ventilation and exhaust system
- (gg) Vessel ventilation drawings for the wheelhouse, cabins and other spaces.
- (hh) Shiplside valves construction.
- (ii) Fire fighting system including engine room fixed carbon dioxide system.

- (jj) Drawings of the main switchboard and all panel boards and the electrical system.
- (kk) Vessel alarm and signals systems, internal communication systems and public address systems plan.
- (ll) Vessel overall lighting arrangement and light control plan
- (mm) Navigational lights, sound and signal diagrams and any other external lighting arrangement plan.
- (nn) Lines diagrams of electrical switchboard, protection devices, electrical distribution and installation including cable type, size and working load in the circuits, type and make of circuit breakers and fuses
- (oo) Lighting fixtures and fittings
- (pp) Battery charging system
- (qq) Installation diagram and systems of electronic navigational equipment.
- (rr) Fire detection systems
- (ss) Life-saving plan and Fire Safety Plan.
- (tt) All manuals and instructions.
- (uu) Any other drawings as required by GNC.

1.3 Documents to be provided by the Contractor

- (a) In not less than one (1) month before the Delivery Acceptance of the Vessel, the Contractor shall provide for GNC acceptance a list of all documents to be provided.
- (b) When the Vessel is delivered to the Government Dockyard the Contractor shall deliver to the Government all the technical information including but not limited to leaflets, literature, manuals and booklets and whatsoever items that are necessary for the operation, handling, services, maintenance, spare parts, repairs and the technical understanding of any one of all the engines, machinery, motors, pumps, equipment, fittings and outfitting items of the Vessel.

Annex 8 - Definitions of Wave and Sea

Beaufort number	Description	Wind speed	Wave height	Sea conditions	Land conditions
0	Calm	< 1 km/h (< 0.3 m/s)	0 m	Flat.	Calm. Smoke rises vertically.
		< 1 mph	0 ft		
		< 1 knot			
		< 0.3 m/s			
1	Light air	1.1–5.5 km/h (0.3–2 m/s)	0–0.2 m	Ripples without crests.	Smoke drift indicates wind direction. Leaves and wind vanes are stationary.
		1–3 mph	0–1 ft		
		1–3 knot			
		0.3–1.5 m/s			
2	Light breeze	5.6–11 km/h (2–3 m/s)	0.2–0.5 m	Small wavelets. Crests of glassy appearance, not breaking	Wind felt on exposed skin. Leaves rustle. Wind vanes begin to move.
		4–7 mph	1–2 ft		
		4–6 knot			
		1.6–3.4 m/s			
3	Gentle breeze	12–19 km/h (3–5 m/s)	0.5–1 m	Large wavelets. Crests begin to break; scattered whitecaps	Leaves and small twigs constantly moving, light flags extended.
		8–12 mph	2–3.5 ft		
		7–10 knot			
		3.5–5.4 m/s			
4	Moderate breeze	20–28 km/h (6–8 m/s)	1–2 m	Small waves with breaking crests. Fairly frequent whitecaps.	Dust and loose paper raised. Small branches begin to move.
		13–17 mph	3.5–6 ft		
		11–16 knot			
		5.5–7.9 m/s			
5	Fresh breeze	29–38 km/h (8.1–10.6 m/s)	2–3 m	Moderate waves of some length. Many whitecaps. Small amounts of spray.	Branches of a moderate size move. Small trees in leaf begin to sway.
		18–24 mph	6–9 ft		
		17–21 knot			
		8.0–10.7 m/s			
6	Strong breeze	39–49 km/h (10.8–13.6 m/s)	3–4 m	Long waves begin to form. White foam crests are very frequent. Some airborne spray is present.	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic bins tip over.
		25–30 mph	9–13 ft		
		22–27 knot			
		10.8–13.8 m/s			
7	High wind, moderate gale, near gale	50–61 km/h (13.9–16.9 m/s)	4–5.5 m	Sea heaps up. Some foam from breaking waves is blown into streaks along wind direction. Moderate amounts	Whole trees in motion. Effort needed to walk against the wind.
		31–38 mph			

Beaufort number	Description	Wind speed	Wave height	Sea conditions	Land conditions
		28–33 knot 13.9–17.1 m/s	13–19 ft	of airborne spray.	
8	Gale, fresh gale	62–74 km/h (17.2–20.6 m/s)	5.5–7.5 m	Moderately high waves with breaking crests forming spindrift. Well-marked streaks of foam are blown along wind direction. Considerable airborne spray.	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
		39–46 mph	18–25 ft		
		34–40 knot			
		17.2–20.7 m/s			
9	Strong gale	75–88 km/h (20.8–24.4 m/s)	7–10 m	High waves whose crests sometimes roll over. Dense foam is blown along wind direction. Large amounts of airborne spray may begin to reduce visibility.	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over.
		47–54 mph			
		41–47 knot	23–32 ft		
		20.8–24.4 m/s			
10	Storm, whole gale	89–102 km/h (24.7–28.3 m/s)	9–12.5 m	Very high waves with overhanging crests. Large patches of foam from wave crests give the sea a white appearance. Considerable tumbling of waves with heavy impact. Large amounts of airborne spray reduce visibility.	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
		55–63 mph			
		48–55 knot	29–41 ft		
		24.5–28.4 m/s			
11	Violent storm	103–117 km/h (28.6–32.5 m/s)	11.5–16 m	Exceptionally high waves. Very large patches of foam, driven before the wind, cover much of the sea surface. Very large amounts of airborne spray severely reduce visibility.	Widespread damage to vegetation. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
		64–73 mph			
		56–63 knot	37–52 ft		
		28.5–32.6 m/s			
12	Hurricane	≥ 118 km/h (≥ 32.8 m/s)	≥ 14 m	Huge waves. Sea is completely white with foam and spray. Air is filled with driving spray, greatly reducing visibility.	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris and unsecured objects are hurled about.
		≥ 74 mph			
		≥ 64 knot	≥ 46 ft		
		≥ 32.7 m/s			

World Meteorological Organization (WMO) Sea State Code		
Sea State Code	Wave Height (meters)	Characteristics
0	0	Calm (glassy)
1	0 to 0.1	Calm (rippled)
2	0.1 to 0.5	Smooth (wavelets)
3	0.5 to 1.25	Slight
4	1.25 to 2.5	Moderate
5	2.5 to 4	Rough
6	4 to 6	Very rough
7	6 to 9	High
8	9 to 14	Very high
9	Over 14	Phenomenal
Character of the Sea Swell		
	0. None	
Low	1. Short or average	
	2. Long	
Moderate	3. Short	
	4. Average	
	5. Long	
Heavy	6. Short	
	7. Average	
	8. Long	
	9. Confused	