

Part VII – Technical Specifications

Supply of One (1) Aluminium Alloy Hydrographic Survey Vessel for the Civil Engineering and Development 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 Ship Office
- 4.4 Toilet
- 4.5 Fore Peak
- 4.6 Pantry
- 4.7 Fuel Oil Tanks
- 4.8 Side Deck
- 4.9 Mast and Open Deck
- 4.10 Seating
- 4.11 Bow and Stern
- 4.12 Anchoring, Mooring and Towing
- 4.13 Fenders
- 4.14 Cathodic and Hull Surface Protection
- 4.15 Lightning Protection
- 4.16 Deck Equipment

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 Engines
- 7.5 Electric Engine Control
- 7.6 Instrumentation and Control
- 7.7 Reduction Gearboxes
- 7.8 Waterjet System and Propulsion Controls
- 7.9 Emergency Steering
- 7.10 Engine Room Ventilation
- 7.11 Air-Conditioning System
- 7.12 Piping System
- 7.13 Fuel Oil System and Fuel Oil Tank
- 7.14 Fresh Water System
- 7.15 Bilge System
- 7.16 Seawater System
- 7.17 Sanitary, Grey and Black Water System
- 7.18 Open deck drainage system
- 7.19 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 Cable, Wiring and Fuse
- 8.10 Lighting Fixtures
- 8.11 Navigational Light
- 8.12 Searchlight
- 8.13 Floodlight
- 8.14 Power Receptacles / Sockets
- 8.15 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 and Fluxgate Compass
- 9.4 Marine Radar
- 9.5 Electronic Chart Display and Information System (ECDIS) with Differential Global Positioning System (DGPS) and Echo Sounder with one personal computer
- 9.6 International Maritime Mobile (IMM) VHF Radio with GMDSS
- 9.7 Automatic Identification System (AIS)
- 9.8 Installation Requirements
- 9.9 CCTV System
- 9.10 Acceptance Test
- 9.11 Documentation for the Proposed Equipment

Chapter 10 Hydrographic Survey Equipment

- 10.1 Introduction
- 10.2 Single Beam Echo Sounder Transducer
- 10.3 Installation Requirements
- 10.4 Acceptance Test
- 10.5 Documentation for the Equipment

Chapter 11 Services Support

- 11.1 General Philosophy
- 11.2 Information to be Provided Prior to and at Delivery Acceptance

Chapter 12 Training

- 12.1 Training on Electronic Navigational Equipment (ENE) and Hydrographic Survey Equipment
- 12.2 Training on Operation and Maintenance of the Vessel

Chapter 13 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 Endurance and Performance Test
- Annex 6 As-fitted Drawings and Machinery/Equipment documents and information literature to be delivered to the Government after Delivery Acceptance
- Annex 7 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 **one (1) unit of aluminium alloy Hydrographic Survey Vessel** (viz., “Vessel”) for use by the Civil Engineering and Development Department (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) 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]; and
 - (c) Desirable Specifications [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 (b) 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 working vessel will be designed and fitted with specialised, high resolution multi-beam sonar and position fixing equipment mainly for hydrographic surveying within Hong Kong Waters:
- (a) To Perform survey duties at shallow and/or congested waters with required speed and manoeuvrability; and
 - (b) To Perform emergency survey across Hong Kong waters with high transit speed from GD base to scene.

- (c) In addition, the Vessel shall also be designed for cruising operations, under the conditions as further specified in paragraph 2.4.3 of this Part.
- 1.2.2 The Vessel shall be designed and constructed for a service life of at least 15 years under reasonable maintenance.
- 1.2.3 In addition to those Equipment which are specifically mentioned in this Part VII that they shall be Proprietary Made, all Equipment specified in Schedule 6 must be Proprietary Made by the Manufacturers specified in Schedule 6 and be of the same model as specified in Schedule 6.

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 the supervision work including plan reviewing work during the construction stage to private consultancy firms to act on behalf of the Government.
- 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 Vessel construction.

1.5 Design and Construction Responsibility

- 1.5.1 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.
- 1.5.2 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.

- 1.5.3 The Vessel is required to be issued with a certificate of class (without condition) 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.
- 1.5.4 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.
- 1.5.5 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.
- 1.5.6 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 Contactor 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 as stated in paragraph 2.4.1 of this Part or the Committed Contract Speed committed by the Contractor in Schedule 7 (whichever is higher) shall be achieved by the Vessel in the Official Speed Trail under Official Speed Trial Conditions as stated in Annex 5 to this Part. If the Vessel fails to achieve the aforesaid Contract Speed 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) Function test for Hydrographic Survey Equipment.

- (j) Performance test to check if the percentage of roll reduction achieved by the gyro stabilizer is in compliance with that stated in the Paragraph 4.16.13.

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, acceptance test and on-site commissioning test for Hydrographic Survey Equipment as mentioned in Chapter 10 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 11.2 of Chapter 11, 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.

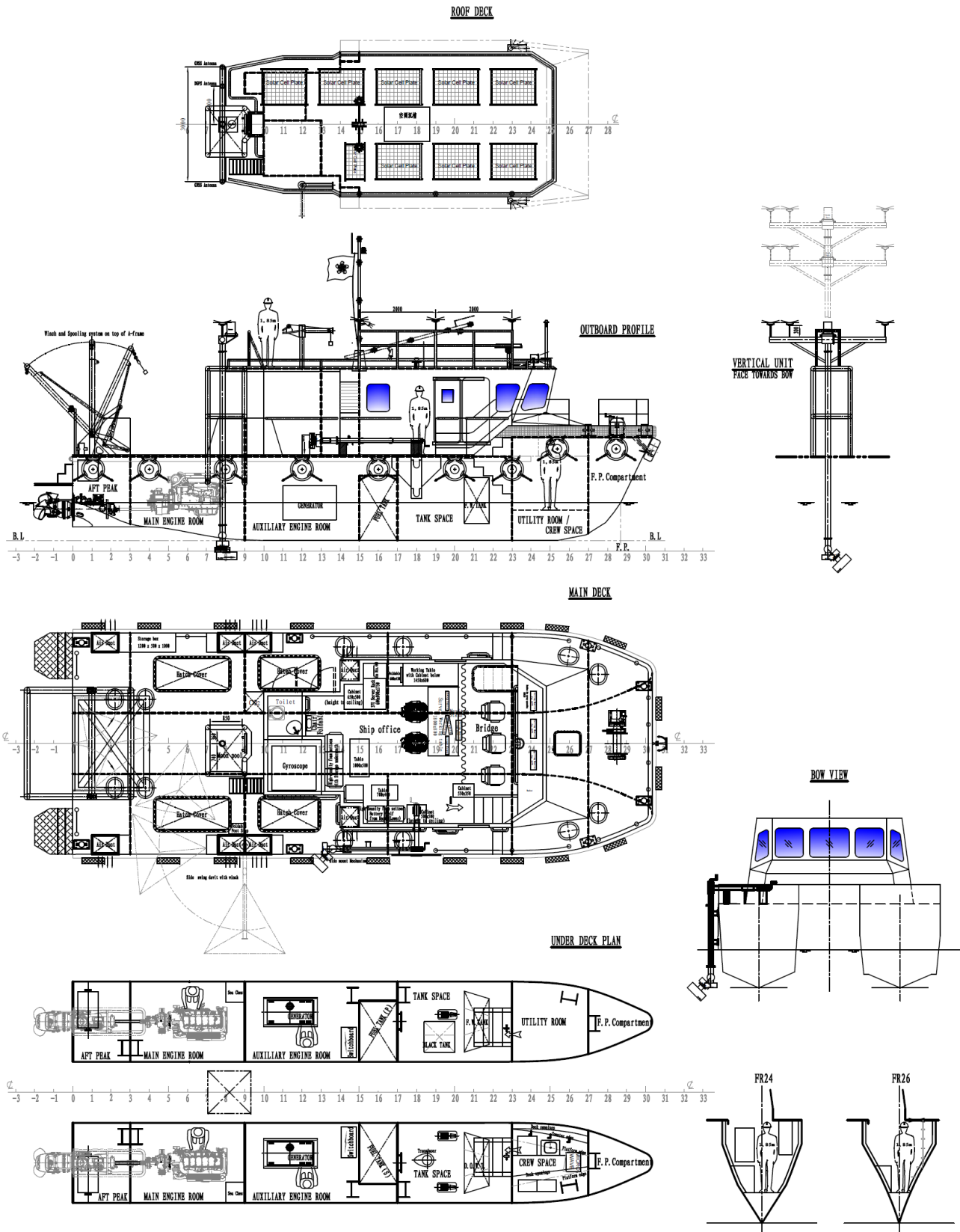
1.11 Asbestos Free

- 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 are 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 one (1) unit of aluminium alloy Hydrographic Survey Vessel for the Civil Engineering and Development 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.
- 2.3.2 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.
- 2.3.3 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.

- 2.3.4 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 of Shipping	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 A464(XII) and A626(XV).
- (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 **18** knots when both of the main engines driving the waterjet propulsion units through the reversing gearboxes 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.
- 2.4.3 The Vessel shall also be designed for surveying operations, at Vessel speeds within the range of 4 to 8 knots in the condition with 12 persons on board and 50% of fuel, water and storage. [E]

Official Speed Trial Condition	Requirement
Contract Speed	Not less than 18 knots @ 100% MCR
Surveying speed	about 4 to 8 knots

2.5 Principal Dimensions

General Requirements	Twin Hull	[E]
Length Overall (LOA):	Not more than 16.5 metres (Fenders included)	[E]
	It is a desirable specification that the LOA (Fenders included) is within the following range: 16.0 metres \leq LOA \leq 16.5 metres	[D]
Maximum Breadth:	Within the range of 5.0 – 6.0 metres (Fenders excluded)	[E]
Depth	Design to suit (Small freeboard is preferable)	
Extreme Draught:	Design to suit (It is a desirable specification the extreme draught is smaller than or equal to 1 metre)	
Maximum air draught:	8 metres	[E]

2.6 Material of the Structure

Material of Hull & Superstructure: Marine Aluminium Alloy

2.7 Vessel Operating Profile and Environment

- 2.7.1 The Vessel shall be designed for deployment on at least 250 days per year with provisions for overnight voyages for the use by the Civil Engineering and Development Department. The Vessel shall be designed and built to operate in Hong Kong Waters.

Summary of Operational Hours / Range

Number of hours/day :	8 hours/day	
Number of days/year :	250 days/year	
Endurance for fuel capacity:	at least 9 hours at Contract Speed and 15 hours at 6 knots with 10% margin.	[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 **6** & Sea State **5** (set out in Annex 7 to this Part) at transiting speed and Beaufort scale number 4 at surveying speed.
- 2.7.3 Total carrying capacity of the Vessel is 12 persons including 3 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 the form of GA Plan in details for MD’s approval.
- The deckhouse compartment consists of three parts.
- (a) Bridge
 - (b) Ship office
 - (c) Pantry and Utility Room
- 2.8.2 Hand rails and grab rails shall be provided with to secure the person in position safely while the Vessel is at the Contract Speed under the sea conditions specified in Paragraph 2.7.2.

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. All labels shall be fluorescence in according the RO requirements.
- 2.9.6 Safety markings for the prevention of person tripping in the Vessel shall be provided where necessary. Safety markings of deck equipment's danger zones on deck 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;
 - (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;
 - (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 berth at GD.
- 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 porpoising at all speeds so that there is no loss of directional control.
- 2.11.5 Installation of the Hydrographic Survey Equipment shall be under the instruction of the supplier and MD and CEDD officers.

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 twin-hull form and the hull structure shall be constructed in Marine Aluminium Alloy.
- 3.1.2 The Vessel 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 The Single Beam Echo Sounder is hull-mounted. The hull design is critical to the installation of the transducer and there shall have sufficient space inside the hull surrounding the sonar head tank, and the Contractor shall consult the manufacturer of

Single Beam Echo Sounder along its own design.

- 3.1.13 The primary purpose for the Vessel shall conduct hydrographic surveys using sonars and other equipment. Hence the hull design shall be optimised to be highly stable, quiet and have minimal vibration at survey speeds of 6 knots, noise level shall not exceed 75 dB.
- 3.1.14 The hull design shall ensure that the underwater flow pattern is smooth without significant bubble wash down to affect the performance of echo sounders and other hydrographic survey equipment.
- 3.1.15 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, “Part 2 -Rules for Materials and Welding of Steel Vessels under 90 Meters in Length of American Bureau of Shipping” 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.
- 3.1.16 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.
- 3.1.17 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 GD 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 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.
- (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 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 650 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 equipment to shore for maintenance and repair.
- (e) The door in the deckhouse shall have clear toughened safety glass windows.
- (g) A weather-tight door 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 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 one year's 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 proposed Vessel and the preliminary stability information and calculation with the curves of stability, including damaged stability for each compartment of the proposed Vessel shall be submitted with the tender by the Tender Closing Date. [E]
- (b) The weight and center of gravity prediction calculations with breakdown for the Vessel. [E]
- (c) The estimated engine propulsive power from all engines required for attaining the Contract Speed of the Vessel under the Official Speed Trial conditions as stated in Annex 5 to Part VII, together with a descriptive account of the engineering principles and methodology employed for such propulsive power estimate and evaluation ("propulsive power estimate"); and the committed Contract Speed of the proposed Vessel based on the propulsive power estimate ("Committed Contract Speed");. [E]
- (d) The Preliminary Construction plan - midship, deckhouse, profile and deck, bulkhead of the Vessel. [E]
- (e) 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 fully loaded conditions, noting the importance of the vessel remaining trim and heel free during operation. [E]

(All calculations and drawings should be in metric units.)

The calculations shall be carried out by using a proven computer system, with evidence (viz. recognised by a government authority or an 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.

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 1.7.6 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%	12 persons, plus effects
2	Full Load Arrival Condition	10%	10%	98%	98%	12 persons, plus effects
3	Light Load Departure Condition	50%	50%	10%	10%	3 persons, plus effects
4	Light Load Arrival Condition	10%	10%	98%	98%	3 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 6 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.

- (a) The weather criterion $K = \frac{l_g}{l_f} \geq 1$;
- (b) The initial transverse metacentric height shall not be less than 0.35 metre.
- (c) Full load state, when the passengers 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 Damaged Stability Criteria

- (a) Suitable watertight transverse bulkheads shall be arranged to maintain the stability of the while 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 grating 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 0.6 metre
Clear headroom for ship office, bridge and pantry	Minimum 2.0 metres

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 three sections:

- (a) Bridge
- (b) Ship office
- (c) Toilet

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) Walk around deck facility which provides easy access to fore deck or aft deck.
 - (iv) The walking area on deck should be well illuminated in dark environments.
 - (v) 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.
 - (vi) The fore deck should exhibit a flush deck free of anchoring/mooring equipment.
 - (vii) 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.
 - (viii) The main deck and the top deck external spaces shall be provided with railings along the sides. Railings fitted on the port side and starboard sides of the main deck shall be removable.
- (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 pantry.

- (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 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 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 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, ship office shall not exceed 75 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 and pantry 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 and openings 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 and ship office 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 600 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) Three 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 mock-up of the bridge including the equipment arrangement, seats and other fittings as required under this Part VII. The mock up shall be inspected and agreed by GNC.
- 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) waterjetpropulsion unit is controlled by a quick action lever control (Joystick);
 - (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) Fire detection system control panel;
- (k) Emergency stop switch for accommodation ventilation fans;
- (l) Meter/Gauge indicating the quantity of fuel remained in the fuel tank;
- (m) Electric horn, siren, and flashing beacon control panel; and
- (n) Gyro Stabilizer.

4.2.14 Visibility

- (a) The visibility from the bridge shall not be obstructed.
- (b) 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.
- (c) One each large sliding window shall be fitted at port and starboard side to facilitate direct downward viewing to the side of the Vessel.
- (d) Vision blind spots or sectors shall be as few and small as possible, and in any case they should not adversely affect the keeping of a safe look-out from the helm position in the bridge. The arrangement shall be agreed by GNC in the Mock-up inspection.
- (e) 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. [D]
- (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 straight line type 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 electrically operated fresh water window washing systems shall be fitted for ALL the bridge front windows as well as the forward section of the port and starboard side windows. Heavy-duty marine type wipers (preferable of straight-line type) 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) One set of pigeon holes for stowage of international code flags;
- (c) One set of international code flags suitable for the mast;
- (d) One shelf for the stowage of log books and files;
- (e) One dial type inclinometer and one thermometer for marine use;
- (f) Three cup holders;
- (g) One metal rubbish bin with cover shall be stored inside a cabinet/locker;
- (h) One metal box for keys shall be provided and fitted inside the bridge;

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

4.2.18 A stairway shall be arranged for leading from the upper deck to the Pantry & Utility Room. Flush deck hinged hatch fitted with waterproof soft patch or gasket shall be provided. Soft patches shall be secured properly and to GNC's satisfaction. The hinged hatch covers shall be provided with means to hold them in the fully operated position.

4.3 Integrated Management System [D]

4.3.1 A system ("Integrated Management System") shall be provided to allow the display of the information from the ENE as listed in paragraph 9.1.1 of this Part, the control and monitor system of the main engines and the generator engines, the close circuit television system, the position keeping and shipboard alarm system. [D]

4.3.2 The Integrated Management System shall be a field bus communication system to enable the message and information of the equipment and systems mentioned in paragraph 4.3.1 above which are connected to a controller area network to be further sent and fed to the display and control unit. [D]

4.3.3 The control and display unit is only the extension of various systems and equipment as mentioned in paragraph 4.3.1 above. The interfacing of message and information from various systems and equipment shall not have any adverse effect on these systems and equipment. Any breakdown or defect of the Integrated Management System shall not affect the normal operation of the systems and equipment as mentioned in paragraph 4.3.1 above. [D]

4.3.4 At least one display unit shall be provided for each position (i.e. officer in charge, coxswain, engineer). All the information of the systems and equipment as mentioned in paragraph 4.3.1 above including ECDIS, Radar, DGPS and AIS and information of each of the other ENE shall be is capable of being displayed in the same display unit by selecting different screen pages. [D]

4.3.5 Redundancy of CPU (Central Processing Unit) shall be provided in the Integrated Management System. Breakdown of one CPU shall only send out an alarm and activate the stand-by CPU to continue to take up the functions of the Integrated Management System. [D]

4.4 Ship Office

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

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 The basic layout of all the facilities in the ship office are illustrated in the Conceptual General Arrangement Plan. Final layout and details of all facilities shall be submitted to GNC and CEDD designated officers for approval.
- 4.4.4 Notwithstanding anything in this Part VII to the contrary, the ship office shall include but not limited to the following features:
- (a) A survey working table (1800mm x 800mm) with height not less than 1m (subject to the height of the upholstery seat) shall be installed. Multiple arms monitor desk mount bracket with one or two poles to accommodate four sets of 24" mounted LCD monitors in 1+2+1 format shall be installed on table. The bracket shall be rigid with no vibration experienced in any operating condition. This table shall be built with side-drawers and cabinet. Storage spaces underneath the table shall be agreed with MD;
 - (b) A 37U server rack (600mm (W) x 800mm (D) x 1750mm (H)) shall be installed firmly with wire rope isolators. Rack cooling fans, two rack mount sliding shelves, three rack mount fixed shelves and two aluminium case PDUs with at least six number of Type G sockets for connecting UPS shall be included. A 3000VA rack mount Uninterruptable Power Supply (UPS), not larger than 4U, with LCD display panel and control console, two numbers of IEC 320 C19 output connections and eight numbers of IEC 320 C13 output connections and power surge protection shall be included in the server rack;
 - (c) At least four numbers of 24V DC with Type M sockets and four numbers of 240 AC with Type G sockets shall be provided nearby the server rack;
 - (d) 100mm x 50mm cable ducting with cover shall be installed from the aft deck trunk to server rack for the wiring of survey equipment cables;
 - (e) 50mm x 50mm cable ducting with cover shall be installed from survey working table to server rack for the wiring of survey equipment cables;
 - (f) Another working table (1900mm x 600mm) with a foldable side table (600mm x 430mm) and cabinet underneath shall be installed next to the survey working table mentioned in (a) above. The compartment of the working table such as drawers and layers shall be agreed with CEDD designated officers;
 - (g) Two small tables shall be installed nearby the two settees. The table at the starboard side must not affect the operation of manual mechanical unit for the deployment and recovery of the additional side mount. The location and size of the tables shall be agreed with CEDD designated officers;
 - (h) Two up to ceiling cabinet and one up to ceiling Luggage/ cabinet for crew bag storage shall be installed.
 - (i) Handrails and/or floor-to-ceiling poles shall be secured to provide support for persons in deck office. The number and location of floor-to-ceiling poles shall be agreed with GNC.
 - (j) One electric powered marine wall-mounted clock;
 - (k) One 240VAC wall mounted fans of dia. 300 mm;
 - (l) One wall mount display board shall be installed for the posting of plans, maps and notices etc.;
 - (m) 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;
 - (n) Wall-mounted electrical sockets for facilities including but not limited to 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 operational need. Numbers of spare sockets shall be agreed with MD.
- (p) Ten coat hooks fitted on the wall/cabinet.
- (q) 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.

4.5 Toilet

- 4.5.1 Toilet shall be provided and well ventilated. One electric exhaust fan shall be provided and the exhaust air shall be routed to outside of the Vessel.
- 4.5.2 Aluminium toilet door shall be fitted with louvre and opened outward with locks which could be released from outside.
- 4.5.3 Safety facilities such as enclosed gunwale, handrails, railings shall be provided to prevent falling off or being thrown on deck or overboard when walking along the corridor from Ship Office to toilet during transiting at high speed.
- 4.5.4 Flush toilet and sewage flushed from toilet shall be stored in grey water tank and/or discharge direct overboard.
- 4.5.5 A toilet with non-slip flooring and waterproof grating shall be provided with following installations and fittings:
 - (a) One stainless steel wash basin with a spring loaded cold 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) One deep bowl water closet,
 - (i) Stainless steel hand rails as appropriate to allow safe use of the facilities while at sea,
 - (j) Matt-glass window with curtain blind,
 - (k) Three coat hooks, and
 - (l) One paper towel waste bin;

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 Sparred wooden shelves for stowage of mooring ropes and equipment shall be provided inside this compartment.
- 4.6.4 Racks for stowage of navigational equipment shall be provided inside this compartment.
- 4.6.5 Racks for shapes shall be provided inside the fore peak.

4.6 Pantry and Utility Room

- 4.6.1 The pantry shall be located under-deck (or partially under-deck) aft the fore peak.
- 4.6.2 Notwithstanding requirements specified in other sections, the pantry shall include the following:
 - (a) A stairway with handrail shall lead directly from the upper deck to the pantry.
 - (b) One emergency escape hatch to the exterior deck with a fixed escape ladder as a means of escape to the main deck from pantry.
 - (c) Some storage lockers. Each locker shall be able to fit standard Marine Department bags (approximate 500 mm x 300 mm x 300 mm)
 - (d) The pantry shall be ventilated by a split-type air-conditioning
 - (e) Grab rails shall be provided where necessary
 - (f) One microwave oven
 - (g) One refrigerator with positive latches (total net capacity not less than 110 litres)
 - (h) One 240VAC electric tea kettles securely fixed in location;
 - (i) One stainless steel kitchen sink with a spring loaded cold freshwater supply tap
 - (j) Appropriate number of electric sockets should be provided.

4.7 Fuel Oil Tanks

- 4.7.1 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.
- 4.7.2 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.
- 4.7.3 The only outlets for drawing fuel from the fuel system shall be the plugs in petrol filter bowls intended solely for the purpose of servicing the filter;
- 4.7.4 Earthing device shall be provided for fuel filling system.
- 4.7.5 Grounding wires shall not be clamped between a hose and its pipe or spud.
- 4.7.6 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.
- 4.7.7 Quick closing valves (control from above the main deck) shall be fitted to the fuel oil tanks outlets.
- 4.7.8 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.
- 4.7.9 The tanks shall be hydrostatically tested as required by an approved standard and connections shall be proven tight.

4.7.10 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.

4.7.11 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. The static test pressure shall be applied for six hours without pressure drop. After the test, the test fuel tank shall not show any leakage;
- (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.

4.7.12 Diesel Oil Tank

- (a) 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.
- (b) 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.
- (c) The total capacity of the diesel oil tank shall be provided. Fuel supplied shall be not less than requirement of the Vessel operation as Paragraph 2.7.1 of Part VII of the Tender Documents with 10% margin. The unpumpable quantity of each tank shall not be more than 10% of the capacity of that tank.
- (d) Internal surfaces of the diesel tank shall be left unpainted and the diesel tank internal shall be cleaned thoroughly to the satisfaction of MD.

4.8 Side Deck

4.8.1 The width of the passage deck on both sides should be at least 600 mm for providing safe passages for crew/other persons to walk.

4.8.2 Accesses shall be provided on each port and starboard sides. The width of each accesses door shall be at least in 0.75meter.

- 4.8.3 (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.
- 4.8.4 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.
- 4.8.5 (a) Sufficient illumination lights shall be provided at each side.
- (b) Illumination lights should not provide obstruct the movement of personnel.

4.9 Mast and Open Deck

- 4.9.1 The Contractor shall propose a measure such as guard railing to safeguard the person from working at height during the vessel docking.
- 4.9.2 Permanent stanchion with chains for safe embarkation and disembarkation shall be provided.
- 4.9.3 All guard rails shall comply with the RO Requirements for protection of persons on board.
- 4.9.4 A stair/ladder(fitted with handrails on each side) is located at the back of the deckhouse for access to a working platform at the upper open deck level located next to the top of moonpool. The inclined angle of the ladder should be to GNC's satisfaction. Open decks shall be covered with non-slip material or paint.
- 4.9.5 Appropriate safety measures shall be taken to ensure the safety of personnel working on the platform beside the moonpool.
- 4.9.6 One self-supporting mast 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).
- 4.9.7 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.
- 4.9.8 Access for maintenance and servicing of Equipment and its fittings shall be provided.
- 4.9.9 The arrangement shall be such that the Equipment on the mast shall not interfere with each other.
- 4.9.10 All Equipment and their components including but not limited to cables, conduits, connectors, junction boxes, glands and fittings shall be water proof and be able to function in all weather conditions at sea.

- 4.9.11 (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 deckhouse aft.
- (c) All hardware for them, such as screws, hooks, hasps, hinges, handles and sliding bolts shall be made of stainless steel.
- 4.9.12 The solar panel systems shall be fitted on the top of the deckhouse as shown in the Conceptual General Arrangement Plan. The solar panel shall be fitted as much as possible.

4.10 Seating

- 4.10.1 Three 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, 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°
- 4.10.2 Two upholstery seats shall be provided in the ship office for the survey staff. Requirements of the seats shall be:
- (a) Seats shall be of a hydraulically damped in ergonomics design with adjustable headrest
- (b) Adjustable seat height with foot rest
- (c) Fore and aft adjustment
- (d) Shall equip with slide guide rail and positioning base for left and right adjustment
- (e) Turntable/Mounting pedestal 0° - 180°
- (f) Foldable armrests
- (g) Adjustable backrest angle
- (h) Foldable footrest
- (i) Seatbelt
- 4.10.3 Two high-density foam settees, with arm rails at two sides and storage space underneath, accommodating not less than three persons each shall be provided in the ship office as shown in the Conceptual General Arrangement Plan. Floor-to-ceiling poles and/or handrails shall be provided near the settees to prevent person from falling or being thrown on deck during transiting at high speed.
- 4.10.4 One individual wall mount foldable chair, as shown in the Conceptual General Arrangement Plan, shall be provided in the ship office.
- 4.10.5 The seat structures shall be permanently fitted to the structure of the Vessel by means of an attachment system which could be dismounted easily. The seat and the attachment system shall be acceptable by GNC.
- 4.10.6 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.
- 4.10.7 Seat materials of upholstery shall be of water resistant materials such as fire retardant foam/reinforced nylon laminated neoprene/heavy duty cordura laminate.

4.11 Bow and Stern

- 4.11.1 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.
- 4.11.2 As part of the boarding frame, a permanent forward stanchion for safe embarkation and disembarkation shall be provided.
- 4.11.3 The deck floor shall be covered with anti-slip material.
- 4.11.4 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.
- 4.11.5 All stanchions and railings, with opening for deployment of hydrographic survey equipment, on deck shall be of stainless steel in SS316.
- 4.11.6 Stainless steel fresh water taps with hose at sufficient length shall be provided at both port side and starboard side for washing of hydrographic survey equipment and the cleaning of ship deck.

4.12 Anchoring, Mooring and Towing

4.12.1 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 nylon line shall be provided. All Equipment to be sized as per the RO Requirements. shall be provided.
- (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.

4.12.2 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.
- (d) Emergency stop button for the windlass shall be provided at bridge control station and locally.
- (e) Windlass cover shall be provided.

- 4.12.3 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).
- 4.12.4 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).
- 4.12.5 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.
- 4.12.6 Two stainless steel boat hooks with 3-metre staves and stowage arrangement shall be provided.
- 4.12.7 Mooring - As a minimum eight deck cleats on deck shall be provided with eight-strand nylon 40 metres long (minimum) mooring ropes. Size of the deck cleats shall be agreed by GNC.

4.13 Fenders

- 4.13.1 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 as shown in the General Arrangement Plan to be submitted after the Contract award shall be to MD's satisfaction.
- 4.13.2 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, stern and stem at main deck level. Thickened and heightened fenders shall be installed along the bulwarks of the raised deck at the bow, samples of this fender is shown below:



- 4.13.3 Additional Rubber Tyre Fenders at Bow and Ship's Sides:

Sufficient numbers of rubber tyre fenders of appropriate size with stainless steel securing rings shall be provided. Two (2) of them shall be fitted on bow forward for embarkation/disembarkation and facilitate inspection operations by pushing the vessel bow against piers or seawalls.

- 4.13.4 At least eight units of portable air filled fenders at diameter not smaller than 450mm shall be provided. Two of these fenders will be used for side pole protection when deployed.
- 4.13.5 The arrangement shall be submitted to MD for approval prior to installation.

4.14 Cathodic and Hull Surface Protection

- 4.14.1 The machinery and equipment under the water such as waterjet propulsion units, and the

lightning protection shall be protected by a cathodic protection system which protection system in turn shall have at least one year' life.

- 4.14.2 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.
- 4.14.3 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.

4.15 Lightning Protection

- 4.15.1 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.
- 4.15.2 Methods and working principles of protection shall be submitted for MD approval before the installation of the protection system.

4.16 Deck Equipment

- 4.16.1 Material for all deck equipment, inclusive of lifting appliance, lifting gear, units, parts and accessories, shall be marine grade, corrosion resistance and stainless steel in SS316. All Deck Equipment and their components including but not limited to cables, conduits, connectors, junction boxes, glands and fittings shall be waterproof and be able to function in all weather conditions at sea.
- 4.16.2 Detailed designs of all Deck Equipment shall be discussed at the kick-off meeting and shall be approved by RO, MD and CEDD designated officers. The Contractor is required to submit all Deck Equipment design drawings in details for RO, MD and CEDD designated officers approval.
- 4.16.3 The design, construction, testing and examination of all Deck Equipment shall be completed in compliance with all the related Hong Kong safety legislative requirements that apply to lifting appliances and lifting gear. All testing and examination of lifting appliance, lifting gear, units, parts and accessories must be completed by competent personnel and suitably marked with a Safe Working Load (SWL) and "Next Inspection Date". All testing, examination and inspection reports and certificates shall be properly kept and handed over to MD.
- 4.16.4 All deck equipment dangerous zones shall be clearly defined and marked with paint on deck.
- 4.16.5 Openings with sufficient spaces for deployment of hydrographic survey equipment at stern and gunwale shall be constructed by stanchions and railings with stainless steel in SS316;
- 4.16.6 Maintenance instructions and operation manuals of all deck equipment shall be provided.
- 4.16.7 At least 6 pairs of recessed tie down lashing eyes with ratchet tie down straps shall be reserved on the wall and aft deck for fixation of survey equipment during transiting at high speed;
- 4.16.8 A hydraulic A-frame equipped with a towing device shall be fitted at the stern for survey equipment deployment. The A-frame shall meet the following requirements, unless otherwise specified: -

- (a) The SWL of A-frame shall be 250kg or at a level that capable to achieve the requirements of: 1) deploying, recovering & towing the below “Side Scan Sonar” (about 35 kg) down to 25m underwater at 6 knots and 2) deploying & recovering a 2.1m (height) x 2.4 m (diameter) object (about 50 kg) into and out of water;

The A-frame shall be driven by hydraulic cylinders to provide 1.5m in and out reach from the edge of the stern for safe launch and recovery. The inner width and headroom of the A-frame shall be sufficient for the deployment and recovery of survey equipment mentioned in item (a) above;

- (b) The material, plating and quality of hydraulic cylinders shall be at a level that are resistant to corrosion caused by long time exposure to marine environment;
- (c) Multi lifting eyes on soffit of beam and both sides of the A-frame shall be provided for lifting gears;
- (d) A 5/8” x 11 female threaded GNSS adaptors shall be installed at the top mid of the A-frame.
- (e) The towing device shall consist of a winch with at least 100m wire rope, drum guard and spooling system. The power, loading, drum capacity and drum speed of the winch shall be capable to achieve the requirements as stipulated in the item (a) above. The winch shall be installed at the top centre of the A-frame. It shall equip with a wire counter and display unit for counting the speed, length of cable out and loading of the wire rope;
- (f) The winch shall equip with a diamond screw level wind with rollers to facilitate wire spooling;
- (g) The contractor shall refer to the requirements as stipulated in the item (a) to calculate the expected underwater drag force caused by instrument towing so as to determine the appropriate SWL, power, loading, drum capacity and drum speed of the A-frame and winch;
- (h) A waterproof control console with display unit for the A-frame and towing device shall be fixed on a stand at the starboard side with a safe distance away from the danger zone;
- (i) A built-in safety function of hydraulic overload protection and an emergency stop button shall be required;
- (j) The wire rope shall be properly terminated with wire rope clips and thimble. Below shackles & quick release swivel shackles at appropriate SWL and hook and moor telescoping boat hooks shall be provided;



- (k) Waterproof covers for the towing device and control console shall be provided;
- (l) Samples of the A-frame are shown below:

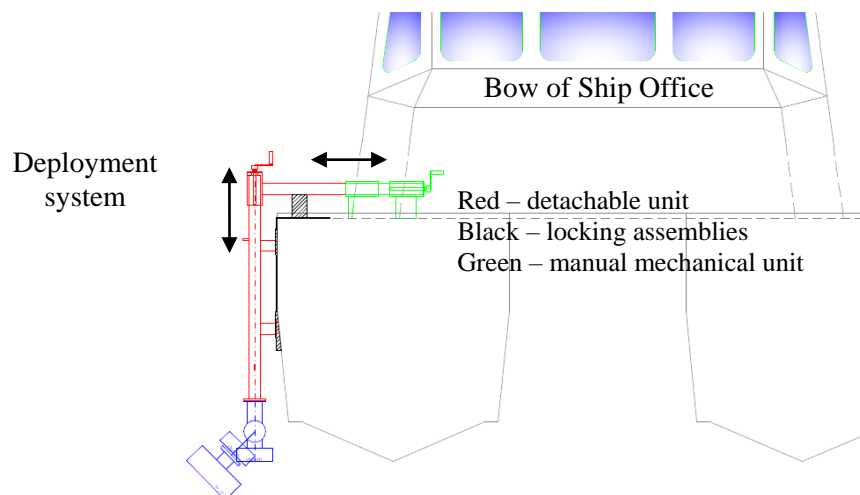


4.16.9 A swing davit shall be installed to meet the following requirements, unless otherwise specified: -

- (a) The davit with SWL of 100kg shall be fixed on the starboard side gunwale;
- (b) The davit shall be at least 2.5m height with at least 1m out and in reach from the edge of the vessel for deploying and recovering an object of 2.1m (height) x 2.4 m (diameter) into and out of water;
- (c) The davit arm with a diagonal supporter shall allow at least 270° rotation for survey equipment assembling and deployment;
- (d) Dowel pins shall be provided to lock the swing davit in at least 45° interval;
- (e) Multi lifting eyes on the davit arm shall be provided for shackles and pulleys installation;
- (f) A winch with at least 30m wire rope shall be installed on the swing part of the davit. The power, loading, drum size and drum speed of the winch shall be capable to deploy and recover a 20kg object into and out of water;
- (g) A waterproof winch control console shall be installed in a safe distance away from the danger zone enclosed in the watertight cabinet. A built-in safety function of overload protection and an emergency stop button should be included;
- (h) The wire rope shall be properly terminated with wire rope clips and thimble;
- (i) Drum guard and waterproof cover for the winch and control console shall be provided;
- (j) A capstan winch shall be installed at the bottom of the davit. It shall be able to swing together with the davit. The power, loading, drum size and drum speed of the capstan shall be capable to deploy and recover a 50kg object into and out of water;
- (k) The winch shall be controlled by up and down foot pedals fitted on the deck surface away from the danger zone;
- (l) A built-in safety function of overload protection and an emergency stop button shall be included;
- (m) All watertight openings and ducting for cable connection to the server rack in deck office shall be provided;
- (n) Waterproof covers for the capstan winch and its pedal control shall be provided;
- (o) A foldable 400mm long foot step with height sufficient for staff to access open block pulley shall be fixed beside the swing davit;
- (p) Open block pulleys and single sheave open type wire rope pulleys at appropriate SWL shall be provided;
- (q) Some samples of the above are shown as below:



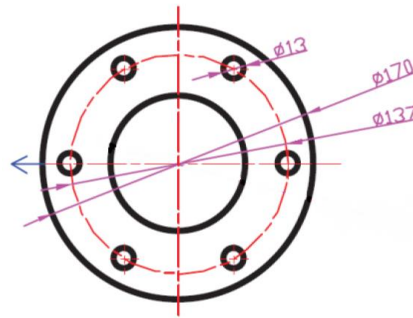
4.16.10 An additional side mount system for transducer deployment shall be securely fixed on the starboard deck near COG. It shall include a detachable unit, locking assemblies outside the ship office, and manual mechanical unit firmly fixed inside the ship office. It shall be free of unacceptable structural vibration in any operating conditions.



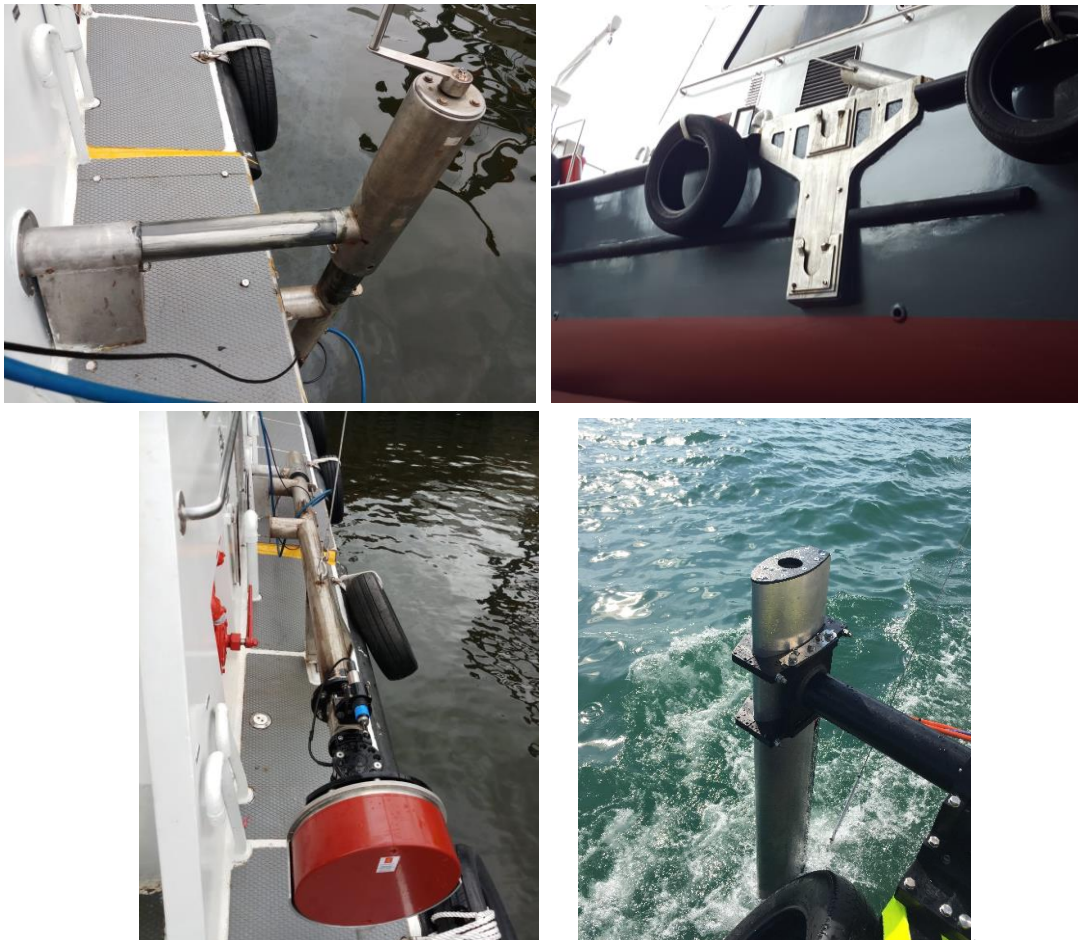
With the two directions manual extension mechanisms, the side mount shall be able to move in up-down and port-starboard directions. It allows the sonar transducer pole to be deployed from deck level into the water smoothly and vice versa. The side mount system shall meet the following requirements, unless otherwise specified: -

1. The deployment system shall be of appropriate size, strength and loading to deploy and recover a 40kg sonar transducer;
2. The whole detachable unit shall be a portable design to facilitate transportation, installation, operation and demobilisation;
3. The sonar pole of the detachable unit shall be long enough to deploy a sonar transducer into water level at 0.5m below the keel;
4. With the assistance of the davit and winch, the manual extension mechanisms shall allow the sonar pole on deck to be deployed into the water and to be recovered inboard of the gunwale and secure on deck firmly;
5. The locking assembly used for vertical deployment of the sonar pole into the water during sounding survey shall be firmly fixed on the hull. It shall sufficiently maintain the stability of sonar pole in every deployment, free of vibration;
6. The stand for stowing the sonar pole inboard when not in use shall be firmly fixed on the deck. It shall be detachable for easy storage when the additional side mount is not in use;

7. The underwater portion of sonar pole shall be surrounded by extruded aluminium hydrofoil to minimise underwater drag force;
8. The bottom flange of sonar pole shall be with bolt hold pattern (in mm) presented as follows:



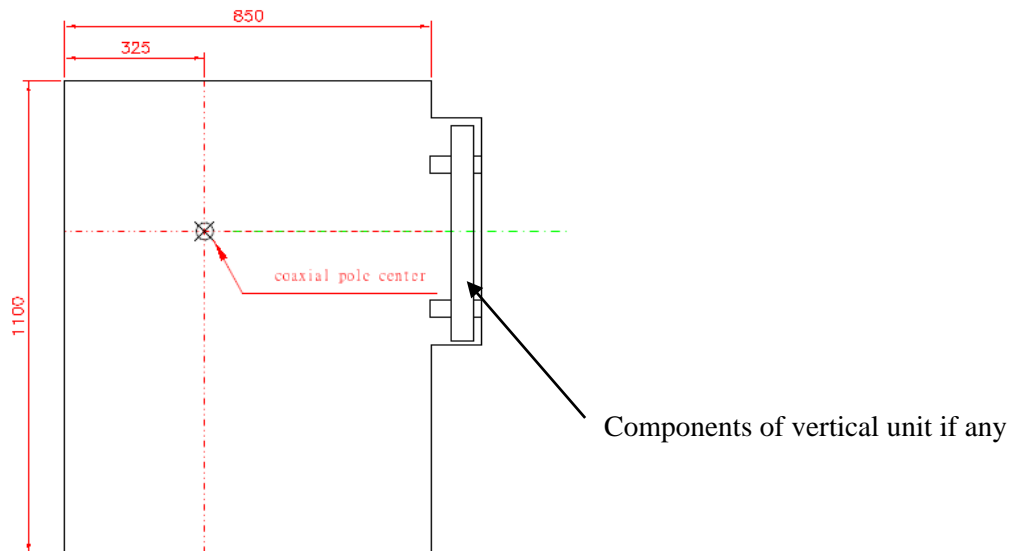
- (a) All watertight openings and ducting for cable connection to the server rack in deck office shall be provided;
- (b) A mechanism shall be included to detach and demodularise the detachable unit from the manual mechanical unit for easy storage when not in use;
- (c) Samples of the additional side mount unit are shown as below:



4.16.11A moon pool with 1.1m x 0.85m opening shall be located nearby the COG of the vessel. A vertical unit equipped with a lifting appliance shall be fixed at the aft centre next to the

toilet for lifting and lowering of vertical unit into and out of water. The vertical unit shall comprise of a coaxial pole which allow a Multibeam Echo Sounder (MBES) transducer installed at the bottom and 3 GNSS antennas & a lasers scanner installed at the top. [E]

4.16.12 The coaxial pole shall be fixed at the position shown as follows or otherwise specified:



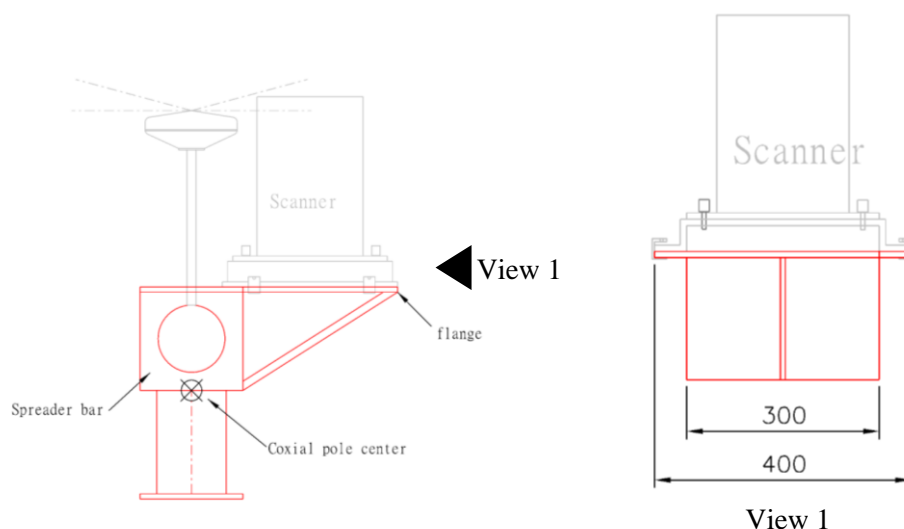
The lifting appliance shall be fixed outside the moon pool or in a position not affecting the vertical movement of the coaxial pole with MBES transducer installed. The whole system shall meet the following requirements, unless otherwise specified: -

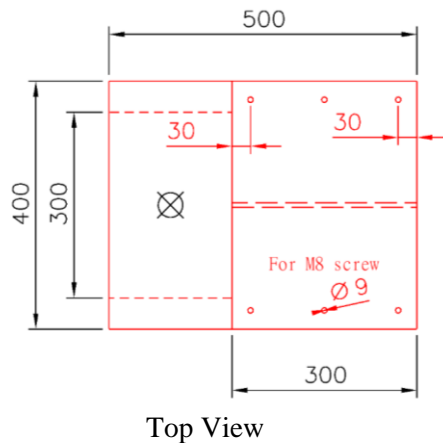
The moon pool, vertical unit and lifting appliance shall be constructed such that no vibration is experienced in any operating condition. The design shall be of appropriate size, strength and loading to deploy and recover the vertical unit with a 40kg sonar transducer and a 20kg laser scanner installed;

- (a) The contractor shall calculate the expected underwater drag force caused by the 40kg sonar transducer dragging in water at 6 knots and determine the appropriate size, strength and loading of the moon pool, vertical unit and lifting appliance;
- (b) The underwater portion of coaxial pole shall be surrounded by extruded aluminium hydrofoil to minimise underwater drag force;
- (c) The vertical unit shall be able to be demobilised into two pieces for easy installation and maintenance, if required;
- (d) The lifting appliance shall comprise of multistage hydraulic cylinders with position sensors or other practical mechanical appliance for raising and lowering the vertical unit with locking mechanism to fix it at the below 4 different levels to:
 - i. allow the bottom of MBES transducer 0.5m below the keel for surveying;
 - ii. allow the bottom of MBES transducer slightly below the keel for surveying;
 - iii. allow the bottom of MBES transducer 0.5m above the waterline for transiting;
 - iv. allow the bottom of MBES transducer 0.3m above the deck level for maintenance;
- (e) Material, plating and quality of the hydraulic cylinders shall be suitable for the rods

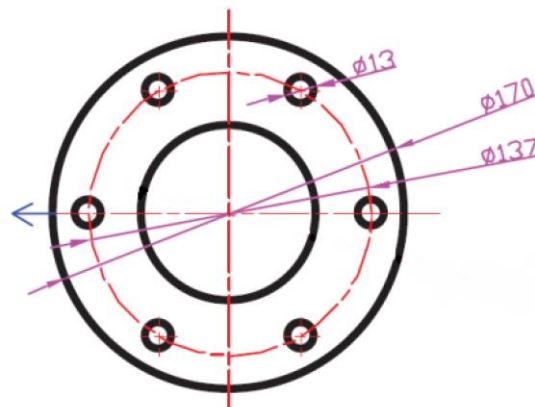
which are submerged in sea water where the cylinders are exposed to the marine environment regularly;

- (f) A locking mechanisms shall be provided to ensure every installation and deployment of the vertical unit is maintained in the same position and orientation to ensure survey accuracy;
- (g) Stainless steel spring pin latch locks or dowel pins shall be installed to support the fixation of the vertical unit at 4 different levels;
- (h) A marine grade heavy-duty plastic guide rail and/or spring-loaded roller guide rail or any other practical rails shall be used as the vertical linear guide of the lifting appliance;
- (i) Cables of the MBES transducer, laser scanner and GNSS antennas shall be protected by “cable and hose carrier” or ”cable protective drag chain” with guide channel to allow cable slag for vertical movements;
- (j) All watertight openings and ducting for cable connection to the server rack in deck office shall be provided;
- (k) A detachable spreader bar not less than 3.1m long shall be installed on the top of the vertical unit for the installation of 3 GNSS antennas;
- (l) The centre part of the spreader bar shall be horizontally and firmly attached at the top of the vertical unit with diagonal support;
- (m) Two 5/8” x 11 female threaded GNSS adaptors shall be installed at both ends of the spreader bar at a distance of 3m. The third 5/8” x 11 female threaded GNSS adaptor shall be installed in 0.5m away from either one of the above;
- (n) The length of the vertical unit shall be capable to support the spreader bar up to the roof deck level allowing clear sky window for GNSS antennas at elevation $> 15^\circ$ when the unit is fully deployed into water;
- (o) An upper unit involved in the spreader bar illustrated as below shall be firmly fixed at top of the vertical unit. The top of the spreader shall embed a rectangle flange for scanner installation towards bow with a diagonal supporter.





- (p) The bottom and top flanges of vertical unit shall be with bolt hold pattern (in mm) presented as follows:



- (q) At least two pieces of lightweight waterproof moon pool covers with quick release fixations shall be provided to avoid water blowing up from the moon pool. Covers' opening in the moon pool center shall be reserved to allow covering when the unit is fully deployed;
- (r) A waterproof control console for lifting appliance shall be installed in a safe distance away from the danger zone. A built-in safety function of overload protection and an emergency stop button should be included;
- (s) Safety guards for all the moveable mechanical parts shall be installed. Hinged guards with stainless steel spring pin latch locks shall be provided at the openings reserved for equipment mobilisation and maintenance;
- (t) A working platform with safety access and enclosure shall be provided at the roof deck for mobilisation and maintenance of the antennas and laser scanner.

4.16.13A low profile and lightweight swing davit with manual winch at appropriate SWL shall be installed at the starboard side of the roof deck for raising and lowering survey equipment up to 20kg from and to the main deck. Drum guard and waterproof cover shall be provided. A sample of swing davit is shown as follows:



4.16.14A gyro stabilizer is required on board. The expected percentage of roll reduction contributed by the gyro stabilizer shall be not less than 60% 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 m. The stabilizer shall meet the following requirements, unless otherwise specified: -

- (a) Noise insulation shall be installed if the stabilizer is installed nearby the deck office or sonar equipment.

4.16.15 Twin substantial dive platforms with stairs, as illustrated in the below figure, shall be installed behind the stern seal to access the waterline for deployment and recovery of survey equipment.



4.16.16A 1.2m (L) x 0.5m(W) x 0.5m(H) waterproof lifting gears storage box with hinged cover and stainless steel spring pin latch lock shall be fixed on aft deck near the staircase, if required.

4.16.17The below control points with locations agreed by CEDD designated officers. shall be demarcated on the vessel for surveying purpose:

- (a) Ten pairs of punch marks or screw heads on metal surface of main deck;
- (b) Six pairs of punch marks or screw heads on metal surface of roof deck;
- (c) Six pairs of punch marks or retro reflective targets in the deck office.

4.16.18Another 4.1m long spreader bar for three GPS/GNSS antennae installation shall be firmly fixed 1.2m above roof deck. It shall be free of unacceptable structural vibration in any operating conditions. Two 5/8" x 11 male threaded adaptor for GNSS antennae shall be fixed 4m apart at the both ends of the spreader bar. The remaining one for DGPS navigation shall be fixed at the middle of it.

4.16.19 A 5/8" x 11 female threaded GNSS adaptors shall be installed at the mid top of railing at the bow.

Chapter 5 - Safety Equipment

5.1 General Provisions

- 5.1.1 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.
- 5.1.2 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.
- 5.1.3 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.
- 5.1.4 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.
- 5.1.5 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.
- 5.1.6 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.
- 5.1.7 All deck finish materials shall comply with the FTP Code.
- 5.1.8 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.
- 5.1.9 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.
- 5.1.10 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, ship office, pantry etc. to meet 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 pantry.
- 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 One portable fire pump located outside of the machinery space shall be provided to have sufficient capacity to pump seawater with a jet throw of at least 6 metres.
- 5.4.3 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 (can 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 signals of fire detection system and bilge alarm system shall be sent to the shore office or supervisor automatically.
- 5.6.3 An electric bilge pump shall be provided for all compartments.
- 5.6.4 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 shall be provided in the Vessel at appropriate locations in accordance with the RO Requirements.
- 6.1.2 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.
- 6.1.3 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.
- 6.1.4 Adequate number of lifebuoys shall be provided as per the RO Requirements. Lifebuoys shall be marked with ship names on both sides.
- 6.1.5 Approved LSA Plan by RO in frame shall be posted on the wall of Ship Office.

Chapter 7 - Machinery

7.1. General Requirements

- 7.1.1 The main engines, gearboxes, electric generator sets and any other machinery offered by the Tenderer are those at present commonly used by ships operating in Hong Kong Waters, and that they have good support for spare parts and after sale services locally in Hong Kong. Support and maintenance services 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.
- 7.1.2 All the machineries and equipment shall be installed according to the requirements of the supplier, and effective measures shall be taken to reduce noise and meet the requirements as mentioned in 3.1.13.
- 7.1.3 The Vessel shall be equipped and fitted with all machineries described in this Chapter 7 each complying with the specifications set out in this Chapter for such machinery. The 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.
- 7.1.4 Two accesses with reasonable separation shall be provided for the engine room. The design of the engine room layout shall be approved by an RO and 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.
- 7.1.5 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, gearboxes, generator set, fuel oil tanks, etc. shall be carefully designed and provided to enable their removal from ships for maintenance in a practicable manner so to avoid the need for the deck or shell plate to be cut.
- 7.1.6 All parts of machinery, hydraulic, 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.
- 7.1.7 Provision shall be made to facilitate cleaning, inspection and maintenance of main engines, electric generator sets, fire pumps, etc. and their associated piping and equipment.
- 7.1.8 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 Safety Working Load (SWL) shall be marked after the load test.

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 bridge.

7.2 Main Propulsion Engines (or main 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 proposed model of the engines as published by the manufacturer shall support an annual operation of 2,000 hours. The diesel engines shall at least meet IMO Tier II emission requirements or such higher standards as the Contractor may have committed in its tender for the Contract. (The aforesaid 2000 hours are calculated as follows: 8 hours/day and 250 days/year = 2,000 hours/year). [E]

7.2.2 It is desirable that the diesel engines shall meet higher emission standards than that specified in paragraph 7.2.1 above. [D]Type approved certificates issued by an RO or other entities acceptable by GNC to prove compliance with the emission standards as specified in paragraph 7.2.1 above or such higher standards as the Contractor may have committed in its tender for the Contract shall be provided and attached to Schedule 7 of Part V.

7.2.3 The main engines shall drive the waterjet propulsion units through reduction gears.

7.2.4 Each 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.

7.2.5 The main engines 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 bridge, they shall be ergonomically laid out and grouped around the steering position in the bridge control console.

7.3.2 Instrumentation and controls in the control console shall be comprehensive and shall include:

- (i) Starting and stopping of main engines from the bridge.
- (ii) Emergency stop button with guard cover.
- (iii) bridge /local control change over switch and indicator.
- (iv) Speed control device.
- (v) Rudder angle indicator.
- (vi) Engine tachometers with running hour meter.
- (vii) Sea water cooling pressure.
- (viii) Coolant water temperature and pressure.
- (ix) Engine lubricating oil temperature and pressure gauges.
- (x) High cooling water temperature alarm and de-rate function.
- (xi) Engine low lubricating oil pressure alarm and trip.
- (xii) Gearbox lubricating oil low pressure gauge.

- (xiii) Gearbox lubricating oil low pressure alarm and trip .
- (xiv) Ammeter for each engine.
- (xv) Engine exhaust gas pyrometer.
- (xvi) Fresh water tank content gauge.
- (xvii) Fuel oil tanks content gauge.
- (xviii) Overspeed alarm and trip.
- (xix) Main engine expansion tank low level alarm.
- (xx) Battery charging control lamps.
- (xxi) D.C. power on light.
- (xxii) Central illumination dimmer for all light in the control console.
- (xxiii) Lamp test.
- (xxiv) Alarm test and reset.
- (xxv) A standard engine maker's engine control panel to be provided in the engine room.
- (xxvi) Any other instrumentation recommended by the engine maker and GNC.

7.4 Electric Generator Engines

- 7.4.1 Two (2) electrically started, fresh water-cooled electric engines integral with alternating current alternator of self-excited, brushless and ventilated type, shall be installed on the Vessel. Synchronizing operation is not required.
[E]
- 7.4.2 The capacity of these generating sets shall be such that either one of the two generating sets shall be able to supply all electricity necessary to ensure that normal operational conditions and safety can be achieved.
- 7.4.3 Each electric generating set at its continuous service rating, shall have sufficient capacity for:
- i) supplying 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
 - ii) permitting 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 set is supplying full operational electrical load including air conditioning running at full capacity of the whole Vessel.
- 7.4.4 Electrical load analysis and calculations shall be approved by an RO before submission to GNC.

7.5 Electric Generator Engines' Control

- 7.5.1 The controls and instrumentation of the generator engines shall be designed for one man operation in the bridge, the instrumentation and controls in the control console shall be comprehensive and include:
- i) Remote start and stop.
 - ii) Tachometer with running hour meter.
 - iii) Cooling water temperature gauge.
 - iv) Exhaust gas temperature gauge.
 - v) Lubricating oil pressure gauge.
 - vi) Battery charger ammeter.
 - vii) Fault indicating lights and alarms.

- viii) Protective devices such as overspeed, low lubricating oil pressure trip, etc. as recommended by the engine builder.
- ix) A standard manufacturer's local control panel shall be fitted in the engine room.

7.6 Instrumentation and Control

- 7.6.1 A control station in the bridge 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 an 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 bridge 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 bridge control station under any operating conditions shall be available.

7.7 Reversing Gearboxes

- 7.7.1 The reversing gearboxes shall be resilient-mounted to the ship's structure. Gearboxes shall be provided with clutches, alarm senders, and switches.
 - i) 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.
 - ii) The gearboxes shall be provided with the ratio to match the main engines and waterjet propulsion units.
 - iii) The main engines shall be designed to have their minimum speeds in keeping the loitering speed of 4~8 knots, repeated cycling of the clutches in and out of gear shall be avoided.
- 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 bridge.
- 7.7.3 The impeller shall be capable of being reversed in rotation and thrust through the main engines' reversible gearboxes for back flushing and clearing of the waterjet intake grill.
- 7.7.4 Manholes in way of the housing of the impellers for manually clearing of the waterjet intake grill shall be provided.

7.8 Waterjet System and Propulsion Controls

- 7.8.1 The design and installation of a waterjet propulsion system shall follow the RO and IMO requirements and shall comply with all specifications set out in this paragraph 7.8.
- 7.8.2 A dynamic positioning system connecting to the waterjet propulsion units and GPS shall be provided. Station keeping should preferably be maintained in a position over a point of not more than two metres.
- 7.8.3 For the avoidance of doubt, the following requirements shall also be met:
- (i) The waterjet propulsion system shall be installed in accordance with the engine maker's instructions and RO requirements.
 - (ii) The Vessel shall also be provided with the following items:
 - (a) The design of the whole waterjet propulsion system together with its control system shall be of a design approved by one of the RO.
 - (b) The RO's design and construction inspection certificates of the waterjet propulsion units shall be provided to GNC before the Acceptance Delivery.
 - (c) The waterjet propulsion system shall be installed in accordance with manufacturer's instructions as well as to the RO's regulations and requirements.
 - (d) Torsional vibration calculations approved by the RO for the shafting system shall be provided to GNC before the Acceptance Delivery.
- 7.8.4 The Waterjet Propulsion Units
- (i) General
 - (a) Each waterjet propulsion unit shall be driven by a main propulsion engine through the reduction/reversible gear and flexible coupling.
 - (ii) The gearbox shall include the following:
 - (a) A flexible coupling of proprietary make;
 - (b) Build in gear type oil pump;
 - (c) Oil temperature high alarm;
 - (d) Higher oil temperature cut out.
 - (iii) The waterjet propulsion system shall include the panel containing all the essential instrumentation and alarm devices for the effective monitoring and control of the waterjet propulsion units at the Wheelhouse. The alarms with individual warning indications as listed as follows:
 - (a) Power failure of the control system;
 - (b) Power failure of the alarm system;
 - (c) Low level in lubricating oil tank (if provided);
 - (d) Low lubricating oil pressure;
 - (e) Low level in the hydraulic system;
 - (f) Power failure safety system.
 - (iv) The waterjet propulsion units shall be made of corrosion resistant materials and that the whole system is well insulated and arranged to prevent galvanic corrosion.

- (v) The control system
 - (a) Speed and Maneuvering/Reverse Control
 - 1. Control and instruments of the main engines/ and waterjet propulsion units shall be designed for a one-man operation in the bridge.
 - 2. Vector joystick (combined joystick) shall be provided in the bridge.
 - (b) Back-up Control System
 - 1. One back up control panel for steering and reversing operation to be provided on main station in the bridge.
 - 2. The back-up system shall be capable of being use immediately if a fault occurs in the main system.
 - 3. A selector with a button situated in the vicinity of the back-up lever shall be provided. Automatic switch-over is not necessary.
 - 4. All maneuvering actions performed by the main system shall be able to be performed by the back-up systems.
 - 5. Training for the use of this back-up control system, including steering and reversing, shall be provided by the Contractor to MD and CEDD designated officers.

7.9 Emergency Steering

- 7.9.1 The Vessel shall be designed for retaining safe control when there is any loss of control functions.
- 7.9.2 The Vessel shall be capable of being handled, controlled, maneuvered and operated directly using the manual operation mechanism located in the port and starboard side engines rooms or aft peak compartments.
- 7.9.3 The forward/reverse and steering operations of the Vessel shall be carried out directly after the system is changed over to the manual mode control.
- 7.9.4 Communication between Stations: -
 - (i) Remote start and stop. Telephones for communication between Wheelhouse Control Console (WHCC) with Engine Room Control Console (ERCC), one head set shall be provided for each ERCC together with sufficient length of cord, and flashlight and siren.
 - (ii) Engine Room Control Console (E/R C.C.) shall include the following: -
 - (a) Main engine start/stop push button;
 - (b) Main engine RPM control and indication;
 - (c) Gearbox control and indication;
 - (d) Shaft tachometers;
 - (e) Sea water temperature and pressure gauges;
 - (f) Fuel supply pressure gauges after fuel filters;
 - (g) Engine LO pressure gauges for main engines, generator engines, and gearbox system;
 - (h) Engine cooling water temperature gauges for main engines, generator engines, and gearbox system;
 - (i) Any other essential gauges and fittings required for the effective operation of emergency engine room control;

- (j) Telephone;
- (k) Any other controls necessary for the effective control of the propulsion and positioning system;
- (l) Common audible and visual alarms (both siren & beacon) for ALL the machinery faults (amber), intercom (blue), fire (red) and CO₂ (red) shall be fitted in the engine room in an easily noticeable position;

7.10 Engine Room Ventilation

- 7.10.1 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.
- 7.10.2 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).
- 7.10.3 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.
- i) 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. The ventilation design shall be such to avoid any hot spot or “dead air” area.
 - ii) 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).
- 7.10.4 Waterjet compartment and tank space shall be adequately 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.
- 7.10.5 For guidance, the ventilation air to the compartment as stated should:
- (i) limit the temperature rise in a machinery space to 10°C above ambient temperature;
 - (ii) 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%.
- 7.10.6 Automatic shut-off device shall be provided according to RO Requirements when CO₂ system activated.
- 7.10.7 Calculation for the capacity of the fans to meet the minimum air changes requirements should be submitted to the RO for approval.

7.11 Air-Conditioning System

- 7.11.1 The air condition control shall be provided to the following spaces: -
- i) Wheelhouse
 - ii) Ship office
 - iii) Pantry and Utility Room
- 7.11.2 A Proprietary made split-type air-cooled air-conditioning units are preferable to be provided each for the Wheelhouse and Ship office.
- 7.11.3 The supply/exhaust of the circulation air through the air-duct installing under the ceiling or the side-wall is preferable.
- 7.11.4 The temperature of the compartments as stated in Paragraph 7.11.1 shall be maintained at 22°C for 60% relative humidity when the external ambient air temperature is 38°C at 90% relative humidity with full complement and passengers 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.
- 7.11.5 The design of the cooling air capacity shall be evenly distributed. An individual control shall be provided in each compartment.
- 7.11.6 The location of air-conditioning indoor and outdoor units shall not create obstructions to the removal of any hatch covers or direct maintenance of any major machinery and equipment.
- 7.11.7 The way of refrigerant copper tubes between indoor unit and outdoor unit shall not create obstructions to the removal of any hatch covers or direct maintenance of any major machinery and equipment.
- 7.11.8 The supporter rack for each outdoor unit shall be provided. Removable covers shall provide for protection the external unit of the air-conditioner from sunlight / rain.
- 7.11.9 The refrigerant shall be CFC and HCFC free.
- 7.11.10 Emergency stop switches of the air conditioning system in addition to the normal power 'on' and 'off' switches shall be installed in the bridge control station.
- 7.11.11 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.
- 7.11.12 Mould and bacteria resistant replaceable filters shall be fitted at air inlets.
- 7.11.13 The air-conditioning indoor units shall be located in the compartments for its efficient operation within the cabin environment, as recommended by the air-conditioner manufacturer, with due regards to air moisture at sea environment to avoid undue condensation formation. In view of design constraints with respect to the already compact cabin space and its other installed fixtures and fittings, the Contractor shall agree with GNC the exact installation position of the indoor units before installing the indoor units in the cabin(s).
- 7.11.14 Sufficient ventilation shall be provided in case of air-conditioning breakdown.

7.12 Piping System

7.12.1 Pipes connection and bending.

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

7.12.2 The piping material shall be copper chrome plated or stainless steel 316L. The thickness accords with RO requirement.

7.12.3 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.

7.12.4 Suitable provision for expansion is to be made, where necessary, in each range of pipes.

7.12.5 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.

7.12.6 So far as practicable, pipelines, including exhaust pipes from engines, are not to 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 shields shall be provided as found necessary.

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

7.12.8 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 used in the system.

7.12.9 Machinery and piping designation and marking.

- i) 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.

- ii) 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

7.13 Fuel Oil System and Fuel Oil Tank

- 7.13.1 As Government vessels are committed to utilize 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 labelled B5) and approved by the engine makers.
- 7.13.2 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.
- 7.13.3 Quick closing valves (control from above the main deck) shall be fitted to the fuel oil tanks outlets.
- 7.13.4 Boost pumps shall be arranged to lift fuel to the engines through coalescing filters.
- 7.13.5 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.
- 7.13.6 The tanks shall be hydro-statically tested as required by an approved standard and connections shall be proven tight.
- 7.13.7 An electric motor-driven pump shall be provided for transferring the fuel.
- 7.13.8 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.
- 7.13.9 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.
- 7.13.10 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.
- 7.13.11 An easily removable coarse strainer shall be built into the filling line.
- 7.13.12 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.
- 7.13.13 Where necessary, flexible pipes of approved type may be used as short joining lengths to the engine.
- 7.13.14 Water separators should be fitted to the fuel supply line, if required.
- 7.13.15 Fuel piping material shall be 316L stainless steel. The thickness accords with RO requirement.
- 7.13.16 Fuel Oil Tank(s)
 - i) 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 tanks 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.

- ii) 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.
- iii) 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.
- iv) Internal surfaces of the fuel oil tank shall be left unpainted and shall be cleaned thoroughly to the satisfaction of GNC.
- v) Provisions to the fuel oil tank
 - (a) A tank content level gauge in liters and low level alarm shall be fitted on the bridge control station. The level gauge of each fuel oil tank shall be marked with markings of level;
 - (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;
 - (d) Suitable provision such as drip trap shall be made for collecting the oil discharge;
 - (e) 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;
 - (f) 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;
 - (g) 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;
 - (h) Sounding pipes with chained cap shall be provided;
 - (i) Tank drain shall be provided; and
 - (j) The compartment or space containing the fuel oil tank shall be fitted with two ventilating pipes of arrangement acceptable to GNC.

7.14 Fresh Water Tank

7.14.1 Fresh water tank arrangement

- i) One independent stainless steel fresh water tank with a total capacity of not less than 500 liters shall be arranged in the Vessel to supply fresh water to the main deck, under-deck and wash room.
- ii) It should be installed in the tank space as indicated on the Conceptual General Arrangement Plan.

7.14.2 The fresh water shall be supplied by a fresh water pump to achieve a pressure at the tap located at main deck, under-deck and wash room to GNC 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.

7.14.3 Marine grade stainless steel 316L shall be used for fresh water tank. The fresh water tank shall be flushed clean before installation and delivery of Vessel.

- 7.14.4 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:
- i) Inspection / cleaning access cover
 - ii) Filling / sounding pipe
 - iii) Air pipe
 - iv) A tank content level gauge in liters and low level alarm shall be fitted on the bridge control station.
- 7.14.5 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.
- 7.14.6 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.
- 7.14.7 The freshwater tank shall not be directly adjacent to any other tanks carrying liquid of any kind.
- 7.14.8 The freshwater tank shall be tested without leakage 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.
- 7.14.9 A capacity indicator calibrated in liters shall be provided.
- 7.14.10 The impressed unit shall be provided with a starter, pressure switch, pressure gauge, relief valve and suction valve. The freshwater pump shall maintain the pressure automatically.
- 7.14.11 Domestic freshwater piping shall be made of copper or stainless steel 316L. Certificate of piping material shall be submitted before the delivery of the Vessel. The welding joints of the domestic fresh water piping's 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.
- 7.14.12 Stainless steel cold freshwater taps completed with PVC braided / reinforced transparent hoses should be fitted on the main deck aft, pantry and deck-house top to provide a rinse off facility for cleansing purposes.

7.15 Bilge System

- 7.15.1 The Vessel shall be fitted with a bilge system to the requirements of the RO.
- 7.15.2 A bilge audible and visual alarm panel shall be fitted in the bridge control station for engine room, waterjet room, pantry and utility room, fore peak and tank space.
- 7.15.3 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 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. The additional protection shall be able to be turned on and off when required.

- 7.15.4 A bilge water holding tank of minimum of 300 litres in capacity shall be provided in the engine room. Marine grade stainless steel 316L shall be used for bilge water holding tank.
- 7.15.5 The bilge of the engine room and waterjet room 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 pass through International oil and water connection. A direct overboard shall be provided in case of emergency affecting the safety of the Vessel.
- 7.15.6 Bilge piping shall be made of stainless steel 316L.

7.16 Seawater System

- 7.16.1 All sea valves shall be compatible with the hull material, connected to the sea chests shall be tested according to RO Requirements.
- 7.16.2 Sea chests provided for the main and auxiliary machines should be installed in the vicinity of their respective seawater pump suction but with adequate distance between each other to avoid water flow Disturbance.
- 7.16.3 Seawater piping shall be constructed of material to GNC's satisfaction. A suitable strainer with isolation valves and air vent shall be fitted to each seawater system. Due consideration shall also be given for quick and easy access to the seawater strainers.
- 7.16.4 Cathodic protection shall be provided as necessary.

7.17 Sanitary, Grey and Black Water System

- 7.17.1 One stainless steel grey / black water holding tank with capacity of not less than 300 liters shall be installed in the tank space or other compartment for sanitary purposes.
- 7.17.2 A sanitary/sea water pump shall be installed in the engine room to supply sea water for sanitary service. Pressurize seawater shall be distributed to the toilets through pressure reducing valves or for flushing by direct pressure via flushing valves.
- 7.17.3 Toilet, basin and galley sink shall be designed to discharge into the 300 liters grey / black water holding tank and ashore. Alternative pipings shall be arranged for the wash basins to be discharged directly overboard through a non-return ship-side valve.
- 7.17.4 The tank shall be fitted with a level gauge and a "Tank Full" indicator installed in a highly visible location in the bridge. and high-level alarm shall be fitted on the bridge.
- 7.17.5 A discharge macerator electric pump shall be provided for pumping out the contents of the holding tank. This shall be primarily led 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.
- 7.17.6 Sanitary, Grey and Black Water piping shall be made of stainless steel 316L.

7.18 Open deck drainage system

- 7.18.1 The Vessel shall be fitted with an Open deck drainage system to the requirements of the RO.

7.19 Floor Plates, Handrails and Guards

- 7.19.1 The floor of the engine room shall be covered with unpainted aluminium chequer plate for safe operational use.
- 7.19.2 All boundary bars, handrails, gratings, ladders, platforms, stanchions and vertical supports, etc. in the engine room and steering gear compartment shall be of lightweight construction. Aluminium chequer floor plates shall be secured by fixing with sections but shall be readily removable for access to bilges, pumps, shaft, pipe work and strainers, etc. for ease of maintenance.
- 7.19.3 Hinged access plates shall be fitted in way of valves. Suitable arrangements shall be provided for hinged plates to avoid rattling noise.
- 7.19.4 Removable guards for the protection of personnel and machinery shall be provided over exposed moving parts of the machinery, hot pipe work, etc.
- 7.19.5 Splash plates, casings, fenders, screens, etc. shall be provided for the protection of personnel and machinery.

Chapter 8 - 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 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.
- 8.1.3 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.
- 8.1.4 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.
- 8.1.5 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.
- 8.1.6 All Equipment installed shall be provided with manuals for operation and maintenance.
- 8.1.7 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.

8.2 Electricity Distribution Network

- 8.2.1 The main electrical AC power supply shall be supplied from one (1) of the two (2) generating sets. Each of the generating set shall give sufficient power for normal operation of the auxiliary power network of the Vessel. At normal operation, the load on the generator set is $\leq 90\%$. The generator shall have unrestricted continuous rating and be located in the auxiliary engine room.
- 8.2.2 Starting and stopping of the generators can be done locally in the auxiliary engine room, or in the bridge. The standby generator set shall be brought online automatically in the event of blackout of the running set.
- 8.2.3 The 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, D.C., shore power, and ship service systems. The Vessel's electrical load calculation shall be approved by the RO and accepted by GNC.
- 8.2.4 The generator set will maintain an output voltage within ± 5 percent over the entire load range and frequency within ± 1.5 Hz.
- 8.2.5 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).

- 8.2.6 The generator shall be protected against short-circuits and overloads by multipole circuit breakers (overload protector).
- 8.2.7 The distribution of the electricity to the equipment is through circuit breakers fitted on an electrical distribution board.
- 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 bridge. A special arrangement is required for the navigational lights supplied from this prime panel.

8.3 Main Switchboard

- 8.3.1 Switchboards shall be in according with Classification requirements. The main switchboard shall be separated into two equal switchboards and located in the engine room near the generator. Each switchboard shall be connected to its respective generator.
- 8.3.2 These two (2) switchboards are normally linked together by means of a cable. In case of emergency the switchboards can be electrically separated by a moulded case circuit breaker (MCCB) in each switchboard.
- 8.3.3 Switchboards for main 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.
- 8.3.4 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:
 - (i) IP 67 as a minimum, if exposed to short-term immersion; IP 55 as a minimum, if exposed to splashing water;
 - (ii) IP 20 as a minimum, if located in protected locations inside the Vessel.
- 8.3.5 Switchboards shall be permanently marked with the nominal system voltage.
- 8.3.6 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 engine room and shall contain the following:

- (i) Sector for electric generator set 220V AC
 - (ii) Sector for 24 V & 12V D.C.
 - (iii) Sector for shore power
 - (iv) Sector for solar power
- 8.3.7 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.
- 8.3.8 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.
- 8.3.9 An appropriate laminated electrical diagram shall be attached on each switchboard.
- 8.3.10 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.
- 8.3.11 Apart from the spare feeder breakers, the switchboard shall contain but not be limited to the following:
- (i) Electric Generator Set Sector with the following:
 - (a) Air circuit breaker of adequate capacity with over-current trip and short circuit trip;
 - (b) Interlock device to ensure only one electric generator is connected to the busbar;
 - (c) Voltmeter, ammeter, wattmeter and frequency meter;
 - (d) Indication lights for "Power Available", "Breaker Opened" & "Breaker Closed";
 - (e) All necessary fittings and any other protective devices.
 - (ii) 220V Single Phase Sector with the following:
 - (a) Meters or earth lamps to indicate the state of insulation;
 - (b) 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;
 - (c) Any other necessary fittings and protective devices.
 - (iii) 24V and 12V D.C. Feeders Sector:
 - (a) 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;
 - (b) Magnetic automatic relay switch for activating emergency 24V D.C. supply in event of AC power failure;
 - (c) Supply source indicator lamp for transformer / rectifier;
 - (d) Ammeter for charging unit;
 - (e) Voltmeter with selector switch;
 - (f) Metres or earth lamps to indicate the state of insulation;
 - (g) Moulded case circuit breakers with over-current and short circuit trips for

- 24V D.C. bus and feeder circuits; and
- (h) Any other necessary fittings and protective devices.

(iv) Shore Power Connection Sector:

- (a) Moulded case circuit breaker for shore connection box shall be provided on the main switchboard.
- (b) The shore connection box shall be capable of receiving 220V single phase 50 Hz 30 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.
- (c) An earth terminal shall be provided for connection of the Vessel's earth to the shore earth.
- (d) An instruction shall be provided at the connection box to give full information of the system and the procedures for carrying out the connection.

8.4 D.C. Power Source

8.4.1 Batteries for Main Engines and Electric Generator Set Starting

- (i) Independent bank of 24V batteries shall be provided for starting of each of the two main engines and the electric generator set.
- (ii) 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.
- (iii) 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.
- (iv) 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.
- (v) Batteries to be of maintenance-free type
 - (a) 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.
 - (b) 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.
- (vi) Each engine driven alternator shall have its own built-in voltage regulators, automatic cut-off, and any other required protective devices.
- (vii) 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 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

- (i) 24V battery shall be provided for routine and emergency supply, all emergency equipment shall operate from a dedicated 24V D.C. power supply.
- (ii) 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.
- (iii) 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 six hours.
- (iv) 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 Batteries for Electronic Equipment

- (i) 12V battery shall be provided solely for the electronic equipment.
- (ii) 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.

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

- (i) Navigation light control panel and navigation lights
- (ii) Horn
- (iii) General lighting
- (iv) Compass light
- (v) Instrument panel in control console
- (vi) One hand-held searchlight and one fixed searchlight
- (vii) Siren
- (viii) Any other navigational and electronic equipment (if applicable).
- (ix) Hydrographic Survey Equipment

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:

- (i) 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.
- (ii) The chargers shall be fitted with a pilot lamp, a charging adjustment, a voltmeter and an ammeter indicating charging current.
- (iii) Discharge protection shall be provided to prevent a failed charger component from

- discharging the battery bank.
- (iv) 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.
 - (v) 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 and utilise maximum practical roof space for maximum solar collection.
 - (vi) Battery selector/isolator switches shall be provided between battery chargers and the battery banks they serve.
 - (vii) 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 bridge.
- 8.4.9 Batteries shall be permanently installed in a dry, ventilated location above the anticipated bilge-water level.
- (i) Battery compartment(s) shall be actively ventilated whenever batteries are charging.
 - (ii) 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 bridge.
 - (iii) All battery storage boxes shall be provided with removable covers and locking clips for ease of maintenance.
 - (iv) 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 emergency switchboard.

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) 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

- 8.8.1
 - (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 bridge.
- 8.8.2 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.
- 8.8.3 A circuit diagram shall be placed in the local control box of each electrical installation.

8.9 Cable, Wiring and Fuse

- 8.9.1 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.
- 8.9.2 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.

- 8.9.3 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.
- 8.9.4 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.
- 8.9.5 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.
- 8.9.6 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.
- 8.9.7 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.
- 8.9.8 Wiring shall be run along perforated metal trays and shall be secured in such positions as to allow easy maintenance.
- 8.9.9 Wiring shall not be installed below the engine room floor plates.
- 8.9.10 Cables and wiring inside accommodation areas shall run behind linings which shall have removable panels for inspection and maintenance.
- 8.9.11 Where electric cables have to be fitted on the decorative surface of bulkheads, they shall be enclosed in conduits.
- 8.9.12 (a) RO approved watertight, fire resistant and gastight cable transit system shall be provided in way of watertight bulkhead or deck penetrations.



- (b) The penetration should be located as high as practicable and well clear from the ship side.
- 8.9.13 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.
- 8.9.14 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.
- 8.9.15 Tally plates showing the cable size and the number of cores shall be provided for each of the main power cables.
- 8.9.16 All fuses are preferably of cartridge type and rated adequately for the protected circuits.

- 8.9.17 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.

8.10 Lighting Fixtures

- 8.10.1 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.
- 8.10.2 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.
- 8.10.3 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.
- 8.10.4 All lighting in the bridge shall be fitted with a dimmer control 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.
- 8.10.5 Emergency exit routes shall be identified and illuminated as required by RO Requirements.
- 8.10.6 Suitable lighting shall be provided in ship office and pantry above the desks and working areas such as working table.
- 8.10.7 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.
- 8.10.8 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.
- 8.10.9 All sockets, terminal blocks, and switch and receptacle interiors shall be made of non-flammable phenolic material.

8.11 Navigational Light

- 8.11.1 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.
- 8.11.2 The lighting shall be controlled from a control and alarm signal panel in the bridge. Each

navigation light 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.

- 8.11.3 Navigation 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.
- 8.11.4 The following navigational and signal lights (with double-pole circuit breakers) and shapes shall be provided:
- (i) Port-side light;
 - (ii) Starboard-side light;
 - (iii) Stern light;
 - (iv) Masthead light;
 - (v) Anchor light;
 - (vi) 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;
 - (vii) One all round flashing red light on top of mast without restriction, indicating the vessel is on duty;
 - (viii) Black ball (three numbers);
 - (ix) Black diamond;
 - (x) Ball diamond ball;
 - (xi) Whistle;
 - (xii) Bell; and
 - (xiii) Any other navigation lights as required.
- 8.11.5 Three sets of spare bulbs (one per light) shall be provided for the navigational and signal lights.

8.12 Searchlight

- 8.12.1 One Proprietary Made 220V AC 600 W adjustable remote control searchlight shall be provided.
- 8.12.2 The searchlight shall be installed on the top of the deck-house. The switch for the searchlight shall be mounted adjacent to the searchlight control handle/joystick. The searchlight shall be remotely controlled by handle/joystick located in the bridge control station for turning and tilting.
- 8.12.3 Tarpaulin covers shall be provided for the searchlights.
- 8.12.4 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 bridge.

8.13 Floodlight

- 8.13.1 Two Proprietary Made 220V AC LED remote power-operated floodlights (with luminosity equivalent to not less than 300 W conventional type) shall be installed on the top of the deck-house.
- 8.13.2 One floodlight shall be fitted at the forward end of the Vessel on the embarkation

handrail to illuminate boarding and landing operations. The orientation of this floodlight shall be manually adjustable.

8.14 Power Receptacles / Sockets

- 8.14.1 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.
- 8.14.2 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.
- 8.14.3 Socket outlets for 220V AC, 24V D.C. and 12V D.C. shall be provided in the bridge.
- 8.14.4 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.
- 8.14.5 The pantry require 220V AC power sockets for the Equipment including but not limited to portable apparatus and the domestic equipment.
- 8.14.6 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.
- 8.14.7 Sockets for different voltage systems shall be clearly labelled and with different pin sizes so that one system cannot plug into the other.
- 8.14.8 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.

8.15 The solar systems

- 8.15.1 The solar 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 as per Conceptual General Arrangement Plan and utilise maximum practical roof space for maximum solar collection.
- 8.15.2 A solar panel system to convert solar energy sufficiently to power shipboard AC220V lighting and others, such as cabin lighting, fans, the portable apparatus and the domestic equipment, etc.
- 8.15.3 Rigid service walkway shall be provided for maintenance.

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 a 12-month warranty 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 on board the Vessel:

- (a) Loudhailer/Siren and public address system with USB player,
- (b) Magnetic compass and fluxgate compass,
- (c) Marine daylight viewing colour radar with Differential Global Positioning System (DGPS),
- (d) Electronic Chart Display and Information System (ECDIS) with DGPS, echo sounder & depth indicator,
- (e) International Maritime Mobile (IMM) VHF radio with Global Maritime Distress Safety System (GMDSS), and
- (f) Automatic Identification System (AIS)
- (g) Closed circuit television (CCTV) system

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 (g). References to “Electronic Navigation Equipment” or “ENE” or “Electronic Navigational Equipment” throughout the Tender Documents or Contract shall mean individually or collectively the above-mentioned Equipment / systems in (a) to (g).

- 9.1.2 (a) It is a desirable specification that the Tenderer shall offer in Integrated Management System as further specified in paragraph 4.3 of this Part. [D]
- (b) The Contractor shall refer to the Annex 6 to this Part for the conceptual block diagram of ENE for the Vessel as reference.
- 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 sea 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 obtain the corresponding licenses from the Office of the Communications Authority (OFCA) of Hong Kong and, in this connection, shall be of a type acceptable to the OFCA and shall meet any other licensing conditions imposed by the OFCA.
- 9.1.7 All siting, 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.

9.2 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.

9.2.2 Loudhailer/Siren

- (a) The system shall comprise two master control units in bridge and two weather proof horn type loudspeakers, in conformance to IPX5 or better, located at forward and afterward of the Vessel respectively.
- (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 bridge with the following facilities provided at the front panel:
 - (i) Power ON/OFF
 - (ii) Hail volume control
 - (iii) Function control
- (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: 10 mV or better
 - (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 and Fluxgate Compass

9.3.1 The Contractor shall provide one magnetic compass and one fluxgate compass with digital display.

9.3.2 The fluxgate compass shall consist of at least a sensor unit and a display unit, and be compact and easy to operate. It shall have direct connection to the radar.

9.3.3 (a) An electronic display unit shall be installed at a position for easy viewing of Vessel heading by the coxswain.

(b) Digital display is preferred. [D]

9.3.4 The fluxgate compass shall be electronic such that GPS/DGPS will not cause deviation.

9.3.5 The fluxgate compass shall be provided to allow the operation of the radar in north stabilised mode and supply heading direction information to the colour plotter system.

9.3.6 Performance Requirements of Fluxgate Compass:

- (a) Reference : Either magnetic north or true north
- (b) Accuracy : $\pm 1.0^0$ typical or better
- (c) Resolution : 0.1^0 or better
- (d) Deviation Compensation : Automatic
- (e) Operating Temperatures : 0°C to 50°C
- (f) Waterproofing : IPX5 or better

9.4 Marine Radar

9.4.1 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 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

9.4.2 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) Pulse length : Equipped with long, medium and short pulse modes for close, medium and long range operation
 - (iii) 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.

9.5 Electronic Chart Display and Information System (ECDIS) with DGPS and Echo Sounder with one personal computer

9.5.1 The ECDIS will show the AIS, depth of water by echo sounder, hydrographic survey and ENC information in one picture.

- (a) General Requirements
 - (i) One set of Electronic Chart Display and Information System (ECDIS) must provide the following functions:
 - (1) Navigational calculation
 - (2) Chart updating
 - (3) Piloting
 - (4) Voyage monitoring.
 - (ii) One set of ECDIS with DGPS receiver and echo sounder shall be installed. It shall consist of three 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) One screen monitor of size not less than 19 inches shall be provided. The screen monitors must fulfil the following features:

- (1) 1000 nits Brightness
 - (2) 610mm active viewing area
 - (3) HDMI, DVI and composite inputs with a pre-installed cable to the Server Rack for transmission of hydrographic survey information as secondary input
 - (4) On-class menu keys
 - (5) Can be operated as components including but not limited to radar, chart plotter, depth sounder and alarm.
- (v) The 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.
- (vi) The system shall be equipped with navigational sea charts in details covering the entire Hong Kong Waters.
- (vii) The information received by the AIS shall be able to display on the screen monitors of ECDIS.
- (viii) 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.
- (ix) The processor unit of the ECDIS shall accept and display information given by the ENE: Radars, VHF, AIS transponder, DGPS and control console. The processor unit shall have high-performance quad-core processor for rapid, responsive operation of the multiple touch screen monitor.
- (x) One personal computer must be separately installed. The Contractor shall confirm the installation location with the user. This personal computer must fulfill the following requirement:
- (1) Operating system : Window 10 Professional (Chinese) or better
 - (2) CPU : Intel Core i7 Processor 3GHz or higher
 - (3) RAM : 8 GB or better
 - (4) Display card : Up to 1920 x 1080 HDMI, DVI interface, VGA and provide the dual displays function which provide display signal to the monitor of ECDIS
 - (5) Monitor : 19 inches or better
 - (6) HDD type : SSD
 - (7) HD : 500 GB or above
 - (8) Interface : Serial port x 1, USB (3.0) x 3, USB (2.0) x 4, Bluetooth (receive NMEA Data from AIS and DGPS, connect the printer, multi-card reader and USB device)
 - (9) Accessories : Multi-card reader (SD/MMC+/miniSD, Micro SD, Compact Flash I/II, MS PRO/MS PRO Duo)
 - (10) Software : Orca Master (ECS Software), Microsoft Office Standard 2013 or the latest version.
 - (11) Printer : Multi-functional laser printer (copy, print and scan) connect to personal computer through USB, the print & copy speed at least 35 pages per minute and support auto double-sided printing, copying and scanning.

: The dimensions (width, depth and height) of the printer should be 494 mm x 430 mm x 448 mm.
[D]

- (xi) ECDIS display may also be used for the display of radar, radar tracked target information, AIS and other appropriate data layers to assist in route monitoring.
[D]
- (xii) ECDIS should provide appropriate alarms or indications with respect to the information displayed or malfunction of the equipment.
[D]
- (xiii) ECDIS is capable of reading and loading IHO S-57 (Version 3.1) ENC data file and update the same where necessary. Also it is able to handle the different chart format such as S-57 digital charts, SevenCs directENC charts, SevenCs Bathmetic ENCs, ARCS charts, VMAP/DNC charts, AML charts, BSB charts, WMS charts and Geo TIFF.
- (xiv) The chart information to be used in ECDIS shall be the latest edition, can be corrected by official updates (S-57 digital charts, SevenCs directENC charts, SevenCs Bathmetic ENCs) by the MD with records of update shown on the ECDIS.
- (xv) ECDIS should enable the mariner to execute in a convenient and timely manner all route planning, route monitoring and positioning currently performed on paper charts. It should be capable of continuously plotting the ship's position.
[D]
- (xvi) The ECDIS shall be capable of displaying both English and Chinese characters of the ENC.
- (xvii) ECDIS should store 12 hours history voyage record and can be reproduced on the ECDIS. [D]

9.5.2 Performance requirements

- (a) 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
- (b) Electrical and Physical
 - (i) Power source : 12 - 24V D.C. (external)
 - (ii) Display (screen type) : 24 inches or greater diagonal high resolution colour display, resolution 1280 x 1024 pixels or better for 4:3 aspect ratio
- (c) Environment
 - (i) Operating temperature : -10 °C to +50 °C
 - (ii) Storage temperature : -20 °C to +60 °C
- (d) 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
- (e) Differential Beacon Receiver
 - (i) Frequency range : 283.5-325 kHz
 - (ii) Frequency step : 500 Hz
 - (iii) Position accuracy : No greater than 5 m
- (f) 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]
- (g) 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.

9.6 International Maritime Mobile (IMM) VHF Radio with GMDSS

9.6.1 General Requirements

- (a) The IMM VHF radio shall meet the relevant requirements of the International Maritime Organization (IMO).
- (b) 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.
- (c) The radio shall be fully compatible with GMDSS, which is a class A Digital Selective Calling (DSC) transceiver fully compatible with the GMDSS carriage requirements of the IMO.
- (d) 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.
- (e) 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.

- (f) The operating temperature shall be -5°C to $+55^{\circ}\text{C}$ or better. The water ingress protection shall be IPX7 or better.
- (g) The radio shall be supplied with a belt clip and a shoulder carrying case.
- (h) 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.
- (i) 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)

9.6.2 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 μV 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.

9.7 Automatic Identification System (AIS)

9.7.1 General Requirements

- (a) The equipment shall receive navigation information from local AIS-equipped vessels.
- (b) The equipment shall be a Class A universal AIS complying with the requirements of the IMO, including but not limited to, IMO MSC. 74(69) Annex3, IEC 61993-2, ITU-R M.1371-3, ITU-R M.493-13, ITU-R M.825(DSC), IEC-60945, IEC-61162-

1/2.

- (c) The AIS transponder (receiver module) shall be able to receive AIS information from AIS-equipped vessel nearby such as 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 names, type of ship, call signs, length and beam, heading, destination, latitude, and longitude, location of position-fixing antenna on the ship), short safety-related messages and other navigation data, from vessel nearby.
- (d) The AIS supplied shall be completely compatible with all system using NMEA standard and be able to interface with system including but not limited to RADAR, ECDIS, GYRO COMPASS, and external GPS.
- (e) Edition of user message on navigation & ship securities shall be available.
- (f) The AIS shall be easy to identify other ship's status by providing electronic chart data.
- (g) The AIS shall have self-restoring function to enhance stability.
- (h) The AIS shall adopt user-friendly one touch keypad (or equivalent).
- (i) The AIS shall be weather-proof suitable for outdoor use for ship or vessel (or equivalent).
- (j) Each set of AIS shall include :
 - (i) AIS 5.6 inches (or larger) LCD color graphic display unit
 - (ii) AIS transponder unit
 - (iii) VHF antenna
 - (iv) GPS antenna
 - (v) Installation / operation handbook

9.7.2 Performance Requirements

- (a) The AIS shall comply with the following specifications :
 - (i) General
 - (1) Power supply : 12V D.C. + 10%
 - (2) Default frequencies : AIS1 (CH 87B): 161.975 MHz
AIS2 (CH 88B): 162.025 MHz
DSC (CH70): 156.525 MHz
 - (3) Frequency range : 156.025 ~ 162.025 MHz
 - (4) Transponder size/weight (+ 2%): 221 x 165 x 95 mm, 1.5 kg
 - (5) MKD display : 5.6 inches (or larger) Colour TFT LCD
 - (ii) AIS Transmitter
 - (1) Power output : 12.5W or 1.0W (41 dBm \pm 1.5 dB or 30 dBm \pm 1.5 dB)
 - (2) Antenna impedance : 50 ohms (SO-239)
 - (3) Channel spacing : 25 kHz
 - (iii) AIS Receiver
 - (1) Sensitivity : (BER) < 20% at -107 dBm
 - (2) Modulation : GMSK
 - (3) Data rate : 9600 bits/s
 - (4) Frequency stability : < \pm 1 ppm
 - (5) Co-Channel : 10 dB
 - (6) Adjacent channel : 70 dB
 - (7) IMD : 65 dB

- (8) Blocking : 84 dB
- (iv) DSC Receivers
 - (1) Sensitivity : BER 10^{-4} at 107 dBm
 - (2) Modulation : FSK (1300 Hz / 2100 Hz)
- (v) Interfaces
 - (1) Sensor ports : 4 numbers to IEC61162-1/2 (input only)
 - (2) Other interface ports : Long range ports to IEC61162-1/2; auxiliary port (configurable for RTCM input) and pilot port
- (vi) GPS Antenna & Receiver
 - (1) Antenna : Patch Antenna
 - (2) Receiver type : 16 channel, L1 frequency, C/A code
 - (3) Sensitivity : Acquisition -140 dBm / Tracking -150 dBm
- (vii) Environment
 - (1) Operation temperature : -15°C to +55°C
 - (2) Storage temperature : -25°C to +75°C
 - (3) Vibration : IEC 60945
- (b) Aerial and Feeder
 - (i) The aerial provided shall be 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 joint shall be properly covered by waterproof tape or material.

9.8 Installation Requirements

9.8.1 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 siting 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.

9.9 CCTV System

9.9.1 CCTV system with nine (9) cameras (four for engine room, one for forward, one for aft deck, one for starboard, one for port and one for afterward respectively) and four (4) monitors (three in bridge and one in ship office) shall be provided.

9.9.2 Unless otherwise specified, the CCTV system 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: Outdoor equipment shall be IP56 or better, inside of up-deck shall be IP20 or better, and under-deck shall be IP44 or better.
- (ii) All cameras shall have an image stabilization function to accommodate the rough sea conditions.
- (iii) Each of the cameras shall be able to be used with a wide angle lens or a standard lens according to the actual condition.
- (iv) All camera images shall be recorded by a Network Video Recorder (NVR), which shall also be capable of an instant playback function.
- (v) The NVR shall have sufficient disk space to archive sixty (30) days of video images

from all cameras in high definition format at 25 frames per second.

- (vi) CCTV images shall be displayed on the 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 so that in the event of outage of the normal power supply to the CCTV system, the UPS can back up the operation of the 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 provided with time from the DGPS for clock synchronization, which will be displayed on the recorded images.
- (x) All cameras shall be powered by Power over Ethernet (PoE) as part of the CCTV system.

9.9.3 Details of CCTV systems shall be submitted to GNC for approval before order and installation.

9.10 Acceptance Test

9.10.1 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.

9.10.2 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.

9.10.3 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.

9.10.4 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.

9.10.5 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.

9.11 Documentation for the Proposed Equipment

9.11.1 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.

9.11.2 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.

Chapter 10 – Hydrographic Survey Equipment

10.1 Introduction

- 10.1.1 The Contractor shall supply one set of Hydrographic Survey Equipment and be responsible for the supply, delivery, testing, installation, commissioning and warranty (at least 12 months from the date of the Acceptance Certificate) and provision of operational and maintenance service manual. This Hydrographic Survey Equipment shall have a good support for spare parts and after sale services locally in Hong Kong.
- 10.1.2 The Hydrographic Survey Equipment shall include
- (i) Single beam echo sounder transducer
- 10.1.3 The Contractor shall provide all labour, material, transportation, installation, calibration, testing and commissioning, Warranty Services in Warranty Period and test equipment etc. which are necessary to complete the work required in this Chapter.
- 10.1.4 The transducer shall complete with all standard and/or maker recommended accessories as required for normal operation.
- 10.1.5 The transducer shall be compatible with CEDD's existing Odom Echotrac MKIII and Echotrac CV300 echo sounders.

10.2 Single Beam Echo Sounder Transducer

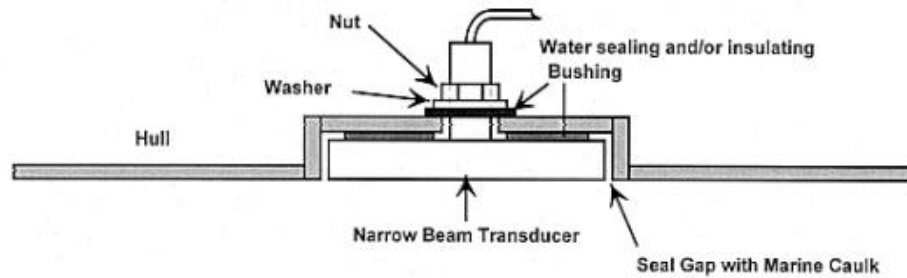
- 10.2.1 The Single Beam Echo Sounder Transducer shall meet the following requirements, unless otherwise specified:

Frequency	24 kHz & 200 kHz, dual channels
Beam Width	20° at 24 kHz & 4° at 200 kHz
Depth Range	Up to 1000m
Bandwidth	3.2KHz at 24 kHz & 100KHz at 200 kHz
Cable type	C43(2-14 AWG)

10.3 Installation Requirements

10.3.1 General

- (i) The hull mounted transducer shall be flush with the hull or any other location as approved with suitable fairings to protect the transducer from damage and turbulence.
- (ii) Samples of the related installation are shown below:



Transducer must be flush with hull

- (iii) The installation of the transducer shall follow the instruction of transducer's manufacturer.
- (iv) The related cables shall be laid to the server rack inside the deck office through water tight openings and ducting.
- (v) Each cable shall be clearly labelled and carry its own unique identification code.
- (vi) Surfaces exposed to salt water shall be coated with antifouling paint.

10.4 Acceptance Test

10.4.1 The acceptance tests shall comprise the following:

- (i) 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 specification.
- (ii) On-site commissioning test shall be carried out by the Contractor in the presence of the CEDD designated officers after completion of the installation. The overall installation standard and operational features of Equipment shall be evaluated. The test shall be carried out during sea trial.

10.4.2 The Contractor shall deliver the Equipment to the CEDD designated officers 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 CEDD designated officers to re-conduct the bench acceptance tests.

10.4.3 The Contractor shall submit a schedule of commissioning tests installed onboard of the Vessel at least one month prior to the on-site commissioning test date.

10.4.4 The Contractor shall provide all the necessary test equipment and tools for carrying out the all tests as mentioned in this Chapter at no extra cost to Government.

10.4.5 At least one month before the end of the Warranty Period, the Contractor shall arrange and perform confirmation test in the presence of the CEDD designated officers. 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 CEDD designated officers. The Warranty Period shall be extended correspondingly for so long as the defects are not fixed by the Contractor.

10.4.6 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.

10.5 Documentation for the Equipment

- 10.5.1 The Contractor shall within one month after delivery of the Vessel supply three sets of Operation Manuals, Service Manuals and integrated system/equipment schematic diagram in English (at least two sets of which shall be original).

Chapter 11 - Services Support

11.1 General Philosophy

- 11.1.1 In determining the appropriate design for the Vessel, all of the following factors shall equally be taken into account without one outweighing another.
- (i) Vessel performance (including engine rating and size of the Vessel).
 - (ii) Initial cost.
 - (iii) On-going cost (including maintenance cost, petrol consumption, and spare parts).
 - (iv) Reliability (frequency and time to repair breakdown).
 - (v) Time between maintenance periods.
 - (vi) Time to undertake scheduled maintenance (downtime).
 - (vii) All machineries and equipment installed in the Vessel shall be serviceable in the Hong Kong.
- 11.1.2 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.
- 11.1.3 Maintainability – the Vessel shall be easy to maintain by ensuring that there shall be:
- (i) Good access to all installed items for monitoring, service and overhaul.
 - (ii) Ease access to in-situ service and maintenance in Hong Kong.

11.2 Information to be Provided Prior to and at Delivery Acceptance

- 11.2.1 Information provided prior to Delivery Acceptance:
- (i) Detailed inventory list for the whole Vessel to be submitted to the Government for approval.
 - (ii) The Inventory List shall cover all discrete items down to major component/unit level.
 - (iii) Full details of each item including:
 - (a) Item number
 - (b) Description
 - (c) Type or model (if applicable)
 - (d) Quantity
 - (e) Manufacturer
 - (f) Manufacturer's reference number
 - (g) Location in Vessel
 - (h) Local agent/supplier address, telephone and fax numbers
 - (iv) Four paper copies and One soft copy of the Inventory List shall be provided to MD.
- 11.2.2 "As Fitted" drawings and other information shall be supplied
- The Contractor shall supply the following items upon Delivery Acceptance of the Vessel:
- (i) Four complete sets of paper print drawings of the Vessel and ONE soft copy in Compact Disk (CD-ROM).

- (ii) 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.
- (iii) Four copies of equipment list for all Equipment. The list shall include:
 - (a) Description
 - (b) Type or model (if applicable)
 - (c) Makers part number or equivalent (if applicable)
 - (d) Location
 - (e) Quantity
 - (f) Supplier or agent's name and contact address
- (iv) Four copies (at least one original) of maker operation, maintenance and workshop manuals for each piece of Equipment in English.
- (v) 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.
- (vi) Four copies of On board Operator's Manual (English and Chinese) covering:
 - (a) Daily user check and operation procedure.
 - (b) Operating detail of each system.
 - (c) 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.)
- (vii) 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.
- (viii) The documentation for all Equipment, Spare Parts, special tools and test equipment shall be provided at the Delivery Acceptance of the Vessel.

11.2.3 Tools & Test Equipment for Electronics

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

11.2.4 Photographs

- (i) As-Fitted Photographs
 - (a) 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.
 - (b) Each print shall be enclosed in a suitable album and labelled showing the position of the content.
- (ii) Official Photographs
 - (a) 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.
 - (b) 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.
 - (c) 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.

11.2.5 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:

- (i) Associated test certificates.
- (ii) Test performance certificates of Equipment as required in this Part VII.
- (iii) Main engines performance test certificates.
- (iv) Complete record of the trial commissioning tests.
- (v) Original copy of the warranty certificates of all Equipment (valid for 12 months from the date of Acceptance Certificate of the Vessel).
- (vi) Certificates issued by the manufacture of light and sound signalling equipment.
- (vii) Builder certificates.
- (viii) Certificates of building material.
- (ix) Deviation card for compass (after adjustment in Hong Kong).
- (x) Hull construction material issued by the RO.
- (xi) 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
- (xii) Certificate of Class issued by the relevant RO.
- (xiii) Any other certificates as appropriate.

11.2.6 Ship Model

- (i) The Contractor shall supply two ship models (scale 1:25) for display and training purpose.
- (ii) 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 12 - Training

12.1 Training on Electronic Navigational Equipment (ENE) and Hydrographic Survey Equipment

12.1.1 General Requirements

- (i) All training courses shall be held in Hong Kong.
- (ii) The Contractor shall provide appropriate classroom as well as on board training to the operational and technical staff to familiarise with the operation and maintenance of the ENE and Hydrographic Survey Equipment being supplied and installed. The trainer shall be able to communicate with the local trainees effectively.
- (iii) It is anticipated that two distinct types of training shall be required, namely:
 - (a) Operator Training
 - (b) Equipment Maintenance Training
- (iv) The Contractor shall submit a detailed course syllabus and a schedule for conducting the training course.
- (v) Each trainee shall receive one copy of comprehensive training documents before the start of each course.
- (vi) 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.

12.1.2 Operator Training Course

- (i) This course shall provide training for trainers.
- (ii) 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.
- (iii) The course shall be held immediately before the commissioning of the ENE on the Vessel.
- (iv) A total of up to 20 trainees will attend the course. The training course shall accommodate the specified number of trainees.

12.1.3 Equipment Maintenance Training Course

- (i) The equipment maintenance training course shall enable the maintenance staff to:
 - (a) 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 and Hydrographic Survey Equipment being offered; and
 - (b) effectively maintain the ENE and Hydrographic Survey Equipment. This shall include practical demonstrations and tests.
- (ii) The maintenance training course shall include, but not be limited to the following items:
 - (a) Introduction of the ENE and Hydrographic Survey Equipment locations;

- (b) ENE and Hydrographic Survey Equipment operational, working principle and functional descriptions;
 - (c) ENE and Hydrographic Survey Equipment block and schematic functional descriptions;
 - (d) ENE and Hydrographic Survey Equipment adjustment/calibration procedure and parameter settings;
 - (e) ENE and Hydrographic Survey Equipment construction and mounting;
 - (f) ENE and Hydrographic Survey Equipment interfacing and signal interfacing;
 - (g) Preventive maintenance and trouble-shooting
- (iii) The course shall be held immediately after the commissioning of the ENE and Hydrographic Survey Equipment on the Vessel.
 - (iv) A total of up to 20 trainees will attend the course. The training course shall accommodate the specified number of trainees.

12.2 Training on Operation and Maintenance of the Vessel

- 12.2.1 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 or any Government Representatives.
- 12.2.2 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.
- 12.2.3 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.
- 12.2.4 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 13 - 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
HDCP	High -bandwidth Digital Content Protection
HDD	Hard Disk Drive
HDMI	High Definition Multimedia Interface
Hz	Hertz
IBSS	International Bibliography of the Social Sciences
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
ISO	International Organization for Standardization
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:

Any notification of claimed defect to be sent from MD to the Contractor or the GRSS appointed by it through a defined route.

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.

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.

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 1.7.1 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:

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.

To provide all necessary transport, replacements Equipment, spare parts, labour and materials, tools and testing instruments required for the corrective maintenance and rectification.

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

- (i) 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.
- (ii) 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.
- (iii) 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.
- (iv) 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

- (i) Renew the lubricating oil and replace the filters for the main engines and gearboxes as per the manufacturer's recommendations;
- (ii) Clean all the engine air filters and change the filter elements as necessary;
- (iii) The coolers of the engines shall be cleaned with all zinc anodes renewed if provided;
- (iv) All the belts of engines shall be checked and adjusted if necessary;
- (v) Tappet clearances for the inlet and exhaust valves, ignition timing and idle speed shall be checked and adjusted if necessary;
- (vi) Function tests for the engines' protection system and their associated sensors, gauges and other measuring devices shall be conducted;
- (vii) All the above work shall be carried out by the manufacturer's authorised agent.
- (viii) 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)

(i) Paint Under Water Line

- (a) Paint under water line shall be checked by paint manufacturer's representative for the effectiveness of two years protection against marine growth;
- (b) Hull shall be cleaned;
- (c) Damaged paint shall be repaired according to paint manufacturer's procedures;
- (d) 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
- (e) 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.
- (f) All zinc anodes shall be renewed.

(ii) Paint Above Water Line

- (a) Hull and deck including deckhouse above waterline shall be cleaned.
- (b) 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;

- (c) 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.
- (d) Vessel's name, draft marks and insignia two coats shall be painted; and
- (e) The open and side deck shall be applied with one full coat of anti-slip paint.
- (f) Inspect, clean, polish ,coated with oil if necessary.
- (g) 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:

- (i) Engine control and steering system.
- (ii) Engine alarm and shut down function (including emergency stopping of engines).
- (iii) Navigational equipment, light and sound signal.
- (iv) Ahead and astern running and crash stop test.
- (v) Steering trial.
- (vi) Fire pumps.
- (vii) CO2 smothering system.
- (viii) Fire detection system and manual call points
- (ix) Other trials as required by Government Representative.
- (x) 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 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)	<i>On or before the Delivery Date applicable to the same Vessel</i>
9	Delivery Date	<i>The Delivery Date for the Vessel shall be no later than the date set out in Schedule 2 (Delivery Schedule) of Part V</i>

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			
Waterjet Hydraulic System diagram			
Details of Waterjet Electronic Remote Control System			

Drawing Title	For Approval (A) or Reference (R) by RO	Submission Date	Completion Date
Diagram			
Details of waterjet propulsion units Installation Arrangement			
Details of Galvanic Corrosion Prevention (throughout the 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			
		1st vessel	2nd vessel	3rd vessel	4th vessel
	HULL				
	Mould commencement				
	Construction material				
	Mould process inspection for hull and internal				
	Inspection of installation of various items including doors, hatches, windows, mast, etc				
	Function test of various outfitting items				
	Compartment, void space, fresh water tank, black water tank				
	Watertightness or weather tightness of openings including manholes, hatches, doors, windows, air pipes, cable gland etc.				
	Painting inspection				
	Installation of zinc anodes and lightning protection				
	Vessel dimension verification				
	Draught marks verification				
	Hull completion survey				
	Deckhouse console mock up				
	Interior furnishings in ships officer cabin, pantry etc.				
	Inclining experiment				
	MACHINERY AND ELECTRICAL				
	Diesel engines and generators installation				

	Function test of machinery and electrical equipments				
	Function test of all piping system				
	Control system installation and testing				
	Cables layout and installation				
	Steering system installation and test				
	AC and DC power distribution				
	Main and emergency switchboard, shore power supply				
	Electronic Navigational Equipment installation and testing				
	Air conditioning system installation and testing				
	FIRE DETECTION AND FIRE FIGHTING AND LIFE SAVING				
	Fire detection system installation and test				
	Fire fighting system installation and test				
	Lifesaving appliances				
	SEATRIAL				
	Dock trial				
	Official sea trial in Hong Kong				
	Inventory check				
	Document check				
	Cleanliness of vessels before acceptance				

Annex 5 - 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	12 Persons		Dummy Weight 75 kg/Persons
Fuel (Petrol)	Not less than 50% of Fuel Tank		Other Equipment 100 kg
Sea Conditions	Calm sea with wind speed below 6 knots / maximum wave height less than 0.5 m / Sea Water Depth not less than 5 meters		
Engines:	Port Side	Starboard Side	Propellers: Port Side Starb. 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 (in) CW Temp. (°C) Others Others
___% of rated Power	At Minimum Surveying 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		Not less	

rated Power			30minutes					
90% of rated Power			Not less 30minutes					
100% of rated Power (Endurance Test)			Not less 120 minutes					
Remarks:								
Witnesses by:	GNC Representative		Contractor Representative			User Representative		

Annex 6 - 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.
- (i) General Arrangement Plan.
 - (ii) Lines Plan and Offsets Data.
 - (iii) Stability information booklet and the inclining experiment report.
 - (iv) Hydrostatics, Cross Curves and intact and damage stability calculations for all ship loading conditions specified in the Technical Specifications.
 - (v) Painting scheme of the whole Vessel.
 - (vi) Draught mark diagram.
 - (vii) Detail Layout Plan of the Deckhouse showing the disposition of all main equipment, fittings and fixtures, furniture, doors, windows, hatches, manholes and access openings.
 - (viii) Structural Construction plan, including Profile and Deck, Frame Construction, Shell Expansion, Bulkhead Construction, Deckhouse Construction, Bow construction, Engine girder and seatings, etc
 - (ix) Deck Edge and Bulwark (if any) details and construction plan, including detailed structural arrangement drawings of hull to deck connection.
 - (x) Closing appliances.
 - (xi) Detailed cathodic corrosion prevention and arrangement plans and drawings for the Vessel throughout.
 - (xii) Mast construction Plan and Mast Arrangement Plan.
 - (xiii) Navigational lights, sound and signal diagrams and any other external lighting arrangement plan.
 - (xiv) Vessel lighting arrangement and light control plan.
 - (xv) Vessel alarm and signals systems and public address systems plan.
 - (xvi) Docking Plan.
 - (xvii) Fuel oil tank drawing and its associated piping, filling, overflow and ventilation system
 - (xviii) Anchor and mooring arrangements. Main propulsion and auxiliary machineries
 - (xix) Engine Room Layout
 - (xx) Propulsion system torsional vibration analysis
 - (xxi) Main engine and gearbox control and monitoring systems.

- (xxii) Waterjet system and waterjet propulsion unit installation diagrams
- (xxiii) Waterjet control and monitoring system
- (xxiv) 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.
- (xxv) Engine room ventilation and exhaust system
- (xxvi) Shiplside valves construction.
- (xxvii) Drawings of the main switchboard and all panel boards and the electrical system.
- (xxviii) 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.
- (xxix) Lighting fixtures and fittings.
- (xxx) Battery charging system.
- (xxxi) Installation diagram and systems of electronic navigational equipment.
Lifesaving and Firefighting
- (xxxii) Fire detection systems.
- (xxxiii) Fire-fighting system including engine room fixed carbon dioxide system.
- (xxxiv) Life-saving plan and Fire Safety Plan.
- (xxxv) Distress signals, alarm systems, and internal/external communication arrangement and system plan.
- (xxxvi) All manuals and instructions.
- (xxxvii) Any other drawings as required by GNC.

Annex 7 - 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			

Beaufort number	Description	Wind speed	Wave height	Sea conditions	Land conditions
		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			
		17–21 knot	6–9 ft		
		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			
		22–27 knot	9–13 ft		
		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 of airborne spray.	Whole trees in motion. Effort needed to walk against the wind.
		31–38 mph			
		28–33 knot	13–19 ft		
		13.9– 17.1 m/s			
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			
		34–40	18–25		

Beaufort number	Description	Wind speed	Wave height	Sea conditions	Land conditions
		knot 17.2– 20.7 m/s	ft		
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.	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	Considerable tumbling of waves with heavy impact. Large amounts of airborne spray reduce visibility.	
		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.	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	Very large amounts of airborne spray severely reduce visibility.	
		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	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed
		≥ 74 mph			
		≥ 64 knot	≥ 46 ft		

Beaufort number	Description	Wind speed	Wave height	Sea conditions	Land conditions
		≥ 32.7 m/s		visibility.	sheds and barns are damaged. Debris and unsecured objects are hurled about.

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	