Part VII – Technical Specifications

Supply of One (1) Glass Reinforced Plastic Boat for Hydrographic Office of the Marine Department

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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 glass reinforced plastic boat** (viz., "Vessel") for use by the Hydrographic Office of the Marine 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]; 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 boat will be designed and fitted with specialised, high resolution multi-beam sonar and position fixing equipment for hydrographic surveying within Hong Kong Waters:

(a) To Perform survey duties at shallow and/or congested waters with required speed and maneuverability;

(b) To Perform emergency survey across Hong Kong waters with high transit speed from GD base to scene.

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 conditions) with notation by the RO as specified in Schedule 9. All plans, particulars and documentations which are required for the classification of the Vessel by the RO, in addition to those listed in Annex 3 to this Part shall be approved by the RO before submission to MD for endorsement and final approval prior to commencement of work. Any subsequent modifications or additions shall be treated in the same manner. Those drawings which are not required under ship classification approval shall be submitted to MD for approval before work is carried out.

1.5.4 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 to be achieved by the Vessel in the Official Speed Trial shall be at speed of not less than 30 knots with the engine power at 100% Maximum Continuous Rating (MCR) and the Vessel under Official Speed Trial Conditions as stated in Annex 5 to this Part. If the Vessel fails to achieve the speed of 30 knots under the aforesaid conditions, the Government will deem that the Vessel has failed to pass the Official Speed Trial and therefore fails Technical Acceptance.

(g) The instrument use in measuring the Contract Speed for the Official Speed Trial shall be provided either by:

(i) the Contractor provided that the speed measuring device has been calibrated by a certified body in Hong Kong acceptable to GNC; or

(ii) Global Positioning System (GPS) supplied by the Government.

The GPS or Differential Global Positioning System (DGPS) which is properly calibrated (with supporting calibration documents) and installed on board the Vessel and is acceptable to GNC; or other speed measuring methods acceptable to GNC.

(h) The Vessel must be in the trial conditions (see Annex 5 to this Part for the conditions of the trials) during the Official Speed Trial. All Equipment shall also have been passed the Technical Acceptance and be in operation during the Official Sea Trial.

(i) The information including but not limited to the speed, time of the day, engine running conditions and sea condition shall be properly recorded by the Contractor, and signed as witnessed by GNC surveyor (or GNC representatives) during the Official Sea Trial. A copy of the Official Sea Trial Report as required in Paragraph 1.7.6 below shall be given to GNC before Delivery Acceptance.

(j) Upon successful completion of the Official Speed Trial in Hong Kong, the Contractor shall arrange GNC officers to carry out hull bottom inspection on the Vessel to check for any hull damage before delivery.

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

(a) Endurance Test

The Endurance Test shall be carried out for different engine loading and speeds to obtain the speed/fuel consumption curves (or data) for the Vessel, with the engine(s) operating within the manufacturer recommended engine operating conditions. The test results shall be recorded in accordance with the requirements stipulated in Annex 5 to this Part. The report submitted shall include a curve or curves showing ship speed versus propulsion engine(s) rpm and power, with particulars of the vessel loading and displacement in the test(s).

(b) Manoeuvrability Test

Forward turning circle tests to port and starboard sides shall be carried out with

(i) both engines running, and

(ii) single engine running.

The minimum time for turning to both sides at 15°, 90°, 180°, 270° and 360°shall be recorded.

(c) Crash Stop Test

The minimum time and distance achievable by the Vessel when running from full ahead to stop, and then to full astern shall be determined at the Crash Stop Test.

(d) Astern Running Test / Emergency Steering Test

The maximum astern running speed achievable by the Vessel shall be determined by the test. Also an emergency steering test shall be carried out to ascertain satisfactory emergency steering operations.

(e) Starting Tests for Main Engines and Electric Generator Engines

(f) Anchoring Test

(g) Noise level test as per the requirements in Paragraph 4.1.2(i)(i)(3) of Chapter 4 of this Part.

(h) Megger test as mentioned in Paragraph 8.3.6 of Chapter 8 of this Part.

(i) Function test for Hydrographic Survey Equipment.

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 9.1 of Chapter 9, 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.

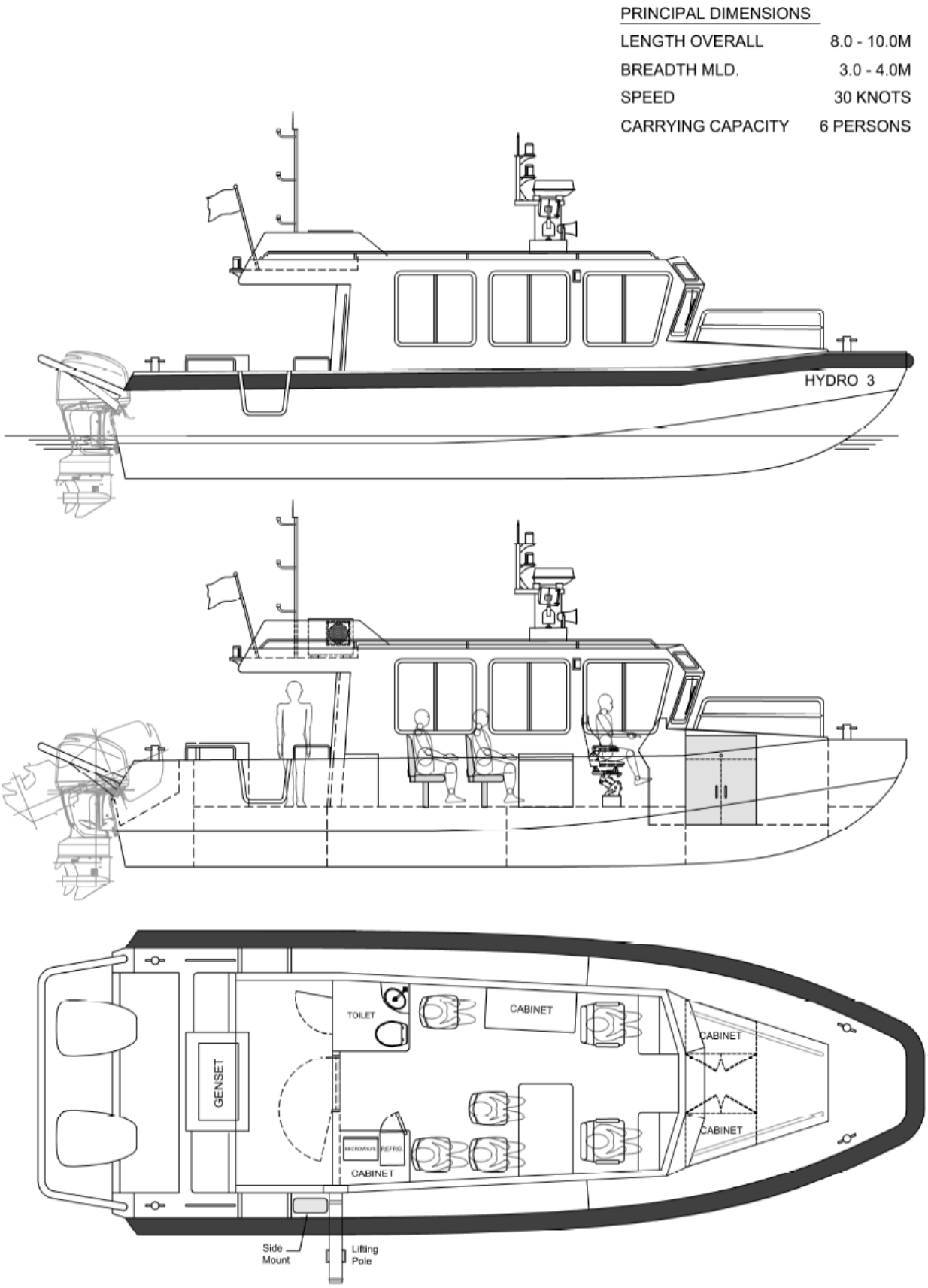
1.10.2 The above applies not only to main engines but also to all other Equipment installed in the Vessel. Support and maintenance services/agents must be available (i.e. serviceable) in Hong Kong in respect of all Equipment installed in the Vessel and return of the whole or part of the Equipment to 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 GRP patrol boat for Hydrographic Office of Marine Department. Workmanship, functions, characteristics and performance shall be in accordance with this Part VII, best marine construction practices, and the regulatory standards herein specified or otherwise applicable.

2.2.3 The Contractor is required to exercise its professional expertise and knowledge to come up with an appropriate design for the Vessel which can comply with all requirements of the Contract. The Conceptual General Arrangement Plan shown above only serves as guidance and is a reference drawing to help to explain the requirements stated in this Part VII.

2.2.4 During the design and construction of the Vessel, the Contractor is required to submit a detailed General Arrangement Plan (GA Plan) for GNC approval and acceptance.

2.2.5 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 30 knots when both of the outboard engines running with the output power at 100% of Maximum Continuous Rating (MCR) under the Official Speed Trial Conditions as stated in Annex 5 to this Part. [E]

2.4.2 The Contract Speed prescribed above shall be achieved without porpoising, or other dynamic instabilities. The propeller selected shall match the engine profile and avoid cavitations as far as possible.

2.4.3 The Vessel shall also be designed for loitering operations during which the outboard engines operate continuously, at Vessel speeds of 4 knots or less in the condition with on board 6 persons and 50% of fuel, water and storage. [E]

Official Speed Trial Condition	Requirement
Contract Speed	Not less than 30 knots @ 100% MCR
Loitering speed	Not more than 4 knots

2.5 Principal Dimensions

Length Overall (LOA):	8.0 – 10.0 metres (Fenders included)	[E]
Maximum Breadth:	3.0 – 4.0 metres (Fenders excluded)	[E]
Extreme Draught:	0.6 – 0.8 metres at location of sonar head (including sonar head)	[E]

2.6 Material of the Structure

Material of Hull & Superstructure: Glass reinforced plastic

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 Hydrographic Office of the Marine 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 4 hours at 30 knots and 4 hours at 4 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 Sea State 5 set out in Annex 7 to this Part. Total carrying capacity of the Vessel is 6 persons including two crew to operate the Vessel.

2.7.3 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 ºC
Internal air	: + 20 ºC
Maximum seawater temperature	: + 30 ºC

2.8 Arrangement of Deckhouse and Compartments

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

The deckhouse comprised of two compartments:

(a) Wheelhouse

(b) Ship office

2.8.2 The Vessel shall be designed to accommodate total 6 persons including two crew operating the Vessel. [E]

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

2.9 Markings and Colour Scheme

2.9.1 Markings and colour scheme for the Vessel shall be provided by the Contractor. Colour scheme shall be approved by 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 MD 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 shall also be marked at both sides of bow and stern port in the same manner as the vessel name. Vessel's identification shall be marked as large as possible at the deckhouse top for helicopter viewing.

2.9.4 All labelling, stencilling and marking (not limited to the hull but including all aspects of the Vessel) shall be made on separate plaques, boards or labels attached to the structure. By default all displays, control actuators, electric switches, valves, and other equipment shall be labelled to indicate their type and function as appropriate.

2.9.5 Exits shall be identified and labelled. Stowage locations for life jackets and quantities of life jackets contained therein shall be identified.

2.9.6 Safety markings for the prevention of person tripping in the Vessel shall be provided where necessary.

2.10 Tally Plates

2.10.1 The following information shall be displayed on the builder's plate.

(a) Builder's name;
(b) Vessel's name;
(c) Year of build;
(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 designated point of berth at Government Dockyard.

2.11.2 Permanent list is not allowed.

2.11.3 Permanent ballasts can only be used as agreed by GNC.

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 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 mono-hull form and the hull structure shall be constructed in glass reinforced plastic (GRP)

3.1.2 The Vessel's design stresses and load (wave height versus speed), maximum acceleration considered and scantlings calculation including internal structural members shall be designed according to the rules as stipulated in Paragraph 2.3.4 of this Part VII. It shall be capable of withstanding stress coming from wave impact and operation environment conditions. All material and build processes for GRP shall comply with an approved standard. This shall recognise the boat through life cycle and service conditions for ease of repair in the event of hull damage.

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 The hull design shall incorporate a self-bailing deck with scuppers capable of draining the cockpit in accordance with ISO 11812:2001 Small Craft – Watertight Cockpits and Quick-Draining Cockpits requirements.

3.1.6 Relevant records of reinforced plastic hull structural materials data sheet and certificates; including records of types of curing systems identified and recommended by the resin manufacturer shall be strictly maintained. These records of the structural materials used for vessel construction and up-to-date copies shall be provided to GNC before the construction stage of the Vessel.

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 multibeam echo sounder is hull-mounted. The hull design is critical to the installation of dual head transducer and there shall have sufficient space inside the hull surrounding the sonar head tank, and the Contractor shall consult the manufacturer of multibeam echo sounder along its own design.

3.2 Hull and Deckhouse Structural Requirements

3.2.1 Hull Structure Material and Build Process.

General

(a) All materials and build processes for GRP construction shall comply with an approved standard. Their selection shall recognise the craft through life cycle and service conditions for ease of repair in the event of hull damage.

(b) All materials used in the construction shall be agreed by GNC prior to construction.

(c) 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.

(d) 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.

(e) Materials for composite structures construction shall be traceable to ensure quality, and follow good materials handling procedures; in accordance with the ISO 12215 on workshop conditions, material storage and handling, and requirements for the manufacturing of the craft. Humidity and temperature shall be continuously recorded during the build process and shall be referenced against the composite parts built at any one time.

(f) The keel structure shall be arranged to accommodate vessel's dry docking and lifting requirements in the Government Dockyard in Hong Kong.

(g) Stem shall be fitted with a stainless steel covering plate of about 2 mm thickness to protect the stem in case hitting against hard floating objects.

3.2.2 GRP Hull Structure Construction

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 Fairness

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 Glass reinforced plastic (GRP) Shell, Stiffening and Framing Requirements:

The following sections of the proposed Vessel shall be made of GRP and the respective GRP construction methods shall be: [E]

Sections of Vessel	GRP Construction Method	
Hull Bottom to Top Side	: Single skin	[E]
Bulkheads	: Sandwich	[E]
Decks	: Sandwich	[E]
Deckhouse	: Sandwich	[E]

Composition of the GRP material is provided below:

Item	GRP Material
Reinforcement	: E-Glass
Resin	: In order of preference - Epoxy, Vinylester, Polyester
Foam (sandwich construction)	: Closed cell type

3.2.6 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.

3.2.7 Main Deck

The main deck (and where relevant cabin roof) shall be fitted with wateright hatches for removal of electric generator as well as separate tanks from various tank spaces.

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

3.2.8 Hull Platforms and Flats

Walking 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.

(b) All decks and floors shall be sufficiently reinforced to prevent unnecessarily deflection that might be caused by service loads.

3.2.9 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.

(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.

3.2.10 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 deck hatches shall be installed for fuel oil tanks removal purposes with functional arrangements equal to engine removal hatches.

(f) Flush access to fore peak from main deck shall be provided.

(g) Hinged hatch covers shall be provided with means to hold them in the fully opened position.

(h) A weather-tight door shall be installed for ship office to provide access to aft deck space.

3.2.11 Deckhouse Closures

(a) The weather-tight door complied with the requirements of RO shall be provided for access into the deckhouse, to/from duty officer cabin.

(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.

(e) The door in the deckhouse shall have clear toughened safety glass windows.

3.3 Stability and Subdivision

3.3.1 The offered Vessel shall meet the Intact Stability Criteria and Damage Stability Criteria specified in Paragraphs 3.3.4 and 3.3.7 of this Part VII. The offered Vessel shall maintain stable when travelling at about 4 knots.

3.3.2 (a) The lines plan with offset table and the preliminary stability information, including damaged stability calculation with any single compartment damaged and taking into account of wind force effect of the Vessel, shall be provided.

(b) Weight and center of gravity prediction calculations with breakdown for the proposed Vessel shall be provided.

(c) A preliminary estimate of the fore and aft draught and the position of the centre of gravity (longitudal, transverse and vertical) of the proposed design for the Vessel in its lightship, sea trial and full loaded conditions shall be provided.

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 Intact Stability Criteria

Stability shall only be considered satisfactory for the loading conditions set out in Paragraph 3.3.6 (c) if, the following criteria are complied with either:

(a) The International Code on Intact Stability, 2008 and its latest amendments with compliance of the conduct of Inclining Experiment as specified in Paragraph 3.3.5 of this Part VII, and requirements of Stability Information Booklet as specified in Paragraph 3.3.6 of this Part VII; or

(b) The criteria specified in ISO 12217-1 for Category B vessels, or

(c) As per stability requirements of the RO.

3.3.5 Inclining Experiment

(a) An inclining experiment shall be carried out with the attendance of MD officer(s) and/or appointed consultant.

(b) At least 7 working days in advance of the inclining experiment specified at Paragraph 3.3.5 (a), the "Scheme of Inclining Experiment" (“Scheme”) shall be approved by the RO and submit to MD 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.

3.3.6 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 inclining experiment report shall be approved by the RO.

(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 the IMO Code on Intact Stability.

Loading Conditions		Fuel oil	Payload	Persons & Effects
1	Full Load Departure Condition	98%	120 kg	510 kg (6 crew, plus effects)
2	Full Load Arrival Condition	10%	120 kg	510 kg (6 crew, plus effects)
3	Light Load Departure Condition	75%	40 kg	170 kg (2 crew, plus effects)
4	Light Load Arrival Condition	10%	40 kg	170 kg (2 crew, 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 weight of additional payload shall be as stipulated in Paragraph 3.3.6 (c) to be evenly distributed along the deck and the VCG of the additional payload shall be assumed as 500 mm above deck.

(iii) The maximum free surface moments shall be used for calculating the stability of the Vessel in all the above conditions.

(iv) 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.

(v) The Vessel shall be capable of operating safely at WMO Sea State 5.

(d) The Stability Information Booklet shall be approved by the RO before submitting to MD for comments. The Contractor shall provide MD with four copies of Stability Information Booklet (as built) at no extra cost, which must be given to MD at Delivery Acceptance.

3.3.7 Damaged Stability Criteria

(a) Suitable watertight transverse bulkheads shall be arranged to maintain the Vessel still floating while any one watertight compartment damaged and flooded. The residual buoyance and stability shall be sufficient to maintain the Vessel afloat in case of damage for each loading condition as specified in 3.3.6(c) above.

(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) Damage stability calculation shall be submitted for approval by GNC and RO.

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 metal 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 boat shall be applied on the following areas below the water line to provide at least two years protection against the marine growth.

(a) Exterior of the hull; and

(b) Sea chest, sea chest grate and sea suction pipe.

3.4.7 A TBT free certificate issued by the paint manufacturer shall be submitted before the Delivery Acceptance. The fluoropolymer foul release coating/antifouling paint (e.g. Intersleek 1100SR or equivalent) shall comply with the International Convention on the Control of Harmful Anti-fouling Systems on Ships as adopted by the IMO.

3.4.8 All deck areas shall be covered with hard wearing and anti-slip epoxy paint.

3.4.9 A painting report shall be submitted to MD upon completion of work.

3.4.10 Surfaces that require painting shall be fully prepared to meet with paint maker's requirement prior to painting.

3.4.11 All fastening preparation and other penetrations shall be completed before painting of any surface.

3.4.12 All surfaces and any parts of the hull, deck or machinery, fittings that may cause glare or reflection must be matte powder-coated.

Chapter 4 - General Arrangement

4.1 Arrangement on Main Deck and Under-deck

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

Dimension	Guidance
Side deck walkway width	Minimum 0.35 m
Minimum clear headroom for ship office, wheelhouse and crew space	Minimum 2.0 m

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 two sections:

(a) Wheelhouse
(b) Ship office

4.1.2 General Provisions

(a) External deck spaces shall include:

(i) Clean and simple bow deck area for efficient boarding and return operation.
(ii) Clean and simple aft deck area for efficient boarding and return operation.
(iii) (1) Walk around deck facility (350 mm wide minimum) which provides easy access to fore deck or aft deck. There shall be no steps along the length of the exterior deck between the fore deck and aft deck.
(2) The walking area on deck should be well illuminated in dark environments.
(iv) The fore deck geometry of the Vessel shall be carefully designed to facilitate safe boarding/landing to MD's satisfaction. Adequate geometry can be achieved with the addition of fender mouldings adequately fitted to the Vessel.
(v) The fore deck should exhibit a flush deck free of anchoring/mooring equipment.
(vi) All exterior deck areas shall be covered by an appropriate anti-slip surface for boarding / landing and deck covering requirements. The anti-slip paint shall not be made of a mix of paint and added grit material ("sand") and shall be to GNC's satisfaction.

(b) All cabins shall be designed and arranged so as to protect the occupants from weather and sea conditions, and aim to minimise risk of injury.

(c) Natural light should be allowed as far as possible in the crew space.

(d) All interior decks shall be vinyl composition tile or sheet, colour to be selected by MD.

(e) All controls, electrical equipment, high-temperature parts and pipelines, rotating assemblies or any other items in cabins and compartments shall be properly placed not to cause injury.

(f) Windows

(i) All windows shall be manufactured from clear toughened safety glass, secured to the

structure and be of any one of the ROs listed in Paragraph 2.3.4(a) to (i) approved type which is suitable and safe for marine use.

(ii) All wheelhouse 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) 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. Water-tightness 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 wheelhouse, ship office shall not exceed 70 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 wheelhouse, ship office and crew cabin 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 and 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) Wheelhouse 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 650 mm above the main deck.

(vi) All ventilators shall be provided with weather-tight covers.

(vii) Natural ventilation for all the compartments of Paragraph 4.1.1 of this Chapter shall be provided.

4.2 Wheelhouse

4.2.1 The outside configuration of the wheelhouse 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.

4.2.2 The wheelhouse shall be designed with a wheelhouse control station for one-man operation comprising controls and instruments for navigation, manoeuvring, communication and machinery operation.

4.2.3 (a) Two 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. [D]

(c) Behind the seats, sufficient space shall be provided in there in order that two or three officers can stand there for searching the target vessels.

4.2.4 The Contractor shall build a mock-up of the wheelhouse 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 wheelhouse control station shall be at a forward position in the wheelhouse. 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.

4.2.13 The following controls, displays and equipment are required to be incorporated into the wheelhouse control station so that all relevant controls can be reached from a fixed working position (e.g. sitting, standing or both):

(a) Steering is controlled by steering wheel and quick action lever control (Joystick);
(b) Engine speed and clutch controls;
(c) Rudder or steering angle indicators;
(d) Electronic navigation equipment and displays;
(e) Speed log;
(f) Echo sounder;
(g) Lighting control panel incorporating controls for navigation lights, alarms, search lights and flood lights;
(h) Main and auxiliary engines monitoring indicators and tachometers;
(i) Instrument & control and alarming system for major machinery containing start/stop switches;
(j) Exhaust temperature gauges;
(k) Fire detection system control panel;
(l) Emergency stop switch for accommodation ventilation fans;
(m) Meter/Gauge indicating the quantity of fuel remained in the fuel tank; and
(n) Electric horn, siren, and flashing beacon control panel.

4.2.14 Visibility

(a) The visibility from the wheelhouse 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 must not adversely affect the keeping of a safe look-out from the helm position in the wheelhouse.
(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 wheelhouse 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 wheelhouse 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 wheelhouse 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 wheelhouse to allow the vision as wide as practical.

(d) (i) At all times, regardless of the weather conditions, all wheelhouse front windows shall be provided a clear view without obstruction.

(ii) Where practical, depending on the design of the wheelhouse configuration, more windows are preferred to provide a wider clear view. [D]

(e) Wheelhouse 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) The following items/requirements shall be provided:

(i) Marine type wide span and large area wipers with D.C. electrically operated fresh water window washing systems shall be fitted for ALL the wheelhouse 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 wheelhouse 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 wheelhouse 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 wheelhouse, 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 wheelhouse:

(a) One display board including but not limited to posting plans, maps and notices;
(b) Two wall mounted fans of dia. 300 mm;
(c) One set of pigeon holes for stowage of international code flags;
(d) One set of international code flags suitable for the mast;
(e) One shelf for the stowage of log books and files;
(f) One marine chart table with lamp and dimmer over, with 4 drawers below for storing of nautical charts at the starboard side behind the chair;
(g) One dial type inclinometer and one thermometer for marine use;
(h) One electric powered marine wall-mounted clock;
(i) Two cup holders;
(j) One swing-type metal rubbish bin with cover shall be stored inside a cabinet/locker;
(k) One metal box for keys shall be provided and fitted inside the wheelhouse;
(l) 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;
(m) Four coat-hooks;
(n) At least two storage lockers;
(o) Surface finishing and interior linings of the wheelhouse should be of a matt non-reflecting finish to facilitate night operation; [D]
(p) One framed safety plan of appropriate size;
(q) One magnetic compass;
(r) Air conditioning unit;
(s) Non-skid handholds at suitable locations for crew movement in rough sea conditions; and

4.3 Ship Office

4.3.1 The ship office shall be located on the main deck abaft of wheelhouse.

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

4.3.3 Notwithstanding anything in this Part VII to the contrary, the ship office shall have the following features:

(a) Four upholstery seats shall be provided in the ship office for the survey staff;
(b) A working table to accommodate three sets of 24" mounted LCD monitors. This table must be built with side-drawers, tailor made rack and cabinet to accommodate one desk top computer and one notebook computer;
(c) Storage space;
(d) One multi-tray cabinet for duty officers;
(e) Five drawers for storage of documents;
(f) Luggage / cabinets for crew bag storage;
(g) One electric powered marine wall-mounted clock;
(h) Two wall mounted fans of dia. 300 mm;
(i) One display board including but not limited to posting plans, maps and notices;
(j) One weather-tight sliding door 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;
(k) Wall-mounted electrical sockets for facilities including but not limited to photocopier, computer, notebook computer and mobile station shall be provided. The number of and the location of sockets shall be proposed by the Contractor and be subject to MD approval; and
(l) Spare sockets for 220VAC and 24VDC to be supplied for operation need. Numbers of spare sockets shall be agreed with MD.

4.4 Fore Peak

4.4.1 The fore peak shall be watertight and located at the foremost end of the hull, separated with a watertight collision bulkhead. A chain locker shall be provided inside this compartment.

4.4.2 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.

4.4.3 Sparred wooden shelves and perforated marine plywood flooring shall be provided for storing the anchor chains.

4.4.4 Sparred wooden shelves for stowage of mooring ropes and equipment shall be provided inside this compartment.

4.4.5 Racks for shapes shall be provided inside the fore peak.

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

4.5.4 A toilet with non-slip flooring and waterproof grating shall be provided with following installations and fittings:

(i) One stainless steel wash basin with a spring loaded cold freshwater supply tap,
(ii) One water delivery point under basin with a plastic hose for toilet cleaning,
(iii) One cabinet with mirror with vanity lights,
(iv) One toilet paper holder,
(v) Sufficient lighting,
(vi) One liquid soap dispenser,
(vii) 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,
(viii) One deep bowl water closet,
(ix) Stainless steel hand rails as appropriate to allow safe use of the facilities while at sea, and
(x) Matt-glass window with curtain blind
(xi) Three coat hooks.

4.6 Fuel Oil Tanks

4.6.1 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.

4.6.2 Each component of the system, and the system as a whole, shall be capable of operation within an ambient temperature range of -10^{o}C to +82 ^{o}C, without failure or leakage, and be capable of being stored without operation within an ambient temperature range of -30^{o}C to +80^{o}C, without failure or leakage.

4.6.3 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.

4.6.4 No electrical component/device/cable shall run through or installed inside the petrol tank

compartment, otherwise, the electrical component/device/cable located in compartment shall be ignition protected so that

(a) It will not ignite a flammable hydrocarbon mixture surrounding the device when an ignition source causes an internal explosion, or

(b) It is incapable of releasing sufficient electrical or thermal energy to ignite a hydrocarbon mixture, or

(c) The source of ignition is hermetically sealed.

4.6.5 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;

4.6.6 Earthing device shall be provided for fuel filling system.

4.6.7 Grounding wires shall not be clamped between a hose and its pipe or spud.

4.6.8 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.

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

4.6.10 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.

4.6.11 The tanks shall be hydrostatically tested as required by an approved standard and connections shall be proven tight.

4.6.12 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.

4.6.13 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.

4.6.14 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 onemetres 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.

4.6.15 Petrol Tank

(a) One stainless steel petrol tank shall be mounted at under deck position. The tank 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, with due consideration given to upward and downward

acceleration due to the Vessel's movements at maximum speed in the sea. In this respect, continuous flexible supports spreading loads are preferable to rigid ones.

(b) The total capacity of the tank shall not be less than requirement of Paragraph 2.7.1 of Part VII of the Tender Documents with 10% margin. The unpumpable capacity of the each tank shall not be more than 10% of the capacity of that tank.

(c) The stainless steel fuel oil tank(s) shall be fitted/installed in the Tank Space, actual location to be designed and accepted by GNC.

(d) The tank 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 hull structures.

i) Marine grade stainless steel (316) with increased resistance to corrosion shall be the material to construct with.

ii) 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.

(e) Internal surfaces of the fuel oil tank shall be left unpainted and shall be cleaned thoroughly to the satisfaction of MD.

4.6.16 Diesel Oil Tank

(a) One marine grade stainless steel 316 diesel tanks shall be mounted at under deck position. 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, with due consideration given to upward and downward acceleration due to the Vessel's movements at maximum speed in the sea. In this respect, continuous flexible supports spreading loads are preferable to rigid ones. The design and tests shall comply with the requirements of Recognised Organisation 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 to electrical generator shall not be less than requirement of the Vessel's operation as Paragraph 2.7.1 of Part VII of the Tender Documents with 10% margin. The unpumpable capacity of the each tank shall not be more than 10% of the capacity of that tank.

(d) All seals such as gaskets, O-rings and joint-rings shall be of non-wicking, i.e. non-fuel absorbent, material. All materials used shall be resistant to deterioration by the fuel for which the system is designed and to other liquids or compounds with which the material can come in contact as installed under normal operating conditions, e.g. grease, lubricating oil, bilge solvents and sea water.

(e) Internal surfaces of the diesel tank shall be left unpainted and the diesel tank internal shall be cleaned thoroughly to the satisfaction of MD.

4.7 Side Deck

4.7.1 The width of the passage deck on both sides should be at least 350 mm for providing safe passages for crew/other persons to walk. [D]

4.7.2 (a) Components including but not limited to air vents and pipes are preferably recessed into the deckhouse side. [D]

(b) Excessive protrusion of components including but not limited to air vents and pipes shall be avoided to prevent obstructions.

4.7.3 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.

4.7.4 (a) Sufficient illumination lights shall be provided at each side.

(b) Illumination lights should not provide obstruct the movement of personnel. [D]

4.8 Mast and Open Deck

4.8.1 Open decks, shall be fitted with guard railings at their perimeter for the safety of persons on board, except where the convenience of crew operation (e.g. at the bow area) requires otherwise.

4.8.2 A stair/ladder is located near the stern for access to the upper open deck, from the weather deck. Open decks shall be covered with non-slip material or paint.

4.8.3 All guard rails shall comply with the RO Requirements for protection of persons on board.

4.8.4 One self-supporting mast shall be fitted on the wheelhouse 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).

4.8.5 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 wheelhouse 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.

4.8.6 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.

4.8.7 Access for maintenance and servicing of Equipment and its fittings shall be provided.

4.8.8 The arrangement shall be such that the Equipment on the mast shall not interfere with each other.

4.8.9 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.

4.8.10 (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. [D]

(c) All hardware for them, such as screws, hooks, hasps, hinges, handles and sliding bolts shall be made of stainless steel.

4.9 Seating

4.9.1 Two upholstery seats shall be provided in front of the wheelhouse console for the coxswain and crew. Requirements of the seats shall be:

(a) Seats shall be of comfortable type
(b) Adjustable seat height with foot rest

(c) Backrest angle adjustment around 12°
(d) Fore and aft adjustment around 160 mm
(e) Safety belt to be provided
(f) Adjustable armrests
(g) Turntable/Mounting pedestal 0° - 180°

4.9.2 Four upholstery seats shall be provided in the ship office for the survey staff. Requirements of the seats shall be:

(a) Seats shall be of high comfort-backrest with integrated headrest
(b) Foldable armrests
(c) Adjustable backrest
(d) Seat rotates 360°
(e) Fold-away seat cushion
(f) Foldable footrest
(g) Height adjustable
(h) Seatbelt

4.9.3 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.

4.9.4 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.

4.9.5 Seat materials of upholstery shall be of water resistant materials such as fire retardant foam/reinforced nylon laminated neoprene/heavy duty cordura laminate.

4.10 Bow and Stern

4.10.1 The fore deck geometry of the Vessel shall be carefully designed to facilitate safe boarding/landing. Adequate geometry can be achieved with the addition of fender mouldings adequately fitted to the Vessel.

4.10.2 As part of the boarding frame, a permanent forward stanchion for safe embarkation and disembarkation shall be provided.

4.10.3 A permanent aft stanchion with chains for safe embarkation and disembarkation shall be provided.

4.10.4 The deck floor shall be covered with anti-slip material.

4.10.5 Notwithstanding requirements specified in other sections, the aft deck shall have the following fittings:

(a) one 24VDC waterproof power socket,
(b) one 240VAC waterproof power socket, and
(c) one waterproof shore connection.

4.10.6 All stanchions and railings on deck shall be of stainless steel in SS316.

4.11 Anchoring, Mooring and Towing

4.11.1 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) A minimum 9 metres shackle of stainless steel chain and 100 metres of nylon line shall be provided. All Equipment to be sized as per the RO Requirements.

(f) The anchor shall be handled by use of an electric windlass and associated fittings. A hatch shall be fitted on the deck leading down to chain and lines locker.

4.11.2 Windlass

(a) An electric 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 wheelhouse control station and locally.

(e) Windlass cover shall be provided.

4.11.3 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).

4.11.4 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).

4.11.5 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.

4.11.6 The size of chain locker shall be suitable for self-stowing of chain by gravity in all sea conditions. The chain locker shall be fitted with a hard wood grating not less than 50 mm thick on the bottom.

4.11.7 A flush type water-tight access hatch should be provided for the chain locker compartment. [D]

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

4.11.9 Mooring - As a minimum six deck cleats on deck shall be provided with eight nylon 40 metres long (minimum) mooring ropes. Size of the deck cleats shall be agreed by GNC.

4.12 Fenders

4.12.1 Side and Stern Fenders:

Fixed hollow D shape rubber fenders of suitable size (e.g. 200 mm high x 100 mm depth or other size acceptable to MD) for deck edge mounting shall be fitted continuously along the ship sides and stern at main deck level. Internal steel stiffeners shall be suitably provided to strengthen the hull structures.

Fender system shall be provided on the gunwale and diagonally on the hull as shown on the Conceptual General Arrangement Plan. The fender arrangement shall be to MD's satisfaction.

4.12.2 Additional Rubber Fenders at Bow and Ship's Sides:

Sufficient numbers of rubber tyre fenders of appropriate size shall be provided on bow for

embarkation and disembarkation.

4.12.3 The arrangement shall be submitted to MD for approval prior to installation. At least four units of portable air filled fenders shall be provided.

4.13 Cathodic and Hull Surface Protection

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

4.13.2 Service life expectancy of GRP 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 (for example NAVSEA Standard 009-32).

4.13.3 Service life expectancy of GRP fiberglass 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 (for example NAVSEA Standard 009-32).

4.14 Lightning Protection

4.14.1 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.

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

4.15 Side Mount Facilities

4.15.1 The Vessel shall be fitted with a mount bracket made of marine grade stainless steel 316L at the side of the vessel for deployment of survey equipment. Sample of mount bracket is shown in the following photograph.

Sample of mount bracket as following photo:

4.15.2 The Vessel shall be fitted with slewing jib crane for deployment of survey equipment with safe working load (SWL) of not less than 130kg with length of lifting chain not less than 50m. The slewing jib shall include the sub-assemblies but not limited to:-

(a) electric cross-travel unit for moving heavy loads,

(b) electric chain hoist for handling loads,

(c) electric slewing drive as an inverter control for particular smooth slewing motions,

(d) engineered square pillar and hammerhead-design pillar head for widest possible slewing angle, and/or wall bracket used to attach a slewing jib crane

(e) power supply line and

(f) the jib.

4.15.3 The slewing jib crane and the mount bracket should be on the same side of the vessel.

4.15.4 Detailed design of side mount facilities and slewing jib crane will be discussed at the kick-off meeting and shall be approved by RO and GNC.

4.16 Miscellaneous

4.16.1 Navigational shapes shall be provided and properly stowed in the Vessel.

4.16.2 The keel shall allow installation of sonar head intruding through the hull together with the protective fairing.

4.16.3 A spare six inches diameter hole with cap cover shall be provided at stern of ship office.

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/m^2 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 wheelhouse.

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 wheelhouse control station.

5.2.4 Fire detectors to be installed in wheelhouse, ship office, 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 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.

5.4 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.

5.5 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 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 An electric bilge pump shall be provided for all compartments.

5.6.3 The additional protection should be able to be turned on and off when required. [D]

5.6.4 Navigational shapes shall be provided as per the RO Requirements.

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 Lifejackets shall be so placed as to be readily accessible and their positions shall be clearly indicated.

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 shall be posted on the wall of Ship Office.

Chapter 7 - Machinery

7.1 General Requirements

7.1.1 The Tenderer should note that the Vessel is for use in Hong Kong and it is desirable that the main engines and any other machinery offered by the Contractor are those at present commonly used by ships operating in Hong Kong Waters, and that they have good support and after sale services locally in Hong Kong.

7.1.2 The Vessel shall be powered by twin outboard petrol engines. Both engines shall be four-stroke inboard petrol engines of adequate power to achieve the Contract Speed as stated in Paragraph 2.4 of this Part VII. The Spare Parts and Warranty Spare Parts to be provided shall be of the same model as supplied for the Vessel and shall equally comply with all specifications set out in this Chapter.

7.1.3 The estimated engine propulsive power from both engines required for attaining the Contract Speed of the proposed Vessel (viz., not less than 30 knots) under the Official Speed Trial conditions as stated in Annex 5 to Part VII, together with a descriptive account of the philosophy and methodology employed for such propulsive power estimate and evaluation shall be provided. [E]

7.1.4 The Vessel shall be equipped and fitted with all machineries described each complying with the specifications set out in this Chapter for such machinery.

7.1.5 Sufficient space and headroom in the vicinity of the machinery for local operation, inspection and routine maintenance for all the machinery shall be provided. Procedures and sequences for complete removal of the major items such as the main engines, generator set and fuel oil tanks shall be carefully designed to enable their removal from ships for maintenance in a practicable manner so to avoid the need for dismantle of built-in furniture or deckhouse structure.

7.1.6 All parts of machinery, piping, control and other systems and their associated fittings which are under internal pressure shall be subjected to appropriate tests including a pressure test before being put into service for the first time.

7.1.7 Provision shall be made to facilitate cleaning, inspection and maintenance of components including but not limited to main engines, electric generator set and fire pumps and their associated piping and equipment.

7.1.8 The electrical cables, piping for petrol and diesels oil lines run between the console, fuel tanks and the stern of the Vessel shall be suitably designed for ease of maintenance. They shall be supported properly to prevent chafing and unnecessary tension.

7.1.9 Each engine system shall include the following accessories:

(a) Electrical alternator and remote starting control;

(b) Dead-man switch or emergency cut-off;

(c) Engine protection system as required by engine manufacturer, with audio and visual warnings at the console; and

(d) Each engine shall incorporate one alternator for battery charging.

7.1.10 The Contractor shall supply the Vessel with a comprehensive vessel information and display on the displays located at the console information including but not limited to the following:

(a) Engine rpm;

(b) Engine running hours;

(c) Oil temperature and pressure;

(d) Fuel level and range until the fuel tank is empty;

(e) Battery voltage;

(f) Course and speed;

(g) Engine faults and notification alarms; and

(h) Any other data which the supplied system, generator and outboard engines are capable of generating.

7.2 Main Propulsion Engines

7.2.1 The Vessel shall be powered by the engines which shall be twin four stroke outboard petrol spark ignition engines of adequate power to achieve the Contract Speed. The engines shall drive stainless steel fixed pitch propellers through the integral gearboxes.

7.2.2 The Tenderer shall be responsible for ensuring the correct installation and setting up of the engines including the choice of propellers so as to avoid ventilation and cavitation.

7.2.3 The declared (rated) power of an engine model or propulsion system shall be the full throttle power at the declared (rated) speed at the final output shaft of the engine or propulsion system as offered for sale by the manufacturer. The power measurements and declarations for the engines and the propulsion system shall comply with the requirements in accordance with International Council of Marine Industry Associations (ICOMIA) 28/83.

7.2.4 The emission of the engines shall comply with 3 Stars (Ultra-Low Emission) or higher required by California Air Research Board (CARB) star system that describes exhaust emissions of four-stroke outboard engines or equivalent. [E]

7.2.5 Each of the engines shall be controlled by one set of throttle/forward/reverse lever. The two levers will be conveniently placed for one handed simultaneous operation by the coxswain.

7.2.6 The engine throttle control head shall be provided on the right hand side of the steering wheel.

7.2.7 The engines shall be equipped with power trim. And a switch at the helm that enables the operator to adjust the trim angle. The engines shall be designed to trim fully in to start, and trimmed out as the boat gains momentum, until it reaches the point just before ventilation begins.

7.2.8 The engine located at the transom shall be easily accessed for maintenance and routine checking even underway. A working platforms for engine maintenance purpose shall be fitted.

7.2.9 The electrical cables, pipings for petrol and hydraulic oil run between the console/fuel tanks and

the stern shall be suitably designed to ease the maintenance. They shall be properly supported to prevent chafing and unnecessary tension.

7.2.10 Each engine system shall include the following accessories:

(a) 24V or 12V electrical system c/w alternator and remote starting control;
(b) Dead-man switch/emergency cut-off;
(c) Power trim and tilt system with trim gauge at console;
(d) Engine protection system as required by engine manufacturer, with audio and visual warnings at console;
(e) Each engine shall incorporate one alternator for battery charging; and
(f) Engine tie bar with each pair of engines.

7.2.11 Spark/ignition proof electric/electronic sensor/equipment should be used for petrol tank/lines/compartment.

7.3 Engines Installation

7.3.1 The main and auxiliary engines shall be installed in accordance with the engine maker's instructions and requirements. The Contractor shall submit a certificate/report issued by the engine maker showing that the design and workmanship, power output of the engine installation is suitable for the application / service profile of the Vessel and up to his satisfaction.

7.4 Propellers

7.4.1 All propellers shall be of stainless steel with fixed pitch. Removable propeller shrouds shall be provided for propellers but not be fitted during the Official Speed Trial.

7.5 Electric Generator Set

7.5.1 One 220 Voltage (V) Alternating Current (AC) single phase marine diesel driven generating set of proprietary make with sound shield shall be installed. Detection system for fire or gas in generator compartment shall be provided. [E]

7.5.2 The output power of the generator set shall be sufficient to meet ship’s loading requirement for air-conditioning plus 20% reserve margin.

7.5.3 The generator set shall be DC battery started, attenuator to be drip-proof construction, and its starting/stopping and on-loading shall be by manual means.

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

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

7.6 Electric Generator Engine Control

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

(a) Remote start and stop
(b) Tachometer with running hour meter
(c) Cooling water temperature gauge
(d) Exhaust gas temperature gauge
(e) Lubricating oil pressure gauge
(f) Battery charger ammeter

(g) Fault indicating lights and alarms
(h) Protective devices such as overspeed and low lubricating oil pressure trip as recommended by the engine builder
(i) A standard manufacturer's local control panel to be fitted in the engine room.

7.7 Air-conditioning System

7.7.1 Air-conditioning with adequate back up ventilation shall be provided for the wheelhouse compartment to maintain comfort when operating in heavy spray and in a high temperature, high humidity summer.

7.7.2 The temperature of the wheelhouse and ship office shall be maintained at 22°C for 50% relative humidity when the external ambient air temperature is 33°C at 85% 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.

7.7.3 The interval time for first operating to low the space temperature from initial temperature to 24°C (dry bulb) for 50% relative humidity shall be within 20 minutes.

7.7.4 The air-conditioner shall be of a proprietary make with local control in wheelhouse.

7.7.5 The heat exchange fins shall be provided with anti-corrosion treatment.

7.7.6 The refrigerant shall be CFC and HCFC free.

7.7.7 Remote emergency stop buttons in the wheelhouse shall be provided to stop the air-conditioning units in an emergency.

7.8 Steering System

7.8.1 The Vessel shall be fitted with a hydraulic steering system approved by the engine's manufacturer as evidenced by a confirmation issued by the engine's manufacturer.

7.8.2 The hydraulic steering system shall be designed with two hydraulic cylinders operating in parallel. The steering capability must be maintained with one cylinder malfunctioned. If the oil supply to the hydraulic steering system fails or too small, the steering unit shall be able to work in an emergency manual steering mode.

7.8.3 A redundant system with independent power supply shall be provided to maintain the vessel steering capability in case of main power supply failure.

7.8.4 The hydraulic oil tank shall be located that ready access is available for level checking.

7.8.5 Outboard engines shall be designed so that, with any combination of engine turn and tilt, there shall be no damaging interference between the motor, its accessories, and both the craft-mounted and the engine-mounted system.

7.8.6 Connections, fittings, oil fill openings and air bleeders shall be accessible.

7.8.7 Components in the system shall be externally protected against corrosion. The complete hydraulic steering system shall be designed to withstand conditions of pressure, vibration, shock and movement without failure or leakage.

7.8.8 Hydraulic systems shall be capable of operation throughout an ambient temperature range of -10°C to +60 °C and be capable of withstanding storage at -30 °C to +60 °C.

7.8.9 Materials used in hydraulic steering systems shall be resistant to deterioration by liquids or compounds with which the material may come in contact under normal marine service, e.g. grease,

lubricating oil, hydraulic fluid, common bilge solvents, salt and fresh water.

7.8.10 The type of hydraulic fluid to be used in a hydraulic steering system shall be specified by the manufacturer of the steering system and shall be stated in the owner's manual. The hydraulic fluid shall be non-flammable or have a flash point of 157oC or over.

7.8.11 Hydraulic lines shall be supported by clips, straps or other means to prevent chafing or vibration damage. The clips, straps or other devices shall be corrosion resistant and shall be designed to prevent cutting, abrading or damage to the lines and shall be compatible with hydraulic line materials.

7.8.12 A flexible section shall be installed between rigid piping and cylinder(s).

7.8.13 The steering wheel shall be fitted with an anti-slip covering.

7.8.14 The piping shall comply with one of the international standards as stated in Clause 2.3.4 to this Part.

7.8.15 All the fittings (hoses and piping) shall withstand the system test pressure without leaks.

7.9 Piping System

7.9.1 (a) Piping connections and joints shall be constructed and designed in accordance with the rules and regulations of the RO.

(b) Pipe bends should be kept to a minimum and have sufficient radius to facilitate smoothness of flow. [D]

7.9.2 Piping material should be of copper and chrome plated of substantial thickness. [D]

7.9.3 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.

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

7.9.5 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.

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

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

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

7.9.9 Machinery and piping designation and marking.

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

(b) Colour coding of machinery and piping shall be in accordance with the following:

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

7.10 Fresh Water System

7.10.1 One independent stainless steel fresh water tank with a total capacity of not less than 800 litres shall be arranged in the Vessel to supply fresh water to the main deck and crew space.

7.10.2 The fresh water shall be supplied by a fresh water pump to achieve a pressure at the tap located at main deck and crew space to GNC's satisfaction. This system act as the potable fresh water system and a hose which freely reaches all parts of the Vessel shall also be provided.

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

7.10.4 The fresh water tank shall be designed to easily accessible for maintenance. It shall also be arranged with its own fill and vent pipes with gauze to prevent ingress of material / bugs to the tank. The freshwater tank shall be fitted with the following:

(a) Inspection / cleaning access cover
(b) Filling / sounding pipe
(c) Air pipe

7.10.5 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.

7.10.6 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.

7.10.7 The freshwater tank shall not be directly adjacent to any other tanks carrying liquid of any kind.

7.10.8 The freshwater tank shall be tested without leakage by a head of water equal to the maximum to which the tank may be subjected, but not less than 2.5 m above the top of the tank. The static test pressure shall be applied for five minutes without pressure drop.

7.10.9 A capacity indicator calibrated in litres shall be provided.

7.10.10 The pressurised unit shall be provided with a starter, pressure switch, pressure gauge, relief valve and suction valves. The freshwater pump shall maintain the pressure automatically.

7.10.11 Domestic freshwater piping shall be made of copper. Certificate of piping material shall be submitted before the delivery of Vessels. The welding joints of the domestic fresh water pipings shall be free from lead. The domestic fresh water from the fresh water tank shall be free from any substance harmful to health and shall comply with the Government requirements for domestic water.

7.10.12 Cold freshwater taps completed with PVC braided / reinforced transparent hoses should be fitted on the main deck aft and wheelhouse top to provide a rinse off facility for cleansing purposes. [D]

7.11 Bilge System

7.11.1 The Vessel shall be fitted with a bilge system conforming to the requirements of the RO.

7.11.2 A bilge audible and visual alarm panel shall be fitted in the wheelhouse control station for all compartments, such as, steering gear room, fore peak and tank space, etc.

7.11.3 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 five 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. The additional protection shall be able to be turned on and off when required.

7.11.4 A bilge water holding tank shall be provided with its capacity to meet with RO requirements.

7.11.5 The bilge shall lead to the bilge water holding tank. An electric motor-driven pump with associated piping shall be provided in pumping out the bilge water ashore. A direct overboard shall be provided in case of emergency affecting the safety of the Vessel.

7.12 Seawater System

7.12.1 The piping system of sea-water pumping shall be protected from overpressure. The piping system shall also be suitably protected from corrosion and capable of draining thoroughly during operation

7.12.2 The piping system of sea-water pump shall be designed to avoid water hammer and similar hydraulic shocks within the system and providing the means to purge air from the piping system at low flow velocities.

7.12.3 All sea valves shall be compatible with the hull material, connected to the sea chests shall be tested according to the RO Requirements.

7.12.4 Sea chests provided for the main and auxiliary machineries should be installed in the vicinity of their respective seawater pump suctions but with adequate distance between each other to avoid water flow disturbance. [D]

7.12.5 The sea water inlet at sea chest shall be fitted with strainer plates at the Vessel's shell. The strainer plates shall possess a clear area at least twice that of the sea valves. The edges of strainer plate slots or holes shall be rounded to prevent the cavitation. Compressed air or other effective means shall be provided for clearing off debris from the strainer plates.

7.12.6 (a) Seawater piping shall be constructed of stainless steel pipe SS316L with sufficient thickness.

(b) A suitable strainer with isolation valves and air vent should be fitted to each seawater system. [D]

(c) Due consideration shall also be given for quick and easy access to the seawater strainers.

7.12.7 Sea water inlet and sea chest shall be arranged and located at position as low as practical to avoid clogging due to debris from sea.

7.12.8 The suction arrangement for the fire pump shall include a sea chest with screened inlet, a valve near the sea chest outlet and a valve vent to atmosphere shall be provided.

7.13 Sanitary, Grey and Black Water System

7.13.1 One stainless steel grey/black water holding tank with capacity of not less than 450 litres subject to RO requirements shall be installed in the tank space or other compartment for sanitary purposes.

7.13.2 A sanitary/sea water pump shall be installed in the engine room to supply sea water for sanitary service. Pressurised seawater shall be distributed to the toilets through pressure reducing valves or for flushing by direct pressure via flushing valves.

7.13.3 Toilet and basin shall be designed to discharge into the grey / black water holding tank and ashore. Alternative pipings shall be arranged for the wash basins to be discharged directly overboard through a non-return shipside valve.

7.13.4 The tank shall be fitted with a level gauge and a "Tank Full" indicator installed in a highly visible location in the wheelhouse.

7.13.5 The design of the toilet shall be agreed and acceptable to GNC before installation. Alternative piping to be provided to discharge the toilet directly overboard in emergency.

7.13.6 A discharge macerator electric pump shall be provided for pumping out the contents of the holding tank. This shall be primarily lead to the shore connection, but shall also be arranged with a backup direct overboard discharge via non-return valve. The shore connection shall be arranged with an international shore connection.

7.14 Floor Plates, Handrails and Guards

7.14.1 The floor in compartments under main deck shall be covered with unpainted aluminium chequer plate for safe operational use.

7.14.2 All boundary bars, handrails, gratings, ladders, platforms, stanchions and vertical supports in the compartments shall be of lightweight construction. Aluminium chequer floor plates shall be secured by fixing with sections but shall be readily removable for access to the components including but not limited to bilges, pumps, shaft, pipe work and strainers for ease of maintenance.

7.14.3 Hinged access plates shall be fitted in way of valves. Suitable arrangements shall be provided for hinged plates to avoid rattling noise.

7.14.4 Removable guards for the protection of personnel and machinery shall be provided over exposed moving parts of the components including but not limited to machinery and hot pipe work.

7.14.5 Components including but not limited to splash plates, casings, fenders and screens shall be provided for the protection of personnel and machinery.

Chapter 8 - 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 provided by an electric generator. The electric generator shall have unrestricted continuous rating.

8.2.2 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.

8.2.3 The generator set will maintain an output voltage within ±5 percent over the entire load range and frequency within ±1.5 Hz.

8.2.4 The generator starting circuit shall be 24 VDC. Starting and normal shutdown controls shall be mounted on the generator along with generator oil pressure and water temperature gauges; AC voltmeter and ammeter shall be directly connected to existing wiring systems with the use of a double-pole, double-throw (DPDT) transfer switch / centre-off switch for an ammeter to read both legs (AC Volts readings).

8.2.5 The generator shall be protected against short-circuits and overloads by multipole circuit breakers (overload protector).

8.2.6 The distribution of the electricity to the equipment is through circuit breakers fitted on an electrical distribution board.

8.2.7 Power distribution panels / electrical distribution boards shall be positioned in the wheelhouse.

8.2.8 Circuit breakers shall be provided for each circuit. Circuit breakers shall be of the proper voltage rating, manual reset type, designed for inverse time delay, instantaneous short circuit protection, and capable of repeatedly opening the circuit in which it shall be used without damage to the circuit breaker. Circuit breakers shall indicate whether they are in the open or closed position. All circuit breakers shall be labelled to identify the circuit being protected.

8.2.9 Twenty percent (minimum of three) spare circuit breakers shall be provided in each distribution panel, both AC and D.C. The Vessel's electronic navigation equipment shall be supplied from an independent distribution panel, which shall in turn be supplied from a single breaker in the main D.C. panel.

8.2.10 Twenty percent (minimum of two) spare wiring penetrations shall be provided through each bulkhead except the forward collision bulkhead. Spare penetrations shall be plugged watertight with rubber plugs.

8.2.11 All single-phase loads shall be balanced on each light feeder. Loads of one type such as heaters or receptacles shall not be concentrated on a single branch or leg.

8.2.12 All supply panels shall be fitted with a miniature circuit breaker of double-pole type with over-current and short circuit trips. All junction boxes shall be readily accessible and the prime supply panel shall be positioned inside the wheelhouse. A special arrangement is required for the navigational lights supplied from this prime panel.

8.3 Main Switchboard

8.3.1 Switchboards for main and emergency power supplies shall be installed such that the control elements, indicating instruments, circuit breakers and fuses are readily accessible. The terminal side shall be accessible.

8.3.2 Under all normal conditions of operation, power is distributed from the main switchboard and the distribution system shall be designed to keep cable costs to a minimum by distributing to power panels located close to the user services and in general located in the engine room. Connections and components on panel-boards shall be in locations protected from the expected conditions in conformity with IEC 60529:

(a) IP 67 as a minimum, if exposed to short-term immersion; IP 55 as a minimum, if exposed to splashing water;

(b) IP 20 as a minimum, if located in protected locations inside the Vessel.

8.3.3 Switchboards shall be permanently marked with the nominal system voltage.

8.3.4 A self-standing dead front marine type main switchboard of aluminium construction with adequate ventilation louvres shall be fitted in an accessible and well ventilated position in the engine room and shall contain the following:

(a) Sector for electric generator set 220V AC
(b) Sector for 24 V & 12V D.C.
(c) Sector for shore power
(d) Sector for solar power

8.3.5 Due consideration shall be given in respect of the switchboard location to avoid any risk of damage resulting from oil and water spray or other mechanical hazards. Adequate guardrail(s) and insulated mat(s) shall also be provided.

8.3.6 Megger test and other relevant tests shall be carried out and witnessed by GNC. The results for these tests shall form part of Sea Trial Report that shall be submitted to GNC before Delivery Acceptance.

8.3.7 An appropriate laminated electrical diagram shall be attached on each switchboard.

8.3.8 All switchboard instruments, controls, and all circuit breakers, both on external panels and inside the switchboard, shall be provided with labels of durable flame-retardant material bearing clear and indelible indications. The appropriate ratings of fuses, the setting of adjustable protective devices and the full load current of electric generator shall be indicated.

8.3.9 Apart from the spare feeder breakers, the switchboard shall contain but not be limited to the following:

(a) Electric Generator Set Sector with the following:
  (i) Air circuit breaker of adequate capacity with over-current trip and short circuit trip;
  (ii) Interlock device to ensure only one electric generator is connected to the busbar;
  (iii) Voltmeter, ammeter, wattmeter and frequency meter;
  (iv) Indication lights for "Power Available", "Breaker Opened" & "Breaker Closed";
  (v) All necessary fittings and any other protective devices.

(b) 220V Single Phase Sector with the following:
  (i) Meters or earth lamps to indicate the state of insulation;
  (ii) Moulded case circuit breakers with over-current and short circuit trips for the distribution of 220V AC power supply to their components including but not limited to lighting services, fans and motors;
  (iii) Any other necessary fittings and protective devices.

(c) 24V and 12V D.C. Feeders Sector:
  (i) Transformer / rectifier of adequate capacity for converting AC power to D.C. power. The rectifier shall be of 1-phase full wave regulated type with voltage regulation ±5% and ripple factor 4% at 100 Hz;
  (ii) Magnetic automatic relay switch for activating emergency 24V D.C. supply in event of AC power failure;
  (iii) Supply source indicator lamp for transformer / rectifier;
  (iv) Ammeter for charging unit;
  (v) Voltmeter with selector switch;
  (vi) Metres or earth lamps to indicate the state of insulation;
  (vii) Moulded case circuit breakers with over-current and short circuit trips for 24V D.C. bus and feeder circuits; and
  (viii) Any other necessary fittings and protective devices.

(d) Shore Power Connection Sector:
  (i) Moulded case circuit breaker for shore connection box shall be provided on the main switchboard.
  (ii) The shore connection box shall be capable of receiving 220V single phase 50 Hz 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.
  (iii) An earth terminal shall be provided for connection of the Vessel's earth to the shore earth.
  (iv) An instruction shall be provided at the connection box to give full information of the system and the procedures for carrying out the connection.

8.4 D.C. Power Source

8.4.1 Batteries for Main Engines and Electric Generator Set Starting

(a) Independent bank of 24V batteries shall be provided for starting of each of the two main engines and the electric generator set.

(b) The capacity of the batteries shall be sufficient to provide at least six consecutive starts of each one of the main engines, and at least three consecutive starts of each one of the electric generator set from cold, without recharging.

(c) Electrical connections shall be arranged so that the batteries can be used to start either main engine or generator engine by operating a manual change-over switch in the engine room.

(d) The batteries shall be charged by engine driven alternators with backup service provided by an automatic battery charger. Interlock or protective devices shall be provided to prevent simultaneous charging from the charger and the alternator. The battery charger shall also be prevented from charging the batteries during main engine starting.

(e) Batteries to be of maintenance-free type

(i) There will be five sets of 24V batteries charged directly from engine driven alternators, generator set and/or the solar panel system. There shall be one battery set allocated to each engine.

(ii) Power supply batteries shall be portable, maintenance free, heavy duty, deep cycle and produced from environmentally friendly materials. They shall have a minimum life expectancy of five years, or 200 full discharge cycles at full load, rated in accordance with cognizant regulatory body requirements.

(f) Each engine driven alternator shall have its own built-in voltage regulators, automatic cut-off, and any other required protective devices.

(g) The batteries shall be located as close as practicable to the engines in order to minimise the voltage drop. The battery bank shall be housed in a separate GRP or GRP lined storage box. Each box shall be provided with a removable cover with locking clips for ease of maintenance.

8.4.2 Batteries for Routine and Emergency Supply

(a) 24V battery shall be provided for routine and emergency supply, all emergency equipment shall operate from a dedicated 24V D.C. power supply.

(b) In event of main electrical AC power failure, 24V D.C. batteries shall act as an emergency supply for all communication equipment, navigation and emergency lighting, fire monitoring and control system, and other vital instrumentation and control systems for the Vessel to return to base.

(c) This emergency supply shall come into operation automatically in the event of main electrical power supply failure. The capacities of these sets of batteries shall be sufficient to maintain the emergency supply for a period not less than six hours.

(d) The batteries shall be installed in a separate compartment located outside of the engine room above deck. The compartment shall be well ventilated and prevent ingress of water.

8.4.3 Batteries for Electronic Equipment

(a) 12V battery shall be provided solely for the electronic equipment.

(b) 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:

(a) Navigation light control panel and navigation lights
(b) Horn
(c) General lighting
(d) Compass light
(e) Instrument panel in control console
(f) One hand-held searchlight and one fixed searchlight
(g) Siren
(h) Any other navigational and electronic equipment (if applicable).
(i) 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:

(a) 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.

(b) The chargers shall be fitted with a pilot lamp, a charging adjustment, a voltmeter and an ammeter indicating charging current.

(c) Discharge protection shall be provided to prevent a failed charger component from discharging the battery bank.

(d) 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.

(e) 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.

(f) Battery selector/isolator switches shall be provided between battery chargers and the battery banks they serve.

(g) Provisions shall be made to allow either main engine to be started by the other engine's starting batteries.

8.4.8 An instruction plate with a schematic wiring diagram illustrating the operating procedures and precautions for the selection of battery banks and charging of batteries shall be provided in the vicinity of the charger, battery selection switchboard and charging distribution board. All charging control shall be conducted in the wheelhouse.

8.4.9 Batteries shall be permanently installed in a dry, ventilated location above the anticipated bilge-water level.

(a) Battery compartment(s) shall be actively ventilated whenever batteries are charging.

(b) Batteries shall be located in areas so as to avoid heat soak. Emergency batteries shall be located in the area outside the engine room such as wheelhouse.

(c) All battery storage boxes shall be provided with removable covers and locking clips for ease of maintenance.

(d) Drainage shall also be provided to avoid accumulation of moisture.

8.4.10 Batteries shall not be installed directly above or below a fuel tank or fuel filter.

8.4.11 Any metallic component of the fuel system within 300 mm above the battery top, as installed, shall be electrically insulated.

8.4.12 Battery cable terminals shall not depend on spring tension for mechanical connection to them.

8.4.13 A battery-disconnect switch shall be installed in the positive conductor from the battery, or group of batteries, connected to the supply system voltage in a readily accessible location, as close as practical to the battery or group of batteries except the circuits for engine starting and navigation

lighting and electronic devices with protected memory and protective devices such as bilge-pumps and alarms, if individually protected by a circuit breaker or fuse as close as practical to the battery terminal.

8.4.14 Local information plates showing the voltage, ampere-hour rating, group number and application shall be provided for each battery set.

8.5 Arrangement of Emergency Power

8.5.1 The back-up control panels and the indication panel for manoeuvring shall always be supplied by the 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

(a) Where a starter is situated remotely from the motor, stop and start buttons should be provided near the motor for local operation.

(b) All electric motors of essential services shall have separate start and stop push buttons plus running indication lights (with dimmer control) inside the wheelhouse.

8.8.1 Motors installed in the engine room and other enclosed spaces shall be of semi-enclosed drip-proof type. Motors installed in locations exposed to weather or moisture shall be of waterproof construction. Insulation of motors shall not be less than Class B standard.

8.8.2 A circuit diagram shall be placed in the local control box of each electrical installation.

8.9 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 (Hilti, RISE or equivalent).

(b) The penetration should be located as high as practicable and well clear from the ship side. [D]

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. [D]

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 wheelhouse 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 crew cabin above the desks and working areas such as chart 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 wheelhouse. 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:

(a) Port-side light;
(b) Starboard-side light;
(c) Stern light;
(d) Masthead light;
(e) Anchor light;
(f) Combined NUC and diving lights as follows: three all-round lights in a vertical line where they can best be seen. The highest and lowest of these lights shall be red and the middle light shall be white, all lights shall be independently operated for different use;
(g) One all round flashing red light on top of mast without restriction, indicating the vessel is on duty;
(h) Black ball (three numbers);
(i) Black diamond;
(j) Whistle;
(k) Bell; and
(l) 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 wheelhouse. 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 wheelhouse 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 wheelhouse.

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 wheelhouse.

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 wheelhouse.

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 crew space and 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.

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).

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

9.1.2 (a) An integrated system covering all ENE is preferred, so that information and also the display monitors of different systems, such as colour plotter system, radar system, can be shared in order to utilise the limited space available in coxswain operation area and to provide users a better displaying interface. [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 be of a type approved by the Office of the Communications Authority of Hong Kong.

9.1.7 All sitting, installation and cabling in respect of components including but not limited to compass, VHF and radar shall comply with the relevant rules and regulations of Hong Kong.

9.1.8 All ENE shall have warranty support services in Hong Kong and on-site maintenance shall be available in Hong Kong.

9.1.9 When the generation / use of calendars are employed for logging of reports, activation off equipment, or as any essential part of logic for the proper functioning of the system, then the calendar generation shall function without any error or manual intervention for all leap years.

9.1.10 The circuit breaker for the ENE shall equip with lockout device so that the breaker can be locked during the equipment maintenance.

9.1.11 Lightning protection shall be provided and installed wherever applicable. The lightning arresters for all outdoor antennas shall be installed at the antenna ends.

9.1.12 Equipment supplied shall complete with all standard and/or maker recommended accessories as required for normal operation.

9.2 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 wheelhouse 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 wheelhouse 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	:	0.1^0or better
(d)	Deviation Compensation	:	Automatic
(e)	Operating Temperatures	:	0℃ to 50℃
(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 Contactor 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℃ to +55℃ or better
(xiii)	Relative humidity	: 90% or better

(c) Transceiver

(i)	Operating frequency	: 9410±30 MHz (X–band)
(ii)	Peak power output	: At least 6 kW
(iii)	Pulse length	: Equipped with long, medium and short pulse modes for close, medium and long range operation
(iv)	Overall noise figure	: 6 dB or better

(d) Antenna

(i)	Operating frequency	: 9410±30 MHz (X–band)
(ii)	Aerial type	: Open array radar antenna
(iii)	Horizontal beam width	: 2.0 degrees or less
(iv)	Vertical beam width	: 26.0 degrees or less
(v)	Polarization	: Horizontal
(vi)	Rotation speed	: Not less than 24 rpm within satisfactory operation at relative wind speed up to 70 knots. Manual and automatic selection of antenna rotation speed such as 24 rpm, 36 rpm and 48 rpm shall be available according to detection range.
(vii)	Operating temperature	: -15℃ to +55℃ 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	:	warming 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 radar, AIS, depth of water by echo sounder and ENC information in one picture.

(a) General Requirements

(i) One set of Electronic Chart Display and Information System (ECDIS) 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
(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 quard-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 indictor 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 be a type approved make by the Office of the Communications Authority of Hong Kong.

(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 International Maritime Organization (IMO) GMDSS carriage requirements.

(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 radio shall be completed with electrical components including but not limited to antenna and integrated microphone, loudspeaker, control knobs/keys, display screen and re-chargeable battery, necessary for a stand-alone portable radio. The radio shall be equipped with a 220 VAC battery charger (for battery charging on shore) and one extra set of spare re-chargeable battery. The Contractor shall provide proper stowing space and facilities for keeping of the portable radio and the spare battery such that the crew can take the portable radio out for use when necessary.

(g) The operating temperature shall be -5℃ to +55℃ or better. The water ingress protection shall be IPX7 or better.

(h) The radio shall be supplied with a belt clip and a shoulder carrying case.

(i) 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.

(j) 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 uV for 20 dB SINAD or equivalent
(ii) Adjacent channel selectivity : 60 dB or better
(iii) Spurious image rejection : 65 dB or better
(iv) Intermodulation : 65 dB or better

(v) Audio output : Not less than 1 Watt at rated audio power output with less than 10% distortion

(c) Aerial and Feeder

(i) The aerial provided shall be a marine type aerial with at least 3 dBi gain, vertically polarised, omni-directional and suitable for mounting on the launch.

(ii) The V.S.W.R. of the aerial installed shall be less than 1.5 : 1.

(iii) The aerial feeder shall be RG58U type or equivalent.

(iv) Coaxial cable lightning suppresser with appropriate earthing connection shall be provided for protecting the radio equipment. All outdoor connector joints shall be properly covered by waterproof tape or material.

9.7 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 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 consumption : 50W peak / 10W average (main unit)
(2) Power supply : 12V D.C. + 10%

(3) Default frequencies : AIS1 (CH 87B): 161.975 MHz
AIS2 (CH 88B): 162.025 MHz
DSC (CH70): 156.525 MHz

(4)	Frequency range	:	156.025 ~ 162.025 MHz
(5)	Transponder size/weight (+ 2%)	:	221 x 165 x 95 mm, 1.5 kg
(6)	MKD display	:	5.6 inches (or larger) Colour TFT LCD
(7)	MKD size/weight (+ 2%)	:	255 x 162 x 75 mm, 0.9 kg
(8)	GPS size/weight (+ 2%)	:	90 x Ø65 mm (+140 mm mounting bar), 0.2 kg

(ii) AIS Transmitter

(1)	Power output	:	12.5W or 1.0W (41 dBm ±1.5 dB or 30 dBm ±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	:	< ±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) Serial inputs/outputs

(1)	Sensor ports	:	4 numbers to IEC61162-1/2 (input only)
(2)	Long range port, auxiliary and pilot port	:	IEC61162-1/2 (input & output), also auxiliary port configurable for RTCM input
(3)	Display	:	RS422 non-isolated

(vi) GPS Antenna & Receiver

(1)	Antenna	:	Patch Anetenna /TNC (RG58U)
(2)	Receiver type	:	16 channel, L1 frequency, C/A code
(3)	Accuracy	:	Acquisition -140 dBm / Tracking -150 dBm

(vii) Environment

(1)	Operation temperature	:	-15℃ to +55℃
(2)	Storage temperature	:	-25℃ to +75℃
(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 sitting, installation and cabling work shall be undertaken to the highest standard to ensure:

(i) satisfactory performance of the Equipment,
(ii) protection from mechanical and water damages,
(iii) ease of accessibility for maintenance and repair, and
(iv) manufacturers' recommendations shall be strictly observed.

(h) (i) The power, signal and control cables connecting to the flush-mounted equipment shall be long enough to let the equipment wholly rest on a secure surface with valid cable connections for fault finding and equipment testing. These extended cables shall be properly managed and resided inside the console.

(ii) Induced mutual interference should be within an appropriate level which would not affect normal operation. [D]

(i) Installation location

(i) Installation location of the Equipment shall be easily accessible for inspection and maintenance. Exact location shall be subject to the approval of the Government.

(ii) Installation location of the Equipment shall not cause interference with other Equipment including any emitted interference.

(j) Material and Workmanship

(i) Material and Equipment shall be of high quality, and shall comply with, where

applicable, the appropriate British Standards and Code of Practice, together with any amendments made thereto, suitable for installation in the Vessel.

(ii) All the designs shall be subject to the approval of the Government and the respective works shall be carried out in a first class workman-like manner.

(iii) The Government reserves the right to reject any part of the installation not compliant with these Specifications. The Contractor shall carry out the necessary remedial work or replacement at its own cost and expense and without delay.

(iv) The Contractor shall provide all installation materials including but not limited to cables, casing and mounting accessories which are durable and fire retarding. Where it is impracticable for signal cables for data to be run inside conduits, PVC insulated and sheathed with armoured cable shall be used.

(k) Equipment Fixing and Interconnection

(i) All switches, connectors, jacks and receptacles shall be clearly, logically and permanently marked during installation. All wires and cables shall be identified at every termination and connection point with permanent type markers suitable for installation in the Vessel.

(ii) Interconnection of various items of Equipment shall be mechanically and electrically connected by multi-pin connectors or terminals.

(iii) All cables shall be joined by properly designed connectors or inside joint boxes. Where terminal blocks are used for connection cables, the tip of each conductor shall be crimped with a suitable terminal pin before it is inserted into the terminal block.

(iv) The Contractor shall be responsible for providing and installing properly rated power cables from the power points to its own equipment.

(l) Electricity

(i) The power supply shall be compatible with Vessel's D.C. electrical system.

(ii) The Equipment shall be protected by appropriately rated fuses. The fuses shall be contained in independent fuse holders which are easily accessible.

(m) Cable

(i) All exposed cables and wiring shall be sheathed or protected by metal conduits.

(ii) Watertight cable glands shall be provided by way of watertight bulkhead or deck penetration.

(iii) Signal wiring shall be separated from power supply cables and housed in separate screened conduits or cable trunks.

(iv) Cables and wirings shall run behind the compartment lining. Where electric cables are necessary to be fitted on the decorative surface of bulkheads, they shall be enclosed in proper metal conduits.

(n) Labelling and Marking

(i) Each cable shall be clearly labelled and carry its own unique identification code.

(ii) Polarity of power cables shall be labelled.

9.9 CCTV System

9.9.1 CCTV system with three (3) cameras (one for forward, one for stern deck and one for afterward respectively) and four (4) monitors (three in wheelhouse and one in ship office) shall be provided. 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 deliver each set of Equipment to the EMSD representatives for bench acceptance test prior to the installation on the Vessel. Where the test is failed (i.e. the Equipment does not comply with any requirements as set out in this Chapter or in other applicable part of the Contract), the Contractor shall provide a brand new replacement to the EMSD for reconduct of the bench acceptance tests.

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

9.10.4 The Contractor shall provide all the necessary test equipment and tools for carrying out all tests as mentioned in this Chapter 9 at no extra cost to Government.

9.10.5 At least one month before the end of the Warranty Period, the Contractor shall arrange and perform confirmation test in the presence of the representatives from EMSD. Should any defects be found during the confirmation test, the Contractor shall fix the defects as soon as possible and in any event no later than the time prescribed by the EMSD representatives. The Warranty Period shall be extended correspondingly for so long as the defects are not fixed by the Contractor.

9.10.6 For defects found during the confirmation test, the Equipment or its parts shall be repaired or replaced, and the Warranty Period of the Equipment shall be extended for one more year.

9.11 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 and training. 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

(a) Multibeam echo sounder with dual sonar heads;
(b) Inertial Navigation System (INS);
(c) Mini Sound Velocity Sensor;
(d) Single beam echo sounder;
(e) Differential Global Navigation Satellite System (DGNSS)/Beacon Receiver;
(f) Software for navigation and data-capture system;
(g) Sound velocity profiler;
(h) Computers System;
(i) Forward Looking Sonar and
(j) Acoustic Doppler Current Profiler (ADCP).

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. References to "Equipment" in this Chapter shall mean any or all of the above-mentioned Equipment in (a) to (i) of paragraph 10.1.2. References to "Hydrographic Survey Equipment" throughout the Tender Documents or Contract shall mean each set of the above-mentioned Equipment in (a) to (i) of paragraph 10.1.2.

10.1.4 When the generation or 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.

10.1.5 The circuit-breaker for the ENE equipment shall equip with lockout device so that the breaker can be locked during the equipment maintenance.

10.1.6 Lightning protection shall be provided and installed wherever applicable. The lightning arresters for all outdoor antennas shall be installed at the antenna ends.

10.1.7 Equipment supplied shall complete with all standard and/or maker recommended accessories as required for normal operation.

10.2 Multibeam Echo Sounder

10.2.1 The multibeam echo sounder is the major bathymetric sensor for the proposed Vessel to perform sounding survey. It shall have dual transmit and receive transducers configuration and work with the Inertial Navigation System (INS), the mini-sound velocity sensor, the Differential Global Navigation Satellite System (DGNSS) receiver and the sound velocity profiler in order to provide a complete system to meet the 'Special Order' accuracy requirement of the International Hydrographic Organisation (IHO) Standards. It shall cover a swath profile of minimum 10 times the water depth of a flat seafloor. [E]

10.2.2 The dual transmit and receive transducers shall be mounted to the hull of the proposed Vessel or any other location as approved with suitable fairings. The operation of the multibeam echo sounder shall be controlled and monitored using a software program. The software shall be provided to calibrate the system, capture and store all incoming raw data, show the sea bottom in color-coded cross-section, 2-Dimension (2D) and 3-Dimension (3D) view. The software shall also have the functions of capture backscatter data and water column data. [E]

10.2.3 Technical Specifications of multibeam echo sounder: [E]

Frequency range:	200 kHz to 400 kHz in steps of 10kHz
Beam width:	1 * 1 degree at 400 kHz
Max ping rate:	50 Hz
Swath coverage sector:	Up to 130 degrees (single head), 200 degrees (dual head)
Sounding patterns:	Equiangular, equidistant and high density
No. of soundings per ping:	400 (single head, single swath)
	800 (single head, dual swath)
	1600 (dual head, dual swath)
Roll stabilised beam:	+/- 15 degrees
Pitch stabilised beam:	+/- 10 degrees
Yaw stabilised beam:	+/- 10 degrees (dual head)
Depth;	Not less than 520 m (200 kHz), 350 m (400 kHz)
Coverage across:	Not less than 580 m (single head), 700m (dual head) at 200 kHz
	Not less than 375m (single head), 530m (dual head) at 400 kHz
Shortest (CW) pulse length:	14 microseconds or less
Water column display:	Yes
Sonar head physical dimensions:	Not larger than 0.35m in diameter and 0.12m in height

10.3 Inertial Navigation System (INS)

10.3.1 The INS comprises an Inertial Measurement Unit (IMU), processing unit, HMI unit, monitor and dual GNSS Receivers and integrates them together to provide the blended best possible solution in position, attitude and timing**.** The Contractor shall provide a compatible GNSS-Aided Inertial post-processing software for georeferencing data collected from multi-beam sonars.

10.3.2 The Inertial Navigation System (INS) can integrate Real Time Kinematic (RTK) Global Navigation Satellite System (GNSS) data with the inertial sensor data from the Motion Gyro Compass (MGC). The MGC part of INS functions both as Inertial Measurement Unit (IMU) of INS and as stand-alone IMO type approved gyro-compass. The Technical Specifications of INS are as follow: [E]

<u>Accuracy Root Mean Square (RMS)</u>

Roll, Pitch accuracy:

0.01° or less

Heading Accuracy:

0.01° or less with 4 m antenna baseline

0.02° or less with 2.5 m antenna baseline

Heave Accuracy:

Real Time: at most 5 cm or 5% (whichever is greater)

Delayed signal: at most 2 cm or 2% (whichever is greater)

Horizontal Position Accuracy:

0.5m or less for DGNSS operation

±(10 mm + 1 ppm x baseline length) or less for RTK operation

Data Output

Communication ports: 8 serial RS-232, RS-422 lines and 16 Ethernet UPD/IP ports

Data output interval: Programmable in 0.005-se steps and 1PPS pulse

Output rate: up to 200 Hz

Analog output: 3 user configurable channels, +/- 10 Volt

1PPS signal accuracy: 220 nsec

10.4 Mini Sound Velocity Sensor (Mini SVS)

10.4.1 Mini SVS shall be installed near either one multibeam transducer head so as to provide the real time sound velocity at the depth of the multibeam echo sounder.

10.4.2 Technical Specification

Resolution	0.001m/s or better
Range	1375 - 1900 m/s
Accuracy	+/- 0.02 m/sec or less
Sensor size	50mm or as approved by the Government

10.5 Single Beam Echo Sounder

10.5.1 The single beam echo sounder is used to measure the water depth and serve as an independent check on the multibeam echo sounder. The transducer shall be installed in the hull or any other location as approved with suitable fairings.

10.5.2 Technical Specification of single beam echo sounder:

Frequency range	10 kHz -250 kHz, 2 channels
Depth Range	0.2m -500m
Resolution	1 cm or better
Interface	3 x serial interface (RS232)
	Input: GPS position and time, heave , motion, heading
	Output: depth
	1x Ethernet LAN interface (full communication interface)
	1x sync connector (with external trigger and syn pulse out)
Input power	90-260VAC, 10-30VDC
Ping rate	50Hz or better
Dimensions	Not larger than 300 x 83 x 220 (L*H*W) mm
Transducer range	24 to 200 kHz
Q (transmit)	5 at 24 kHz
Balanced Impedance	70 ohms at 24 kHz

Transducer size	Not larger than 330 mm (L) x 230 mm (W) x 120 mm (H)
Beam width	4° at 200 kHz

10.6 DGNSS Receiver

10.6.1 The receiver is used for position fixing of the sounding instrument on board the Vessel. The receiver can receive the DGPS and Differential GLONASS correction signals broadcasted at frequency 289.0 kHz from the Hong Kong Kau Yi Chau reference station.

10.6.2 Technical Specifications of DGNSS Receiver:

Receiver Name	DGNSS/Beacon Receiver
Configuration Option	
Receiver Type	Modular
Rover operation	Yes
Rover position update rate	1 Hz, 2 Hz, 5 Hz, 10Hz
Antenna	L1 GNSS (GPS, Glonass, Galileo, BeiDou, QZSS), MSK Beacon, L1 SBAS
Waterproof	IP67 for submersion to depth of 1 m (3.3 ft), dustproof
Measurements	220-channel L1 C/A code
	2-channel MSK Beacon
Code Differential GPS Positioning	
Correction type	DGPS RTCM version 2.3, DGNSS RTCM v2.4
Correction source	Internal MSK Beacon, DGPS Base via ext. radio, NTRIP via IBSS or VRS
Horizontal accuracy	±(0.30m + 1 ppm) RMS ±(1.0 ft + 1 ppm) or better
Vertical accuracy	±(0.50m + 1 ppm) RMS ±(1.6 ft + 1 ppm) or better
Communications	Ethernet
Supported data formats	
Correction Inputs	CMR™, CMR+™, CMRx, RTCM 2.x, RTCM 3
Correction Outputs	Repeat RTCM from internal Beacon source
Data Outputs	NMEA, GSOF, 1PPS Time Tags
Internal MSK Beacon receiver	Frequency range 283.5–325.0 kHz
	Channel spacing 500 Hz
	MSK bit rate 50, 100, and 200 bps
	Demodulation minimum shift key (MSK)

10.7 Navigation and Data Capture System

The navigation and data capture system shall include one (1) licence of the software using in field and office for the purpose of navigation, data collection for multibeam echo sounding data, single beam echo sounding data, INS, DGNSS position, on board raw data processing and display.

Technical requirements

(a) Support the multibeam system and INS in para 10.2 and 10.3;

(b) Support the Kinematic GNSS/INS post-processing software;

(c) Display of raw and processed data for all sensors in database format;

(d) Both raw and processed data storage;

(e) Provide full backup of raw data for the Kinematic GNSS/INS post-processing software;

(f) Replay function for re-processing of acquired data;

(g) Calibration module to correct for roll, pitch and yaw misalignment of multibeam transducer;

(h) Real-time graphical display of navigation data, designed survey lines and surveyed areas;

(i) Real-time DTM production;

(j) 3D grid display;

(k) SVP profiles and tidal information can be (re-) applied here;

(l) Capture backscatter data and water column data

10.8 Sound Velocity Profiler

10.8.1 Sound velocity profiler with cable reel provides a digital velocity of sound for the multibeam of echo sounder.

10.8.2 Technical Specification of sound velocity profiler:

General Specifications:

Velocity range	:	1400 - 1600 m/s
Velocity resolution	:	0.03 m/s
Temperature range	:	4° C - 40° C (39° F - 104° F) typical
Sing-Around frequency	:	11 kHz
Velocity accuracy	:	+/- 0.3 m/s
Sample rate	:	10 Hz
Depth Sensor accuracy	:	31.0 cm RS232,
Communications	:	selectable baud rate and choice of output formats. Display and download/logging software included
Probe weight	:	Below 2.0 kg in air
Cable length	:	At least 50 m
Cable reel	:	Yes
Handheld unit		Display the measurement and operate the equipment

10.9 Computer System

10.9.1 The computer system is to store all raw data and perform the communication between all devices. It consists of two workstations, one notebook computer, four monitors, one network switch, one uninterruptible power supply (UPS) unit, two network-attached storage (NAS) servers and one network rack cabinet.

10.9.2 Workstation (2 nos.)

Features	Requirement
Device Type	- Rack mount
Rack Size	- Compatible to the Workstation in this paragraph
Processor	- Intel Core i9-9900 (9th generation), 5GHz Max Turbo Frequency, 16MB SmartCache Cache, 8 Cores, 16 Threads or above
Memory	- 16 GB DDR4-2666 SDRAM (2 x 8 GB) or above
Internal storage	- 2 TB 7200 rpm SATA or above
Hard drive	- 256 GB PCIe® NVMe™ SSD
Optical drive	- DVD writer
Graphics	- NVIDIA® GeForce® GTX 1070 (8 GB GDDR5 dedicated) or above
Ports	- Front: 1 headphone/microphone combo; 1 USB 3.1 Type-C™ Gen 2; 2 USB 3.1 Gen 1; 2 USB 3.1 Gen 2
	- Rear: 2 USB 2.0; 4 USB 3.0; 1 audio-in; 1 audio-out; 1 microphone-in media card reader
Network interface	- **I**ntegrated 10/100/1000 GbE LAN
Wireless	- 802.11a/b/g/n/ac (2x2) Wi-Fi® and Bluetooth® 4.2 M.2 combo
Input Devices	- 1 HP Wireless Optical Mouse
	- 1 HP Wireless Black Mouse
	- 1 HP Wireless Black Keyboard with volume control
	- 1 HP Wireless Keyboard with volume control
Operating Systems	- Windows 10 Enterprise LTSB 64 bit
Video connectors	- 1 DVI; 1 HDMI; 3 DisplayPort™
Memory card device	- 3-in-1 memory card reader
Power supply type	- 500 W internal power supply
	- ENERGY STAR® certified; EPEAT® Silver registered

10.9.3 NoteBook Computer (1 no.)

Features	Requirement
Operating Systems	- Windows 10 Enterprise LTSB 64 bit
Processor	- Intel® Core™ i9-8950HK processor
	- 2.9GHz hexa-core with 12MB cache or above
Graphics	- NVIDIA® GeForce® GTX 1050 Ti
	- Video memory: 4GB GDDR5 VRAM
Display	- At least 15.6" LED-backlit 4K UHD (3840 x 2160) 16:9 touchscreen, color calibration: Delta E < 2, 100%Adobe RGB color gamut
	- 7.3mm-thin bezel with 83% screen-to-body ratio
	- 178° wide-view technology
	- ASUS Eye Care technology for up to 30% blue-light reduction
Memory	- At least 16GB 2400MHz DDR4 onboard
Storage	- At least 1TB PCIe® SSD

Interface	- 2 x Type-C™ USB 3.1 Gen 2 (Thunderbolt™ 3)
	- 2 x Type-A USB 3.1 Gen 2
	- 1 x HDMI
	- 1 x Combo audio jack
	- 1 x MicroSD card slot
Keyboard	- Full-size backlit, with 1.5mm key travel
	- Fingerprint sensor supporting Windows Hello
ScreenPad	- 5.5" FHD (1920 x 1080) Super IPS+ display
	- 178˚ wide-view technology
	- Glass-covered for fingerprint and smudge resistance
	- Precision touchpad (PTP) technology supports up to four-finger smart gesture
Audio	- ASUS SonicMaster stereo audio system with surround-sound; smart amplifier for maximum audio performance
	- Array microphone with Cortana voice-recognition support
	- 3.5mm headphone jack
	- Long-travel voice coils for improved low-frequency response
	- Certified by Harman Kardon
Camera	- VGA webcam
Wireless	- Wi-Fi, Dual-band 802.11ac gigabit-class Wi-Fi
	- Bluetooth, Bluetooth 5.0
Battery and Power	- Up to 9.5 hours battery life
	- 71Wh 8-cell lithium-polymer battery 150W power adapter
	- (Output: 19.5V DC, 7.7A, 150W)
	- (Input: 100-240V AC, 50/60Hz universal)
Included Software	- ScreenPad Toolbar
	- ScreenPad Launcher
	- ScreenPad Music Player ScreenPad Calendar
	- ScreenPad NumKey
	- ScreenPad Calculator
	- ScreenPad for Office
	- ScreenPad Online Video Player
	- ASUS Sync
	- ASUS Battery Health Charging ASUS GIFTBOX
	- ASUS Splendid
	- ASUS Eye Care
	- ASUS Tru2life Video

10.9.4 20-Inches Monitors (1 Unit)

Features	Requirement
Diagonally Viewable Size	- At least 19.5 inches
Maximum Resolution	- 1600 x 900 at 60 Hz

Aspect Ratio	- 16:9
Viewing Angle	- 160° (vertical) / 170° (horizontal)
Connectivity	- 1 x DP (ver 1.2), 1 x HDMI (ver 1.4); 1 x VGA, 1 x USB 3.0 port - Upstream, 2 x USB 3.0 ports - Side, 2 x USB 2.0 ports - Bottom
Adjustability	- Tilt (Typical: 5° forward or 21° backward), pivot (90°), swivel (45°), height adjustable (130 mm)
Backlight Technology	- LED

10.9.5 24-Inches Monitor (2 Units)

Features	Requirement
Diagonally Viewable Size:	- At least 23.8"
Maximum Resolution	- 2560 x 1440 @ 60Hz
Aspect Ratio	- 16:9
Viewing Angle	- 178° (Vertical) / 178° (Horizontal)
Connectivity	- 1 x DP (ver 1.2), 1 x HDMI (ver 1.4), 1 x USB 3.0 port - Upstream, 2 x USB 3.0 ports - Side, 2 x USB 3.0 ports - Bottom
Adjustability	- Tilt: -5°/21°, swivel: -45°/45°, pivot: 90° clockwise, height-adjustable: 130 mm
Backlight Technology	- White LED edgelight system

10.9.6 28-Inches Monitor (1 Unit)

Features	Requirement
Diagonally Viewable Size:	- At least 27.9"
Maximum Resolution	- 3840 x 2160 @ 60Hz
Aspect Ratio	- 16:9
Viewing Angle	- 160° (Vertical) / 170° (Horizontal)
Adjustability	- Tilt
Connectivity	- DisplayPort 1.2 /mini-DisplayPort, 2 x HDMI (MHL) 2.0, 2 x USB 3.0 (downstream), 1 x USB (upstream), Audio line-out
Backlight Technology	- LED

10.9.7 Network Switch (1 no.)

Features	Requirement
General	
Device type	Switch - 8 ports - unmanaged
Enclosure type	Desktop
Ports	8 x 10/100/1000
Power over Ethernet (PoE)	N/A
Performance	Switching capacity: 16 Gbps ¦ Forwarding performance (64-byte packet size) : 11.9 Mpps
MAC address table size	4000 entries
Jumbo frame support	Yes
Features	Flow control, Layer 2 switching, auto-negotiation, auto-uplink (auto MDI/MDI-X), Weighted Round Robin (WRR) queuing, quality of service (QoS), cable diagnostics, loop detection, Energy Efficient Ethernet
Compliant standards	IEEE 802.3, IEEE 802.3u, IEEE 802.3z, IEEE 802.3ab, IEEE 802.3az, IEEE 802.1p, IEEE 802.3x
Status indicators	Power, link/activity, cable diagnostics, loop detection
Expansion and Connectivity	
Interfaces	8 x 10Base-T/100Base-TX/1000Base-T - RJ-45
Power	
Power device	Power adapter - external
Voltage required	DC 12 V
Electric current required	1.00 Amps
Miscellaneous	
Width	5.1 in
Depth	5.1 in
Height	1.1 in
Weight	13.4 oz
Fanless	Yes
Compliant standards	CSA, UL, UL 60950, CSA C22.2, FCC CFR47 Part 15, FCC Part 15 A
Localization	North America
Software/System Requirements	
OS required	Linux, Apple MacOS X, Microsoft Windows
Manufacturer Warranty	
Service and support	Limited lifetime warranty
Service and support details	Limited warranty - replacement - lifetime ¦ Limited warranty - power supply and fans - 1 year ¦ Technical support - phone consulting - 1 year

Environmental Parameters	
Min operating temperature	32 °F
Max operating temperature	104 °F
Humidity range operating	10 - 90% (non-condensing)
Min storage temperature	-4 °F
Max storage temperature	158 °F
Humidity range storage	10 - 90% (non-condensing)

10.9.8 Uninterruptible Power Supply (UPS) units (1 no.)

Features	Requirement
Output Power Capacity	- At least 2700 Watts / 3000 VA
Nominal Output Voltage	- 230V
Mount Type	- Rack mount
Rack height	- 2U
Output Connections	- At least 8 no. IEC 320 C13
Nominal Input Voltage	- 230V
Input Connections	- IEC-320 C20

10.9.9 Network-attached storage (NAS) servers (2 nos.)

Features	Requirement
CPU	- Intel® Xeon® E-2124 quad-core 3.3 GHz processor (burst up to 4.3 GHz)
CPU Architecture	- 64-bit x86
Hard Disk	- Bundled with 8 numbers of 8TB 3.5”SATA 6Gb/s Hard Drives for each NAS server - Data buffer (MB): not less than 256 - Rotation speed (RPM) : not less than 7200 - Latency average (ms) : not greater than 4.16 - Interface transfer rate: not less than 600 - Sustained transfer rate: MiB/sec, not less than 243; MB/sec, not less than 255 - Seek time (read/write, ms): not less than 8.0/8.6 - All hard drives must be officially compatible with the NAS (i.e., HDD model should be included in the official HDD compatibility list which is prepared by the NAS manufacturer)
Floating Point Unit	- Yes
Encryption Engine	- Yes (AES-NI)
System Memory	- 8 GB UDIMM DDR4 ECC (2 x 4GB)
Maximum Memory	- 64 GB (4 x 16 GB)
Memory Slot	- 4 x DDR4 long DIMM

Flash Memory	- 4GB (Dual boot OS protection)
Drive Bay	- 8 x 3.5-inch
Drive Compatibility	- 3.5-inch bays: 3.5-inch SATA hard disk drives 2.5-inch SATA hard disk drives 2.5-inch SATA solid state drives
Hot-swappable	- Yes
SSD Cache Acceleration Support	- Yes
Gigabit Ethernet Port (RJ45)	- 4
10 Gigabit Ethernet Port	- 2 x 10GbE SFP+ SmartNIC port
Jumbo Frame	- Yes
PCIe Slot	4 Slot 1: PCIe Gen2 x4 (PCH) Slot 2: PCIe Gen3 x8 (CPU) Slot 3: PCIe Gen3 x4 (CPU) Slot 4: PCIe Gen3 x4 (CPU) Slot 4 is preinstalled with a 10GbE network adapter
USB 3.1 Gen 2 (10Gbps) Port	- 2 x Type-C USB 3.1 Gen2 5V/3A 10Gbps 4 x Type-A USB 3.1 Gen2 5V/1A 10Gbps
Form Factor	- 2U Rackmount
LED Indicators	- HDD 1-8, Status, LAN, storage expansion port status
Buttons	- Power, Reset
Dimensions (HxWxD)	- Not greater than 90 × 490 × 570 mm
Weight (Net)	- Note greater than 11 kg
Operating temperature	- 0 - 40 °C (32°F - 104°F)
Relative Humidity	- 5-95% RH non-condensing, wet bulb: 27˚C (80.6˚F)
Power Supply Unit	- 300W(x2), 100-240V
Power Consumption: Operating Mode, Typical	- 89.99 W - with drives fully populated
Fan	- System: 2 x 6.0cm fan (12V DC)
Sound Level	- 42 db(A)
System Warning	- Buzzer
Kensington Security Slot	- Yes
Operating System	- QTS 4.3.5 (embedded Linux) or the latest version
Supported Clients	- Apple Mac OS 10.7 or later - Linux and UNIX - Microsoft Windows 7, 8, and 10 - Microsoft Windows Server 2003, 2008 R2, 2012, 2012 R2 and 2016
Supported Browsers	- Apple Safari 7 or later - Google Chrome

	- Microsoft Internet Explorer 10 or later - Mozilla Firefox
Multilingual Support	- Chinese (traditional and simplified), Czech, Danish, Dutch, English, Finnish, French, German, Greek, Hungarian, Italian, Japanese, Korean, Norwegian, Polish, Portuguese (Brazil), Romanian, Russian, Spanish, Swedish, Thai, and Turkish
File System	- Internal hard drive (EXT4) - External hard drive (EXT3, EXT4, NTFS, FAT32, HFS+, and exFAT) Note: To use exFat you must purchase an exFAT driver license from License Center
Networking	- TCP/IP: Dual stack (IPv4 and IPv6) - Jumbo frame - Port trunking（Link aggregation） failover Load balancing - DHCP server and client - RADVD - USB Wi-Fi adapter Note: This feature does not support ad hoc networks because of security considerations. - Virtual switch Network Address Translation (NAT) Spanning Tree Protocol (STP) Software-Defined Switch mode - Static Route - NCSI (Network Connectivity Status Indicator) - DDNS settings (Customize & Multiple Service)
Backup Solution	- Cloud storage backup to Amazon Glacier, Amazon S3, Azure Storage, Google Cloud Storage, HKT Object Storage, OpenStack Swift, WebDAV - Cloud storage syncing with Alibaba Cloud, Amazon Drive, Amazon S3, BackBlaze B2, Box, Dropbox, OneDrive, Google Drive, HiDrive, hubiC, OneDrive, OneDrive For Business, ShareFile, Yandex.Disk - RTRR server & client with bandwidth control - Rsync server with download bandwidth control - Remote server syncing (CIFS/SMB, FTP, Rsync, and RTRR) - Scheduled backup to local and remote storage spaces - Backup versioning (RTRR) - Encryption, compression, and file filters

	- Centralized management for backup, restoration, and sync jobs - Support for Apple Time Machine - Data backup to multiple external storage devices - Desktop backup for Windows - Support for the following third-party backup software: Veeam Backup & Replication, Acronis True Image, Arcserve Backup, Retrospect, Nakivo Backup & Replication, and Veritas Backup Exec
Security	- Network access protection with auto-blocking (SSH, Telnet, HTTP(S), FTP, CIFS/SMB, and AFP) - Host access control for shared folders (CIFS/SMB) - AES 256-bit folder-based and volume-based encryptions which are validated by FIPS 140-2 CAVP (Cryptographic Algorithm Validation Program) - 256-bit external drive encryption (AES) - Importing of SSL certificates from Let's Encrypt - Instant alerts through email, SMS, push service, audio, - 2-step verification
Storage Management	- Supported RAID types: RAID 0, 1, 5, 6, 10, 50, 60, JBOD, Single - RAID Hot Spare and Global Hot Spare - RAID Rebuild Speed Customization - Online RAID capacity expansion - Online RAID level migration - SSD RAID Over-provisioning Note: RAID 0 and JBOD Data RAID does not support Over-provisioning. - SSD RAID Performance evaluation (with SSD Profiling Tool) - Bitmap support - Disk auto S.M.A.R.T. data migration - Disk bad block scan and S.M.A.R.T test. - Disk bad block recovery - Disk secure data erase - Ironwolf Health Management - Storage pools - Qtier™ Data Tiering Technology Automatic or scheduled data tiering IO-aware auto tiering Shared folder tiering on demand - Flexible volumes and LUNs with thin provisioning

	and space reclaiming - Online volume expansion - Volume type convert - Volume shrink - Storage space utilization - Snapshots Volume and LUN snapshots Snapshot Dashboard Snapshot Manager Snapshot local restore and revert Snapshot Clone Snapshot Replica and Snapshot Vault Snapshot remote restore and revert Unified Snapshot Directory Support for Windows Previous Versions (CIFS/SMB) Snapshot Agent for Microsoft Windows and VMware vSphere - Storage expansion using QNAP expansion units - JBOD enclosure roaming - SSD read-only and read-write cache Note: SSD Cache support Single, RAID 0, RAID 1, RAID 5, RAID 6, RAID 10 configuration. The maximum cache size depends on installed memory.
iSCSI (IP SAN)	- iSCSI targets with multiple LUNs per target Note: The maximum number of targets is 256. - LUN mapping and masking - Online LUN capacity expansion - SPC-3 persistent reservation - MPIO & MC/S - iSCSI Extensions for RDMA (iSER) with VMware ESXi Note: This feature requires an Intel or AMD-based NAS with a PCIe slot, and a compatible Mellanox network card. - iSCSI LUN backup, one-time snapshot, and restoration - Virtual disks using iSCSI initiator Note: The maximum number of virtual disks is eight. - Stack chaining master
Power Management	- Wake-on-LAN (WoL) - Standby mode for internal drives

	- scheduled power on and off - Automatic power on after power recovery - USB and network UPS support with SNMP management
Domain Authentication Integration	- Microsoft Active Directory (AD) and domain controller support - LDAP server and client - Domain user login (AFP, CIFS/SMB, FTP, and File Station)
Access Right Management	- Multiple user creation - User data importing and exporting - User quota management - Local user access control (AFP, CIFS/SMB, FTP, and WebDAV) - Application access control (File Station, Music Station, Photo Station, and Video Station) - Subfolder permissions (AFP, CIFS/SMB, FTP, and File Station)
Web Administration	- Multi-window, multitasking system management - Smart toolbar and dashboard for system status display - SNMP versions 2 and 3 - Resource monitor - Network recycle bin - Recover files deleted using AFP, CIFS/SMB, and File Station Automatic cleanup - File type filter - Comprehensive logs (events and connections) - Syslog server and client - Backup and restoration of system settings - Mobile application for remote system monitoring and management
Others	- 4 nos. of SFP+ 10GbE 3.0M cables - 2 nos. of rail kits for rackmount

10.9.10 Accessories

All accessory items including power cable, Gigabit network cable, 8 port Gigabit Ethernet Hub, spare kit etc must be provided in sufficient number to function satisfactorily to meet the above mentioned specification.

10.10 Forward Looking Sonar

The Contractor shall propose, supply, deliver and install a set of hull-mounted Forward Looking Sonar to the Vessel for the purposes of Obstacle Avoidance in accordance with following specifications. It shall be installed in the hull or any other location as approved with suitable fairings.

Features:

(a) High Definition Display Unit: At least 19" (Diagonally Viewable Size);

(b) Real time system and 3 dimensional displays;

(c) Screen updates every 1 to 2 seconds or better;

(d) 200m forward range or better;

(e) 100m depth range or better;

(f) Beam width 90 degrees (vertical plan) or better;

(g) Beam width 60 degrees (horizontal plane) or better;

(h) Operational Speed: up to 18 knots;

(i) 200 kHz frequency or as approved by the Government;

(j) Multiple display options;

(k) Colour coded depth;

(l) Full High Definition capable;

(m) Outputs: HDMI, DVI, VGA, S-video, comp-video;

(n) Ethernet style transducer connection (allows data cable up to 150m);

(o) 12/24V operating voltage.

10.11 Acoustic Doppler Current Profiler (ADCP)

The Contractor shall supply a four-beam solution Acoustic Doppler Current Profiler (ADCP) for the purposes of water current and water depth measurement. The ADCP shall also have the functions of bottom tracking for over the side mount applications and water pressure measurement. The specifications are as follows:-

(a) Water profiling range: at least 50 meters

(b) Vertical resolution of water profiling: at least 0.5m

(c) Velocity resolution: at least 1mm/sec

(d) Number of depth cells: 1-255

(e) Ping rate: Up to 10 Hz

(f) Transducer beam angle: 20 degrees

(g) Transducer configuration: 4-beam, convex

(h) Equipped with pressure senor

The accessories and other requirements are as follows:-

(a) 256 MB memory module

(b) Data communication RS-232 or RS-422

(c) Two alkaline battery packs

(d) 220V AC power supply

(e) 5m Data/Communication cable

(f) User’s guide, manual and tools

(g) Standard software for data acquisition, data display and export

(h) Modification to direct-reading mode

10.12 Additional option / accessories

The Contractor may submit a comprehensive list of additional options/ functions/ accessories / spares kit for the proposed equipment for consideration. The Government has absolute right to accept or reject any items.

10.13 Installation Requirements

10.13.1 General

(a) The control panel of all Hydrographic Survey Equipment shall be installed and flush-mounted in the ship office unless otherwise specified. The Inertial Measurement Unit (IMU) must be installed on a secure and stable platform as agreed by the Government. The Contractor shall carry out dimensional control survey using the method recommended by the manufacturer of the multibeam echo sounder and agreed by the Government and submit a survey report with plan showing the exact locations of the Equipment.

(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 stabilizer or regulator shall be provided and installed at no extra cost if required.

(d) All wiring shall be finished in a neat and appropriate manner approved by the Government.

(e) Adequate measures to prevent interference amongst the Equipment shall be taken which include:

(i) Separate independent screened conduits or trunkings for survey equipment 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.

(f) All sitting, installation and cabling work shall be undertaken to the highest standard to ensure:

(i) Satisfactory performance of the Equipment.

(ii) Protection from mechanical and water damages.

(iii) Ease of accessibility for maintenance and repair.

(iv) Manufacturers' recommendations shall be strictly observed.

(g) The power, signal and control cables connecting to the flush-mounted equipment shall be long enough to let the equipment wholly rest on a safe place like on the panel, table, etc. with valid cable connections for fault finding and equipment testing. These extended cables shall be properly managed and resided inside the console.

(i) Induced mutual interference should be within an appropriate level which would not affect normal operation.

(h) 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. The Contractor shall submit a layout plan showing the locations of the Equipment before installation. The layout plan shall be commented by the manufacturer of the multbeam echo sounder and agreed by the Government before installation.

(ii) Installation location of the Equipment shall not cause any interference to other Equipment by way of the emitted interference.

(i) 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 this Specification. 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 cables, casing, mounting accessories and etc. 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. All installation materials, casing, mount accessories etc must be marine grade 316 stainless steel or approved by the Government.

(j) 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.

(k) Electricity

(i) The power supply shall be compatible with Vessel's A.C and 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.

(l) 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.

(m) 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.

(n) Dimensional Control Survey

The Contractor shall carry out dimensional control survey measuring offsets and alignments that are required for the correct geo-referencing of survey data. The Contractor shall conduct dimensional control survey using total station, 3D laser scanner or other method agreed by the Government. The Contractor shall submit a survey report and plan showing the exact locations, offsets and alignments of the Equipment and the Centre of Gravity of the offered Vessel to the Government. The survey report shall be accepted by the Government before delivery of the vessel.

10.14 Acceptance Test

10.14.1 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 specification.

(b) On-site commissioning test shall be carried out by the Contractor in the presence of the MD 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 sea trial.

(c) Calibration of survey equipment i.e. Patch Test shall be carried out on site before and after the offered Vessel delivered to Government Dockyard by the Contractor in the presence of the MD representatives to ascertain the performance of the multibeam echo sounder system .

10.14.2 The Contractor shall deliver each set of Equipment to the MD representatives for bench acceptance test prior to the installation on the Vessel. Where the test is failed (i.e. the Equipment does not comply with any requirements as set out in this Chapter or in other applicable part of the Contract), the Contractor shall provide a brand new replacement to the MD to re-conduct the bench acceptance tests.

10.14.3 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.

10.14.4 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.

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

10.14.6 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.

10.15 Documentation for the Equipment

10.15.1 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.

(a) Vessel performance (including engine rating and size of the Vessel).
(b) Initial cost.
(c) On-going cost (including maintenance cost, petrol consumption, and spare parts).
(d) Reliability (frequency and time to repair breakdown).
(e) Time between maintenance periods.
(f) Time to undertake scheduled maintenance (downtime).
(g) All machineries and equipment installed in the Vessel shall be serviceable in the Hong Kong.

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:

(a) Good access to all installed items for monitoring, service and overhaul.
(b) 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:

(a) Detailed inventory list for the whole Vessel to be submitted to the Government for approval.
(b) The Inventory List shall cover all discrete items down to major component/unit level.
(c) Full details of each item including:
    (i) Item number
    (ii) Description
    (iii) Type or model (if applicable)
    (iv) Quantity
    (v) Manufacturer
    (vi) Manufacturer's reference number
    (vii) Location in Vessel
    (viii) Local agent/supplier address, telephone and fax numbers
(d) **FOUR** paper copies and **ONE** soft copy of the Inventory List shall be provided to MD.

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:

(a) **FOUR** complete sets of paper print drawings of the Vessel and **ONE** soft copy in Compact Disk (CD-ROM).

(b) **FOUR** complete sets of paper print as fitted electrical schematic, cabling, wiring and single line diagrams for electrical equipment installed on board and conduit / trunk route diagram and **ONE** soft copy in CD-ROM as per the Vessel delivered.

(c) **FOUR** copies of equipment list for all Equipment. The list shall include:
    (i) Description
    (ii) Type or model (if applicable)
    (iii) Makers part number or equivalent (if applicable)
    (iv) Location

(v) Quantity
(vi) Supplier or agent's name and contact address

(d) **FOUR** copies (at least one original) of maker operation, maintenance and workshop manuals for each piece of Equipment in English.

(e) **FOUR** paper copies and **ONE** soft copy in CD-ROM "Docking Plan" of the Vessel which shall include the profile, plan and sections shall be prepared by the Contractor.

(f) **FOUR** copies of On board Operator's Manual (English and Chinese) covering:

(i) Daily user check and operation procedure.
(ii) Operating detail of each system.
(iii) Emergency operation procedure.

(The precise format and detail required will have to be subject to the GNC's approval when the configuration of the Vessel and outfitting is decided.)

(g) The first draft of the On board Operator's Manual (in both English and Chinese) shall be submitted to GNC for approval one month before documentation acceptance.

(h) The documentation for all Equipment, Spare Parts, special tools and test equipment shall be provided at the Delivery Acceptance of the Vessel.

11.2.3 Tools & Test Equipment for Electronics

(a) Delivery of all test and tool equipment for the electronics equipment of the Vessel will be directly to EMSD.

(b) All items shall be properly documented, preserved and packed.

11.2.4 Photographs

(a) As-Fitted Photographs

(i) Two sets of colour prints (130 mm x 90 mm) from different aspects to give an overall picture of the various parts/areas of the Vessel shall be provided upon Delivery Acceptance.

(ii) Each print shall be enclosed in a suitable album and labelled showing the position of the content.

(b) Official Photographs

(i) Four framed colour photographs of picture size not less than 350 mm x 270 mm and frame size not less than 510 mm x 400 mm showing the profile of the Vessel in Hong Kong Waters shall be provided upon Delivery Acceptance.

(ii) Four 200 mm x 150 mm colour photographs with specifications of vessel particulars showing the profile of the Vessel in Hong Kong Waters shall be provided upon Delivery Acceptance.

(iii) Four 150 mm x 100 mm colour photographs showing the profile of the Vessel in Hong Kong Waters shall be provided upon Delivery Acceptance.

(c) Softcopy of Photographs

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

11.2.5 Certificates and Reports

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

(a) Associated test certificates.
(b) Test performance certificates of Equipment as required in this Part VII.

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

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

11.2.6 Ship Model

(a) The Contractor shall supply two ship models (scale 1:25) for display and training purpose.

(b) The purpose of the ship model shall provide a reasonable realistic appreciation to the viewer (who cannot see the actual vessel) about the shape, scale, construction of the Vessel and the machinery installations and fittings therein. Hence the model shall include the position and look of the major external fittings including but not limited to the skeg, appendages, shafts, propeller (propulsion units), rudders, mast, mast fittings and navigation lights and any other external above and under water items; and the Vessel shall be made to an overall exact scale standard relevant to model making.

Chapter 12 - Training

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

12.1.1 General Requirements

(a) All training courses shall be held in Hong Kong.

(b) The Contractor shall provide appropriate classroom as well as on board training to the operational and technical staff to familiarise officers 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.

(c) It is anticipated that two distinct types of training shall be required, namely:

(i) Operator Training
(ii) Equipment Maintenance Training

(d) The Contractor shall submit a detailed course syllabus and a schedule for conducting the training course.

(e) Each trainee shall receive one copy of comprehensive training documents before the start of each course.

(f) Training manual in Chinese and English shall be provided and submitted to MD and EMSD for approval at least one month prior to commencement of the aforementioned two types of training respectively.

12.1.2 Operator Training Course

(a) This course shall provide training for trainers.

(b) The course shall provide a full knowledge and appreciation of the day-to-day operation of all ENE and Hydrographic Survey Equipment. This shall include hands-on demonstrations and operation of all ENE and Hydrographic Survey Equipment including the necessary routine cleansing requirement.

(c) The course shall be held immediately before the commissioning of the ENE and Hydrographic Survey Equipment on the Vessel.

(d) A total of up to 20 trainees will attend the course. The training course shall accommodate the specified number of trainees.

12.1.3 Equipment Maintenance Training Course

(a) The equipment maintenance training course shall enable the maintenance staff to:

(i) acquire full knowledge and appreciation of all aspects of the design considerations, day-to-day operation, inter-connected system operation, fault breakdown, routine maintenance and fault finding/ repairing procedures of the ENE and Hydrographic Survey Equipment being offered; and

(ii) effectively maintain the ENE and Hydrographic Survey Equipment. This shall include practical demonstrations and tests.

(b) The maintenance training course shall include, but not be limited to the following items:

(i) Introduction of the ENE and Hydrographic Survey Equipment locations;
(ii) ENE and Hydrographic Survey Equipment operational, working principle and functional descriptions;

(iii) ENE and Hydrographic Survey Equipment block and schematic functional descriptions;
(iv) ENE and Hydrographic Survey Equipment adjustment/calibration procedure and parameter settings;
(v) ENE and Hydrographic Survey Equipment construction and mounting;
(vi) ENE and Hydrographic Survey Equipment interfacing and signal interfacing;
(vii) Preventive maintenance and trouble-shooting

(c) The course shall be held immediately after the commissioning of the ENE and Hydrographic Survey Equipment on the Vessel.
(d) A total of up to 20 trainees will attend the course. The training course shall accommodate the specified number of trainees.

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.

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	Internetwork 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)

Part VII - Annex 1 - Warranty Services and Guarantee Slipping

1. Warranty Services

1.1 The Contractor shall provide 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 an authorised agent to perform the Warranty Services, the Contractor shall ensure that the authorised agent 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.

1.2 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 the Equipment in respect of which the manufacturer/supplier does not offer a one-year free warranty on such equipment, the Contractor shall provide the Warranty Services throughout the Warranty Period at the Contractor's own cost. For other loose equipment and installations, such as life-saving and firefighting equipment, etc., which are required to be serviced, inspected or renewed annually, the Contractor 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 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 an authorised agent 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. The Certificate of Insurance and evidence showing that the premium has been 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 Warranty

It is required that the Vessel is covered by free of charge Warranty Services for one year after the date of the issue of the 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 electronic navigational equipment), fittings and outfit (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/manufacturer's 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:

1.6.1 Any notification of claimed defect shall be sent from MD to the Contractor through a defined route.

1.6.2 There shall be a joint inspection to examine the defect and the Contractor shall propose the appropriate and necessary remedial action to the satisfaction of MD.

1.6.3 The Contractor shall undertake on-site Warranty Services (including provision of all replacement Warranty Items, labour, materials, test equipment, and transportation) wherever, at the option of the Government, the Vessel is berthed in the Government Dockyard or maintenance bases of the user department. Taking the Vessel to the shipyard of the Contractor should be avoided unless absolutely necessary.

1.6.4 Rectification of defects must have a minimum effect on the operation of the Vessel by the provision of on loan equipment if 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 the Government, include Warranty Services to be performed by the Contractor described in the following sub-paragraphs:

1.7.1 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 to rectify 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. The MD must be informed of what corrective maintenance and rectification actions have been taken within 72 hours of receiving the relevant fault report.

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

1.7.3 Any replacement item or part to be used shall originate from the manufacturer of the original Warranty Item to be repaired and must be able to be found in the latest spare parts list issued by such manufacturer. Alternative components shall not be used without the prior approval in writing of the MD.

If the Contractor fails to respond to any reported warranty claims within 48 hours, the MD may arrange corrective maintenance and rectification of the defect either on its own or by deploying a third party contractor as deemed appropriate with a view to minimising 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

1.8.1 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 date when the relevant fault report was first issued.

1.8.2 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.

1.8.3 In relation to a Warranty Item, references to Warranty Period shall be construed to include such extended warranty period as mentioned in Paragraph 1.8.1 and/or 1.8.2 above, depending on whichever is applicable.

1.8.4 Equipment which is found to be 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 the 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 the Government's advance written consent 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 which the Contractor shall use for performing the Warranty Services. The Government will not provide its own inventory of the Spare Parts 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 Items 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 modifications and changes shall be provided at the expiry of the Warranty Period.

1.13 Warranty of Electronic Navigational Equipment

Please refer to the Paragraph 9.1.1 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, labour and equipment in order to carry out such work:

2.2.1 Engines

(a) Renew the lubricating oil and replace the filters for the main engines as per the manufacturer's recommendations;

(b) Clean all the engine air filters and change the filter elements as necessary;

(c) Clean the coolers of the engines and renew all zinc anodes if provided;

(d) Check all the engines' belts and adjust if necessary;

(e) Check tappet clearances for the inlet and exhaust valves, ignition timing and idle speed and adjust if necessary;

(f) Conduct function tests for the engines' protection system and their associated sensors, gauges and other measuring devices; and

(g) Any other work required or recommended by the engine manufacturer.

All of the work listed at Paragraphs 2.2.1(a) to (g) shall be carried out by the manufacturer's authorised agent. All the work procedures shall comply with the manufacturer's specifications and requirements.

2.2.2 Hull and Deck Items (where applicable)

(a) Paint Under the Water Line

(i) Paint under the water line shall be checked by the paint manufacturer's representative for the effectiveness of one year's protection against marine growth;

(ii) The hull shall be cleaned;

(iii) Damaged paint shall be repaired according to the paint manufacturer's procedures;

(iv) After the repair of the damaged paint as specified at Paragraph 2.2.2(a)(iii) above, two coats of touch up primer and one coat of touch up shall be applied; and

(v) One full coat of finishing paint shall be applied to the hull below the water line.

(b) Paint Above the Water Line

(i) Damaged paint on the hull above the water line shall be repaired properly. After repair, two coats of touch up primer and one coat of touch up shall be applied;

(ii) Two coats of paint shall be applied on the Vessel's name, draft marks and insignia; and

(iii) One full coat of anti-slip paint shall be applied to the open and side deck.

(c) Inspect and clean propellers.

(d) Free, clean, grease and recondition all moving parts of the deck fittings, i.e. WT (water tight) hatches, vent covers, rollers and fairleads and anchor chain stoppers, etc.

(e) Renew all zinc anodes.

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

(a) Engine control and steering system;
(b) Engine alarm and shut down function (including emergency stopping of engines);
(c) Navigational equipment, lights and sound signals;
(d) Ahead and astern running and crash stop test;
(e) Steering trial;
(f) Other trials as required by the Government Representative; and
(g) Any item or component found defective shall be repaired or replaced.

Milestones		Completion Dates
1	Kick-Off Meeting	To be held within two (2) months after the Contract Date at the Government Dockyard or the Contractor's Shipyard, as to be directed by the Government.
2	Completion of hull structures	The Contractor shall propose the completion dates of Milestones 2 to 6 for GNC's approval within two (2) months after the Contract Date.
3	Completion of installation of engines	
4	Completion of installation of electronic navigation equipment	
5	Pre-shipment Construction and Handling Inspection	
6	Shipment to Hong Kong	
7	Delivery Date	The Delivery Date for the Vessel shall be no later than the date set out in Schedule 2 (Delivery Schedule) of Part V

Drawings Approval	Completion Date
General Arrangement Plan	All the drawings are required to be submitted in two months after Signing of Articles of Agreement for GNC's approval / reference.
Lines Plan	
Structural Construction Plan in Mid-Ship and Bulkhead Section	
Construction Profile and Deck Plan	
Shell Expansion Plan	
Tank Capacity Plan	
Engine Mounting Arrangement	
Power / Speed Estimation and Curve	
Intact and Damaged Stability Plan	
Details of Navigational / Communication Equipment	
Details of Deck Equipment, Outfitting, Furniture, etc.	
Details of Engines' Arrangement	
Control Console Arrangement and Schematic Diagram	
Instrumentation and Control System	
Calculation of Fuel Capacity	
Details of Electrical and Electronic Equipment	
Electrical Load Calculations	
Schematic Layout of Electrical Circuits	
Paint Schedule	
Lightning Protection Arrangement	
Torsional Vibration Calculation (if applicable)	
Others as required	

Part VII Annex 4 - Main Items Inspection Timetable

Vessel Name : "Hydro 3"				
Item No.	**Items to be inspected**			**Completion Date**
	Hull Structure, Layout and Outfitting Inspection			
H-1	Mould Lofting			
H-2	Construction Materials – checking for hull & superstructure			
	(a)	Material certificates verification		
	(b)	Test of GRP specimen		
H-3	Welding consumables & welders certificates (if any)			
H-4	Keel laying for hull			
H-5	Fabrication of hull up to main deck in stages of work, including:			
	(a)	Alignment		
	(b)	Edge Preparation		
	(c)	Workmanship		
	(d)	Compliance with approved plans		
	(e)	Plating thickness gauging		
H-6	Superstructure scantling checking			
H-7	Welding construction and pressure tests of tanks			
	(a)	Fuel oil tank		
		(i)	Tank construction (internal/external/fitting)	
		(ii)	Tank pressure test	
	(b)	Freshwater tank		
		(i)	Tank construction (internal/external/fitting)	
		(ii)	Tank pressure test	
	(c)	Grey water tank		
		(i)	Tank construction (internal/external/fitting)	
		(ii)	Tank seating construction/securing arrangement	
	(d)	Oily Water tank		
		(i)	Tank construction (internal/external/fitting)	
		(ii)	Tank seating construction/securing arrangement	
H-8	Hose test for hull & superstructure			
H-9	Mock up inspection for the wheelhouse			
H-10	Installation of various outfitting items			
	(a)	Anchor and chain		
	(b)	Windlass		
	(c)	Hand pump		
	(d)	Hatches		
	(e)	Doors		
	(f)	Windows		

	(g)	Ventilators	
	(h)	Seating of heavy equipment and masts	
H-11	Function tests of various outfitting items		
H-12	Watertightness or weathertightness of openings		
	(a)	Manholes	
	(b)	Hatches	
	(c)	Doors	
	(d)	Windows	
	(e)	Ventilator & air pipes	
H-13	Painting inspection of different layers		
H-14	Draught marks and vessel dimensions verifications		
H-15	Arrangement of wheelhouse and accommodation		
H-16	Zinc anodes and lightning system		
	(a)	Installation of zinc anodes	
H-17	Inspection of fire, heat and sound insulation		
	(a)	Fire insulation	
	(b)	Heat insulation	
	(c)	Sound insulation	
H-18	Interior furnishings		
	(a)	Console area	
	(b)	Wheelhouse	
	(c)	Crew space	
	(d)	Toilets and pantry	
H-19	Lifesaving appliances and fire fighting appliances		
	(a)	Lifesaving appliance	
	(b)	Fire fighting appliance	
H-20	Inspection of sea chest and grating		
	(a)	Sea chest	
	(b)	Grating	
H-21	Inclining experiment		
H-22	Sea trials including operation test of outfitting equipment		
H-23	Towing hook static bollard pull test		
H-24	Site towing demonstration trial		

H-25	Cleanliness inspection before acceptance		
H-26	Inventory check in the HKSAR		
H-27	Acceptance and delivery		
H-28	Acceptance of As-Fitted drawings and Engines/Equipment Manuals and documentations.		
	Electrical and Machinery Installation		
EM-1	General inspection on installation of machinery:		
	(a)	General inspection on installation of main engines	
	(b)	General inspection on installation of generator sets	
	(c)	General inspection on installation of auxiliary engines	
	(d)	General inspection on installation of shafting	
EM-2	Main engines:		
	(a)	Test of engine safety devices and alarms	
	(b)	Test of emergency stop	
	(c)	Break-in test	
EM-3	Hydrostatic test of sea valve		
EM-4	Inspection of sea water suction strainer		
EM-5	Freshwater system:		
	(a)	General inspection & dimension checking of freshwater system	
	(b)	Freshwater tank low level alarm test	
	(c)	Freshwater tank final cleaning/internal inspection before filling	
	(d)	Freshwater tank high level alarm test	
	(e)	Freshwater tank content gauge calibration and test	
	(f)	Inspection of piping penetration of bulkhead and deck	
	(g)	Hydraulic test of freshwater piping	
	(h)	Functional test of freshwater system	
EM-6	Fuel oil system:		
	(a)	General inspection & dimension checking of fuel oil system	
	(b)	Fuel oil tank low level alarm test	
	(c)	Fuel oil tank final cleaning/internal inspection before filling	
	(d)	Fuel oil tank high level alarm test	
	(e)	Fuel oil tank content gauge calibration and test	
	(f)	Inspection of piping penetration of bulkhead and deck	
	(g)	Hydrostatic test of fuel oil piping	
EM-7	Bilge system:		
	(a)	General inspection & dimension checking of bilge system	
	(b)	Bilge tank high and low level alarms test	
	(c)	Inspection of piping penetration of bulkhead and deck	
	(d)	Hydrostatic test of piping	
	(e)	Functional test of bilge system	

EM-8	Sanitary system:		
	(a)	General inspection & dimension checking of sanitary system	
	(b)	Inspection of piping penetration of bulkhead and deck	
	(c)	Hydrostatic test of piping	
	(d)	Functional test of sanitary system	
EM-9	Fire fighting system:		
	(a)	General inspection & dimension checking of fire line system (including the emergency fire line system)	
	(b)	Inspection of piping penetration of bulkhead and deck	
	(c)	Hydraulic test of fire line	
	(d)	Function test of fire line (including emergency fire line)	
EM-10	Fire extinguishing system:		
	(a)	General inspection & dimension checking of fire extinguishing system	
	(b)	Hydraulic & blow test of fire extinguishing piping	
	(c)	Test of fixed fire extinguishing alarm system	
	(d)	Test of fire detection (smoke & heat detectors) alarm system	
EM-11	Functional test of drainage system		
EM-12	Hydraulic system		
	(a)	General inspection & dimension checking of hydraulic system	
	(b)	Inspection of piping penetration of bulkhead and deck	
	(c)	Hydraulic test of piping	
	(d)	Functional test of hydraulic system	
EM-13	Ventilation system:		
	(a)	Inspection of ventilation fans installation	
	(b)	Function test of start/stop at remote and local control for ventilation fans	
EM-14	Air conditioning system:		
	(a)	General inspection of air-conditioning system	
	(b)	Inspection and hydraulic test of cooling water system	
	(c)	Function test of air-conditioning system	
	(d)	Air conditioning full load test during sea trial	
EM-15	Batteries:		
	(a)	Inspection of battery connectors and housing boxes	
	(b)	Inspection of battery charger	
	(c)	Operational test of battery charger Test of main engines and generator consecutive starting by each group of battery (start/stop at remote and local control)	
EM-16	Electrical installation:		
	(a)	Inspection of lightning conductor	
	(b)	General inspection of cable layout & checking of cable sizes	
	(c)	Inspection of cable penetrations of bulkhead and deck	
	(d)	Inspection of transformers	
	(e)	Inspection of tally plates	

EM-17	Main switchboard & panels:		
	(a)	Main switchboard & panels - high voltage injection test	
	(b)	Cable size checking of electrical switchboard installations	
	(c)	Inspection of AC distribution panel	
	(d)	Inspection of DC distribution panel	
	(e)	Megger test of the electrical system	
	(f)	Earthing test of the electrical system	
EM-18	Control console:		
	(a)	Inspection of wheelhouse control console	
	(b)	Functional test of wheelhouse console controls	
	(c)	Inspection of navigation equipment control panel	
EM-19	Lighting:		
	(a)	Inspection and functional test of general lighting	
	(b)	Inspection and functional test of emergency lighting	
	(c)	Inspection and functional test of floodlight installation	
	(d)	Inspection and functional test of searchlight installation	
EM-20	Navigational lights and signals		
	(a)	Inspection and functional test of navigational lights	
	(b)	Test of horn/whistle	
EM-21	Test of window wipers		
EM-22	Inspection of lightning conductor		
EM-23	Electronic equipment tested by EMSD		
EM-24	Test of noise level during sea trial		
EM-25	(a) Official Speed Trial		
	(b) Other Official Sea Trials		

Note:
The inspection items are preliminary and not exhaustive, any items found necessary to be included at a later stage will be added to this list.

Part VII - Annex 5 - Official Speed Trial - Endurance Test

Date of Test:		Place of Test:	
Vessel's Identification:		Vessel's Name:	

Conditions at Official Speed Trial - Endurance Test			
Person On board	**6 Persons**	Dummy Weight	
Fuel (Petrol)	**75% of Fuel Tank**	Other Equipment	**40kg**
Sea Conditions	**WMO Sea State 0 to 2**		

Engines:	**Port Side**	**Starboard Side**	**Propellers:**	**Port Side**	**Starboard Side**
Maker			Maker		
Type			Type		
Serial Number			Diameter		
Rated Power			Pitch		
Rated Speed			Direction of Rotation		

Engine Load	**Engine Speed (rpm)**	**Vessel Speed (Knots)**	**Time (Start)**	**Time (Finish)**	**Fuel Consumption (litres/mintue)**	**Engine Oil Pressure (Bar)**	**Engine (in) CW Temp. (^{o}C)**	**Others**	**Others**
__% of rated Power	At Minimum Crusing Speed		Not less 15 mintues						
50% of Rated Power/rpm			Not less 15 mintues						
60% of Rated Power/rpm			Not less 15 mintues						
70% of Rated Power/rpm			Not less 15 mintues						
80% of Rated Power/rpm			Not less 15 mintues						
90% of Rated Power/rpm			Not less 15 mintues						
100% of Rated Power (Endurance Test)			Not less 60 mintues						

Remarks:

Witness by:	MD Representative	Shipyard Representative

Part VII - Annex 6 - As-fitted Drawings and Machinery/Equipment documents and information literature to be delivered to the Government after Delivery Acceptance

1. As-Fitted Drawings

1.1 Upon delivery of the Vessel, the Contractor shall deliver to the Government four (4) hard copies and two (2) soft-copies in pdf. and dwg. files of the following plans and drawings that contain the technical information of the Vessel and its machinery and equipment as they are when the Vessel is on the day accepted by the MD. These are termed the final version of the "As-Fitted" Plans and Drawings, and they must consist of the following ones as well as any other additional ones that may be required by GNC/MD during the design and construction of the Vessel and before 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 business sector. All 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 officer.

1.2.1 General Arrangement Plan
1.2.2 Lines plan and offsets data and table.
1.2.3 Stability information booklet and the inclining experiment report.
1.2.4 Hydrostatics, cross curves and intact and damage stability calculations for all ship loading conditions specified in the Technical Specifications.
1.2.5 Vessel subdivision drawings and stability calculations.
1.2.6 Painting scheme of the whole Vessel.
1.2.7 Vessel draught marking diagram.
1.2.8 Detailed arrangement and layout plan of the wheelhouse, cabins, decks showing the disposition of all main equipment, fittings and fixtures, furniture, doors, windows, hatches, manholes and access openings. The down-flooding openings (points) shall be clearing indicated on the drawings.
1.2.9 Equipment layout diagram.
1.2.10 Hull structural construction and hull scantlings drawings.
1.2.11 Hull shell and frames and the framings arrangement and construction plan.
1.2.12 Hull shell expansion plan.
1.2.13 Keel construction plan.
1.2.14 Steering system and steering arrangement diagrams.
1.2.15 Superstructures and deck structural and construction plan.
1.2.16 Hull watertight bulkheads construction plan.
1.2.17 Superstructures to deck connection detailed construction plan.
1.2.18 Deck edge and bulwark (if any) details and construction plan, including detailed structural arrangement drawings of hull to deck connection.
1.2.19 Detailed cathodic corrosion prevention and arrangement plans and drawings for the Vessel throughout.
1.2.20 Mast structural and construction plan and mast equipment arrangement plan.
1.2.21 Anchoring arrangement plan.
1.2.22 Piping diagrams for fuel oil, freshwater, lubrication oil, bilge, firefighting, scuppers and drains, sewage system.
1.2.23 Fire prevention, fire control and firefighting system drawings.
1.2.24 Drawings of the main switchboard and all other switchboards and the electrical system.
1.2.25 Wheelhouse and cabin sound and heat insulation system diagram.
1.2.26 Main engines and generator sets arrangement and sitting plans and drawings of their fuel lines and exhaust gas piping and arrangement.
1.2.27 Vessel ventilation drawings for the wheelhouse, cabins and other spaces.
1.2.28 Main fuel oil tank drawing and its associated piping and manifold(s), and filling, overflow and ventilation system.
1.2.29 Freshwater tank and its associated piping arrangement.

1.2.30 Fuel oil tank(s) and its associated piping system
1.2.31 Drawings for anchor, windlass and the anchoring system.
1.2.32 Lifesaving appliance arrangement plan and fire safety plan.
1.2.33 Distress signals, alarm systems, and internal/external communication arrangement and system plan.
1.2.34 Navigational lights, sound and signal diagrams and any other external lighting arrangement plan.
1.2.35 Hydrographic survey equipment arrangement plan and diagrams.
1.2.36 Vessel overall lighting arrangement and light control plan.
1.2.37 Vessel alarm and signals, internal communication systems and public address systems plan.
1.2.38 General layout and arrangement drawing of the air-conditioning system.
1.2.39 Refrigerant piping layout drawing of the air-conditioning system.
1.2.40 Air-conditioning load calculation.

Note: These items are preliminary and not exhaustive, any items found necessary to be included at a later stage will be added to this list.

1.3 Documents to be provided by the Contractor

1.3.1 In not less than one (1) month before the Delivery Acceptance of the Vessel, the Contractor shall provide for GNC acceptance a list of all documents to be provided.

1.3.2 When the Vessel is delivered to the Government Dockyard the Contractor shall deliver to the Government all the technical information including but not limited to leaflets, literature, manuals and booklets and whatsoever items that are necessary for the operation, handling, services, maintenance, spare parts, repairs and the technical understanding of any one of all the engines, machinery, motors, pumps, equipment, fittings and outfitting items of the Vessel.

Part VII - Annex 7 – Definitions of Wave and Sea

Beaufort scale number	Description	Wind speed	Wave height	Sea conditions	Land conditions
0	Calm	< 1 km/h (< 0.3 m/s) < 1 mph < 1 knot < 0.3 m/s	0 m 0 ft	Flat.	Calm. Smoke rises vertically.
1	Light air	1.1–5.5 km/h (0.3–2 m/s) 1–3 mph 1–3 knot 0.3–1.5 m/s	0–0.2 m 0–1 ft	Ripples without crests.	Smoke drift indicates wind direction. Leaves and wind vanes are stationary.
2	Light breeze	5.6–11 km/h (2–3 m/s) 4–7 mph 4–6 knot 1.6–3.4 m/s	0.2–0.5 m 1–2 ft	Small wavelets. Crests of glassy appearance, not breaking	Wind felt on exposed skin. Leaves rustle. Wind vanes begin to move.
3	Gentle breeze	12–19 km/h (3–5 m/s) 8–12 mph 7–10 knot 3.5–5.4 m/s	0.5–1 m 2–3.5 ft	Large wavelets. Crests begin to break; scattered whitecaps	Leaves and small twigs constantly moving, light flags extended.
4	Moderate breeze	20–28 km/h (6–8 m/s) 13–17 mph 11–16 knot 5.5–7.9 m/s	1–2 m 3.5–6 ft	Small waves with breaking crests. Fairly frequent whitecaps.	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	29–38 km/h (8.1-10.6 m/s) 18–24 mph 17–21 knot 8.0–10.7 m/s	2–3 m 6–9 ft	Moderate waves of some length. Many whitecaps. Small amounts of spray.	Branches of a moderate size move. Small trees in leaf begin to sway.
6	Strong breeze	39–49 km/h (10.8-13.6 m/s) 25–30 mph 22–27 knot 10.8–13.8 m/s	3–4 m 9–13 ft	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.
7	High wind, moderate gale, near gale	50–61 km/h (13.9-16.9 m/s) 31–38 mph 28–33 knot 13.9–17.1 m/s	4–5.5 m 13–19 ft	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.
8	Gale, fresh gale	62–74 km/h (17.2-20.6 m/s) 39–46 mph 34–40 knot 17.2–20.7 m/s	5.5–7.5 m 18–25 ft	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.
9	Strong gale	75–88 km/h (20.8-24.4 m/s) 47–54 mph 41–47 knot 20.8–24.4 m/s	7–10 m 23–32 ft	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.

10	Storm, whole gale	89–102 km/h (24.7-28.3 m/s) 55–63 mph 48–55 knot 24.5–28.4 m/s	9–12.5 m 29–41 ft	Very high waves with overhanging crests. Large patches of foam from wave crests give the sea a white appearance. Considerable tumbling of waves with heavy impact. Large amounts of airborne spray reduce visibility.	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	103–117 km/h (28.6-32.5 m/s) 64–73 mph 56–63 knot 28.5–32.6 m/s	11.5–16 m 37–52 ft	Exceptionally high waves. Very large patches of foam, driven before the wind, cover much of the sea surface. Very large amounts of airborne spray severely reduce visibility.	Widespread damage to vegetation. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 118 km/h (≥ 32.8 m/s) ≥ 74 mph ≥ 64 knot ≥ 32.7 m/s	≥ 14 m ≥ 46 ft	Huge waves. Sea is completely white with foam and spray. Air is filled with driving spray, greatly reducing visibility.	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris and unsecured objects are hurled about.

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	